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Environmental Assessment of the Alaskan Continental Shelf

Final Reports of Principal Investigators

Volume 1. Physical Science Studies

Outer Continental Shelf Environmental Assessment Program
Boulder, Colorado

March 1979

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

U.S. DEPARTMENT OF INTERIOR
Bureau of Land Management

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March 1979

U.S. DEPARTMENT OF COMMERCE
Juanita M. Kreps, Secretary

National Oceanic and Atmospheric Administration
Richard A. Frank, Administrator

The facts, conclusions and issues appearing in these reports are based on interim results of an Alaskan environmental studies program managed by the Outer Continental Shelf Environmental Assessment Program (OCSEAP) of the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce, and primarily funded by the Bureau of Land Management (BLM), U.S. Department of Interior, through interagency agreement.

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ANNUAL REPORT - FINAL REPORT

(Gulf of Alaska Only)

COASTAL MORPHOLOGY, OIL SPILL VULNERABILITY AND SEDIMENTOLOGY
-- NORTHERN GULF OF ALASKA --

Miles O. Hayes - Principal Investigator

Christopher H. Ruby - Co-Investigator

Coastal Research Division
Department of Geology
University of South Carolina

Contract No. 03-5-022-82

Research Unit 59

I. Summary of Objectives, Conclusions, and Implications with Respect to OCS Oil and Gas Development:

These topics are addressed within the body of the Final Report which follows.

II. Introduction:

See Final Report which follows

III. Current State of Knowledge:

See Final Report

IV. Study Area:

See Final Report

V. Sources, Methods and Rationale of Data Collection:

Included in the Final Report

VI. Results:

Included in the Final Report

VII. Discussion:

See Final Report

VIII. Conclusions:

See Final Report

IX. Needs for Further Study:

We feel that this type of study should be extended to include the entire shoreline of Alaska. Presently, we are applying these techniques to Kotzebue Sound and the Beaufort Coast. This summer, we will continue our studies in those areas and add the coastline of Kodiak and Afognak Islands. Prince William Sound and/or the Aleutian Islands might be logical areas to study next year. A Final Report (after the completion of the entire coastline of Alaska) would include a detailed coastal atlas showing both coastal morphology, sediment characteristics and the vulnerability to potential oil spills.

X. Summary of January - March Quarter:

A. Laboratory Activities:

The Coastal Research Division, over the past year, has been modifying a 200cm settling tube so that raw data obtained from the tube can be interfaced directly into a small analog computer and flat bed plotter. This new system is now operative and substantially reduces the time required to run sediment samples (1½-2½ hrs. for sieves vs 15mins. for the tube) while maintaining data accuracy. During January - March, the system was checked against our old sieve technique, afterward, the sand size sediment samples from Kotzebue Sound were run through the tube. We are presently writing a Fortran program which will permit the settling tube output to be run through the large University computing facility. This will permit the data to be stored on magnetic tapes which are then sent to the NODC.

APPENDIX

The following were submitted as part of this report:

Hayes, M.O., C.H. Ruby, M.F. Stephen, and S.J. Wilson (1976). "Geomorphology of the Southern Coast of Alaska", Proceedings of the 15th Coastal Engineering Conference, Honolulu, Hawaii, pp. 1992-2008.

Ruby, C.H. (1977). Coastal Morphology, Sedimentation and Oil Spill Vulnerability - Northern Gulf of Alaska, Technical Report No. 15-CRD, Department of Geology, University of South Carolina, Columbia, SC 29208, 223 pp.

This report represents the Final Report for our research area in the Gulf of Alaska.

FINAL REPORT

Contract: #03-5-022-56
Task Order: #6
Research Unit: #99
Reporting Period: 6/30/75-
12/31/77
Number of Pages: 26

THE ENVIRONMENTAL GEOLOGY AND GEOMORPHOLOGY OF THE COASTAL ZONE OF KOTZEBUE SOUND AND THE CHUKCHI SEA FORELANDS FROM CAPE PRINCE OF WALES TO CAPE LISBURNE

Dr. P. Jan Cannon
Principal Investigator

Department of Geology
University of Alaska
Fairbanks, Alaska 99701

June 1978

FINAL REPORT

Project Title: The Environmental Geology and Geomorphology of the Coastal Zone of Kotzebue Sound and the Chukchi Sea Forelands from Cape Prince of Wales to Cape Lisburne

Contract Number: 03-5022-56

Task Order Number: 6

Principal Investigator: Dr. P. Jan Cannon

I. TASK OBJECTIVES

A. To produce three maps, with explanations, which will display certain baseline data necessary for an environmental assessment of the regions. The maps will be constructed from various types of remote sensing data.

1. Environmental geologic map of the entire forelands from Cape Prince of Wales to Cape Lisburne which will include the lowlands of the Kobuk Delta, the Noatak Delta, and the Kotzebue Moraine.

2. A coastal landforms map of the region identifying and describing important geomorphic features.

3. A map which indicates potential tectonic and geomorphic hazards.

B. To produce a report on the unique geologic setting of the Kobuk Delta indicating the possible effects (beneficial and adverse) of petroleum related development in the area.

C. Direct the acquisition of remote sensing data of the area for Cannon, Hayes and other investigators.

D. Construct a mosaic of the area of sequential LANDSAT data for Cannon, Hayes, and other investigators.

E. Construct an annotated mosaic of the area from SLAR imagery.

II. INTRODUCTION

The purpose of this investigation was to conduct an environmental study which would provide information about the existing natural conditions along the coastal plain areas adjacent to Kotzebue Sound. An understanding of the natural conditions can be used to determine the possible extent of natural processes and the impact that man-related activities may have upon the environment. The environment of a particular area is the assemblage of landforms and the geomorphic processes which are effected by the creation of the landform assemblage. The identification of a landform, or a landform assemblage, provides information about the natural environmental conditions which can be used to interpret the existing environment and the natural history of an area. This interpretation can then be used to determine the possible extent of natural processes and to appraise the impact of man-induced changes.

The maps which accompany this report identify the landforms and landform assemblages of the coastal plain. Natural environmental information must be displayed in a spatial format if a realistic evaluation is to be made of an area. The components of natural environments must be displayed in a spatial framework which portrays the degree of physical association between components. Because, if changes are induced, the components of natural environments respond to all dimensions. These factors make it necessary to display environmental information on maps.

Environmental geology contributes to bridging the gap between required resource use and necessary environmental protection. The term, environmental geology, may be displeasing to some geologists, but more importantly, the term serves to focus the attention of the nonscientist on the critical need for geologic input in planning and inventory. Environmental geology involves the inventory of natural systems and the matters of site-specific impact problems. Unfortunately only field biologists, wildlife specialists, and geologists seem to recognize the variability inherent in natural systems. Proper environmental regulations should be compatible with natural variation. Unnecessary controls or overdesign in a stable environment are just as inadvisable as indiscriminate use of delicately balanced environments. It is important to convey to the nonscientists that change in nature through time is not only natural but inescapable. Man may thwart nature for awhile, but change will eventually occur. The concept of natural evolution of natural systems in response to geologic processes is important when considering environmental impact.

III. STUDY AREA

The Chukchi Sea Forelands exhibit a complex history of sea level fluctuations. This history is unique because both tectonic and eustatic changes in sea level are recorded. The record exists because the geomorphic processes which usually destroy the indicative features in a short time are retarded by the effects of the arctic winter.

The Chukchi Sea Forelands consist of geomorphic features that show regular deposition is occurring in some areas, while intense erosion is occurring in other areas. A nearly complete range of depositional or erosional features appears to exist between the extremes.

The forelands are divided into four geomorphic divisions for this investigation. The four divisions are: 1) Lisburne Headlands, 2) Kivalina Coastal Complex, 3) Kotzebue Sound, and 4) Shishmaref Barrier Island-Beach Systems.

The northernmost division is the Lisburne Headlands which extends south from Cape Lisburne to Kilikralik Point. Erosion is so intense in this division that it is dangerous to work in the area because landslides (rockfalls) can be observed daily.

The Kivalina Coastal Complex includes the stretch of coast from Kilikralik Point southeastward to Cape Krusenstern. The major geomorphic features of this division are Point Hope, Cape Thompson, Kivalina Lagoon, and Cape Krusenstern.

The Kotzebue Sound division includes several major geomorphic features which border the Sound. Starting at Cape Krusenstern and going clockwise around the Sound, the major geomorphic features are Sheshalik Spit, Noatak Delta, Baldwin Peninsula, Hotham Inlet, Kobuk Delta, Eschscholtz Bay, Goodhope Bay, and Cape Espenberg. This range of features indicates that the geomrophic history of Kotzebue Sound is quite complex. Kotzebue Sound itself is a shallow, sediment-filled embayment. The major portion of its sediments come from the Kobuk and Noatak Rivers. Minor contributions of sediments come from the Selawik and Buckland Rivers.

The southernmost division is the Shishmaref Barrier Island-Beach System. This division extends southwestward from Cape Espenberg to Cape Prince of Wales. The major geomorphic features are the large lagoons and inlets, and the sheltering chain of barrier islands.

IV. MAJOR LANDFORMS AND GEOMORPHIC PROCESSES

Landforms are the products of the manner in which the energy of geomorphic agents (such as wind, water and ice) is expended upon terrestrial materials. Since geomorphic agents interact to various degrees at or near the earth's surface, a variety of landforms can be generated in almost any locality. Landforms are, therefore, a record of the geomorphic agents which have dominated or are presently dominating the patterns of energy interchange at some point on the earth.

The assemblage of landforms and the geomorphic processes which are effected as a result of the creation of the assemblage form that which is termed "the environment" of a particular area on the earth's surface. The identification of a landform or of an assemblage of landforms provides information about the environment which can be used to evaluate the natural history of the environment and to appraise the impact of induced changes.

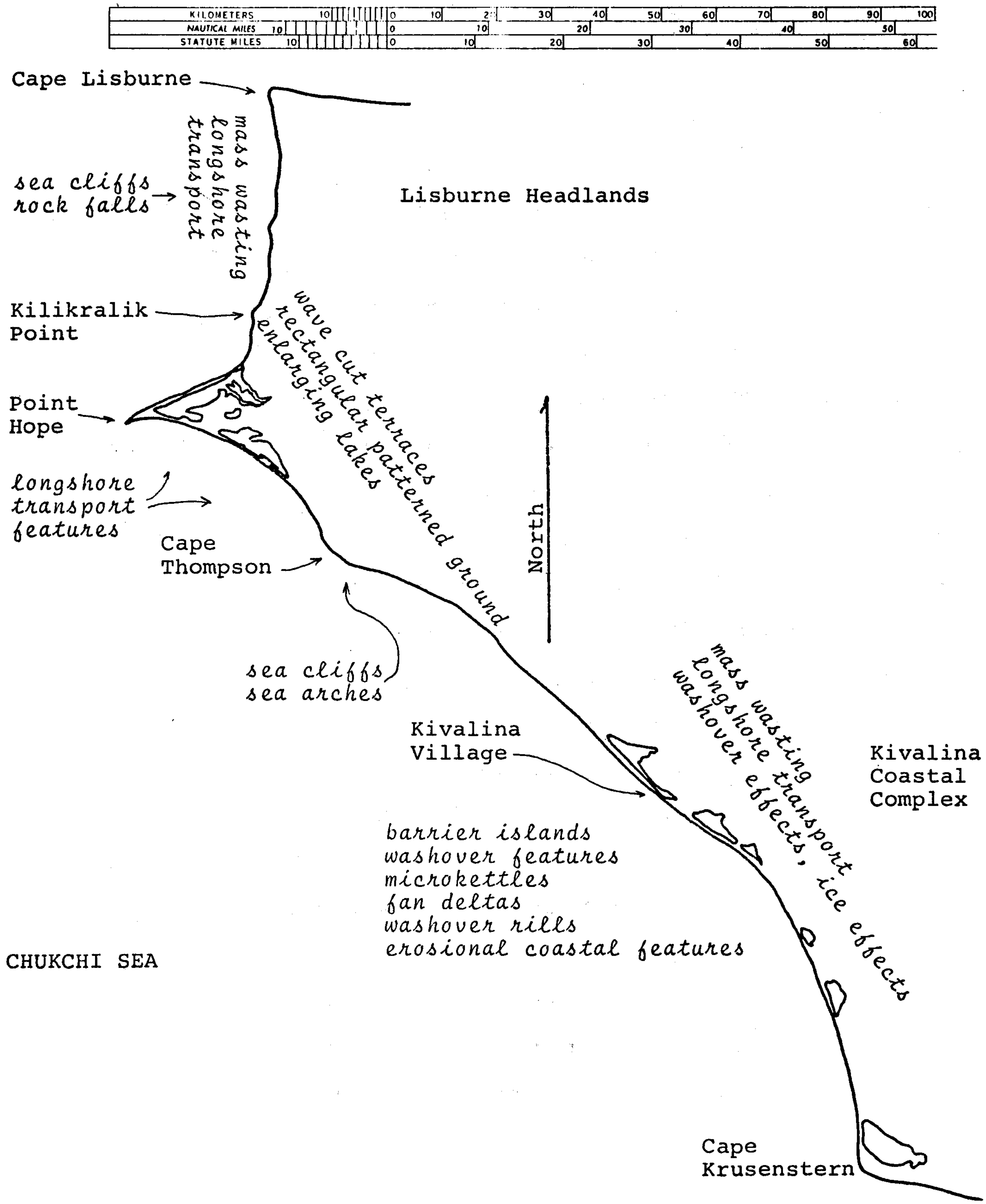
MAP 1

Lisburne Headlands

This is the westernmost extention of the Brooks Range. Here a low mountainous terrain is abruptly truncated by the sea. The coast consists of steep clifts and a narrow rocky beach. The narrow rocky beach consists mainly of materials mass wasted off the nearly 1000 foot high clifts. Wave action transports some of the debris alongshore towards the north. However, most of the rock debris is carried seaward from the clifts down the steep sea floor. Mass wasting is the major geomorphic process occurring in the area. Landslides (rockfalls) can be observed almost daily in the area, even during the winter. Erosion is so intense that the beach and clifts are dangerous places to work.

Kivalina Coastal Complex

This division includes a very diverse stretch of coast from Kilikralik Point southeastward to Cape Krusenstern. The coastal foreland is mainly low rolling bedrock hills or planar wave-cut terraces. The beaches are



Map 1. Major landforms and geomorphic processes of the two northern geomorphic divisions, the Lisburne Headlands and the Kivalina Coastal Complex. These two divisions present an unprotected, mostly stable coastland.

composed mainly of gravel. The gravel is being derived from the local bedrock by wave and ice action. The longshore transport of the gravel is fast enough to create and maintain barriers in front of the mouths of some of the creeks forming several narrow lagoons. Washover rills and fan deltas occur on the lagoon side of the gravel barriers. The washover materials (mainly gravel) are pocked with microkettles, which are created when ice buried in the gravel melts.

Point Hope and Cape Krusenstern are made up of multiple beach ridges. The lakes and lagoons created by the beach ridges are in some cases enlarging. It appears that the lakes and lagoons for the most part have been created by the loss of ice under or in the multiple beach ridges because the patterned ground which is on the above water materials exists on the floors of the lakes and lagoons also.

Ice shove reworks some of the near shore gravel but does not add much to beaches at all. However, mass wasting does bring a noticeable amount of materials down even minor clifts to the beaches. During breakup in April and May, debris slides occur and long black tongues of rock, mud and organic debris slide down the clifts at the back of the beaches and across the frozen beaches.

Due to the amount of bedrock at or near the surface, the coastal foreland and coastline are considered mainly stable in light of environmental development. However, it is an unprotected coastline and the erosional features attest to this.

MAP 2

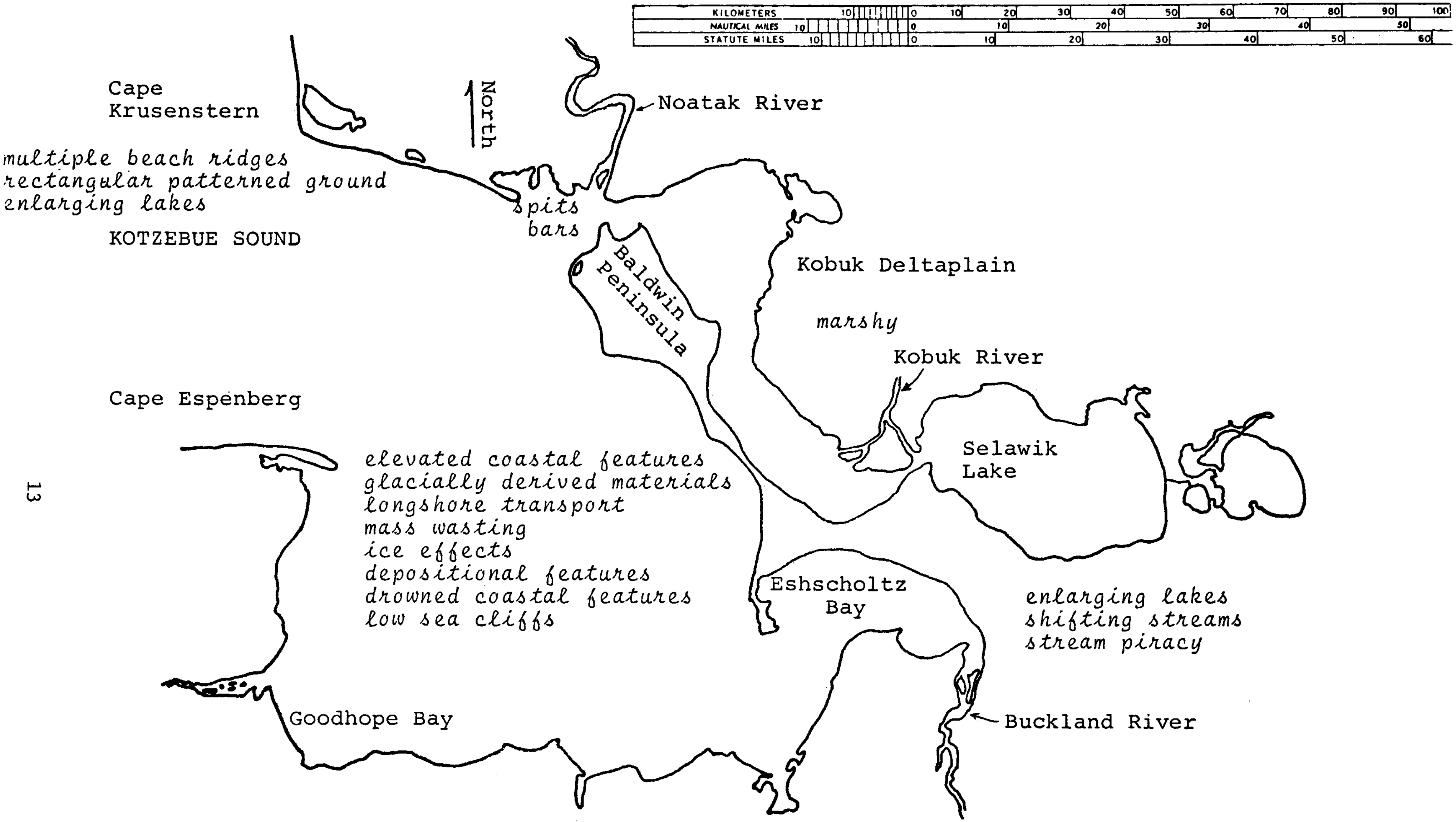
Kotzebue Sound

A variety of landforms occur in this geomorphic division. The variety results from the protected nature of the coastline. The protection from intense wave action causes landforms generated by minor or low energy geomorphic processes to be preserved. Unlike the divisions shown on Map 1 where intense wave action overwhelms most low energy geomorphic processes.

Spits and bars of sand and gravel extend from various points around the sound. The Noatak Delta contains marshy and muddy areas which attest to a low energy environment. The Kobuk Delta is completely protected from strong wave action by the bedrock buttress of Baldwin Peninsula. Wedges of flat marshy materials occur at the mouths of even some of the small streams around the Sound. These wedges of unconsolidated materials are formed from alluvial materials dropped at the mouths of the small streams into what appears as drowned extentions of the stream valleys.

The unsolidated masses of material, such as the beaches and deltas, contain much ice and would be considered as unstable in light of various types of development. The bedrock areas, however, would provide stable areas for development.

A large number of fires occurred in the watersheds that drain into Kotzebue Sound during the summer of 1977. Runoff of fine-grained materials should be heavy during the following years until a protective cover reestablishes itself.



Map 2. Major landforms and geomorphic features of the Kotzebue Sound geomorphic division. This is a protected, variously stable coastland with a high oil spill vulnerability.

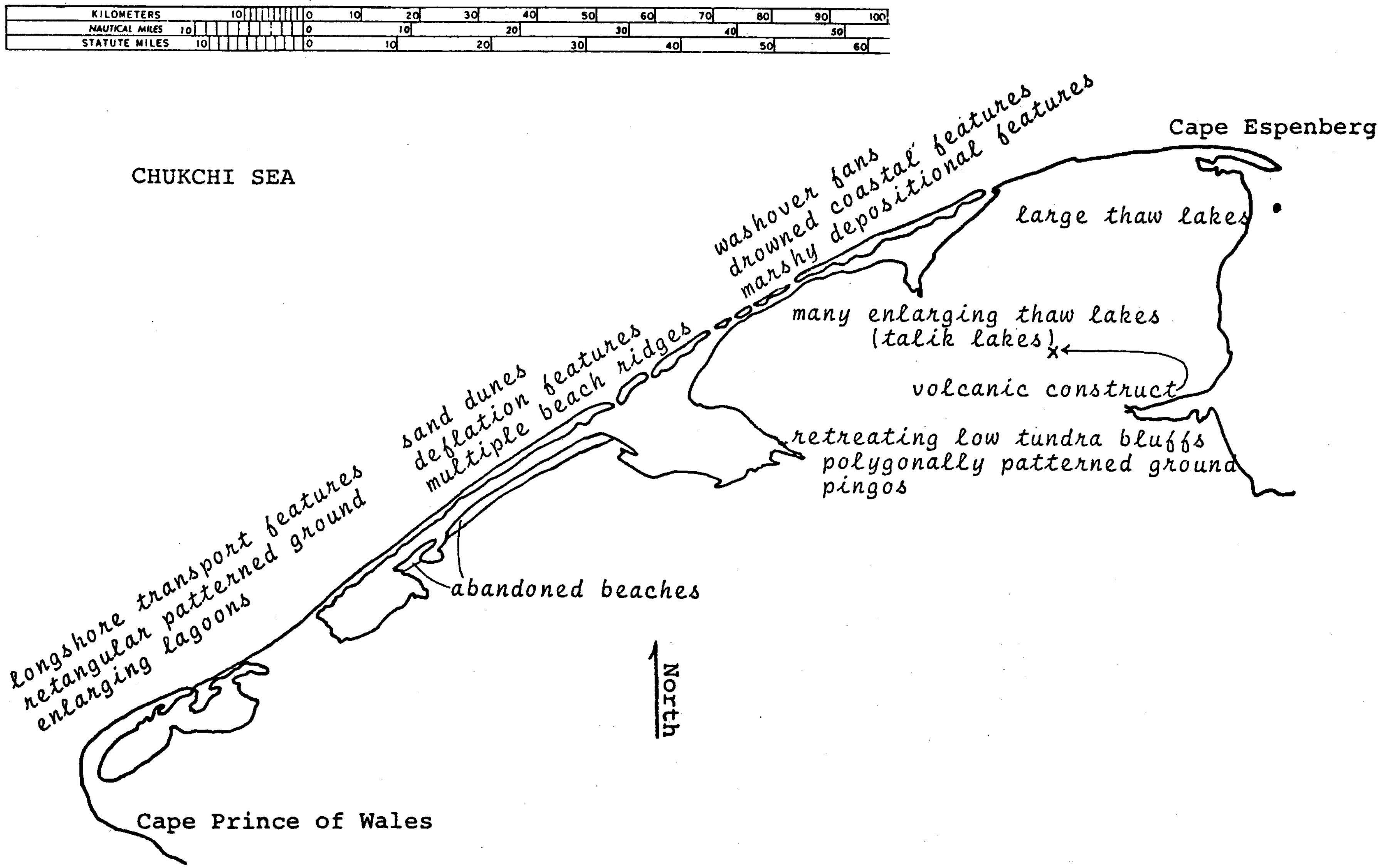
MAP 3

Shishmaref Barrier Island-Beach System

This geomorphic division has an unprotected coastline. The coastline receives the full force of storms in the Chukchi Sea. The coastal foreland consists mostly of ice-rich, unconsolidated materials and is rapidly changing by natural processes.

The beaches are composed mainly of sand and show the effects of longshore transport and storm washover. Sand dunes and deflation basins line the back part of beach in many areas. Multiple beach ridges and fan deltas occur on the lagoon side of the barrier islands. Abandoned beach ridges are found on the coastal plain landward from the lagoons. Some of the lagoons are in part drowned valleys. Most of the lagoons are probably due to the loss of ice in the unconsolidated materials. Sequential photography shows that the lagoons are enlarging.

Aerial photography taken in 1949 was compared with aerial photography taken in 1976 of the area. This comparison of sequential photography revealed that parts of the shoreline had retreated 40 meters during that 27 year time span. The rate of retreat of the tundra bluffs along the back beach and the lagoons appears to range between 1.0 and 1.5 meters per year. The shorelines around the lakes on the coastal plain are also retreating. Values on some lakes about 500 meters across were as high as 2.9 meters per year. The best generalization that can be made about the lakes is that the shorelines of the larger lakes are retreating faster than the shorelines of the smaller lakes. As a function of time, it could be seen in the 27 year time span, new lakes are formed and other lakes drained. This change in the lakes is due to continued loss of ice in the subsurface. The coastal



Map 3. Major landforms and geomorphic processes of the Shishmaref Barrier Island-Beach System and the adjacent coastal plain. This is an unprotected, unstable coastland.

plain exhibits the frozen ground features of polygonally patterned ground and pingos. All of the lakes appear to be talik lakes, those formed by the melting of ice below the surface. The Killeak Lakes, the Devil Mountain Lakes, and White Fish Lake have been previously assumed to be volcanic maars. However, a detailed photographic study revealed no geomorphic features which support these lakes as being volcanic maars. The lake basin morphology and the subsidence features on the margins of the lakes strongly indicate that they are talik lakes formed by the melting of subsurface ice.

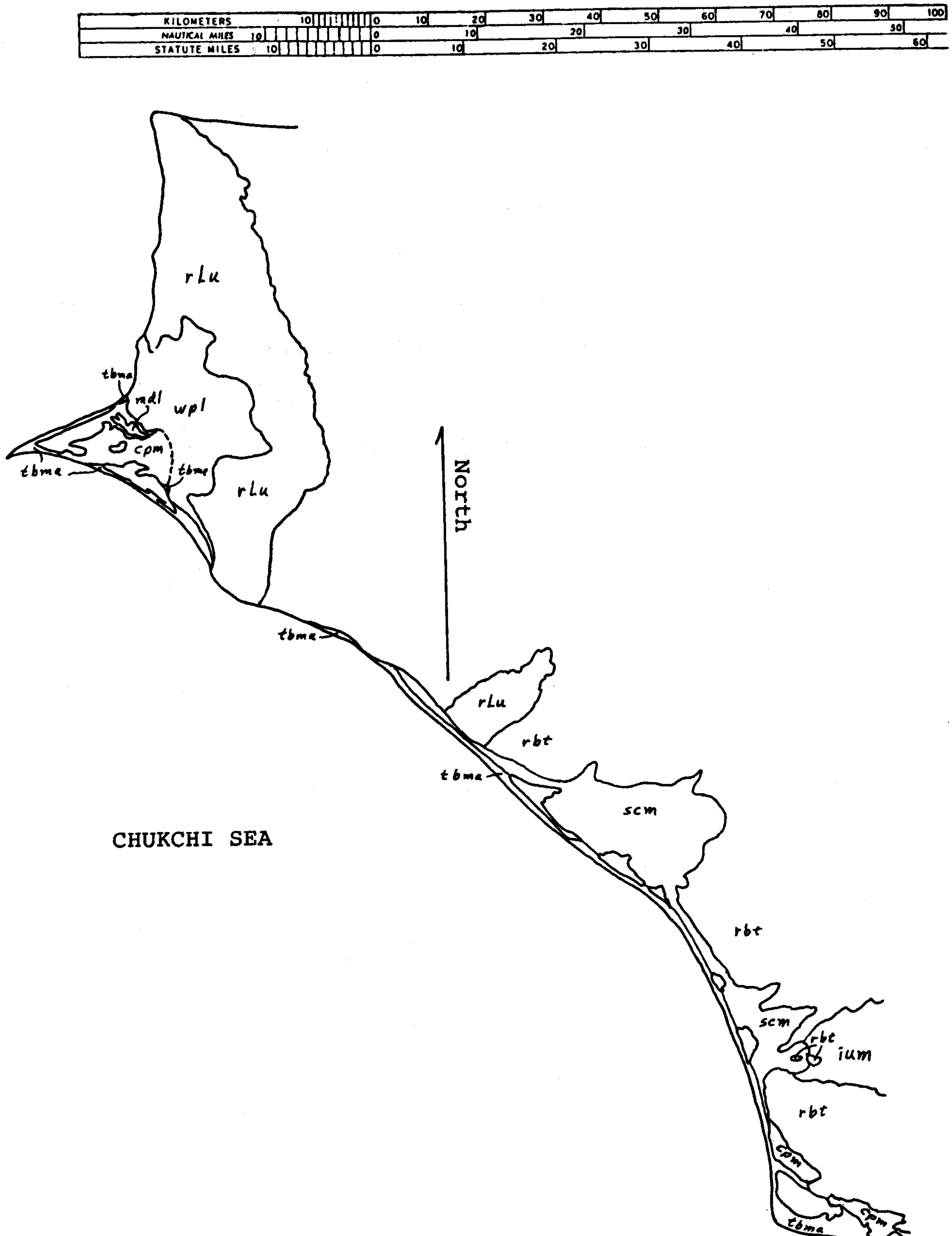
V. ENVIRONMENTAL GEOLOGY AND STABILITY

Environmental geologic data must be displayed in spatial format if a realistic evaluation is to be made of an area. If changes are induced, natural environments respond in all dimensions. Therefore, components of natural environments must be displayed in a spatial framework which portrays their degree of physical association. This makes it necessary to display environmental information on maps, because point values cannot convey a complete indication of the degree of interface between components. This is important if predictive model studies are to be made of the area. A geomorphic history is based on the construction of a chronology of geomorphic events. Spatial information and sequential observations of large portions of the coastal zone is necessary in order to construct a chronology. A geomorphic history reflects the natural stability of an area.

MAP 4

Lisburne Headlands and Kivalina Coastal Complex

This map shows 8 different environmental geologic units which provide a spatial presentation of the existing natural environments and their relative



Map 4. Environmental geologic map of the Lisburne Headlands and the Kivalina Coastal Complex. Map symbols and units are described in text.

stability. The 8 units are as follows:

cpm - coastal plain materials: Nearly flat, tundra covered areas back of the beaches and lagoons. The materials are ice-rich unconsolidated mixtures of gravel, sand and silt. The areas usually show talik (thaw) lakes and patterned ground. The areas are poorly drained and abandoned beach ridges occur in some places.

ium - ice laden unconsolidated materials: Hummocky, gently sloping to gently rolling, tundra covered areas occurring mostly inland, back of the coastal plain materials (cpm). The materials are ice-rich unconsolidated materials which are in part glacial drift. The areas are better drained and usually show fewer lakes than the coastal plain materials.

mdl - marshy delta lowlands: Flat, low marshy areas at the mouths of small streams. Consists mostly of alluvial materials reworked in part by waves and tides. Apparently fills drowned portions of some stream valleys. Contains variable amounts of ice and some areas are flooded by storm tides.

rbt - rolling bedrock terrain: Areas of gently to moderatly rolling bedrock hills usually less than 1700 feet in elevation inland behind the units of cpm and ium. Areas are covered with rock rubble and solifluction lobes. The lower slopes are covered with tundra which thins to bare bedrock on the higher slopes. The unconsolidated mantle of debris usually contains ice.

rLu - rolling Lisburne uplands: Areas of moderately to strongly rolling bedrock hills usually less than 2500 feet in elevation. The bedrock is the Lisburne Group, of Early and Late Mississippian age, which consists chiefly of limestone and dolomite beds. The slopes are greater here than in other units and the areas of this unit are well drained. The slopes are covered with bare rock rubble or sparse tundra over rock debris. The thin mantle of rubble or rock debris usually contains some ice.

scm - sloping coastal plain materials: Areas similar to the unit, cpm, but having very gentle slopes and few lakes. Also similar to the unit, ium, but not as hummocky. The materials are poorly to moderately drained and contain ice.

tbma - transported beach materials, type a: Beach and back beach materials consisting chiefly of gravel which has been deposited by longshore currents. The beach areas are in transit and the back beach areas show patterned ground and lakes. The areas are crossed in some places with washover rills and fan deltas generated by storms. Micro-kettles are common in the fans of washover materials. Contains ice in variable amounts.

wpl - wave-planed lowlands: A flat wave-cut bedrock terrace back of Point Hope between 100 feet and 500 feet above present day sea level. The area is moderately drained, covered with a thin mantle of rock debris and tundra. The thin mantle contains much ice. This is a text-book example of a wave-cut marine terrace. The area is about 180 miles square and would be quite stable due to the shallow depth to bedrock and the nearly flat nature of the surface.

MAP 5

Kotzebue Sound Geomorphic Division

This map shows 7 different environmental geologic units, five of which are shown on Map 4. The two additional units represent the masses of unconsolidated materials comprising the deltas of the Kobuk and Noatak rivers. These two units are as follows:

Kdm - Kobuk delta materials: The marshy unconsolidated mass of mud, silt, and sand, which comprises the Kobuk deltaplain. Poorly drained, contains much ice, and may be in part reworked glacial drift. All of the area is below 100 feet in elevation. Appears to cross-cut unit, ium. Large islands of unit, ium, occur in the deltaplain.

Ndm - Noatak delta materials: The marshy unconsolidated mass of mud, silt, and sand, which comprises the Noatak deltaplain. Poorly drained, probably contains much ice, all of area is below 50 feet in elevation.

The following units are described on Map 4:

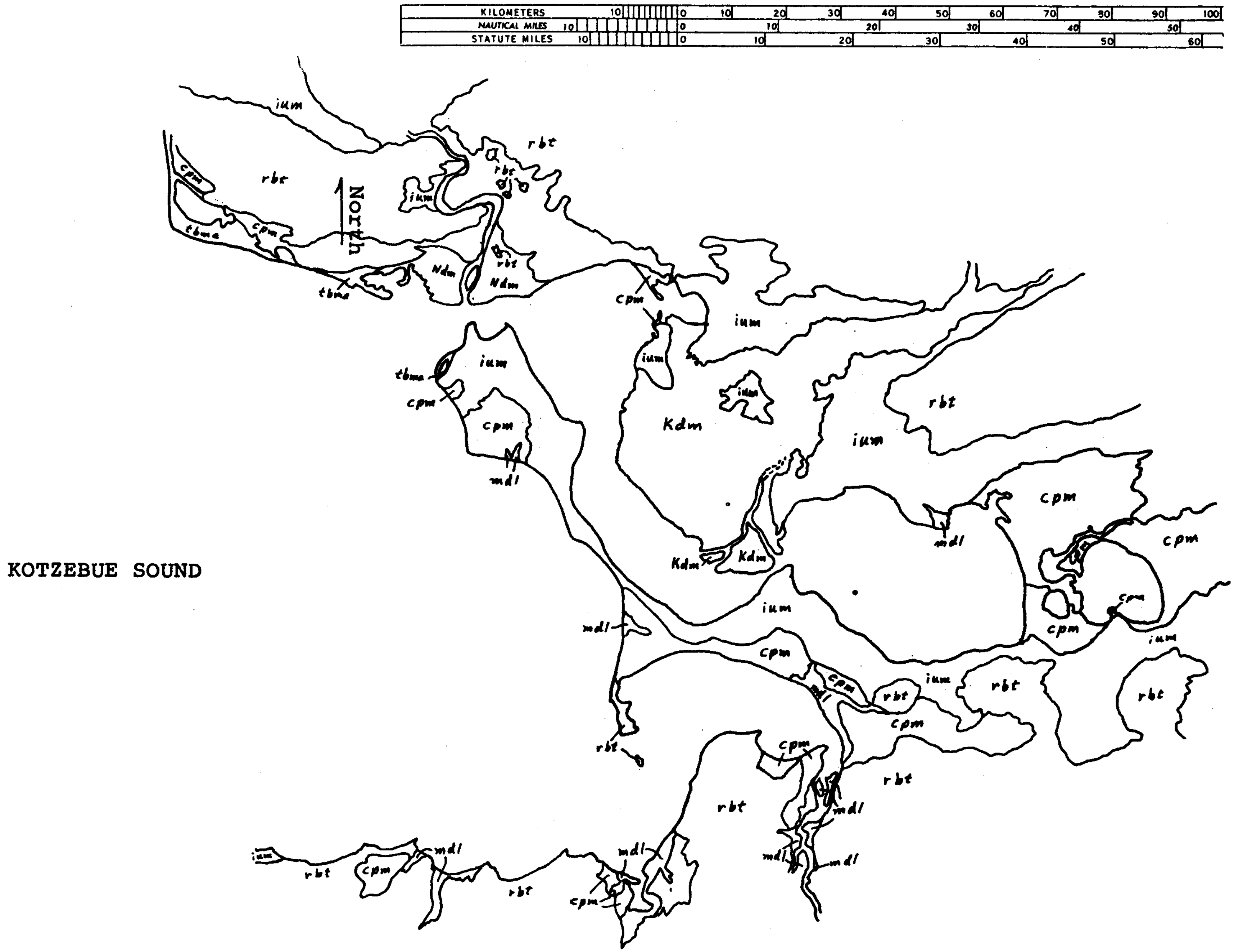
cpm - coastal plain materials

ium - ice laden unconsolidated materials

mdl - marshy delta lowlands

rbt - rolling bedrock terrain

tbma - transported beach materials, type a



Map 5. Environmental geologic map of the Kotzebue Sound geomorphic division. Map symbols and units are described in text.

MAP 6

Shisrnaref Barrier Island-Beach System

This map shows seven different environmental geologic units, five of which are also shown and described on Map 4. The two additional units are as follows:

tbmb - transported beach materials, type b: Beach and back beach materials consisting chiefly of sand which has been deposited by longshore currents. The beach face is actively being reworked by waves. The back beach shows washover fans, sand dunes, and deflation features. Where the back beach grades into multiple beach ridges, lakes have formed and rectangular patterned ground occurs in some places. Contains ice in variable amounts.

vcm - volcanic construct materials: The pile of volcanic materials which makesup Devil Mountain. This is a well drained, moderately sloping area extending to almost 800 feet in elevation. Appears to be a cluster of heavily eroded cinder cones. However, weathered features can be deceptive and the cluster of rock pinnacles may represent a plug.

The following units are described on Map 4:

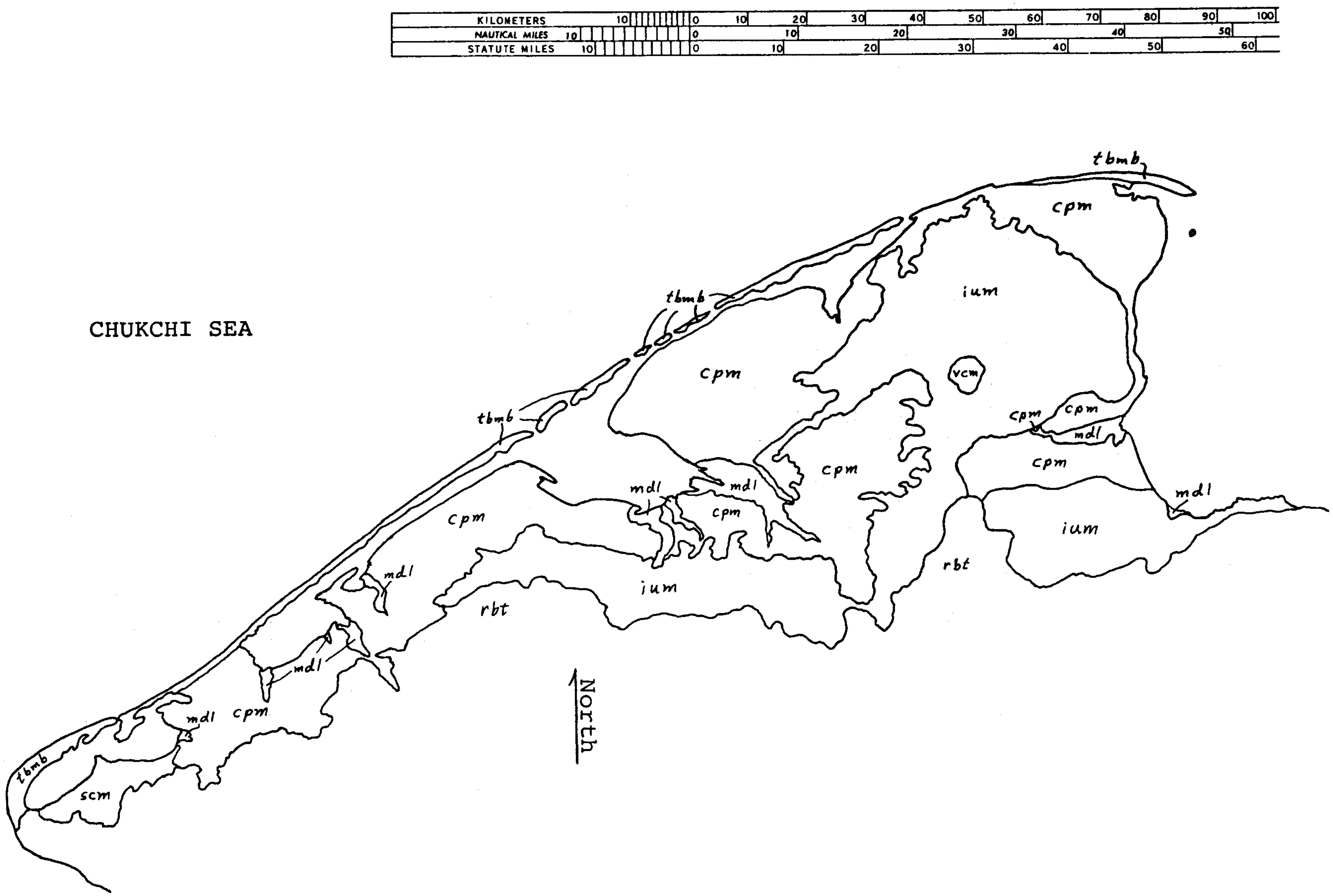
cpm - coastal plain materials

ium - ice laden unconsolidated materials

mdl - marshy delta lowlands

rbt - rolling bedrock terrain

scm - sloping coastal plain materials



Map 6. Environmental geologic map of the Shishmaref Barrier Island-Beach system and the adjacent coastal plain. Map symbols and units are described in text.

VI. OIL SPILL VULNERABILITY

Miles O. Hayes, principal investigator of research unit #59 in the OCS program, has developed a relative oil spill vulnerability index which qualitatively ranks the impact of an oil spill on a beach. The index enumerates from 1 to 10 which ranks the impact as the longevity of the accumulated oil, where 1 is the lowest longevity. The vulnerability is related in this manner to the energy expended on the beach, the beach materials, and the degree of flushing that can occur along the beach. The following list shows the oil spill vulnerability risk factor of the four geomorphic divisions discussed in this report:

Geographic Division	Risk Factor
Lisburne Headlands	1
Kivalina Coastal Complex	1-2
Kotzebue Sound	9-10
Shishmaref Barrier Island-Beach System	9-10

The Lisburne Headlands and the Kivalina Coastal Complex have a low oil spill vulnerability index because the unprotected beaches have alot of wave energy expended upon them and are rapidly flushed by longshore currents.

Kotzebue Sound has a high oil spill vulnerability index because the beaches are protected and oil would not be flushed out of the Sound very soon, if at all, by longshore currents.

The Shishmaref Barrier Island-Beach System has a high oil spill vulnerability index because the oil could become buried on the sandy beaches and oil that entered the lagoons would probably not be flushed out.

VII. THE KOBUK DELTA

The Kobuk Delta is approximately 600 square miles of low marshy delta-plain which perhaps occupies a rather unique geologic setting. The delta is completely sheltered from strong wave action and longshore currents by the Baldwin Peninsula. Most deltas suffer the direct forces of the seas and must maintain a balance of sediment being brought down the river and deposited to the amount of sediment that is eroded away by wave action and longshore currents in order to even exist. An objective was to determine how the Kobuk delta compared to other deltas.

A good introduction into deltas is presented in a paper by Fisher et al. (1969). The paper shows the morphologies of several deltas and discusses the processes which shape them. The paper divides deltas into four basic types:

Type 1 - high-constructive, elongate

Type 2 - high-constructive, lobate

Type 3 - high-destructive, wave-dominated

Type 4 - high-destructive, tide-dominated

The delta type there is a representation of the existing balance between fluvial processes and marine processes. The following list provides some examples of the four basic types:

Type 1 - modern Mississippi

Type 2 - LaFourche, Colville

Type 3 - Rhone, Yukon, Nile

Type 4 - Papua, Kuskukwim, Copper

Using the features provided in Fisher et al. (1969), the Kobuk delta is elongate. The Kobuk delta shows only very minor wave effects, has an irregular distributary system, and the mouths of the distributary branches are almost closed with fine sediment.

It the Kobuk delta was an elongate delta, because like the Mississippi delta it was receiving a huge influx of sediments, there would have to be a large amount of sediments being carried away by marine processes such as in the Mississippi delta, or the Kobuk delta would soon fill up the area behind Baldwin Peninsula.

A large amount of sediments are not being carried away from the Kobuk delta by marine processes because it is sheltered from them by the Baldwin Peninsula. Therefore the Kobuk River must not be delivering a large influx of sediments to the delta, or it would fill up Hotham Inlet rapidly.

The Kobuk delta is a growing delta system (Type 1) only because the meager sediment influx is not being rapidly carried away by marine processes. This brings up two important environmental points: 1) the protected nature of the delta must be maintained in order to preserve the delta habitat, and 2) the sediment influx from the Kobuk River must not be lowered or increased, or the delta will erode or fill up the inlet.

Using this association of geomorphic features to type a delta should apply to the Noatak delta as well. The Noatak delta is unlike the Kobuk delta in that the Noatak has such features as spits, channel mouth bars, strandplains, and an adjacent shelf of shallow mud flats. This would be the associated geomorphic features of a Type 3 delta. Indeed, the Noatak appears to be a high-destructive wave-dominated delta.

A quantitative test of deltas has been devised by Smart and Moruzzi (1972). This quantitative test was applied to the Kobuk delta in order to determine if the test supported the delta type as determined from associated geomorphic features. The quantitative values were taken from the distributary system of the Kobuk delta (Fig. 1).

The quantitative values (Fig. 1) taken from the Kobuk delta distributary system were compared with similar values taken from seven other deltas. The values indicate, without reservation, that the Kobuk delta is of the high-constructive type. The values appear inconclusive as to the Kobuk delta being elongate or lobate.

References Cited

Fisher, W. L., Brown, L. F., Scott, A. J., and McGowen, J. H., 1969, Delta Systems: Bureau of Economic Geology, Research Colloquium Syllabus, 200 p., University of Texas at Austin, Austin, Texas.

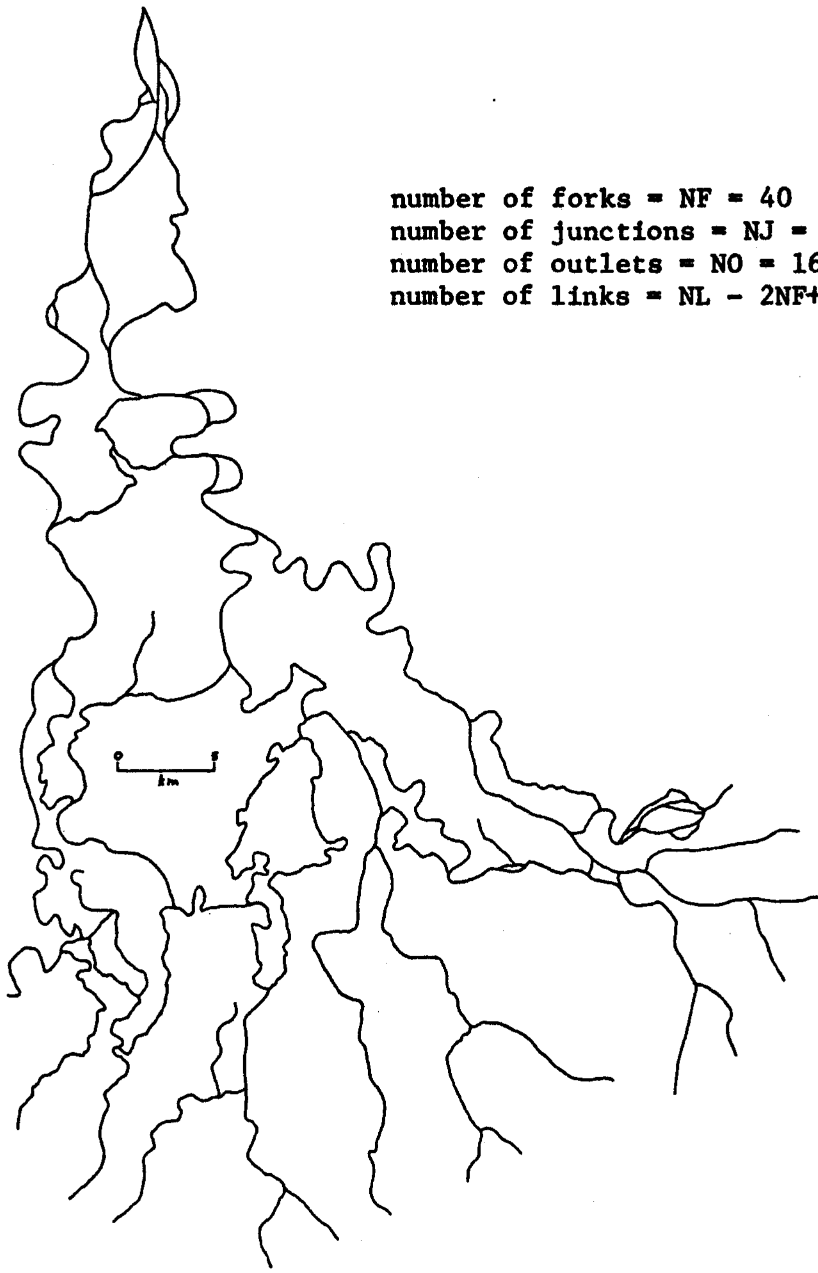
Smart, J. S., and Moruzzi, V. L., 1972, Quantitative properties of delta channel networks: Z. Geomorph. N. F., vol. 16, no. 3, pp. 268-282.

VIII. REMOTE SENSING APPLICATIONS

This study was performed using a wide range of remote sensing data. The data included records of reflected electromagnetic radiation in the visible part of the spectrum, the near infrared, and the microwave regions. This use of a wide range of electromagnetic radiation is termed an "expanded spectrum analysis".

Passive photographic data was used of the visible and near infrared regions. Passive imagery of the visible and near infrared, and active imagery of the microwave spectral regions were also used as data sources.

Black and white aerial photographs taken in 1949 for the U.S.G.S. were used in conjunction with 1976 NOS color and color infrared aerial photography for detail studies. Passive LANDSAT imagery was used for broad scale



number of forks = NF = 40
number of junctions = NJ = 24
number of outlets = NO = 16
number of links = NL - 2NF+NJ = 104

recombination factor $= \frac{NJ}{NF} = 0.60$

bifurcation factor $= \frac{NO}{NF} = 0.40$

efficiency factor $= \frac{NO}{NL} = 0.15$

Figure 1. Distributary system of the Kobuk Delta. Quantitative values are taken from the distributary network shown above. The delta is a high construction, elongate (Type 1) delta.

mapping and sequential studies. Active SLAR imagery was used for mapping and verification studies.

The ice-free LANDSAT infrared (band 7) imagery and concomitant SLAR imagery (X-band) provided the optimum information for studies concerning open water bodies. The best information concerning topographic textures was taken from late winter LANDSAT imagery and SLAR imagery acquired with a very low depression angle.

IX. NATURAL HAZARDS

The most outstanding natural hazards posed by natural processes in the area are those related to mass wasting, particularly in the areas of high sea clifts such as those existing in the Lisburne Headlands and the Cape Thompson area. The geomorphic features indicate no outstanding tectonic hazards other than those which might be related to mass wasting. Climate related natural hazards concerning storms and high winds are important factors to be considered here, but not to the magnitude as in the Gulf of Alaska.

X. CONCLUSIONS

When considering environmental conditions and impact in the Chukchi Sea coastal forelands, the following pertinent points should be carefully reviewed:

1. Extensive ground ice exists almost everywhere in unconsolidated materials.
2. On the coastal plain in the Shishmaref area, lakes are enlarging and tundra bluffs are retreating due to the loss of ground ice.

3. The Kotzebue Sound and Shishmaref Barrier Island-Beach geomorphic divisions have a very high oil spill vulnerability index.
4. The Lisburne Headlands and the Kivalina Coastal Complex geomorphic divisions have a very low oil spill vulnerability index.
5. In most places beach materials are being readily replenished by natural processes.
6. The Kobuk delta exists in a delicate natural balance in an unique geologic setting.
7. The most outstanding natural hazard of the area concerns the effects produced by mass wasting.

EXPERIMENTAL MEASUREMENTS OF SEA ICE FAILURE STRESSES NEAR GROUNDED STRUCTURES

Final Report

NOAA Contract No. 03-05-022-55, Task 7

by

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I. SUMMARY

The objectives of this study were to measure, _in-situ_, the stresses generated in a sea ice sheet as it fails in the vicinity of a static obstacle, and the rate of approach of the ice sheet during this process.

II. INTRODUCTION

Recently the mechanics of the interaction of large sea ice sheets with fixed obstacles has become of interest. This new interest has sprung up because of the need in the near future for fixed offshore structures in ice-bound waters. Of major importance to the design of such structures is a knowledge of the forces which would be applied to the structure by sea ice moving past it. The magnitude of these forces depends on three general factors:

a. The mechanics of elastic and plastic deformation of the quasi-continuum of ice floes in the ice sheet.

b. The failure strength of the ice as found in nature.

c. The nature of the forces driving the ice sheet and the associated strain rates during ice-structure interaction.

Each of these factors may be examined experimentally, but it is now known that the results are affected by the size of the ice sample and the degree to which natural conditions are preserved in the experiment. Because of this, the excellent work done on sea ice in the past 20 years has served to provoke nearly as many new questions as it has answered, and there is the need for full scale _in-situ_ experiments which preserve as many natural variables as possible. Tabata's large scale beam tests (1958), the plate bending tests performed by Hobbs et al. (1962) and the

Aidjex experiments are examples of this development. When it comes to ice-structure interaction, full-scale tests are not so easily performed. For Arctic conditions, almost any structure large enough to provide an adequate test would be quite expensive. For this reason, the work reported here used naturally occurring obstacles as "test structures." Four such static obstacles occur in the Arctic environment:

1. Islands
2. Ice Islands
3. Grounded accumulations of ice
4. Grounded pressure ridges at the seaward edge of shore-fast ice

In order to examine the stresses when moving pack ice encounters a structure, measurements were made near the grounded pressure ridges at Barrow, Alaska and near a grounded ice accumulation located in the open ocean 175 KM (109 miles) N.W. of Barrow at 72° 3.4' N., 162° W. This latter accumulation of ice floes and ridges has been termed a "floeberg" by Stringer and Barrett (1975), but as pointed out by Kovacs et. al. (1975), is not a "floeberg" as the term has been classically used. In this report, the term floe-island will be used to indicate that it is a more or less permanent feature composed of grounded ice floes and ice ridges. Our primary purpose was to measure the stresses present in a failing ice sheet near such an obstacle and this was accomplished by the use of embedded load cells (stress transducers). A secondary objective was to measure ice motion and/or strain. At Barrow, this was provided by radar surveillance of the ice pack. For the experiments at the floe-island, no such instrumentation was available and ice motion was inferred from satellite photography, and navigational data obtained from the helicopter used for logistics.

III. PRESENT STATE OF KNOWLEDGE

Several studies have been conducted in which instrumented pilings were used to measure forces imposed by moving ice when failure is of the crushing or "cutting" type. The study by Blenkarn (1970) is typical while that by Schwartz (1970) is the most complete in that 50 points were instrumented on the piling. Both of these studies dealt with warm, relatively thin ice. Theoretical studies have been performed on the interaction of ice with pilings and with piers whose surfaces slope in order to induce bending in the ice. No experimental data are available in the open literature for structures of an extended nature where the ice must fail by pressure ridging, although several proprietary studies have been done by Imperial Oil Limited. Artificial islands, ice islands, causeways, and docks are typical extended structures which would induce pressure ridging. In addition, multiple piling or single piling structures might have an effective radius much larger than the nominal radius if hummocked ice were to adfreeze to them, or if the cutting action were prevented by interaction with a deep or partially grounded moving pressure ridge. In this case, the structure would become an extended structure for which the ridging mechanism would apply.

IV. STUDY AREA

All studies were conducted near the grounded ice feature or floe-island located approximately 109 miles west of Barrow at 72° 3.4' N, 162° W., and adjacent to and within the fast ice at Barrow, Alaska.

V. EQUIPMENT AND METHODS

A. Introduction

In previous work, we had used self-contained remote data stations to measure stresses in land fast ice. An aerial reconnaissance of the floe island was made in May, 1975 and again in September, 1975. These flights disclosed several features of its morphology which dictated important changes in the data-gathering techniques to be used there. We had previously envisioned laying cables from a safe location to several sites of ice activity where transducers would be emplaced. The size of the island and its extreme ruggedness made this impossible and required radio telemetry links for data transmission. Very little was known about the rapidity with which stresses fluctuate in breaking ice. However, it was known that the rate of stress application seriously affects the measured strength of sea ice in laboratory tests, and Schwartz's (1970) results from an instrumented bridge pier included some variations at frequencies above 10 Hertz. A digital recording system using magnetic tape was initially selected as the one most likely to meet the requirements of power consumption and frequency response. In this system, which was designed and built at the University of Alaska, data acquisition was under the control of a micro-computer which made decisions as to whether significant changes in stress have occurred within successive sampling periods. If so, the data was recorded, together with time reference data. During inactive periods, no data was to be recorded.

B. Equipment

The stress measuring technique used during the experiments has been described by Nelson (1974, 1975). While the electronics instrumentation used at the floe-island differed from that used at Barrow, the principle of stress measurement was the same in each case: The stress transducers used in these tests are essentially uniaxial load measuring devices. When embedded in a material such as ice, their output is directly proportional to whatever loading is transferred to them from the ice. If a transducer is stiff, it supports more than its share of the stress. In this case, the transducer output reflects both the magnitude of the ice stress, and a stress concentration factor which depends on transducer geometry, transducer stiffness, and rheology of the ice. It has been shown (Hawkes, 1969; Nelson, 1975) that the stress concentration factor is reasonably constant for a given transducer, regardless of the effective ice stiffness (including creep), provided it is in fact stiff relative to the surrounding material. Therefore, such a load cell can be used as an embedded stress-measuring transducer. Nelson et al., (1972) have found that stiff transducers can be used to measure ice stresses close to the compressive failure of the ice. In addition, stiff transducers should be capable of measuring initial stresses present at the time of transducer installation if the host material can creep. An in-situ emplacement usually involves removing a block of ice from an existing ice floe, making a small hollow in the ice to accept the transducer, and refreezing the block and the transducer into the ice sheet. Subsequent creep in the ice should readjust the local stress field until the transducer and replaced block assume their full share of the load, a process which takes place most rapidly for warm, saline ice.

Although these are uniaxial transducers, they do have a transverse sensitivity; a transverse compression will register as an apparent axial tension with a magnitude indicated by Poisson's ratio for the ice. This has been discussed more completely in Nelson et. al., (1972).

The transducers used in the land-fast ice near Barrow in 1975 were 1.5 inches in diameter by 5 inches long and contained four strain gages connected in a Wheatstone bridge supplied by a Zener diode-regulated DC source. The signal from the bridge was amplified by an operational amplifier. A DC to DC converter provided $\pm$ 15 V from a 12 V source. A relaxation oscillator and solid state timer provided timing pulses to a relay which shunted the bridge with 750,000 ohms once each hour to provide time marks on the recorder chart. Two-point Rustrak recorders were used to record signals at 1 point per 8 seconds and 1 inch per hour chart speed. The movement was diode protected. Since each recorder had two data channels, one channel was used at a sensitivity corresponding to approximately 0 $\pm$ 90 psi ice stress. The second channel monitored the same transducer at approximately 0 $\pm$ 1800 psi to record high stress events. Both the batteries and the electronics were housed in a rugged, insulated box which had a thin, uninsulated bottom. Snow was heaped up around the box for further insulation. Thus the effects of severe air temperature variations on the electronics, recorder, and power supply were minimized by the insulation and the thermal mass of the ice, while the interior of the box was heated by power dissipated in the electronic package.

The transducer bodies used in 1976 and 1977 are shown in Figure 1 with the protective copper sleeve removed. The brass slug is 5.08 cm (2 inches) in diameter by 16.9 cm (6.67 inches) long, and 10.2 cm (4.0 inches) in the center section have been milled to a 2.54 cm x 3.56 cm (1 x 1.4 inches) rectangular cross section to make room for strain gauges and electronics.

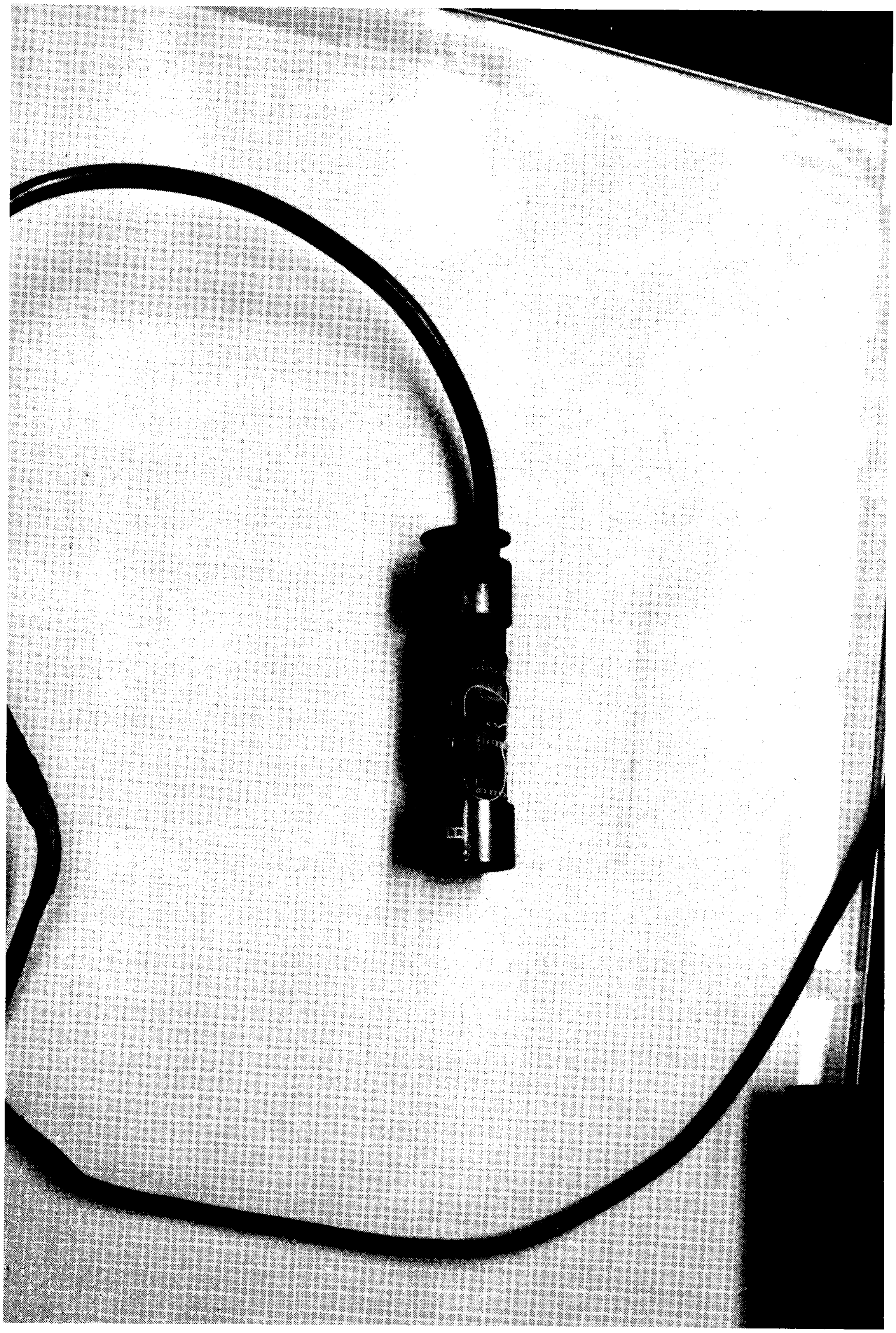

Figure 1.   Ice stress transducer with tubular cover removed.

Because of the remoteness of the floe-island, its size, and the fact that destruction of the data gathering stations was likely, it was decided to telemeter data from the stress transducers to a safe recording location at the center of the island, or, in the case of experiments near Barrow, to a safe location on the shoreline. For this purpose, each transducer was equipped with an internal voltage controlled oscillator (VCO) to convert the amplified output of the 1000 ohm strain-gauge bridge to a frequency modulated (FM) signal. Four FM signals were multiplexed into one transmitter (Monitron T-15F-13) whose signal was sent to the central receiving station. Standard IRIG center frequencies were used for the VCO's with $\pm$ 7 1/2% modulation. At each transmitter three channels were used for stress transducers while the fourth was available for an auto-calibration signal. Each transducer was fitted with a 2.37 megohm resistor which could be shunted through a relay across one leg of the Wheatstone bridge to provide a known calibration signal. These relays were controlled by a central timing network which also controlled the signal level on the fourth channel. In the reduction of the data, a signal on channel four going from negative full scale to positive full scale was regarded as an indication that the outputs of all channels during that period were to be regarded as calibration data. For the floe-island experiment, system sensitivity was set at 6.89×10^6 N/M^2 (1000 p.s.i.) full scale. At Barrow during 1977, sensitivity was set at 2.52×10^6 N/M^2 (366 p.s.i.) full scale for #3 transducer, 3.06×10^6 N/M^2 (444 p.s.i.) full scale for #2, and 3.16×10^6 N/M^2 (458 p.s.i.) full scale for #1.

Because of the possible temperature changes during the experiments, close attention was paid to thermal compensation of the transducer systems. Since the strain bridge, amplifier, and VCO were all contained in the transducer shell (see Figure 2) a two point thermal compensation of the entire subsystem could be effected by including a thermistor (THMS). The system was balanced to zero output at 0° C by adjusting resistors (B) and (F). The system was then cooled to -20°C and rebalanced with resistor (T_c). This provided the desired thermal compensation and reduced temperature generated signals to less than 0.138 x 10^6 N/M^2 (20 p.s.i.) between the two calibration points. Thermally caused variations in the transmitter were specified by its manufacturer to be less than 0.005% of center frequency over the range of -40°F to +80°F. The transducers and transmitter were powered by lithium batteries placed in an insulated box on the ice, for the brief floe-island experiment, and by Carbonaire batteries for the longer experiments at Barrow.

Each transmitting channel used a Monitron R-15F-N receiver. The four signals on each channel were then separated and demodulated. The four data channels were then sequentially sampled and converted to digital information at a rate of one channel every 0.008 seconds. This permitted recording at frequencies up to 15 Hertz when eight data channels (two transmitters) were in use. The frequency response was limited by the digital panel meter which was used to digitize the analog data. Channel sampling was under the control of the central processor (CPU) which stored the signal level of each channel and the time only if the stress level was $\pm$ .0689 x 10^6 N/M^2 (10 p.s.i.) different from the previously stored reading on that channel. When the CPU memory filled up, all recorded data were dumped onto the magnetic tape in B.C.D. code and the memory was reset for further data acquisition. Data was put on the tape at a density of 1.66 x 10^4 data points per tape. During the

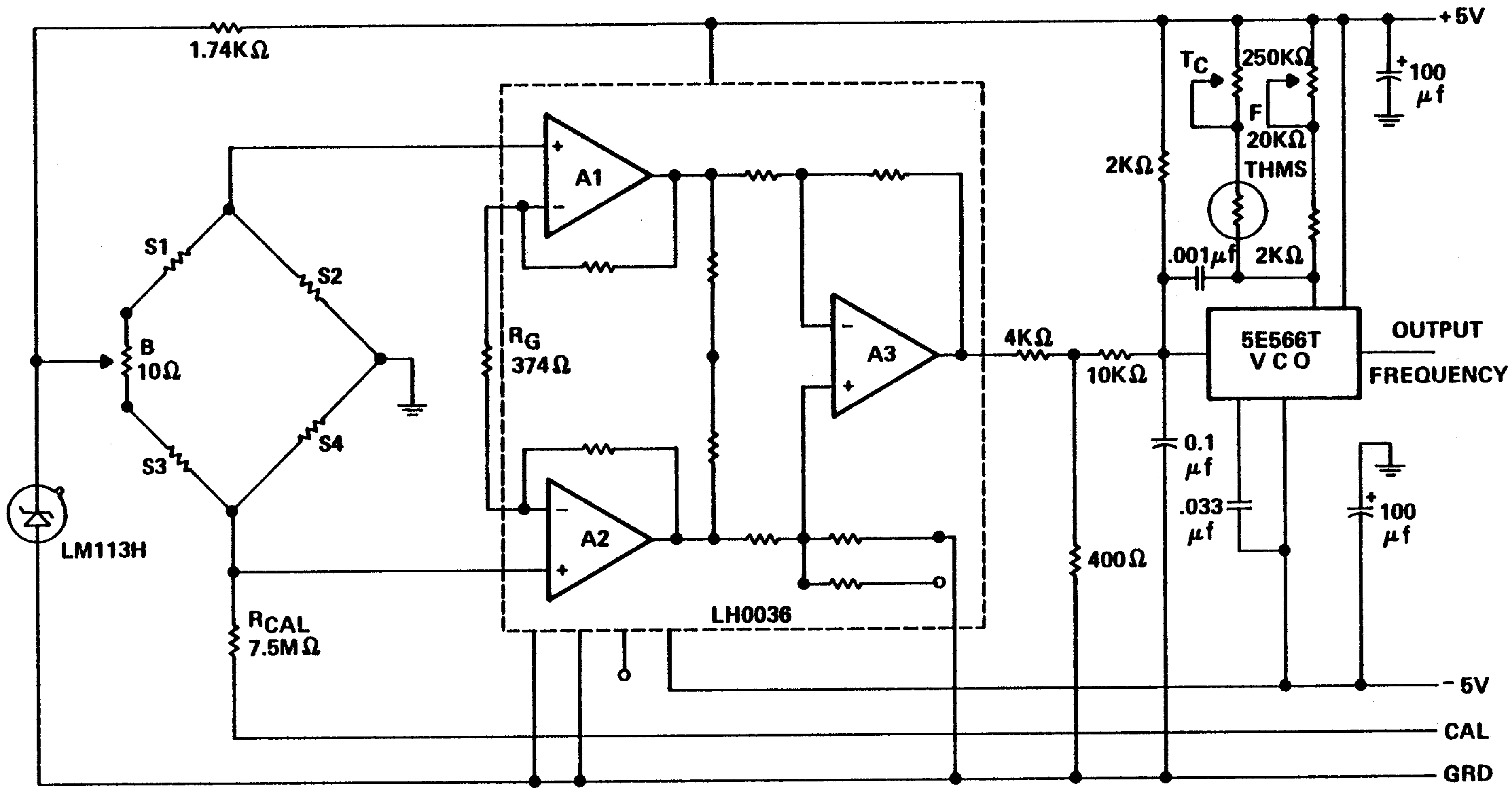

Figure 2. Electronic circuit contained within transducer housing.

time the data was being dumped to the tape, frequency response was limited to 0.15 Hertz.

Since the equipment at the central data recorder was in a protected environment, its thermal sensitivity was less critical than the transducers. The equipment was located in an insulated box inside a shelter at the center of the floe-island. Lead/acid batteries were used to supply power. A parallel recording system using Rustrak recorders was included to provide redundancy.

C. Methods

After the initial deployment of the ice stress telemetry system at the grounded ice mass located 100 miles west of Pt. Barrow in 1976, plans were made for the 1976-77 winter season which would increase the time for data acquisition, provide for more exact detection of ice movement, and reduce the time required for initial data reduction. The essential focus of the experimental program was examined to determine whether such data could be gathered within the range of the ice movement radar station at Pt. Barrow. Although ice ridgebuilding and failure is occurring virtually continuously at the grounded ice mass, which is exposed to the movement of the pack ice directly, the ice movements near the shoreline at Pt. Barrow can occur as seldom as a few times each winter, so that the fortuitous cooperation of nature was more essential, and provision was made for data acquisition for as much of the 1976-1977 winter as possible.

It was decided to install the ice stress telemetry transmitter beyond the farthest grounded pressure ridge at Pt. Barrow in 1977, and provide it with battery power sufficient for at least four months of the active ice season. The receiver and recorders, located at the radar site on the shoreline, could then be operated indefinitely from the line voltage available there. The grounded pressure ridge served as the static obstacle for the experiment. Movement of the ice was automatically recorded on film by the ice dynamics radar located there, so that ice ridging motions could be qualitatively described and related to ice stresses observed by the telemetry system.

Prior to the 1977 deployment, detailed laboratory checks of the 1977 system were made, which included load calibration, low-temperature calibration, and other tests. An analog recording system was implemented for the receiver station, since a heated and accessible location was available. Three Esterline-Angus chart recorders were driven from the output of the IRIG discriminators, at 730 Hertz, 1300 Hertz and 2300 Hertz, corresponding to the three channels of ice stress data. Because it was expected that data would only be obtained during a limited number of ice stress events, which could readily be analyzed from chart recordings, the provision for digitally-recorded data and subsequent computer processing was deemed unnecessary, and was not utilized.

VI. FIELD OPERATIONS, RESULTS AND DISCUSSION

A. SHOREFAST ICE AT BARROW, - NOVEMBER, 1975:

It was originally planned to conduct a field trip to the floe-island during late October 1975. However, the telemetry stress stations were not available at that time.

It was brought to our attention at that time that a number of grounded multi-year ice floes were present in water up to about 15 meter depth at Barrow, Alaska. If massive enough and truly grounded, one of these floes would provide a safe location for non-telemetered instruments, while forcing the surrounding annual ice to break during the approach of pack ice. An additional factor was that the ice surveillance radar system operated by the University of Alaska, at the Naval Arctic Research Laboratory (NARL) at Barrow, Alaska, would be available to monitor ice motion. On a reconnaissance flight, in October, 1975, a suitable grounded floe was found by Dr. Lewis Shapiro and Mr. Robert Simms. Six transducer systems were obtained on loan from the University of Alaska Sea Grant Program and prepared for service. On November 5, 1975, a second reconnaissance flight was made to find the previously selected floe. However, in the interim the pack ice had begun to move, closing the open lead near the shorefast ice, and generating a strong shearing action as it moved in a generally southwesterly direction parallel to shore. As a result the once-smooth shorefast ice was deformed into a field of broken blocks composing the early stages of the barrier ridge which would form along the coast later. The previously selected floe could not be found and was apparently either buried or broken up. An alternate floe was located near the shear ridge which was then active parallel to shore, but when equipment was landed on it by helicopter, it became apparent that it was not secure, as the adjacent blocks were visibly moving and the floe itself was cracking. On November 7, a third floe was located approximately 2.4 Km off-shore of N.A.R.L. Six transducers were installed at this location on November 9.

By this time, the ice action had ceased and later the pack moved away. Since the ice surrounding the floe was broken and piled to about 1 meter it was not possible to install the transducers in ice adjacent to the floe. Therefore, they were installed in the floe itself at a depth of 0.25 meters. It was reasoned that stresses in the floe would be related to forces at the border between the pack and shorefast ice masses during subsequent motion. No other measurements would have been feasible.

Although no thickness measurements were made, it is unlikely that the floe or the adjacent broken ice was grounded since the water depth at this location is approximately 30 meters.

Several days after installation of the transducers, the pack ice returned. The instruments and data were retrieved on December 18, 1975.

Examination of the time lapse films taken of the ice surveillance radar screen during November 1975 shows that the ice approached the instrumented site with a relative motion nearly parallel to the landfast boundary, which lay about 4 kilometers offshore, with about 2.4 kilometers of ice extending seaward from the main pressure ridge. No new pressure ridge formation could be detected on the radar image. This shearing motion continued with some interruptions until December 6, 1975. No ice motion with a strongly on-shore velocity component occurred during this period and there was no accumulation of ice at the boundary. The chart records from all of the stress stations have been examined to locate high stress events. All of the charts contain off-scale events, with some records being highly erratic much of the time. We do not believe these events are valid occurrences of high stress. Instead, we feel that they are spurious results which are due to damage caused to the main electronics battery pack which was dropped while being unloaded from the helicopter. Previous experience has shown that the DC to DC converters used in the electronics package have a poor tolerance for supply voltage variations, and when the battery voltage is too low, a specific type of off-scale event occurs. This low battery condition is characterized by operational failure of the relays in the timer circuit and in the coarse/fine alternation circuit. The result is the loss of both timing marks and the coarse trace (low gain trace). Discounting records of this type, there was no indication of high stress events in any of the recorded data. Those periods of time where one or more channels were in operation indicate only semi-diurnally varying stresses of about 10 p.s.i. peak to peak, which are probably tidally generated.

On December 6, 1975, at about 2100 hours, the moving ice approached the shorefast ice at an angle of about 45° to the edge of the land fast ice. That is, it approached from nearly due north. Between 2130 hours and 2200 hours, a pressure ridge formed at the outer edge of the shore fast ice, about 2 1/2 miles offshore. The ridge grew progressively from the northeast to the southwest and was clearly discernable on the radar images. None of the stress transducers were operating during this time as their batteries had all apparently been depleted.

Because of difficulties with the battery pack, the experiment produced only intermittent data and it is difficult to draw firm conclusions about the stresses in the ice during this time. Further complicating the picture is the fact that the transducers were placed within a large hummock field and over 1.6 KM. from the boundary at which ice activity occurred following their placement. However, the distinct lack of either identifiable stress events or deformation in the fast ice indicates that stresses generated in the interior of land-fast ice may be low when the pack shears past it. Further experiments with telemetered data and extensive on-site visual monitoring obviously were required to adequately examine this mode of ice action. Such an approach was used in Spring 1977, and is discussed below.

B. PACK ICE, FLOE-ISLAND (SPRING, 1976)

The main experimental periods at the floe-island were selected to be March 15-23, 1976 and April 3-10, 1976. These periods coincided with coverage of the area by the LANDSAT II Satellite. On February 20, 1976, an initial visit was made to the floe-island. A major purpose of this visit was to determine whether an adequate radio link could be established by the 10 foot high antennas which were to be placed on the top of high ridges in the floe-island and the adjacent pack. A transmitting station, consisting of a transmitter and an antenna, was established near the southwest end of the floe-island. The floe-island in this area consisted of flat floes about 100 meters in diameter and pressure ridges 3 to 6 meters high. A floe was selected which was well removed from the new ice which had formed behind the island. We then expected to move away several kilometers toward the head of the island and check for radio reception. However, operational problems with the helicopter forced an immediate return to Barrow without being able to retrieve the transmitting station. Further logistic difficulties with the helicopter prevented our return for 7 days. During this time, the ice in the area reversed its motion, breaking up both the new ice and the existing floes and creating ridges as high as 15 meters. The transmitting station was not at its previous location, and could not be found.

On March 17, 18 and 19, 1976, coincident with the LANDSAT II overpasses, logistics items (fuel and shelter) were successfully deployed to the floe-island by helicopter. Extensive aerial photography was obtained for the three days. The change in ice configuration around the island during the changing weather conditions of the three days provided considerable insight into the dynamics of pack ice around grounded structures. Both steady-state and transient flow patterns of the ice sheet were observed.

During the emplacement of the shelter and reserve fuel supplies at the island on March 17-19, 1976, a trip was made on each of the three days in a Bell 205 helicopter, which afforded the opportunity to observe and photograph the patterns of the pack ice in the vicinity of the grounded ice mass. Visibility was virtually unlimited, and the daily changes in the ice were very prominent. As a point of reference, the image of the grounded ice mass as shown on LANDSAT on March 18, 1976, at 12:04 AST, is presented in Figure 3.

On March 17, the wind had been blowing from the northwest for five days, allowing the pack ice around the island to develop a steady flow pattern past the island, as is crudely sketched in Figure 4. The island was elongated, and there was open water along both sides. The major axis of the island was aligned approximately with the prevailing wind. At the ends of the elongated island were a number of smaller ice floes, and a definite pattern of long, parallel cracks had developed in the pack ice. These cracks were aligned with the wind direction. There were several such cracks windward of the island extending more than 20 miles, as illustrated, and several leeward of the island as well. There was a second, smaller (100 ft.) fragment of grounded ice in the open water to the west of the major island. The pattern of ice flow is reminiscent of the slightly divergent flow of granular material past a fixed obstacle, a behavior of ice which has also been noticed by Sodhi (1977). A wedge-shaped region of relatively fixed, but probably ungrounded, ice floes appeared at the end of the elongated island facing the flow of ice, as has been noted by Barrett and Stringer (1978).

On March 18, 1976, after an absence of 20 hours, the grounded ice mass was revisited (at 0900 AST). The intensity of the wind had diminished from its previous 5-10 knots to less than 5 knots, in fact to nearly calm, and was shifting towards the east. However, the existence of open

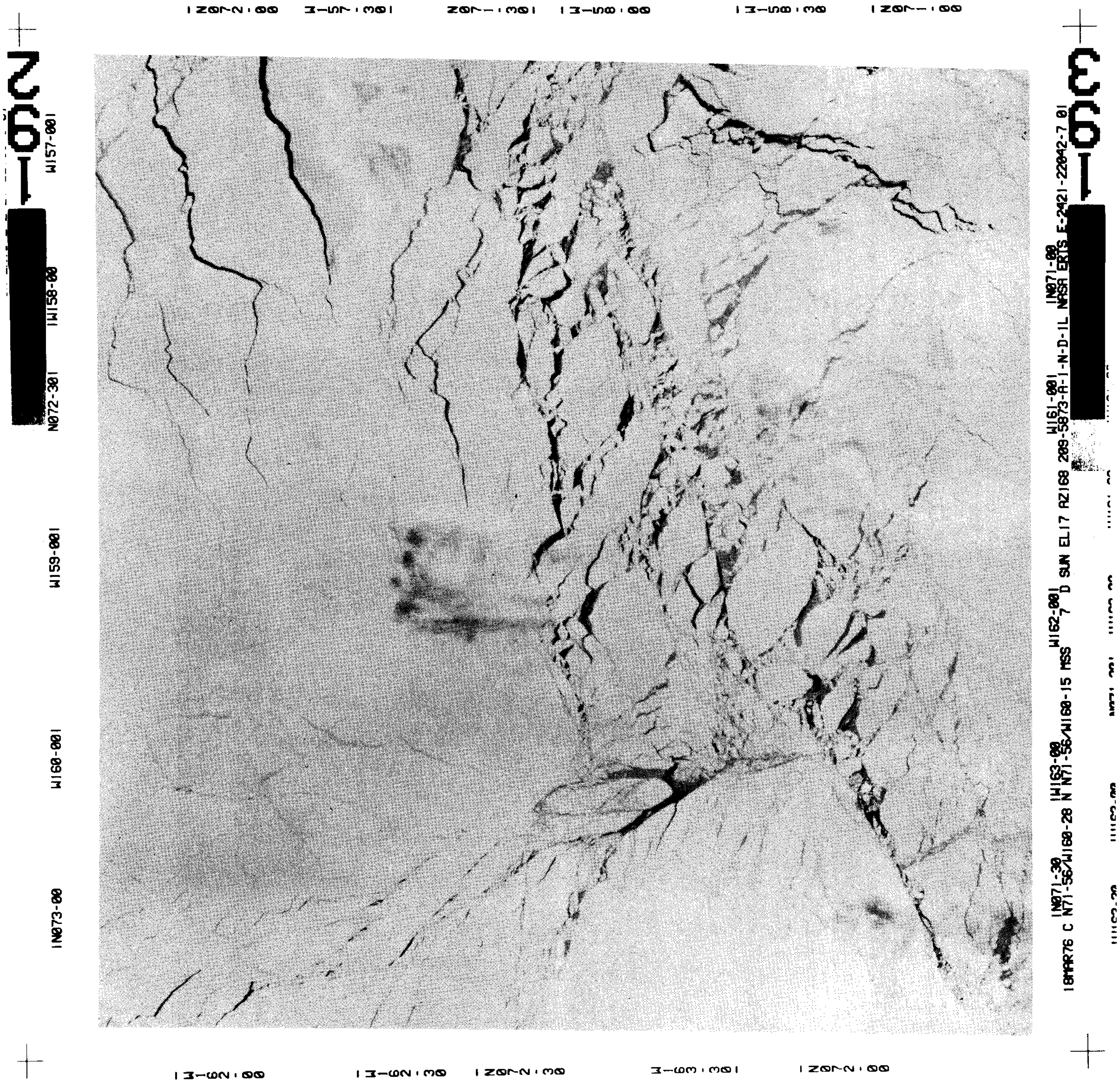

Figure 3. LANDSAT photo of grounded ice mass on March 18, 1976.

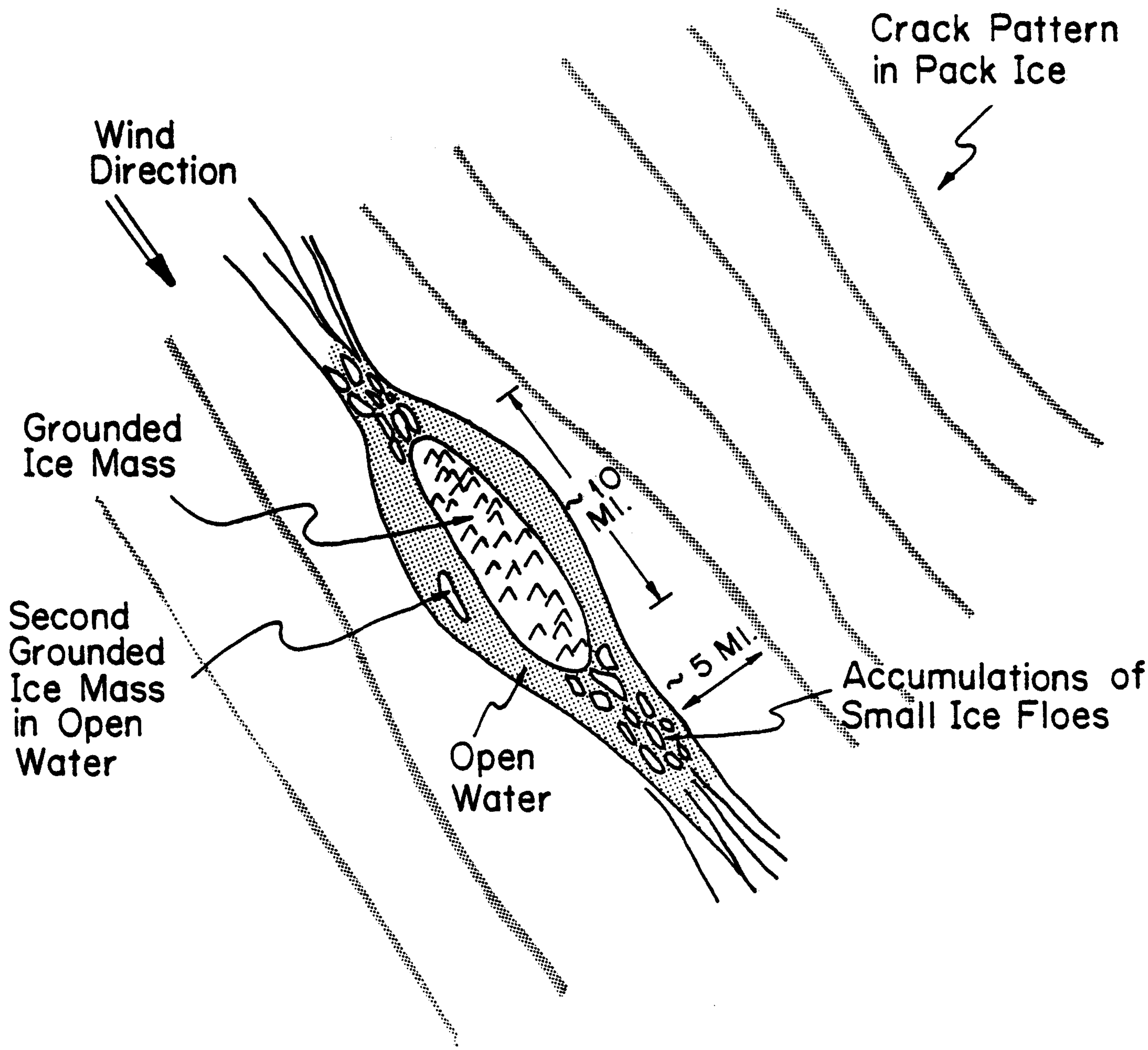

Figure 4. Sketch of pack ice pattern around grounded ice mass, March 17, 1976 (1200 AST) after five days of steady wind.

water indicated that pack ice motion at the island was still occurring, because of internal forces in the pack transmitted from great distances. A local, approximate sketch of the new island shape is shown in Figure 5, and the large-scale ice patterns for that time is shown in Figure 3. A dramatic series of ice events had taken place at the head of the island, involving the building of many parallel ridges. These ridges were obviously newly-formed, since there was no windblown snow about them, and they were not observed on the previous day. The open water on the sides of the island had disappeared, but a small region of open water was observed just south of the island. New, thin ice was forming in the open water adjacent to the island, and was attached to the island indicating that the direction of pack movement was from the north. One can infer that the extensive ridgebuilding which occurred at the head of the floe-island was in a region of poorly-grounded, fractured ice floes which were subjected to a shear movement by the pack during this transition in wind direction. The ice ridges on the island were up to 7 meters high, and resembled ridges in shorefast ice except that the ridges were more numerous, and that they did not seem to go in any preferential linear directions in the interior of the island, but formed random polygonal patterns with some small (200 meter) flat regions between them. These flat regions were some 1-2 meters lower at their center than at their edges, implying that they were supported to some extent by grounded ice ridges at their edges.

A third visit to the island was made on March 19, 1976 (at 1200 AST). The wind had been blowing gently from the east, at about 5 knots, for 24 hours. This wind had the effect of moving the pack ice away from the shorefast ice at Barrow, where there was about one mile of open water when we departed, and approximately ten miles when we returned. The tension in the pack west of the projecting Point Barrow was compensated

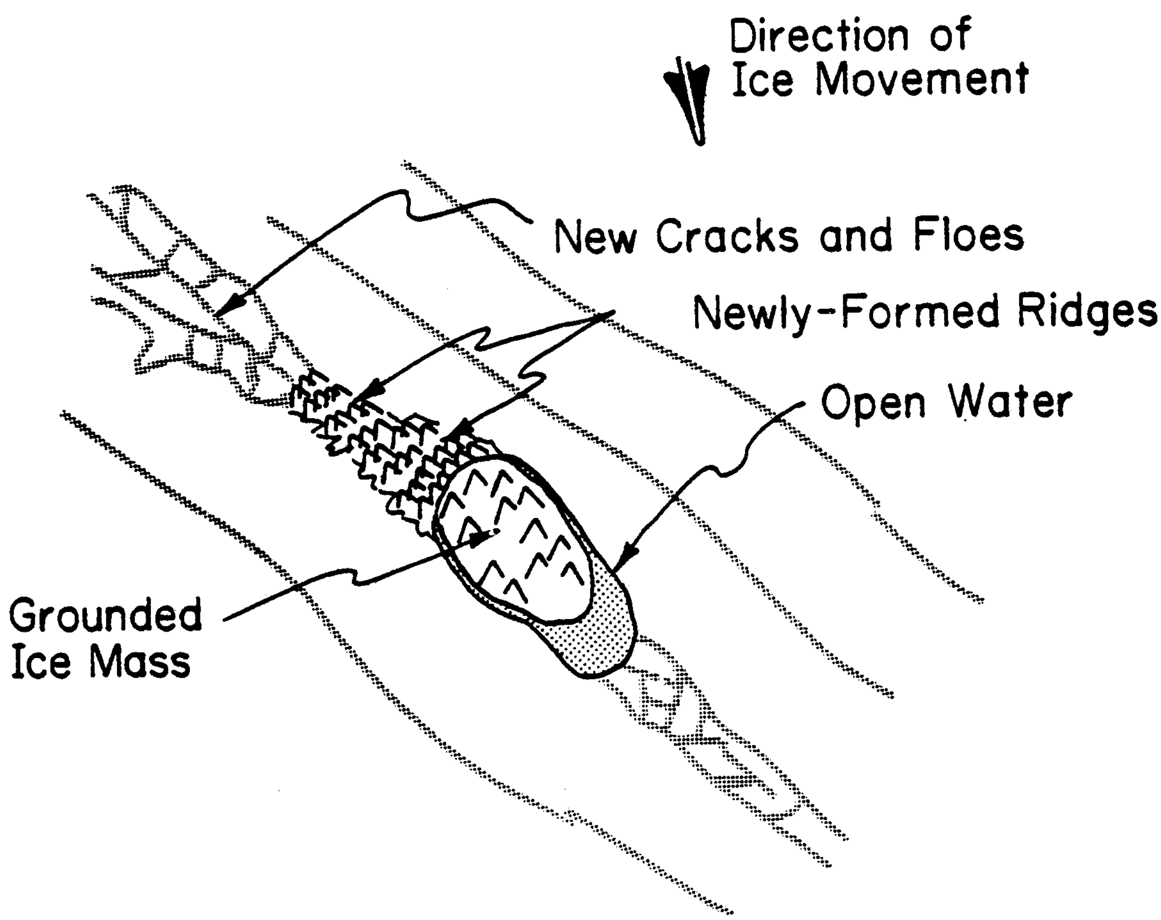

Figure 5. Sketch of pack ice patterns around grounded ice mass, March 18, 1976, (0900 AST), after wind had decreased to nearly calm.

by the presence of the grounded ice mass over a region 20 miles to the east of the island, in which no tension cracks were evident. In fact, there were many new ridges at the island, on the windward side, as crudely sketched in Figure 6. These were linear, parallel to the boundary of the island, and one can infer that they were formed by compression of the pack against the island. Buckling seemed to be a more dominant feature in these ridges, with many fragments upended, and buckled ice sheets between ridges. The only open water was to the southwest direction, and the open water was virtually free of ice floes and new ice, extending more than 30 km., beyond the limit of visibility which was set by the evaporation of ice fog from the open water, and by the aircraft altitude (400 meters). The Landsat photos for that day were quite obscured by this fog. A very large fragment of multi-year ice was discovered upended, and been pushed to a height of approximately 25-30 meters, near the south end of the island (Figure 7). In Figures 8-10, typical examples of the ridge patterns at the grounded ice mass are shown. Additional discussions of the ice patterns for this time interval, based upon interpretation of Landsat imagery, have been given by Barrett and Stringer (1978).

After observing pack ice movement around the grounded ice mass, several general impressions can be mentioned. First, it appears that the occurrence of regions of ice ridging and of open water are consistent with normal expected flow behavior for particulates. Second, it appears that the response time of the floating ice to changes in wind direction is within 1-4 hours. Third, it appears that the ice which is relatively free, on the lee side of the island, can move at average speeds of 2-3 km/hr., in a 5-10 knot wind. Fourth, the pack ice forces are definitely long-range forces, acting over distances of 50 km and more. Fifth, the ice pattern can be either steady state (such as probably existed on March 17) or transient (such as on March 18 and 19). Sixth, ridges are

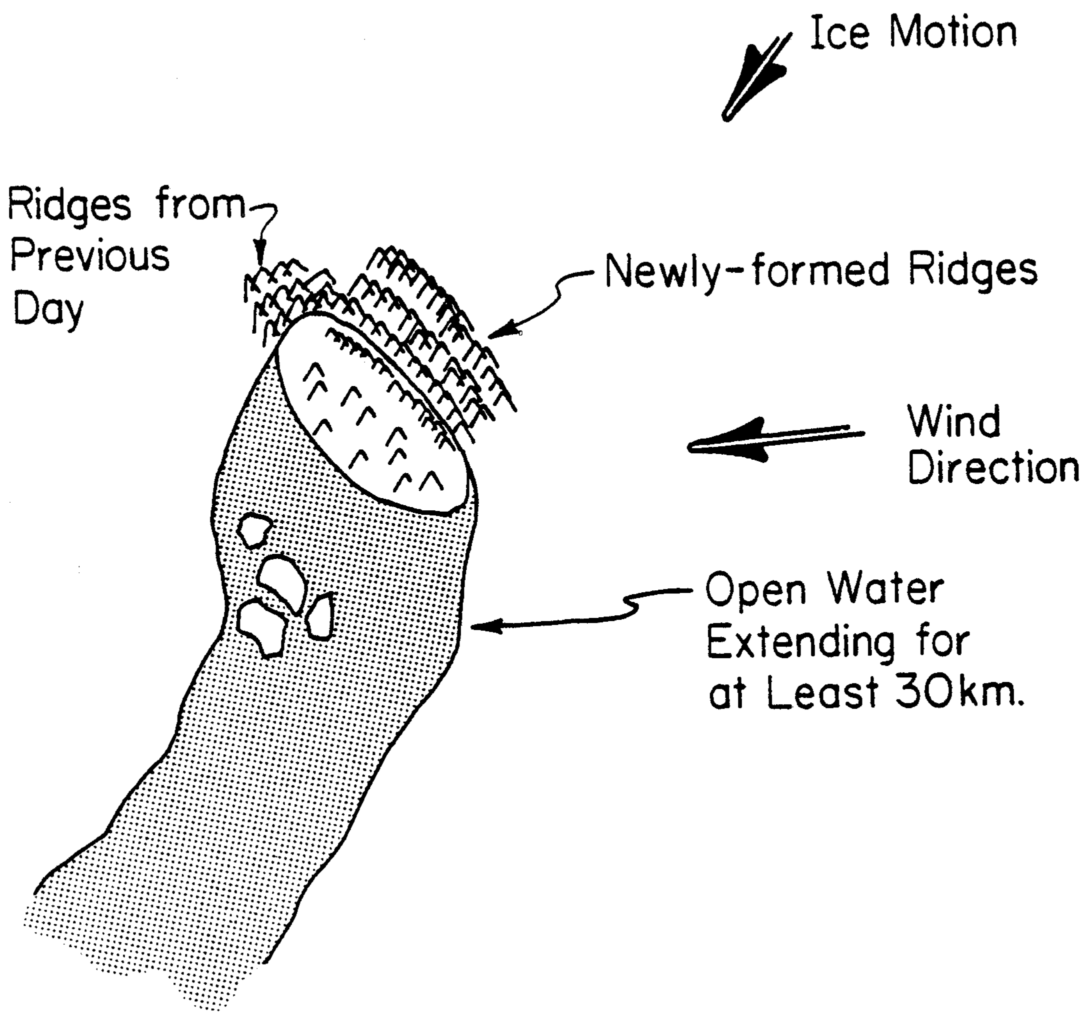

Figure **6.** Sketch of pack ice pattern around grounded ice mass, March 19, 1976, (1200 AST), after wind from the east for 24 hours at about 5 knots.

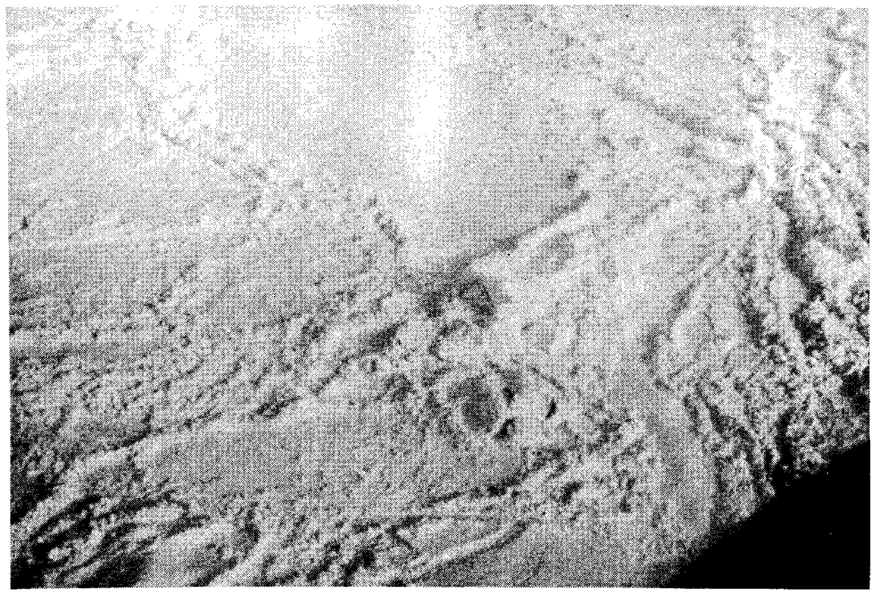

Figure 7. Photograph of ice fragment near south end of grounded ice mass, March 19, 1976.

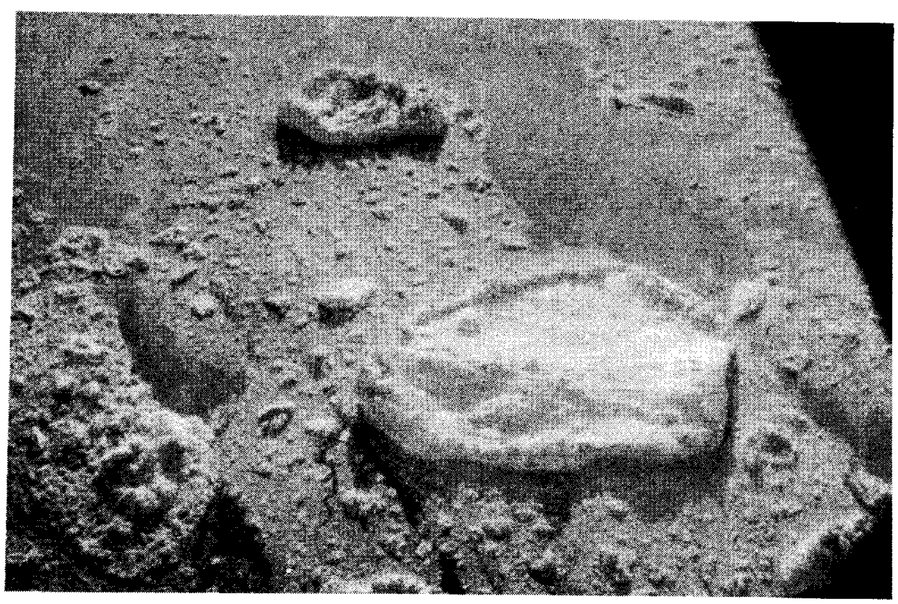

Figure 8. Photograph of small ice floe in open water adjacent to grounded ice mass, March 17, 1976.

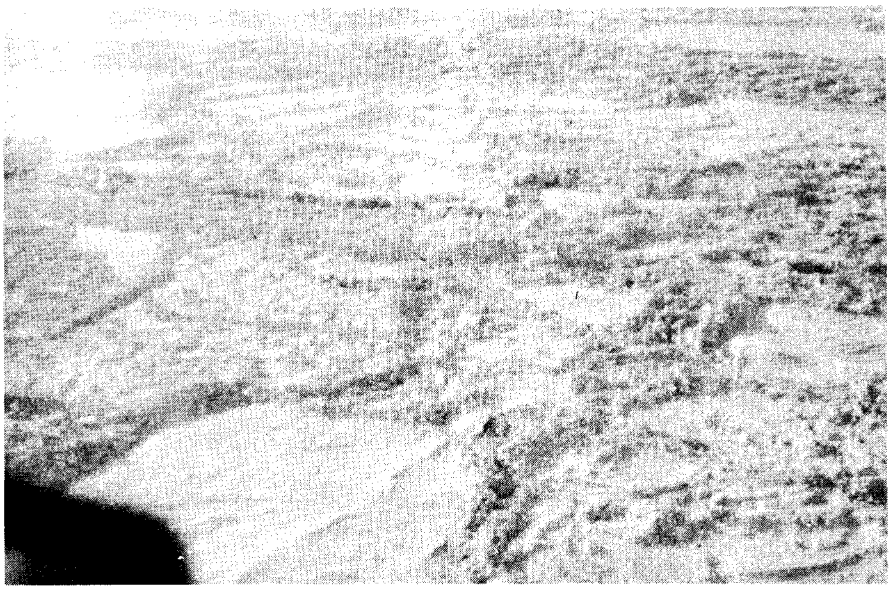

Figure 9. Photograph of ridges formed on Northeast edge of grounded ice mass, March 19, 1976.

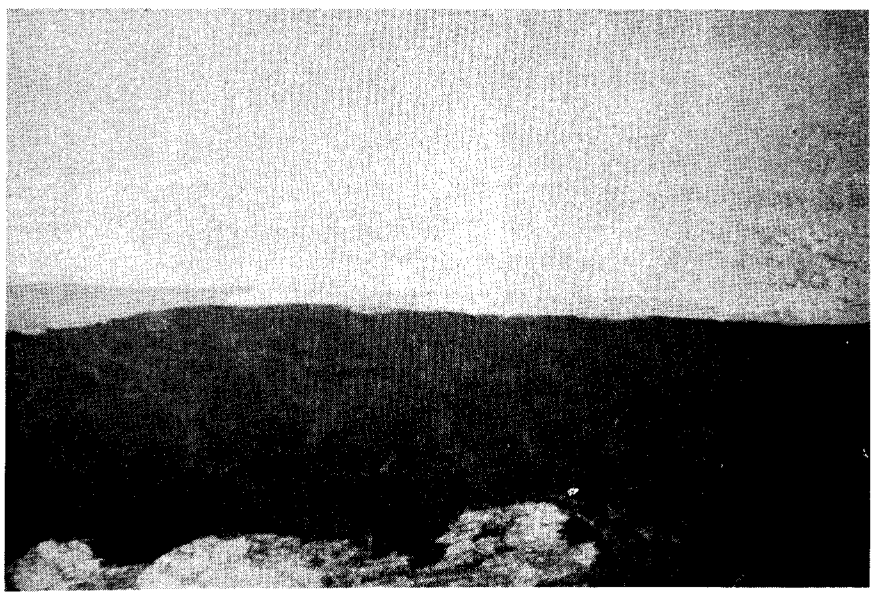

Figure 10. Photograph of open water on southwest side of grounded ice mass, March 19, 1976.

almost always forming at some point on the boundary of the "extended" grounded ice mass. With these rather general observations in mind, one can further appreciate and analyze the ice stress data which was obtained during the subsequent visit to the island, April 17-25, 1976, which is discussed below.

University of Alaska personnel arrived at Barrow, April 17, 1976, prepared to set up two stress experiments at the floe-island. However, a second aircraft was not available to escort the helicopter until April 19, and by this time the area was covered by low clouds and fog which made flying hazardous. The weather improved on April 20 and upon arriving at the floe-island we found that the instrument hut which had been placed on the island in March was still there and that the location was stable enough to place the data-gathering station there. A 4.6 meter (15 feet) high UHF antenna mast was installed on the hut roof with one antenna for receiving data, and a 91 meter (300 feet) long antenna was strung about two meters off the ice to provide a radio beacon for later navigation.

On the following day, April 21, the data receiver, microprocessor, and recorders were installed at the hut, and one station of three transducers was set out on the ice. The transducers were set in the middle of an ice floe, approximately 30 kilometers from the hut on a bearing of N15° E (magnetic). These figures were obtained from the helicopter's air speed and magnetic compass heading and are therefore approximate. The site was selected to be well out into the dynamic region of the ice on the windward side of the island. The ice in this region was composed of many floes separated by three to seven meter-high recent pressure ridges, with short re-frozen leads in several places. The ice was generally continuous and considerably more compact than that on the sides of the island. The thickness of the ice blocks in the ridges surrounding the floe was about 50 cm.

Because of threatening weather, time did not permit a thickness measurement of the floe, and only shallow salinity samples were obtained. The salinity was 0.5 p.p.t. at 5 cm depth and 1.5 p.p.t. at 25 cm depth. Thus the floe was probably multi-year ice. Three ice stress transducers were set out on this floe near its center and buried about 30 cm deep in the ice. Twenty to forty centimeters of wind-packed snow covered the site. The three transducers were oriented in a 0°-45°-90° rosette with transducers #17 (1700 Hertz center frequency) oriented to measure stress along a North-South magnetic bearing, #8 (3000 Hertz) magnetic East-West, and #6 (960 Hertz) magnetic North-West/South-East. The approximate location and orientation of the transducers is shown in Figure 11. The 4.6 meter high antenna for the UHF transmitter was placed on the high point of an adjacent pressure ridge and secured with ice pitons screwed into ice blocks. A large red cloth marker was laid out over the ridge and weighted down with ice blocks to help identify the site later. The installation process required two men working at top speed for two and a half hours. Once the transmitting site was in operation, it was necessary to return to the instrument hut to ascertain whether data was being received and to rotate the antenna for optimal gain. With this done, the unit was left to operate on its own with battery power to last for two days. Further deterioration in the weather prevented us from returning to the site for about one week. When the weather had cleared enough to return, the computer, recorder, and beacon had all ceased to operate because their batteries had been depleted. These instruments were retrieved but the floe with its transmitting site could not be located.

As described previously, the telemetered data was recorded simultaneously on strip charts and on magnetic tape. Reduced copies of the

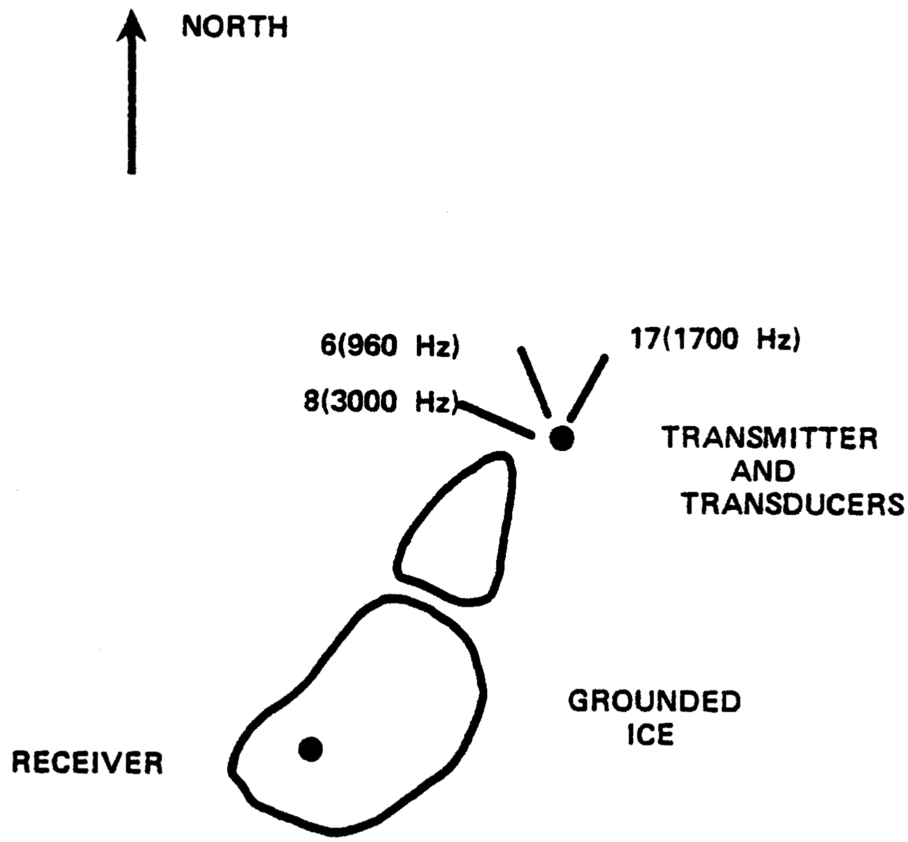

Figure 11. Approximate location of ice stress transducers at grounded ice mass on April 21, 1976. Lines give orientations of stress measuring axes.

strip charts for the three data channels and one unused channel are given in Figure 12, and details of some of the periods of activity are given in Figures 13-17. Because unregulated DC motors drive the strip charts, the time scale varies between the two charts. However, the beginning of the experiment and the time when the receiver batteries were exhausted are both clearly evident and allow justifying the time scale. Time data from a previous experiment with these recorders have provided the time scale which is superimposed on the charts and is estimated to be accurate to $\pm 5\%$. Since the stress transducers are essentially load measuring devices, it is necessary to convert the load sensed by them to stress in the nearby ice according to the following equation:

$$\text{ICE STRESS} = \frac{\text{Load}}{(\text{Transducer face area})\ (\text{Stress concentration factor})}$$

For the 5.08 cm (2 in) diameter transducers used here the stress concentration factor in sea ice is 3.2. This was determined experimentally by embedding a transducer in a 0.61 meter (2 feet) block of annual ice cut near shore at N.A.R.L. (Barrow, Alaska), on April 19, 1976, and loading it with a flat-jack as shown in Figure 18. The block was split vertically to facilitate removal from the ice and installation of the transducer, then both halves were replaced in the hole with plastic sheeting on the bottom to prevent re-freezing. The saw cuts were filled with fresh water, and after they had re-frozen the sides were relieved with a chain saw so that applying pressure to the flat-jack closely simulated uniaxial compression in the horizontal plane. A stress concentration factor of 3.2 has also been determined for 3.81 cm (1.5 in) diameter stress gauges with effective elastic modulus and length-to-diameter ratio identical to the gauges used here (Nelson, 1974).

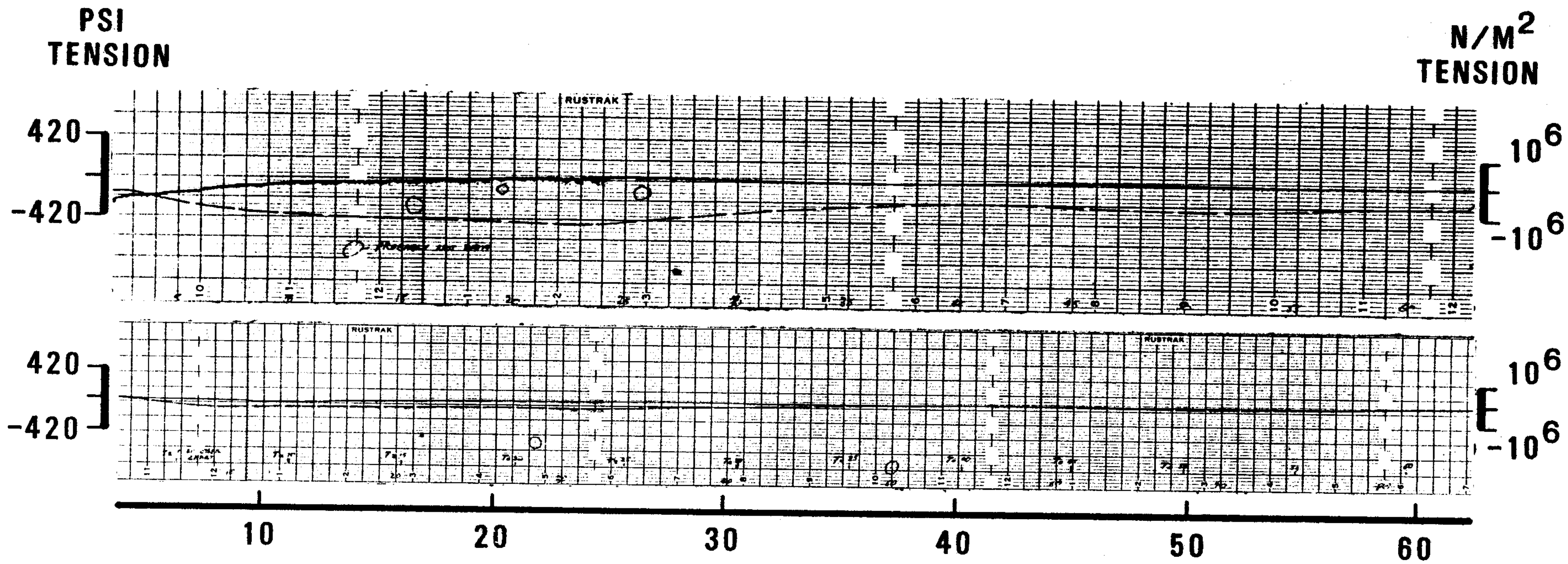

Figure 12. Chart recordings of stress transducer signals at grounded ice mass. The initial and final few hours described in the text have been omitted. The upper solid trace is the 3000 Hz sensor; the upper borken trace was unused. The lower solid trace is the 960 Hz sensor; the lower broken trace is the 1700 Hz sensor.

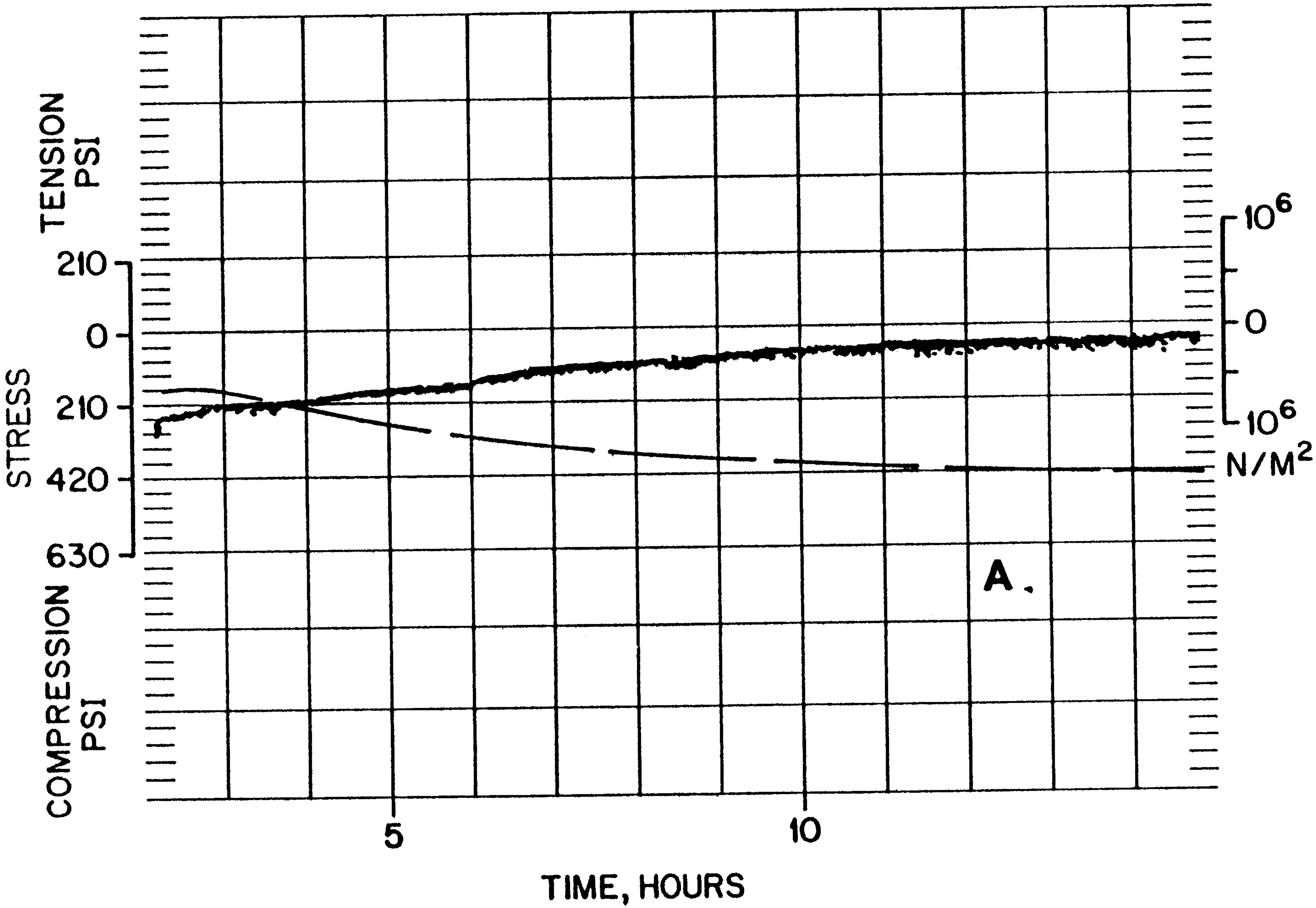

Figure 13. Details of stress data.

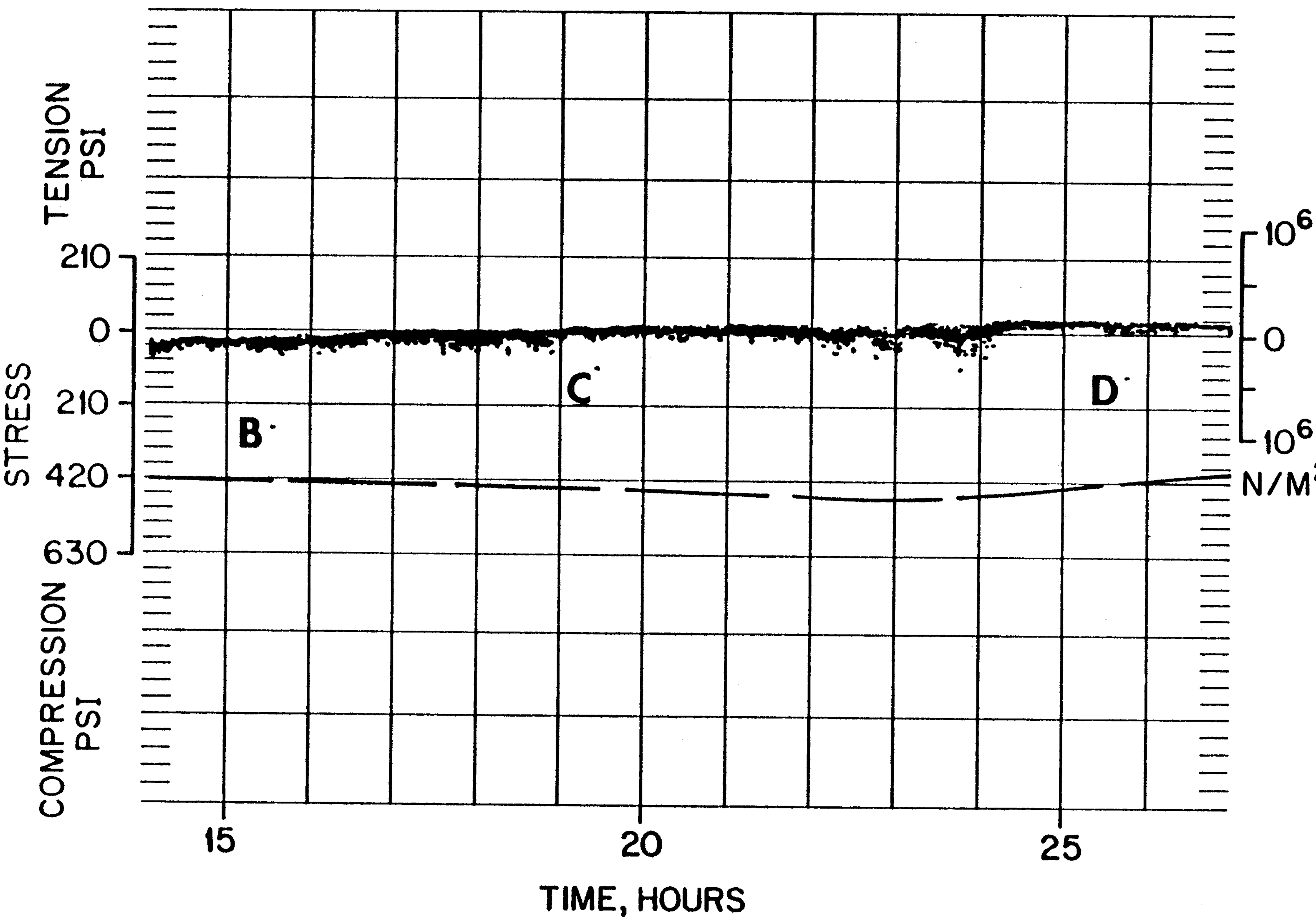

Figure 14. Details of stress data.

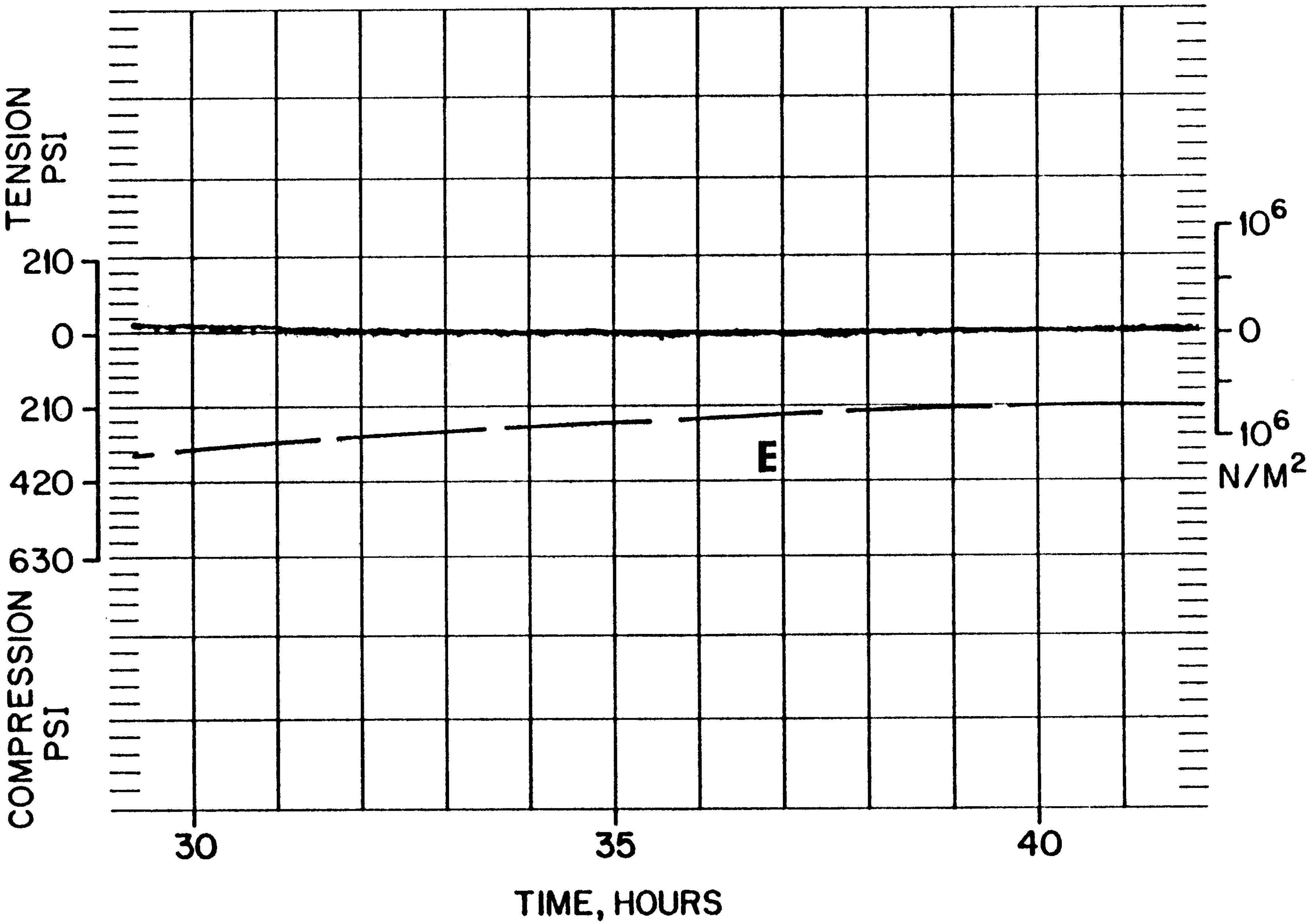

Figure 15. Details of stress data.

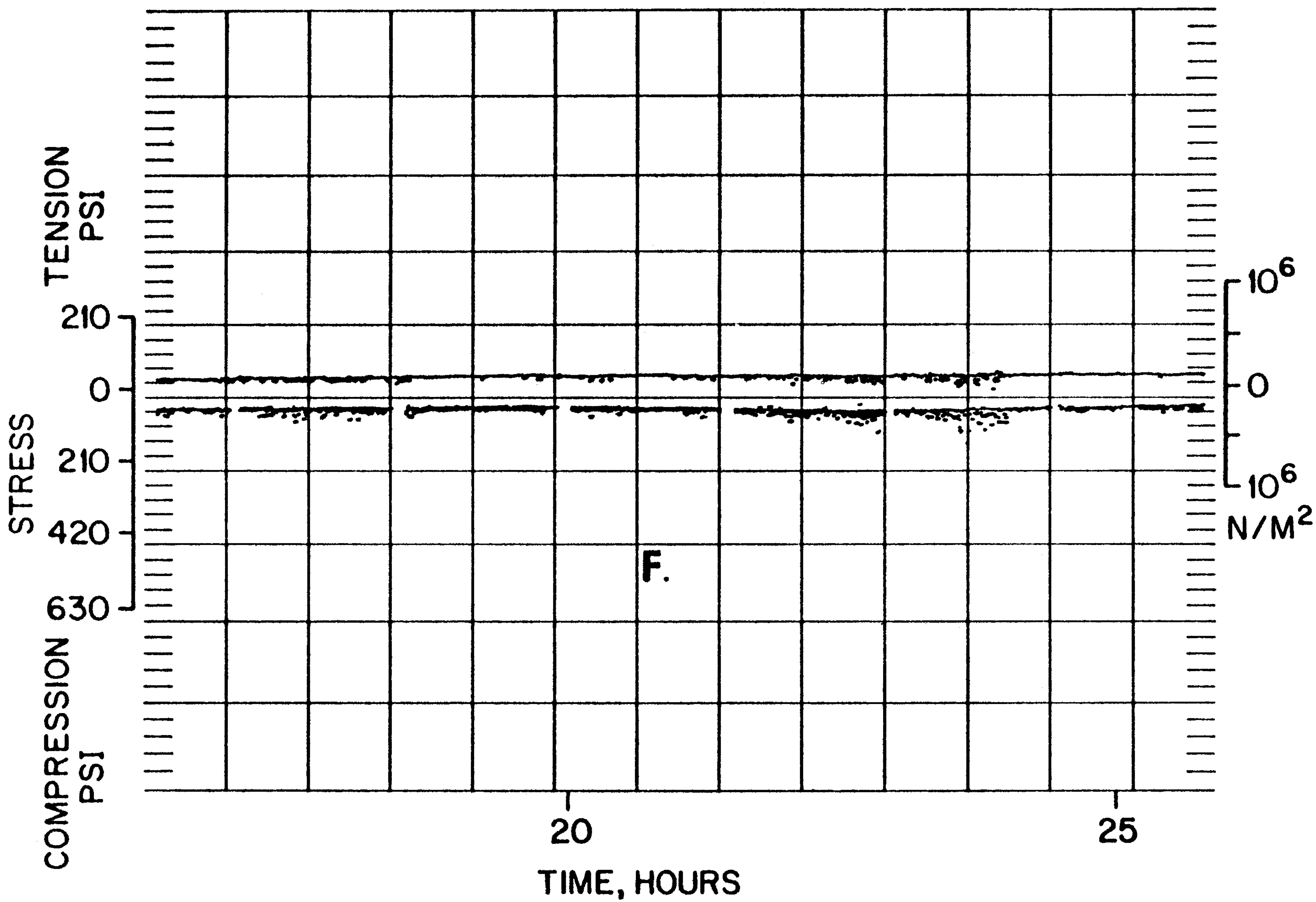

Figure 16. Details of stress data.

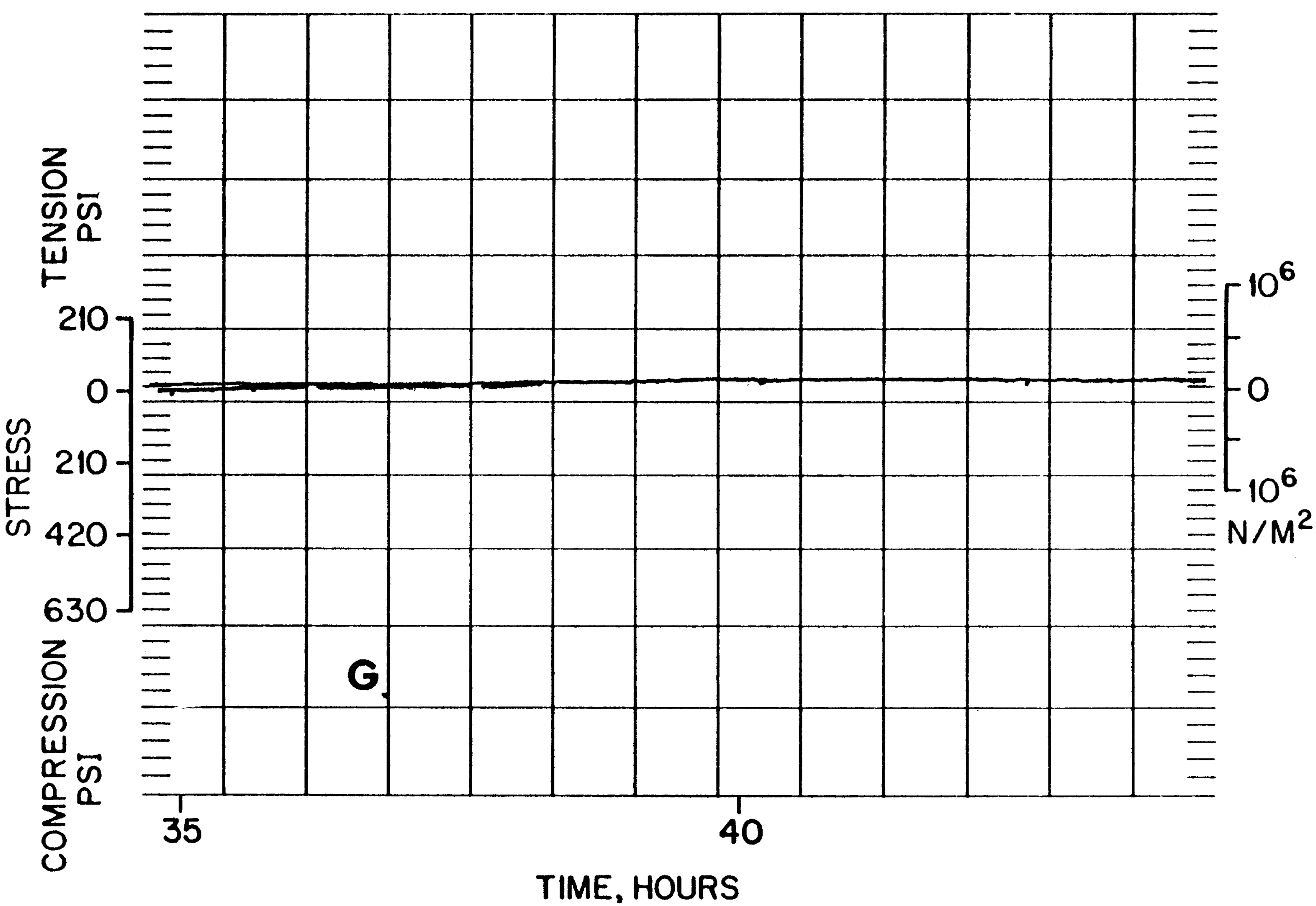

Figure 17. Details of stress data.

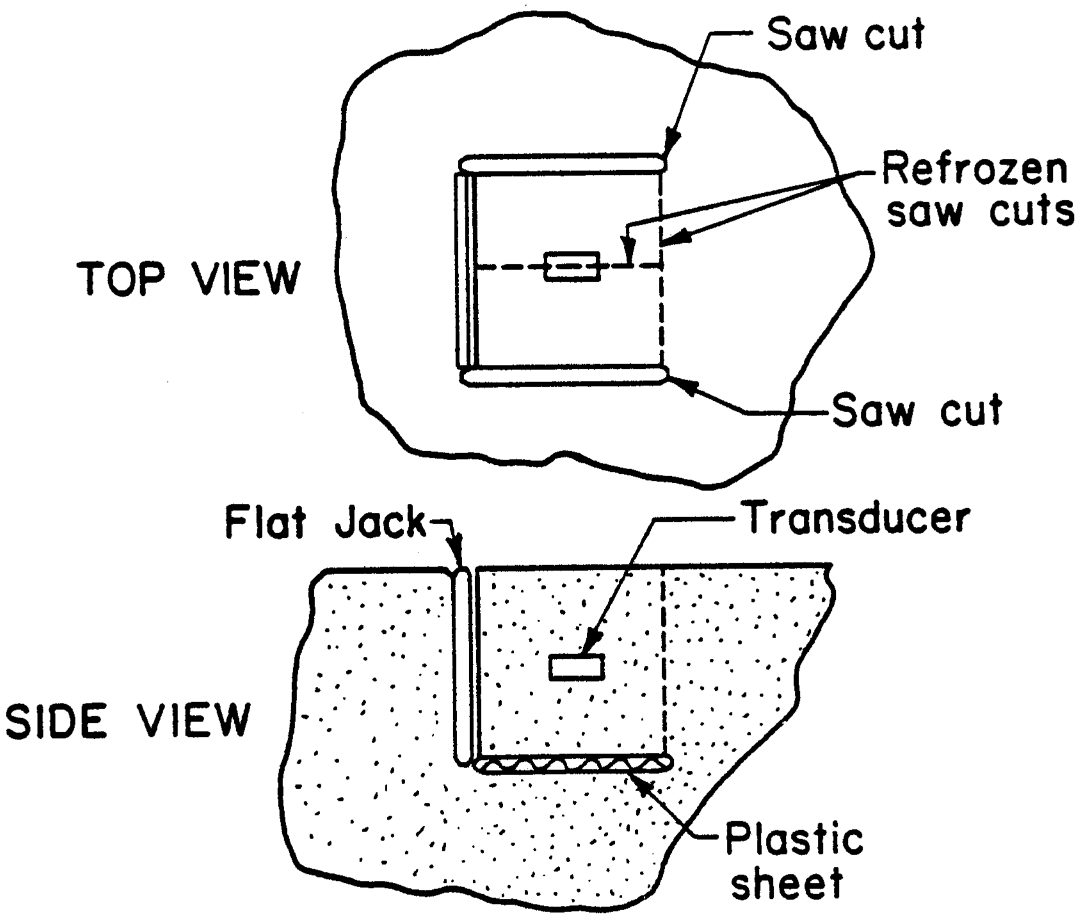

Figure 18. Calibration of stress gage.

A second installation using two transmitting sites was also planned for May 21, 1976. However, the ice proved to have too many areas of open water to allow safe operation of a helicopter without floats. Since no helicopter was available with floats at this time, the installation was cancelled. In June, a float-equipped aircraft became available, but at this time the weather was too warm to assure that the transducers would properly freeze into the ice, and hence no further installations could be made in Spring 1976.

The strip chart recordings for the period April 17-25, 1976, contain four significant changes which should be discussed:

1. Starting and ending behavior
2. Long-term drifts
3. Areas of clear stress events
4. Isolated single data points of high stress

At the start of each data trace is a period of about 2-1/4 hours which contains a broad noise band. During this time the receiver was working, but the transmitters were not yet powered, and the receiving antenna was connected to the wrong receiver. This noise band is characteristic of data obtained when the telemetry link is broken, and indicates that transmission was adequate during the rest of the period. At the end of the chart each trace becomes noisy, then goes off scale as the battery voltage powering the receiver fell below that necessary to operate the DC to DC converter. A separate battery powered the chart recorders which continued to operate.

There are several factors which contributed to the long-term drifts evident in the data. First, a catalytic heater was used to heat the building in which the receivers were located, and its fuel supply was exhausted after about 24 hours. Thus, since the receivers and discriminators had some thermally-induced drift, this temperature change produced a drift which was most evident in the unused channel whose receiver was unpowered. Second, a compressive transient is usually found in the stress transducer output as it is frozen into the ice sheet. Much of this stress transient occurred during the initial noise period, and only the decay was evident, lasting about 20 hours. Third, diurnal variations are seen in the last 48 hours which could have been either due to solar heating of the instrument hut, or due to thermally generated stress in the ice. As will be discussed below, it is felt that there was little stress on the ice floe during the last twenty hours of operation, and therefore the zero stress scales have been placed at these levels.

During the first 26 hours of the experiment, the floe on which the transducers were located appears to have been jostled about. Imagery of the region obtained by the NOAA II satellite for April 20, 21 and 22 is shown in Figure 19, and gives the impression that the location of maximum pressure on the island shifted from the Northeast edge on April 20 to North on April 21, and West on April 22. Thus, the location of the transducers may not have been at the point of maximum pressure during installation. However, it should be pointed out that only a few leads were encountered on the flight to the floe-island from Barrow and only one on the way to the transducer site. Thus, the apparent open water to the Northeast of the island, shown on satellite imagery, may in fact be warmer portions of thin ice in a region of re-frozen leads.

The change in direction of pack movement apparently is responsible for the random appearance of compression stresses in the traces for the first 26 hours of the experiment. Even in a position somewhat removed from the stagnation point, significant pressure could be expected as the pack moved past the fixed floe-island and the individual floes jostled one another, fracturing in areas of re-frozen leads and rearranging

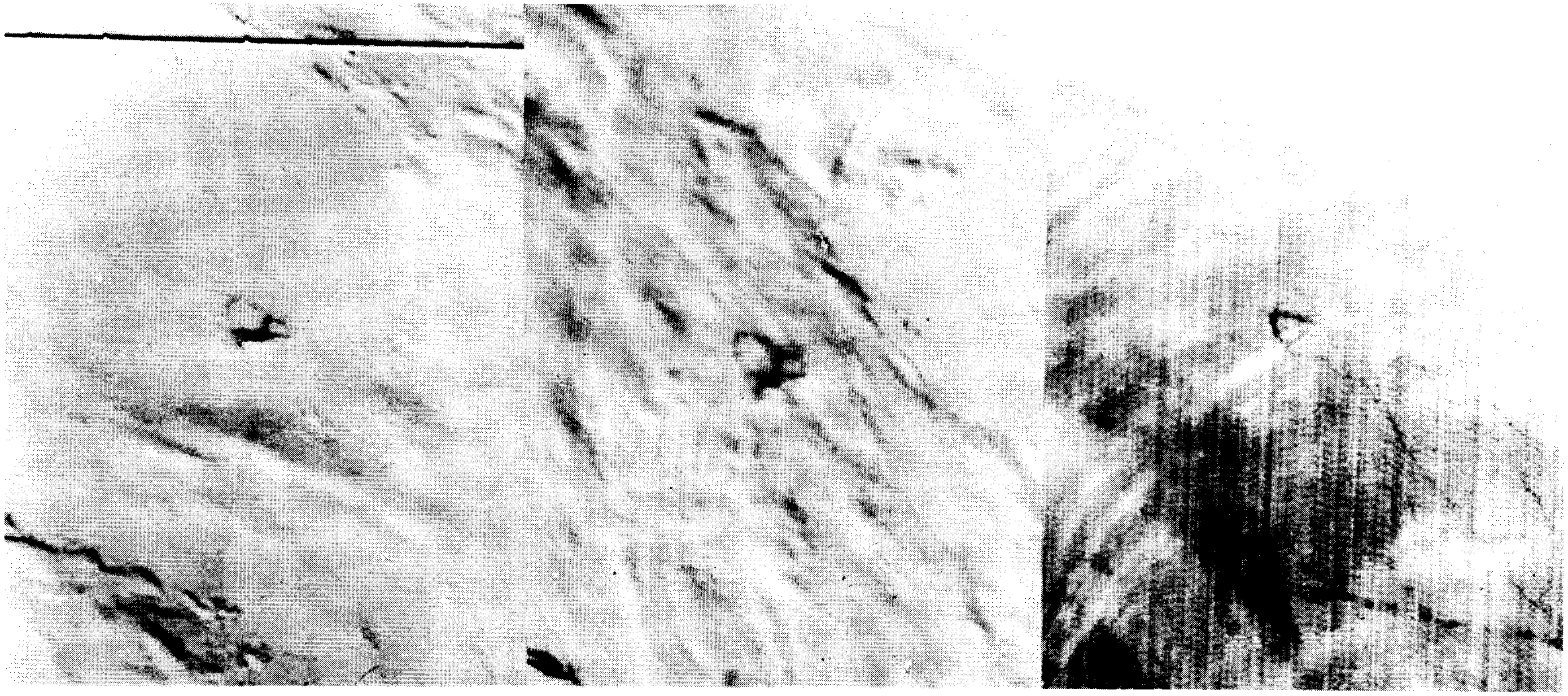

Figure 19. Grounded ice mass photographed by NOAA II satellite; ice mass is located at 72^{o} 3.4'N, 162^{o} 4.6'W.

themselves. This seems to explain why the traces are discontinuous; the recorders sample one data point each 16 seconds, so they could not be expected to follow rapid events continuously. The bursts of high frequency stress found on the magnetic tape recording would also be characteristic of this jostling and fracturing. The event at about 24 hours is most dramatic and seems to consist of several pulses. It is possible to calculate the magnitudes of the principal stresses during this period, but only if an assumption is made concerning the timing of the data points registered on all three traces. Because of the coarse time scale on the chart recorders, we do not feel that such an assumption is warranted. It is clear from the data, however, that the direction of maximum compression generally had a west to east orientation, and this corresponds to the direction of ice motion which can be inferred from the patch of open water or loose ice adjacent to the floe-island. Apparently, at about the 26th hour of the experiment, the stagnation region shifted so that the instrumented floe was in the lee of the floe-island, as shown in the NOAA II photos. The stress records indicate that the loads applied to the floe were much less severe after this time and we assume that it was essentially unstressed.

Many of the isolated data points marked A-G on Figures 13-17 appear to be portions of moderate-frequency high-intensity stress events. The points marked B, C, and D have the same elongated character as the pen marks in the main trace and are clearly data. Those marked A, F, and G are not the right shape and are probably scratches in the waxed paper surface of the chart record. Those marked E are data points, but it is unclear whether they are associated with the active channel or the inactive channel which they seem to follow with a slight off-set. The Rustrak recorders act as a two-stage mechanical filter in reproducing the stress events. First, since one data point per sixteen seconds is registered on the chart, it is difficult to resolve a pulse shorter than 64 seconds duration. Even for pulses of this length, a reasonably unrelated blurr of points results when several occur in a row, because the chart speed is 0.63 cm per hour. For shorter pulses, it is a matter of chance whether the peak is recorded, and for recordings where only one data point is recorded, the pulse length must have been less than 32 seconds. Nevertheless, instantaneous data would have been reproduced without attenuation until the inertia of the galvanometer movement becomes the limiting factor. For these recorders, this corresponds to a pulse length of 0.33 seconds, and the attenuation factor is 0.1 for pulse lengths of about 0.08 seconds.* Therefore one can estimate that the peak compressive stress during the interval of activity was at least as great as the values recorded, and the durations of the isolated pulses B, C, and D were probably between 32 seconds and 0.33 seconds.

In view of the location of the instrumented floe and the fact that only one floe was instrumented, very little can be inferred about the pressure distribution around the floe island, or the total load imposed upon it. The extensive instrument deployment which would have been required to determine such data was beyond the scope of the project. The data obtained are probably characteristic of stress levels in a floe located in a field of jostling floes anywhere in the dynamic pack. Even as such, these data are applicable to the design of offshore structures for the following reasons. First, the strength of sea ice is known to exhibit a significant size effect, (Croasdale, 1975) and the degree to which full-scale strength is lower than small-scale strength has been a source of much confusion. Previously available data on naturally-occurring stresses in fast ice <u>protected by grounded ridges</u> (Nelson et

*The frequency response for these recorder movements is 3 db down at 15 Hz., and 20 db down at 6 Hz. Pulses may be assumed to be half sine waves.

al., 1976) did not include compressive stress pulses greater than 0.138 x 10^6 N/M^2 (20 p.s.i.) while compressive strengths of 6.89 x 10^6 N/M^2 (1000 p.s.i.) have been measured for small specimens by Peyton (1966). The data obtained here imply that at least 1.72 x 10^6 N/M^2 (250 p.s.i.) compression (point B) was briefly sustained, and possibly more, since we do not know where fracture occurred, the thickness of the ice there, or the duration of the stress pulse. Second, the resonant frequencies of actual offshore structures can be in the range 0.5 Hertz to 18 Hertz (see for example Reddy, et al., 1975 or Määttanen, 1975). Since the frequency spectrum of the stress pulses recorded here may also have overlapped this range of frequencies, the design of future offshore structures subjected to pack ice forces should allow for dynamic excitation as well as static loading. Reddy et al., (1975) have discussed this, and much more information on the spectrum of ice loading forces should be available before optimal designs can be produced.

C. PACK ICE, BARROW, 1977

Early in the winter of 1976-1977, the Alaskan North Slope was subject to the unseasonably warm weather which included the rest of Alaska. Ice growth and ridgebuilding was minimal until early in December, when cold weather finally began. However, ridgebuilding did not progress to the stage where the ridge at the 20 meter water depth contour became grounded until midwinter. Helicopter operations were suspended, for equipment reasons, when temperatures colder than -35° F were encountered, so the deployment of the ice stress telemetry was scheduled for early in March 1977.

The ice stress telemetry transmitter, with three stress sensors, was deployed on March 12, 1977, in the location shown on the map in Figure 20. This was 2 km from shore, in a water depth of 20 m, just beyond the farthest grounded pressure ridge. The farthest grounded pressure ridge, normally a prominent linear feature along the 20-meter water depth contour, was barely discernable in this year, and there were only a few separate locations along the ridge where ice piles were high enough to cause obvious grounding to the sea floor. Considerable activity had resulted in a random collection of ice fragments and piles throughout the shorefast ice zone. The number of points which were grounded to the seafloor could not be determined directly, but the qualitative impression of the height of the ridges and piles led one to believe that the grounding was much less than in previous years. The three ice stress sensors were installed in a pan of ice from a refrozen lead, of nominal thickness 70 cm, which was located beyond a large ice pile (of height 5 meters), part of the barely-discernable linear ridge feature at the 20 meter water depth contour described above. A detailed sketch of the installation site is given in Figure 21. The ice salinity was 9‰ to 10‰ taken at 10 cm depth at sites #2 and #3. Snowcover varied from 10 cm over most of the refrozen pan, to 1 meter at the edges near the broken ice fragments around the boundary. These fragments around the boundary were only 1 meter to 1.5 meters in height. Transducers #1 and #2 were installed at a depth of 30 cm in the ice; sensor #3 was installed at a 25 cm depth. Freeze-in transient temperatures and stresses were not monitored, but a final field check indicated that all transducers were functioning satisfactorily. A strong signal was received at the recording station, and data collection began on March 12, 1977. Data was recorded continuously (except a one week period in May), until final destruction of the transducers during breakup on June 12. Photographs were taken and cracks in the ice were observed on reconnaissance visits March 18, April 13, and May 29.

The ice stress transducers, together with the telemetry transmitter, were checked during a visit to the field site on May 29, 1977. Their

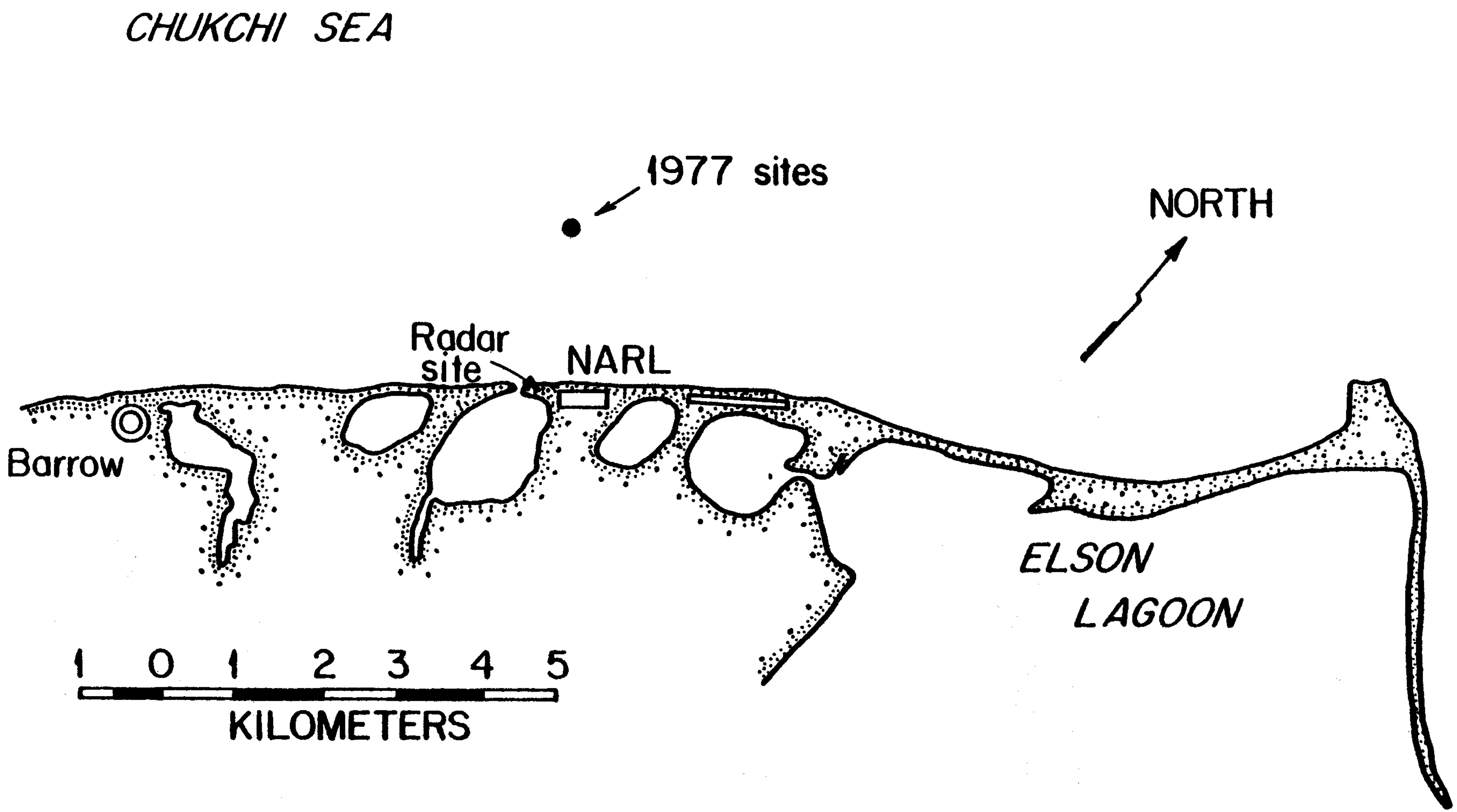

Figure 20. Location of transmitter and ice stress transducers for March 12, 1977 installation.

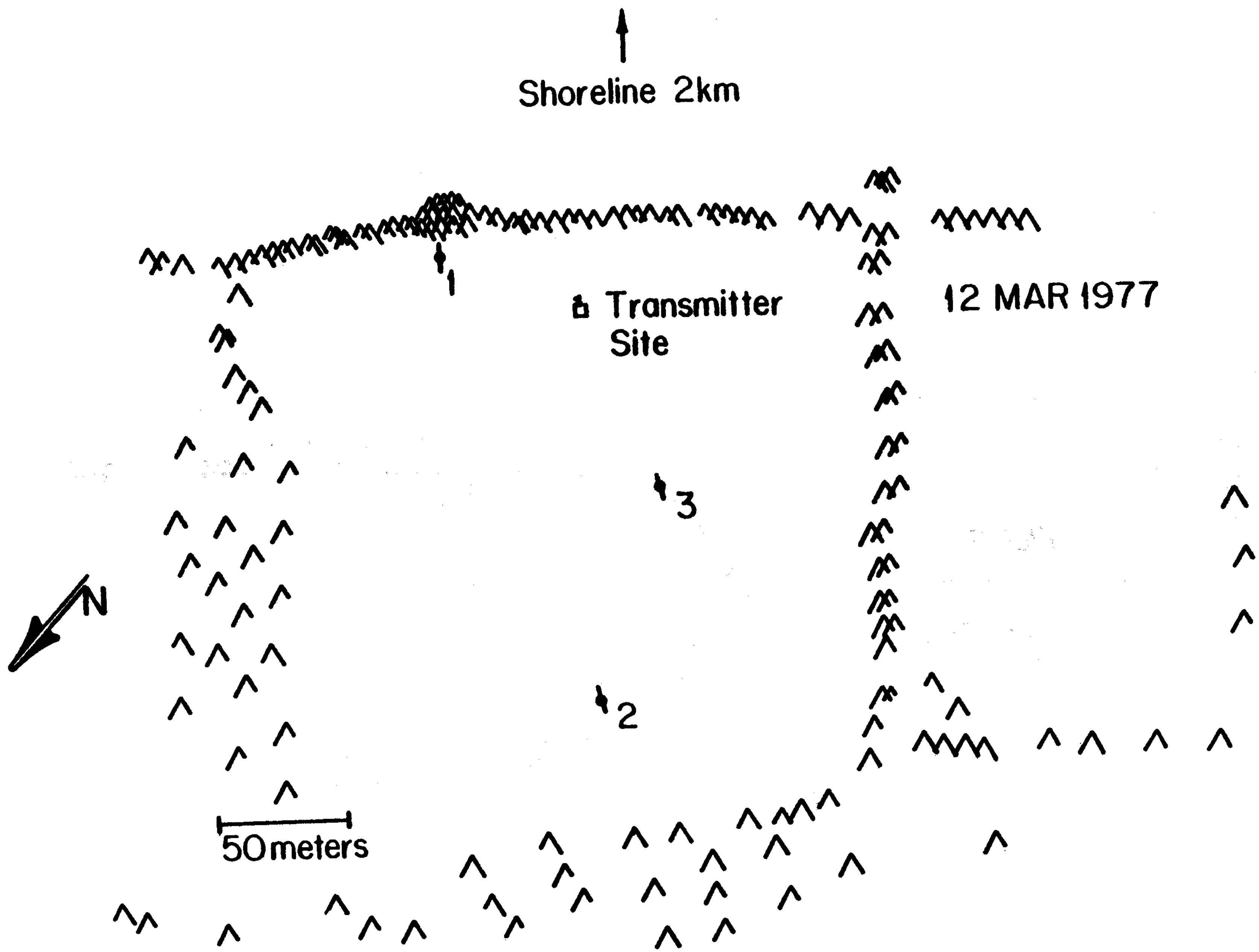

Figure 21. Detailed location map for ice stress transducers for March 12, 1977 installation.

position was as shown on the original map of the installation, Figure 21. There was no sign of melting or other disturbance of the ice stress transducers during this visit; the snow cover at the site had not yet melted enough to form pools of meltwater. Beginning at 0023 ADT June 12, 1977, a sequence of ice fracture events took place which resulted in the destruction of all of the stress transducers within a matter of hours. The most seaward transducer, #2, was destroyed first, followed by transducer #3, and finally by transducer #1. Prior to destruction, each transducer transmitted in-situ stress data to recorders located safely on shore; the data from this breakup sequence, presented in Figures 30 through 34, has been analyzed, and is discussed and interpreted below.

1. March 16-18, 1977

At the time of installation on March 12, 1977 the pack ice was close to the shoreline, and there were no open leads offshore. The wind was from 070°, at less than 15 km/hr. Since the shoreline is oriented at 043°, there was a wind component parallel to the shoreline, and a component perpendicular to the shoreline (offshore). This wind increased until, on March 16, 1977, enough stress had developed in the pack to cause activity in the ice and data collection by the ice stress telemetry system.

The wind direction and magnitude at Barrow are given for March 16, 1977, and March 17, 1977 in Table 1. Since this wind direction, 070°, had prevailed for several days, the pack ice may have responded by moving in the same approximate direction. The shorefast ice began to develop tension cracks near the shoreline at 1500 AST on March 16, according to observers there. In particular, the tide crack near the shore opened to 10-20 centimeters, and a crack approximately 70 centimeters wide opened at about 200 meters offshore, beyond the ice mechanics research site of Dr. L. Shapiro. The tension developed at all three remote ice stress stations simultaneously, at 1951 AST, as can be seen in Figure 22. All sites recorded a rise in tension over a period of one hour, after being at equilibrium for four days. The tension field applied to the ice pan was smallest near the grounded ice pile, site #1, but was larger at site #3 and largest at site #2, which was the farthest from the grounded ice pile. The largest tensile stress recorded was at site #2 at 2200 AST, a value of 0.68×10^6 N/M^2 (100 p.s.i.), after which the stress dropped quickly, reaching zero after six hours. A similar behavior was noted at site #3, but the maximum tensile stress there was 0.42×10^6 N/M^2 (61 p.s.i.). The site #1, near the grounded ice pile, sustained a modest tension of 0.08×10^6 N/M^2 (12 p.s.i.) during this interval and beyond, as shown in Figure 22. Both sites #2 and #3 briefly went into compression, then into tension again, then into compression, and finally back into tension. This behavior can best be understood by including an observation made of the site on March 18, and again on April 13, after the above action had occurred. The time of reconnaissance is indicated on Figure 22 by the vertical arrow. The reconnaissance showed that a new crack had developed as shown in Figure 23, and that it had refrozen. This new crack was between sites #2 and #3, and obviously was a result of the tension developed during the time period of 16-18 March. It is wider near site #2, indicating that it initiated seaward of site #2 and propagated beyond site #3. Based upon the short distance (approximately 4 meters) from the crack to sensor #2, and the data shown on Figure 22, the following explanation is proposed, to relate the data to the crack formation.

Table 1. Wind at Barrow, Alaska for March 16-17, 1977

	Time (AST)	Wind Direction (o)	Wind Speed (KM/HR)	Max Gust (KM/HR)
16 MAR	1500	070	42.6	55.6
	1600	070	37.0	50.0
	1700	070	40.7	51.9
	1800	060	38.9	55.6
	1900	070	40.7	53.7
	2000	060	38.9	48.2
	2100	070	38.9	51.9
	2200	070	33.3	42.6
	2300	060	27.8	-
	2400	060	25.9	-
17 MAR	0100	060	27.8	-
	0200	070	31.5	-
	0300	060	27.8	
	0400	070	29.6	

Similar direction and magnitude for the remainder of March 17.

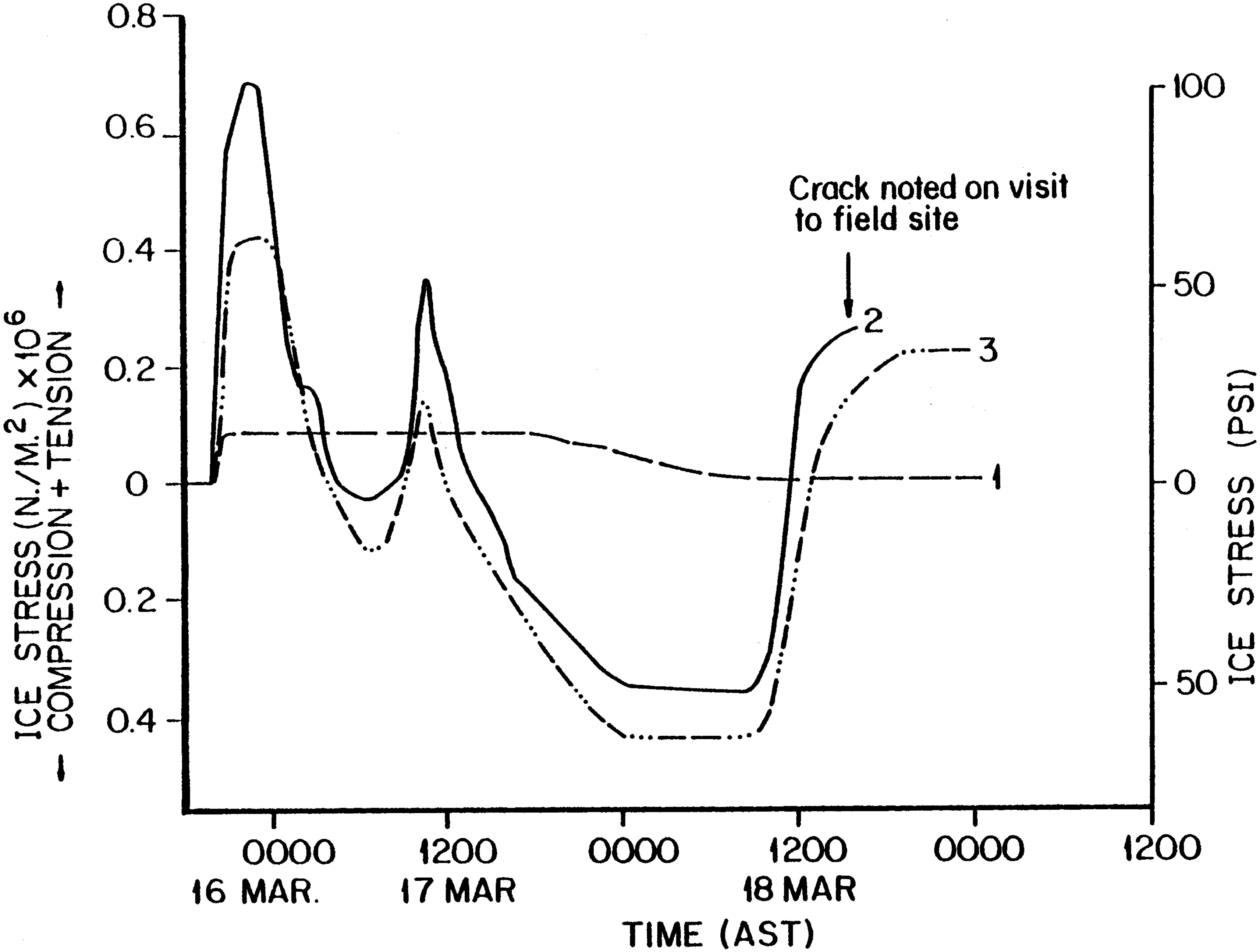

Figure 22. Time variation of stresses at Barrow sites, March 16-18, 1977.

The initial buildup of tension was sufficient to cause a crack to form at approximtely 2200 AST on March 16, after which the tensile stress was relieved. This crack initiated seaward of site #2 and propagated through the ice pan, separating #2 from #3. From 0400 to 0800 AST on March 17, some limited compression was observed which may have been due to refreezing of sea water in the very narrow crack. Then, from 0800 to 1030 AST, further wind and water stress caused an tension to develop again, ultimately resulting in fracture and widening of the original crack at 1030 AST. From 1200 AST on 17 March to 1000 AST on 18 March, both sites #2 and #3 recorded compression which may have been produced by the refreezing of water in the crack after it was opened the second time. Finally, on March 18, further ice motion in the pack caused tension to build once again. The direction of crack formation appears to be approximately perpendicular to the wind direction, as might be expected.

The reconnaissance visit to the site on April 13 revealed that this explanation was essentially correct, and that additional cracks had formed as well, as shown in Figure 24. The results of the aerial survey of March 18 were refined and corrected. The pattern of refrozen cracks observed on April 13 is shown in Figure 24. When a crack forms, sea water enters from below, and rises to a level just below the top of the ice. Thus a refrozen crack has a step down on one side, and a step up on the other. The crack shown passing 4 meters from site #2 had one such step (of height 5 cm) where it was a single crack line, but had two steps where it split into a Y-shaped double crack feature. The width of this Y at the point closest to site #2 was 0.8 meters. It was obvious that a second tension crack had opened down the middle of the refrozen

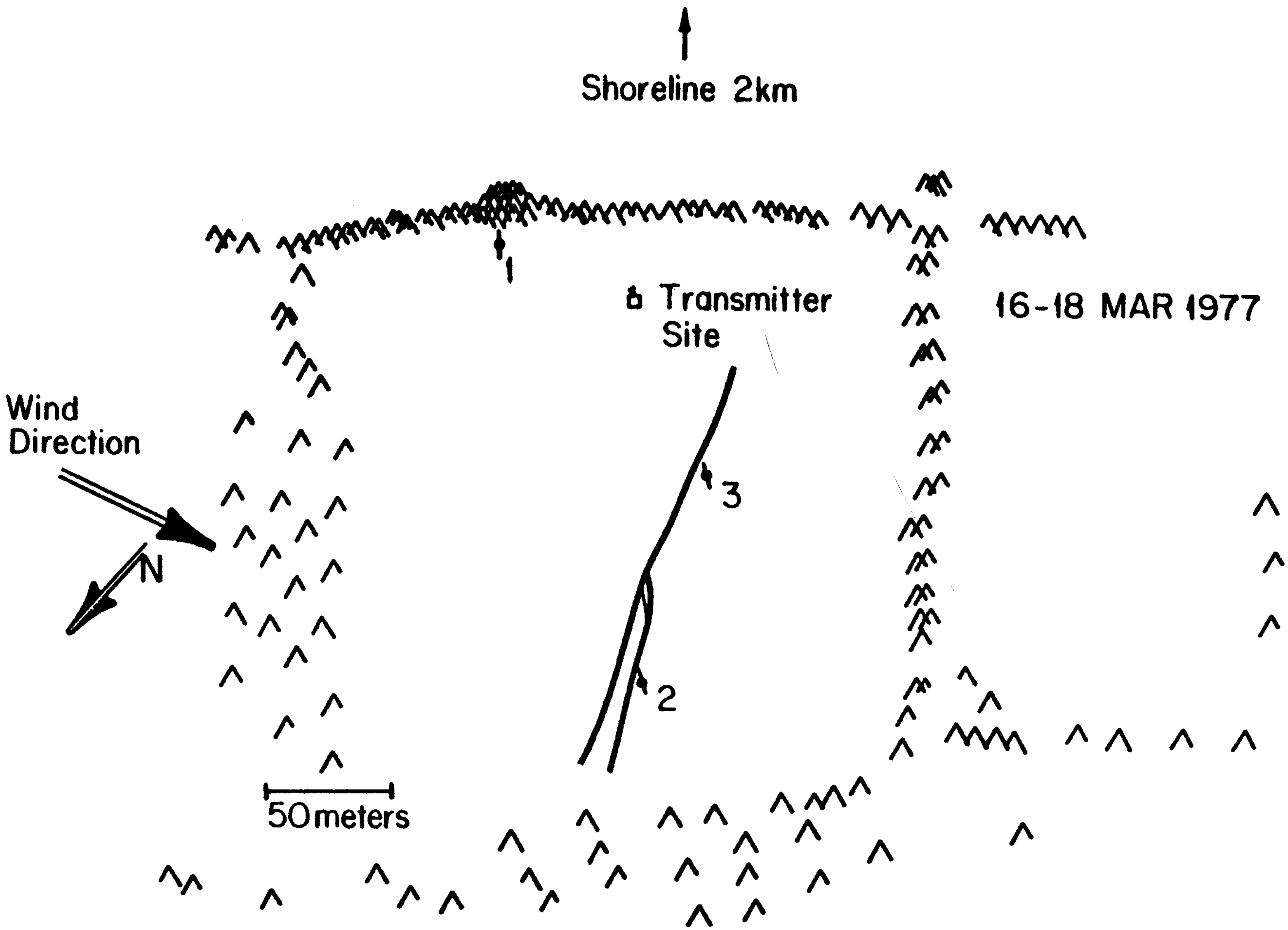

Figure 23. Approximate location of crack after ice stress events of March 16-18, 1977 (from aerial reconnaissance).

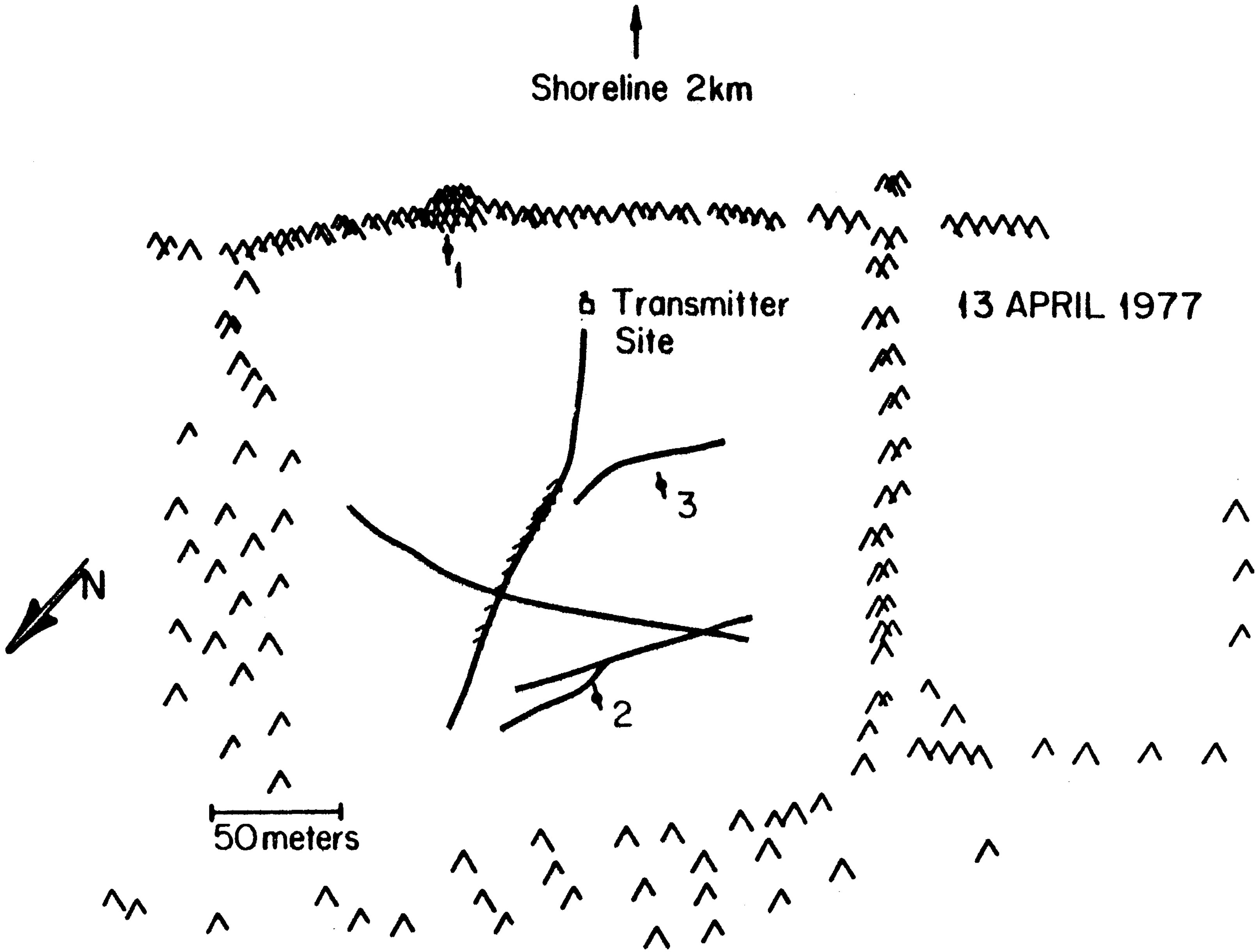

Figure 24. Pattern of refrozen cracks at ice stress measurement site (from reconnaissance visit of April 13, 1977).

first crack, but had only propagated just past site #2, and then had refrozen. This crack was oriented approximately at 015°, adjacent to site #2, but changed direction along its length.

Another single crack was noted shoreward of transducer #3, and a long crack of a different type had formed through the ice floe, passing through the transmitter site. This latter crack had opened as wide as 30 cm, refreezing progressed until the ice was about 4 cm thick, and then the crack closed, thrusting the newly-formed ice upwards into a miniature ridge about 20-40 cm high. A photo of a typical ice fragment from this ridge is shown in Figure 25, which includes the detail of the ice crystals growing on the bottom of the ice sheet which were preserved and displayed on the side of the uplifted ice fragment. The time of formation of this feature is not known exactly, but was sometime between March 18 and April 13, 1977.

On the visit of April 13, it appeared in comparison with conditions on March 12 that the ice ridges had grown both in extent and in height around the ice floe in which the instruments had been placed. However, no differences were noted between April 13 and May 29.

2. April 6, 1977

The ice stress events of April 6, 1977, are of rather different character than those that occurred in March and in June of that year. As is shown in Figure 26, there were four specific events, which showed in coincidence at all three transducer locations. The first event began at 1840 AST, and was of three minutes duration. It involved tension at the exposed locations #2 and #3, which unfortunately resulted in some readings off the instrument scale, implying that values of 0.97×10^6 N/M^2 (140 p.s.i.) and 0.84×10^6 N/M^2 (122 p.s.i.) were exceeded at #2

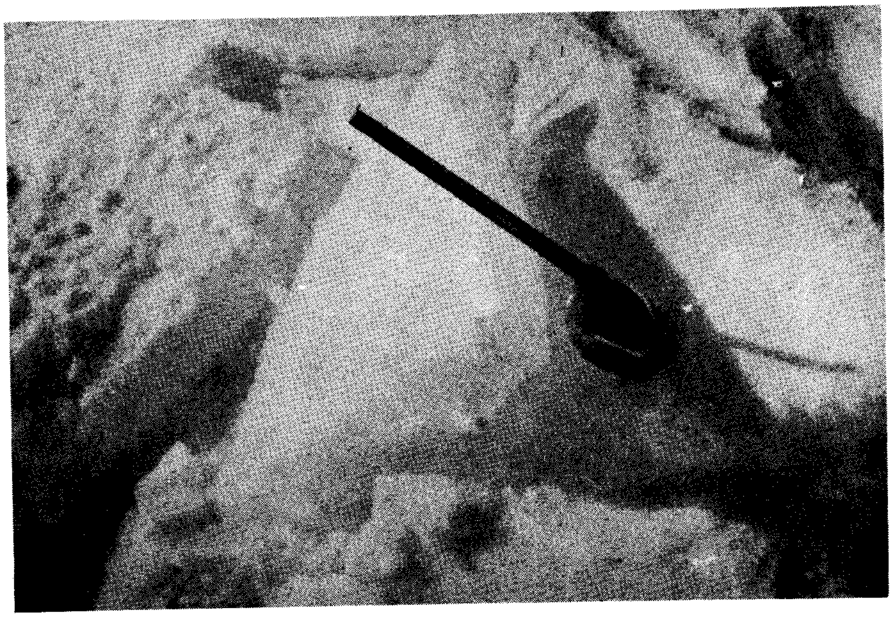

Figure 25. Photograph of small ice ridge fragment formed from a refrozen lead during stress measurements of Spring 1977.

and #3 respectively. There were many cycles of low-frequency stress during that interval, events which were recorded on all three channels and which probably had frequency components near the cutoff frequency of the recorders, approximately 2.5 Hz. Such a frequency might be produced by the rearrangement of ice blocks in a ridge, or perhaps by some fracture sequence in a thrusting ice sheet during ridgebuilding. Kivisild (1969) has discussed the possible existence of a band of natural frequencies associated with the flexure of ice sheets, and inasmuch as there was no resonant artificial structure in our experiment, this data may support future developments of such ideas. The second event, which appeared on all three transducers, is an abrupt tension pulse. It was offscale at #2 and #3, and small at #1. The third mark is a timing pulse; the next event is similar to the first, in that it consists of many oscillatory events in the one Herz range, superimposed upon a large tension at #2 and #3. The duration of the tension was 2 minutes, with additional oscillations for 2 more minutes on #3. The final sequence of events involved three successive tension pulses, again with accompanying oscillations. The greatest detail was shown on #3, but the basic behavior was evident on the other channels as well. Finally, on each channel, a second time mark appears.

In order to relate these observations to the environmental conditions, the wind records for this period were examined. To summarize the wind situation at that time, on April 5 the wind was light (e.g. 7 knots) from the south. By 2355 AST on April 5, however, the wind had changed to 230°, at 10 knots. This continued on April 6, with the direction 240° to 250°, a situation in which the wind velocity had approximately equal components parallel to the shoreline and orthogonal to it, onshore.

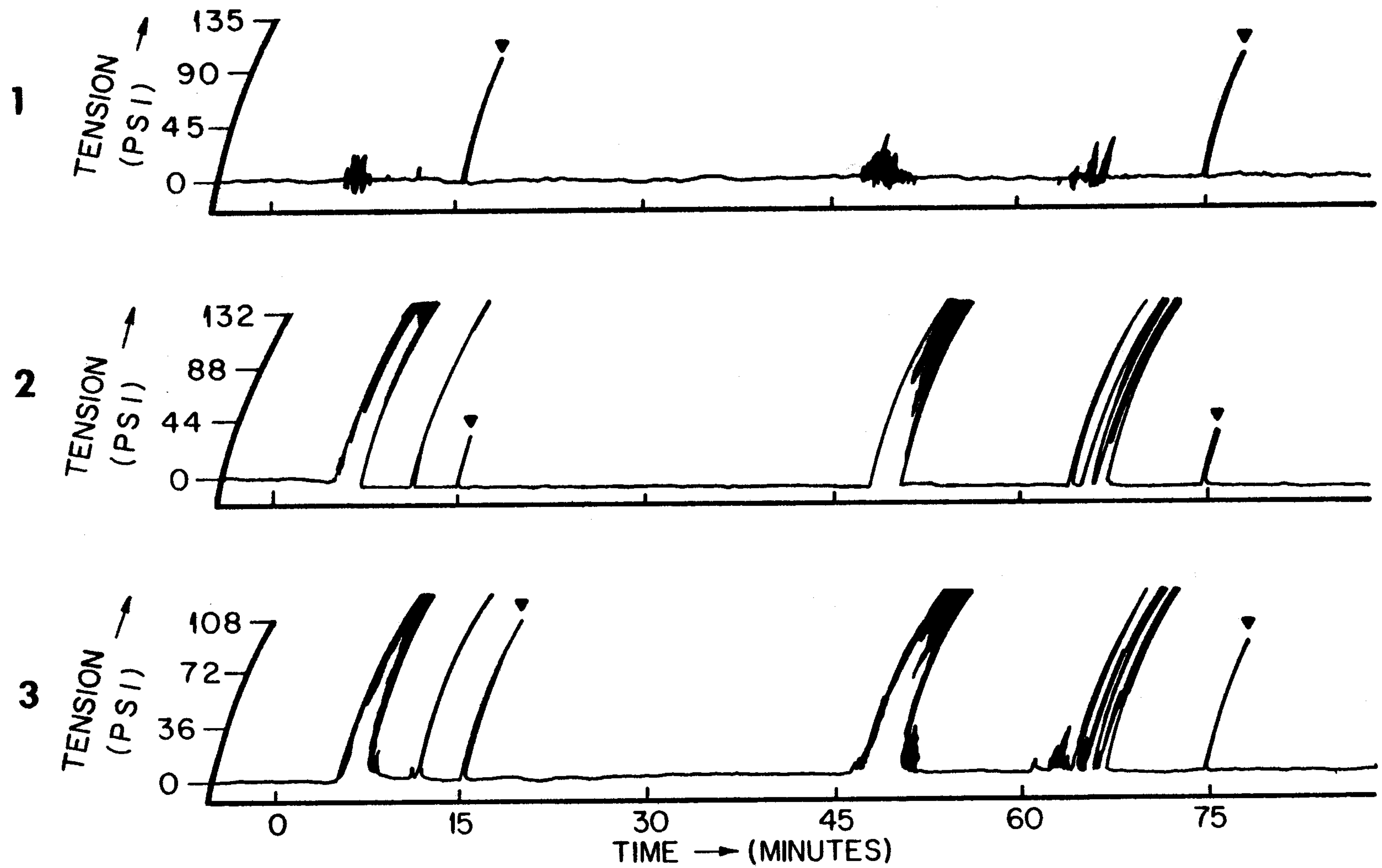

Figure 26. Ice stress events occurring at 1840 AST, April 6, 1977. Time marks clearly visible on #1, and coincident time marks on #2 and #3, denoted by ▼ (at one hour intervals).

The intensity of the wind increased, to peak values of 16-18 knots in early afternoon. By the time of the observed tension events, 5 hours later, the wind speed had dropped to 11-12 knots, but was still in the same direction. It appears that the delay between the wind buildup and the observed ice stress events may have been due to the time taken for closure of the open leads farther offshore.

Without on-site visual observations during crack formation, it is difficult to determine which of the cracks observed during the reconnaissance visit of April 13 were formed during this particular ice stress event. However, there was a crack observed on April 13 which was roughly parallel to the wind direction of April 6. One possible explanation for its formation is that the pack ice was forced against the shorefast ice on April 6, along the 240° wind direction, and that a compression along that direction took place, because of the grounded ridges on the opposite side of the polygonal ice floe in which the transducers were located. Just as in the familiar Brazil-test of specimens in the laboratory, such a compression could induce tension in the orthogonal direction, perhaps leading to a tensile crack in the ice in the direction of applied wind stress. Unfortunately, there were not enough transducers installed to determine the principal stresses in the ice floe, so that this explanation must be regarded as tentative. The relative movement of one separate plate against another, a stick-slip or grinding movement at the crack boundary, might have caused the high-frequency stress loading superimposed on the tension events. In any case, the cause-effect relationship of the wind to the tensile stresses is evident, and the band of oscillations in the stress records offer, to the designer of offshore structures, some indication of the naturally-occurring frequency spectra which must be taken into account in the dynamic analysis of offshore structures.

3. June 3-6, 1977

During the interval from June 3, 1977, to June 7, 1977, there were signs of ice activity on the stress transducers and on the ice dynamics radar. Examination of the radar imagery for that period has shown no gross movements of large masses of the shorefast ice, but nevertheless a considerable activity was in evidence, characterized by the intermittent appearance and disappearance of a great many of the minor ice ridge features on the radar. The major features of the grounded ice ridges remained continuously in place, but the minor ice features between the ridges alternately disappeared and reappeared in a random fashion, over time intervals of the order of several hours. This has been observed before, and is explained by assuming that planar faces of ice ridge fragments turn slightly, so that in one orientation they offer a face perpendicular to the radar beam, and specular reflection gives a strong return; in a slightly different orientation, this face is no longer perpendicular to the radar beam, and the reflection from the ice ridge fragment is drastically reduced. During the entire interval of June 3-7, 1977, this activity continued, indicating that in most locations of the shorefast ice, the ice ridge features were unstable, and were moving slightly under the influence of winds, currents, tides, and gravity.

The wind increased early on June 3, and the ice stress transducers showed an increase in tension. In Figure 27, the wind component parallel to the axis of the transducers has been plotted as a function of time. From June 3 to June 5, there was an appreciable offshore component of the wind. The accompanying graph of ice stresses in the same figure shows that tensile stress built up at sites #2 and #3, and that the stress increase lagged behind the wind increase by 18 hours. Both sites showed a tension increase and decrease together, as is evident from the figure. Unfortunately, both chart traces went off scale, and the exact values of tensile stress during a 9-hour interval of maximum stress are not known. During this period when the wind speed component along the axis of the gages reached 15 knots, the tension did reach and exceed 0.85×10^6 N/M^2 (124 p.s.i.). When the wind decreased, the tension in the ice decreased simultaneously. Subsequent fluctuations in the ice stress at the end of the interval were small, and may be due to other forces such as tides or currents; it appears that the wind was not dominant at the end of the interval. No stresses were observed at site #1 during this entire time period, June 3-6, 1977. The NOAA satellite photographs for this period (Figures 28 and 29) show that the offshore wind produced an open lead west of Barrow, and it appears that the ungrounded ice seaward of the stress transducers was wide enough to couple to the offshore wind and to produce the tensile stresses at sites #2 and #3. These stresses may or may not have produced tension cracking in the warm, decaying ice at that time, but if tension cracks had occurred near the transducers, it is felt that this stress relief would have been recorded. Since abrupt stress relief was not noted until the wind decreased, it is felt that the ice was capable of sustaining this level of tension without cracking, preceeding breakup. Some relief and rearrangement was obviously taking place along the boundaries of the ice floes, where the minor ridges were located, however, as is shown in the radar record. This rearrangement could account for the time lag between the rising wind and ice stress levels.

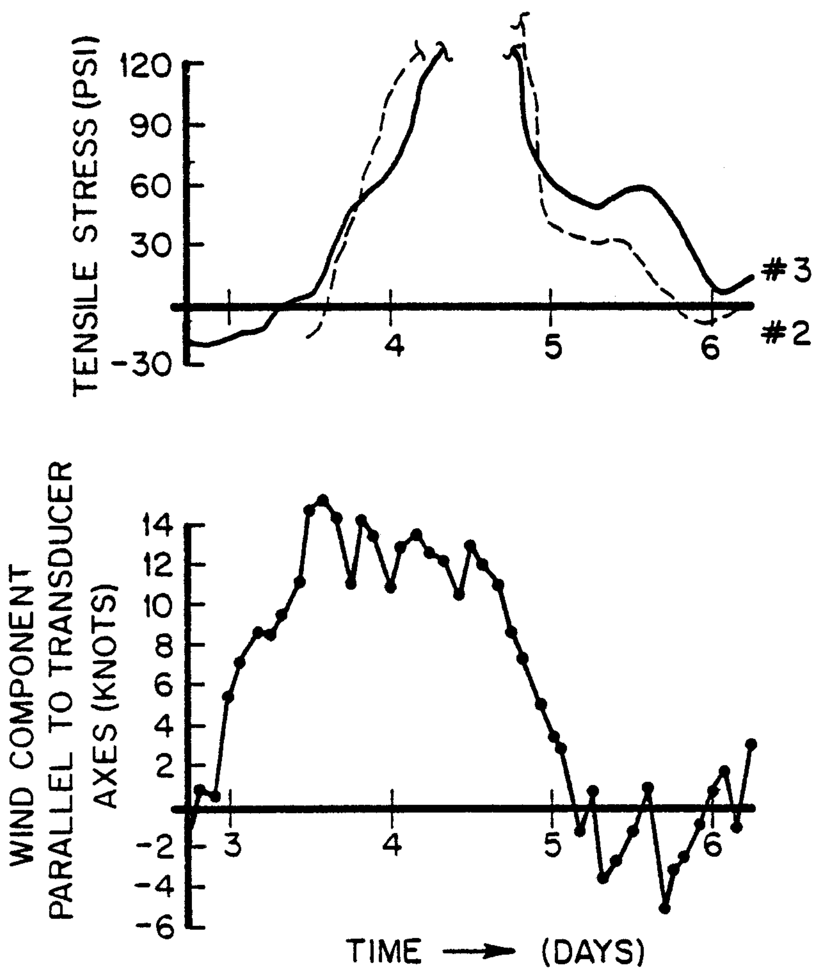

Figure 27. Ice stress and wind component parallel to transducer axes for the period June 3-6, 1976.

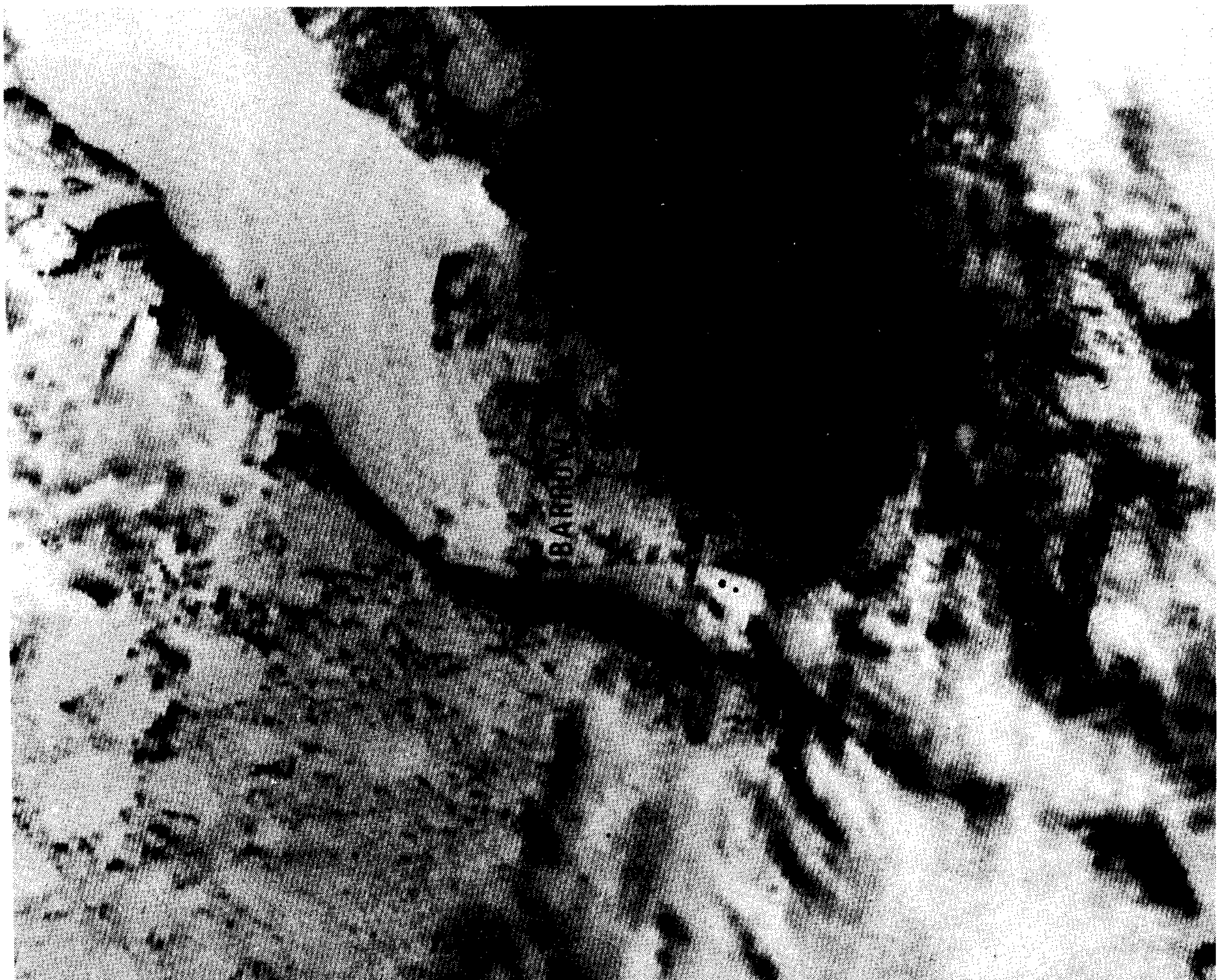

Figure 28. NOAA satellite image of Barrow vicinity, June 4, 1977, showing open water between pack ice and shorefast ice.

Figure 29. NOAA satellite image of Barrow vicinity, June 6, 1977, showing narrow section of open water between pack ice and shorefast ice.

4. June 12, 1977

The wind direction was essentially offshore at this time early on June 12; Table 2 shows the wind speed and direction as recorded at the National Weather Service Office at Barrow during the day prior to this event, and during the breakup event. Unfortunately, the sea ice radar located on the shoreline, which normally recorded ice motion in this region using time-lapse photography, suffered a breakdown two days prior to this event, so that detailed ice motion records of the breakup are not available. From previous experience and by careful examination of the ice stress data, however, it is possible to infer the ice movements which very likely did occur. Satellite imagery from both NOAA and Landsat were obscured by clouds on June 11-12. However, a NOAA satellite photo from June 10 (Figure 35) shows that the edge of the shorefast ice is approximately 4.2 km. offshore on that day, with open water beyond. The ice configuration as observed by radar 6 days prior to the breakup sequence is shown in Figure 36. From bathymetric charts it is clear that the ice seaward of the site was not likely to be grounded, since the water depth was approximately 20 meters at the site. The ice activity during the week prior to final destruction, as discussed in the preceeding sections, also indicates that the ice seaward of the farthest grounded pressure ridge was substantially free from the sea floor.

The first sequence of ice stress events is shown in Figures 30 and 31, for stations #2 and #3, respectively. The most exposed transducer, #2, registered a small compression, followed by a large tension, then an abrupt and very large compression, followed by failure. The irregular fluctuating traces after failure are characteristic of the behavior of the phase-locked loop in the receiver when no signal is present. At the

TABLE 2

Windspeed and Direction at Barrow, Alaska
For June 11-12, 1977

Time	Wind Direction (°)	Windspeed (Knts)
June 11		
0055	090	11
0155	110	09
0255	130	07
0355	150	07
0454	220	05
0555	240	07
0655	290	07
0755	290	08
0855	310	07
0955	310	05
1055	290	07
1155	320	06
1255	290	05
1355	300	06
1455	290	06
1555	290	08
1655	350	07
1755	300	05
1855	360	05
1955	060	05
2055	120	03
2155	120	08
2255	120	07
2355	150	07
June 12		
0017	150	09
0049	150	07
0055	150	08
0155	150	10
0255	140	08
0301	150	10
0355	160	10
0455	150	11
0550	150	12
0602	140	11
0647	150	10
0655	170	10
0706	180	12
0712	170	13
0725	180	11
0755	210	14
0855	220	09
0955	210	10
1055	230	13
1155	220	10
1255	220	11
1355	220	10

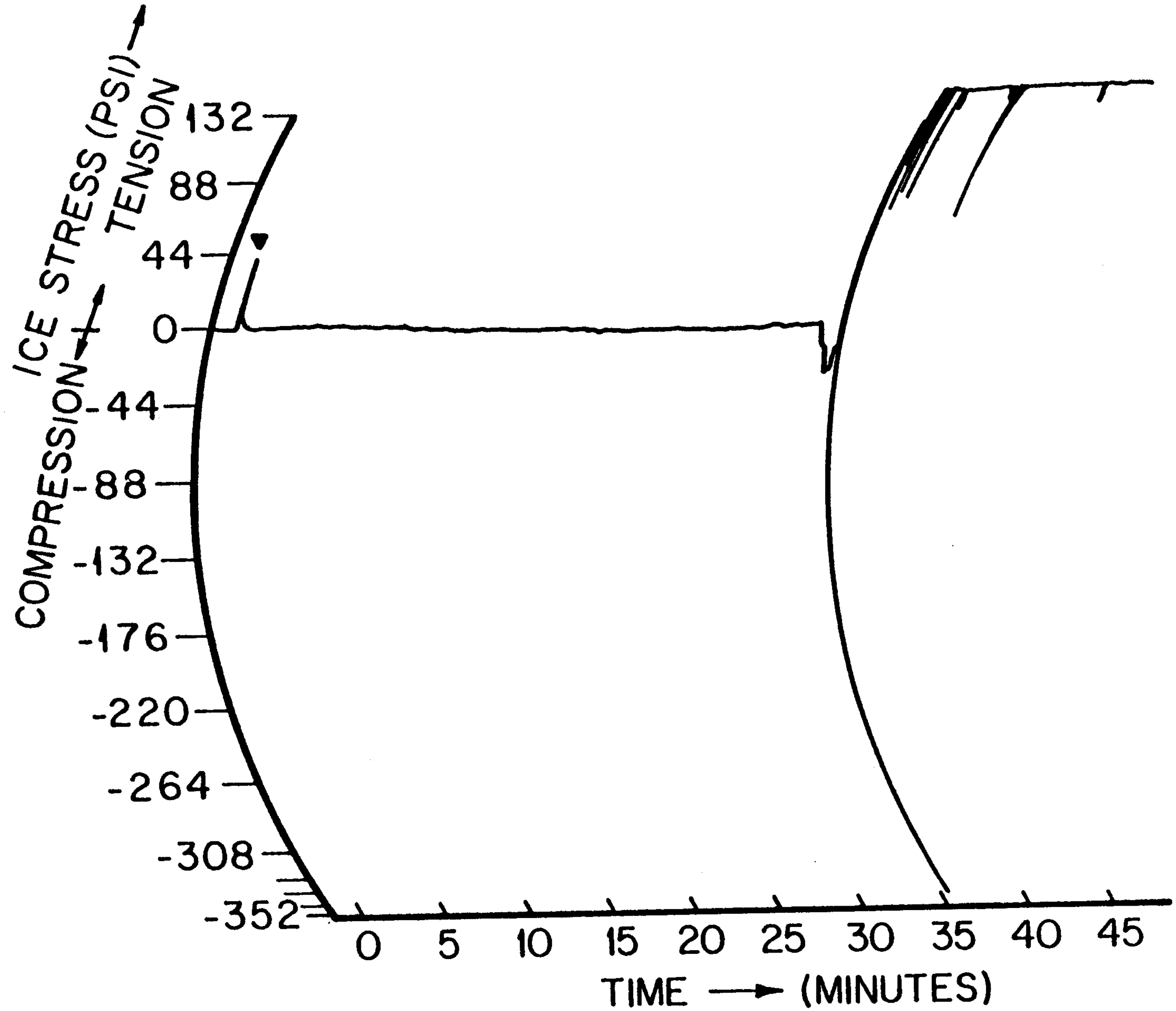

Figure 30. Ice stress during breakup, June 12, 1977, Site #2. Timing marks indicated by (▼).

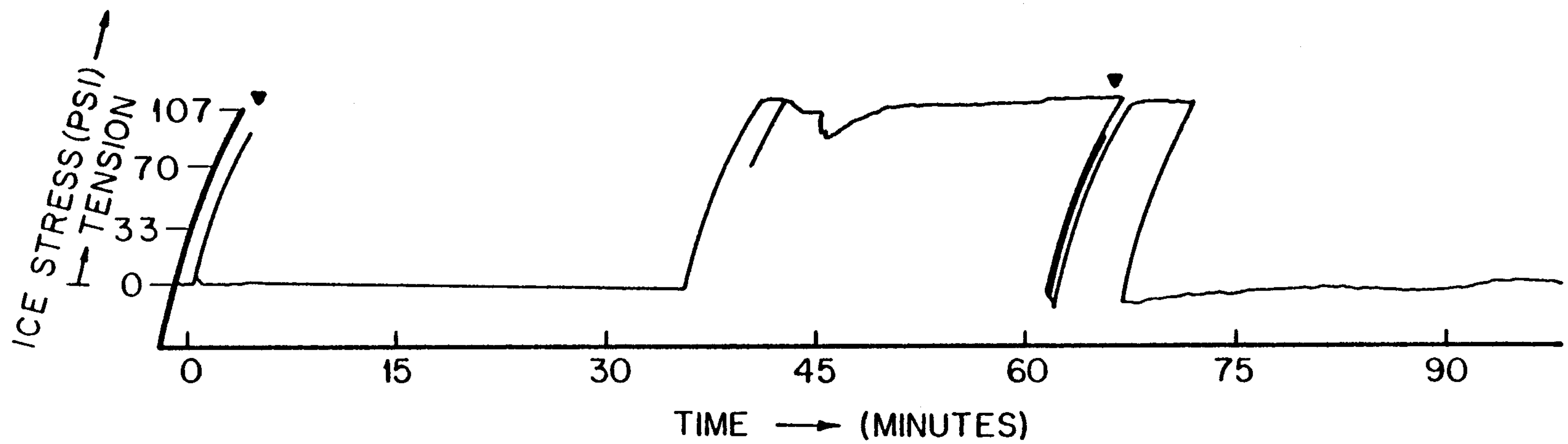

Figure 31. Ice stress at initiation of breakup, June 12, 1977, Site #3. Timing marks indicated by (▼).

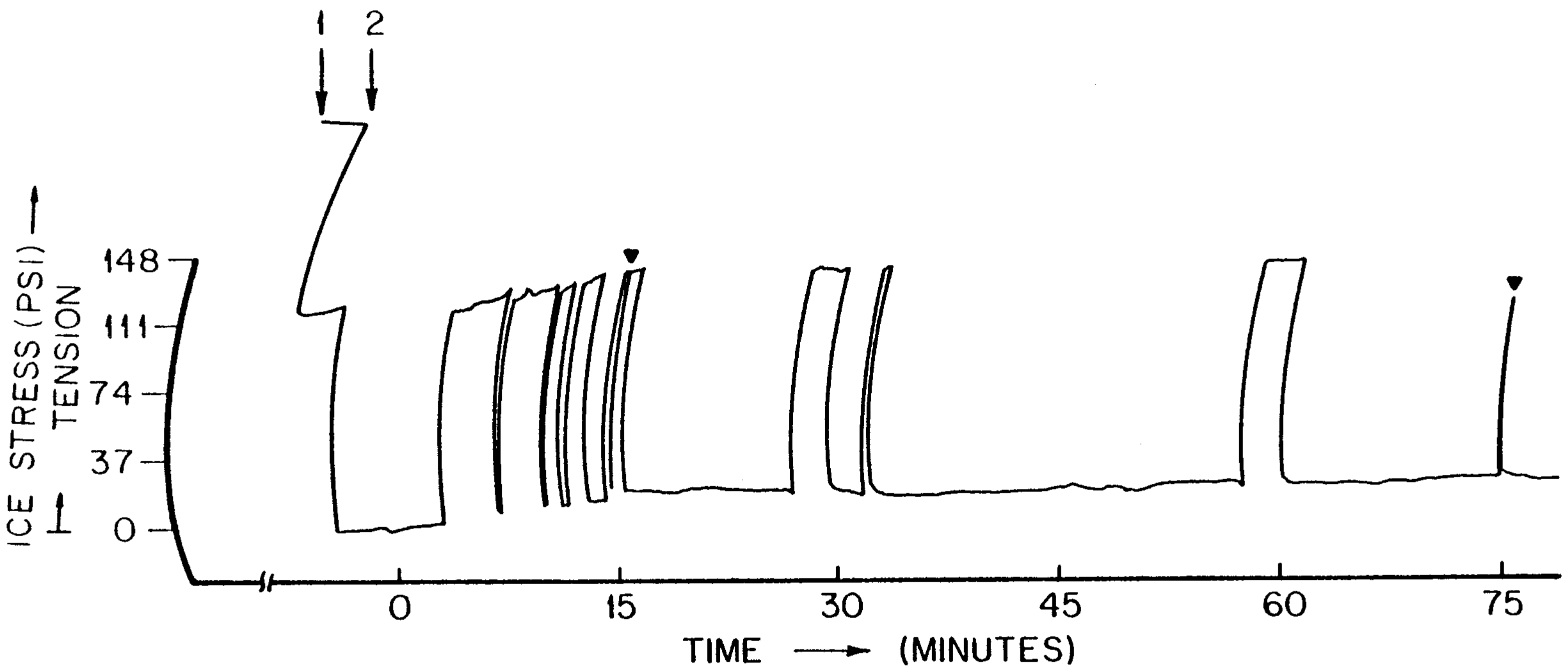

Figure 32. Ice stress at site #3, June 12, 1977, after site #2 was destroyed. Arrow #1 indicates the time when recorder speed was lowered to normal (6 inches/hour); Arrow #2 indicates the time when scale was rezeroed. Timing marks indicated by (▼).

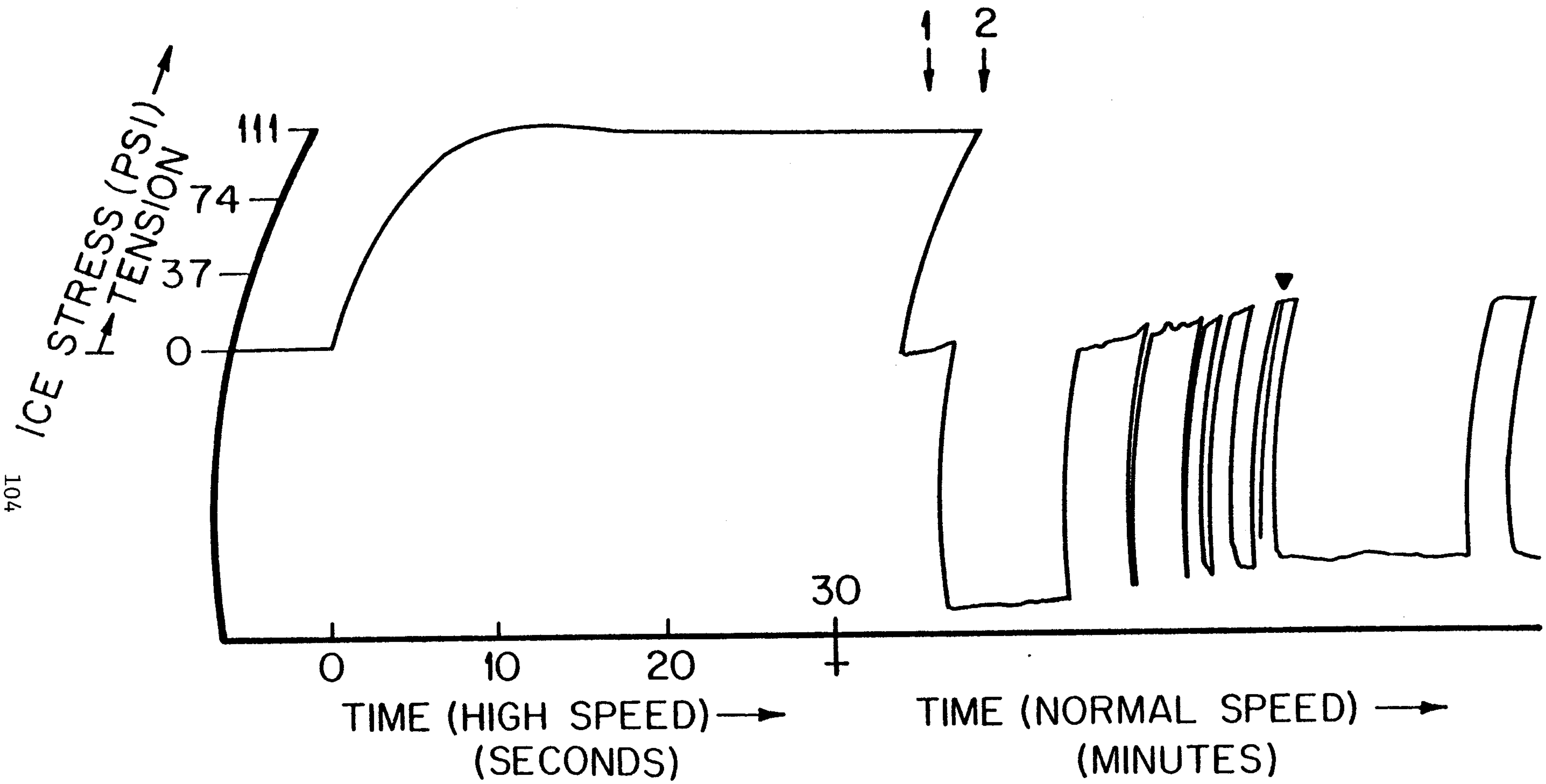

Figure 33. Ice stress at site #3, June 12, 1977, after site #2 was destroyed. Detail of risetime for ice stress event shown with high chart speed (6 inches/minute). Arrow #1 indicates when recorder speed was lowered to normal; arrow #2 indicates the time when scale was rezeroed.

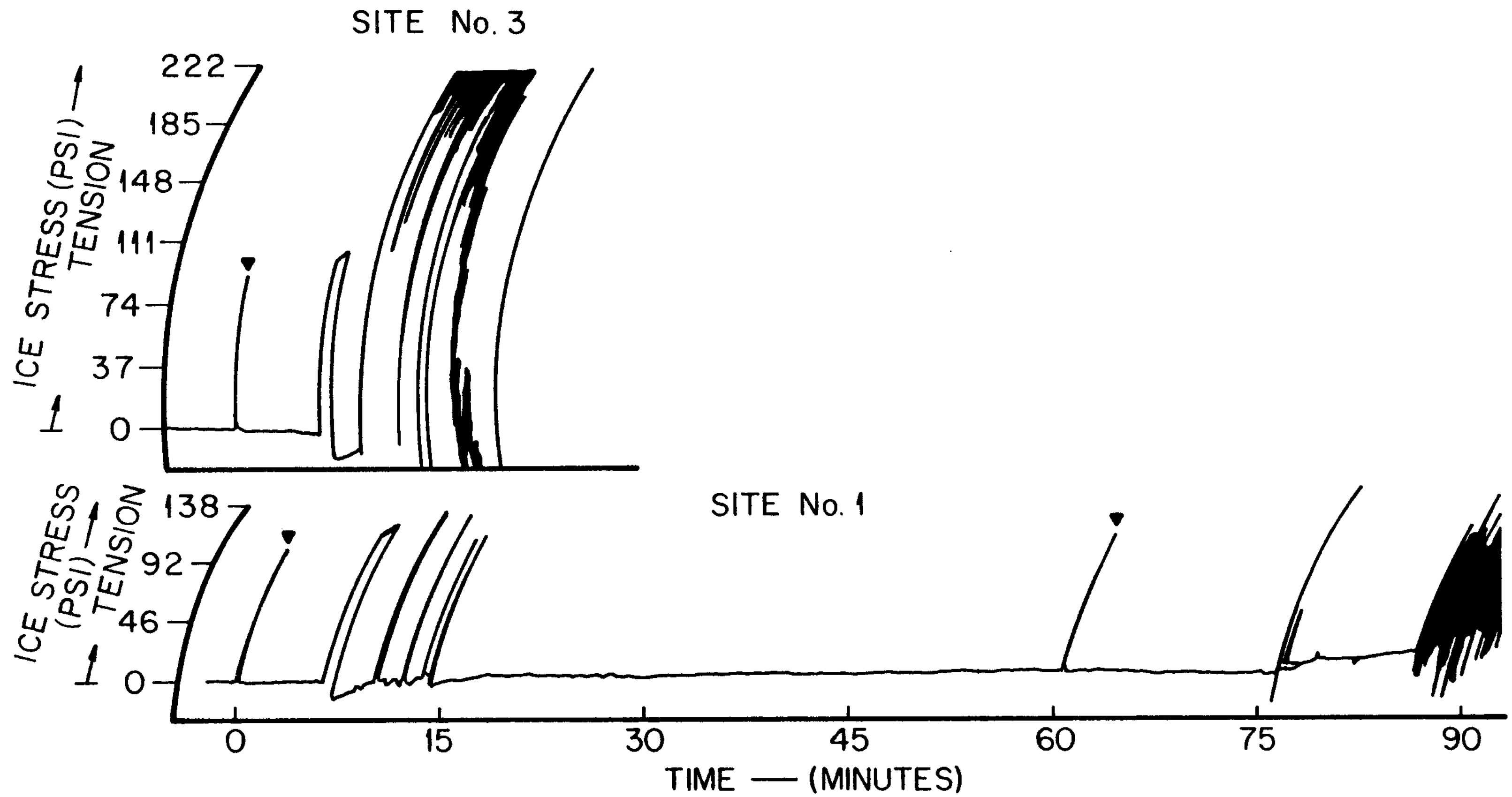

Figure 34. Ice stress at sites #3 and #1, June 12, 1977, showing final destruction of both sites. Time marks shown as (▼).

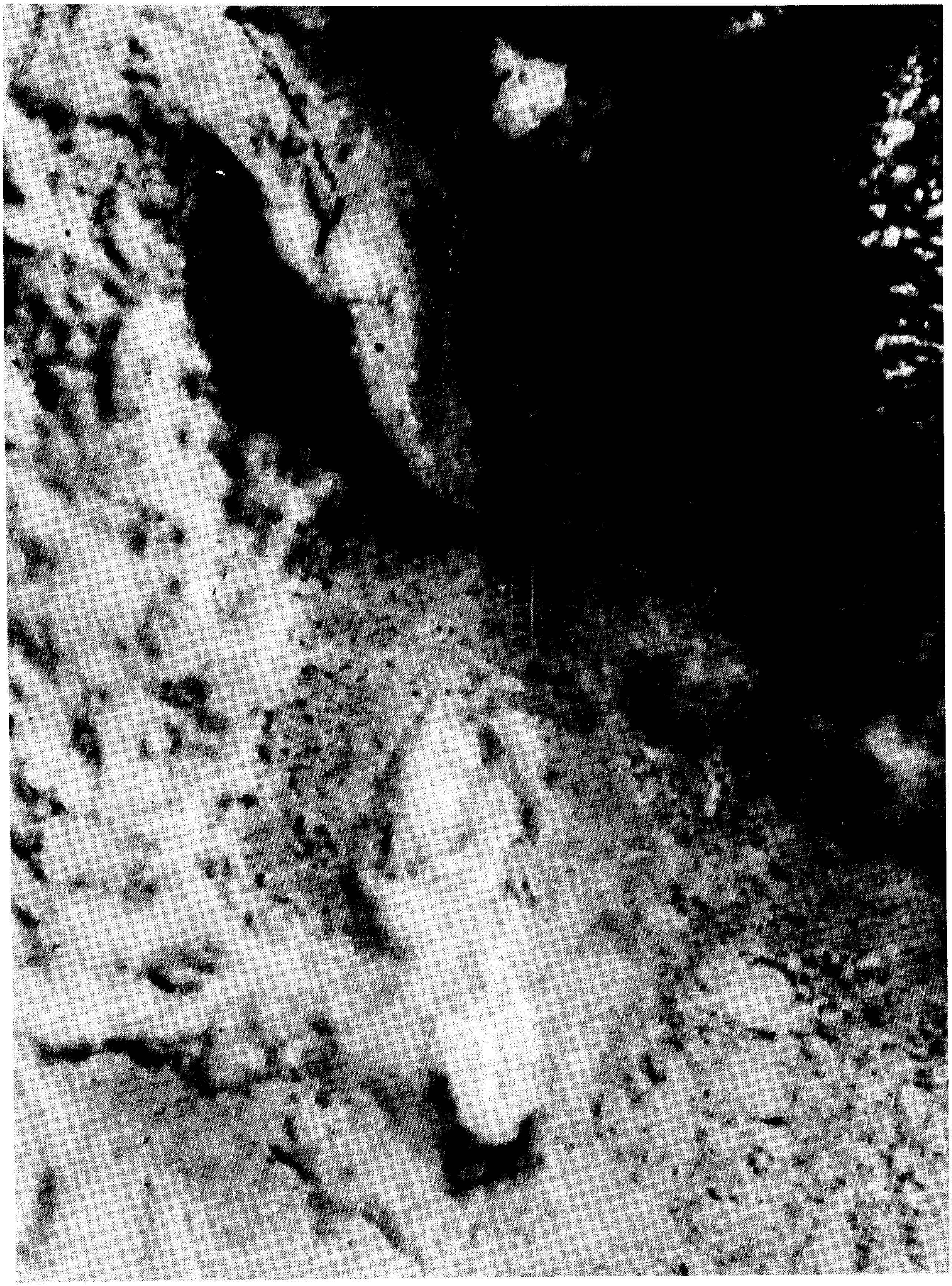

Figure 35. NOAA satellite photo of shorefast ice conditions near Point Barrow on June 10, 1977.

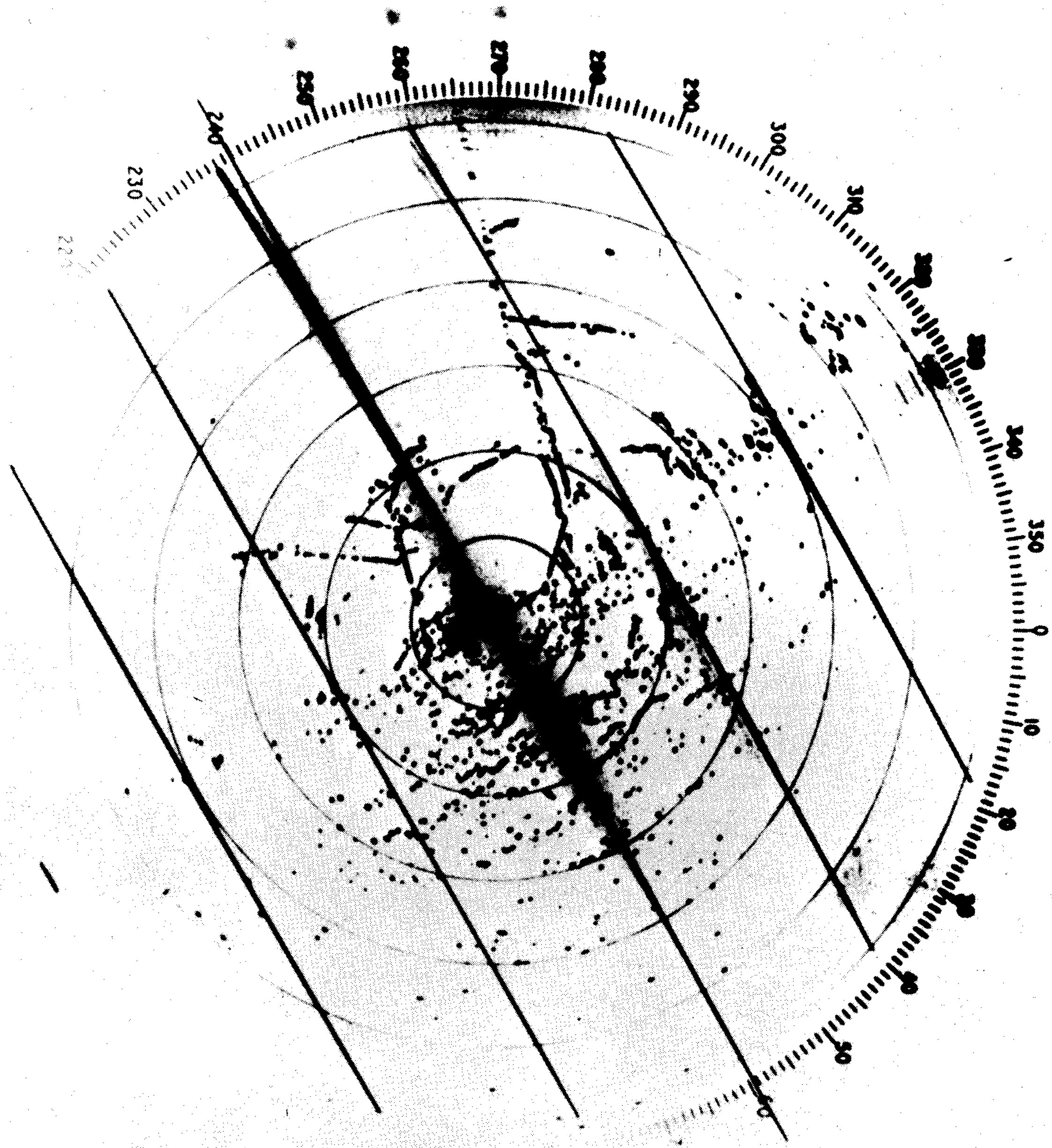

Figure 36. Radar image of shorefast ice conditions near Point Barrow on June 6, 1977.

same time, station #3 experienced tension, which was relieved briefly at the instant that #2 was destroyed, but which was quickly restored. Subsequently, #3 experienced alternate tension and relief many times, as shown in Figure 32. The risetime for one of these tension events on #3 was 4 seconds, as measured with fast (6" per minute) chart speed and shown in Figure 33. For all of the other events, slow chart speed (6" per hour) was used, and measurements of the risetimes and decaytimes of the other events were difficult. However, they appear to be consistently close to this value. The risetime limitation of the recorders used was 0.4 seconds for the amplitudes observed, so the risetimes observed were not limited by the recorder.

One possible explanation of the data is that a crack formed, and then a sequence of stick and slip events took place along the crack. There are other possibilities, of course, which have been considered as well, but after careful examination of all of the information available, the stick-slip model seems to be most likely, as is discussed below.

The offshore component of the wind, together with the frequent occurrence of tensile stresses, leads one to first consider the possible formation of simple tensile cracks in a direction perpendicular to the wind stress. It is possible that the wind stress acting on the floating ice seaward of the gauges could have caused a tension buildup, which would be relieved by a crack formation. However, in such a simplified model, the floating ice sheet would then move out to sea, and no explanation is provided for the compressive pulse at #2 or the sequence of tensile stresses at #3. In fact, #3 is still in tension just after #2 has been destroyed; if a simple tension crack destroyed #2, and the ice sheet separated and moved out to sea, there would be no way for tension to be sustained at #3. In addition, the stresses recorded March 16, which were apparently wind-related, show a very different time dependence. Therefore, this model is too simple, and an alternative explanation must be sought.

A model for ice motion which involves buckling and ice over-ride at the location of the gauges appears to be unlikely, because a shoreward movement of the pack would be required. The large expanse of open water observed on the satellite imagery two days earlier, plus the sustained offshore wind preceeding this breakup sequence, lead one to reject the hypothesis of a shoreward component of motion. Also, if there were such a movement, it is likely that all of the gauges would have shown a significant buildup of compressive stress prior to buckling, yet this was not observed. The fact that the compressive pulse at #2 is not coincident in time with the tension at #3 is evidence that a buckling is an unlikely cause of the destruction at that specific site.

Previous breakup sequences have been observed in prior years by radar in the same location. A consistent ice movement along the coastline has often been observed during breakup, indicating that currents along the shoreline have a major role in determining the direction of ice motion in breakup. Depending upon the wind direction, the moving ice floes can either pile up against the grounded ridges and against the shoreline, or they can veer out to sea, often freeing some of the grounded ridges and carrying them along. Since the wind had an offshore component during this particular breakup sequence on June 12, it is likely that the ice motion did as well. An essentially continuous ice sheet moving along nearly parallel to the shoreline would certainly interact with the grounded ridge adjacent to transducer #1, and the ice surrounding and connected to that ridge. Transducer #3 would be closest to the moving ice, and indeed this transducer does show a tensile stress first, which could be caused by the moving ice as it pivots seaward around the grounded ridge and its associated adjacent ice. It appears that the tension in the region caused a crack to form, probably in the previously-cracked ice, running from #3 towards #2. As this happened, the tensile field near the tip of the crack propagated towards #2, showing as a sudden increase in tension at site #2. Simultaneously, tension at site #3 was relieved briefly, as is indeed shown on that record. With the crack formed, then, a first shear movement is possible, and apparently took place. After moving only a very short distance, the movement very likely stopped, and the crack boundary stuck, thus restoring tension at site #3, as observed, and giving a very high local compression at site #2 due to stress concentration. In order to explain this localized compression, we can recall that in late March a crack occurred very close to site #2, and subsequently refroze. This refrozen crack branched into two refrozen cracks, similar to a Y-shape, just adjacent to site #2. The width across this Y-shape was 0.8 meters at site #2, and the crack was at an angle of about 30° with respect to the shoreline. If the crack formed during breakup along this old fault, and followed the left leg of the Y, the resulting interlocking could cause a high local compressive stress concentration at site #2 which was sufficient to destroy the gauge. The maximum compression recorded during the instant of gauge destruction exceeded the limit of the recorder range, which means that the compressive stress was greater than 2.34×10^6 N/M^2 (340 p.s.i.). Although the gauge itself is robust enough to withstand this stress, it is likely that local ice fracture severed the wires leading from it. The continued small fluctuations in tension on site #3 indicates that there was probably some movement as the ice in the area of stress concentration around site #2 was destroyed. After seven minutes, this process was completed and a steady tension was sustained at site #3 for seventeen minutes, until the next release.

It should be pointed out that these rather dramatic events did not cause any significant stresses on transducer #1, which was located approximately 10 meters from the grounded pressure ridge. In particular, the tension field at site #2 and #3 did not appear at site #1, and the sudden compressive pulse which destroyed #2 did not appear at #1. However, the ice destruction at site #2, of seven minutes duration, which showed on the chart #3, also did appear as a small 0.12×10^6 N/M^2 (18 p.s.i.) compressive stress at site #1. It therefore appears that, during this type of natural breakup event, ice stresses tend to be localized over distances of the order of meters, rather than being sustained over 100 meters or more.

With the destruction of site #2, and the definition of a crack, transducer #3 then showed many events of tension and release, which could be explained by a stick-slip mechanism. Table 3 has been constructed to summarize this data. It is difficult to explain the time intervals between tension release and a subsequent buildup, without having an intimate knowledge of the ice displacements and velocities on a local basis. Of some interest is the fact that the tensile stress, at the gauge, once built up, was quite uniformly equal to 0.83×10^6 N/M^2 (120 p.s.i.) just prior to release in each case. Because the exact location and orientation of the stick-slip boundary is not known, and only a single gauge was installed at each site, it is unfortunately not possible

Table 3. Tension and release events at site #3 during the sequence leading to destruction on June 12, 1977.

Tension Increase (psi)	Tension Release (psi)	Duration (min)
106	120	6.5
113	120	3.8
113	120	2.9
115	120	0.9
117	120	1.2
124	120	1.25
120	120	2.4
120	120	0.5
119	120	2.7
102	120	0.9

Table 4. Tension and release events at site #1 during the sequence leading to destruction on June 12, 1977.

Tension Increase (psi)	Tension Release (psi)	Duration (sec)
119	137	60
137	137	18
137	137	12
109	105	6
109	114	6
150	169	-

to calculate the failure stresses at that boundary from this data. However, since the ice at the gauge apparently did not fracture, it is apparent that sea ice of this age, salinity, and temperature can sustain at least 0.83×10^6 N/M^2 (120 p.s.i.) in tension. However, again, there is very little sign of this activity at site #1, 125 meters away.

The time constants for ice stress buildup and release at transducer #3 appear to be in the range of 4 ± 2 seconds; this may be of value in considering the dynamic response of elastic bottom-founded structures subjected to ice loads during breakup. These types of loads were encountered when the stick-slip boundary was within a few tens of meters of the stationary transducer. In most events, the rapid tension buildup seems to be followed by a very small 0.05×10^6 N/M^2 (7 to 9 p.s.i.) and gradual increase in tension, until the time of release. This might possibly be related to ice creep, or a change in the ice loading conditions, at the stick-slip boundary.

During the five hour period encompassing this breakup sequence, transducer #1, located near the grounded ice ridge, showed a very gradual drift of 0.12×10^6 N/M^2 (18 p.s.i.) in the tension direction. A similar trend was noted at site #3. This is probably due to the moving ice pushing against the remains of the pan of ice in which these stations were mounted. Just prior to the destruction of site #3, there is a long interval (80 minutes) when the stick-slip sequence did not act. This can be explained by the hypothesis that the crack may have been wide enough at that time so that no load was transmitted across it; or it may have been that there was no driving force transmitted through the region from the pack ice seaward. At the end of that interval, one additional tension event occurred which registered at both sites #3 and

#1. This could have been associated with crack formation between the two remaining stations, because two minutes later, transducer #3 failed. It went dramatically in the tension direction, which was probably caused by a parting of the wires leading to the transducer. One minute later, site #1 experienced an abrupt tension event, which was followed by several more, as shown in Figure 34.

The fact that site #3 was destroyed at this time, when tension is finally showing at site #1, is further evidence that ice activity and breakup produces these stresses which are observable only a few tens of meters away.

The final events recorded at site #1 are summarized in Table 4. These events were of very short duration, in the range 6-18 seconds, and had very short buildup and release times. They were all tension events, the largest of which was 0.94 x 10^6 N/M^2 (137 p.s.i.). The final failure of transducer #1 may in fact have been a collapse of the transmitter tower and the adjacent electronics, rather than a failure at the transducer itself; ice movement would likely have destroyed the transmitter first. The large final pulse of data in Figure 34, because it occurred so quickly, may be an artifact of incipient instrumental failure at the site, rather than actual stress data. The short pulses preceeding failure, however, may be short stick-slip events or may represent impact by ice floes which are not in contact for a long time, but which strike the remains of the grounded ice ridge from such a direction that tension is produced at the gauge site.

It should be emphasized that this discussion of the data represents only one possible interpretation, which the authors feel is most likely, in view of their experience in observing the breakup of sea ice. An infinite number of ice configurations and breakup conditions are possible; in fact, at other sites, a different set of circumstances would most likely prevail. However, in the region surrounding a grounded obstacle, it appears that sea ice breakup generally involves the buildup of local tension fields, to a level of 0.83 - 0.97 x 10^6 N/M^2 (120-140 p.s.i.), followed by crack formation. The cracks may be subjected to a stick-slip sequence as the ice is beginning to disperse, whereas impact events are more likely as the pack opens up, and large-scale motion ensues. High compressive stresses are likely to be rare and localized, such as adjacent to fixed locations which tend to concentrate stresses, however, these local compressive stresses can exceed 340 p.s.i. briefly during ice failure. Time constants for the buildup and release of tension and compression seem to be in the range of 4 $\pm$ 2 seconds, which will be of importance in the design of elastic structures affixed to the sea floor. For a particular structure design, however, it is necessary to consider the likely modes of ice failure with great care, and to estimate the ice forces which will be transmitted to the structure. It is hoped that this data will be useful in the design of such structures.

VII. CONCLUSIONS

1. An ice stress telemetry system was developed, which provides a method for recording the ice stress in hazardous locations during times of ice movement, and which can record the local ice stress during failure of the ice.

2. The compressive strength of the multi-year sea ice at a grounded floe-islands northwest of Barrow was at least 1.72 x 10^6 N/M^2 (250 p.s.i.), and may have been much higher. For the annual ice at Barrow,

the compressive strength was probably greater than 2.34 x 10^6 N/M^2 (340 p.s.i.). Local brief stresses of such magnitudes can be produced by natural ice movements.

3. The tensile strength of annual ice, in-situ, can be as high as 0.83-0.97 x 10^6 N/M^2 (120-140 p.s.i.) during spring conditions. This appears to represent a strength characteristic of large volumes of ice. This conclusion is based on the stress levels during wind-driven events.

4. Considerable ice activity can occur without causing thick ice to buckle. In such cases, the floes may interact as plates, with stick-slip relative motion. Tensile stresses generated during such activity may be more important than previously supposed in reducing the likelihood of buckling and over-ride.

5. Stresses generated and transmitted in mobile ice may vary rapidly, with small-amplitude stresses having frequencies in the 1 Hz range, but where large stresses are generated by relative motion of ice floes, risetimes of 4 $\pm$ 2 seconds are more typically encountered.

6. Where stresses are produced by relative motion of ice floes, they may be localized to a range of less than 100 meters.

7. Stresses generated by the wind can be high enough to fracture fast ice in tension. Wind generated stress in shorefast ice is not characterized by rapid variations, and may lag several hours behind increases in wind velocity.

8. Drifting pack ice patterns, in the vicinity of grounded obstacles, respond quickly to changes in wind direction.

VIII. RECOMMENDATIONS FOR FURTHER STUDY

One of the significant results of this program was the measurement of the risetime of sea ice stress during times of high stress and ice breakup. Although risetimes are of less importance when one is considering gravel artificial islands as drilling platforms, risetimes are of great importance in analyzing the dynamic response of steel artificial structures. Measurements taken in the past on actual vibrating structures subjected to ice stresses have been complicated by the presence of the natural vibration modes of the structure, modified by ice loading; such measurements also require the presence of a relatively expensive structure. Risetime measurements of ice stress taken at the edges of rigid, massive grounded obstacles, with instruments either in the ice sheet or mounted on the grounded obstacle, are very worthwhile and should be continued, to form a statistically significant data base for future structural vibration analyses. Frequency spectra up to at least 20 Hz should be recorded.

Other researchers in the OCSEAP program have discovered that the sea ice is anisotropic and uniformly oriented over large distances in the shorefast ice zone, and that the sea ice in the middle and lower layers of the ice sheet has a much higher compressive strength than sea ice near the surface of the ice sheet. As a consequence of these findings, it now appears probable that the naturally-occurring sea ice stresses in the middle and lower regions of the ice sheet are complex, because of the anisotropy of the material, and are very important when calculating total ice force against an offshore structure, because of the higher strength of the anisotropic ice. In order to reliably predict ice forces on an offshore structure, more information on the naturally-occurring stresses deep in the ice sheet must be known. Such information would also be of value in predicting particular modes of ice failure adjacent to specific structural profiles. Several uniaxial gauges, or a single more elaborate sensor (not yet developed) are needed to adequately determine the stress tensor deep in the ice sheet.

Finally, it remains to be determined in what regions and, to what extent, a uniform ice sheet will develop compressive, tensile, and shear stresses when it begins its advance against an artificial island. After ice failure has progressed, and ridges have built around the artificial island boundaries, the degree to which ice stresses are actually transmitted to the island boundary during motion of the ice sheet still remains to be determined. Calculations of such forces on artificial islands have been and will be made by island designers. Such calculations will perforce contain many assumptions; these calculations should be examined, and their predictions should be verified by the installation of stress instrumentation around the first actual artificial island, after it is constructed. It is extremely important that the first artificial island, and the first steel structure, installed in the Beaufort Sea, be adequately instrumented, to insure that design calculations were appropriate, and to provide a firm basis for the design of subsequent offshore structures for the Beaufort Sea.

In summary, then, three topics for further study are recommended:

1. Frequency spectra of naturally-occurring ice stresses should be recorded.
2. The stress tensor for naturally-occurring stresses deep in the ice sheet should be measured.
3. Calculations of total ice forces on offshore structures should be made. Ice stresses should be measured at the boundary of the first artificial island, and the first steel offshore structure, in the Beaufort Sea.

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FINAL REPORT

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A BASELINE STUDY OF HISTORIC ICE CONDITIONS IN THE BEAUFORT SEA, CHUKCHI SEA, AND BERING STRAIT

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PART I

REPORT NARRATIVE

Part I

REPORT NARRATIVE

A. Historic Sources: Values and Limitations

Records of navigation in the Bering Strait and the Chukchi and Beaufort seas provide a valuable observation of natural phenomena from the bridge and crow's nest. Ice conditions on any given day loomed large in the considerations of whaling men, traders, and government skippers. Depending upon the cruise's purpose, the captains approached the navigational problem in diverse ways. Traders like C. T. Pedersen had the simple object of working their vessel inshore as closely as possible. With a ship of shallow draft they expected to pass between the ice pack and the shore ice, exercising their skill and patience to reach their destination. They did not depend upon their ships' hull strength or engine power, but on guile and painstaking observation. Pedersen seldom left his crow's nest for long once his vessel passed through the Bering Strait unless open water was extensive.

Whaling men, on the other hand, faced a more complicated task. Their course was not set toward a native village or trading station, although it was a directed one. They were directed by the necessities of the hunt in which they engaged. Bowhead whales moved along the edge of the ice pack in their migration, and whaling men had to follow in their wake. To the whalers a lead was more than a transit route, it was primarily a hunting ground. Their ships were sometimes strengthened for ice work, but they were not designed to batter their way through ice, and they were low powered.

Government patrol vessels like those of the U. S. Revenue Marine or Revenue Cutter Service (the title depending upon the date, but the predecessor agency of the U. S. Coast Guard) took the most objective view of ice among the three categories of voyagers under consideration. They went where other vessels, generally whalers, could be found, and, when necessary, called at Barrow or other communities to meet their other obligations. Plotting their tracks is an exercise in frustration for anyone seeking a pattern in ice movements because patrol vessels steamed from point to point, doubling their track when necessary, avoiding the ice, of course, but otherwise disregarding it.

One factor is common to all three types of Arctic cruises from which data has been drawn: the ice was viewed as a potential obstacle, an impediment to navigation. It was not a seasonal physical feature subjected to long ranged scientific curiosity. There were no standards by which its particular qualities might be described; comparisons were not drawn from season to season; information was never collected or exchanged. In fact, the ice observer was happiest when he had no reason to mention ice conditions. Ice represented a bother and a peril; when it was neither, it did not interest the voyager. So we are dealing with the records of practical men who dealt with their own problems according to the immediate exigencies. It is not surprising that their ice data was limited and that their method of reporting lacked consistency.

It is interesting to compare the historic ice observations of polar explorers who probed for the Northwest Passage or a feasible route to the North Pole. Their goals were closely defined: a route through open water or a passage over supporting ice determined the respective achievements. Explorers pondered over the reports of their predecessors with the zeal of fanatics, and the determination of men playing for the high stakes of glory and survival. How well did they do in building upon knowledge gained by their predecessors? If we judge their efforts by the time elapsing between the initial voyages and the attainments of both polar goals, we might conclude that 400 years indicates a wanting of diligent application. But, or course, the endeavors should not be evaluated in such a cavalier manner. It is an exaggeration to describe the exploration as a sustained one except in the most general terms; and the probings, for many good reasons, were not consistently directed to any one sector of the arctic vastness. What would be fairer to note of explorers--for purposes of comparing them with the whalers-traders-Revenue Service-Coast Guard men whose records are the basis of this study--might be the quality of their ice observations. Explorers as experienced as Fridtjof Nansen and Robert E. Peary gave widely varying estimates of pressure ridge elevations; John Ross, Peary, and others located lands where none existed; and a whole school of American explorers were duped into a belief in an open polar sea because one of Elisha Kent Kane's men confused a polyana with an open sea.

The comparison gives us some perspective in evaluating the recorded log data compiled here for the Bering Strait, Chukchi and Beaufort seas. Whatever limitations the data shows, it is remarkable for the absence of fancy and imaginative speculation presented as factual observations. Aside from a few errors, some of which might have occurred in transcription, the record appears to be accurate. While we might wish for references to special ice events, the record is not confused by mysterious and questionable sightings. Our mariners showed no inclination for supporting pet geographic theories and offered no special pleading.

Whalers enroute to the arctic generally encountered the receding Bering Sea ice pack in mid-April, at some point between Cape Navarin and St. Matthew and Nunivak Islands. Navigators then worked their way towards the Bering Strait through leads in the ice pack, hunting as they went. Two routes generally were favored, an eastern passage from St. Matthew Island to St. Lawrence Island; and a western one skirting the Siberian coast from Cape Navarin to Anadyr Gulf, thence to Plover Bay, St. Lawrence Island, and north into Bering Strait. Usually it was late June before even steam whalers could penetrate either the western or eastern Chukchi Sea, so the fleet customarily retreated to Port Clarence for reprovisioning in preparation for Chukchi and Beaufort Sea openings. By late July ships passed Icy Cape and worked east to Point Barrow, exercising extreme caution since the pack was often close inshore and without warning strong winds could move the ice coastwards to crush any ships unfortunate enough to be caught. Early in September whalers not wintering over moved back into the Chukchi Sea, near Herald Island, for a last hunt before passing through the Bering Strait for the south.

Fog often impeded a navigator's ability to fix his position accurately, much less make any useful ice observations. In 1884, for example, conditions were particularly bad, although navigators were likely to encounter fog occasionally in any year. As the captain of the Revenue Steamer Corwin wrote of 1884: "I have never seen a season like the past. From the time of first reaching the ice up to leaving the arctic dense fog has been almost constant." (Healy, Cruise of the Corwin, 1884). For "weeks at a time it was impossible to take observations, dead reckoning was almost worthless, owing to the continual changes in force and direction of the currents." Such weeks, Captain Mike Healy admitted "ages a man and breaks down his constitution." With such travails as that Healy described, it is little wonder that in plotting the positions recorded by some masters, we are sometimes confused by coordinates placing a ship firmly on land.

Early whalers were reluctant to cruise north and east of Icy Cape; it was not until the late 1880s that the first hunting was done in the Mackenzie River delta, and it became customary to extend cruises into the eastern Beaufort Sea.

The fall movement of ice in the Bering Strait was a matter of concern to early whalers, and in 1890 the first government report to summarize the experience of the 1870s and 1880s was published. (Cruise of the Corwin, Wash.: GPO, 1890).

> In the northern part of Bering sea young ice commences to form in small quantitites on the bays and along the shore, about October 15, as far south as Indian point. In St. Lawrence bay, after October 25, when the northerly winds prevail, it forms quite solid along the shore, while it still remains not solid enough to travel on in deep water. In 1881 it remained in this condition until November 31, too heavy to work a boat through, but too light to travel on, when in one night it froze solid. Very few pieces of old ice are seen, the whole formation being young ice which piles into heavy masses.
>
> December 1, the ice is solid for the winter, the pack breaking off from 6 to 8 miles off shore, with shifting winds, until the spring southerly winds start it north. When the pack comes in at these times it forces the ice up 20 and 30 feet, forming hummocks of heavy ice. Off shore young ice, of sufficient thickness to impede and perhaps prevent a steamer's progress, forms from November 1-15, and at St. Lawrence island November 25.
>
> On the east side of Bering sea, in Norton sound, and in the vicinity of St. Michaels, young ice forms in small quantities October 12-18, and by October 25-28 is strong enough to travel on. It forms for a "full due" for the winter between November 1-10, and St. Michaels is considered closed to navigation for the winter after October 15.

All the ice found in Norton sound is made up of young ice, which forms every fall and entirely disappears during the following summer.

The ice continues to form, extending farther and farther to the southward, breaking up, piling, and telescoping with variable winds and currents, and so forms the Bering sea pack, which has its limit, as a solid mass, a little to the southward of St. Matthew island. To the southward of that, the ice found consists of detached floes, which are driven off from the mouths of the rivers on the Alaska side.

At Pribyloff islands it takes fully three weeks of north-easterly winds to drive the ice down on the islands, a northwest wind being unaccompanied by ice. This ice is looked for during the latter part of December or early January, and is continually in motion, with variable winds, being much broken up.

Some years the islands are free of ice.

The farthest south the ice has ever been known to extend is Akoutan pass, and this occurred about January 15, 1978, when it only remained a few days.

In 1850 the Swallow, a whaling ship, wintered over in St. Lawrence Bay, Siberia--the first wintering for a whaler in the North Bering Strait or the Arctic. Eight years passed before ship wintered along the Beaufort Sea coast, and the practice was followed on only nine other cruises until 1890, when four ships wintered. Subsequently, until 1910, a number of ships wintered, usually at Herschel Island. Peak years were 1894-1895 when 16 ships wintered; 1895-1896 with 15 ships; and 1905-1906 with 19 ships.

Unfortunately, this sustained commercial experience did not provide any ice information beyond that recorded during the summer crusing season. Since the ships were scattered along the entire western arctic, particularly in years of severe ice conditions, a record of observations could be useful. But navigators close their log books when their ships are not underway, so no records exist for the entire wintering period of whalemen. Some ice observations made from land, at Barrow, are available for several consecutive years of this period. See Part IV of this report: Shore Observations from Barrow, 1891-1896.

B. The Charts (See Part II)

According to the Project Office requirements, the ice data has been recorded on designated charts--the Universal Transverse Mercator Projection.

The charts showing the ice edge of the Chukchi Sea during the historic period for which data has been found indicate average monthly conditions for particular periods. Data was not available for all years of the historic coverage, so it was not feasible to produce charts in ten year segments as originally planned. In determing the number of charts and their time coverage several factors were considered, but leading emphasis was placed on representing the average ice edge position in given months upon sufficient data to provide a meaningful basis. It seemed important, also, to offer the data in a form that could be used conveniently. An excessive number of charts could confuse rather than clarify. Users intent upon the acquisition of all the data bearing on ice conditions in a particular area can consult Part III of this report.

Ice edges were determined by plotting the tracks of the ship records examined, noting the log descriptions of ice conditions, and determining the ice position for the year and place. Some interpolation was necessary where log entries were imprecise or discontinuous. By determining an average over a number of years for the navigation months, the possible effect of errors made in interpolating could be minimized.

Consideration was given to the question of describing varying ice conditions. Although the achievement of standardized descriptions from historic data for specific condition of the sea ice was recognized as desirable, it was not possible. Several factors mitigated against the possibility, particularly the varied usage of descriptive terms by the navigators, and the overriding goal of clarity in presentation. The risk of confusing users of the charts with descriptive terms of uncertain value was too great.

C. The Log Data (See Part III)

The data has been taken directly from source materials, primarily ship logs. In the interest of a faithful reproduction of the records, no attempt has been made to edit entries for spelling, punctuation, standardization of observations, or for any other reason. Editorial concern for good form by contemporary standards could be a source of errors; and certainly would reduce the unique value of data that is not available in compilation in any other form.

Access to Part III data presents no particular difficulty. Ship log data is organized chronologically insofar as it is possible. Certain overlaps in chronological sequence have been necessary in order to hold the cruises of a single ship together.

D. Shore Observation Data (Part IV)

Between 1891 and 1896 the federal government maintained a shore observation station at Point Barrow. The investigators are uncertain as to the exact location of this observatory.

The records for the five year period note the movement of the polar pack, give wind velocity and direction, as well as the temperature from time to time. The station attendants also counted the ships off Point Barrow, and when available, gave information on the number of bowhead whales caught.

Examples of observations follow.

September 4, 1891

This morning report from the Point says two steamers lying there direct from McKenzie Bay with 21 whales, bound to S.F. direct as soon as ice opens. Ice still heavy and compact off this station--no chance for the ships to get out.

September 5, 1891

In the night heavy showers of rain. Wind changing suddenly from S.E. to S.W. in heavy squalls. Ice leaving shores.

September 19, 1891

Sea quite clear of ice.

October 2, 1891

No ice nor sail in sight

October 5, 1891

In the morning clearing weather but still cloudy. Plenty of heavy pack ice drifting down.

October 7, 1891.

No ice but a few drifting pieces in sight.

October 10, 1891

Pack ice setting in on shore.

October 13, 1891

Light winds, some floating ice in sight.

October 15, 1891

In the p.m. the sea covered with ice.

On Ocotober 17 the pack ice was in sight some six miles offshore, and on October 27 the weather was fair with the wind from the west having shifted in the night from the S.E. There was much open water and the winds coming off it quite warm. Conditions changed from day to day, the pack ice moving in and out depending on wind velocity and direction. On December 24 there was no open water in sight and the observers heard the ice grinding and crushing together.

In the summer of 1892 the shore observer added wind measurements in his notes. For example, on July 1, 1892 he observed

8 a.m.: Wind E steady, 14 miles an hour

Noon : Wind E steady, 19 miles an hour

8 p.m.: Wind E steady, 15 miles an hour

In the a.m. moderate winds and partly cloudy. But little ice in sight. In the p.m. clearing, warmer.

On August 20, 1893 the observers changed. The new man no longer gave the exact wind velocity, and instead used terms such as a.m. wind S.E. light, p.m. fine, light air from S.

On April 16, 1894 the observer reported that the first whale had been seen going north early in the morning, and on April 30, the first ducks of the season passed by on their way north.

In January of 1896, the federal government discontinued the station.

E. Severe Ice Events

1871 - Whaling fleet caught off Point Belcher in October. Thirty-one vessels abandoned.

1873 - Helen Mar passes East Cape into Chukchi Sea on June 6. On the 7th off Cape Serdez (Serdtse Kame) sees "no ice in sight, something that has not been before in my recollection."

1876 - Thirteen whaling vessels caught off the Sea Horse Islands in October, drifted north and east of Barrow and abandoned.

1894 - California, August. "No ice in sight around Point Barrow." C. T. Pedersen confirms.

1897 - Eight whalers crushed near Point Barrow.

1898 - C. T. Pedersen reported ice pack hugging coast at Point Barrow in August.

1905 - C. T. Pedersen reported a very bad ice year.

1906 - Duchess of Bedford caught in Camden Bay, and other ships unable to sail east of Flaxman Island.

1911 - U. S. Revenue Cutter Bear on August 1-2 steaming from Icy Cape to Point Barrow, reports "no ice of any description, even grounded ice, was sighted until in about the latitude of the Seahorse Island, when a few pieces were seen, from the masthead well off shore...The present season in the Arctic has been one of the most remarkable, so far as ice conditions are concerned, within the memory of the oldest inhabitants. The ice left Point Hope the latter part of June and early in July the Arctic was practically free of ice...at Point Hope there had been no real Arctic pack during the entire winter."

1913 - Ships of Canadian Arctic Expedition and others unable to sail east of Point Barrow and Collison Point, Camden Bay. C. T. Pedersen reported open conditions west of Camden Bay and solid ice to the east which remained closed for the season.

1917 - C. T. Pedersen reported "bad year for ice" along western Arctic coast.

1922 - Joe Bernard's Teddy Bear unable to reach Wrangel Island from Nome in August. C. T. Pedersen reported "a very hard year for ice" along western Arctic coast.

1923 - C. T. Pedersen reports "ice pack solid at Icy Cape on 19 July--a bad year.

1924 - C. T. Pedersen reports "much ice as far as Herschel Island." Two ships carried away in pack and one crushed.

1929 - July 13-14. C. T. Pedersen took 3 1/2 hours "steady working and some blasting to break through the 8 miles from Tom Gordon's place to Point Barrow."

1931 - C. T. Pedersen reports "bad ice year." July 9: "Found ice pack at Point Hope and to the north. Prevailing easterly winds kept the ice pack hard against the land.

August 13: Barrow. "Ice shoved up on beach and not water enough to float the canoe up along the beach, as seen from Irish Cliff."

August 22: "Found more or less ice along coast from Barrow to Beechey Point.

August 38: Baychimo left Herschel Island but returned five hours later "on account of ice pack tight."

August 29: Baychimo tried again. Returns after seven hours effort trying to get through the pack.

September 9: Barrow: "Found ice pack in all the way to Icy Cape...Trader at Wainwright reported later that ice pack shoved up on beach 9 hours after we left there, and did not slack up all winter."

1933 - July 13. C. T. Pedersen: "Ice pack tight north of Point Hope and had to return to Point Hope."

July 16: Working around Cape Lisburne. "Spent many days bucking and blasting ice inside of the ground ice, as the ice pack was slowly moving north in a tight mass against the outside of the ground ice. Used 30 blasts in 8 hours one day."

July 28: Icy Cape. "Ice pack very tight against land, but moving north about a mile per hour."

Summary of C. T. Pedersen 1894-1934

The Arctic ice pack is usually never far off the coast between Barrow and Herschel, or Baillie Island, and a spell of strong westerly wind brings it back to shore as a rule. The summer of 1912 was about the [only] real safe year for navigation between Point Barrow and Cambridge Bay that I can recollect, since 1894. However, I did not enter the Arctic from 1904 to 1907, inclusive, but several whaling steamers were forced to spend the winter in the vicinity of Herschel Island in 1904 or 1905, as the pack was against the shore, and winter set in very early. I was master of the little whaling schooner "Elvira" in 1912 and we did encounter some ice on the way to Herschel but we had several prolonged North East gales in August and all the ice was driven out of the Beaufort Sea, and I estimated that the ice pack must have been about 200 miles off shore along the Coast between Herschel and Barrow. We cruised for whales about 100 miles off the Coast, from Herschel Island to Harrison Bay without seeing any sign of ice, and no ice blink, and it was the same all the way to Barrow, as we cruised along far off shore, after killing three Bowhead whales in near Harrison Bay. The year 1902 was also an open season along in August and September. I was mate in a little sailing schooner in that year and N. E. Gales again drove the pack far off shore. Such N.E. gales will clear the whole Arctic Coast, but there are years when westerly winds prevail, and they make it a cold and icy season, with an early freeze-up. However, a vessel reaching Point Barrow on or about August 1st has a reasonable good chance of making it in to Cambridge Bay, and out around Barrow again, especially in a vessel built for ice work. I have never had a vessel that was built for use in the Arctic, but managed to get through the ice and out again, except 1913.

As mentioned above, August 1st is about an average date on which a vessel should figure on reaching Barrow. There can be whole months variation in the seasons. In 1931 it was physically impossible for a vessel to reach Herschel Island before August 26th, as against July 26th in 1932. The "Baychimo" (H.B. Co.) was three days behind us coming out from Herschel in 1931 and was frozen in just south of the Sea Horse Islands, and was carried off by the ice pack during a S.W. gale early in 1932.... She was a very good vessel for the Arctic as she was built for the Baltic ice work. The 10,000 ton Russian Ice Breaker "Krassin" could not do anything against the Western Arctic ice pack in the vicinity of Point Barrow when she went up there in Aug. 1937 in search of the Russian plane which was lost, after crossing over the North Pole.

There are no harbours for a large vessel between Herschel Island and Point Barrow, but there are a few points of land which afford some shelter from certain winds. Pauline Cove at Herschel Island is a small harbour, and 3 1/2 fathoms of water is about all there is in the opening of the harbour, shoaling to about two fathoms in about a quarter mile towards the head of the bay. There is no shelter between Herschel Island and Baillie Island, but some shelter behind the S.W. sandspit of the main island, for a vessel drawing up to 18 feet. I found that this shelter had shoaled up some after we wintered there in 1899-1900. A vessel drawing less than 18 feet can get inside of the sandspit of Cape Bathurst, at the eastern end of Baillie Island, but there is not much swinging room inside of the sandspit, and there is a shoal extending well cut from the island across the entrance to the harbour, with a narrow channel along the Cape Bathurst sandspit. The next Harbour east is Langton Bay, some miles east from Horton River, and if I remember correctly it could accommodate a large vessel, as I think there is from five to eight fathoms of water inside. I have not been in there since 1895, am not sure about the depth.,

Some years there are mostly westerly winds, making an icy season. There is also much calm weather (in which we pray for a northeaster). Such winds are very scarce in many years.

It is quite shallow along the Coast from Point Barrow to Baillie Island, and a few shoals close in, but the largest shoal is between Herschel Island and Kay Point, but nearer Kay Point. There is a depth of six feet of water or less on this shoal. If the Coast is fairly clear of ice east of Barrow, or only scattered ice, we always kept outside of seven fathoms of water, and always kept the hand lead going.

We always had considerable fog in the Arctic, but not so much during the latter part of the open season.

The main pack usually moves along with the current in a solid pack, but at times it is slack on the edge. In the early part of the season, there is much heavy ground ice along the coast in from 7 to 12 fathoms of water, and the pack moves back and forth on the outside of this ground ice, depending on the direction of the winds. A N.E. wind of near gale force will create a three to four knot current setting west along the Coast and lowering the water several feet if the wind lasts a few days. This current appears to be swifter along the shore between the beach and the ground ice, but it will open up many small leads, or leave the ice slack enought to work through, and the main pack will move out of sight of land in a few hours, even though the wind is blowing on to the shore a couple points or more. A strong S.W. wind will create a strong current setting eastward, and bring the pack into the beach, if there is no heavy ground ice to keep it off. This wind blows off the land a couple points, but the ice comes in just the same, and the water rises a few feet in a prolonged gale. It has often been said that there must be some land to the northward, causing the pack to set inshore in a S.W. gale."

During the immediate pre-war and World War II years, there was little ice navigation recorded. After the voyages of small schooners like the Royal Canadian Mounted Police's St. Roch and C. T. Pedersen's trading vessels in the 1920s and 1930s, the post war record opens with a new type of vessel--the icebreakers of the U. S. Coast Guard. The new technology gave a new dimension to observation of ice conditions. Descriptions of ice became more precise and were standardized, thus breaking with the rather haphazard pattern of earlier recording. In another sense these voyages broke with the past as well. Their capacity for challenging ice gave them far greater mobility than other vessels had and allowed them the option of seeking leads or manageable ice seawards of the near shore passage that had been used customarily.

The meaning of "Heavy ice" and "unusually severe ice conditions" changed with the use of icebreakers, although the record continues to show a variety of conditions from year to year. It was not all clear sailing yet as the Burton Island's 1950 Cruise shows.

1950 - Burton Island, U.S.C.G. Icebreaker reports heavy ice year. August 4, 70°36', 148°44': hull plating "dished in" two inches by heavy ice.

Data of Part III includes voyages of the U.S.C.G. Burton Island between 1948 and 1962; the U.S.C.G. Storis, 1952-1954, 1956, and 1959; the U.S.C.G. Staten Island for 1967; the U.S.G.S. Balsam, 1957; the U.S.G.S. Glacier, 1970; the U.S.G.S. Northwind, 1970. The Northwind's voyage is interesting because it started in March, and had a good deal of difficulty freeing itself from the ice.

For ice events as observed from shore at Barrow (1891-1896), see the summary of this narrative which describes Part IV of this report.

F. Methodology and Scope

Data for Parts II and III was gathered primarily from original ship logs of whaling, trading, and government patrol vessels. The considerable published literature has also been examined, particularly memoirs of mariners, explorers, and government agency reports, but the published literature does not usually offer the detail needed for determining ice conditions. Such literature has been useful, however, for identifying and confirming severe ice events.

Newspaper sources do not exist to any great extent. The Arctic has not enjoyed the close attention of journalists. In 1899 the first newspaper commenced publication at Nome, and its files provide a treasury of social data, but yield little that bears on this study.

A number of libraries and archives were examined in the course of this investigation, including those of the University of Alaska, Fairbanks, the Naval Arctic Research Lab at Barrow, the Alaska State Library in Juneau, the Stefansson Collection of Dartmouth College's Baker Library, the San Francisco Museum of Science, the Scott Polar Research Institute, the Public Archives of Canada, the Library of Congress, the U. S. Coast Guard Head quarters, the National Archives, the Fleet Weather Facility, Navy Department (Suitland, Maryland branch of the National Archives), and the Old Whaling Museum in New Bedford, Massachusetts, the Free Public Library of New Bedford, Massachusetts, and other whaling depositories in New England.

Of these facilities the National Archives and Old Whaling Museum have held the most significant materials.

Records of historic activity are not invariably of easy access. Systems of bibliographic reference and guides to location are notable by their absence. Custodians of such records have been extremely helpful, but have not always been able to close gaps in the record. Potential sources of data have been lost and destroyed over the years, and some that exists has been ravaged by time. Legibility of hand written notes has presented a taxing problem, and one that is compounded when material has been made available only on microfilm. Errors can slip into a report at several points of transcription, but the greatest hazards exist when a transcription is made from an original source which might be difficult to decipher.

The loss of pertinent records could be anticipated considering the time frame of this study. What had not been anticipated was the complete absence of data in sources known to exist. Two outstanding examples illustrate the circumstance. Since the Department of the Interior has operated ships annually since the 1920s to provision Alaskan Native villages of the Bering Strait and the Arctic, the logs of several Bureau of Indian Affairs ships were eagerly sought. On their examination, however, it was disappointing to learn that ice observations were not systematically recorded. The paucity of data cannot be attributed to negligence of reporting standards of an earlier age, as it shown by a second case. The logs of the Foss Tug Co. for recent years of barge voyages to the Arctic are sprucely kept and generously accessible, yet the printed form used by navigators has not provided for ice observations. This situation can be understood, of course. Captains of both types of vessels were never indifferent to the ice, and they guided their ships in response to the closest scrutiny of the ice. Yet, except in the general sense, history was not made in documented form.

On the positive side, research has been speeded through the kindness and cooperation of others. One instance springs to mind because it saved countless hours of research for pertinent material: A U. S. Coast

Guard commander in Washingtong produced a list of vessels operated in the Arctic during specific periods to eliminate the necessity of handling hundreds of logs concerning other regions.

Biological, Climatic, and Social Information

Statistics on the oil and baleen taken in Alskan waters from 1845 to the end of the whaling era have been published in U. S. government reports (Cited in Hunt, W. R. Arctic Passage. New York: Scribners, 1975, p. 131) and in other publications. Detailed information on the numbers of whales killed at various points in the Bering Strait and Chukchi-Beaufort seas has been compiled from individual logs and secondary studies based on logs, and other reports. Yet the same information is available in much more detailed form in this report, and additional information bearing on the weather and other factors has not hitherto been available.

The same situation exists for information regarding other sea mammals, birds, and fish catches. Totals of walrus taken have been compiled, but this study provides more detail than exists elsewhere. Whalemen took many walrus in the last decades of the last century, hunting the mammals with particular zeal when whales were scarce. One ship, for example, the Helen Mar took 325 walrus in June and July in the Chukchi Sea.

Scattered information exists in the log data of Part III of this report on the consumption of fish and caribou by individual whaling fleets.

In Revenue Cutter Service and Revenue Marine logs and trading ship logs a great deal of biological data can be found. It is unlikely, however, that reports are consistent enough for any one region over a long enough period to provide a useful compilation.

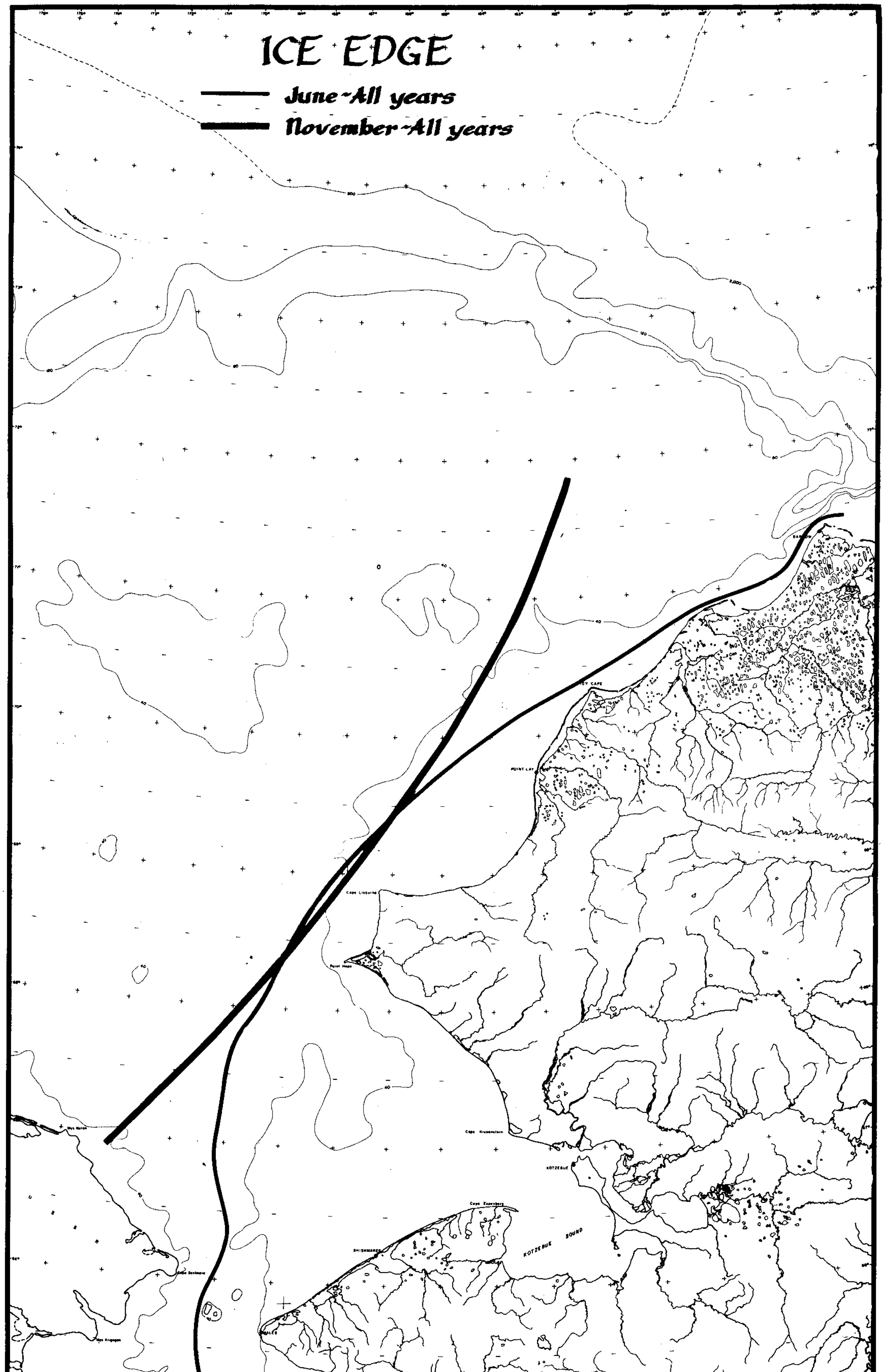
Climate data comprises part of standard log entries, but whether the record is full and detailed enough for any particular region remains questionable.

Social data abounds, not so much in whaling logs, since recorders confined themselves for the most part to customary navigational information, but in the records of government patrol vessels. As law enforcement officers, the government men were called upon to settle disputes on vessels at sea and among whites and Eskimos ashore. Information gathered on patrols provided the basis for revisions of government regulations and legislation. Such social data as forms part of this report can be more readily complemented by other sources than can biological data.

Acknowledgements

The Project Office has been extremely helpful and efficient in directing this study, and a number of investigators involved in other project phases have offered helpful suggestions. On several occasions the composition of the charts (Part II) have been discussed, and the Beaufort Sea series was presented at the Barrow meeting of March, 1977. Several requests for copies of the charts have been received from the scientific and commercial communities, but it was impossible earlier to provide the full scale charts which now form part of this Final Report.

Charles Swithinbank's fine Ice Atlas of the Canadian Arctic suggested a model for the cartographic portion of this study, but one which, for a number of reasons could not be used. Particular mention is made of it here because Swithinbank's atlas is not limited to the Canadian Arctic, as the title suggests, and users of this study may find it exceedingly helpful.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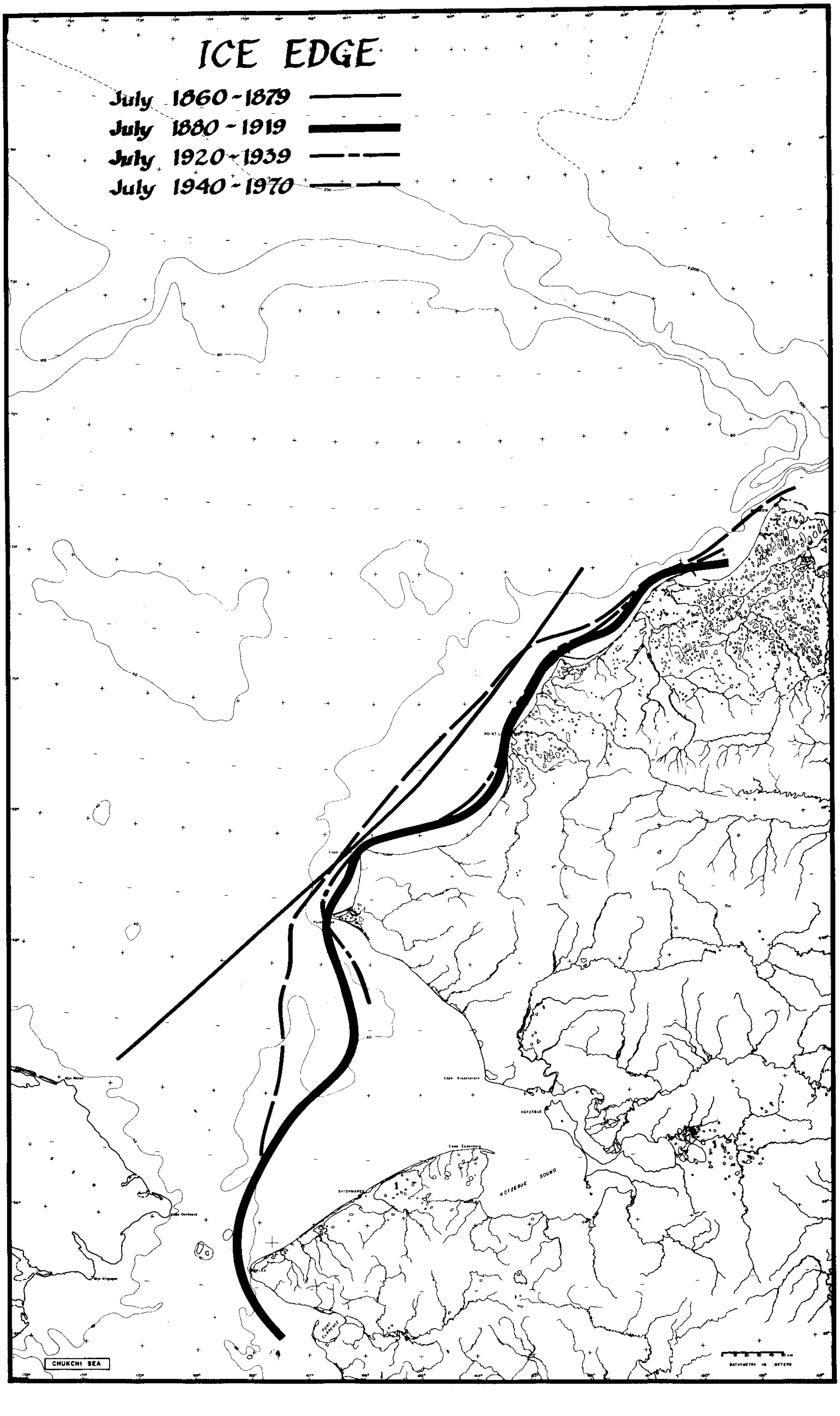
June-All years
November-All years
CHUKCHI SEA
KOTZEBUE SOUND
BATHYMETRY IN METERS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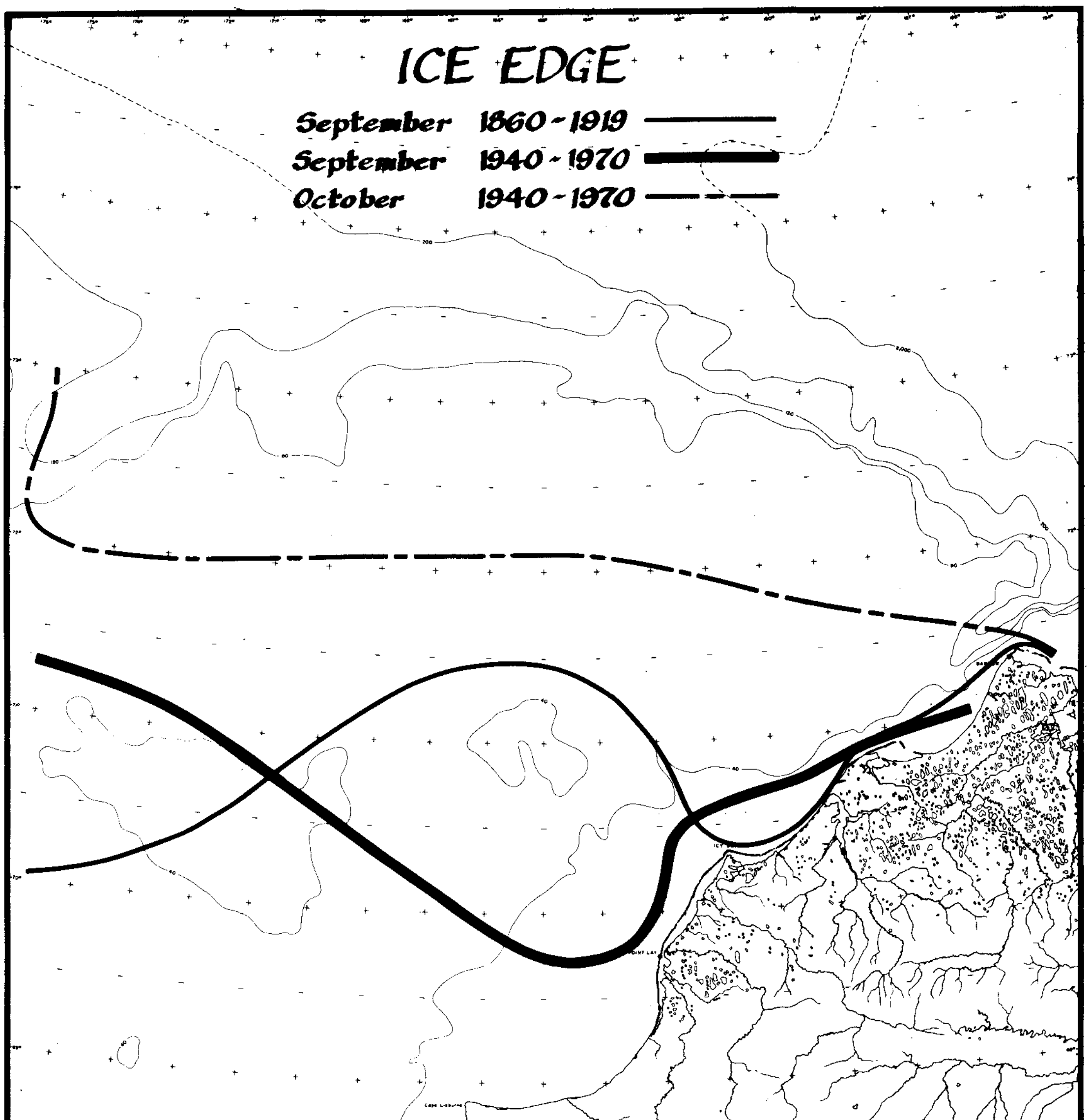
July 1860-1879
July 1880-1919
July 1920-1939
July 1940-1970
KOTZEBUE SOUND
CHUKCHI SEA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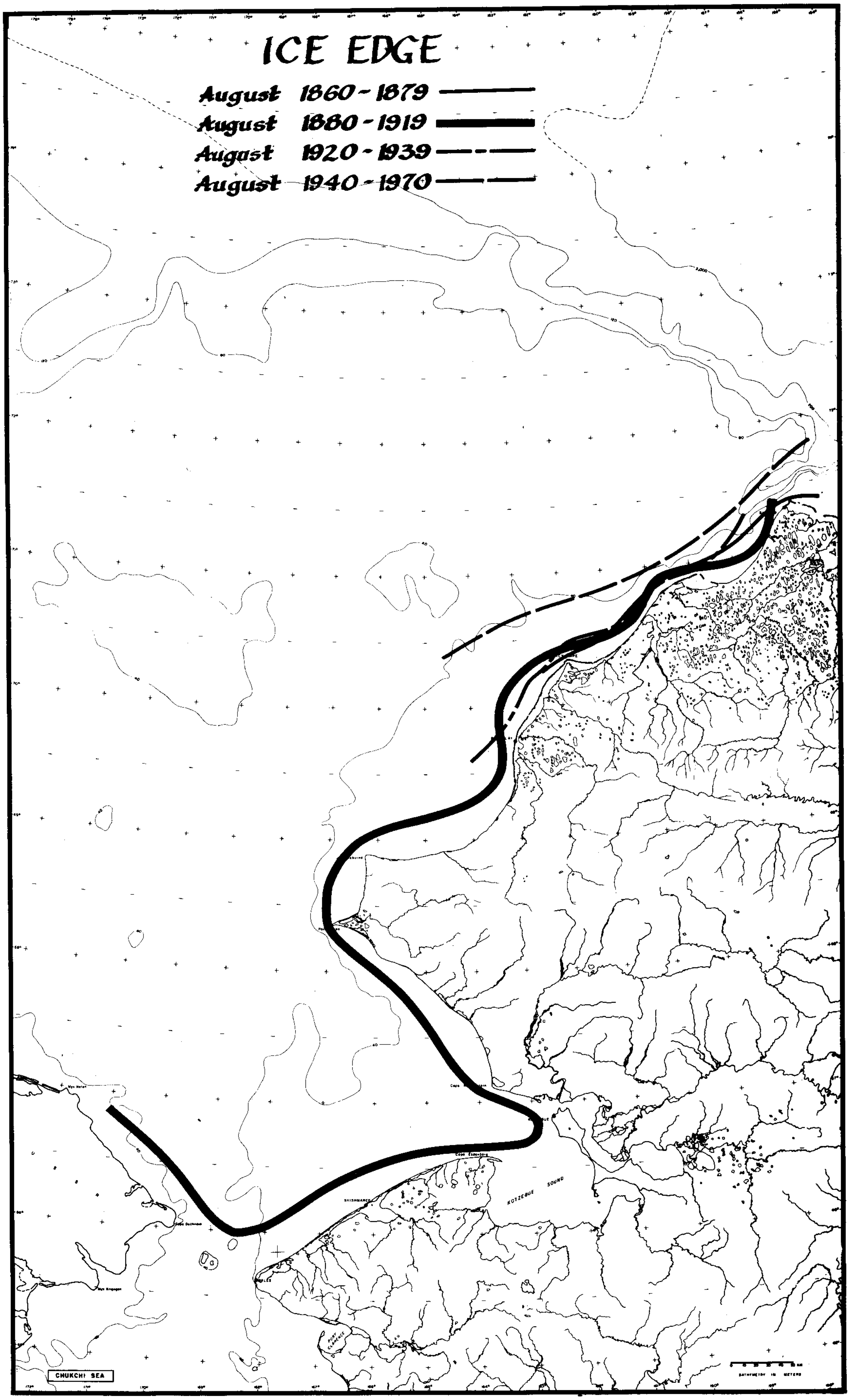
September 1940-1970
October 1940-1970
KOTZEBUE SOUND
CHUKCHI SEA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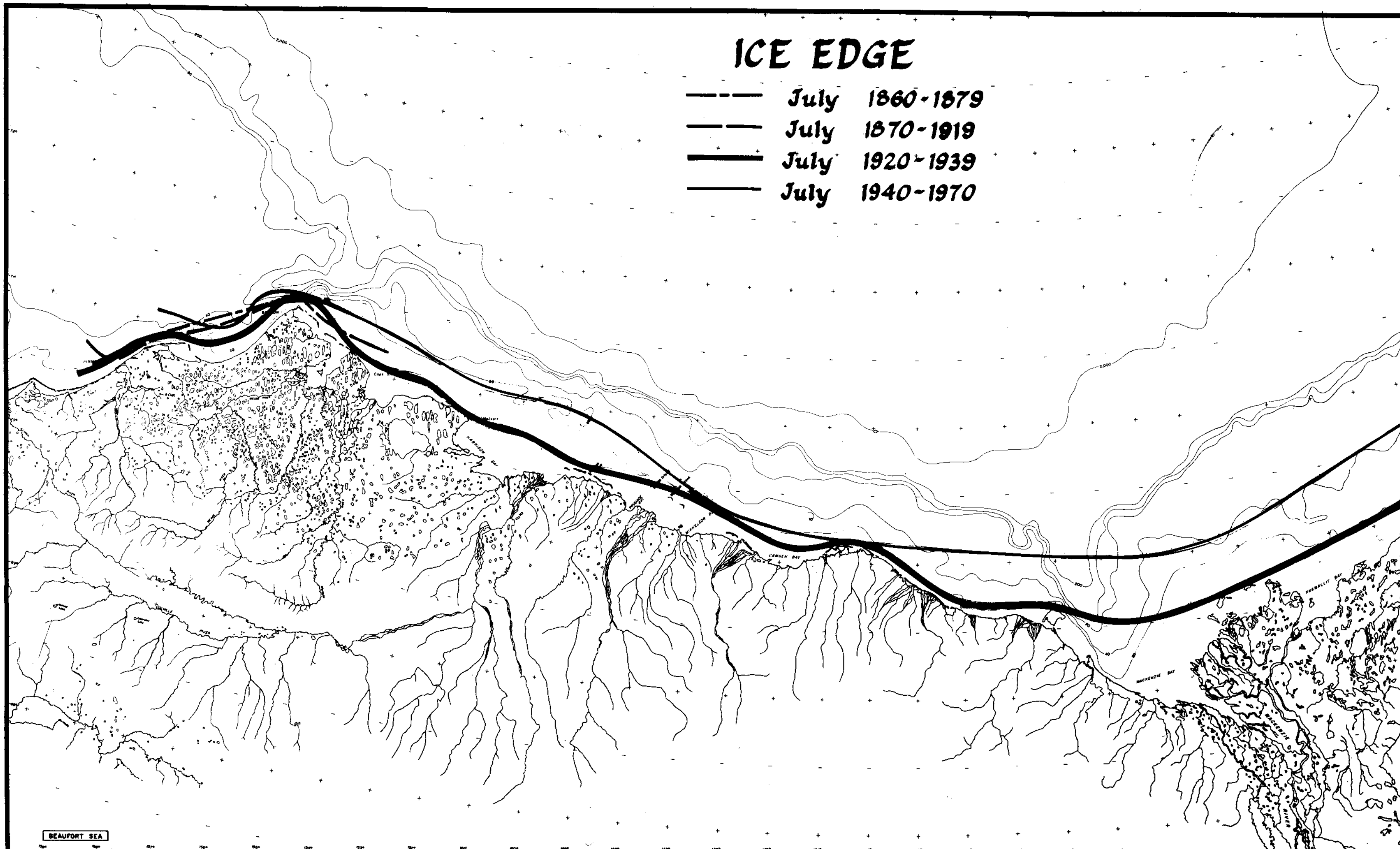
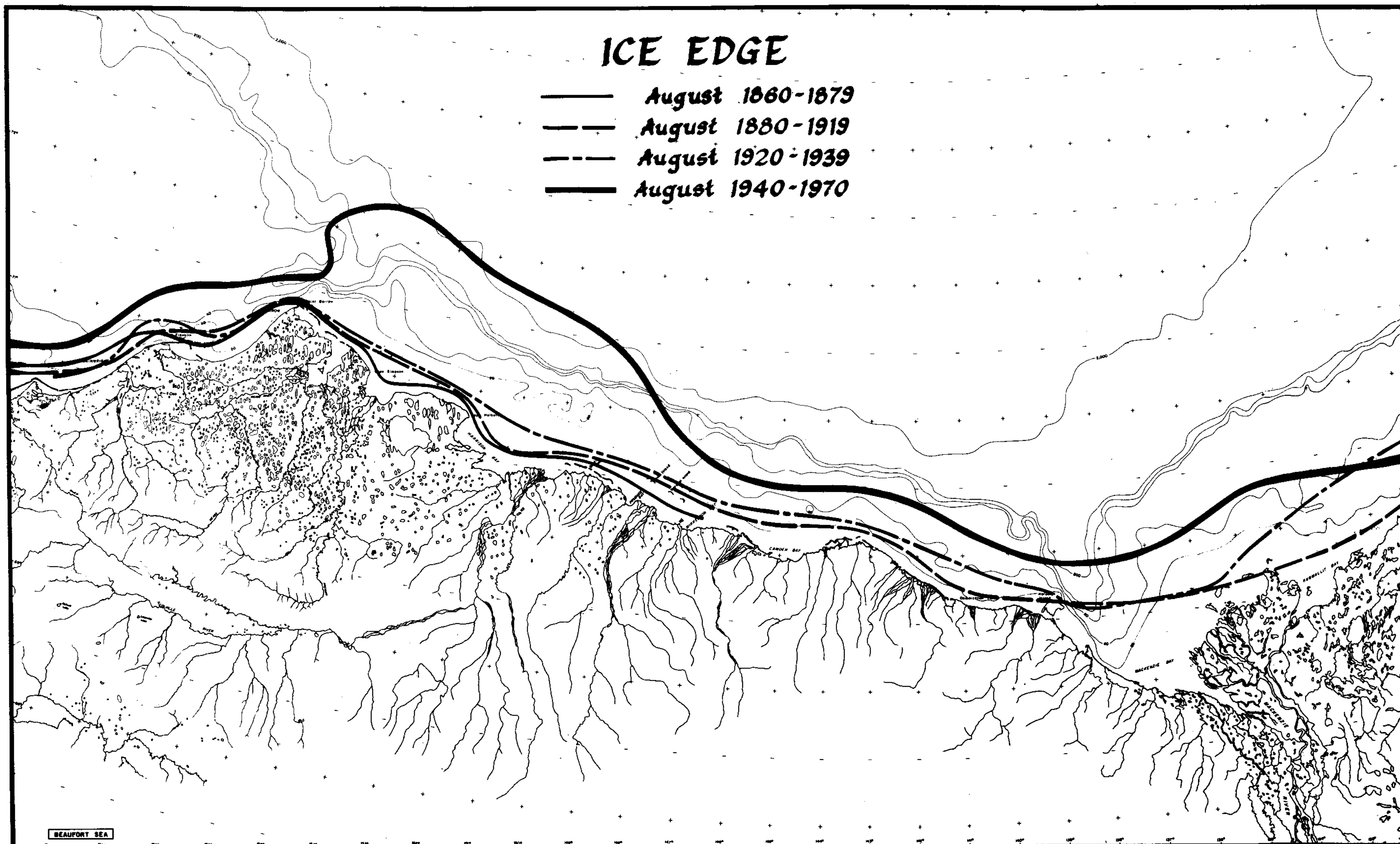
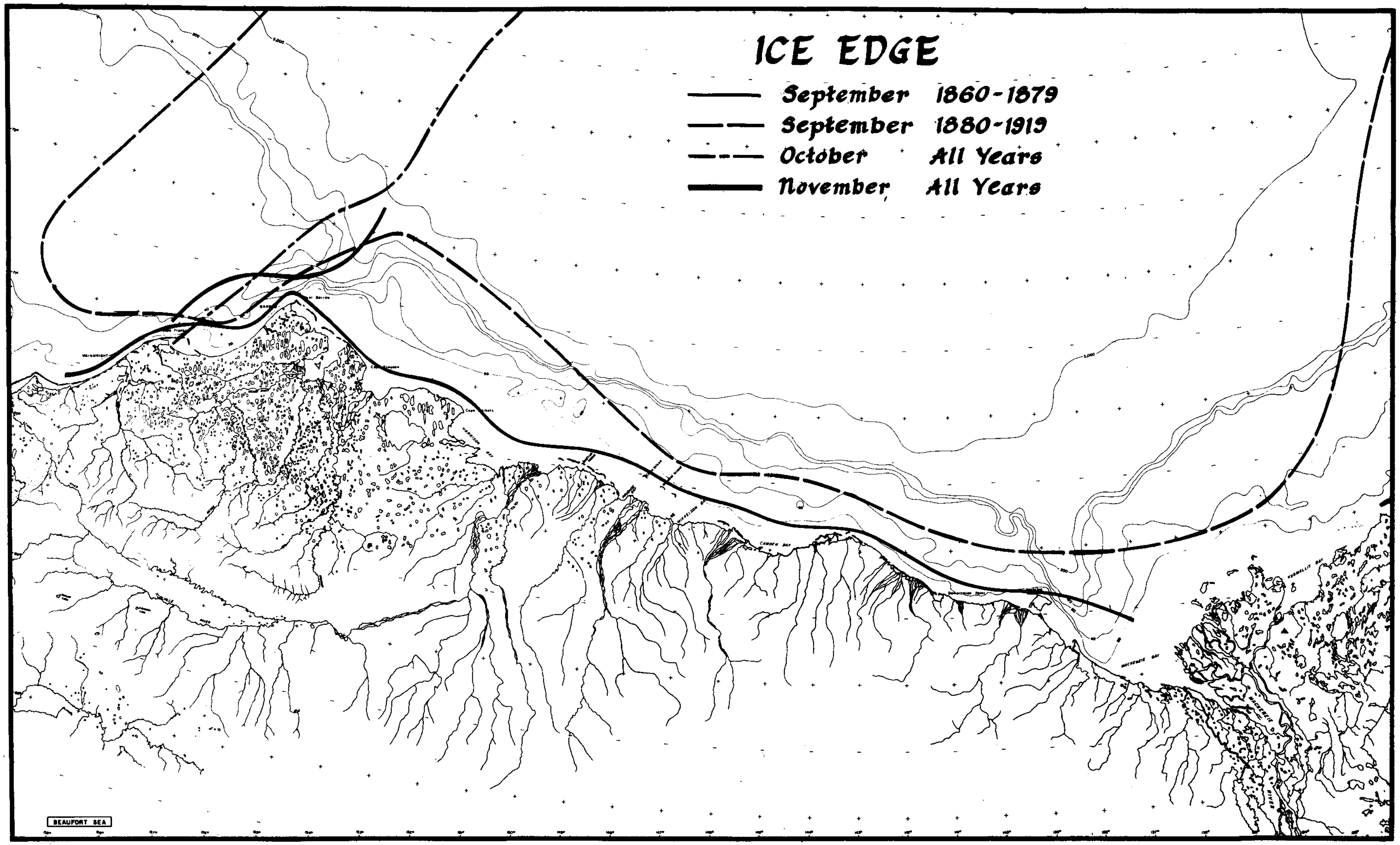
August 1860 - 1879
August 1880 - 1919
August 1920 - 1939
August 1940 - 1970
KOTZEBUE SOUND
CHUKCHI SEA


ICE EDGE
July 1860-1879
July 1870-1919
July 1920-1939
July 1940-1970
BEAUFORT SEA


ICE EDGE
August 1860-1879
August 1880-1919
August 1920-1939
August 1940-1970
BEAUFORT SEA


ICE EDGE
September 1860-1879
September 1880-1919
October All Years
November All Years
BEAUFORT SEA

PART III

LOG DATA

Excerpts from Cruise of Bark Helen Mar on cruise to Arctic in 1872, 1873.

May 13, 1872

Strong wind from NE. Kept off along the ice to SSW. Middle part laying aback, latter part at daylight running along the ice, wind N.
Lat. 58.11 N.

May 14, 1872

Strong wind from N, running along the ice to the SSW. Latter part moderate, made sail heading NNW, have got around the ice.
Lat. 57.05 N.

May 15, 1872

1:30 midnight raised the ice, tacked ship latter part working along the ice to the westward.
Lat. 58.13 N Lon. 174.10 W.

May 17, 1872

Latter part steering along the ice, wind NE.

May 23, 1872

Strong wind from NE at 2 PM made the ice, tacked ship heading ENE along the ice.

May 24, 1872

Light winds from NE, laying aback in the ice. Latter part working along the ice to the eastward.
Lat. 59.39 N.

May 25, 1872

Strong wind from NE, back and forth along the ice. Latter part steering to the westward.
Lat. 59.39 Long. 173.10.

May 26, 1872

Strong wind fron NE working to the NW through the ice. Land ten miles off
Lat. 60.30 N.

May 31, 1872

Middle part steering NE, latter part at 9 AM took the ice.
Lat. 60.38 N.

June 1, 1872

Fresh wind from SW steering through the ice. Middle and latter part in thick ice.

June 2, 1872

Strong gale from SE with a very heavy swell in heavy ice.
Lat. 60.55.

June 3, 1872

Light wind from NE with a very heavy swell in thick ice. Latter part made sail heading E, ice opening.
Lat. 60.47 W.

June 4, 1872

Light winds from NE in ice.
Lat. 60.52 N.

June 6, 1872

Light winds from NE working to windward through the ice. Latter part light airs from SW steering through the ice.

June 7, 1872

Light winds from SW steering N by W. Middle part strong wind. At 2 PM got through the ice. At 8 PM raised Cape Thadeus bearing NNE 20 miles off.

June 19, 1872

Got 32 walrus. Cape Serdz in sight bearing S distance 10 miles.

June 22, 1872

Steering by the wind to the NNW. Cape Prince of Wales in sight bearing SE.

July 28, 1972

Cape Lisborn in sight.

August 5, 1872

16 ships in sight.

August 6, 1872

Laying in the ice.

August 8, 1872

At 6 PM passed Blossom shoals, 23 ships in sight.

August 10, 1872

Stong winds from SW, raining. At 1 PM got underway to keep clear of the ice.

August 11, 1872

5 of wrecked ships in sight, at noon, other wrecks in sight at Point Belcher. All of them broke up but the Seneca, Minerva and Thomas Dickerson. The Seneca and Thomas Dickerson are in six feet of water with there spars standing.

August 12, 1872

Strong wind from NE working to the NE. Middle part laying aback, have seen several whales in the ice. Latter part steering S. Sea Horse islands bearing SSE.

August 15, 1872

At 2 PM hauled aback heading NNW. Latter part steering WSW and NW along the ice.

August 16, 1872

Strong wind from N steering along the ice to the Westward.

August 17, 1872

At 11 AM anchored at the sea horse Islands.

August 20, 1872

Picked up a dead whale. At anchor since 17th. Latter part got underway to southward.

August 25, 1872

Spoke to Bark Arctic. They told us of Bark Helen, Snow, Roscoe, and Sea Breeze being lost in the ice to the eastward of Point Barrow.

August 26, 1872

Steering along ice to westward.

August 28, 1872

At 2 PM lowered for a bowhead, it being the first time this season. Have seen several going fast to the westward.

September 1, 1872

Have seen a number of whales going NNW fast.

September 2, 1872

Fresh breeze from S steering along the ice to the NW. Have seen several whales.

September 6, 1872

Working along the ice to the westward.

September 10, 1872

Steering along the ice to the westward.

September 13, 1872

Begins calm. Middle part light airs from NE heading NW laying aback latter part light NE wind. Spoke Bark Active heading NW. No ice in sight at merridean made ice.

September 14, 1872

Fresh winds from NE heading along the ice to the westward. Got one whale.

September 19, 1872

Latter part light airs from NE working along the ice to the eastward.

September 24, 1872

Steering along the ice to the westward.

October 1, 1872

Laying aback off and on the ice. Got one whale.

October 2, 1872

Made sail in the ice.

October 4, 1872

Light wind from NE laying off and on the ice. Latter part working to windward along the ice.

October 9, 1872

Ship covered with ice.

October 10, 1872

The ship one mass of ice.

October 12, 1872

At 10 AM sighted Cape East.

October 13, 1872

Strong gale from NE steering SSE at 5 PM. Passed Fairway rock. Middle part blowing a heavy gale from NE steering SE by S at 7 AM sighted St. Lawrence island bearing SW.

May 12, 1873

At 10 AM came up with the ice, tacked ship heading NE along the ice.
Lat. 60.54 N. Long 177.20E.

May 15, 1873

Working through the ice.
Lat. 61.33N

May 16, 1873

Working to windward in the ice clear water in sight. Middle part got through the ice.

May 18, 1873

Ship in the ice. Cape Naverrene in sight bearing E 15 miles distance.

May 19, 1873

Light winds from S. Ship laying in thick ice. Middle part the same. Latter part trying to get out of the ice.

May 20, 1873

At noon got out of ice.

May 22, 1873

Light airs from SW steering through the ice to the NE.

May 23, 1873

Light wind from W. Clear water in sight. At 4 PM got through the ice steering NNE with strong SW winds.

May 24, 1873

Light wind from S steering NE under all sail through heavy scattered ice.

May 25, 1873

Working around in the ice.

May 29, 1873

Steering E NE through the ice.
Lat. 64.21 N.

May 30, 1873

Working through the ice to the eastward. Latter part clear ice open working through it.

June 3, 1873

PM in large open ice, at 7 PM got through the ice. At 11 AM raised Indian piont, anchored.

June 5, 1873

East Cape in sight bearing N.

June 6, 1873

At 5 PM passed Cape East and entered Arctic Ocean.

June 7, 1873

Steering NW at 7 PM hauled up NNE Cape Serdez bearing SW 30 miles, no ice in sight, something that has not been before in my recolection.

Middle part at 2 AM rasied ice latter part steering along the ice to the eastward. The ice a sold pack with not a breake in it.

June 9, 1873

Light wind from SE working to windward along the ice.

June 10, 1873

Light wind from SE working along the ice to windward. Have seen two bowheads going very fast to the N.

June 12, 1873

Light wind from NW. Middle part light wind clear beating to windward along packed ice. Latter part the same.
Lat. 66.35N. Lon. 167.35W

June 13, 1873

Steeering SW at 10 AM. Raised the land steering for Cape Prince Wales.

June 19, 1873

Cape East bearing W 6 miles distance.

June 20, 1873

The natives came onboard from the Diomeeds. Got 1 walrus.

June 21, 1873

Steering NE along the ice.

June 23, 1873

Strong wind from S steering NW ice in sight. Middle part steering along the ice to the NW.

June 29, 1873

The ice packed solid.

July 1, 1873

Light wind from S steering along the ice to the NE. Got 6 walrus.

July 3, 1873

Working along ice.

July 4, 1873

Fresh wind from S steering along the ice.
Lat. 70.08.

July 5, 1873

Light wind from SE steering to the NE. The land and ice in sight.
Lat. 70.12 N

July 6, 1873

Lat. 69.54 N.

July 9, 1873

Light wind from NE steering SW the ice in sight. Latter part steering W along the ice.

July 10, 1873

Latter part heading NW with strong wind in scatered ice.

July 11, 1873

At 8 PM raised Harled Island bearing NW 40 miles. Middle part at 11 AM hauled to the SE the Island 15 miles off bearing WNW.

July 12, 1873

Ice in sight.

July 13, 1873

Lat. 69.40N. Long. 172.40W.

July 14, 1873

Lat. 68.50N.

July 15, 1873

Got 7 walrus, latter part working to the NE.
Lat. 69.30 Long. 168.40W

July 16, 1873

Light wind from NE heading N by W along the ice, middle part the same, latter part heading NNE. Got 11 walrus.
Lat. 70.44N. Long. 168.20W.

July 17, 1873

Light wind from E heading NNE. Got 16 walrus. Latter part heading NNE in scatered ice.
Lat. 71.23. Lon. 167.00W.

July 19, 1873

5 PM raised the ice and land kept off to the NE.

July 20, 1873

Strong wind from SW at 11 midnight got under way the ice coming down on us.

July 23, 1873

Latter part anchored 10 miles to the NE of sea horse islands.

July 26, 1873

6 AM passed PT Barrow. Got 1 whale.

July 27, 1873

Point Barrow bearing SW 10 miles off 21 ships in sight.

July 28, 1873

Light wind from E, laying off and on the ice.

August 3, 1873

Laying around in the ice.

August 6, 1873

Light airs from N heading E 8 ships in sight off Beams(?) Inlet.

August 7, 1873

At 8 PM passed Point Barrow. Struck and killed 1 breeching whale (one that comes up out of water).

August 12, 1873

At 4 PM came to anchor one mile to the eastward of Point Barrow. The ice closed on the land.

August 13, 1873

Strong wind from SW laying at anchor raining at 7 PM got under way to go in shore clear of the ice went in to 3 1/2 fathoms of water and anchored.

August 14, 1873

At anchor.

August 15, 1873

Middle part went out to the Point and anchored again. Latter part at 6 AM got underway and made all sail steering along the ice to the SW. 20 ships in sight.

August 17, 1873

Strong wind from NE, steering SW along the ice.

August 21, 1873

At 2 PM passed Point Barrow.

August 26, 1873

At 9 PM anchored off Point Barrow.

August 28, 1873

Point Barrow bearing SE 7 miles off.

August 31, 1873

Middle part laying aback off Harrison Bay 80 miles E of Point Barrow.

September 6, 1873

At 6 AM passed Poitn Barrow bound to the westward.

September 9, 1873

Lat. 72.53N.

September 12, 1873

Latter part steering along the ice to the westward.

September 19, 1873

Strong wind from SW heading WNW. Middle part wind W at midnight ship heading SSW latter part wind NW heading WSW.
Lat. 72.15N Long. 173.31W.

September 20, 1873

Steering SSW at daylight raised Herald Island.

September 21, 1873

Light air from E, Herald Island 10 miles off scattering ice in sight.

September 24, 1873

At 10 AM the ice in sight.

September 28, 1873

Lat. 71.45N Long. 170.40W

October 15, 1873

At 4 PM raised the land to the N of Cape Prince Wales. Middle part steering S at 2 AM raised Diomeds Islands.

1874

April 25, 1874

Light winds from ENE heading N. Latter part working along the ice to the NE. There is about 10 miles of ice packed hard on the land.
Lat. 60.40N.

May 1, 1874

Lat. 60.14N Lon. 173.40E

May 2, 1874

Land and ice in sight.
Lat. 61.14N

May 3, 1874

Steering along the ice.
Lat. 61.28

May 6, 1874

Steering E by N at AM took the ice heading NE.
Lat. 61.43.

May 8, 1874

Cape Naverrane 10 miles off bearing NW.

June 3, 1874

At 5 PM raised the land. Middle part working along the land to windward. Latter part the natives came onboard at St. Lawrence Bay.

June 4, 1874

Fresh winds from NE off St. Lawrence bay. The land and ice in sight.

June 8, 1874

Strong wind from N. Latter part in thin ice Cape in sight.

June 12, 1874

Strong wind from N at 2 PM clear Cape East in sight. Middle part passed Cape East.

June 14, 1874

Cape Serdz in sight.

June 15, 1874

In thin ice.

June 16, 1874

In thin ice, struck and lost 1 devil fish.

June 25, 1874

Pt. Hope in sight.

July 11, 1874

Off Cape Serdz

July 17, 1874

Passed Cape Lisburn

July 19, 1874

Sea horse islands in sight.

July 20, 1874

Passed Pt. Barrow with very little ice.

August 3, 1874

At 4 PM anchored off Cape Hallet in 3 fathoms of water. Latter part boats off in the ice.

August 6, 1874

Light airs from NE steering along the ice to the westward.

August 7, 1874

Fresh winds from NE steering along the ice middle part Point Barrow in sight. Latter part working to the eastward.

August 12, 1874

Strong wind from NE at anchor of Colville river.

August 28, 1874

Steering SE at 11 AM rasied Pt Barrow.

September 9, 1874

Pt. Barrow in sight.

September 19, 1874

Struck and killed 1 whale, at meridean got the whale to the ship.

September 21, 1874

Fresh wind from NE the ice in sight N of Point Barrow.

September 30, 1874

Herald Island in sight.

October 5, 1874

Herald Island in sight.

October 9, 1874

Lat. 69.50N. Lon. 173.50W.

October 19, 1874

St. Lawrence Island bearing W.
Lat. 60.40

1875

June 9, 1875

Sighted the eastern ice.

June 11, 1875

Boats in Ice. King Island 15 miles E.

June 21, 1875

Got 48 wall ruses. Ship in the open ice, Caught 7 walrus
Lat. 66.47

June 22, 1875

Sighted the western ice.

June 24, 1875

Working to the N along the Western Ice. Got 11 walrus.

June 28, 1875

Got 46 walrus. Lat. 68.20

July 2, 1875

Sighted the Western Ice. Midle and latter part on difirent tacks at meredion

July 12, 1875

At 3 PM tied the ship up to the Ice that had the walrus on. At 9 AM cast off and stood out of the Ice to the Eastward. Got 161 walrus.

July 19, 1875

Steering to the Southard a long the ice.

July 22, 1875

Got 40 walrus. Cape Serdze in sight.

July 25, 1875

Scatering Ice. Got 60 walrus.

July 27, 1875

Begins with a fresh SE wind at 3 PM, lowred and got 76 walruses have used up all of the ammu ~~ann~~nition have got 1,250 all told.

August 26, 1875

Got 1 whale, off Harrison Bay

August 28, 1875

Got 1 whale off Colville River

1877

July 5, 1877

Wirking a long the ice looking for walrus the ice is so scaterd that the walrus have gon back to the main pack.

July 11, 1877

Steering along ice eastward at 2 PM raised Cape lisbon 35 miles of bearing ESE.

July 12, 1877

This day pleasent with a light breaze from the eastward at 1 AM raised sum

July 13, 1877

Wirking a long the east shore saw sum walrus and got 25 of them.

July 14, 1877

Ship a mong the scatring ice looking for walrus saw sum and got 29 of them.

July 15, 1877

Stearing to the N latter part a strong breaze from the S. raised sum walrus and the captan shot 100 of them we went on the ice to skin them and it was so rough that the sea washed over the ice and broak it up we saved but 40 of them.

July 29, 1877

Ship stearing to NE point Barrow in sight we found very heavey ice a ground all a long the bank and the ice was paeked on the land so that we could not git in to the point so went to the North until we came to the solid pack but see nothing and we steard to the S.W. and came back to point Barrow.

July 30, 1877

Slight breeze from NE stearing a long the ground ice to the SW. Got one whale.

July 31, 1877

Ran down to Cape Smith.

August 3, 1877

Ship cruising along ice to the N of point Barro.

August 4, 1877

Ship cruising of the ice to the N of Pt. Barrow. Got 1 whale.

August 5, 1877

The whales are very wild and going quick the ice began to come in to the land so we had to run to the south of the point.

August 9, 1877

The ship at anchor of the ice north of Point Barro.

August 11, 1877

Ship all at anchor and the boats cruising in the ice. Several whales struck but most of them tuck the lines under the ice.

August 13, 1877

The ships at anchor of the ice, boats cruising along the ice looking for whales. At 3 PM the wind haled to the westward and the ships had to get underweigh and stand of to the westward.

August 14, 1877

Thick fog, at 11 AM came to anchor of the ice. At 5 PM the fog cleared of from the land so we got under sway and steared to the eastward.

August 15, 1877

Cruising eastward, struck and killed one whale.

August 17, 1877

Cruising of Smiths Bay plenty of ice in sight.

August 19, 1877

At 6 PM the ice came in around the ships, had to leave.

August 20, 1877

Strong breeze from NE the ice came in around the ships we had to git underway we found the ice open to the Eastward.

August 21, 1877

Moderate breeze from NE, ship bearting along shore to eastward plenty of scattering ice but no pack the ship of the East head of Smiths Bay.

August 22, 1877

Working along land to Eastward, plenty of ice all along the shore.

August 24, 1877

Slight breeze from NW with fog squalls working to eastward along land, find plenty of scattering ice.

August 25, 1877

Beating along land of Cape Halket, there is plenty of ice and fog.

August 26, 1877

Ships at anchor of the west head of Harrisons Bay, at 8 AM steared for westward for Point Barrow.

August 27, 1877

Ship at anchor of Cape Simpson, at 9 AM a light breeze from SE, sterd to the eastward.

August 28, 1877

At 8 PM ship Milton struck a peace of ice, leaking badly, so far down couldn't be patched.

August 29, 1877

Steering eastward

August 30, 1877

Moderate breeze from N, at 7 AM came to anchor of return reef found the ice quite thick and the pack was about 1 mile from the point of the reef.

September 1, 1877

Steering westward, got one whale of Point Tangent.

September 2, 1877

Ship at anchor to eastward of Point Barrow, plenty of scatering ice.

September 3, 1877

Working westward, light breeze from N through ice, at 10 PM raised Point Barrow.

September 4, 1877

Ship cruising westward, a few whales in the ice going westward and boats cruising in ice. Came to anchor to eastward of the Point in 5 fathoms of water.

September 5, 1877

Light breeze from N, ship cruising among scatring ice to eastward of Point Barrow.

September 6, 1877

Strong breeze from NE, ship cruising in scatring ice to NE of Point Barrow. At 10 PM anchored westward of point the ice was coming in shore quick to the eastward of the point.

September 7, 1877

Strong breeze from NE, ships at anchor 1 mile SW of Point Barrow. Ice coming in very quick at 3 PM the ice commenced to come in where we were anchored and ships had to flee, we anchored close to the ground ice.

September 8, 1877

Moderate sail from NE, all of ships at anchor close to Pt. Barrow. Bark Three Brothers is fast in the ice two miles East of the Point and close to the shore and there is fear that she will be drove on shore. Sum ice came foul of us and the shacked broak in the ring and we lost our anchor.

September 9, 1877

Steered to westward until we came to the pack and then steered to South along ice. Snowing quite hard most of day.

September 10, 1877

Steering to S along the pack is close to the sea horse island.

September 11, 1877

Moderate breeze from NE, steering along ice to westward -- same next day.

September 13, 1877

Ship steering along ice to westward.

September 14, 1877

At 11 PM we saw Herald Island bearing NNW 40 miles, ice is packed on to the island.

September 15, 1877

Cruising along ice, lat. 70.02, Lon. 173.43

September 16, 1877

Cruising along ice to eastward

September 17, 1877

Ship working to N. Herald island in sight bearing NW 20 miles.

September 18, 1877

Strong breeze from SE, ship cruising to NE of Herald Island. Got one whale and another one in the afternoon.

September 19, 1877

Ship cruising to NE of Herald island. Got another whale.

September 21, 1877

Freezing hard, ship cruising NE of Herald Island. Boats are badly iced up. Spoke to Bark Norman which reports the Bark Three Brothers abandoned frozen in the ice to the eastward of Point Barrow.

September 22, 1877

This day commences with a strong breeze from the NE. The ship under reef top sails, cruising to the NE of Herald island the weather very cold the ship and boats coverd with ice saw sum whales and loard for them the waist boat carted at one but did not git fast the larbord boat struck one got fast with one iron and the whale went into the ice and Ihad to hold on to him so hard that the iron draud out.

September 24, 1877

Cruising to the SE of Herald Island

October 4, 1877

Pleasant weather and moderate breeze from westward. Herald island 15 miles of beraing SW by W. Plenty of whales in sight. Got 1 whale.

October 6, 1877

Cruising on NE side of Herald Island. Got 1 whale

October 10, 1877

Ship steering ESE bound out of the Arctic

October 12, 1877

Saw land of Point Hope

October 13, 1877

Steering S for East Cape

October 23, 1877

Been at anchor in St. Lawrence Bay. Get underway for Plover Bay to get water -- the water in St. Lawrence Bay all froze up.

1878

May 3, 1878

Ship working through ice to SW. Lat. 60.23 N Log. 181.56W

May 14, 1878

Strong breeze from N, ship laying blocked in ice.
Lat. 60.16 N Long 182.49

May 15, 1878

Ship laying in ice
Lat. 60.12 N Lon. 183.19

May 16, 1878

Ship laying fast in ice, strong breeze from N.

May 17, 1878

Gale from N with snow storm at 11 PM. Ice opened and worked to NW under top sails.

May 20, 1878

Working through ice to NE, land in sight.
Lat. 60.00 N. Lon. 189.18W

May 22, 1878

Working through ice to N, got 1 whale.

May 23, 1878

Ship laying in ice.

May 24, 1878
Ship laying a round in the ice.

May 25, 1878

Ship working through ice to NW, same next day.

May 27, 1878

Light breeze from SW, the ship fast in the ice, land in sight 20 miles off.

May 28, 1878

Laying in ice.

May 29, 1878

Ship working through ice to the SE.

May 30, 1878

Ship laying in ice with all sails firled, later ice opened and we worked to eastward.

May 31, 1878

Ship under all sail working through ice to NE.

June 1, 1878

Ship under all sail working through the ice to the NNE.

June 2, 1878

Ship laying blocked in the ice.

June 3, 1878

Ship laying in ice with all sail fireld getting water off the ice, 80 barrels of it.

June 4, 1878

Working NE through ice.

June 5, 1878

Ship under top sails working through the ice to the NE.
Lat. 61.20N Long. 183.13E.

June 6, 1878

Working NE through ice.

June 7, 1878

Working eastward through ice. Cape Navarene in sight.
Lat. 61.30 Long. 182.28 E

June 8, 1878

Light breeze from SW. Ship under all sails steering NNE. The ice is very open today.

In Anadir Sea

June 19, 1878

Pleasant weather and a light breeze from NE, ship under all sail beating through Berring Strates. Natives came on board from the Dimeads and we got sum boots and clothing.

June 20, 1878

Got 50 walrus

June 22, 1878

Working in the ice of Cape Surge. Got 14 walrus.

June 24, 1878

Slight breeze from NW. Ship under all sail working through the ice scattring ice. Got 11 walrus.

June 25, 1878

Steering along the ice to the SW. Got 3 walrus.

June 27, 1878

Cruising along the ice of Cape Surge 11 sails in sight.

June 28, 1878

Captan shot 32 walrus

June 30, 1878

Captan shot 126 walrus.

July 1, 1878

Commences with a light breaze from the S.E. with fogey weather finished skinning the walrus this morning and had to leave them on the ice the walrus was so far in the pack that we could not git them of so we anchored the cacke of ice that thay wer on and left them thear.

July 2, 1878

Commences with a calm and fog the ship laying of the ice latter part of the day clear with a light breaze from the SE we came to anchor close to the pack in 25 fathoms of water and haled the ice that the walrus was on out to the edge of the pack and got the blubber on bord then got under way.

July 6, 1878

Captan shot 28 walrus

July 9, 1878

Got 5 walrus

July 10, 1878

beating along the ice of Cape Surge

July 11, 1878

Got 52 walrus

July 12, 1878

Got 7 walrus

July 13, 1878

12 sails in sight and walrus very scarse. AT 5 PM started for St. Larance Bay.

July 16, 1878

Ship beating through the berring strates.

Northern Light - 1873

June 5, 1873

(56.50 N, 173.33 W) Mod. breeze from E. At 4 PM scatter ice.

June 6, 1873

Wind ENE. The ship working to the windward on short tacks along the ice.

June 7, 1873

Steering along ice.

June 20, 1873

Light air from N., off Cape East, scatter ice.

June 22, 1873

A fresh breeze from the S. Cruising along the ice.

June 26, 1873

Light air from SE, steering to N between land and ice. The land 10 mi off the ice. The ship off Icy Cape. Working thru between land and ice.

July 1, 1873

Overcast, light breeze from NW. Scatter ice to the S.

July 2, 1873

Clear ice in sight

July 3, 1873

Ship cruising along the ice.

July 5, 1873

A light breeze from SE, the boats in the ice, sm boats hunting walrus.

August 6, 1873

Cruising off Pt. Barrow - a snowstorm from the NW the ships all steering to SW along the ice.

Steering along the ice.

September 10, 1873

Cruising off Hearld Island

September 24, 1873

At daylight ice in sight
(69.44, 170.30)

1875

August 29, 1875

Came to ice
(Approx 69.00)
Working along the ice

September 2, 1875

(70.57, 166.32) along the ice.

September 19, 1875

Cruising around the ice

Bark Northern Light, Gilbert L. Smith, Master, Voyage of 1876

May 15, 1876

Good deal of new ice.
Lat. 62.35N Long. 177.12W

May 16, 1876

Lying in the ice
Lat. 62.43N Long. 176.03W

May 17, 1876

Ship out of thick spring ice, worked through thin Ice to the S and W., thinking we could get round the ice to the Westward.
Lat. 62.8N Long 176.35W.

May 27, 1876

In vicinity of St. Lawrence Island. Ship running along the ice . Plenty of walrus in sight going North.

May 28, 1876

Saw a good show of walrus, went inand shot and got quite a number.

May 29, 1876

Got about 170 walrus.

May 30, 1876

Got 8 walrus.

June 1, 1876

Got 75 walrus, King Island in sight.

June 3, 1876

Shot 82 walrus but only got 25 to the ship, skinned 34 more, got most of it in the Boats and had to take it out of the Boats the ice shot around the Boats had hard work to get out had to haul the Boats over the Ice to get out.

June 5, 1876

Near St. Lawrence Island. Ship heading to the North, not much ice at 6 AM. At 9 AM plenty of ice and walrus. At 11 AM Captain and 2 men went in and shot 89 walrus, got them on board at 10 PM.

June 6, 1876

Got 21 walrus. Ship Marengo and Aeros Barnes in sight walrussing.

June 7, 1876

Plenty of walrus in sight but very shy. Shot and got on board 16 walrus. King Island in sight, bearing N.N.E. 20 miles off.

June 9, 1876

Ship cruising along ice to the South looking for Walrus, did not see any. King Island in sight.

June 15, 1876

Cruising along the ice to N and E. At Noon spoke Bark Desmon she had 350 walrus.

June 16, 1876

Got 16 walrus.

June 23, 1876

Got 23 walrus.

June 25, 1876

Got 100 walrus

June 26, 1876

Got 138 more walrus.

June 27, 1876

Got 28 walrus.

June 28, 1876

Steering to the S and W along the Ice. Got 54 walrus and 1 Polar Bear.
Later part standing to the Eastward along the Ice.
Lat. 67.36N Long. 170.38W

July 1, 1876

Got 21 whales

July 2, 1876

Shot 24 walrus and lsot them all.

July 8, 1876

Shot 122 walrus.

July 14, 1876

Got 83 walrus

July 15, 1876

Got 83 walrus

July 17, 1876

Got 152 walrus

July 18, 1876

Got 66 walrus

July 19, 1876

Got 17 walrus

July 20, 1876

Standing off and on the ice.
Lat. 68.46N Long. 172.6W

July 24, 1876

Got 85 walrus

July 25, 1876

Got 160 walrus

August 16, 1876

Ship between the land and Ice about 4 miles from the land to the South of Blossom Shoals. Found the ice sitting on the shoals quite fast.

At 12:00 noon Capt. Campbell of the Norman came on board and said he had been within 8 miles of Wainwright Inlet and found the ice maid on the Land (?) and he did not think a whale boat could get along the Beach.

August 21, 1876

Ship working to N between land and ice. Came up to heavy ice, worked back south. Ice working in shore fast had to carry all sail to work. At 2 Night off Point Belcher, at 6:15 PM came to anchor about 10 miles North of Icy Cape.

September 1, 1876

Ship standing off and on the ice to the South of Blossom Shoals. Passed over Blossom Shoals, at 12 Noon. Pack ice 6 miles off, plenty of scatering. About 18 miles N of Icy Cape.

September 3, 1876

Got into thick ice, had to make sail and work to the NE along the land, got up to within 10 miles of Wainwright Inlet and found the Ice maid on the land. A Native canoe came to the Norman and reported the fleet of ships to the north of Point Belcher fast in the ice.

September 6, 1876

Steered along ice to the Southward. Lat. 70.54N Long. 169.16W

September 7, 1876

Working to the Westward along the ice. Lat 70.29N. Long. 170.1W

September 8, 1876

Ship working to the westward along the ice on different tacks. Found the ice making pretty well.
Lat. 70.02 N. Long. 172.05W.

September 10, 1876

At 8 AM rose Herald Island bearing W. at 5:30 PM. Came up to heavy ice that maid aroundto the Northward and Southward of the Island.

September 12, 1876

Working to the S, Herald Island bearing SW distance about 20 miles. Ship up to the Western ice.

September 17, 1876

Got 2 bowhead whales.

October 20, 1876

Got 1 cow whale and 1 big calf. Cow sank.

October 24, 1876

Recovered cow.

Northern Lights of New Bedford 1877-78

May 12, 1877

Fresh breeze from East, foggy. 11 AM made the ice in Lat. 58.51, Lon 180.00. Ice scattering -- considerable ice.

May 13, 1877

Strong breeze from E. and clear ice to the N. Scattering ice in sight.

May 15, 1877

Fresh from NNE, clear. Laying aback in scattering ice.

May 16, 1877

Strong breeze from NE, heavy ice to N., scattering ice to SE.

May 18, 1877

Breeze, NNE, snow squalls -- ice heavy to N. Working to NE amongst scattering ic. (Lat. 60.02)

May 19, 1877

Foggy, strips of heavy packed ice to N and NE.

May 20, 1877

(60.10, 183.46) Light wind NE, thick fog, heavy ice to N.

May 21, 1877

Light breeze W., snow. Making through ice to N. Shot several seal, saved one.

May 22, 1877

Light airs from W and NW, stearing thru thick ice--thick ice as far as can be seen from mast. Head open ice to the SW.

May 23, 1877

Light breeze from SW, clear, all sails working thru thick ice to N. Ice packed, has made but very little heading.

May 24, 1877

(60.33, 183.58) Calm and thick fog in packed ice.

May 25, 1877

Light airs from NE, thick ice. Stearing N thru loose ice.

May 26, 1877

Light breezes from S., clear, stearing thru loose ice--ice opens for a few hours each day and closes up thereby gaining slowly to the North.

May 27, 1877

Foggy in thick ice, wind light, ice slack for the greater portion of these 24 hours.

May 28, 1877

Light breezes WNW in heavy ice working to the NE. Ice slacking up, ship drifting fast to SW, stuck several times quite hard. 12 Noon made fast to 2 large pieces of ice.

May 29, 1877

Wind fresh from NE, packed ice.

May 31, 1877

Moderate breeze NE, fast to large piece of ice, heavy ice to N and NW and W. More broken to S and E.

June 1, 1877

Heavy ice as far as can be seen.

June 4, 1877

30 miles so. of C. Navarine. Saw whales. One in heavy packed ice, other in very thick ice.

June 5, 1877

(61.22, 181.34) Heavy ice as far as can be seen. Ice more open in shore.

June 7, 1877

Light airs from NE, ice quite open, weather fine.

June 8, 1877

Light breeze from W. scattering ice. Ice very open around C. Navarine.

June 12, 1877

(Lat. 64.31 Long. 2) Heavy ice close to the land.

June 19, 1877

Fresh breeze from N and clear, working up thru Bering Strait, scattering ice in sight.

June 21, 1877

Moderate breeze from N., foggy. Heavy ice to N. saw walrus, Devil fish. (66.33 Long. W)

June 22, 1877

Breeze from N., foggy, scattering ice. Ice packed to N., Heavy ice to East and SE.

June 25, 1877

Moderate Breeze SE, fine weather, laying around the ice pack.

June 28, 1877

Light airs and fog from SE. Heavy ice in sight. Working SW along edge of packed ice.

July 4, 1877

Calm, weather fine. 55 walrus caught.

July 5, 1877

(67.19, 170.31) Moderate breeze and fine weather, loose ice 2 walrus.

July 6, 1877

Light breeze from the W. Packed ice to the westward.

July 7, 1877

Packed ice to NW. 21 walrus.

July 8, 1877

Light breeze from S, laying around edge of packed ice. 50 walrus.

July 9, 1877

12 walrus.

July 10, 1877

41 walrus. Loose scattering ice. Lost a great many by the ice.

July 11, 1877

(67.30) 170.13. Light breeze from W. and clear, scattering ice. Ship close to ice.

July 12, 1877

16 walrus

July 13, 1877

Light breeze from W. fine weather. A great deal scattering ice. 9 walrus

July 14, 1877

2 walrus.

July 15, 1877

Light breeze W., clear, laying aback in open ice 45 walrus. Heavy ice around.

July 16, 1877

Open ice.

July 17, 177

Loose ice, wind light, south and clear weather 50 walrus.

July 18, 1877

Moderate breezes from W. foggy, open ice. Packed ice to the W. 5 pm all aboard made all sail working e. thru heavy ice. 31 wal.

July 19, 1877

Light breeze from NE, fog. A great deal of heavy ice 22 wal.

July 21, 1877

5 wal.

July 23, 1877

Light airs and variable, foggy. Heavy ice to north. 17 wal.

July 24, 1877

Light winds and fog. Heavy ice. Stearing to the N along the edge of scattering ice.

July 25, 1877

100 wal.

July 26, 1877

124 wal.

July 28, 1877

Light air from SW in scattering ice. 75 wal.

July 29, 1877

107 walrus

July 30, 1877

Fresh breeze and fine weather. Wind SW and blowing fresh ice setting in around us, have to get out of the ice. Move ship to clear water. 105 wal.

August 4, 1877

Moderate freeze from NE, fine weather. Saw a few pieces of ice. Finished stowing oil.

August 8, 1877

Calm and foggy, laying aback close to packed ice.

August 9, 1877

Moderate breeze from E. laying aback off Sea Horse Islands. Packed ice extending from Wainwright - inlet - to the NE as far as we can see. Packed ice about 10 miles distant from the land.

August 10, 1877

Fresh breeze from SW, rain. Working to the SW. Ice pack distant from land about 5 mi. Some ice in shore. Ice in sight to the SW.

August 11, 1877

Light breeze from SW. Anchored off Woody Inlet. Some of the points of the pack setting in shore very close to us.

August 12, 1877

Light SW and rain, ice in shore of us. No ice in sight off shore.

August 13, 1877

Ditto

August 14, 1877

Fresh breeze from NE, thick fog. Ice in shore aground and the pack off shore 6 mi.

August 15, 1877

Strong breeze from NE, clear, Pt. Barrow in sight. Packed ice close to the land.

August 16, 1877

Strong breezes from NE., snow. 8 AM got underway and went in shore. Ice pack setting in shore fast. Later. ice pack distant from the land about 10 miles and strong breeze from N and snowing.

August 25, 1877

Wind light, NE and foggy. At anchor 5 mi SW of Cape Smythe. 2 mi NE of Cape S. found the ice into the land.

August 26, 1877

Light breeze from SW and foggy. (Middle part) Considerable ice around the ship. Ice setting in close to us.

August 27, 1877

Fresh breeze N.E., fog. at anchor under Pt. Barrow ice setting in close to us. 7 PM got underway to clear the ice. Later the ice set in and grounded. Preventing the fleet from getting out.

August 28, 1877

Mod. breezes from NE, fog. 12 ships ice bound behind Pt. Barrow - the rest of the fleet. Worked to SW. Ice distant off shore 3 mi.

August 29, 1877

Wind light, S.W. 6 AM ice setting in shore. A few pieces of scattering ice.

August 30, 1877

Fresh SW wind, scattering ice. 7 PM Sea Horses Islands distance 5 mi.

September 1, 1877

Fresh NW wind, clear weather. Working to westward between the ice and the land.

September 3, 1877

Daylight, kept her off along the edge of the ice. Ice in sight ot the north.

September 5, 1877

Light variable airs, clear. The fleet all out of the ice, bound to the westward.

September 8, 1877

(70.28, 171.39) Light EN winds. 6AM raised the ice, running the ice along the westward. Ice in sight to the north.

September 9, 1877

Pack ice to the westward.

September 10, 1877

Packed ice to the westward with an open space running NW.

October 3, 1877

Fresh breeze from N. dark gloomy weather. Herald Island in sight -- bearing NE dist. 12 mi. Great deal of young ice in sight. 1 whale

October 5, 1877

Got whale

October 12, 1877

Passed between Cape East and Diomede -- scattering ice from N. of East Cape to south of it.

Helen Mar - No. 2

July 25, 1878

Ship alongside the Sysen discharging oil and bone. Total of 16,771 gallons of oil and 4,352 lbs. Bone (in St. Larance Bay).

July 30, 1878

Ice Cape. Got 9 walrus.

July 31, 1878

Moderate breeze from SE. Ship steering NE along land, 12 other sails, at 7 PM anchored of point Belcher but the ice came so fast that we had to git under way again.

August 1, 1878

L AM anchored of sea horse island the ice to the N quite thick. At 3 PM underway to try and git to Point Barrow.

August 2, 1878

Strong breeze from NE, ship working along land of Cape Smith the packed ice is about 7 miles of shore and there is sum grounded ice in shore. At 2 PM the wind reard A round to the NW and we warped (roped) the ship through a pasage in the groune ice and cam to anchor.

August 3, 1878

Ran up to Pt. Barrow and came to anchor to the Eastward of the point the packed ice is hard up a gainsed to grounded ice.

August 4, 1878

Moderate breeze from SW. Steered eastward of the point went about 10 miles and found the ice qutie thick so anchored close to shore.

August 5, 1878

Cruised around the ice, current running quite strong and wind light so had to anchor.

August 6, 1878

Strong breeze from E, at 6 AM the ice came down quite thick so we had to git underway and run back to Pt. Barrow.

August 8, 1878

Strong breeze from NW, clear weather. Steering eastward, there is a considerable scatring ice but no pack. Anchored of the E head of Harrisons Bay.

August 12, 1878

At anchor of Lion Reef

August 14, 1878

Strong breeze from NE, thick fog at 9 AM cleared went in between Lion Reef and the land and beat to the Eastward found from 3 1/2 to 4 fathoms of water in the lagoon.

August 15, 1878

Gale from NE with clear weather. Ship at anchor inside of Lion Reef the cie is closely packed on the outside .

August 16, 1878

Ship at anchor of fogey Island.

August 17, 1878

Gale from NE with snow squalls. Ship at anchor in Lagoon of fogey Island.

August 19, 1878

Glae from kE. At 6 AM underway, found ice quite open to the westward, steered in to the NW and SW.

August 20, 1878

Ship at anchor of Lion Reef, at 9 PM anchored in Harrisons Bay in 4 fathoms of water.

August 21, 1878

Steered westward and found the ice quite close to point sandflut. 8 PM anchored westward of Point Barrow.

August 22, 1878

At anchor of Pt. Barrow. Blowing a gale from NE with snow squalls.

August 23, 1878

Blowing a gale from NE with fog and snow. At anchor of Pt. Barrow.

August 24, 1878

Moderate breeze from SE, ice came in here so all ships had to go to eastward of the point.

August 26, 1878

Strong breeze from NE. At 10 AM the ice came in around the ships, all had to flee to westward of point.

August 27, 1878

Very light breeze from NE. Ships all at anchor of Pt. Barrow, the ice came in around the ships and we all had to warp the ships in close to shore.

August 28, 1878

Moderate breeze from NE, ships at anchor of west side of point Barrow ice is packed in around us and the clear water is about a mile of.

August 29, 1878

Slight breeze from SW at 5 PM ice opeend and started to NE very quick warped to shore to get underway but the ice closed in on us and had to anchor again--both anchors to hold ship.

August 30, 1878

Ice going to NE very quick. Strong breeze from westward.

August 31, 1878

Ship packed in the ice to westward of the point, both anchors down wind from westward the ice of shore from us is going to the NE.

September 1, 1878

Strong breeze from S, at 4PM ice started to open around us. At 10 AM wind haled to the SSE the ice going very quick to the N. Ship went on shore with the stabord side to beach in 12 foot of water.

September 2, 1878

Gale from westward, ship aground in 12 feet of water.

September 3, 1878

Afternoon wind veered from NW to NE and ice went offshore.

September 4, 1878

Cruised to N and then SW.

September 6, 1878

Anchored of Cape Smith, wind from SW so sailed S.

September 8, 1878

NE wind with snow squalls, steered SW and passed through a good deal of scattered ice, passed sea horse islands ship heading W by S along the packed ice.

September 9, 1878

Strong NE gail, steering along packed ice to westward. Ice is very solid and close packed.

September 10, 1878

Moderate breeze from NE, steering WNW no ice in sight.

September 13, 1878

NE breeze moderate, steering westward raised Herald Island bearing WNW 25 miles. Ice all around island.

September 15, 1878

No ice today.

September 16, 1878

Laying off the ice on opposite tacks.

September 20, 1878

Laying off the ice to the NE of Herald Island with strong NE gale. lat. 71.50, Long 173.02

September 22, 1878

Lat. 71.40N, Lon. 172.39

September 23, 1878

Herald Island in sight.

September 27, 1878

Lat. 69.35 Lon. 174.20

September 30, 1878

Lat. 70.21, Lon. 177.75

October 1, 1878

Lat. 69.32 Lon. 172.23

October 2, 1878

Got 1 whale

October 3, 1878

Killed but lost one whale.

October 4, 1878

Got one whale.

October 8, 1878

Off Herald Island.

October 10, 1878

Lat. 69.30 Lon. 174

October 12, 1878

Raised Cape Prince of Wales bearing SSE so steered to SSW, passed East Cape at 10 PM.

October 13, 1878

Strong breeze from N

Voyage of the Syren recorded by Gideon N. Bartlett, 1878

July 5, 1878

Lat. 65.15 N. Long. 171.49 W.
Both heads of St. Lawrence Bay in sight. Plenty of floating ice, and when we could see the Bay found it to be full of ice so that we could not get in.

Bartlett transferred to the Rainbow under Capt. Cogan, on July 24, 1878

July 25, 1878

Ship between the Diomedes and East Cape. Little later saw American shore, Cape Prince of Whales.

July 27, 1878

Off Cape Lisbourne. Plenty of ice around. All day between Cape Lisbourne and Point Hope. Quite heavy scattering of ice.

July 28, 1878

Plenty of very heavy ice. Passed a large floe tonight 15 ft. high and aground in 14 fathoms. In the vicinity of Point Lay.

July 29, 1878

Off Icy Cape. Shot about 40 walrus. At night raised the ice ashore on Blossom Shoals.

July 30, 1878

Off Wainwright Inlet. Scattered ice, some of it very heavy.

July 31, 1878

Off the Sea Horse Islands, Amongst heavy ice all day.

August 1, 1878

Off Woody Inlet. Scattering ice very heavy and thick.

August 2, 1878

Off Point Barrow. Bad drifting ice. Ice anywhere from 2 ft to 20 ft. high, and in cakes from 2 ft. square to five or eight miles.

August 3, 1878

In the Pack Ice drifting NE. As far East as Coopers Island - got out of pack and to Point Barrow.

August 4, 1878

Off Point Barrow.

August 5, 1878

Off Point Barrow.

August 6, 1878

Off Point Barrow.

August 7, 1878

Off Smiths Bay. Started eastward in the morning. Thick, scattering ice.

August 8, 1878

Off Harrison Bay. Through scattering ice all day. Then very open.

August 9, 1878

Off Return Reef. Fog thick.

August 10, 1878

Off Point Anxiety. Well named for everyoen is anxious to know whether they are going to get out with the ship or not.

August 11, 1878

Off Lion Reef. Lost rudder today.

August 12, 1878

Inside Lion Reef -- others maintain it is Return Reef.

August 13, 1878

Inside Lion Reef -- others maintain it is Return Reef.

August 14, 1878

Locked in ice off Lion Reef.

August 15, 1878

Off Return Reef. Some ships started east, 20 miles, found the ice hard on to the land.

August 16, 1878

Off Return Reef. Heavy ice drifting by us and in the distance from SW. Clear around to the NE is seen plainly the large high and bright ice which shows us that there is plenty of ice in those direction.

August 17, 1878

Off Beeckey Point.
Had not run long before ice came in thick. We ran close along the main pack ice.

August 18, 1878

Off Harrison Bay.

August 19, 1878

Off Smiths Bay. Going West. As we approached Pt. Barrow found a little scattering ice and some large ground ice.

August 20, 1878

Off Point Barrow.

August 21, 1878

To Cape Smiths

August 22, 1878

Back to Point Barrow. This is, they say, the only season for years that there has been no whales taken before this.

August 23, 1878

Off Point Barrow

August 24, 1878

Off POint Barrow. Towards evening the ice seems to be working up towards us, and we may have to soon leave here if only for a little ways. The ice seems to be scattered all around the Point, with just about water enough to work around with a ship.

August 25, 1878

Off Pt. Barrow. In the morning currents driving the ice toward 19 anchored vessels - all got underway and went around to the North side of the Point and anchored. We cannot get East or in any direction as the ice is all around.

August 26, 1878

Off Pt. Barrow. Plenty ice around.

August 27, 1878

Ice shut ships in.

August 28, 1878

Worked out of ice and into clear water. Off Cape Smith.

August 29, 1878

Beat it to the Sea Horse Islands, between the ice and the land.

August 30, 1878

Off Sea Horse Islands.

August 31, 1878

Beating to the southward, trying to get to Pt. Belcher, but only made 12 miles. As we work South we find that the pack ice is nearer the land than it is North, it only being about 15 miles off shore around the Sea Horse Islands. Off Sea Horse Islands.

September 1, 1878

Off Sea Horse Islands.

September 2, 1878

Off Woody Inlet.

September 3, 1878

Near Refuge Inlets

September 4, 1878

Near Off Point Belcher.

September 5, 1878

Running along edge of ice in vicinity of Ice Cape towrad Herald Island.

September 6, 1878

Lat. 70.39N. Long. 163.51W. We stood in close to the ice. Saw large quantities of walrus, shot 29.

September 7, 1878

Lat. 7.37N. Long. 165.50W. We are running through scattering ice today just on the edge of the main pack. See thousands of walrus.

September 8, 1878

Lat. 70.30N. Long 171.15W. Saw plenty of walrus.

September 9, 1878

Lat. 7.23N. Long. 173.58W

September 10, 1878

Ran through a strip of ice 20 miles Northeast of Herald Island.

September 11, 1878

Ran through a strip of ice 20 miles SW of ship. Got 1 whale.

September 12, 1878

Off Herald Island.

September 12, 1878

Off Herald Island. Here Barlett transfers to the Progress.

September 14-20, 1878

Off Herald Island.

Steamer Corwin, March 1, 1881 to October 23, 1881

July 22, 1881

4 to 9 PM. Standing to the N and E, around the shoal off Ice Cape, at time through quantities of drift ice. At 7 PM, ice appearing closely packed to the N and E, put the vessel about and stood to the S and W.
Lat. 70°04' 25"N.
Long.162°35' 00" W

July 23, 1881

4 to 8 PM, to E, along shore. At 6:10 came up to drift ice well inshore got boat out and found ice drifting to the S.
Lat. 70°14'43"N
Long. 161°55'00"W

July 25, 1881

4 to 8 PM gentle N breeze, clear weather. Standing to the N and E, along the shore, between the ice pack and the shore. At 6:20 reached Icy Cape, found the ice on the Cape and extending, unbroken, from N.E. to S.S.W., leaving only a narrow passage along the shore which the vessel came through. At 6:25, being unable to proceed further, put the vessel about and stood to the S and W of the Cape.

8 to mid. Wanted to go up coast in small boats but the condition of the ice rendered it dangerous. Quantities of drift ice passing the vessel.
Lat. 69°58' N
Long. 162°15'00"W

July 27, 1881

4 to 8 AM At 4:15 came to in 4 1/2 fathoms of water off coal vein, Cape Lisburne bearing S.W. by W, distant about 22 miles. All hands employed mining coal. Meri'd to 4 PM. Crew employed getting out and boating off coal. Finished July 28 - received 20 $\frac{1060}{2240}$ tons.
Lat. 68° 50' 00"N
long. 165° 10" 00"W

July 29, 1881

8 to midnight - Ice in sight on starboard beam.

Lat. 69° 38'00"N
Long. 165°14'00"W

July 30, 1881

Midnite to 4 AM Sounded hourly in 23, 22 1/2, 23, fathoms. At 8 AM temperature at bottom 43° (series of bottom temperatures).

4 to 8 PM 5:45 entered drift ice. Steering various courses through drift ice toward Herald's Island.

July 30, 1881 continued

8 to midnite, working through heavy drift ice. 9:45 made fast to the ground ice, close in to the east side of the Island. Worked vessel through the drift ice around the northern end of the Island. Current setting to the N at rate of a knot an hour.
Lat. by DR. at Noon 70°48'00"N
Long. by D.R. at Noon 174°41'00"W
Lat by observations at noon 70"49'22"N
Lat by chro. from forenoon observ. 174°32'00"W

Variation of the compas by Azimuth observed at Herald Island 24°47'00"E

July 31, 1881

Midnite to 4 AM steamed to E through drift ice.

4 AM to 8 AM through drift ice to E, 6:30 reached clear water, Herald Island bearing NW by W, distant 12 miles. Stood to the S & E along the edge of the ice.

8 to Merid. Steering various courses to the S, outside of the ice pack. 37 fathoms - temp. 39.

Merid. to 4 PM to W through drift ice, 3:35 came up to the pack and stood to S and W along edge of it.

4 to 8 PM. Standing to the S and W along the edge of the pack and through drift ice. At 7:45 ice in sight from NE to SE
Lat. 70°50'54"N
Long. 175°40'00"W

August 1, 1881

4 to 8 AM at 4:35 steamed ahead to S and W around the ice pack, at times through drift ice.
Lat. 70°15'00"W
Long 178°20'00"W

August 2, 1881

4 to 8AM. At 4:15 steamed ahead to N and W, through drift ice. At 5:10 found ice drifting to N 1/4 knot an hour. At 5:15 steamed ahead through opening in ice. At 7:45 ice becoming closely packed.

8 to Merid. 8:15 anchored to ice. At 11:50 ice opening some, steamed N and W Merid. to 4 PM. Saw several polar bear following ship, killed 2 of them. At 1:45 ice becoming so closely packed that we were unable to proceed nearer to land. 20 miles of heavy ice windward of us, put vessel about to S and E, through ice towards clear water.

8 to midnite. Ice in sight windward.
Lat. 70°35'00"N
Lon. 179°10'00"W

August 3, 1881

Merid. to 4 PM. Light westerly wind and dense fog. At 2:15 fog lifted, underway and stood towards the land to N and W, through drift ice.

4 to 8 PM. At 6 current setting to W 3/4 knot per hour. Unable to proceed nearer the land on account of the heavy ice, put the vessel about to S and E. Land in sight from WNW to N by E. Worked through the ice remains of watch.

8 to midnite. Reached clear water at 8:15.
Lat. 70°23'00"N
Lon. 179°15'00"W

August 4, 1881

Midnite to 4 AM. Light SW winds to light airs. Standing to the eastward along edge of ice. Sounded hourly in 22, 22, 23, and 24 fathoms; temp. at bottom 36°, 36°, 39°, and 38".

4 to 8 AM. Standing to the S along the edge of the ice. Sounded hourly in 24, 24, 24, and 24 1/2 fathoms; temp. at bottom 39°, 39°, 40° and 40°.

8 to merid. Light S.E. iwnd, cloudy. Standing S and W along edge of ice pack. Sounded at 25, 241/2, 24 and 25 fathoms; temp. at bottom 39°, 35°, 36° and 39°.

Merid. to 4 PM steered various courses to the S and E to avoid heavy ice. At 3:07 getting clear of ice. Sounded in 26, 25, 25 and 25 fathoms, temp. at bottom 41°, 36°, 36° and 34°.

6 PM sounded in 20 fathoms, temp. at bottom 34°, at 8 PM in 10 fathoms, temp. 34°.

8 to midnite. Gentle breeze from E and cloudy. Steering various courses along the land to S.E. through drift ice. 19, 21, 22, and 22 1/2 fathoms. temp. at bottom 34°, 34°, 35°, and 36°.
Lat. 69°10'00"N
Long. 179°05'00W

August 5, 1881

Midnite to 4 AM. Light breeze from SE and cloudy. Steering various courses to S and E along edge of ice.

4 to 8 AM standing to S and E, around the ice, at times through quantities of drift ice.

4 to 8 PM along land. At 5:50 came to in 3 fathoms of water, off Cape Wanharem.
Lat. 68°03'00"N
Long. 175°40'00"W

August 7, 1881 Cape Wanharem

Midnight to 4 AM. Light SE wind, at 1:30 wind shifted to W. At 3:30 drift ice in sight moving to the E along the shore.

August 7, 1881 - continued

8 to meridian 9:15 weighed anchor to avoid contact with heavy ice, at 9:30 came to in 5 fathoms.
Lat. 67°52'00"N
Long. 175°18'00"W

August 8, 1881

Steamed to N, masses of floating ice in sight to N and W.

Merid. to 4 PM. Quantities of floating ice around the vessel.

4 to 8 PM. Light to gentle breeze from E NE cloudy. Steering various courses to N and W along shore, and to avoid ice.
Lat. by D.R. at noon 68°12'00"N
Long. by D.R. at Noon 178°02'00"W
Lat. by Observations at noon 68°05'52"W
Long by Chro from Forenoon Observations 176°30'00"W

August 9, 1881

8 to merid. at 10:10 made drift ice ahead.
4 to 8 PM. At 4 made ice pack ahead, drifted 5 1/2 knots per hour.
Lat 70°21'00"N
Long. 178°23'00"W

August 11, 1881

Worked through drift ice midnight to 4 AM to N and W.
4 to 8 AM Standing to the N and W toward the land. 4:30 find ice so heavy that impossible to force vessel any farther, conpelled to give an attempt to reach the land. With considerable difficulty put the vessel about and worked to S and W at 7:30 stopped and took bearings of land: westend bearing W by N 1/2 N; high mountains, North; east end N by E 3/4 E (Magnetic)

8 to Merid. Standing along edge of ice to N and E.
Merid. to 4 PM. Light westerly wind, cold. Standing to the N and E outside of the ice pack. At 4:30 found a lead in the ice opening to N and W, hauled up for it. 4 to 8 PM At 4:45 entered ice. At 5:40 stopped at edge of heavy ice, at 6 put vessel about and steamed to S and E, the land about 6 miles distant. At 6:30 found current setting to N and E 3/4 knots per hour.

8 to midnite, Ice drifting into vessel, got underway again at 8:50 and steamed to N and E, anchored at 9:50.
Lat. 70°33'00"N
Long. 178°05'00"W

August 16, 1881

4 to 8 AM. Cautiously through drift ice. 8 to Merid. At 10:35 stopped, large quantities of heavy ice (grounded) around the vessel, and fog so dense as to be unable to see a ship's length. Current setting to N at 1 1/4 knots per hour.

4 to 8 PM. Steaming cautiously along the land toward Point Barrow.
Lat. 71"14'00"N
Long. 156°42'00"W

August 17, 1881

Mid. to 4 AM. Light easterly wind, partly clear. Ice drifting by the vessel. Merid. to 4 PM. At 3:40 anchored off settlement at POint Barrow. Measured current setting E N E (True) 1 3/4 knots per hour. 8 to Mid. Light easterly wind; overcast with fog and rain. Quantities of ice drifting past the vessel.
Lat. 71°26'00"N
Long. 156°05'00W

August 18, 1881

Mid. to 4 AM. Light S breeze, overcast with fog and rain. Quantities of ice drifting by the vessel.

Merid. to 4 PM. 1:30 got underway and stood around the Point. Drift ice in sight during the watch.
Lat. by D.R. at Noon 71°20'00"N
Long. by D.R. at Noon 156°17'00"W
Long. from chro. from Forenoon Observation 156°14'40"W
Variation of the comp. by Azimuth, 11 AM 37°18'00"E

So ends 1881

Log of U. S. Revenue Steamer Corwin under the command of 1st Lieut. M. A. Healy

August 10, 1882

Sighted ice pack to the N, distant 8 miles.
Lat. 70.42.11 N
Long. 159.25 W

August 11, 1882

Off Cape Smyth. Came up with the ice pack and stood to the Ed. Drift ice in vicinity.
Lat. 71.46 N
Lat 159.47 W

August 12, 1882

Steering various courses to avoid pack ice through drift ice.
Merid. to 4 p.m. steering through Harrison Bay, passing through heavy drift ice.
Lat 70.45 N
Long. 150.23 W

August 15, 1882

Anchored off coal mine, men employed mining.
Lat 68 N
Long. 165.10 W

Between August 15 and 23, when vessel arrived at Port Clarence, no mention of ice.

Fleetwing - 1882

August 13, 1882

Anchored off Pt. Belcher. Scattering ice is from 8-10 miles off shore. About 18 ships around here and the rest of fleet at Pt. Barrow.

August 27, 1882

Got as far as Cape Smyth, plenty of ice coming. Came near going on shore but the ice grounded outside of us.

Bark Lucretia, 1883 Voyage, Captain Edward Kelley replaced by R. P. Gifford

May 27, 1883

Tried to work to the N.W. but the ice being too heavy had to give it up.
Lat. 61.12 N
Long. 179.12 W.

June 5, 1883

Ice closed.
Lat. 62.14 N.
Long. 180.45 W.

June 7, 1883

Working through the ice, scattering but heavy.
Lat. 63.10 N.
Long. 179.10 W.

June 8, 1883

Some times working through the ice and some times ice bound.
Lat. 63.18 N.
Long. 179.17 N.

June 9, 1883

Working through the ice to the N.E., ice open.
Lat 63.26 N.

June 17, 1883

Working to the northward. Some ice in sight. Point Hope in sight. Came up with the pack ice.

June 21, 1883

Shot about 40 or 50 walrus, got 18. Bad ice and bad luck.

June 24, 1883

Got 4 walrus.

June 25, 1883

Got 18 walrus.

June 27, 1883

Got 12 walrus.

July 2, 1883

Lowered for walrus together with the Orca, got 12 each.

September 21, 1883

Got 1 whale

Log of the U. S. Revenue Steamer Corwin under the command of Captain M. A. Healy

July 27, 1883

Passed Cape Lisburne, distant about four miles, and steered along the coast to the Ed through drift ice.
6 to 8 p.m. close to shore through drift ice.

Steam Whaler Bark Lucretia of New Bedford, Capt. Carter, 1884 Voyage

May 6, 1884

7 a.m. Got steam worked through the ice under steam and sail.
7 p.m. Banked fires, fast in the ice.
Lat. 60.30 N
Long 179.40 W

May 7, 1884

To north working through ice.

May 11, 1884

Bark fast in the ice.
Lat. 60.40 N
Long. 177.00 E

May 13, 1884

Bark heading to N and Eastward under steam and sail in through ice.
Lat. 16.00 N
Long. 177.40 E

May 19, 1884

Bark fast in ice.
Lat 61.36 N
Long. 177.01 E

May 20, 1884

Ice opened a little, worked to Eastward.
Lat 61.37 N
Long. 177.21 E

May 30, 1884

Bark fast in the ice.
Lat 63.28 N
Long. 178.28 W

through June 2

Fast in ice.

June 5, 1884

Worked to NE through the ice
Lat. 64.25 N.
Long 177.00 W

June 10, 1884

Bark fast in the ice.
Lat 46.05 N
Long 175.10 W

June 26, 1884

Got 6 walrus

June 28, 1884

Got 15 walrus

June 29, 1884

Got 8 walrus in vicinity of Point Hope.

July 24, 1884

Working through the ice to Cape Lisburn.

July 25, 1884

Got steam worked in through the ice to the coal mine, sent the boats in for coal.

July 31, 1884

Got steam, worked to NE through the ice towards Icy Cape.

August 2, 1884

Got 3 walrus

August 17, 1884

Made fast to the ground ice North of Point Belcher.

August 21, 1884

Bark made fast to the ground ice off Sea Horse Islands.

September 8, 1884

Struck a devil fish, sank, parted the line.

September 12, 1884

Got 1 whale.

September 28, 1884

Got 1 whale.

October 4, 1884

Got 1 whale.
Lat 68.57 N
Long 169.39 W

October 6, 1884

Got 1 whale.

October 12, 1884

Anchored off Plover Bay.

Log - Revenue Steamer "Corwin" 1884, M. A. Healy

June 11, 1884

Ahead slow thru drift ice.
Lat. 65°50
Long 164°32

June 12, 1884

Ice very heavy. Heavy packed ice as far as eye can reach by glasses from most head.
Lat 66°44
Long 166°58

June 13, 1884

Working thru heavy pack ice
Lat 66°52
Long 164°50

June 19, 1884

Ice drifting down on vessel
Lat 65°35
Long 170°43

June 20, 1884

Heavy drift ice.
Lat 66°52
Long 167°35

June 22, 1884

Steaming along ice pack
Lat 66°55
Long 167°79

June 27, 1884

Cruising along western edge of pack ice
Lat 66°08
Long 168°33

July 5, 1884

Ship surrounded by very heavy drift ice.
Lat 66°46
Long 164°56

July 10, 1884

Sailing thru drift ice.
Lat 67°03
Lat 164°30

July 11, 1884

Sailing along the ice pack, dist. from pack 1 1/2 miles.
Lat 68°10
Long 166°56

July 13, 1884

Passing thru large quantities of drift ice
Lat 67°55
Long 166°47

July 16, 1884

Heavy drift ice.
Lat 67°04
Long 169°12

July 17, 1884

Pt. Hope--ice being too heavy to get within 2 miles of the shore.
Lat 68°38
Long 167°18

July 19, 1884

Entered the drift ice and steamed in the N. of Pt. Hope for a safe anchorage. It being too rough to lay outside of the Point.
Lat 68°22
Lat 166°41

July 20, 1884

Ice drifting out of harbor
Lat 68°11
Long 166°15

July 21-23, 1884

Drift Ice.

August 23, 1884

Large quantities of drift ice passing the vessel
Lat 70°49
Long 157°23

August 24, 1884

Steaming along the ice pack thru drift ice.
Lat 71°09
Long 157°14

August 26, 1884

Drift ice.
Lat 68°50
Long 165°08

Revenue Steamer "Corwin", 1884, NA RG 26 Stack Area 10E2 Row 4 Compartment 19 Shelf 2 (Bear)

June 11, 1884

Behrings Strait.
At 1 Cape Prince of Wales. Ahead slow through drift ice.
4 to 8 Diomedes bering W 5/8 W p. d. dist. 10 miles. Observed the phenomenon of mirage in a marked degree throughout the latter part of watch.
8 to merid. At 10 made fast to iceberg for the purpose of watering ship.
Merid. to 4 p.m. Crew employed watering ship from top of ice.
4 to 8 p.m. Crew watering--receinved on board 1600 gals. 7:20 cast from iceberg and stood to N & E. Vessel steaming through heavy drift ice.
8 to Mid. Steaming various courses through heavy drift ice to th NNE.
Lat 66°26'30"
Long 167°47'10"

June 12, 1884

Ice very heavy
4 to 8 a.m. Drifting to the N & E. Vessel entirely encompassed by heavy drift ice.
8 to merid. At 10 a.m. worked ahead for 20 minutes endeavoring to free vessel from ice pack.
Merid. to 4 p.m. At 3 p.m. vessel working through the ice to the westward. Heavy packed ice as far as eye can reach by glasses from masthead.
4 to 8 p.m. Slight air from NW, partly clear. VEssel drifting to N & E in the ice. No clear water visible from the masthead.
8 to mid. Light to gentle winds from NW & clear until 11 p.m. then foggy.
8 to 11 p.m. Working to reach clear water. Ice very thick. No clear water visible from masthead.
Lat 66°44'18 N
Long 166°58'10" W

June 13, 1884

Working through heavy ice to the West.
4 to 8 a.m. Light NW wind, overcast and foggy. Steaming through heavy pack ice to the westward. At 6:30 a.m. clear of heavy ice, passing drift ice at times.
Lat 66°52'54" N
Long 164°50'10"

June 17, 1884

At St. Lawrence Bay. Ice breaking up in the bay.
Lat 65°35'00" N
Long 170°43'00" W

June 21, 1884

4 to 8 p.m. Steamed E to clear heavy drift ice.
8 to Mid. Fresh to strong breeze from S. Steaming around edge of ice pack.
Lat 66°52'00" N
Long 167°35'00" W

June 22, 1884

8 to Mid. At 9:15 sighted ice pack wore ship to the W. In all sail steaming along ice pack making by W course.
Lat. 66°55'56" N
Long 167°29'00" W

June 23, 1884

4 to 8 a.m. Made ice ahead hauled of S. Ice ahead and to leeward.
8 to Merid. Light NW wind, steaming along in pack W1/2 to 9:15 then S at 11:15. Made fast to iceberg, sounding in 14.13. 12 x 11 1/4 faths
4 to 8 p.m. At 6:50 iceberg capsized, steamer clear of it and stood to westward into clear water at 7:45. East Cape Prince of Wales S 1/2 W.
8 to Mid. Stood to westward clear of ice.
Lat 66°10'00" N
Long 167°00'00" W

June 24, 1884

to 4 a.m. Light NNE wind, sea smooth.
At 3:45 ice in sight bearing NW just about 2 1/2 miles.
Lat 66°30'06" N
Long 167°21'15" W

June 25, 1884

8 to mid. At 10 sighted ice pack
Lat 66°56'54" N
Long 168°07'15" W

July 27, 1884

4 to 8 a.m. Steaming along edge of ice
8 to Merid. Cruising along western edge of pack ice
8 to Mid. Standing through the straits, under sail.
Lat 66°08'08" N
Long 168°33'37" W

June 28, 1884

4 to 8 a.m. Moderate N to NNW wind and part clear. At 5:30 passed Fairway Rock and stood in for Cape Prince of Wales, passing drift ice.
8 to Mid. Light variable air to calm and partly clear. Passing through drift ice, sea smooth.

June 29, 1884

4 to 8 a.m. At 8 shaped course E 1/2 S, steaming through detached ice to eastward.
Lat 65°13'00" N
Long 167°20'00" W

July 5, 1884

Mid to 4 a.m. Entered the ice making East course. At 3:10, near Kotzebue
4 to 8 a.m. At 4:05 ship surrounded by heavy drift ice.
4 to 6 p.m. Light NE wind and partly clear. Steaming along the ice pack making SSE 1/e E course.
6 to 8 p.m. light NE wind, vessel drifting to SW by S through heavy drift ice.
8 p.m. to Mid. Stodd to N & E through drift ice. At 11 Cape Kruzeushern about 17 miles NE
Lat 66°46'54" N
Long 164°56'00" W

July 6, 1884

Kotzebue Sound.
Mid to 4 a.m. 12:30 Westward through drift ice, al 1:10 clear of drift ice.
Lat 66°52'00" N
Long 164°25'00" W

July 7, 1884

Merid to 4 p.m. Light ESE wind, foggy, vessel streaming through drift ice to S & E
4 to 6 p.m. steaming through drift ice.
6 to 8 p.m. Light ESE breeze. Steaming through drift ice.
8 to Mid. Light ESE wind, steaming in toward Cape Blossom. No ice within 6 miles of ship.
Lat 66°52'00" N
Long 164° 15'00" W

July 8, 1884

Note to Bockstoce--account of trading with natives--Hatham Inlet Kotzebue Sound.

July 9, 1884

8 to Mid. Passing through large quantities of detached drift ice. Out of Hotham Inlet Kotzebue Sound--toward Cape Kruzenshern NW 1/4 N Cape Blossom NE 3/4 E

July 10, 1884

Mid to 4 a.m. Light ESE wind, vessel sailing through drift ice to S & W
4 to 8 a.m. Through drift ice.
Lat 67°03'74" N
Long 164°30'00" W

July 11, 1884

Mid to 4 a.m. Light ESE wind. At 2:50 sighted ice bearing N dist. 3 miles at 3 changed course to SW by W 3/4 sailing along the ice pack, dist from pack 1 1/2 miles.
4 to 8 p.m. Sighted drift ice.
Lat 68°56'18" N
Long 166°56'00" W

July 13, 1884

8 to Merid. Steaming through drift ice.
Merid to 4 p.m. Light SE to East wind. At 1:30 steamed ahead along the ice pack distance from it 1 mile.
Lat 67°55'42" N
Long 166°47'30" W

July 14, 1884

8 a.m. to Merid. Passing through drift ice, sounded in 25, 23 1/2, 24 and 24 fathoms.
Merid to 4 p.m. Vessel steaming through drfit ice until 2 p.m.
4 to 8 p.m. Pack and floating ice in sight to the E along the coast as far as the fog would permit of its being seen.
Lat 68°14'74" N
Long 166°42'30" W

July 15, 1884

4 to 8 a.m. Drift ice along shore, passing quantities of driftwood.
8 a.m. to Merid. Vessel passing through drift ice.
Lat 67°34'48" N
Long 168°13'45" W

July 16, 1884

Mid to 4 a.m. Sighted ice pack at midnight tacked ship to S by W 1/2 W, sea smooth
4 to 8 a.m. Dense fog.
4 to 8 p.m. 6:25 fell in with heavy drift ice 64°, stood to W. 6:55 reached outer edge of ice and stood SSW
Lat 67°04'06" N
Long 169°14'45" W

July 17, 1884

Mid to 4 a.m. At 12:15 sighted ice. Kept off SSE until 2 a.m., then SE until 4. Ice in sight all the watch.
4 to 8 a.m. Steaming through drift ice, averaging SE 1/4 S.
Merid to 4 p.m. Light NE wind, stood SE by E along the ice pack.
4 to 8 p.m. 4:45 steamed in shore for Point Hope. 5:40 stood back to anchorage the ice being too heavy to get within 2 miles of the shore. At 6 p.m. came to outside of drift ice. Point Hope bearing N by E 1/4 E
Lat 63°38'19" N
Long 167°18'00" W

July 18, 1884

Off Point Hope, anchored.
8 a.m. to Merid. Ice drifting to NW
Lat 68°15'00" N
Long 166°48'00" W

July 19, 1884

4 to 8 a.m. At 4:20 got unde way and stood to N & E. 4:50 entered the drift ice and steamed in the N of Point Hope for a safe anchorage it being too rough to lay outside of the Point.
4 to 8 p.m. Small quantities of drift ice passing the vessel.
Lat 68°22'30" N
Long 166°41'00" W

July 20, 1884

Midnight to 4 a.m. At 12:30 shift forward by heavy drift ice. Ice drifting out of harbor (Pt. Hope).
4 to 8 a.m. At 5:35 a.m. heavy drift ice sitting inshore.
4 to 8 p.m. 4:30 entered drift ice and slowed down until passing through at 6:40 p.m. Came to in 6 fathoms of water to the S of Point Hope inside and to windward of drift ice. Point Hope bearing S by W 1/2 W
Lat 68°14'00" N
Long 166°15'00" W

July 21, 1884

8 a.m. to Merid. Anchored on the N side of Point Hope. Heavy drift ice passing the vessel.
Lat 68°21'00" N
Long 166°17'30" W

July 22, 1884

4 to 8 a.m. Sea smooth, small quantities of drift ice passing the vessel. At 4:30 have short to avoid drift ice. At 6:30 worked engine ahead to clear large cakes of ice.
Lat 68°14'00" N
Long 166°15'00" W

July 31, 1884

4 to 6 p.m. STrong breeze from NNE to NNW heavy squalls of wind and rain, thundering and lightning.

August 22, 1884

4 to 6 p.m. Steaming through small quantities of drift ice.
8 to Midnite. High WSW airs and deuse fog. At 9:15 got under way, stood to S and # through heavy drift ice. At 10 anchored in 4 1/2 fathoms
Heavy drift ice floating past vessel
Lat 70°36'30" N
Long 161°18'00" W

August 23, 1884

Mid to 4 a.m. A large quantity of drift ice passing the vessel. At 1 shifted anchorage to avoid being jammed between drift and grounded ice.
4 to 8 a.m. Small quantity of drift ice passing the vessel.
Merid to 4 p.m. At 12:40 ahead steering various courses trhough heavy drift ice.
6 to 8 p.m. Moderate NE wind, overcast and foggy. Drift ice pasing to the N.
6 to 8 p.m. Ice passing to the North
Lat 70°49' N
Long 157°23 W

August 24, 1884

Midnite to 4 a.m. Light Northweind, snow squalls. Stood to N and E steaming along the ice pack through drift ice.
4 to 8 a.m. Working through heavy drift ice
8 to Merid. Working through ice towards vessels inshore. At 9:20 hauled out to N & W working through floating ice.
Merid. to 4 p.m. Weather thick and snowing kept her south to clear ice.
4 to 6 p.m. Steaming through drift ice.
6 to 8 p.m. Made fast to an ice flow with a line on both bows.
Lat 71°09'36" N
Long 157°14'00" W

August 25, 1884

4 to 8 a.m. At 7:20 cast off from ground ice and stood to the S.
4 to 6 p.m. Vessel passing through drift ic.
Lat 70°40' N
Long 160 W

August 26, 1884

Anchored off Cape Thompson
Lat 68°50' N
Long 165°08' W

Nothing in 1883 log
Nothing in 1882 log

1885 Journey of the Young Phoenix of New Bedford, Capt. Holmes

May 2, 1885

Attempted to work into N.E. but found the ice too heavy.
Lat. 62.07 N
Long. 167.19 W

May 6, 1885

Working to NE along the edge of the ice.
Lat. 62.45 N
Long. 166.29 W

May 8, 1885

Fast in ice. Plenty of walrus but too much young ice to get to them.
Lat 63.03 N.
Long. 167.30 W

May 9, 1885

Got 4 walrus.

May 10, 1885

Got 15 walrus

May 11, 1885

Got 15 walrus, St. Lawrence Island in sight, 35 miles bearing SW

May 12, 1885

Plenty of ice, St. Lawrence Island distant 25 miles.
Lat 63.25 N
Long 167.47 W

May 15, 1885

Ship on different tacks working to the S. Ice looking heavy
Lat 62.50 N
Long 166.59 W

May 19, 1885

Ship on different tacks working S along the ice.
Lat 63.35 N
Long 166.40 W

May 21, 1885

Ship on different tacks of the ice.
Lat 62.24 N
Long 160.33.15 W

May 23, 1885

Working through the ice.
Lat 62.31 N
Long 171.15 W

May 24, 1885

Trying to work to the windward through ice. The west end of St. Lawrence Island bearing N.W. distant 40 miles.
Lat 62.35 N
Long 171.04 W

May 25, 1885

Ship in the ice working from one lead to another
Lat 62.30 N
Long 170.58.30 W

May 31, 1885

In the ice drifting to the N.E. At 11 a.m. cleared the ice. At 1 p.m. St. Lawrence Island in sight bearing N.E. Working ship through heavy ice. St. Lawrence Island distant 15 miles bearing N.E.

June 1, 1885

In the ice drifting to the N.E. At 11 a.m. cleared the ice. At 1 p.m. St. Lawrence Island in sight bearing N.E. Working ship through heavy ice. St. Lawrence Island distant 15 miles bearing N.E.

June 15, 1885

Ship working to the west. At 9 a.m. came to ice, kept off the N.E. and passed a large body of ice at 2 p.m. St. Lawrence Island bearing N.E. by N, distant 55 miles off. At 4 p.m. kept along the ice course N.N.W. At 1:30 a.m. came to a large body of ice.
Lat 62.42 N
Long 173.32 W

June 17, 1885

Plenty of ice but fog so thick hard work to keep clear of it.
Lat 62.55 N
Long 172.41 W

June 22, 1885

Some ice is sight.
Lat 63.48 N
Long 172.52 W

June 24, 1885

Considerable scattering ice.
Lat 64.35 N
Long 171.45.45 W

July 30, 1885

Kept off to the N along the western pack ice, land in sight at Point Belcher, heavy ice about 20 miles off shore.
Lat 70.40 N
No Long. given

August 3, 1885

Course S.W. followed the edge of the western pack - off Icy Cape.

August 6, 1885

Still at anchor to the N of Icy Cape. Considerable ice drifting along.

August 10, 1885

In vicinity of Wainwright Inlet. A large field of ice came down - took anchor and stodd in shore until it passed to the E.

August 16, 1885

Working along the ice. Considerable walrusses on the ice. Some ships after them. Sent in boats and got 7 latter part.

August 18, 1885

Near Icy Cape. Ship working to windward along shore. Considerable ice.

August 19, 1885

Bark Mary and Susan arrived from Point Barrow reporting heavy ice and prospects poor for getting futher.

August 25, 1885

Off Point Barrow. The pack distant 8 miles, very heavy ice.

August 26, 1885

Working along the pack, ice heavy.

August 27, 1885

Working through the ice to N.E. Lucretia took a whale, the first one known of.

September 21, 1885

Crusing along the ice.
Lat. 70.55 N
No Long.

September 27, 1885

Stood to N.E., came to pack ice.
Lat 71.90 N.
Long 167.00 W

October 1, 1885

Running to N.W. along the ice
Lat 71.23 N
Long 167.39 W

October 15, 1885

Saw quite a pack of ice to the W and S.W.
Lat 67.26 N
Long 166.42 W

ROSARIO 1891 - Edwin Coffin, Master

Monday, May 11, 1891

Pleasant weather, working thru ice .
Approx. 61.28(La) 183.19(Lo)

Thursday, May 14, 1891

Working thru ice
61.29, 182.56

Tuesday, May 26, 1891

Tacked off and on the ice several times during the day.

Monday, June 1, 1891

Working in the ice all day long.

Wednesday, June 3, 1891

All day among the ice.

Thursday, June 4, 1891

Laying tied up to the ice.

Friday, June 5, 1891

Working through the ice all day.

Sunday, June 7, 1891

Working ice all day.

Monday, June 8, 1891

Working ice all day.

Tuesday, June 9, 1891

Tied up to a cake of ice.

Wednesday, June 10, 1891

Tied up to a cake of ice.

Saturday, June 13, 1891

Still lying tied up to the ice with no chance of getting along.

Monday, June 15, 1891

3 PM made sail and started through the ice.

ROSARIO 1891

Tuesday, June 16, 1891

Working through the ice all day.

Wednesday, June 17, 1891

Stuck hard and fast in the ice at noon ice began to open, made all sail breeze took us a short distance.

Thursday, June 18, 1891

Stuck in the ice, at 3 PM ice opened made all sail and took a lead which carried us a long distance.

Friday, June 19, 1891

Ice has opened and we are going at a good rate.

Thursday, July 9, 1891

Plenty of ice and no chance to get into Point Hope yet.

Friday, July 17, 1891

Got under way twice today on account of the ice.

(Pt. Hope) 68, 167 (Approx)

Sunday, July 19, 1891

Saw the ice coming in toward us, up anchor and was towed out by Steamer Balasne.

Monday, July 27, 1891

Couldn't get to coal mine because of ice.

Wednesday, August 5, 1891

1 AM wind breezing on sail-and ice coming in stood to the North.

Thursday, August 6, 1891

Latter part-quite moderate ran off in the afternoon toward the Coal mines.

Monday, August 24, 1891

Arrived Pt. Belcher, anchor there at 10:30 AM. Got underway again at 5:30 on account of the ice.

Saturday, August 29, 1891

Started for Cape Smith ran down to the North of the Sea Horses about 10 miles see that-it-was full of ice.

Wednesday, September 2, 1891

Comes in with fresh winds from the SW no chance to leave here yet as the ice has come together.

Thursday, September 3, 1891

The ice pack is on and no chance of starting.

Friday, September 4, 1891

Not much chance of the ice starting yet.

Saturday, September 5, 1891

The ice pack is still on but the ice in shore is scattering.

Sunday, September 6, 1891

The ice is going very fast to the North and the chance looks favorable for getting out in a day or two.

Monday, September 7, 1891

Got underway.

Wednesday, September 9, 1891

Ice very scattering. Lat. 7.17 Long. 163.30

Tuesday, September 22, 1891

Hove to at dard under a strip of ice.

Tuesday, September 29, 1891

Saw Herald Island and some scattering ice hove to under foresail all night.

Saturday, October 3, 1891

Amoung the young ice saw several ships whaling
71.18, 173.20.

Bark Wm. Baylies Log Book

April 9, 1893

Ice to the Northward - came to strip of fine ice at 3 PM. Wind hauled to NW ship working to Northward along the ice.

Lat. 59.47N
Long. 176.00 W

April 10, 1893

Begins with fresh winds SW and snow-squally - ship steering NW by W under all prudent sail - at noon came to small patches of ice at 1 PM. Steered by the wind on Port Tuck --saw a little scattering ice.

Lat. 60.31N
Long. 177.14W

April 11, 1893

Fresh winds WSW - ship working to windward along scattering ice.

April 13, 1893

Moderate gales from NW -- came to scattering ice at 3 AM. - 10 AM no ice in sight.

April 14, 1893

Fresh winds from SE - ship working to W. and N. thru scattering ice.

April 15, 1893

Fresh winds from SE - ship making W along edge of ice.

April 19, 1893

Good weather, lite winds from N. -- saw scattering ice toward windward.

April 20, 1893

Lat. 61.26W Begins with light Baffling Airs from the Northward--ship working to windward along the ice.
Long. 177.00

April 21, 1893

Light airs from WNW ship steering to the N and E thru scattering ice. Land in sight.
Lat. 62.00 N
Long. 177.12E

April 22, 1893

Begins with light Baffling Airs - ship trying wrk ice in comapny of 6 other ships - none of them made much headway at 6 PM.

April 23, 1893

Begins with light airs from Northward - ship working thru ice toward Cape Naverine in comapny with 6 other ships.

Lat. 61.45N, Long. 179.19W.

April 25, 1893

Fresh winds from Northward - ship laying in the ice on opposite tacks.

April 26, 1893

Fresh winds from W and over east - ship under short sail in the ice trying to get to the Northward - 8 ships in sight working the same.

April 27, 1893

Ditto - thru scattering ice.

April 28, 1893

Strong winds from NE and over east. Ship working to N. thru the ice under all prudent sail.

April 29, 1893

Ditto but moderate gales from NE.

May 1, 1893

Fresh winds, working thru ice under prudent sail.

May 2, 1893

Heavy ice, fresh winds NE.

May 3, 1893

Fresh wind, NE scattering ice.

May 6, 1893

Good weather, overcast, ship working in the ice.

May 7, 1893

Winds WNW, ship working to NE thru scattering ice. At 11:00 AM was in thick ice. Lat. 61.00W

May 8, 1893

Begins with light airs from S. Ship stuck in the ice at 8:00 AM -- Ice too close to get Bow Head sighted. At 1 PM lgiht breeze from S loosened a little. 61.02N, 178.40E.

May 9, 1893

Winds from SW, ship working thru ice to N.E. At 8 AM saw BowHead - after lowering 4 boats no whale to be seen.

May 10, 1893

-- good weather, light winds from SW. Ship laying in the ice.

May 11, 1893

Light winds from W., overcast with some snow. Ship laying abark in small hole of clear water.

May 12, 1893

Good weather and calm, ship made little progress

May 13, 1893

Light winds SE. ship working to the Northward

May 14-18, 1893

Fast in ice. NE winds, calm. On 18th light airs from SE.

May 19, 1893

Good weather, ship cruising in the ice.

May 20, 1893

Ditto

May 24, 1893

Fresh winds from NE, ship laying in ice with no sail set. Ship made fast to the ice. At 4 PM, Cape Naverine 25 miles. 61.47N, 179.30E.

May 25, 1893

Winds NE, thick snow storm, ship fast in ice.

May 27, 1893

Tried to haul ship. No use. Ice too heavy.

May 29, 1893

Fresh winds from N, ship working to windward under all prudent sail.

May 31, 1893

scattering of ice, calm weather, light winds SW.

June 2, 1893

Light NE winds, overcast, scattering ice.

June 3, 1893

Fresh winds N and snow squalls, ship laying fast to ice.

June 4, 1893

Fresh winds from N and snow. Ship working to windward thru ice. At 1 PM got stuck fast. 63.24N, 178.52W.

June 5, 1893

L. winds from S. - freed from ice, worked W.

June 6, 1893

Thick fog, light airs from E. Ship working to the N. thru ice. At 6 PM, calm made ship fast to a flow of ice.

June 7, 1893

L. winds from N. Ship fast. Thick fog. 3 PM cleared. Wind hauled NW, made sail and steered to N. thru the ice. Saw Cape Bhering. AT 3 AM got thru the cie into clear water.

June 8, 1893

L. airs, ship steering along the ice. Land, Natives comae on board off Cape Achein.

June 13, 1893

Too much ice to get water. At 7 PM ship working for Diomedes Island with strong winds from N. and thick fog.

June 16, 1893

Good weather, l. breeze from S. 8 AM off King Isl. at 2 PM came to ice, could not go to Port Clarence-ice.

June 17, 1893

Begins the same. At 4 PM came to the shore ice, anchored.

August 10, 1893

Fresh winds NE and fog. Point Belcher N.E. Distance 10 miles, saw scattering ice.

August 11, 1893

Sea Horse Islands and scattering of ice visable, saw Cape Smyth. Bearing NNE. Distance 15 miles.

August 16, 1893

Strong winds N.E., saw ice off the Point

August 18, 1893

Light breeze-- NNE, clear, Ice off Pt.

August 19, 1893

Fresh winds N.E. Ice off Pt. At 9 pm ice came to the ship. Hove up anchor and steered for Cape Smyth. Anchored off the Cape.

August 20, 1893

Strong N.E. Winds, rain. 5 am ice came down to ship again. Hove up anchor and went out of the ice.

August 22, 1893

Fresh ENE winds, fog. Scattering of ice, steered thru ice.

August 23, 1893

L. winds ESE, thick fog, ice to NW.

August 24, 1893

L. breeze SW. 11 AM stips of ice.

August 25, 1893

Fresh winds NE, overcast. steering long the pack ice (72.55N, 169.33W)

August 28, 1893

Ditto, thick fog. 3PM ice 5 mi. to NW.

September 2, 1893

Calm, fog. Squalls at 7 AM light airs from E. Saw some ice.

September 3, 1893

Ice to the Northward.

September 4, 1893

Fresh winds from NE and snow squalls, cruising by ice.

September 5, 1893

Ditto

September 6-16, 1893

Cruising long ice.

September 19, 1893

Lost sight of ice at 3:45 PM

September 20, 1893

(Lat. 72.05N, 171.58W) at 3 AM came to ice.

September 25, 1893

Saw scattering ice to the Northward, light airs from E. Thick snow squalls.

September 26, 1893

Ice at 1:45 PM. Saw Herald Is. Bearing SW, Distance 30 miles.

September 29, 1893

Fresh winds from N and snow squalls. 3 PM saw scattering of ice.

September 30, 1893

Fresh winds from NNE and thick snow, ship cruising amongst scattering ice.

October 15, 1893

Very heavy squalls, wind and snow, bad sea. Saw Cape Prince of Wales 6 AM. At 9:30 AM came to packed ice. Kept off SE long the ice.

Journal of a Voyage on Whaler Wm. Baylies to Arctic Ocean

Wm. Baylies 1894-1895. Wintered at Herschel Island, Arctic Ocean

May 9, 1894

(55.58, 168.05) Raised the Is. of St. Geo. bearing WNW. 50 mi. at 8:30 PM. Shut off steam at 11 PM in strip ice.

May 10, 1894

NW wind and clear. 3:30 am steamed off SW and got out of the thickest of the ice. Plenty ofice for this lat. and time of year.

May 11, 1894

Light airs from SE, making along scattering ice.

May 12, 1894

Scattering of ice.

May 13, 1894

Comes in with a gale from the east. Later, kept off into the ice but had to come out again on account of a heavy swell.

May 14, 1894

60.37N, 179.30W

May 16, 1894

N.E. gale. Ship under the lee of the ice.

May 17, 1894

Strong N winds and thick snowy weather. Ice lays in stips running NW & E.

May 18, 1894

Fresh E winds. At 2 PM steamed into the ice. Shot one seal. Came out of the ice again about 6 PM.

May 19, 1894

Moderate E winds, thick weather, ship got steam and commenced working NNW thru the ice.

May 20, 1894

Ship heading along the land SW of Cape Navarine about 40 mi. Raised the ice and took it at 12:30 PM. Rest of day working ice into the ENE, Saw quite a no. of walrus. Ice is quite heavy. Weather thick and snowy.

May 21, 1894

Strong NE winds. Ship in the ice working NE under steam. Tied the ship up to the ice about 11 PM. Ice grows quite heavy.

May 22, 1894

Snowy and wind NE "as usual." Steamed to the NE ice scattering. (63.30N, 177.21W)

May 26, 1894

Begins with NNE winds, clear. Ship off SouthHead about 5 PM and tied up to the ground ice.

May 27, 1894

Light airs from NE. Tied up to the ice. Made sail at 7 AM and followed ice off to S & E. Ice quite heavy and scattered.

May 30, 1894

Calm and fine weather. Let go from ground ice and steamed over toward the Diomedes. At 7 PM made sail and headed back toward E. Cape. Considerable scattering ice in the straits.

June 1 - 7, 1894

Tied up to ground ice.

June 8, 1894

Thick fog and light E airs. About 10 AM ice came in to where all the ships were tied up and drove us all out. Later came back and tied up again.

June 14, 1894

Strong NE winds. Saw some ice off shore but clear in the Gulf. Anchored at Plover Bay at 6:30 PM.

June 19, 1894

Strong ESE winds, thick rainy weather. Saw some scattering ice. Sighted Halls Island or St. Mathews.

July 17, 1894

Passed Coal Mines at noon. 8 PM saw some scattering ice.

July 19, 1894

Arrived Pt. Belcher at noon-tied up to soem ground ice. Can't get any farther north on account of ice hard on at the Sea Horse Islands.

July 21, 1894

NE breeze. Ship steaming for Cape Smyth. Ice scattering. Arriv. C. Smyth tied up ground ice.

July 22, 1894

Fog. Ice came in and we had to fleet inside of the ground ice opposite the Shooting Station. (Cape Smyth) Ships tied to ground ice at Shooting Station at Pt. Barrow.

July 25, 1894

Left Pt. Barrow heading E., ice scattering.

July 26, 1894

Light S. wind, came to the ice making close on the land. Tied up to ground ice.

July 28, 1894

Light N airs, fog. 3:30 PM. Started to work e. thru ice. Tied up to ground ice.

July 29, 1894

Foggy. Wind ENE., Ship fast to ground ice. Fog cleared, looked pretty ice to NE.

July 30, 1894

Light variable airs, fine weather. Made fast to ground ice.

July 31, 1894

W. puffs and clear area. At 2 AM ships all fleeted insdie some ground ice.

August 1, 1894

No open water to the Eastward.

August 2, 1894

Light W. airs, fine weather, ships all tied up to ice at Cross Island. No movement in ice.

August 4, 1894

Ice does not open up to the east.

August 5, 1894

Shipwreck Reindeer - ice came down and shoved her on shore while at anchor and also put a hole thru her.

August 6-8, 1894

tied to ice.

August 15, 1894

Strong NE wind and clear. Ship still tied up to ground ice. The ice looks close off shore and plenty of it.

August 17, 1894

Ice looks about the same as it did 10 days ago.

August 20, 1894

Light N.E. - working ice in company with the rest of the steamers, got into clear water. Ship under steam working scattered ice.

August 30, 1894

Caught Bowhead. 70.00N, 136.30W.

September 5, 1894

2 whales

September 6, 1894

1 whale. Begin preparations for wintering at Herschel Island.

October 11, 1894

Harbor at dark is full of slus and about impossible to pull a boat thru it.

October 16, 1894

+7°. Wind light. 6 AM got our anchors and started breaking into the ice for winter quarters.

1895

May 16, 1895

Sawing out the starboard side of ship - ice about 5 ft. in thickness.

May 20, 1895

Crew employed in cutting the ice out around the ship.

May 21, 1895

Temp. 72° at noon, ice and snow went fast.

May 23, 1895

Took down remainder of house over main deck.

May 25, 1895

Crew employed in repairing, getting ship ready for sea.

June 23, 1895

Ice is thawing out fast in the harbor. All go on shore in dingkeys.

June 24, 1895

Ship went adrift about 10 AM, let go anchor.

June 26, 1895

Ship ready for sea, but outside there is very little clear water.

June 27, 1895

Ice is on the move around the harbor. Newport let go her fasts on shore and steamed to an anchorage.

June 29, 1895

Harbor full of scattering ice, hard getting around with dingkey.

July 6, 1895

Ice has set on to the Sand Spit so it is impossible to get out. Plenty of clear water to the eastward.

July 7, 1895

We left but got stuck outside the sand spit. At 4:30 made another start. 7 PM all the steamers were well to eastward in clear water under full sail.

July 8, 1895

Came up to some island (Ellice or Pitts) Anchored about noon. Can't proceed any farther east on account of ice.

July 13, 1895

Saw whitefish, anchored off Ballies Is.

July 15, 1895

Light airs and calm. Ship cruising off amongst the ice.

July 16, 1895

SW winds and fog. Ships tied up to ice some of the time. Ice thick in strips.

July 18, 1895

Tied up to ice.

July 20, 1895

SW breeze, clear, 5AM sailed out to the ice, cruised along ice, saw nothing.

July 22, 1895

NW airs. Ship off to the ice. 8 Mi N by E from Cape Bathurst.

July 24, 1895

SW breeze, steamed along ice to W. a few miles then made sail and ran off along the pack until it came in thick.

July 26, 1895

Running the ice all day, ice is well off shore.
(Lat. 70.55) Got up to the pack about 8 PM.

July 28, 1895

E. airs, later N.E. wind ice scattering.

July 29, 1895

Tied up to ice.

July 31, 1895

Light NE winds. Ship made fast to the ice NW of Ballis Is. 10 miles off shore.

August 8, 1895

Off Richards Island. Later Hooper and Pelly Is. in sight. Plenty of ice.

August 9, 1895

Calm. Tied up to ice at 9 PM.

August 10, 1895

Strong NW winds, rain. Ship tied to heavy ice. Plenty of scattering ice.

August 11, 1895

WSW winds. Let go from ice 7 AM. About 11 AM bearing S by E 30 mi. tied up to the Pack ice. Ice is thick and heavy.

August 13, 1895

Ship tied up to the ice NE from Herschel Is.

August 15, 1895

Thick fog. Wind NE. Ice drove us out, moved in shore, it lighted up and we saw the land - called it Kay Pt. Ship has to move once in a while on account of drifting ice.

August 20, 1895

"Small whale" 40 barrels.

September 8, 1895

Saw Flaxmans Island. At 9 PM tied up to a piece of ice, weather being thick and rainy and a stiff breeze from SW.

September 9, 1895

Fine weather, worked out by end of Return Reef into clear water. Ice being close on ship. Saw a very few scattering pieces of ice.

September 13, 1895

NE wind and snow. At 6 AM kept off along the ice about SW. Saw Pt. Belcher. Saw some Devil Fish.

September 14, 1895

Moderate winds, steamed up to the ice.
Lat. approx. 71.00N

September 16, 1895

Strong w. wind, saw some scattering ice.

September 17, 1895

Heading WNW all day came to ice about 6 PM.

September 18, 1895

SW winds. Stood in to some scattering ice in forenoon. (72.00, 168.00)

September 23, 1895

Came up to ice about 8 AM and kept off along the pack about SE.

September 24, 1895

Strong NW winds, Midnight came up to the ice. At 8 AM swing off along the pack. Came to the conclusion that we had been following the western pack into the S.E. for two days.

September 26, 1895

Breeze from SW, fine weather "came to the ice." Steamed to windward again about 3 hours.

Septebmer 27, 1895

S. breeze and moderate. Ship steaming to windward to get clear of ice.

September 29, 1895

Light airs SE by S. and foggy. Ship on different tacks near scattering ice. (70.30, 169.30W)

October 3, 1895

Cloudy, NE wind. Saw one point of ice, looked like the western pack.

October 4, 1895

N winds, little scattering ice. Came to a strip of ice.

October 5, 1895

(71.15N, 169.15W) Some scattering ice but no pack.

October 9, 1895

Gale from NE, -15°, came up to the pack and young ice.

October 14, 1895

Strong N. winds. Passed East Cape. Saw some ice in the straits. Had to luff to an eastern tack on account of scattering ice.

October 15, 1895

Strong winds from NNW. Near Indian Pt. Saw some long strips of scattering ice.

Feb. 1899 - Stms Wm. Baylies Log Book

April 10, 1899 - Monday

Made the ice in Lat. 59.20, Long. 175.25W. Calm steaming along the ice.

April 12, 1899

60.07, 178.19W
Light northerly winds, after steaming along ice, at 6 PM stopped steaming, set sail through strips of young ice.

April 13, 1899

Strong NE winds laying aback amont the ice. At 4 AM made all sail working to westward. At 11:30 came up to heavy ice, could not go through, kept off to SW 60.31N 178.10.

April 15, 1899

Strong NE winds and fog, scattered ice. 6 PM laying aback ice too close to work. Cape Navarin bearing N by W, distance of 40 mi. 61.12, 178.21.

April 16, 1899

Light NE winds heading into the land, steaming thru the ice to Navarin at 3:30 stopped steaming, fast in ice. Cape Navarin. N.E. dist. 25 mi.

April 17, 1899

Strong NE wind, thick snow storm, ice opening up, thick snow storm at 3 PM - fast in ice. Later, clear Cape navarin bearing NE distance of 20 mi.

April 18, 1899

Light N.E. winds, clear, shot 2 seals. 61.50, 178.14E

April 19, 1899

Strong NE winds, thick fog, fast in ice. 8 below 0.

April 20, 1899

NE winds, thick fog, laying in ice. At 5 AM made sail, working out to SE. AT 10:30 AM got out into clear water.

April 23, 1899

Strong NE gale, heavy weather, 5:30 PM came up to strips of small ice.

April 24, 1899

Fresh breeze from N. working thru ice. At 4:30 PM stopped steaming, set sail (wind NW) working thru heavy ice. 9 PM took in all sail, drifting in ice.

April 25, 1899

At 3 PM stopped steaming, came up to heavy ice. 60.00, 177.50E

April 26, 1899

Lgiht NW winds, working thru heavy ice, under all sail. At 9 AM calm, steamed 30 min. ice closed, fast in ice. At 7 PM ice slacked up, steamed until 10 PM, set sail.

April 27, 1899

Light S wind, steaming thru strip of ice, all sail set working along the ice to E.

April 28, 29, 1899

Steaming along ice.

April 30, 1899

At 11 PM came to heavy ice, stopped steaming, laying in the icewith fore & aft sails set. 60.25N, 175.08.

May 1, 1899

Strong NE winds, laying fast in ice. At 2 AM ice slacking up a bit, steaming until 6 AM, ice opening up. 7 PM stopped steaming, heavy ice and close.

May 2, 1899

Light N winds, fast in ice. At 11 AM steaming and all sails set working thru ice. At 10 PM out of the ice in clear water heading NE. 60.35, 175.32.

May 3, 1899

Sight St. Mathews; clear weather, went thru inside Pinnacle Rock, Cape Upright WNW at distance of 12 mi. Working NE thru strips of ice.

May 4, 1899

Begins strong NE winds working thru scattered ice, at 10 AM fast in ice. At 9 PM steamed out of the ice working to the N.

May 5, 1899

Strong N. gale, thick snow squalls, working thru heavy strips of ice.

May 6, 1899

Strong N. winds, at 9 AM came up to heavy pack ice, made all sails stearing E. 6 PM steaming thru strips of ice, later drifting in ice.

May 7, 1899

Laying fast in the ice. Strong NW winds.

May 8, 1899

Light SW winds. At 8 AM steamed out of ice.

May 9, 1899

Light S winds and thick fog, laying fast in ice.

May 10, 1899

Light S winds, thick weather, working thru ice.

May 12, 1899

Light E winds. 9 AM got into stack ice. Made St. Lawrence ice. At 10:30 mistook ground ice for flow. Ice stood so near in that the ship touched bottom lightly.

May 13, 1899

Got stuck in a strip of ice.

May 22, 1899

Arrived at South Head at 1:30 AM and left 10 AM for N. Head, working thru scattering ice with thick fog.

May 23, 1899

Lying at N. Head all day fast in ice.

May 24, 1899

Arriced at Diomede Is., made fast to ice.

May 28, 1899

Stopped steaming at 2 AM and stood over toward Kings Isalnd. Fell in with heavy ice.

May 31, 1899

Got stuck in ice about 8 mi. south of Diomed. Ice stacked up at 6 PM, got out of ice. At 1 PM made fast.

June 1, 1899

Got a large whale.

June 2, 1899

Lying at the ice, NW moderate, the ice coming in made fast.

June 3, 1899

Strong S wind, let go from ice at 9:30 AM and shifted to N. of the ice.

June 6, 1899

Arrived E Cape 12:30. Made fast to the flow, light winds from NE.

June 7, 1899

Arriv. Diomede 4 AM, tied to ice. Fresh breeze from SW.

June 8, 1899

Wind light lying tied to ice, steamed out dropped anchor.

June 9, 1899

Came in, tied to ice. All day drift ice running by our side with Northerly current. Went south to Dutch Harbor.

July 26, 1899

Near Sea Horse Is. Got under way at 8 AM and worked into the NE 20 mi. thru loose ice. tied to a larage flow at 10:30. At 1:30 came back, dropped anchor in 5 fathoms of water. Thick fog. Wind SW. Ice coming in.

July 31, 1899

way
Got under [weigh] (sic) at 7:30 AM steamed up to near Skull Cliff and tied to the ice.

August 12, 1899

One whale.

August 18, 1899

2 whales.

August 20, 1899

Steamed up to the ice.

August 21, 1899

Coming along the ice saw one whale.

August 29, 1899

Light breeze from SW, later fresh breeze, steamed into Camden Bay and tied to ice.

September 1, 1899

Light breeze SE, stood out to the ice, made fast to a ground cake, Later, let go and anchored in 6 fathoms of water.

September 2, 1899

Lite breeze from SW to NW, drifting ice, tied to a gound cake of ice.

September 10, 1899

(Cape Smyth) Hove to ice. Thick weather.

September 15, 1899

Got a whale.

September 18, 1899

Got a whale

September 21, 1899

Got a whale.

September 26, 1899

Got a whale.

October 5, 1899

Very cold, moderate NE wind, standing along the ice.

October 8, 1899

Lying aback in young ice.

October 9, 1899

Young ice all day and night.

October 10, 1899

Got out of young ice having made about 36 mi headway in 36 hrs., Later, clear of ice still steaming southward.

October 12, 1899

Arrived Pt. Hope 6 PM.

1900 - William Baylies

May 11, 1900

Ship in ice 61.35N., Got whale

May 12, 1900

Calm, ship drifting in ice working N.E.

May 13, 1900

fine, calm weather. Ship in ice.

May 16, 1900

Fine weather, NW wind, worked thru ice. At 7 ice closed. Cape Navarine in sight. (61.44N, 177.5 E)

May 17, 1900

Fine weather. SW winds, ice slaked (?) at 8 AM. Worked ice til 5 PM. Ice closed. Shut off steam.

May 20, 1900

Fine weather, NE winds. worked ice til 10 AM. Ice lcosed. At 11 AM ice slaked, got steam and worked along ice. Closed at 10 PM.

May 21, 1900

Misty NE wind. Ship fast in cie all day.

May 22, 1900

Fine weather ship in ice until 12 noon, ice slaked got steam and followed the Beluga until 9:30 PM when ice close and ship couldn't make any headway.

May 23, 1900

First part ship lying in ice. 7:30 AM ice opened enough to move.

June 4, 1900

Strong breeze WNW. Shifted course for Diomede at 11 AM made fast to the ice. Later left Diomede.

June 7, 1900

PM strong breeze from S. Went up to ice off of Whalen and made fast to the ice for shelter.

June 8, 1900

1st part, strong breeze from S. Ship fast to ice. 2nd part, strong gale SSW - all lines fast to ice and steaming ahead. Let go of lines and steamed along the flow.

June 11, 1900

Fine, calm. Went in and tied to flow ice of E. Cape.

June 12, 1900

1st part calm. Ship fast to ice.

June 16, 1900

Strong breeze from N, let got of the ice (2 AM).

June 17, 1900

Fastened to flow ice with lines. 4 PM blowing heavy gale from S.

June 18, 1900

Fine weather, let go the ice of Whalen.

June 20, 1900

Strong gale NW. Ship fast to flow ice. At 5:30AM ice broke.

June 21, 1900

Strong breeze from NW. Ship fast to the flow ice of E Cape. (66.03, 170.14)

June 22, 1900

Calm. Ship lying at E. Cape fast to flow ice. Got whale.

July 13, 1900

(Near St. Lawrence Bay?) 6 AM. Heavy ice.

July 27, 1900

Pt. Belcher, thick fog, NE wind & strong breeze anchored under ground ice.

July 28, 1900

Thick fog, NE wind, strong breeze, scattering ice.

July 30, 1900

Fine weather, worked to E. of Pt. Barrow about 4 mi. came to pack ice and made fast to the flow.

July 31, 1900

Fine wea. Ship fast to flow ice E. of Pt. Barrow. At 6 PM got steam, ice working to windward. Worked south and made fast to flow ice.

August 1, 1900

Thick fog, light breeze, ship fast to flow ice. At 5:30 fog lifted, got steam and worked to E.

August 2, 1900

Fog and NE wind, worked ice all night, cleared, worked in near shore.

August 4, 1900

Thick fog, light NE breeze, heavy ice. Passed Bates Is.

August 5, 1900

Past Herschel Is., thick fog, made fast to the ice.

August 6, 1900

NE strong breeze, working ice. 2 PM made fast to ice.

August 7, 1900

Thick fog, ship fast to ground ice, fog and ice cleared, made hard into land. Shifted in those winds "freezed up."

August 9, 1900

Calm weather, ship fast to ground ice. At 6 AM got steam.

August 10, 1900

N wind. Bowhead in lead, plenty of ice. Tied up to ice of Boyle Is.

August 11, 1900

Fine weather. Ship fast to ice off Smokey Cliffs. Got steam 6 AM worked off shore close to pack ice, and made fast to the ice.

August 12, 1900

Calm, thick fog, ship fast to ice, steaming.

August 16, 1900

Strong breeze N.E., went to Bayle Is. made fast to flow ice.

August 20, 1900

Fine weather, steaming west of Bayle Is., working heavy ground ice.

August 22, 1900

Glae of wind from W. Anchored in shore off ice.

August 25, 1900

E wind, snow squalls, heavy ice. 11 PM made fast to ice.

August 31, 1900

Strong breeze N.E. At 7 AM steared N and came up to pack ice. At 1 PM ran along ice to westward.

September 1, 1900

Worked along pack. 9 PM foggy with snow squalls and 10:50 clear, no ice in sight.

September 13, 1900

Fine weather, 7 AM made the ice, hauled along the edge of apck

Septebmer 16, 1900

NE wind and snow storm, ice in sight at 1:30

September 17, 1900

Got a whale!

September 20, 1900

Got 2 whales!

Septebmer 21, 1900

Got 2 whales!

September 23, 1900

Made the ice.

September 26, 1900

NE gale, scattered ice. (71.35N 168.15W)

September 29, 1900

1 whale

September 30, 1900

1 whale, hauled along side, too rugged to cut.

Excerpts from Log Book, Bark Belvedere, 1897, 1898

April 27, 1897

Fresh NE winds, made fast to the Ice in company with Beluga.
Lat. 60.45 Long.

April 28, 1897

Strong N winds, went 5 miles N made fast to Ice again at 6 PM. Ice opened went N again at 8 PM. Made fast to Ice.
Lat. 61.02 Long 177.49

April 29, 1897

Blowing from N with fine snow fast to the Ice, shifted several times.

May 5, 1897

Moderate NE steering off along the Ice to S Amchinskey Cape at 12 - bearing W, distance 25 miles. At 7 PM took in sail, steamed to SE into the Ice.

May 6, 1897

Fresh NE winds, fog lying amongst scattering Ice, plenty seal around, some feed.

May 7, 1897

Light N winds, working NNE through strings of Ice. Fog most of the time.
Lat. 61'30

May 1897

Light NE, all pm working to NE by large flows [floes] fo Ice. At 8 PM Ice closed, stopped for the night.

May 14, 1897

Light S winds at 7 AM. Ice slacked at 6 PM tied up to the Ice.

May 15, 1897

Blowing SW gale, weather clear, Ice very close, not much mwater. Ship fast to large flow [floe].

May 16, 1897

Strong NW winds. Am fast to the Ice at 2PM. Ice slacked some, working to NE.

May 17, 1897

Light NE winds. Am working ENE at 11 AM. Ice closed up some, made fast to large floe
Lat. 63'02. Long. 175'55

May 18, 1897

Light airs in AM. Ice opened. Working to NE. AT 2 PM. saw the land to N.

May 19, 1897

Light air from SE. At 2 PM got out of the Ice about 20 miles S of Plover Bay. At 5 anchored in Plover Bay.

May 22, 1897

Light air, steaming along the land to E. At 12 off Plover Bay. PM steering over towards St. Lawrence Island. Ice in the middle of Straits. Made sail heading towards Indian Point.

May 23, 1897

Light NE winds, went towards Indian POint. 9 AM hauled by the wind to SE. At 12 went into the Ice working towards St. Lawrence Island. At 5 PM gale, thick with snow, fast tothe Ice all night.

May 24, 1897

Gale from NE. At 7 AM cleared up some, worked out of the Ice. At 12 anchored at the sand spit at St. Lawrence Island.

May 26, 1897

Blowing from NE, cruising. Saw Devil fish. [Gray whales called that]

May 27, 1897

Blowing from the N, thick weather. At 2 PM made fast to the ground Ice of the sand spit of St. Lawrence Island.

May 28, 1897

Thick fog, wind NE, lying fast to the Ice.

May 29, 1897

Lying at St. Lawrence Island in AM.

May 31, 1897

Am strong NW winds, working up the Straits.

June 1, 1897

Light S winds. At 6 AM made fast to the Ice at N Head, at 7 left for Domedes. At 7 PM made fast to the Ice N of the Diomedes.

June 2, 1897

Light S winds. At 7 AM let go from the Ice. Went over towards East Cape. Lowered for a whale, came in fog. Got one.

June 4, 1897

At 6 PM tied up to ground ice N of Diomede.

June 7, 1897

Light S winds, fast to the Ice S of Big Diomede.

June 12, 1897

Light NW winds, steering along the land. Fine, clear weather, some ice off shore.

June 13, 1897

Went through 10 miles of scattering Ice. At 7 off John Howland Bay (Siberia).

July 25, 1897

Calm in AM at 2:30 took anchor S off Lisborne scattering Ice. PM 2:30 working toward land through scattering ice.

July 26, 1897

AM blowing strong from SW at 7 tied up to Piece of ground Ice, strong N current.

July 27, 1897

Variable winds fast to ground Ice about 8 miles N of Pt. Lay. Current running S.

July 29, 1897

Moderate SW winds cloudy, 5 AM let go from the Ice 10 got into clear water outside of shore Ice 12 off Blossom shoals.

August 1, 1897

Blowing from SW fast to ground Ice, weather thick.

August 3, 1897

steering along the Ice to N, at 4:30 PM anchored off Wainwright.

August 4, 1897

NE winds, ice went off shore some anchored about 10 miles N of Pt Belcher, saw Navarch fast in the ice about 10 miles off shore.

August 5, 1897

NE winds thick at 11 AM let go from the Ice. 6 PM in Pearl Bay whole fleet in Company.

August 6, 1897

Light SW winds, at 6 AM went through the Ground Ice off Refuge Inlet -- started E at 5 passed Pt. Barrow shaped course ENE Ice about 10 miles off-shore.

August 7, 1897

At 1 PM off Thetis Island, some scattering ice, at 8 PM passed Cross Island.

August 10, 1897

5 PM anchored in Herschel Island.

August 11, 1897

Started to E, 12 came up to heavy ice turned back made fast to ground Ice in 11 fathoms, at 11 anchored at the Island.

August 14, 1897

Strong S winds, working along the Ice to SW.

August 17, 1897

Blowing W gale with rain. At 4:30 AM anchored at Island. 7 took anchor steered to E some scattering of Ice. 3 PM saw Elice Island.

August 21, 1897

AM strong NW winds with rain. PM at 5 light E winds, took anchor steaming to W, some scattering Ice.

August 24, 1897

9 AM off Flaxman Island

August 25, 1897

At 6 PM anchored off Halkett.

August 27, 1897

Strong W winds with snow squalls. Ice about 1 mile off shore.

August 29, 1897

W winds fine clear weather lying at anchor took anchor several times to clear ice.

August 30, 1897

Light S winds in AM at 6 took anchor steaming W 12 miles off Pitt point. 2 PM thick fog, wind W, made fast to ground ice 6 fathoms. 4 - let go, went in shore 4 fathoms off Drew point.

August 31, 1897

Light W winds and calm. Waiting for the ice to go off hard onto the land. PM light breeze from NE sonw squalls all ships fast to ground ice.

September 1, 1897

Blowing NE gale, snow squalls, fast to ground ice. Ice slacking up some to W.

September 2, 1897

Blowing NE Gale, 6 AM took anchor went to about 8 or 10 miles made fast to ground Ice again. Cape Simpson bearing W dist 15 miles.

September 5, 1897

Calm in morning. 8 fres W winds. 5 AM let go from the Ice started W at 1 PM, anchored about 10 miles from Pt. Barrow in 3 fathoms.

September 6, 1897

Strong WSW winds, Ice went off shore some 7 took anchor went up to Pt. Barrow. 12 M bloing a gale, Ice coming in fast, 5 took anchor went in shore some.

September 7, 1897

Calm. Ice onto the point (Barrow)

September 8, 1897

NW winds light, at anchor, ice on the point.

September 9, 1897

Light NW winds lying at Anchor Ice both sides of the point -- in shore pack 1 mile off.

September 10, 1897

Strong NNE winds. Ice still on the point--pack 1/2 mile off shore.

September 11, 1897

Light NNE lying at anchor. Ice making fast.

September 12, 1897

Light NNE at anchor. Ice making some.

September 13, 1897

Light SW winds -- at anchor. Ice hard on the point.

September 14, 1897

Ice still on the point - scattering.

September 15, 1897

NE winds light. 11 AM too anchor, tried to get through the Ice of shore, could not - anchored S of the point.

September 17, 1897

Strong NNE winds with fine snow, at 1 took anchor tryed to bust out into clear water, could not, anchored under the point, S side.

September 18, 1897

Light NNE winds. 7 AM calm, took anchor. Started to break out of the Ice. Orca in the lead, Freeman in the rear, all hands of all ships out on the edge cutting and blasting, at 8:30 PM within about 200 yeards of the water.

September 19, 1897

Light W winds, at 6 PM finished blasting Ice. At 10 PM got out side of the Ice. Anchored of Cape Smith. Arca with Rudder gone, Belvedere badly sprang Used 800 lbs Powder in Blasting.

September 20, 1897

Light N winds, Ice making fast.

September 21, 1897

Let go from the Ice, started S through Young Ice. 7 PM off Pearl Bay.

September 22, 1897

Strong NW winds, at 6 AM 10 miles W of Sea Horse Islands. 6:30 Ice closed, smashing Orcas stern post and propelar.

September 23, 1897

Strong NE winds, at anchor. Ice onto the land.

September 24, 1897

NW winds, at anchor, pack hard on the land.

September 28, 1897

Light N wind. Went ahsore built a House on big Sea Horse, built out of staves and sails. Put Flour and Bread inside (Orca wrecked)

October 11, 1897

Light NE winds. Clear water 5 miles off. Ice 13 inches thick.

October 15, 1897

Mr. Tillon and 2 Natives with Sled and 8 Dogs started S bound to Sitka for relief and send letters.

October 18, 1897

Ice 15 inches thick.

October 21, 1897

Strong NE winds, plenty clear water ôff shore.

October 22, 1897

BLowing NE gale, snow drifting bad, clear water about 7 miles off shore 5 above.

November 5, 1897

12 below

November 8, 1897

SW winds light, water over the Ice in places. 4 above.

November 16, 1897

Strong SE winds, clear water about 6 miles off. 24 above.

November 24, 1897

Strong NE winds, 18 below. Ship frozen in and wintering - daily entries about weather and temperatures.

March 26, 1898

Lt. Jarvis & Dr. Call of Rev. Cutter Bear arrived with mail 3 months from Pt. Michelas (St.Michaels??)

April 22, 1898

9:30 PM ship broke out - came up 1 foot

May 18, 1898

Crew took a whale.

May 20, 1898

Hauled Bone andWhale Meat to Ship.

June 8, 1898

Ice all broke up.

July 3, 1898

Strong SW winds, ship still in 4 1/2 fths out - Ice out under Quarters, clear all around

July 4, 1898

Strong SW winds, got steam, worked ship of bed, go about 4 feet each way.

July 12, 1898

Ice gone way around ship, got steam, anchored in 3 1/2 fathoms off big sea Horse.

July 15, 1898

Ice breaking up and scattering.

July 17, 1898

Strong breeze from NE lying tied up to ground ice in 5 fathoms. Captain pumping fresh water from top of ice into barrels.

July 25, 1898

Cloudy, fresh NNE winds. Plenty open water to N. Ship still fast to ground ice.

July 27, 1898

Ice open everywhere.

July 28, 1898

Went offshore about 2 miles made fast again.

August 1, 1898

Strong SSW winds, at 10 am anchored off Cape Lisborne in 6 fathoms.

August 15, 1898

At anchor in Pearl Bay, Ice on the land.

August 25, 1898

Took anchor went around the Piont - steering to E in 6 to 8 fathoms. Ice about 10 miles of shore. Rest of ships at anchor at Pt. Barrow. 11 PM anchored about 10 miles W Pt. Tangent.

August 26, 1898

Light S winds, steering E along the Ice at 3PM turned back to W, wind E. 7 PM off Pitt Point, at 11 PM anchored in 7 fathoms, calm.

August 28, 1898

lying at anchor off Cape Smythe.

August 29, 1898

BLowing from NE thick. 5 PM cleared up some and moderated. Took anchor steering off WNW 10 PM came to the Ice, fog at times, steering along the Ice to W.

August 30, 1898

NE winds, fog in morning, 10 clear, steering to W along the Ice. Walrus in abundance around.

September 1, 1898

N winds at 9 AM, got steam sterring to NNW, no Ice, some scattering pieces.

September 2, 1898

Fresh NW winds steering to SW. Ice in sight to N, snow squalls.

September 6, 1898

Strong N winds, snow squalls, Ice scattering. 7 PM Herald Island WNW 20 miles.

September 15, 1898

Moderate N winds, steering along the Ice to Eastward.

September 16, 1898

Strong N winds. Sterring to E along the Ice.

September 17, 1898

Strong NNW winds, 7 am took in square sails steaming to NE along the Ice.

September 18, 1898

Lat. 71.13 Lon. 166.50

September 26, 1898

Lat. 69.05 Lon. 173.40

September 28, 1898

Light N winds, up to the Ice. Steamed to NW, some young ice making.

September 29, 1898

Steamed WSW along the Ice, plenty young ice.

October 2, 1898

Light SW winds. Got small calf, no bone. Lat. 71.06 Lon. 172.26W

October 14, 1898

Lat. 68.54 Lon. 170.30

October 15, 1898

Lat. 68.05 Lon. 170.25

October 17, 1898

Steaming S by W, 4:30 PM off sand spit, St. Lawrence Island.

October 27, 1898

Lat. 49.05
Lon. 162.25

Cruise of the Steamer Alexander - 1901

<u>May 8, 1901</u>

Ship working through the ice. St. George and St. Paul in sight, plenty of ice all over the Ocean.

<u>May 10, 1901</u>

Light wind from the N.E. by compass ship working through the ice to the N.W. plenty ice all over the Ocean.

<u>May 11, 1901</u>

Light wind from the N.E. by compass ship fast in the ice working through the ice when we can get a chance.

<u>May 12, 1901</u>

Ship fast in the ice in Lat. 57-25 N and Long. 175-10 W

<u>May 13, 1901</u>

Blowing from the N.E., ship fast in the ice made a small fun this Afternoon.

<u>May 14, 1901</u>

Strong wind from the N. Ship fast in the ice

<u>May 15, 1901</u>

Light from the N.W. to W by compass, Ship fast in the ice

<u>May 17, 1901</u>

Blowing from E.S.E. to S.S.E. by compass ship fast in the ice

<u>May 18, 1901</u>

Strong wind from the S.E. Ship fast in the ice.

<u>May 23, 1901</u>

Ship's been fast in the ice since 18th

<u>May 25, 1901</u>

Light wind from the S.W. to S.E. Ship fast in the ice no Chance to get a long. Lat. 58-46 N, Long. 175-31 W. We have com through 376 Miles of ice and still St. Mathues is 132 Miles off and Cape Navarin in 263 Miles dist.

May 26, 1901

Blowing Half A Gale from the W. by Compass Ship fast in the ice can't get along

May 26, 1901

Blowing from the Westward Ship fast in the ice

May 28, 1901

Light Wind from the WNW. Ship fast in the ice can't get a long

May 29, 1901

ditto

May 31, 1901

Light winds from the N.W. to N.E. Ship under steam came up to another patch of ice.
Lat. 61-35N Long. 176-46W at 5-31 p.m.

June 1, 1901

Came through one patch of ice. RAised the land at 9 a.m. Plouver Bay.
Lat 63-5N Long 174-49W

June 3, 1901

Ship working across the Staits from the Diemeds island some scatering ice around

June 6, 1901

Ship made fast to the flow ice

June 7, 1901

ditto

June 27, 1901

Blowing half A Gale from the N Ship working up the Straits. Light Rain.
During the day some scatering of ice in sight.

June 28, 1901

Ship Anchord in Port Clarence at the sand spit plenty ice in the Bay

July 3, 1901

Wind from the S. to N.W. Ship at Anchor in Port Clarence at TEll a mining town. Plenty ice in the bay.

July 4, 1901

Blowing Half a Gale from the W. to N.W. Ship at anchor in Port Clarence Last Night the ice came down on us and we lost one Anchor

July 29, 1901

Ship anchored at Point Hope. So scaterin ice along the land

July 31, 1901

Steam bound up the coast course N.E. Some ice in sight

August 1, 1901

Ship bound East of Point Barrow the pack ice is handy can't get through the ice East of Point Barrow

August 2, 1901

Calm weather Ship at Anchor at Point Barrow the ice in on to the land and we can't get past

August 3, 1901

Light wind from the S.E. to W. Ship at Anchor at Point Barrow the Pack ice is close in

August 5, 1901

Light S. and S.E. winds with plenty scatering ice around ship of Cross island working East along the Coast

August 6, 1901

Light wind from the N.E. and calm. Ship working East along the Coast plenty ice around

August 7, 1901

Blowing quite Strong from the N.E. Ship working along the Coast plenty of ice around Herschall isl in sight

August 9, 1901

Ship bound N.E. Plenty scatering ice

August 10, 1901

Light winds from the W.S.W. to N.E. with thick fog plenty ice around ship working East

August 11, 1901

Strong wind from the N.W. to N.N.E. with Rain ship off McKinley Bay plenty scatering ice

August 12, 1901

ditto

August 13, 1901

Blowing from the S.E. to S.W. with fog. Ship tied up to the ice geting water about 60 bàrrels

August 14, 1901

Ship working west plenty ice

August 15, 1901

Strong and Light winds from the N.W. to S.W. Ship at Anchor at Herschall Island. Planety heavy ice around

August 17, 1901

Ship Bound west. Plenty ice around

August 20, 1901

Strong wind from the N.E., clear weather plenty ice around, Ship working west.

August 21, 1901

Light wind from the N.E. to S.S.W. Ship sailing West along the Coast Plenty ice around

August 22, 1901

Strong wind from the N.N.W. to N.E. Ship working West. Come scatering ice around

August 23, 1901

Strong wind from the N.E. to E. Ship bound west along the coast No ice from Harrison Bay west in or off shore

August 26, 1901

Blowing from the N.E. to N with light snow squalls. Ship going West along the ice.

August 27, 1901

Blowing Hlaf a Gale from the N.N.E. to N. with show. Ship bound west along the ice.

August 30, 1901

Herald Island in sight.

August 31, 1901

ditto

September 3, 1901 - off map

Calm weather with fog some ice in sight - same through the 7th

September 9, 1901

Strong wind from the N.N.E. with light snow squals ship working west along the ice.

September 10, 1901

Blowing from the N. Ship by the wind working west. No ice.

September 11, 1901

Blowing A Gale from the N.N.E. Ship under short sail plenty scatering ice all over the Ocean

September 12, 1901

Blowing half A Gale from the N.E. Ship on the wind plenty ice in sight,

September 13, 1901

Blowing A Gale from the N.E. some ice in sight

September 14, 1901

Ship along the ice, raised whales, Lowered the Boats Chased untill dark with success plenty ice around

September 15, 1901

Ship along the ice

September 16, 1901

Some ice in sight

September 17, 1901

Strong and Light winds from the E.S.E. to S.S.E. Ship cruising along the ice

September 18, 1901

Light winds S.S.E. to E.N.E. with fog. Ship around the ice, plenty ice in sight.

September 20, 1901

Strong wind from the N.E. to E.N.E. with snow squalls, plenty ice around. Raised Whales at 7-45 a.m. and Lowered the Waste Boat got fast finished cutting at 1-20 p.m.

September 21, 1901

Strong wind from the N.E. to E.N.E. with snow squalls plenty ice around

September 22, 1901

Light wind from the E. Ship cruising plenty ice in sight

September 23, 1901

Blowing from the E.S.E. to E.N.E., fog. Plenty ice in sight.

September 24, 1901

Strong wind from the E.N.E. to E.S.E. with fog. Ship around the scatering ice.

October 2, 1901

Blowing from the W. to S.W. Raised whales at 9 a.m. Lowered took Chase STarboard Boat got fast Finished Cutting.

October 11, 1901

Blowing half a Gale from the N.E. to N.W. with thick snow storms. Shaped the course for Prince of Wahles. Anchored at the Cape to put some Natives ashore

Cruise of the Steamer Alexander, Voyage to the Arctic Ocean - 1902

April 28, 1902

In Bearing Sea out of Unalaska. Raised the ice.

May 2, 1902

Blowing from the S.S.E. Ship on the wind heading East. No ice
Lat 59-00N Long 168-12W

May 6, 1902

Light wind from the N.E., took the ice at 7 a.m. got out of the ice at 2-45 p.m. Lat 60-43N, Long. 167-55 W

May 7, 1902

Light wind from the N.E.NE. to N. Ship fast in the ice took the ice at 6 a.m. Lat 61-45N, Long 169.39W
ditto until May 11

May 12, 1902

Ice all over the Ocean

May 13, 1902

Blowing Half a Gale from the N.N.E. to N.W. Ship fast to the ice
Lat 61.59N, Long. 170.32W

May 16, 1902

Blowing A Gale from the N.E. to N.N.W. Got through the ice at 9 last night. Raised the Land and Anchord at 6 a.m. Thick snow around the Land. S.E. Cape of St. Lawrence Island

May 17, 1902

Ship left St. Lawrence island at 7.20 for the North. Plenty ice in the Straits.

May 18, 1902

Ship working up the Straits plenty ice in the Straits

May 19, 1902

Blowin from the N. with light snow. Ship working up the STraits under sail. Raised whales at 5 a.m. and took Chase. Sarboard boat got fast took him alongside and cut him.

May 20, 1902

Light winds from the N with Snow, plenty ice.

May 21, 1902

Light and Blowing from the N.E. Ship Cruising in the Straits

May 22, 1902

Plenty ice around

May 23, 1902

Ship at Anchor at St. Lawrence Island. Plenty ice around

May 26, 1902

Light wind from the E.S.E. Plenty ice around. Raised a shale at 8:45. Lowered and starboard got fast a bad whale stove the boat bad finished cutting at 2 p.m.

May 27, 1902

Calm weather, Ship steaming along the ice to the westward across the Straits

May 28, 1902

Ship along the ice

May 29, 1902

Calm weather East Diemeads Prince of Wahles and St. Lawrence Bay in sight. Plenty ice in the Straits.

June 1, 1902

Ship cruising in the Straits. Plenty ice in sight.

June 2, 1902

ditto

June 3, 1902

ditto

June 4, 1902

ditto

June 5, 1902

Raised a whale Lowered took Chase Waste boat got fast took along side and cut him in, plenty ice in sight.

June 6, 1902

Ship crusing in the Straits Chased whales the starboard Boat got fast took him along side and cut him in.

June 7, 1902

Cruising in Straints, plenty ice in sight.

June 9, 1902

Calm and light wind from the N.W. Ship under steam working North along the ice in the Arctic Stoped steaming about 50 miles to the N.N.W. of East Cape

June 10, 1902

Light wind from the N.W. to S.W. with fog. Ship bound South got down to East Cape and found the Straits full of ice. Started steaming to the South for the Diemeads Island.

June 11, 1902

Blowing from the S.W. with thick fog. Ship fast to the flaw ice at the Diemeads.

June 12, 1902

ditto

June 13, 1902

ditto

June 14, 1902

Blowing from the S.S.W. to S.S.E. with fog. Ship crusing the west side of the straits is half full of ice.

June 18, 1902

Calm weather Ship steamed across to Cape York plenty ice along the shore

June 19, 1902

Light wind from the S.E. Ship crusing in the Straits. Plenty ice around.

June 20, 1902

ditto

June 21, 1902

ditto

June 22, 1902

ditto

June 23, 1902

Light wind from the S.E. with thick fog. Plenty ice around ship at anchor in the Straits.

June 24, 1902

Ship cruising in the Straits, plenty ice around

June 25, 1902

ditto

June 26, 1902

ditto

July 16, 1902

Strong wind from the N.W. with fog and rain. Ship anchored at Point Hope. Some ice around.

July 19, 1902

Calm weather with fog. Ship under steam working North found the ice lose to Point Lay

July 20, 1902

Ship along the ice off shore of Icy Cape. Plenty ice can't get into the Land.

July 21, 1902

Light wind from the S.E. to N.N.E. Ship working through the ice along the Land to the North. Plenty ice around. Passed Icy Cape at 3:20 p.m.

July 22, 1902

Light wind from the N.E. to W around to the South with fog and Rain. Ship fast to the ground ice in 4 fathoms water about 5 miles South of Point Belcher.

July 23, 1902

Rain and fog. Ocean covered with ice. Ship anchored to the N.E. of Point Franklin in 4 fathoms of water.

July 24, 1902

Ship anchored off Point Franklin Ocean covered with ice, no chance to get north.

July 25, 1902

Ship Anchored in Pearl Bay, the Ocean covered with ice.

July 26, 1902

Strong wind from the N. to N.E. Ship Anchored at Cape Smith. Plenty ice off shore.

July 27, 1902

ditto

July 28, 1902

ditto

July 29, 1902

ditto

July 30, 1902

ditto

July 31, 1902

Ship at Anchor at Point Barrow

August 1, 1902

Ship bound East, scatering ice around. Ship off Harrison Bay in 10 fathoms water

August 2, 1902

Light wind from the N.W. to W. Plenty ice out side the Reef we got through the Reef and did not know it untill the fog cleared away saw 7 ships out side the Reef working East.

August 3, 1902

Light wind from the N.W. with fog got out of the Lagoon at 1 p.m. and started East plenty ice around the Reefs, ship in Camden Bay at 7 p.m.

August 4, 1902

Light wind from the N.E. Got into Herschael Island at 11 a.m. Left the Island at 5 p.m. bound East. No ice in sight.

August 5, 1902

Ship working along the coast to Cape Bathurst some ice

August 6, 1902

Strong wind from the N to N.N.E. At 9.20 a.m. bound fro Banks Land. Raised the Land at 6.20 p.m. No ice in sight.

August 7, 1902

Light wind from the N.N.W. to N.N.W. Ship about 10 miles from Banks Land. Raised whales at 1.15 a.m. and took Chase the Port Bow Boat got fast took him along side

August 9, 1902

Along the Land, no Ice in sight.

August 10, 1902

Ship cruising along the Land. Past Cape Kellett as far as Cape Worth. Shot 3 Bear in the water.

August 11, 1902

Strong wind from the E.N.E. to N.N.E. Ship off Nelson Head Banks Land. Karluk took 1 whale. Some scatering ice around.

August 12, 1902

Strong wind from the E. to N.N.E. Ship crusing off shore of BAnks Land. Cape Perry in sight. Raised whales at 12.15 a.m., got 2.

August 13, 1902

Ship bound across to Cape Perry. Last night saw the Karluk get 1 whale.

August 14, 1902

Crusing off Darnly Bay. Got 1 whale.

August 15, 1902
Lat. 70.30 W. Long. 126.06 W

August 16, 1902

Calm weather. Ship East of Cape Perry in Darnly Bay, worked out of Perry.

August 18, 1902

Blowing from E.N.E. to N.N.E. Ship off Cape Lambert, Banks Land. Some small ice off the Cape.

August 19, 1902

Got 1 whale.

August 24, 1902

Ship off the East side of Banks Land. Got 1 Whale.

August 25, 1902

Light and Strong wind from the W.N.W. to N. Ship along the ice on the East side of Banks Land.

August 26, 1902

Ship on the East side of Banks Land. Got 3 whales.

August 27, 1902

Light wind from the N.E. to S.E. with rain. Ship crusing off De Salis Bay, Banks Land, some ice in the BAy.

August 29, 1902

Ship off Cape Perry. Took 1 Whale.

August 30, 1902

Ship off Horton River. Got 1 Whale.

August 31, 1902

Ship off Smoking Mountain, Franklin Bay.

September 1, 1902

Ship off Bailey Island

September 2, 1902

Ship off Baylie Island. Took 1 whale.

September 3, 1902

Ship off Cape Brown

September 4, 1902

ditto

September 6, 1902

Ship off shore of Gerry Island.

September 7, 1902

Ship cruising off the River Key Point and Herschael Island in sight.

September 9, 1902

Ship Brond down the coast Past Flaxman Island

September 10, 1902

Passed some scatering ice at Point Tangent. Raised Point Barrow at 7 p.m. 44 hours from Herschael Island to Cape Smith.

September 11, 1902

Ship bound west. Came up to the ice at 12 a.m.

September 12, 1902

Ship run along the Ice all day

September 13, 1902

Ship working alont the Ice to the westward

September 14, 1902

ditto

September 15, 1902

ditto

September 16, 1902

Saw the Beluga take a whale.

September 17, 1902

Saw the Thrasher get a whale

September 19, 1902

Saw the Thrasher take 1 whale

September 20, 1902

Some young ice around

September 21, 1902

Plenty young ice around. Took 1 whale

September 24 & 25, 1902

Some scatering Ice in sight.

September 29, 1902

Herald Island in sight

September 30, 1902

ditto

October 5, 1902

Herald Island and Rangle (Wrangell) Isalnd in sight

October 8, 1902

Anchored at Pt. Hope.

Cruise of the Steamer Alexander to the Arctic Ocean in 1903

<u>April 29, 1903</u>

Ship about 8 miles of shore of Nunivak Isalnd in among scatering ice.

<u>April 30, 1903</u>

Ship working through the ice to the North of Nunivak.

<u>May 1, 1903</u>

Ship working through the ice to the North Cape Ramanzof lays S.E. from us.

<u>May 2, 1903</u> - off map

Ship working through ice North of Cape Romazof

<u>May 3, 1903</u> - off map

ditto
Lat. 62.00N Long. 167.21W

<u>May 4, 1903</u> - off map

Ship fast to the ice. We made about 7 miles through the ice to the West. Got one seal. Lat 61.56N Long. 168.18 W

<u>May 5, 1903</u>

Ship working through the ice towards St. Lawrence Island. Raised St. Lawrence Island at 5.30 p.m.

<u>May 6, 1903</u>

Ship working to the E. and N. Plenty ice this Spring.
Lat. 62.12N Long. 167.52W

<u>May 7, 1903</u>

Ship steaming to the North in clear water cross Norton Sound

<u>May 8, 1903</u>

Ship working the ice to the N and N.E. and back to the South.
Lat. 63.28N

<u>May 9, 1903</u>

Ship working west through the ice. Plenty ice around.
Lat 62.37N

<u>May 10, 1903</u>

Plenty scatering ice around ship. Working through the ice to the N.W. RAised St. Lawrence Island at 2.15 p.m. got through the ice 3 p.m.

May 11, 1903

Ship working up the Straits. Plenty ice in Large patches.

May 12, 1903

Plenty ice. Ship cruising in Straits.

May 13, 1903

Plenty ice. Ship cruising in Straits.

May 14, 1903

Plenty ice. Ship cruising in Straits.

May 15, 1903

Blowing from the N.N.W. Ship cruising in the Straits. Ship off St. Lawrence Bay. Strat full of young ice. Saw 2 Devil fish.

May 16, 1903

In Straits. The ice is going North fast

May 17, 1903

In Straits, plenty of ice. St. Lawrence Bay about 15 miles N.N.W.

May 18, 1903

Offshore of St. Lawrence Bay about 15 miles. The Strait full of ice we cant get any further North.

May 19, 1903

Crusing in the Straits. East Cape and Diomeads Island in sight. Got one seal.

May 20, 1903

Strong wind from N.N.E. In Straits. Plenty ice acorss the Straits from East Cape to Prince of Whales. Plenty white fish around.

May 21, 1903

Plenty ice in Straits.

May 22, 1903

In Straits. East Cape, Diomede Island, Prince of Whales and St. Lawrence Bay are all in sight. Plenty ice in sight.

May 23, 1903

In Straits. Plenty ice.

May 24, 1903

In Straits South of the Diamede Island. Took one shale.

May 25, 1903

Strong and light wind from the N.N.W. to N. Plenty ice, the Straits are choaked with ice cant get into the Arctic

May 28, 1903

In Straits. The ice between Diamede Island and East Cape has brok through this morning.

May 29, 1903

In Straits. East Cape in sight. The ice is agoing North fast. The Straits are open now.

May 30, 1903

In the Straits. Saw several Devis fish. Jeanette got 1 whale.

May 31, 1903

Plenty ice. Took 1 whale.

June 1, 1903

In Straits. Plenty scatering ice.

June 2, 1903

Some scatering ice around

June 6, 1903

In Straits, plenty ice around.

June 7, 1903

In Straits, with plenty scatering ice.

June 8, 1903

In Straits, crusing from East Cape to Fairway Rock. Plenty ice on the East side of the Straits.

June 9, 1903

Plenty ice on the Eastside of the Straits between Diomede Island and Cape Prince of Whales.

June 10, 1903

In Straits. Some scatering ice in sight.

June 11, 1903

ditto. Plenty ice between Prince of Whales and Diomede Island.

June 12, 1903

Ship tied up to the ice at the small Diomede Island. Plenty ice going through the East side of teh Straits--also on 14th.

June 15, 1903

Went across Straits. Some scatering ice. Also on 16th.

June 18, 1903

Some scatering ice going through the Straits.

June 19, 1903

Some scatering ice between Diomede and Prince of Whales

June 20, 1903

Plenty ice in Straits

June 22, 1903

Some scatering ice around

June 23, 1903

Some ice in the Straits

June 25, 1903

Ship Bound to Cape Noam plenty ice in the Straits.

June 28, 1903

Anchored S of Cape Prince of Whales about 10 miles. Plenty scatering ice along the Land going North.

June 30, 1903

Cant get into Port Clarence too much ice.

July 2, 1903

Ship tied up to the ice off Capt York. Plenty ice around.

July 3, 1903

Ship at anchor at Cape York. Plenty ice along the shore, cant get into Port Clarence.

July 4, 1903

ditto

July 5, 1903

Ship at Anchor at Teller, Port Clarence. Finally worked through ice.

July 23, 1903

Ship at Anchor at Point Hope. No ice around here this year.

July 24, 1903

Bound North out of Cape Lisborn (where there was a coal mine) again some scatering ice around.

July 25, 1903

Ship fast to the ground ice between Port Lay and Icy Cape. Some scatering ice along the shore. The pack is about 6 miles off shore

July 26, 1903

The pack has gone off some today.

July 27, 1903

Ship anchored off Icy Cape. Cant get any further North. The Pack is about 5 miles from the land.

July 28, 1903

Anchored off Icy Cape. Plenty ice on the shole can't get around to the North.

July 29, 1903

Made a few miles up the coast in the fog, plenty ice around.

July 30, 1903

Light wind fro the N.N.W. to N.E. by N. with fog. The pack ice makes in to the land and we cant get North.

August 1, 1903

Light wind from the S.W. with fog. Plenty scatering ice around. Pack about 4 miles off shore. Ship anchored at Wenright (Wainwright) Inlet.

August 3, 1903

Blowing from the E.N.E. to S.S.E. with rain squalls. Ship fast to the ground ice off shore from Wenright Inlet in 6 fathoms of water.

August 4, 1903

Calm weather with light rain. Ship tied up to the ice above Wenright Inlet in 7 fathoms water.

August 5, 1903

ditto - tied to ground ice

August 5, 1903

Calm weather with Light wind from the N and thick fog. Ship fast to the ground ice about Wenright Inlet. Cant go North.

August 6, 1903

Light wind from the S. to W. by S. with fog and rain. Ship fast to the ice at the South side of seahorse Islands. Plenty ice around here this year.

August 7, 1903

Light wind from the S.W. to N.E. Ship fast to the ice at Sea horse Islands. The Pack is close in.

August 8, 1903

Strong wind fro the N to N.E. by E. Ship at Anchor above Woody Inlet The pack is not very far off.

August 9, 1903

Strong wind from the N. to N.E. Got under way at 6 a.m. started up the coast, got to Anchor at Cape Smith at 9.30 a.m. Ship fast to the ice North of Point Barrow, ground ice, at end of day.

August 10, 1903

Blowing from the N.E. Ship bound East got under way at 3 a.m. Passed Point Pitt at 1 p.m. Capt Halket abeem at 7 p.m. Ship working ice all day. We had to work ice in 425 fathoms of water.

August 11, 1903

Blowing from the E.N.E. to N.N.E. Ship bound East crossed Harrison Bay in the morning got up to Cross Island at 6.30 p.m. We run ashore between the Land and ground ice in 2 fathoms of water at 9.20 She came off went in 5 fathoms of water and made fast to the ground ice.

August 12, 1903

Blowing from the N.E. Ship fast to the ice at Cross Island. We made a short run down to the Midway Islands this morning. Came back in the afternoon. The ship can't get East of the Cross, too much ground ice in shore and the pack is hard on.

August 13, 1903

ditto

August 14, 1903

Ship fast to the ground ice of Tons Reef.

August 15, 1903

Strong wind from the N.E. with fog and Rain all day. Ship working East. At 6 p.m. Manning Point was abeem. Some scatering ice. Along the Land ground ice.

August 16, 1903

Ship bound east. Raised Herschael Island at 6.30 a.m. Got into an Anchor at 9.20 a.m.

August 17, 1903

Light wind from the N. to N.E. with fog. Ship bound up the Coast. Geary Island in sight at 2 a.m. Came up to ice at 9 p.m. 4 hours after leaving Herschael Island and worked ice to Toker Point which was abeam at 6 p.m.

August 18, 1903

Ship steamed to the Eastward along the ice, passed Cape Brown at 7 p.m. in 8 fathoms water, the ice is well off shore.

August 19, 1903

Blowing from the N.E. Ship at Anchor at Bailey Island. Waiting for the ice to go off. Plenty ice around close in shore.

August 20, 1903

Strong wind from the N.E. Good weather, took Anchor at 4.30 a.m. sail and steam for Banks Land through scatering ice. At noon came to the pack, then we worked along the ice to the Eastward towards Cape Perry. Plenty ice around here this year.

August 21, 1903

Ship 20 miles from Banks Land to the S.W. Took 3 whales and struck another but let him go because he was too small.

August 22, 1903

Ship cruising off Banks Land. Plenty ice around. Narwhale took 1 whale.

August 23, 1903

ditto

August 24, 1903

Calm weather. Ship under steam. Course N. by W. Stopped steaming at 7 p.m. off DeSalis Bay. Light wind from the N. Some small scatering ice around.

August 25, 1903

Ship cruising off DeSalis Bay, Banks Land first part. Second part ship running course S.E. by E. Plenty seals around

August 28, 1903

Off Nelson Head, Banks Land. Took one whale.

August 30, 1903

At Bailey Island, at N.W. end of the island, anchored. The pack ice is about 4 miles off shore.

August 31, 1903

Blowing Half a Gale from the N.W. to W. with snow squalls. Ship at anchor inside the S.W. sand spit. The ice is close inot the Land.

September 1, 1903

Blowing from the W.N.W. to W. with snow squalls during the night. Ship at anchor at the S,W, Land spit of Bailey Island. Plenty scatering ice off the East end of the sand spit. One Native boat came down from Bathurst.

September 2, 1903

Ship across Liverpool Bay, Cape Brown in sight at 11 a.m. At 7 p.m. Toker Point abeam. Ship working ice all the way.

September 3, 1903

Light wind from the S.W. to N.N.W. Ship running along the Islands to the West. Pelly Island in sight at 5 a.m. Came to the pack at 7.30 a.m. Had to go down to King Point in order to get around the ice to Herschael Island, got into the Island to an Anchor at 7 p.m. Plenty ice in sight.

September 4, 1903

Left Herschael Island, to west, Icy Reef at 1 p.m. Scatering ice all the way.

September 5, 1903

Ship working west, Barter Island in sight at 7 p.m. Followed the ice off shore in 17 fathoms of water, came to the pack, had to come back in shore. Anchored off Lions Reef. We went along West out side the Reef, the ice close in on to the Islands.

September 6, 1903

Strong wind from the N.N.E. with snow squalls. Ship bound west along the Coast. Passed Cross Island at 10 a.m. Plenty ground ice along the Reef. Scatering ice all along the Coast

September 7, 1903

Blowing from the N.N.E. to N.E. with snow squalls. Ship working along the Coast west. Tied up to a cake of ice last night off Pacific Shole. Raised Point Barrow at 1 p.m. Plenty scatering ice along the coast.

September 12, 1903

Ship working along the ice to the N.W. Some scatering ice off from the pack. Lat. 71.44N Long. 167.37W

September 14 & 15, 1903

Ship cruising along the ice East and West. Saw some white fish. (Beluga?)

September 16, 1903

Ship under steam bound west, course S.W. by S. Saw plenty of young ice.

September 17, 1903

Ship working west, raised Rangel Island (Wrangell) at 5 p.m. about 40 miles off port.

September 18, 1903

Ship about 20 miles East of Herald Island

September 20, 1903

Ship cruising along the ice in about Long. 167.40W and Lat. 71.50N Took one shale.

September 22, 1903

Cruising along the ice East & West. Plenty walrus on the ice and in the water.

September 23, 1903

Cruising East and West along the ice Plenty walrus around, shot and killed one.

September 24, 1903

Ship cruising along the ice to the East.

September 25, 1903

Ship crusing along ice to West. Plenty walrus in sight.

September 26, 1903

Light wind from the N.E. to E. Ship working west along the ice. The Ocean is covered with young ice. At 7 p.m. we got one POlar Bear in Lat. 73.03N Long. 167W.

October 1, 1903

Ship cruising along the ice. Plenty young ice in the water, mush ice.

October 5 1903

Herald Island about 20 miles off bearing West. - off map

October 9, 1903

Light wind from the E. to E.S.E. Ship up to the ice, young ice, no pack in sight. Saw walrus and white fish. Lat 71.58N Long. 166.22W.

Log Book *Thetis* 1906 - 1907

June 18

Moderate breeze W & S to WSW, overcast and misty, field of drift ice, took in patent log because of ice, Steering various courses thru ice. 62.25° by 171°.55

June 20

N. end of Sledge Is. North 4 1/2 miles distant, Mod. breeze, rain and fog, steered various course thru ice pack.

Log Book of Thetis July 1, 1907 - December 31, 1907

August 3, 1907

Gentle to moderate breeze, N to NE passed thru detached ice. Steaming thru ice
Lat 70.34
Long 161.05

August 4, 1907

School House, Wainwright - Ice drifting to S.
9:25 underway to shift anchorage clear of ice floe. Stopped along side of ice and made fast with ice anchors.

August 6, 1907

Icy Cape School House, entered field of drift ice.

August 7, 1907

Icy Cape School House, floating ice

August 8, 1907

Icy Cape School House, steaming thru ice to N. with Schooner "Volante" in tow. In attempting to turn the ship, failed to answer her helm quickly enough and struck a large cake of ice, stopping her headway. A disloged piece of which fouled the rudder and splintered the rudder head.

August 9, 1907

(70.33, 162.50)

Log Book Thetis January 1 to JUne 30, 1908 - A. J. Henderson, Captain

June 11, 1908

6 p.m. to 8 p.m. At 7:45 sighted first ice, Steering various courses following leads thru ice.
Lat 58.48
Long 170.26

June 12, 1908

Gentle N. breeze, thick and foggy, drift ice thick, Standing various courses to N. thru leads in ice, until 3:10 a.m., ice becoming heavy and leads fewer in number. Turn SW steering thru drift ice.

June 13, 1908

Mid to 4 a.m. Gentle breeze NNE to N foggy and misty, cold, encountered heavy ice
Merid to 4 p.m. Vessel following leads thru ice.
Lat 40.10
Long 169.41

June 14, 1908

4 a.m. Light N and NNW airs, clear, fine weather. Vessel stopped in ice and drifting S.
8 to Merid. Ice becoming more scattered
Merid to 4 p.m. Vessel standing thru ice making course thru leads in ice.

June 15, 1908

Merid to 4 p.m. Ice very thick and closely packed. Steaming thru smaller pieces then stopped as no leads could be seen
4 p.m. to 6 p.m. Vessel moved to ice case drifting in general N direction
6 to 8 p.m. Vessel stopped in ice. At 7:00 mod-fast to large case with ice anchors, drifting in general N direction

June 16, 1908

to 4 a.m. Vessel moved to ice cake drifting with it in gneral S direction
8 p.m. to 12 a.m. Cast off from ice cake and worked thru ice in general NW direction. Ice thick and leads narrow.

June 17, 1908

Cape Romanzof - Light northerly airs. Vessel pushing thru ice
6:45 stopped and made fast to heavy ice cake.
Lat 61.40
Long 167.30

June 18, 1908

Moved to ice cake, drifting in a northerly direction about 1 mile per hour. 3:50 cast off from ice cake and stood to S and W thru ice fields slow speed
Lat 61.40
Long 167.30

June 19, 1908

Steaming thru ice, slow speed to NW scattering ice.
Master of Am. Steamer "Ohio" stated that he had been within ten miles of Sledge Is. and found ice paced so that it was impossible for any vessel to get through.
Lat 62.15
Long 167.30

June 20, 1908

Clear and cold, fresh breeze N & W, ice drifting down from windward. Vessel working thru scattering ice and leads in ice.

June 21, 1908

Strong breeze NNW to NW & N, overcast, ice very much scattered.
Lat 63.08
Long 167.27

June 22, 1908

Scatter ice
4 a.m. to 8 ice becoming thick
Long 63.29
Long 167.23

June 24, 1908

Meet German Steamer "Eutin" of Hamberg, Officer came on board and conferred with C. O. Found she was under Charter to Russian Government bound for Vladivostok to Siberian Parts. Officer reported solid ice from St. Lawrence Island to Siberian mainland
6 p.m. to 8 p.m. 6:40 ice becoming heavy and packed slowed and turned.

June 26, 1908

Some scattered ice in sight
Lat 63.18
Long 167.16

June 28, 1908

7:00 a.m. entered ice. Following leads thru ice. 11:15 when ice becoming thicker and leads fewer, stopped and made fast to large ice cake with ice anchor. Vessel fast to ice cake and drifting to S.
Lat 63.39
Long 166.51

June 29, 1908

Working thru leads in ice. Ice moving to N.
Lat 63.22
Long 166.31

June 30, 1908

Light NNW breeze, half speed thru leads. 1:45 slow speed, ice becoming thicker, turned S. Vessel drifting in ice.
6 to 8 p.m. Some scattering of ice.

Log Book Thetis 1908 - A. J. Henderson, Capt.

July 1, 1908

Light breezes and airs NW & N to N overcast and hazy, Vessel fast to ice cake with ice anchor and drifting NE, "Corwin" also fast to ice.
Lat 63°18 N
Long 167°28 Off Map

July 2, 1908

Partly clear, hazy, light airs from N and NNW, cast off from ice cake, turned and stood SW following "Corwin" thru ice, half speed. Later, encoutering scattered ice. Running thru leads in ice.

July 4, 1908

Sledge Island, Light SE air, scattered ice on S. horizon - Off map

July 8, 1908

Gentle breeze W x N to NW x W
12 to 4 a.m. Partly cloudy, gentle sea, coming up to ice vessel under steam, slow speed, working in ice
4 to 8 a.m. Slow speed thru leads in ice. Ice scattering
Lat 63.52
Long 167.07 Off map

July 9, 1908

Ice scattering
Lat 63.18 N
Long 168.04 W Off Map

July 10, 1908

At 4:00 entered ice field. Making general NxE course until 5:45 when encountering heavy ice. Slow speed thru leads in ice. 6-8 p.m. ice scattered
Lat 63.18
Long 166.17 Off map

July 16, 1908

Center of Sledge Island. Stood SSE1/2E to clear ice.

August 5, 1908

Strong, N. wind; over cast and rainy, sighted ice field to westward. Half spped thru drift ice.
(8-12 midnight) At 8:50 stopped and made fast to ice. Master of Steamer Jeanette came on board and advised that he had been up in lead in the ice for a distance of 30 mi. to N. where ice pack joined the flow, making an impenetrable barrier which caused him to tuen back, as he was afraid of being crushed.
Lat 69°16
Long 165°28

August 7, 1908

(Mid to 4 a.m.) Vessel moored to ice. At 4 am ice closing in. Cast off and stood in shore. Ice moving to N. about 1 knot per hr. Clear moving ice cakes.

August 8, 1908

Ice pack about 1 mi. to N and E.
Lat 69.34
Long 163.27

August 10, 1908

Light airs and breezes E to ENE. Ice moving to N & W. Ice moving slowly off shore and scattering along edge of pack.

August 11, 1908

Moderate NEN to NE breeze. Over cast, thick and foggy. Steering various courses thru ice. At 2:00 coming up to heavy ice with no leads, hunted for birth alongside heavy packed ice. Ice moving in a SW direct. Following leads, south westerly course.
Lat 70.24
Long 162.10

August 12, 1908

(Mid to 4 am) Ice very much scattered. Ice becoming more closely packed. Vessel following leads in ice.
Lat 70.10
Long 162.13

August 13, 1908

(Schoolhouse, Icy Cape)
(Mid to 4 am) ground ice to which vessel was moored got adrift, made fast to another cake of ground ice. At 3:30 noticed drift ice moving about east.
Capt. Clingewberg came on board and advised CO that natives arrived from Pt. Barrow and reported heavy ice north of Blossom Shoals, with unbroken pack N. of Wainwright inlet.
Ice drifting about SW

August 14, 1908

(Mid to 4 am) Light breeze NNE to NE, overcast. Ice moving to SW.
(Merid to 4 pm) Ice across bow at end of watch
(6 to 8) Ice considerably scattered in immediate vicinity of vessel.
(8 to mid) Movement of ice inperspetible.

August 17, 1908

Light airs, SSW to S. Ice drifting ENE.
8 to merid, vessel following leads thru ice, under steam, SW course.
Ice scattered and drifting (Schoolhouse, Icy Cape)

August 18, 1908

(Schoolhouse, Icy Cape NExN, 6 mi)
(mid to 4 am) Following leads. Ice moving N.
(merid to 4 pm) At 1:10 got underway and stood to N. to clear floating ice, making fast with slip ropes to a large cake of grounded ice. Beluga also fast to ice cake.

August 19, 1908

(Schoolhouse, Icy Cape 4 mi)
16 natives and whites come on board. They reported ice with no leads at Sea Horse Islands and Pt. Belcher.

August 20, 1908

Working thru leads in ice. At 7:00 am made solid barrier of ice ahead.
Working to eastward along face of barrier.
Lat 70.29
Long 160.30

August 21, 1908

Light SSW air to calm overcast, thick and foggy, sea smooth, slowly thru leads in ice.
Lat 69.43
Long 163.17

August 24, 1908

Schoolhouse, Icy Cape S1/2E, 6 mi.
Overcast, with rain and mist, mod. to strong breeze NE to NNE, choppy sea. At 4:00 encountered first ice.
(4 am to 6 am) Vessel steaming thru heavy scattered ice
(6 pm to 8) Very little ice in sight during wolck much scattered.

August 25, 1908

Off Sea Horse Islands, Arctic Ocean
Gentle NE breeze, overcast misty and rainy. 12:45 made fast to ground ice. Shaling fleet with exception of Jeanette fast to the ice nearby

August 26, 1908

Schoolhouse, Icy Cape by SW, 10 mi
(Mid to 4 am) Ice coming around vessel, cast off. Moving thru heads in ice.
(8 to noon) Ice becoming thicker, took ice log (58.6) stopped, then went half speed to southward around ice floe.

Log of U.S. Revenue Steamer Bear, Captain M. A. Healy commencing May 5, 1886

June 1, 1886

6:15 made the drift ice. Steaming thru ice floes.
Steaming through heavy drift ice. Made Capt Upright
6-8 p.m. Light NW winds and cloudy. Vessel forcing way thru ice pack.
At 7 p.m. worked into an open lead, steamed along S. Shore of St. Matthews So.
Lat 59.51
Long 171.55

June 2, 1986

Vessel slowly forcing her way thru the ice pack. At midnight ice everywhere in sight from the masthead.
Lat 60.27
Long 174.00

June 3, 1886

Steaming and sailing slowling thru the ice. At midnight no opening visible from the crow's nest.
Lat 61.58
Long 174.50

June 4, 1886

4 a.m. Vessel sailing thru ice floe
6 a.m. Entered open water
8-12 a.m. Sailing thru drift ice.
12-4 p.m. Steamed along edge of ice floe
4-6 p.m. steaming thru drift ice

June 5, 1886

Steaming thru ice.

June 6, 1886

Thick ice everywhere - no opening visable, 14 vessels of the hwaling fleet in sight from the masthead all fast in the ice.
Lat 62.55
Long 178.18

June 7, 1886

Light winds and cloudy. Sailing along the edge of ice pack, 3 vessels in wight all enclosed in ice.
Lat 63.47
Long 178.20

June 8, 1886

8-Merid. 9:35 entered thick drift ice, calm and foggy with lgith snow
8 p.m. - mid. Vessel working through heavy ice. 10:20 vessel unable to force any further thru the pack. Stopped engine.
Lat 64.31
Long 177.27

June 9, 1886

Mid - 4 a.m. Thick fog, gentle breeze NW. Vessel fast in the ice pack.
4 - 8 7:45 started engine and worked vessel thru pack
8 - Mid. Vessel laying still in the ice.
Lat 64.10
Long 176.10

June 10, 1886

Vessel fast in pack
Lat 64.01
Long 175.49

June 11, 1886

Vessel fast in pack after some steaming
Lat 64.01
Long 175.49

June 12, 1886

Vessel fast in pack after some steaming
Lat 64.00
Long 174.42

June 13, 1886

Made St. Lawrence Island. Steaming thru ice pack. Latter part of watch in clear water.
Lat 63.53
Long 174.36

June 16, 1886

6 - 8 p.m. Steaming along edge of So. pack, latter part working thru ice.
Lat 64.36
Long 171.47

June 18, 1886

East Cape, Siberia. Ice drifting on shor from S.
Lat 66.03
Long 169.44

June 19, 1886

Off Cape Prince of Wales. Steaming aslowly along edge of ice.
Lat 64.50
Long 167.14

June 20, 1886

Behring Sea - rapidly drifting ice.

June 22, 1886

Light W. winds, overcast. Steaming along the S.E. edge of the pack.
Near St. Lawrence Island.
Lat 63.17
Long 169.35

July 2, 1886

Lat 63.47
Long 172.0

July 3, 1886

Clear and Mod. S.E. breeze, discovered the ice pack ahead. ·Gentle S.W. wind and cloudy. 12:10 stopped in the ice and boarded and examined Schooner "Clara Light" of S.F. C. B. Kustel master whaling. The Boarding officer reported having found 20 gal whisky in her forecastle, and the master and crew disclaiming all knowledge and ownership of the same it was thrown overboard. 8000 Winchester cartridges were found in the same place, were given in charge of the master and his receipt taken therefore. The crew nearly all of whom were intoxicated volunteered the information that 26 Bbls. of whiskey and 2 cases of arms had been thrown overboard upon the approach of the cutter.

July 14, 1886

Mod. W and N breeze and cloudy 8:45 p.m. steamed ahead. 11:35 hauled in log - 30 on account of the drift ice. 11:48 clear of ice.
Lat 67.22
Long 163.35

July 15, 1886

Light drift ice middle of Seward Penin.
Lat 65.63
Long 164.38

July 26, 1886

P.M. Cape Thompson
Fresh N.W. wind and cloudy. Heavy ice drifting to N.

July 27, 1886

Drift ice.
Lat 68.53
Long 165.44

July 31, 1886

Off Pt. Lay. Light N.E. breeze and foggy. Heavy ice drifting to N and E.
Heavy ice drifting.
Lat 70.05
Long 162.18

August 16, 1886

Mid to 4 a.m. Gentle breeze from W. Overcast and light snow. Vessel steaming slowly through drift ice.

Log Book of the U.S. Steamer "Bear", Captain M. A. Healy, Commencing May 19, 1887

July 5, 1887

4 to 6 p.m. Passing fields of ice.
Lat 62°34
Long 167°31

August 1, 1887

Light drift ice observed
Lat 70°08
Long 163°57

August 2, 1887

Passing through drift ice.

Log of U. S. Revenue Cutter Bear under the command of Capt. M. A. Healy

August 4, 1888

Off Sea Horse Islands heavy drift and field ice.
Barks "Mary and Susan," "Young Phoenix," and "Fleetwing" and schooner "Jane Grey" all wrecked. (August 5, 1888, off Pt. Barrow)
August 8, schooner "Ino" wrecked.

August 10, 1888

Between Pt. Barrow and Cape Smyth. Steaming through drift ice.

August 11, 1888

4 to 8 p.m. Ice pack close about on starboard beam
8 p.m. Position Lat 71.07.00 N, Long 158.06.00 W.

Log of U. S. Revenue Steamer Bear under the command of Captain M. A. Healy

July 11, 1889

Along the ice, heavy ice inshore. Cape Seppings N.E. 1/2 N, Capte Thompson N.W.

July 12, 1889

Off Poing Hope. Harbor full of floating ice.

July 13, 1889

Off Point Hope. Harbor full of floating ice.

July 14, 1889

Anchored off Pt. Hope

July 15, 1889

Anchored off Pt. Hope

July 16, 1889

Anchored off Pt. Hope, drift ice around

July 17, 1889

Anchored off Pt. Hope, drift ice around.

July 18, 1889

Anchored off Pt. Hope, drift ice around

July 24, 1889

Heavy drift ice.
Lat 70.10.30 N
Long 162.27.00 W

July 26, 1889

Wainwright Inlest E x S 4 miles, Drift ice.

July 27, 1889

Steaming slowly through broken ice to Cape Smyth. Anchored at Cape Smyth 11:45 a.m.

[During the summer erected Refuge Station]

August 14, 1889

Pt. Barrow, cakes of ice about

August 15, 1889

Heavy ice off the Point (Barrow)

August 16, 1889

The ice to the Wd of Point Barrow looking broken up and open. Vessel out and around Pt. Barrow through drift ice to Sd and Wd, current 2 knots.

August 17, 1889

Passing through broken ice, later clear water.
Lat 70.47.00 N
Long 159.53.00 W

August 18, 1889

Anchored off Pt. Hope in evening, no ice.

Between August 19, and 26, when vessel reached Norton Sound, no ice.

Log of U. S. Revenue Steamer Bear under the command of Capt. M. A. Healy

July 24, 1890

Noon - Drift ice floating by to Nd
Lat 70.39.0 N
Long 159.55.o W

July 25, 1890

At 8 a.m. near ice field.
Lat 70.48 N
Long 160.17.0 W

July 26, 1890

Off Indian Village, Point Belcher. Ice pack from SW to NW, distant 10-12 miles.
Lat 70.48.0 N
Long 159.34 W

July 27, 1890

Mid to 4 a.m. steamed along edge of pack ice slow speed to Sd and Wd.
At 3:30 made Point Belcher Village bearing S.E. by E 1/2 E
Lat 70.50 N
Long 159.19 W

July 30, 1890

At anchor off Sea horse Islands
11:40 p.m. a large body of heavy floating ice came down upon the vessel
Steamed through ice to clear water
Lat 70.53.0 N
Long 158.44.0 W

July 31, 1890

Mid to 4 a.m. Vessel working through the ice.
4 to 8 a.m. At 7:50 a.m. anchored off Cape Smyth. Quantities of heavy ice drifting by to Nd and Ed
Lat 71.21.0 N
Long 156.37.0 W

August 1, 1890

Cape Smyth - Quantities of heavy ice drifting by to Nd
Lat 71.23.0 N
Long 156.00.0 W

August 2, 1890

Off Point Barrow. Ice pack off shore at N.W., distant 5 to 7 miles.
At 4 a.m. clear about horizon at N.W.
Merid to 4 p.m. Ice pack extending from WSW to NE, observed to be moving off shore.
Lat 71.23.0 N
Long 156.10.0 W

August 3, 1890

Cape Smyth. Ice pack observed off shore at Wd distant 10-12 miles.

August 4, 1890

Anchored off Cape Smyth

August 5, 1890

Anchored off Cape Smyth

August 6, 1890

Anchored off Cape Smyth

August 7, 1890

Anchored off Cape Smyth

August 8, 1890

Anchored off Cape Smyth

August 10, 1890

Through fields of drift ice on way to Outer Sea Horse Islands

No mention of ice between August 11 and August 23, Vessel's arrival at St. Michael.

Log of U.S. Steamer BEAR - M.A. Healy, Captain - (Commencing April 28, 1892)

(63°20, 172.55)

June 9, 1892

10:25 am encountered heavy field ice, steaming thru the ice.

June 10, 1892

Mid to 4 AM. Light breeze from N to N & E. Overcast. Smooth sea. Ice drifting to S.

6-8 PM. Steaming under slow speed. Found ice very thick and to extend as far as teh eye could observe with aid of glasses.

8PM - Mid - Steaming to NNW through heavy broken ice

9:20 ice very heavy ahead.

June 11, 1892 (63.50, 171.35)

4 to 8 AM. Ice moving slowly S. Latter part ice moving to N and W.

June 13, 1892 (64.01, 170.33)

Heavy broken ice.

June 14, 1892 (63.47, 169.46)

6-8 AM. Steaming thru ice to S & E until 6:20 when finding ice packing and getting heavy. Passing thru heavy broken ice under half speed.

8 PM - Mid. Steaming thru scattered ice first hour. Last 3 hours no open water. Vessel under steam (half speed).

June 15, 1892

Kings Island - (64°57, 167°55) Considerable ice around island close to beach.

8 AM to Merid. Made fast to ice along side of beach near village.

8 PM to Mid - Steaming thru broken ice 11:45 encountered heavy ice floe off Cape Prince of Wales. Steamed along edge of ice

June 16, 1892

Mid to 4 AM. Entered ice off Cape P of Wales. Stopping and Starting at intervals. Steaming thru heavy broken ice at 3 AM ice being too thick to get near C P of Wales.

June 17, 1892

4 - 8 AM. Steaming thru heavy drift ice 1/2 speed.

8 - noon. 1st hours thru scattered ice. Last hr in open water.

July 1, 1892

65°22, 167°30) passed thru broken ice.

July 3, 1892

(65°19, 168°26) Ice very heavy.

July 7, 1892

Mid to 4 AM. Light airs from S and cloudy. Shifted anchorage on account of ice.

July 8, 1892

(65°25, 168°04) 4 to 8 AM. Steaming thru heavy field ice.

July 15, 1892

(67.00, 172.00) Scattered ice near vessel.

Log of Revenue Steamer BEAR 1893 - Captain M. A. Healy

July 1, 1893

At anchor, Port Clarence Reindeer Station, Alaska.

July 17, 1893

At Sea, Arctic Ocean. Drift ice passing along in shore with the current 8 PM-Mid. Overcast and foggy, clam to light NW airs 11:15 ice becoming more thickly packed and coming down on vessel.

July 18, 1893

At anchor off Euchomau Village, Siberia 1:15 am ice running heavy and packed in.

July 19, 1893

At Anchor to the westward of Whalen Village, Siberia 4-8AM. ice drifting to NW. 8-Merid. - Heavy drift ice.

July 25, 1893

At anchor, north of Cape Lisburne, AK
(69.13, 164.36)
4:30 AM ice becoming very heavy around the ship.

July 26, 1893

(69.53, 162.46)
Mid - 4 AM. Passed occasional scattered ice floes.
8 pm to Mid. - Till 10:40 working in scattered ice, then ahead NE through scattered ice.

July 27, 1893

Wainwright Inlet, AK
Passing occasional pieces of drift ice.

July 28, 1893

(70.57, 158.52)
8 AM to merid. Very heavy ice floe hanging on the shore.

8 PM. Passing drift cakes of ice and large lfoes.

July 29, 1893

U.S. Refuge Station, Pt. Barrow SSE 1-1/2 mi.
4 - 8AM. Passed Karluk and Belvadere fast to the ice.
Hauled down the edge of the ice to the Southward and at 5:25 came to anchor off U.S. Refuge Station, Pt. Barrow. Jeanie and Jeanette fast to ice. James Allen at anchor near by. Watch employed beating ice from rigging and cleaning decks 8 AM to Merid. Drift ice passing vessel. Heavy ice aground near shore.

July 30, 1893

U. S. Refuge Station, Pt. Barrow.
8 AM to Merid. Ice breaking off and moving to S.

July 31, 1893

Assisted Sch. "Jennie Ward." ice had carried her to shore.

August 4, 1893

8 AM - Merid. Sent officer to consult with the masters of whaling vessels as to the condition of the Stmrs, Orca, Thrasher, Belugas, Mary D. Hume, It was learned that these vessels are in the ice-pack 15 mi. NNE from Pt. Barrow and their situation is thought dangerous. The conditions are such that the steamers can not be reached in order to render assistance, but in view of the number of lives - about 200 souls - and the valuable property involved, it is deemed advisable to await the developments that may be caused by a change of wind.

August 8, 1893

Off Point Barrow.

Mid to 4 AM. Drift ice passing to northward.
9:30 PM perceived two vessels in the ice pack bearing NE 1/4 E and apparently uninjured.

August 9, 1893

Off Pt. Barrow. Mary D. Hume steaming to S & W. When she arrived boarded her and ascertained that the other vessels were in no danger, the ice having opened and freed them. Beluga and Thrasher on their way to in anchorage off the Pt.

August 9, 1893

(71.14, 157.02) Moderate to stiff NE breeze and clear. Passing occasional peices of ice.

August 17, 1893

At anchor, west of Cape Serdze - Kamon, Siberia. Small ice drifting past the vessel.

August 18, 1893

At Sea, Arctic Ocean. 4 to 8 AM. Ran into field ice, steaming thru heavy field ice.

8 PM to mid. - drfit ice passing vessel to the S & E.

August 19, 1893

(66.54, 171.35)

Mid to 4 AM. drift ice moving past the vessel from north, til last hlaf hour, when ice almost topped moving and became more scattered.

8 AM to merid. Heavy ice passing the ship to the E. Working thru heavy ice.

August 23, 1893

(65.20, 167.18) 6 to 8 PM. End of watch field of drift ice ahead. 8 to midnight - light easterly, steamed thru a strip of ice extending NE from East Cape. Ice to westward broken.

August 28, 1893

Off Cape Prince of Wales, AK. 5:30 AM sent 2 officers ashore. 7:10 boat returned and officers reported that Mr. H.R. Thornton, teacher of the Mission Schook, had been shot and killed on the night of the 19th. Inst.(?) by 2 natives Kongok, Dalionowick. The other natives, learning of the murder, shot and killed K. and D., and wounded Titalk, another native who did no shooting but was wtih them at the time. He afterwards got away. The body of Mr. Thornton was found in the house, decomposition having set in. The bodies of the two natives were found on the hillside back of the house where they had been dragged after being killed. Carpenter made a coffin for the remains of Mr. Thornton. Buried remains on hillside back of the Mission House.

August 29, 1893

Mrs. H.R. Thornton came on board for transportation to Cape Prince of Wales.

Log of U.S. Revenue Cutter BEAR under the Command of Captain M. A. Healy

August 4, 1894

Off Wainwright Inelt
Lat. 70.38N
Long. 160.10W
Large field of pack ice ahead and to N.

August 5, 1894

Mid. to 4 AM. Made out the ice ahead and to Westward. Steaming through loose ice. At 3: 50 AM. Point Belcher bore East.
4 - 8 AM. 4:20 clear of ice. 5:25 heavy cie ahead. 6 Sea Horses abeam S.E. & E. Working to Nd and Ed. through the ice. Clear of ice at end of watch.
Merid. to 4 PM. Steaming up toward Cape Smyth. At 1:05 made fast to the ground ice, off U.S. Refuge Station, Station bearing E. 1/2 S.
8 PM - Mid. At midnight observed heavy ice, probably the pack, off to Nd. and Wd.

August 6, 1894

At anchor of U.S. Refuge Station, Pt. Barrow.
Mid. to 4 AM. Ice pack about 15 miles off to Wd. and drifting in slowly.

August 7, 1894

At anchor off U.S. Refuge Station, Pt. Barrow.
Mid. to 4 AM. A strong current to N.E. with large quantities of floating ice.
4 to 8 AM. A strong current setting large quantities of ice to Nd. & Ed.
8 AM to Merid. Heavy ice running to Nd. & Ed.
Merid. to 4 PM. Large quantities of ice moving to the Nd. 12:45 underway and stood to Ed. inside of ground ice, at 1:10 anchored again. At 3:50 large quantities of ice coming, got underway and working out of ice.
TRANSFERRED FRANK YASUDA,
Cabin steward to U.S. Refuge Station. 4 to 6 PM. Working out of ice to Sd.
Native village at Cape Smyth bore N.E. 1/2 distance about 5 miles.

August 8, 1894

At anchor off U.S. Refuge Station, Pt. Barrow.
4 to 8 AM. Heavy running ice 7:25.
Underway because of heavy running ice. Working to the Sd through the ice.
8 AM to Merid. Various courses to the Sd. and Wd. through the ice some of which is very heavy.
Merid. to 4 PM. Various courses to the Sd. at 2:50 got into comparatively open water, about 2 1/2 miles off the beach, and stood S 1/2 W.
4 to 8 PM. Steaming to Sd. along the land. At 5:15 the ice becoming too heavy to proceed, turned and stood to N x E 1/2 E for anchorage in clear water. Anchored off Skull Cliff.

August 9, 1894

Mid to 4 AM. large quantities of heavy ice setting to Nd.
4 to 8 AM. A large quantity of ice around the vessel.
Anchored off Nunaria Village, Pt. Beldier.

August 13, 1894

Anchored of CORWIN COAL MINE.
Lat. 68.53N. Long. 164.48W.

through Bering Straits August 17 - no mention of ice between 9-17.

August 19, 1894

Considerable floating in Bering Straits.

August 31, 1894

4 - 8 AM. 7:00 rounded High Cape and steamed in for Cisang Village, Siberia.
Ice very heavy and thick.
8 AM to merid. Lying of Cisang Village. Ice very heavy and thick.
purchased 16 deer at Kilowroun Village.

September 1, 1894

At anchor off Kilowroun Village, Siberia -- ice thinning out some about the vessel and moving slowly Ed.

September 2, 1894 ditto

Mid. to 4 AM. Ice moving off shore.
4 to 8 AM. Underway and steaming to the Wd. working through the scattered ice 5.55 anchored off Village, Cape Sudyr. 7:05 underway, steamed around Cape Sudyr, working through the ice.

September 3, 1894

Anchored off Envwuman Villages Siberia. Drift ice moving to Eastward.

September 4, 1894

4 to 8 AM. Lat. 67.00 N. Long. 171.30 W.
Working to NE & N through heavy ice.

Log Book of the U.S. Steamer "BEAR" - Captain M. A. Healy USRCS
Commencing April 27, 1895

June 27, 1895

(61°30, 172°10) Passed several small peices of drift ice during watch.

June 28, 1895

Off Village St. Lawrence Is. - Small pieces of mush ice in sight.

July 5, 1895

(65°05, 167°35)
8 AM to Noon - Passing peices of drift ice at intervals some large and heavy.

July 11, 1895

(67°05,170°59) At 3 PM thru scatter ice to W.

July 12, 1895

Kemeshgauu, Siberia. Mid to 4 AM. Considerable drift ice moving to W.
8 AM to noon--9:30 have up anchor on account of large field of ice drifting down on vessel.
noon to 4 PM. 12:25 made fast to large piece of ice.

8 PM- Med. 9:05 cast off from ice and steamed to S and E. passing between land and drift ice.

July 13, 1895

Kilouruu, Siberia. Large amount of drift ice around vessel.

July 14, 1895

(Same location 7/13) Large quantities of heavy field ice passing the vessel.

July 16, 1895

(66°13, 169.50) Mid. to 4 AM scattered ice.

August 7, 1895

At Sea Arctic Ocean (69°09, 165°33) Passed scattered drift ice. (Mid. to 4PM).

August 8, 1895

5:30 AM. Sighted the icepack to N & W, hauled in shore to escape heavy drift ice. At 1:55 heavy ice ahead - come to anchor at anchor off Icy Cape, Ak.

August 10, 1895

Vessel remained at anchor on account of heavy ice to N & W.

August 11, 1895

Noon to 4 PM - got underway passing between drift ice.

August 12, 1895

At anchor, near Ice Cape - vessel moored to grounded ice.
No significant change - conditions and location, little variation.

August 21, 1895

Steaming thru heavy ice 11:15 came to anchor on no. side of Blosom Shoals.

August 22, 1895

Working thru heavy ice. Vessel under steam, slow speed.

Log of U.S. Revenue Cutter Bear under the Command of Captain Francis Tuttle

1896

July 7, 1896

July 7, 1896

4 to 6 P.M. entered ice field.
8 PM to mid. steering various courses in the ice off Cape York. Heavy field of ice to Ed with smaller field to Wd. Lat. 167.20.00N, Long. 65.17.09W

July 8, 1896

Mid. ot 4 AM. Vessel drifting on edge of ice field WSW.
8 AM. to merid. Working in ice, Kings Island bore SSN.
Merid. to 4 PM. Steering along edge of ice field until 3:00. Finding ice so deeply packed from Cape York to Cape Douglass that it was impossible to get through. Stood SSW for Kings Island.

July 10, 1895

Merid. to 4 PM. Large running ice field off Cap Prince of Wales making it impossible to anchor there.
8 PM to Mdi. Lat. 65.10.06N. Long. 167.21.18W
Sea smooth with occasional detached fields of ice. 11:10 entered large field of heavy ice. Steering various courses to Sd through the ice.

July 11, 1896

Mid. to 4 AM. Steering various courses through fields of heavy ice.
4 to 8 AM. Working through heavy ice.
5:50 ice thinning, 6:15 clear of ice.
at 8 AM. Lat 64.50N, Long. 167.27W.
8 AM to merid. Large ice fields on port hand. Steered following courses to keep clear of ice. 8.35 SxE 1/2E (100.3); 8:45 S x E. (9.7); 10.30 SE x S (13.1); 10.00 o'clock. Cape York bore N x W 1/4W, Kings Island NW x W; 11:00 S x E.
Merid. to 4 PM. steering various courses along edge of ice field.
4-6 pm. steering various courses along edge of ice.
6-8 PM. Same.
8-mid. same.
8 pm. Lat 64.03N, N Long. 166.20W

August 1, 1896

At anchor, Kotzebue Sound, Cape Blossom
Mid. to 4 AM. heavy drift ice in vicinity of vessel

August 2, 1896

Same
Noon position lat. 66.46.30N, Long. 163.01.00W

August 3, 1896

bearing Cape Thompson, heavy cakes of drift ice.

August 4, 1896

Mid. to 4 AM. steered various courses through ice field. After 4:00 Cape Lisburne NE x E 1/2 E
4 to 8 AM. various courses, light drift ice. Pos. Lat. 68.58N Long. 165.66

August 5, 1896

Mid. to 8 AM. Working along edge of ice and through heavy drifting ice.
8 AM to merid. At 8:15 on account of heavy ice came to anchor off Icy Cape--bearing N x E 1/2 E, Point of Lagroon ESE. Ice field closing in at noon - underway. 8 PM to midnight -- ice well offshore running to NW.

August 6, 1896

Mid to 4 AM. Underway, in heavy drift ice.
4 to 8 AM. 4:35 entered ice field steering various courses through heavy ice. 7:16 anchored to Sd. of Lay Cape because of heavy grounded ice, Icy Cape bearing N x E 1/2 E dist. 5 miles.
8 AM to merid. heavy drift ice running to Nd.
Merid. to 4 PM. heavy drift ice near vessel.
6 - 8 PM. working through heavy ice.
8 PM to mid. through heavy drift ice to anchorage off Point Lay.

August 7, 1896

At anchor off Pt. Lay, ice field to Wd and Nd.
4 - 8 AM underway, steering various courses around edge of ice.
6 -8 PM. through heavy drift ice.
Noon position Lat. 70.30.24N Long. 162.00.00W.

August 8, 1896

Mid. to 4 am. vessel drifting with ice. 3:15 made Cape Belcher, S x W 15 miles.
4 to 8 AM. steering various courses from NNE to NE x E through the ice. Ice pack to Nd & Wd.
8AM to merid. steering through ice field for station at Pt. Barrow. At 10:00 ice being too heavily packed to reach station stood to Wd & Sd along edge of pack ice.
Merid. to 4 PM. following southern edge of ice pack making good SW x S 1/2S.
4-6 PM ibid.
6-8 along ice pack, Lat. 71.12.30N, Long. 158.46.00W

August 9, 1896

Mid. to 4 AM. End of ice pack to NW and Wd. Vessel drifting to Nw & Ed, current 2 knots per hour.
8 AM to merid. ran into drift ice near Pt. Barrow.

August 9, 1896 - continued

Noon position Lat. 7.18N, Long 156.40W. Merid. to 4 PM drifting to NW & Ew, in heavy drift ice, ice pack to Nd and Wd.
4 to 6 PM. Various courses through drift ice.
6-8 PM. light drift ice SSW. 7:30 clear water.
8 to mid. steering along edge of drift ice along shore-ice pack to Nd.

August 10, 1896

4 to 8AM. entered heavy drift ice. Made ships at Pt. Barrow anchorage. bearing N.E. 6:25 stopped on account of heavy ice, vessel drifting.
8 AM to merid drifting in ice off Cape Smyth. Ice pack to Nd and Wd.
Noon position Lat. 71.14.00N Long 157.20W

August 11, 1896

Noon position Lat. 70.57.30. Long. 158.15 steering through heavy drift ice.
2:50 pm. open water, 3.40 off Skull Cliff.

August 12, 1896

8 AM. to merid. Comparatively clear water at 8:40. 10.07 came up with heavy ice, 10.20 came to anchor on edge of ice field to wait for ice to drift to Nd. Moored vessel to ground ice inshore at night.
Noon pos. Lat. 71.08N, Long. 157.10W

August 13, 1896

Off Skull Cliff, heavy drift ice in vicinity of vessel.
Merid. to 4 PM. Cast off for Pt. Barrow, steered through ice field.
4-6 PM. to Nd through heavy drift and ground ice. 4.40 stopped and made fast to ground ice off Relief Station at Cape Smyth.

August 14, 1896

At anchor off Cape Smyth

August 15, 1896

ditto
8 AM to merid. ice floe breaking up
6-8 PM running through drift ice, open water at end of watch.
8 PM position Lat. 71.10.12N, Long. 157.25.00W

August 16, 1896

through drift ice.
Noon position Long. 70.50N Lat. 159.50W
8 PM. to mid - various courses through ice field making SW first hour,
11:20 Ice Cape ESE 7 miles
Midnight off tail of Blossom Shoals.

August 17, 1896

11:45 PM. stopped and anchored of Corwin Coal mine, Cape Sabine.

No mention of ice on trip south until August 24, 1896

August 24, 1896

Noon position Lat. 66.32N. Long 169.55W. Steering various courses through to Sd and Ed through ice.
4 to 6 PM. through heavy fields of ice sttod SW for East Cape bearing SW x S 3/4 S 10 miles.

8 PM to mid. stopped off Whalen, East Cape, S x E 1/2 E, but owing to heavy drift ice at 8:50 stood to Ed through the ice.

August 25, 1896

4 to 8 am. through heavy drift ice and along edge of floe. 7.00 East Cape bore NW x N 5 miles. Anchored in clear water under East Cape.

Steamer Bear, June 1st to September 17, 1898

July 18, 1898

Mid. to 8 AM. Working through scattering ice.
8 to Merid. Steaming in general NE course through light drift ice.
Merid. to 4 PM through scattering ice. Steaming along beach to N keeping outside 6 fathoms. Open water. Anchored of Pt. Barrow to S of Pt. Lay
Lat. 69° 22'
Long. 163° 30'

July 19, 1898

Midnite to 4 AM. Underway 2:15, steaming along beach, scattering drift ice.
8 AM to merid. stood to N through scattering ice.
Merid. to 4 PM steaming NNE through scattering ice. 1:45 NNW 2:05 SE.
4 to 8 PM. Drift ice running to SSN with current.
8 PM to midnite. Drift ice running to SW with current.
Icy Cape N.E. 10 miles

July 20, 1898

Off Icy Cape at anchor. Midnite to 4 AM drift ice running SW 1/2 knot per hour with current.
4 to 8 AM drift ice running to S. 4:35 lift anchor and steamed around to clear large ice floe. Steamed to N along beach, various courses, considerable drift ice.
8 AM to Meridian. Working through drift ice to hills to N & W, 12 knots.
Merid. to 4 PM. 2:30 turned and headed S for Icy Cape
4 to 8 PM various courses through drift ice.
8 PM to mid. 10:35 clear water, 11:40 anchored 1 mile from beach, 3 miles S of Point Lay.

July 22, 1898

8 AM to Merid. Various courses to N & E through scattering ice
Merid. to 4 PM S of Icy Cape, dist. 4 miles
3:00 underway slowly to S to keep clear of ice.
Icey Cape NE 1/4E 8 miles

July 24, 1898

Off Icy Cape
4 to 6 PM. Fresh NNE breeze. Clear. Soft ice drifting to S & W.

July 28, 1898

4 to 8 AM. 6:00 stopped abrest Cape Smyth on the outside of ground ice. Found no lead inshore. At 8 made fast to ice.

July 30, 1898

Off Cape Smyth. Midnight to 4 AM. 3:20 ice swinging in, underway, 3:30 made fast to ground ice.

August 2, 1898

At anchor off Cape Smyth
Mid. to 4 AM. 3:00 drift ice closing in about ship.
8 AM to merid. Drift ice running N at about 1 knot per hour.
Merid. to 4 PM. Drift ice off shore and filling in around ship.
4 to 8 PM. Drift ice packing around ship.
8 PM to midnite. No movement of ice.

August 3, 1898

At anchor off Cape Smyth
Mid. to 4 AM. Ice packing around vessel at times.
4 to 8 AM. Ice packed in around vessel.
No movement of ice.

August 4, 1898

Anchoraged off Cape Smyth
Mid. to 4 AM. At 3:00 shore ice began setting to N.
4 to 8 AM. no movement of ice.
Merid. to 4 PM. no movment of ice.
8 PM to midnite. 11:45 slight movement of off shore ice to N.

August 5, 1898

still anchored, no ice movement

August 6, 1898

same place. No ice movement.

August 7, 1898

Same place, no movement of ice.

August 8, 1898

Same place, no movement of ice.

August 9, 1898

Same place, no movement of ice.

August 10, 1898

Same place, no movement of ice.

August 11, 1898

4 to 8 PM. Off shore ice moving slowly N -- same 8 PM to midnite - same place.

August 12, 1898

Same place, no ice movement

August 13, 1898

Same place, no ice movement

August 14, 1898

8 PM to midnite. Off shore ice moving rapidly to N.

August 17, 1898

Ice out & moved, ran into drift ice
Lat. 71°06'N
Long. 157°10'W

So ends 1898

Log of U. S. Revenue Steamer Bear under the command of Capt. O. C. Hamlet

July 30, 1905

Merid to 4 p.m. Sighted ice floe ahead, when clear of ice, headed East
Noon position
Lat 70.47.00 N
Long 162.02.00 W

July 31, 1905

Slack ice moving to NW, various courses for Cspe Smyth. At noon off Cape Cmyth.

No ice enountered between July 31 and August 10--when back at Port Clarence.

Must have been a relatively ice-free navigation season

Log of U.S. Revenue Cutter Bear under the command of Captain J. G. Ballinger

June 28, 1911

Detached pieces of drift ice in sight in vicinity of Indian Point, Siberia.
4 to 8 p.m. ice in St. Lawrence Bay and extending East from Cape Munyagmo 7.36 found bay and harbor (St Lawrence Bay and Lutke Harbor) blocked with ice.
8 p.m. to mid. ice a few miles off Cape Munyagmo
8:20 working to NEd through ice

June 29, 1911

8 a.m. to merid. drift ice around Cape Prince of Wales moving Nd
8 p.m. to mid. No ice in sight. anchored off village, King Island.

June 30, 1911

Scattered drift ice off Cape Rodney and Sledge Island. off map

August 2, 1911

Pos. at noon Lat. 71.06N Long 157.50W
sighted ice floes to NWd
merid. to 4 p.m. no ice sighted
Schoolhouse at Barrow bearing NNE
Anchorage off Barrow - no ice in sight

August 3, 1911

Off Barrow, at anchor
no ice in sight

August 5, 1911

At anchor, Wainwright
No ice in sight

October 15, 1911

Vessel at anchor at Sledge Island--no ice reports (must have been an icefree year for the most part)

Log of U.S. Revenue Cutter Bear under the command of J. G. Ballinger, Capt.

July 10, 1912

noon position Cape York, NE x N - 3 1/2 mi.
Scattered ice in strait. Observed current of 2.5 knots to westerly.

July 11, 1912

No ice in sight
4-6 p.m. running through scattered ice
6-8 p.m. scattered drift ice--position N. Cape, St. Laurence Island
Lat 64.44N
Long 171.8W

July 13, 1912

No ice in sight
Lat 64.9N
Long 167.10W

August 4, 1912

8 a.m. Cape espenberg, Lat
Long. by ESE 18 miles
no ice in sight

August 11, 1912

8 a.m. position lat 70.26N, Long 160.18W
No ice in sight
Off Cape Smyth, Barrow no ice in sight
4-8 p.m.

August 13, 1912

Off Cape Smyth, Barrow
No ice in sight

October 29, 1912

Position SW Cape, St. Lawrence Island, Cloudy, squally, snowing, but no report of ice.

Log of the U.S. Revenue Cutter Bear under the command of J. G. Ballinger, Capt.

July 3, 1913

8 a.m. Lat. Cape Prince of Wales
Long. SE 1/2 S-18 miles
Passed through thin drift ice.

August 10, 1913

Pos. Lat. Cape Collie
Long. SExS-3 miles
Sighted ice on port bow
Sighted packed ice about 12 miles off and parallel to shore. Encoutered detached pieces of ice.
noon position - Lat 71.00 N
Long 158.23 W
In field ice, entered ice field. Piloting through various leads at different speeds, NE'ly course.
4-6 p.m. Standing various courses and speeds through heavy ice field for Point Barrow to N'd & E'd. At end of watch no leads in sight prepared to moor ship to ice floe, being unable to make further leadway.
6-8 p.m.- Lat 71.8N
Long 157.5W
At 6:10 anchored to large floe. Crew held dance and sports on ice. Vessel drifting to Northward about 3/4 knots per hour.
8 p.m. to mid. Drifting with the ice field throughout, in a general NE'ly direction at the rate of .4 knots per hour

August 11, 1913

4 a.m. to 8 a.m. - Vessel moored to ice about 8 miles to southward and westward off Cape Smyth. Drifting to northward 0.7 knots per hour.
8 a.m. to merid. - Vessel moored to ice about 8 miles to southward and westward off Cape Smyth. Drifting to northward 0.7 knots per hour
8 a.m. to merid. - Vessel moored to ice about 6 miles to southward and westward off Cape Smyth. Drifting to northward about 0.6 knots per hour.
4 p.m. to 6 p.m. - Drifting to northward about 1 knot per hour - Pt. Barrow bearing ExS at end of watch with open water to eastward of point.
6 p.m. to 8 p.m. - Vessel drifting fast in clutch of pack to northward. Open water to end of Point beyond ground ice. Along ground ice, heavy swirls and grinding floes. Vessel not under control owing to whirls and grinding floes.
8 p.m. to mid. - Inthe ice pack during firest part of watch. Working for a lead to open water east of Point Barrow. 8.50 made open water and headed SW. Anchored 9.35, Pt. Barrow bearing SWxW 3/4 W (mag.), distant 2.3 miles. Ice drifting by vessel about 100 yards off in a general NE'ly direction. Ice moving about 1.5 knots per hour

August 12, 1913

At anchor, off Point Barrow
All day detached pieces of ice drifting past vessel in a NE'ly direction, 0.5 knots per hour.
6 p.m. to 8 p.m. - Some loose drifting slowly by vessel to eastward.

August 13, 1913

At anchor off Pt. Barrow
Mid to merid. - ice drifting by vessel
Merid to 4 p.m. - very few pieces of ice drifted past vessel

August 14, 1913

At anchor off Pt. Barrow
4 a.m. - 8 a.m. - Vessel's anchorage practically free of ice. Ice pack still moving to northward by Point Barrow.
8 a.m. to merid - ice drifting by vessel
Merid to 4 p.m. - wind started ice drifting toward vessel.
4 p.m. to mid - ice drifting past vessel

August 15, 1913

At anchor off Pt. Barrow all day ice drifting past vessel.

August 16, 1913

At anchor off Pt. Barrow.
All day ice drifting past vessel. Since arrival at Pt. Barrow heavy ice pack to the southward and southwest of the point. Vessel remained at anchor awaiting a favorable wind to open ice to permit vessel to proceed south

August 17, 1913

At anchor off Pt. Barrow
Ice conditions to S not favorable

August 18, 1913

At anchor off Pt. Barrow
4 a.m. to 8 a.m. - 5.58 underway and around Pt. Barrow through ice to lead to southward. 6.25 Pt. Barrow ExN-3 miles.
Merid to 4 p.m. - Lat. Skull Cliff
Long. E 1/2 N-5 miles
piloting vessel along edge of ice pack.
4 p.m. to 8 p.m. - 5.55 anchored off Wainwright Inlet

Bear

August 9, 1914

4 a.m. to 8 a.m. - sighted numerous walrus during watch
10:40 a.m. anchored on southside of Icy Cape
1:40 p.m. underway course ?
3:00 p.m. c/c NWxN
3:30 c/c NExE
5:00 p.m. sighted ice ahead, half speed through ice field. Making good courses from ENE to ESE
7:12 c/SE 1/2 S clear of heavy ice, ahead full speed
8:00 c/NExE pos 70°3' 161°12'W
9:30 p.m. c/c NExE 1/2 E
9:45 c/c ENE
10:00 p.m. lost sight of ice to northward

August 10, 1914

12:40 a.m. north point of Wainwright Inlet abeam
7:10 a.m. Pt. Belcher abeam (distance 3/4 mile) c/ NE (23.2) working through loose ice from 6 a.m. until end of watch (8 a.m.)
8 a.m. vc ? in ice pos Pt. Belcher SSW 5 miles
10:40 turned around and headed in general SW direction having encountered heavy ice with no leads
12:00 noon pos Pt. Belcher SWxS 11 miles
12:00 noon vcs through loose ice making good general course SSW at end of watch 4:00 p.m.) found clear water off Pt. Belcher.
4:10 p.m. in open water, ice pack about three miles offshore, stood SW x 1/4 W (31.5) ?

August 11, 1914

Anchored off Wainwright Indlet
Mid - 4:00 a.m. numerous small cakes of ice drifts NE past vessel
4:20 underway ice drifting in on vessel
4:30 c/SSW to evade
8:00 a.m. - noon drift ice passing vessel (still anchored off Wainwright Inlet) during latter part of watch offered to assist a standed vessel but Captain advised against it because "so much ice drifting by"
12:15 heavy ice began drifting down underway vcs through drift ice MGC SWxS
3:30 worked into Clear Water
8:00 p.m. 70°27' 160°55"W (anchored)

August 12, 1914

6:36 a.m. anchored off Wainwright NExE 1/e E-6 miles
11:30 saw ice to the north distant about 3.5 miles
4:15 p.m. sighted ice pack to the northwestward distant about 5 miles

August 13, 1914

(POS) Wainwright Inlet NxE 1/3 E-6 miles
9:15 p.m. ice drifting towards vessel underway c/ SxW 3/4 W
10:50 p.m. clear of ice anchored

August 15, 1914

Mid - 4:00 a.m. loose ice on Starboard drifted to about 3/4 of a mile from vessel
4:20 a.m. ice drifting down a vessel underway stood to south and west
4:55 anchored 17 miles SxW 1/2 W of Wainwright Inlet
8:00 a.m. loose drift ice in vicinity
11:30 underway c/NNE 3/4 E
12:00 (pos) Wainwright Inlet NExN 14 miles VC through loose drift ice
2:15 p.m. anchored off Wainwright near grounded schooner, which was nearly surrounded with ground ice.
8:00 p.m. driftice in near vicinity

August 16, 1914

8:00 a.m. Wainwright Inlet drift ice in near vicinity
6:45 p.m. heavy ice flows fouling vessel underway stood to south and West
8:00 p.m. anchored in fairly open water Wainwright Inlet NxE 6 miles
8:00 p.m. - mid loose ice drifted to southwest past vessel

August 17, 1914

3:15 underway c/NNE through drift ice
4:00 - 8:00 a.m. working thru ice VS
4:45 anchored off Wainwright at stranded boat
10:15 underway full speed to northward VC through heavy drift ice.
Noon - Pt. Belcher NNE - 4 miles working through drift ice, general NE course through various leads
4 p.m. - 8 p.m. wind closing up all leads to Northward VC around Pt. Franklin and Sea Horse Is. to open water
5:40 anchored Pt. Franklin W 5/8 N, False Cape WSW 3/4 W, Ships Head SE
9:30 tide turned and ice drifted to Westward out of Peard Bay

August 18, 1914

7:30 underway NNE
8:00 stood NExE 1/3 E through loose ice in towards shore
8:00 POS Pt. Franklin SW-8 miles
8:35 encountered heavy drift ice with no leads turned and stood VC through ice into Peard Bay
9:20 a.m. anchored
noon - False Cape WxS 5 miles

August 19, 1914

9:30 a.m. tide began to turn and ice drifted past vessel to northwestward

August 20, 1914

5:00 underway through lead in ice to Northward and Eastward
6:40 a.m. no lead in sight, anchored off Skull Cliff
7:27 underway to clear ice
7:35 anchored
8:00 Skull Cliff ESE 1/2 E - 5 miles up anchor VCS through drift ice to southward
10:20 a.m. anchored Peard Bay, False Cape W 1/2 S 6.0 miles

August 21, 1914

5:00 a.m. underway to Northward and Eastward
5:43 Peard Cliff abeam, entered ice field working through ice
8:00 a.m. Skull Cliff SE 1/2 mile VCS NNE along coast through heavy drift ice about one to two miles offshore.
12:00 (noon) off Sinrorua Village
Noon - 4 p.m. MGC of NE in ice, thru various leads
4:00 - 6:00 p.m. working thru heavy ice
6:00 - 8:00 p.m. entered good lead along grounded ice, full spped to northward and eastward
8:00 p.m. Barrow village NxE 3 miles (in sight) general course NNE along grounded ice
8:50 p.m. anchored off Cape Smyth and village of Barrow
(one destilute Eskimo from Stefansson's Canadian Center Expedition on board)

August 22 1914

4:15 a.m. underway steered to southward and westward through a lead in ice
6:45 sightes schooner King & Wizi in ice pack disabled
8:00 a.m. Refuge Inlet NNE - 5 miles
0:10 ahead full through ice into clearer water near shore
11:40 Skull Cliff ESE 4.0 miles
12:00 Torrent Inlet SE - 4 miles in ice field
12:40 p.m. working through ice field VCS
4:20 C/ SW
5:00 clear of ice field off Sea Horse Island c/ SSW 1/2 W
6:55 C/ SxW
8:00 p.m. Wainwright Inlet S 1/2 E - 4 miles
8:40 Wainwright
11;45 depart Wainwright c/ SWxW 1/2 W for Wrangell Island

August 23, 1914

2:00 a.m. came up to southern edge of ice pack c/c SW
2:30 c/c SW 3/4 S passed numerous walrus during watch

August 24, 1914

Noon position 70°35' 173°23' c/ WSW 3/4 W
4:15 p.m. sighted ice on the bow
5:10 made out heavy ice ahead, stopped
5:20 ahead slow c/ NNW along ice field
6:10 c/ NE
8:00 stopped for fog 70°46'N 175°10'W (off map) large pieces of drift ice in close vicinity, drifting in general SxE direction (ship)

August 25, 1914

mid to 4 a.m. sighted large pieces of ice to southward and westward
4:30 underway full speed WxS

August 25, 1914 continued

5:30 made out heavy ice field ahead and to Southward stood NxW 1/2 W
6:00 a.m. C/ NxE
7:15 C/ NNW
8:00 C NE standing along ice field endeavoring to make land 70°42'n 175°20'W (off map)
8:50 C/C n 1/2 W keeping along edge of ice pack
9:55 C/C NNW
10:55 slow, ice pack extending as far to the eastward as NExE
noon 70°53' 175°2'W anchored
1:55 ice drifting down, underway VC to East
3:30 C/ NE
4:20 C ENE 1/2 E
4:35 stopped in lee of ice field
8:00 p.m. 70°52' 174°40'W drifting

August 26, 1914

8:00 a.m. 70°25'N 174°58'W drifting
noon 70°47'N 174°56'W drifting
8:00 p.m. 70°27'N 174°38'W drifting

August 27, 1914

4:15 underway SSE 3/4 E continued bad weather and heavy ice in vicinity of Wrangell and Herald Islands prevented landing coal becoming short started to South and East
8:00 a.m. 69°44'N 174°15'W

August 29, 1914

on patrol off Siberia accord to natives heavy ice South of Wrangell Island

September 7, 1914

noon 68°23' 173°44'W (off map)
7:45 p.m. sighted ice on Port Beam, ahead and on starboard bow C/ NWxW 1/4 W
8:00 p.m. 69°03' 175°10'W
8:50 p.m. reached loose drift ice on account of darkness
10:30 - 10:35 underway to clear pieces drift ice drifting ExS

September 8, 1914

mid - 4:00 a.m. sighted few pieces of loose ice
4:30 underway C/NWxW 1/4 W
7:15 entered loose ice watch ends on C/ NWxW 1/4 W skirting ice field
8:00 a.m. 69°17' 175°14!W, loose drift ice
9:00 C/C NWxW 3/8 W working thru ice
10:00-11:00 steared NW course, clearing pieces of ice
11:00-12:00 C/ NWxW 3/8W
Noon 69°41'N 176°00'W
12:40 stood NNW along heavy drfit ice sent men aboard the King and Wingi learned it had rescued survivors of the "Karluk" and they came on baord Bear
2:50 underway NxW 1/4 W for Herald Isalnd where 4 men of the Expedition were supposed to have landed
5:55 skirting along ice field VC for Herald Is.
8:00 p.m. 70°21' 175°15'W C/ NxW 1/2 W

September 9, 1914

12:05 a.m. VC through drift ice to NE
1:20 stop near large ice field, drifting ENE
4:20 underway VC to Northward along ice field
6:30 sighted Herald Island WxN, 10 miles
7:10 stopped unable to approach Herald Island closer than about 8 miles because of heavy ice barrier. Searched land with binoculars and sounded whistle no sign of Karluk crew
7:20 full speed to lost out of ice.
7:50 C/ SE
8:00 a.m. Wrangell Is WnW - 10 miles

Bear

<u>August 1, 1915</u>

Checked to 8/20 no notes of ice.

<u>August 19, 1915</u>

8:00 p.m. 66°50'N 167°45'W

<u>August 20, 1915</u>

Mid-4:00 a.m. C/ SWxW 1/4 W
4:00 a.m. field ice
5:20 sighted ice ahead and on port beam C/SSE 5/8 E
6:30 a.m. crown South
7:25 C/ SW
8:00 a.m. 66°34'N 170°00'W
10:35 C/C SSW
11/28 C/C SWxS
noon 66°15'N 170°50'W moderate sea ice
12:10 course S 1/4 W
12:30 ice field ahead, making approx SE good
4:35 sighted East Cape ahead VC skirting ice field toward East Cape
5:10 to 5:35 stood in close to walrus on ice
8:00 p.m. East Cape - Right Tangent NNE (10 miles or 1.0 miles ?)
9:10 anchored East Cape

<u>August 21, 1915</u>

Bear

August 8, 1916

August 14, 1916

Noon Wainright
1:15 underway C/ North
2:00 C/C NNE
2:35 Pt. Belcher abeam - 2.5 miles C/C NE 3/4 E
4:40 C/C NE 3/4 N
4:53 C/C NE 3/4 E
5:40 False Cape abeam 7.0 miles passing few scattered ice cakes
6 p.m. - 8 p.m. scattered ice to westward
8:00 p.m. 71°04' 157°23'
10:55 anchored off Cape Smyth heavy ice grounded on bar off Cape Smyth

August 15, 1916

Destitute seamen from "Polar Bear" want transport to Nome

August 16, 1916

8 p.m. 70°31' 161°04' C/ NW passed pieces of drifting ice last part of watch

August 17, 1916

12:15 took in all sails; came up to southern edge of ice pack skirted this pack to westward and southward until 2:00
2:00 a.m. C/C S 3/4 E (left ice ?)

Log of Larsen - M/S St. Roch

July 10, 1928

Unalaska

July 15, 1928

Teller

July 18, 1928

So far no ice in sight
70°6'   162°32'W

July 19, 1928

We are lucky not to have had any ice so far - 1200
70°41'N   169°20'W

July 20, 1928

2:05 rounded Pt. Barrow ice very heavy
5:30 p.m. 5 miles lost of Pt. Barrow ice very heavy found it impossible to proceed further turned back for open water east of Point B.
7:30 anchored off Cape Smyth

July 21, 1928

Laying at anchor waiting for ice to move strong NE wind so it will not take long

July 22, 1928

9:00 took up anchor
10:50 rounded Pt. Barrow and tried to work through the ice
2:50 p.m. turned back found it too much for us heavy ice belocked to shore (?) East of Point. Tied up to ice pan, then headed to Cape Smyth
9:30 anchored west of point two miles west of Pt. Barrow

July 23, 1928-

It anchor 2 miles west of Pt. Barrow and clear of pack moving west

July 24, 1928

11:45 a.m., depart moved lost off Point Ice still too heavy and packed
1:30 moored to grounded ice pan 2 miles east of Point B.

July 5, 1928

9:50 a.m. cast off from ice and tried to work thru ice, ice proved too packed and heavy.
12:00 tied up again to ground ice.

July 26, 1928

2:30 a.m. cast off ice and started to work thru condition much improved
12:00 noon very little ice in vicinity
9:30 p.m. the Tis Island? abeam

July 27, 1928

12:20 heady east very little ice
5:30 am made western pt. of Cross Island headed off shore again encountered heavy pack
2:00 p.m. Flatman Island abeam but ice is to heavy packed to proceed further, moored to ice

July 28, 1928

9:05 p.m. started thru the ice

July 29, 1928

On our way eastward, open water
7:28 a.m. Martin Pt. abeam

July 30, 1928

3:00 a.m. anchored at Herschaell Island

August 2, 1928

(at Shingle Pt)
1:50 depart headed for Ballie Is. no ice in sight
12:00 noon - 69°50'N 135°50'W

August 7, 1928

Tnmon (L) or? Rwn
6:45 p.m. leave for Bernard Harbor no ice in sight

September 4, 1928

anchored inside of ________ Langton Bay for winter?

October 16, 1928

ice forming in the Bay

October 17, 1928

ice breaking up and going out

October 19, 1928 - off map

This morning the bay was covered with slush ice

August 1, 1928

0000 - Anchored Kivalina - 58°T
0910 - Underway 271°
0950 - C/C 311°
1121 - Cape Seppings abeam 5.3 mi.
1700 - Anchored Pt. Hope - 299°T

August 2, 1928

0600 - Underway 180°
0622 - C/C 130°
0800 - 68.09/166.14
1200 - 67.55/165.23
1205 - Cape Seppings beam 5.0 mi.
1410 - Kivalina bearing 60°, C/C 70°
1430 - Anchored Kivalina - 50°T
2230 - Underway 180°
2250 - C/C 157°

August 3, 1928

0350 - Cape Kruzenstern abeam 9.4 mi.
0400 - C/C 137°
0500 - C/C 142°
0800 - 66.41/163.00
0810 - C/C 90°
0840 - C/C 63° off Blossom Shoals
0940 - Anchored Kotzebue - Blossom Shoals 63 1/2°T, dist, 5 mi.
1915 - Underway 269°
1955 - C/C 270°
2000 - 66.42/162.45
225 - Cape Espenberg 166°T

August 4, 1928

0130 - C/C 241°
0433 - C/C 320°
0545 - C/C 196°
0751 - C/C 212°
0800 - 66.25/165.45
0905 - Anchored Shismaref - 180°T
1200 - Anchored
2230 - Underway 325°T
2258 - C/C 285°

August 5, 1928

0800 - 66.24/167.57
0845 - C/C 185°
1200 - 65.51/168.50
1243 - Little Diomede abeam 2.5 mi., C/C 142°
1350 - Fairway Rock abeam 5.0 mi.
1540 - Cape Prince of Wales bearing 60°

August 5, 1928 continued

1600 - C/C 120°
1630 - C/C 115°
1854 - C/C 91°
2000 - 65.16/167.15, C/C 82°
2010 - C/C 74°
2120 - Passed Pt. Spencer abeam 5 mi.
2125 - C/C 82°
2240 - Anchored Teller Reindeer Station (Port Clarence)

August 6, 1928

1400 - Replaced - Cape Riley 189°

August 7, 1938

0845 - Replaced - Point Jackson 274°
1425 - Replaced - 1/2 mi. nearer Teller Mission Point Jackson 272°

August 8, 1928

At anchor

August 9, 1928

At anchor

August 10, 1928

At anchor

October 23, 1928

ice forming rapidly in the Bay

October 24, 1928

Vessel frozen into ice

October 27, 1928

ice seems to deep firm without breaking

November 10, 1928

set in for winter

Log of Larsen - M/S St. Roch

<u>May 1, 1929</u>

commenced ship work again

<u>May 10, 1929</u>

commenced cutting ice around stern of vessel

<u>June 6, 1929</u>

ice getting full of holes

<u>June 18, 1929</u>

ice getting rotten around vessel

<u>June 24, 1929</u>

Broke our way through the ice about 200 yds further from back. Ice moving in and piling up on beach behind vessel

<u>June 25, 1929</u>

heavy ice present in bay vessl forced closer in but no danger as ice solid against the Beach outside the sandspit no ice in sight

<u>June 26, 1929</u>

Went outside of Spit to avoid ice coming out of the bay

<u>July 9, 1929</u>

moved outside Sandspit

<u>July 10, 1929</u>

moved Spit

<u>July 11, 1929</u>

left Langton Bay
11:45 p.m. left Horton River following the coast, large heavy ice floes.

<u>July 12, 1929</u>

1 am ice in the distance
7:45 am anchored at Ballie Island
10:30 am large cakes of ice coming inside sandspit. Left for better shelter, shattering heavy ice flows

<u>July 13, 1929</u>

7:00 am left for Herschel. bucky heavy ice hoam(?) distance 20 miles
70°30' 128°55'W SWxW (course) 2 Prin(?) clear of ice open water (?)

July 14, 1929

enroute Herschel Island
10:00 am tied up to a large ice foe
&;30 pm sighted Herschel Island S/ 1/8 mile (south 1/8 of a mile)?
losts of heavy ice around island

August 10, 1929

left for the east

August 26, 1929

left Herschel Isl for Vancouver fine going no ice

August 27, 1929

1:30 am (ges)? in the ice
11:30 am Flaxman Island abeam 70°20' 146°10'
2:35 pm Peli (sp) Island abeam
5:20 Cross Isl. abeam - Walking ice all day
10:30 moored to ground ice western end of James Island

August 28, 1929

3:20 a.m. left the ice floe
noon 70°52' 152°02'
12:30 Cape Halkit abeam very little ice
8:30 pm Tangent Pt abeam follows close to shore

August 29, 1929

passed Pt. Barrow, C. Symth
3:00 pm Pt. Belcher abeam no ice for the rest of the day

September 8, 1929

Dutch Harbor

Log of Larsen - M/S St. Roch

June 27, 1930

new voyage

July 9, 1930

Dutch Harbor

July 20, 1930

noon 70°53' 159°28' passing great herd of walrus on ice floes
1:00 pm ice getting tight packed along shore unable tp proceed further
8:00 pm vooed to an ice floe about 30 miles west of Point Barrow. Ice broke loose in night, looking for shelter

July 21, 1930

another ship joined them. Cruising along the pack ice unable to penetrate
3:15 am both vessel anchored waiting for the ice to move farther from shore
noon post 71°18' 157°20'W
1:20 pm ice pack approaching vessels - moved southwest - shift position a # of times heading in NE direction?
9:40 vessel moored to heavy pressure ridge remain for night, ice constatnly moving

July 22, 1930

moored to grounded ice ________ pack closing in slowly
1:30 pm ice getting too close for comfort, left mooring head south to clear (in charges)? ice?

July 23, 1930

vessel ice bound
12:30 ice on the ________ Northward (vessel underway)
3:30 pm vessel moored along shore ice of Cape Symth First ship to arrive this season. Ice looks (off)? the Point (Barrow)
4:15 left shore ice strong current, large cakes of ice milling around sheating? to damage the vessel. Unable to force a passage thru vessel nearly got nipped in the ___________ as we were caught and carried off shore.
6:30 pm got loose from the ice pack, returned to former berth awaiting improvements in ice conditions
8:30 pm Ice pack closing in rapidly let go mooring's proceeded due south to avoid being crushed
10 pm ice moving offshore again Ice solid around the Point

July 24, 1930

our vessel in danger of getting _________
2:45 moored in small bay in shore we protected from heavy ice.
3 (am or pm) made another attempt to round the point but no success
4:15 returned to Cape Symth?
8:00 pm keeping lookout for the Ice Pck to move

July 24, 1930 continued

9:30 pm slight improvement we moving out left ice floe
11:15 pm rounding Pt. Barrow running heavy ice slow progress

July 25, 1930

1:30 am clear of the heavy pack C/N 60°T
11:00 am Cape Halket abeam
noon 70°50' 150°52' Dist 100 miles
passing large floes

July 26, 1930

making slow headway floes very large and unbroken
2:00 am sighted Herschel Island. Sometimes it looks like we are stuck for good but we get through foot by foot by backing up and going full speed ahead in the cracks splitting the floes were cracked to star and being a short vessel we can turn easilty Herschel Island

August 3, 1930

4:00 pm left Herschel
6:00 pm moored to large ice floe
8:00 pm proceed heavy ice

August 4, 1930

4:00 am clear of ice C/N20°T
noon 70°00' 132°15'W

August 14, 1930 end

3 pm anchored at Wilmat Island
4:30 pm underway

August 15, 1930

5:00 am drifting ice
9:30 am Cambridge Bay

August 16, 1930

2:30 pm depart Cambridge Bay lots of drifting ice
4:20 pm vessel ran aground on a reef bank, 9 miles from Cambridge Bay

August 17, 1930

vessel still aground lots of ice drifting around

August 23, 1930

underway noon position 68°50' 107°45' ?

August 28, 1930

noon post 70°20'N 134°00'W
4:55 pm encountered heavy ice pack, working our way through the heavy pack ice

August 29, 1930

ice still tightly packed.
3:15 pm __________ at Herschel Island

September 3, 1930

at anchore in Herschel ice filling up the harbor

September 6, 1930

4:00 am left Herschel
4:30 am heavy ice pack
noon 25 miles NE of Herschel Island
123:30 saw open water to north, proceeded manuevering in the ice. Managed to break thru the pack to open water.

September 18, 1930

At winter quarters Two River Tree? True?

September 28, 1930

ice forming around the shore

October 5, 1930

slush ice forming

October 15, 1930

ice forming in the bay all around

October 16, 1930 - off map

proceeded farther in the bay for suitable place to ________________ the ice could hardly break through

October 20, 1930

ice breaking off in large floes and drifting out
11:30 pm ice broke right across the bow and swung around...all the ice in the bay shirfting and in large floes. The shole bay clear of ice in about 30 minutes

October 22, 1930

wind dropped ice forming in the bay

November 7, 1930

the weather getting colder and the ice is cracking like the firing of big guns The Gulf is frozen as far as we can see

December 2, 1930

ice cracking around vessel

December 14, 1930

ice making overflows around ship

Log of Larsen - M/S St. Roch

June 11, 1931

Ice getting rotten around vessel

June 20, 1931

Ice thawed out around the ship

June 24, 1931

ice breaking up all around
6:30 pm pan ice coming down from head of Bay

June 26, 1931

ice coming down on us broke it up be steaming in circles

June 27, 1931

wind forcing ice in the bay
10:43 ice forming; ship forward slow to break up large floes. Ice rotten but tightly packed

July 8, 1931

ice coming in from outside

July 14, 1931

left anchorage for Coppemni

July 15, 1931

3:15 am left Coppermen
7:30 am approaching scattered ice, making slow progress
pm - vessel rocking heavy ice
midnight approached Krusenstern

July 16, 1931

2:00 am off Krusenstern Harbor packed with ice, and ice tightly packed between Larpbert Island and Mainland as far as visible
noon - Bernord Harbor

July 18, 1931

8:20 am underway scattered floe ice
4:00 am Cape Betby abeam

July 20, 1931

3:45 pm left Ballie Island course south 3'W?

July 21, 1931

at midnight got into scattered ice
noon - position 70°8' 133°40'
Pullen Island a beam 15 miles off no ice in sight

July 22, 1931

2:00 am sight Herschel Island got into ice
4:20 pm anchored Bay full of ice, move occasionally to avoid heavy drifting flows

July 23, 1931

Ice melting around vessel

July 24, 1931

anchored at Herschel Island ________ sand spit clear of ice

August 28, 1931

6 pm depart Herschel, toward Baillie Island, heavy ice

August 29, 1931

heading eastward, lots of heavy ice
1:00 pm stopped in heavy ice or fog?
10:00 pm underway clearing a little

August 30, 1931

stopped at midnight - heavy ice
4:00 am underway working thru heavy ice
7:00 am Hooper Island abeam clear of main ice pack
9:00 am Richards Island

August 31, 1931

dig's of ice
11:15 pm vessel anchored at Ballie Island

September 1, 1931

left Ballie Is 7:00 am for Pierce Pt. scattered ice at times

September 3, 1931

3:45 am left Pierce Pt. for Bernard Harbor scattering ice floes
6:25 House St. Eliv's (?) course 55°E steaming along the coast heacing for Bernard Harbor

September 18, 1931

8:45 pm vessel anchored at Tree River

October 22, 1931

Bay covered with mush ice

October 29, 1931

Bay covered with slush ice

November 5, 1931

Bay freezing over

November 6, 1931

Vessel frozen in solid

1932 Winter Quarter Tree River - 1932

<u>April 25, 1932</u>

spring work

<u>April 28, 1932</u>

cut hole in cie - 8 feet thick

<u>June 23, 1932</u>

ice breaking up and moving out of the bay

<u>June 24, 1932</u>

ice moving around end breaking up

<u>June 26, 1932</u>

large ice floe came out from the bottom of the bay and is crossing our bow.

<u>July 17, 1932</u>

Left True river, patches of ice headed to Coppermine

<u>July 19, 1932</u>

1:20 pm Deadman Island
1/03 ? scattered ice
4:00 pm off Krusenttern, ice heavyily packed lots of ice
11:30 pm not clear of ice

<u>July 20, 1932</u>

(early 20th) Entered into heavy pack ice making slow progress
12:57 unable to make headway until ice slackens up
1:50 pm resumed movement, slow progress, very large floes
8:00 pm stopped

<u>July 21, 1932</u>

1:45 am ice slackened underway
2:00 am stopped by ice
4:20 started
4:50 stopped between flows
7:50 ice slackened
1:50 pm Bernard Harbor - 122 miles for True River
Ice drifing in and filling up the harbor

July 22, 1932

waiting for ice to improve
7:45 am changed post to avoid drifting ice floes rough sea ice in the Gulf on the move outward

July 26, 1932

1:45 am Wise Pt abeam
8:00 am moored to large ice floe near shore
11:50 pm Erachets River abeam scattered ice

July 27, 1932

scattered ice
noon - moved to an ice floe heavy ice floes in the vicinity

July 28, 1932

5:55 am left Prince Point, scattered ice floes
1:20 pm heavy ice
1:40 stopped - 2:10 underway - 3:10 stopped heavy ice
4:20 underway
7:40 Booth Island abeam Course S45°W?
8:00 pm scattered ice

July 30, 1932

left Ballie Island - heading to Herschel Is. course S32°W?

Setpember 4, 1934

6:35 pm left Herschel for Vancouver
7:30 pm coasting inside ice pack
10:00 pm course S 70°W

September 5, 1934

day begins near or with __________ ____________ ice floes
6:00 am course S 60°W
10:00 am course S75°W
noon 70°13' 142°40'W, 85 miles from Herschel Is.
5:40 p.m. course S60°W

September 6, 1934

noon 70°44'W 148°35° - 123 miles from Herschel
6:00 pm passed ice shore south side

September 7, 1934

course S 80°W

September 8, 1934

anchored at Wainwright

June 25, 1935

new voyage to __________

July 9, 1935

Dutch Harbor

July 14, 1935

5.25 Cape Prince of Wales

July 16, 1935

9:40 pm Icy Cape Abeam course N31°E

July 17, 1935

8:45 am encountering heavy ice pack proceeded to work out way in shore.
Ice condition fairly good position at noon 71°03' 157°17'
3:00 pm Cape Symth abeam
4:00 pm at Point Barrow, ice conitions not so good. stopped. At Pt. Barrow watching movement of the ice M/S Patterson returning after attempt to get through.
4:30 proceeded to anchorage inside the Point

July 18, 1935

Watch kept on deck to look out for ice.
4:30 am ice in vicinity looks improving left Pt. Barrow and proceeded to work our way around
8:35 shut down awaiting ice pressure to diminish. 5 1/2 fathoms.
Ice all floe ice large unbroken floes which makes it bad for navigation through with engine... Trouble with clutch heating up.
9:50 working in ____________ open leads
12:00 position about 15 miles northeast of Pt. Barrow.
3:07 pm ahead slow in easterly direction
8:30 pm moved from ice pack to open water to await better conditions
9:05 anchored to ice floe
9:15 broke adrift
9:50 moored to ice, drifting SSW

July 19, 1935

drifting with ice pack
4:50 am ice closing in. Left and moved vessel to better position
2:30 moored to ice floe
4:00 pm working through heavy ice
9:30 pm lead closed up working inshore to shallow water. Unable to proceed moored to ice floe. 4 fathoms

July 20, 1935

still moored to ice. No change in ice conditions. Ice solid all around.
No opportunity to go inside ice is (connected to the sand bar).
Position 71°18' 155°00'W

July 21, 1935

still moored to ice no improvements
12:30 left ice floe making our way east to see if any better changes to get Ice ___________ (closed) no sign of lead.
1:30 pm moorved to ground ice.

July 22, 1935

moored to ice. Ice drifting by. Aroun dnoon clearing a little. No propsect of getting through as far as we can see. If ice does not move offshort. This certainly is a very trying experience as we do not know whether we are going to get caught and be set off shore or be crushed by ______________ ice floes
3:00 pm changed to other side of ice floe lots of drifting ice passing. No sign of opening up.

July 23, 1935

moored to ice floe during forenoon ice commenced leaving the shore working our way to shore. Lead going continuoulsy but only 25 fathoms
2:15 pm Cape Sim passed working back to East x ESE large unbroken floes covered with mud and dirt not very thick, but oo heavy for our ship to break through Furthermore we being handicapped by clutch (broken)
5.5 pm unable to proceed ice too heavy drifting ice.
8:15 pm started to work our way off short to deeper water. Ice very little but too jammed together for us to break (worked) our way to 4 1/2 fathoms

July 24, 1935

working our way offshore
0:55 all leads closed, drifting in ice
4:05 SE breeze work our way to shore open water can be seen 5-6 miles away Managed to break our way to within 3-400 yds from open water.. and increased which causes the ice to press together and causes lots of pressure on the vessel. Made approx 50 mile since July 20 est post 70°55' 152°55'
1-2 pm tremendous pressure on vessel, unable to determine if any damage.

July 25, 1935

ship still held by the ice, drifting along, pressure not so strong attempted to get free but so far unable
10:30 am working our way slow in shore to 2.5-3 fathoms. Ice in large sheets covered with ___________ mud which makes it appear as open water in the distance
3:00 pm (Cape Halket abeam)

July 26, 1935

Working leads to the eastward. Position at noon of Colville River 70°38' 150°50'
7:15 tied up to an ice floe

July 28, 1935

3:45 am left Ice floe, heading back to westward
5:00 tied up to ice floe drifting easterly
9:05 left ice floe, proceeding NE
10:25 tied up
11:05 left floe heading SW
12:55 working in closely packed ice to eastward
5:30 Jones Islands
7:40 pm have to at Busby Point
7:50 underway NE direction
9:05 caught in 2 foes ground ice
10:40 ship free

July 28, 1935

working through ice NE dir
4:00 heavy ice (grounded a few times)
9:06 pm Brownles Point stopped

July 29, 1935

Working ice to eastward close inshore
7:00 am Barter Island ice packed close to shore. Working our way close to beach in 3 fathoms
8:30 am sandspit clear of Barter Island working way eastward inside of Bressum Brissum? Ridge Monning Point heavy ground ice. ageam of Griffin Point
70°70' 142°50'
distance 1750 to work ice ?

July 30, 1935

drifting with ice between Griffin and Humphrey Points
5:40 pm ice clearing away proceeded eastward steaming fairly good but ice heavy

July 31, 1935

00:20 abeam of Denareatrum Point ice
6:00 am proceeded eastward
6:45 tied up to ice floe heavy ice to the shore

August 1, 1935

still moored to grounded ice impossible to move in any direction.

NORTHLAND

July 24, 1929

1045 - Underway 45°T to move closer to shore
1110- Anchored - Cape Blossom 316°T
1910 - Underway 283°
2214 - C/C 316°
2312 - C/C 313°

July 25, 1929

0239 - C/C 322°
0710 - C/C 327°
0800 - 67.38/165.16
1200 - 68.01/165.58
1241 - Cape Thompson abeam to starboard, 6.2 mi.
1358 - Point Hope - 253°T
1450 - C/C 333°
1515 - Anchored Pt. Hope - 289°T

July 26, 1929

1155 - Underway 250°T
1200 - 1/2 mi. S. - Pt. Hope
1207 - C/C 230°
1213 - Pt. HOpe bearing 0°, C/C 271°
1321 - C/C 1°
1414 - C/C 40°
1647 - C/C 90° - Stood into Cape Dyer
1750 - C/C 11° - Stood along coast to Cape Lisburne
1808 - C/C 20°
1840 - C/C 3°
1957 - Cape Lisburne abeam to stbd 3.5 mi. Var. courses around Cape Lisburne.
2044 - C/C 90° - Cape Lisburne 180°T
2049 - C/C 45°

July 27, 1929

0000 - Course 44°T
0635 - C/C 91°T
0738 - C/C 70° sighted Pt. Lay
0747 - C/C 46°
0800 - 69.50/163.00, Course 46°
0830 - C/C 37°
1020 - C/C 1°
1055 - C/C 325°
1130 - C/C 15°
1138 - C/C 46°
1200 - 70.12/162.40, C/ 46° through scattered ice
1315 - C/C 37°
1333 - Steering various courses around ice field in northeasterly direction
1500 - Icy Cape bearing 155°, 9 mi., C/C 73° (No ice in sight to northward)
1930 - Wainwright 138°T, 5.6 mi.
2000 - 70.40/160.00
2030 - Anchored Wainwright - 125°T

July 28, 1929

1145 - Underway 17°
1227 - Drift ice
1330 - C/C 40°
1350 - C/C 68° working through field ice
1600 - Working thru field ice.
1800 - Working thru field ice.
1830 - C/C 85°
1900 - C/C 70°
1935 - C/C 60°
1952 - C/C 55°
2000 - 71.15/156.55
2003 - C/C 45°
2110 - Anchored Barrow - 124°

July 29, 1929

0800 - At anchor, shirfting location to avoid drifting ice field.
1315 - Underway clearing ice enclosing anchorage
1335 - C/ 225°
1620 - C/C 263° - Working through field ice latter part of watch
1800 - C/ 263° thru scattered ice.
1807 - C/C 271°
1837 - Sea Horse Is. abeam to port 6.3 mi., C/C 255°
1952 - C/C 235°
2000 - 70.52/159.10 - 235° through scattered ice
2250 - Anchored Wainwright - 139°

July 30, 1929

1055 - Underway 340°
1200 - 70.50/159.50
1230 - Var. courses thru scattered ice
1400 - Stopped - secured to field ice
1600 - Var. C & S through ice
1740 - C/C 180°
1900 - C/C 185°
1955 - Anchored Wainwright - 133°T
2300 - Underway 335°
2324 - C/C 240°

July 31, 1929

0130 - C/C 271°
0800 - 70.33/163.33
1050 - Ice to northward
1200 - 70.39/165.15
1547 - C/C 270°
1645 - Encountered heavy ice
1735 - Clear of ice, C/C 225°
1815 - Scattered ice - C/C 180°
1937 - C/C 130°
1955 - C/C 145°
2000 - 70.30/167.07 - Var. courses along edge of ice pack (Gen. SW course)

Northland

July 23, 1930

0001 - C/ 336°T
0323 - C/C 40°
0405 - Anchored - village 40°T
0829 - Underway 338°
0920 - C/C 328°
0937 - C/C 313°
1010 - Anchored Kivalina 30°T, 2350 yds.
1236 - Underway 295°
1246 - C/C 305°
1330 - C/C 315°
1451 - Cape Seppings abeam to stbd, 3.5 mi.
1558 - Cape Seppings 109°T, 9.5 mi.
1643 - C/C 298°
1801 - Cape Thompson abeam 2.5 mi.
1810 - C/C 323°
1943 - C/C 298°
2005 - C/C 288°
2050 - C/C 323°
2055 - C/C 333°
2100 - Anchored Pt. Hope - 20°T

July 24, 1930

2250 - Underway 208°
2300 - C/C 225°
2305 - C/C 250°
2306 - Pt. Hope bearing 4°T, C/C 270°

July 25, 1930

0052 - C/C 0°
0258 - C/C 34°
0555 - Cape Lisburne abeam 14.5 mi.
0656 - C/C 118°T
0800 - 68.58/166.10
0945 - C/C 90°
1118 - C/C 175°
1200 - 69.00/164.70
1216 - Anchored Corwin Coal Mine - 217°
1610 - Underway 59°
1632 - C/C 71°
1702 - C/C 54°
1730 - C/C 33°
2000 - 69.18/164.00
2312 - Anchored Pt. Lay 40°T, 15.0 mi.

July 26, 1930

0655 - Underway 33°T
0700 - C/C 89°
0714 - C/C 69°
0736 - C/C 33°
0740 - C/C 9°
0750 - C/C 19°
0800 - 69.45/163.00
0840 - C/C 30°

July 26, 1930 continued

0905 - Anchored Pt. Lay 96°T
1617 - Underway 269°
1625 - C/C 0°
1725 - C/C 30°
2000 - 70.16/162.30
2145 - C/C 0°
2318 - C/C 84°

July 27, 1930

0411 - C/C 44°
0430 - C/C 65°
0505 - Anchored Wainwright - 141°

July 28, 1930

0010 - Underway 0°T
0026 - C/C 43°
0114 - C/C 19°
0134 - C/C 43°
0148 - C/C 65°
1345 - Sea Horse Is. abeam
0411 - C/C 80°
0524 - C/C 70°
0651 - C/C 59°
0730 - C/C 41°
0757 - C/C 34°
0800 - 71.23/156.30 - NE thru drift ice
0920 - Anchored Pt. Barrow - 142°T
2130 - Underway 224°
2300 - Working thru field ice

July 29, 1930

0030 - Ou course 223°
0155 - C/C 270°
0305 - Var. speed & courses thru scattered ice
0428 - C/C 260°
0445 - C/C 250°
0522 - C/C 240°
0530 - C/C 230°
1638 - C/C 235°
0715 - C/C 244°
0735 - C/C 230°
1746 - C/C 220°
0756 - C/C 225°
0800 - 70.45/159.45
0843 - C/C 180°
0857 - C/C 203°
0910 - Anchored Wainwright - 143°
1209 - Underway 330°
1352 - Entered ice field
1625 - Heading var. courses out of ice

July 29, 1930 continued

1810 - C/C 130°
1902 - C/C 140°
1918 - C/C 150°
1952 - C/C 155° - Wainwright 154°, dist. 5 mi.
2000 - 70.45/160.00
2015 - C/C 160°
2040 - Anchored Wainwright 140°T

July 30, 1930

0235 - Underway 299°
0247 - C/C 260°
0800 - 70.35/162.05
1022 - C/C 213°
1200 - 70.22/163.20
2000 - 69.28/165.00
2350 - Anchored Cape Lisburne

July 31, 1930

0515 - Underway 256°
0747 - Cape Lisburne abeam to port - 10.8 mi. C/C 201°
0800 - 69.02/166.14 - C/C 231°
0820 - C/C 199°
0908 - C/C 184°
1200 - 68.30/166.30
1232 - C/C 219°
1357 - Anchored N. side Pt. Hope - 106°T

August 1, 1930

0001 - Underway 140°
0800 - 67.27/165.00
1200 - 67.05/164.10
1420 - C/C 129°
1458 - Cape Krusenstern 38°T, 13.0 mi.
1730 - C/C 94°
1813 - C/C 74°
1840 - C/C 59°
1910 - Anhcored Kotzebue 28°T, Cape Blossom 108°T

August 2, 1930

0435 - Underway 154°T
0732 - C/C 140°
0800 - 66.24/162.17 - C/C 147°
0820 - C/C 134°
0845 - C/C 120°
0915 - C/C 100°
0919 - C/C 93°
0947 - Anchored Chamisso Is. - 167°T, Puffin Is. 220°T

August 1, 1931

0515 - Underway 32°
0740 - C/C 20°
0745 - Sighted ice to N.
0756 - C/C 358°
0800 - 70.15/162.29
0830 - C/C 293°
0910 - C/C 228°
0932 - C/C 200°
0956 - Anchored 70.08/162.58
1200 -

August 2, 1931

1102 - Underway 188° - Ice field drifting across bow
1200 - 70.09/162.59
1208 - Anchored 70.08/162.59
1349 - Underway 195°
1627 - C/C 123°
1700 - Anchored Pt. Lay - 98°, 3250 yds.

August 3, 1931

0408 - Underway 270°
0419 - C/C 30°
0800 - 70.12/162.26, C/C 30°
0925 - Anchored Icy Cape - 83°, 5 mi.

August 4, 1931

0414 - Underway 358°T
0430 - Scattered ice (edge of field), westerly course at edge of field.
0640 - C/C 238° - following ice edge
0641 - C/C 253°
0705 - C/C 280°
0733 - C/C 233°
0800 - 70.16/162.37
0815 - C/C 227°
0826 - C/C 258°
0844 - C/C 163°
0855 - C/C 238°
0914 - C/C 300°
0941 - C/C 350°
0958 - C/C 358°
1035 - C/C 30°
1052 - C/C 50°
1200 - At anchor - 70.23/162.52

August 5, 1931

0728 - Underway
0800 - 70.20/163.02
0813 - C/C 180°
0912 - C/C 120°
0941 - C/C 63°

August 5, 1931 continued

1111 - Working thru scattered ice - C/ 358°
1200 - 70.19/162.24
1300 - Steering to clear ice
1400 - Anchored Icy Cape
1430 - Underway 138°T in scatered ice
1540 - Steering 223° field
1600 - Working SW in ice
1605 - Clear of ice field - C/ 223°
1625 - Anchored

August 6, 1931

0900 - Underway 133°
0916 - Ice Cape bearing 84° - C/C 118°
0946 - Anchored Icy Cape - 68°
1140 - Underway 313°
1200 - 70.22/162.04
1230 - C/C 0°
1245 - C/C 45°
1308 - C/C 60°
1349 - C/C 73° to clear edge of ice field
1419 - C/C 203° to avoid extensive ice field
1535 - Underway C/ 135° to clear drifting ice field
1557 - Anchored
1835 - Underway 32° - into loose ice
1913 - C/C 338°
1917 - Var. courses thru scattered ice
1934 - C/ 188°
2000 - 70.33/161.37 - C/C 205°
2010 - C/C 208°
2036 - Anchored - Icy Cape 198°

August 7, 1931

1247 - Underway 133°
2242 - C/C 158°
2256 - Anchored - Icy Cape 256°

August 8, 1931

0800 - 70.24/161.16
1200 - 70.38/161.13
1602 - Underway 0°
1630 - C/C 52°
1800 - C/ 52° M.S. Patterson in sight in ice
1837 - Lights "Bay Chimo" bearing 64 1/2°T
2000 - Anchored - 70.34/160.35

August 9, 1931

0740 - Underway 218°
0743 - Working inshore thru scattered ice.
0800 - 70.31/160.36 - Working thru field ice
0835 - Clear of ice field

August 9, 1931 continued

0845 - C/C 232°
0922 - C/C 203°
0931 - C/C 67°
1018 - C/C 53° - Thru drift ice
1132 - C/C 43°
1155 - C/C 8°
1200 - 70.35/160.13
1209 - C/C 53° - working thru lead in ice field.
1250 - C/C 88°
1320 - Anchored Wainwright - 134°

August 10, 1931

0543 - Underway thru scattered ice to NW
0630 - Anchored Wainwright - 92°
0704 - Underway thru scattered ice to NW
0726 - Anchored Wainwright - 101°
1200 0 70.40/160.10

August 11, 1931

1241 - Underway - 73°
1425 - C/C 225°
1632 - Anchored Wainwright - 150°

August 12, 1931

1241 Underway - 45°
1535 - C/C 65° - Pt. Belcher bearing 177°
1616 - S. S. Ray Chimo sighted in ice, bearing 86°T
1625 - Var. coruses along ice floes.
1643 - C/C 293°
1702 - C/C 268°
1717 - C/C 258°
1723 - C/C 243°
1755 - C/C 231°
1800 - Position 3.7 mi., 5°T Pt. Belcher courses W and S at edge of ice field
2000 - 70.49/160.00 - 13.8 mi., 278°T Pt. Belcher - Heading 273°
2006 - C/C 150°
2100 - Anchored Wainwright - 173°

August 13, 1931

0800 - 70.46/159.30
1052 - Underway var. courses
1130 - C/ 258°
1143 - C/C 248°
1200 - 70.44/160.00
1222 - C/C 258°
1707 - C/C 285°
1723 - C/C 258°
1852 - C/C 235°
2000 - 70.30/162.36, C/C 215°

August 14, 1931

0500 - C/C 215°
0714 - Cape Lisburne bearing 230°
0800 - 69.13/165.06
1200 - 68.57/165.30
1222 - C/C 231°
1243 - C/C 196°
1315 - Anchored Cape Lisburne - 142°
2020 - Underway 356°
2040 - C/C 76°
2140 - C/C 86°
2150 - C/C 96°
2218 - C/C 126°
2222 - C/C 181°
2241 - Anchored - no landmarks visible

August 15, 1931

Anchored Corwin Coal Mines

August 16, 1931

0410 - 315°
0416 - C/C 286°
0441 - C/C 276°
0520 - C/C 266°
0534 - C/C 256°
0540 - C/C 246°
0614 - Anchored Cape Lisburne - 277°
0800 - 68.54/165.40
2000 - 68.58/165.25 - C/ 43°
2202 - C/C 34°

August 17, 1931

0405 - C/C 68°
0630 - C/C 32°
0729 - C/C 27°
0800 - 70.09/162.33
1200 - 70.40/161.45
1229 0 C/C 83°
1600 - Wainwright bearing 73°, 7.7 mi.
1613 - C/C 77°
1639 - C/C 52°
1654 - Pt. Belcher abeam to stbd 2.3 mi.
1700 - C/C 65°
1731 - C/C 265°
1755 - C/C 65°
1858 - C/C 75°
1942 - Anchored Pt. Franklin - 169°, 4 mi.
2000 - 70.58/158.39

August 18, 1931

1003 - Underway 75°
1021 - C/C 90°
1049 - C/C 136°
1131 - C/C 312°
1149 - C/C 314°
1200 - 70.56/158.14
1220 - C/C 270°
1316 - C/C 255°
1320 - C/C 270°
1337 - Anchored Sea Horse Is. - 146°
1542 - C/ 255°
1643 - Anchored Sea Horse Is. - Pinoshuvagin - 140° Atanik - 226°
2000 - 70.55/158.55

August 19, 1931

1835 - C/ 75°
1930 - C/C 90°
1947 - Sea Horse Is. - 196°, 5.7 mi.
1949 - C/C 130°
1955 - C/C 155°
2000 - 70.57/158.15
2005 - Anchored Sea Horse Is. - 226°, 5.5 mi.

August 20, 1931

0419 - C/ 160°
0442 - C/C 120°
0520 - C/C 90°
0544 - Stopped in close pack ice.
0553 - C/ 250°
0608 - Anchored E. end Peard Bay
0748 - C/ Shifting anchorage to clear ice floes.
0800 - Anchored - 70.54/157.52
0837 - Shifting to clear ice field.
0847 - Anchored - Sea Horse Is. - 272°
1307 - Underway thru scattered ice.
1414 - Anchored Skull Cliff - 197°, 3 mi.
2000 - 70.56/157.40

August 21, 1931

0624 - C/ 75°
0632 - C/C 70°
0641 - C/C 60°
0728 - Underway in loose ice - C/ 50°
0800 - 71.03/157.30
0801 - Anchored due to unfavorable ice conditions.
0830 - Underway NE thru ice fields.
0848 - Anchored - unfavorable ice conditions
1228 - Underway thru ice - 45°
1245 - Reindeer Camp - 120°
1548 - Anchored Barrow - 208° - In ice.

August 22, 1931

0048 - C/ 225° thru scattered ice field.
0205 - Reversed course - complete ice blockage to beach. No open water in sight.
0318 - Anchored Barrow
0945 - C/ 225° thru scattered ice.
1200 - 71.07/157.05 - Working in cie, SW
1225 - Clear of ice - C/ 226°
1300 - C/C 231°
1353 - C/C 245°
1448 - C/C 286°
1538 - C/C 328°
1605 - C/C 270°
1643 - Sea Horse Is. - 153°, C/C 255°
1724 - C/C 245°
1822 - Village of Atavik - 155°, 3.3 mi.
1906 - Pt. Belcher - 155°T, 3.7 mi. - C/C 215°
2000 - 71.02/167.45
2042 - C/C 200°
2101 - Anchored Wainwright - 135°

August 23, 1931

1131 - C/ 315°
1147 - C/C 264°
1200 - 70.42/168.00
1644 - C/C 219°
2000 - 70.17/162.49

August 24, 1931

0648 - C/C 202°
0653 - C/C 218°
1622 - Cape Lisburne - 231°, C/C 255°
0800 - 68.57/165.52 - Cape Lisburne - 215°, 7.2 mi.
0843 - Cape Lisburne abeam to port - 4.6 mi.
0846 - C/C 180°
0917 - C/C 185°
0918 - Cape Lisburne - 90°, 2 mi.
1130 - C/C 207°
1200 - 68.30/166.30
1225 - C/C 230°
1319 - C/C 205°
1330 - Anchored Pt. Hope - 111°

August 25, 1931

1330 - Underway C/ 124°
1611 - C/C 131°
1700 - C/C 123°
1726 - Anchored Cape Thompson
2035 - C/220°
2154 - C/C 145°

July 26, 1931

0001 - C/ 319°
0030 - C/C 270°
0100 - C/C 319°
0640 - C/C 150°
0934 - C/C 330°
1225 - C/C 319°
1609 - C/C 297°
1617 - C/C 202°
2016 - C/C 167°

July 27, 1931

0225 - C/C 319°
0335 - C/C 347°
0600 - Right Tangent Cape Thompson - 80° C/C 0°
0653 - Village of Tigara - 341°, C/C 345°
0713 - C/C 327°
0750 - Pt. Hope 0.7 mi.
0833 - Anchored Pt. Hope - 174°T

July 28, 1931

0140 - Underway
0400 - C/ 210°
0412 - C/C 180°
0435 - C/C 135°
0500 - C/C 97°
0531 - C/C 77°
0631 - Anchored S. Pt. Hope - 0°, 2100 yds.

July 29, 1931

0538 - New anchorage N. Pt. Hope - 181°, 1220 yds.

July 30, 1931

1305 - Underway 337°
1730 - C/C 17°
1800 - Cape Lisburne - 66°T, 18 mi.
1805 - C/C 32°
1920 - C/C 55° - Cape Thompson - 106°, 11 mi.
2000 - 68.57/166.25

July 31, 1931

0445 - C/C 93°
0540 - C/C 18°
0600 - Pt. Lay - 50°
0655 - Pt. Lay - 137°, 4 mi.
0709 - Anchored Pt. Lay - 148°
0800 - 69.56.02

NORTHLAND

August 1, 1932

0800 - Pt. Hope - at anchor
1045 - Underway 180°
1108 - C/C 127 °
1200 - 68.13/166/32
1324 - Cape Thompson 101° - C/C 95°
1355 - C/C 305°
1604 - C/C 325°
1725 - Anchored Pt. Hope
2000 - 68.22/166.45 - C/ 8°

August 2, 1932

0157 - Cape Lisburne - 115°, 10.5 mi. - C/c 53°
0800 - 69.24/164.50
1001 - C/C 65°
1200 - 69.40/163.30
1248 - C/C 55°
1300 - C/C 40°
1514 - Anchored Pt. Lay - 138°

August 3, 1932

Anchored Pt. Lay

August 4, 1932

0635 - Underway to new anchorage 127°, 2750 yds
1815 - Underway 295°
1940 - C/C 300°
2000 - 69.46/163.15

August 5, 1932

0150 - C/C 280°
0345 - Sighted small pieces of ice
0555 - C/C 120°
0720 - C/C 124° - Small pice of ice sighted
0800 - 69.46/163.20
0918 - Anchored Pt. Lay
1044 - Underway 314°
1145 - C/C 38°
1200 - 69.50/163.15
1415 - Passing thru drift ice
1453 - C/C 25° to avoid large pieces of ice
1540 - C/C 17° p.g.c.
1552 - C/C 14° p.g.c.
1600 - C/ 38°T thru scattered ice
1700 - C/C 355°

August 5, 1932 continued

1850 - Drift ice getting heavier
1905 - C/C 199°
2000 - 70.25/162.00 - C/ 200°
2020 - Reduced speed thru field ice
2038 - Icy Cape 125°, 7.0 mi.
2042 - Stopped engine, preparing to anchor at edge of ice field.
Icy Cape 117°, 7.5 mi.

August 6, 1932

0620 - Underway C/ 10°
0645 - Quartering NE thru heavy field ice
0800 - 70.30/161.45 - thru field ice
1200 - 70.32/161.00 - Heavy drift ice to E
1320 - Following leads to W
1505 - Icy Cape - 260°, 10 mi.
1600 - Standing thru drift ice - vic. Icy Cape
1654 - Anchored Icy Cape - 179°, 4450 yds
2034 - Underway C/a 70°
2101 - C/C 20° - Working around Blossom Shoals
2355 - Anchored Icy Cape - 103°, 7 mi.

August 7, 1932

0400 - Anchored Icy Cape - Awaiting improvement in ice condition
0800 - 70.23/162.00
0840 - Ice getting heavier
1100 - Ice pan caught on bow causing anchor to drag
1110 - Underway to clear ice pan
1115 - C/ 235° thru drift ice
1200 - 70.20/162.05 - drift ice
1325 - C/C 135°
1405 - Anchored Icy Cape - 144°, 5 mi.
2000 - 70.12/.62.30
2156 - Underway 42°
2232 - C/C 35°

August 8, 1932

0001 - C/ 35° - Scattered ice
0030 - C/C 15° - Scattered Ice
0118 - C/C 60°
0400 - Scattered field ice
0415 - C/C 80°
0500 - C/C 110°
0600 - C/C 125°
0700 - Cleared of ice field - C/ 80°
0800 - 70.28/160.45
1200 - Anchored Wainwright - 133°

August 9, 1932

0930 - Underway 0°
0942 - C/C 45°
1107 - C/C 65° thru scattered ice - Pt. Belcher to stbd 2 mi.

August 9, 1932 continued

1200 - 70.54/159.05 - drift ice
1245 - C/C 75°
1250 - C/C 90°
1419 - C/C 245° - Heavy field ice, no leads
1636 - C/C NNW
1717 - C/C 70°
1721 - C/C 250°
1759 - C/C to S - working thru ice
1800 - C/ S thru ice
1815 - C/ 250° in slack ice
1845 - Anchored - Pt. Belcher 223°
2000 - 70.55/159.03 - Heavy drift ice

August 10, 1932

0545 - C/ 0°
0613 - In pack ice, C/ 65°
0730 - C/C 70° in slack field ice
0800 - 7100/159.20 - C/80°
0808 - C/C 65°
0840 - Working thru heavy drift ice. NE
0908 - Radio compass bearing Barrow 71°
0920 - C/C 250° no leads in field ice
1115 - RC bearing Barrow 69°
1200 - 70.52/159.40 - in ice C/C 125°
1247 - Anchored 5 mi. NE Pt. Belcher
2000 - 70.50/159.35

August 11, 1932

0605 - C/ 0°
0638 - C/C 30°
0715 - Thru slack field ice to N
0800 - 71.00/159.35 - N x NW
0912 - RCb Barrow 68°
1039 - Clear of heavy ice - C/ 65° in light ice
1150 - C/C 74°
1200 - 71.08/158.25
1506 - Barrow - 60° - C/C 60°
1533 - C/C 55° - scattered ice
1640 - Anchored Barrow

August 12, 1932

0250 - C/ 250°
0615 - C/C 255°
0630 - C/C 270°
0645 - C/C 260°
0700 - C/C 250°
0755 - C/C 200° - slack ice
0800 - 71.05/159.05 - heavy ice
0855 - Out of ice
1007 - Pt. Belcher abeam to port, 2 mi. - C/C 225°

August 13, 1932

Anchored Wainwright

August 14, 1932

3:29 p.m. anchored off Blossom Shoals

August 15, 1932

2:05 depart
5:00 p.m. anchored Icy Cape

August 17, 1932

7:24 Pt. Lay

NORTHLAND

July 24, 1933

3:10 p.m. anchor at Wales Ak.

July 27, 1933

8:00 p.m. 76°35' 166°35' C/ 352°T
10:53 sighted image of village of Pt. Hope C/C 15°T
11:36 C/C 25°T
11:50 entering scattered ice off village of Pt. Hope

July 28, 1933

12:45 departed Pt. Hope C/239°T
1:02 Pole (North)? near point 24°T C/C 339°T
1:12 Pole 94°T C/C 24°T1:23 Pole 154°T C/C 15°T
5:2] C/ 53°T
5:55 entering slack ice
7:10 C/ 82°T
8:00 a.m. 69°07' 165°33" commenced steering vc through scattered ice floes
12:00 69°08' 164°15' vcs through scattered ice to north and eastward
4:00-6:00 vcs working through scattered ice to northward
5:30 p.m. sighted Pt. Lay
6:00 p.m. vcs thru scattered ice to northward
7:50 approaching ice pan to anchor
8:00 p.m. 69°51'N 163°08'W
8:05 anchored to large ice floe P.t Lay village 163°T

July 29, 1933

8:00 a.m. 60°53' 163°08'W anchored to ice pan
10:10 depart south breaking ice for SS Anyox
12:00 69°48' 163°11'W
12:00-4:00 breaking a lead vcs fro SS Anyox
4:00-6:00 vcs standing to southward and westward opening in lead for Anyox
8:00 p.m. 69°04' 164°19'W standing to southwestward through scattered ice.

July 30, 1933

mid - 4:00 a.m. vcs thru ice
1:40 stopped Anyox continued alone to Port Clarence (end of ice at this pt)?
12:00 68°54'N 165°46'W anchored (near Cape Lisburne)
9:00 p.m. depart C/352°T
9:20 C/C 276°T
11:00 p.m. Cape Lisburne 142°T? 4.9 miles C/C 198°T

July 31, 1933

12:14 a.m. C/C 193°T to avoid ice
5:55 a.m. anchored at Pt. Hope

August 9, 1934

000 - Underway 18°T
0001 - C/C 54°T - Cape Lisburne bearing 146°T, 5 mi.
0749 - Pt. Lay bearing 83°T, 3.9 mi., C/C 10°T
0800 - 69.45/163.08
0852 - C/C 31°T
1200 - 70.23/162.16
1250 - C/C 86°T
1700 - Anchored Wainwright - 144°T
2000 - Underway 330°T
2220 - C/C 44°T
2340 - C/C 64°T

August 10, 1934

0003 - C/C 50°T
0031 - C/C 64°T
0209 - C/C 90°T
0315 - Scattered ice
0500 - C/C 40°T
0600 - C/C 30°T
0750 - Anchored Barrow - 67°T
1410 - Underway 218°T
1600 - C/C 205°T
1650 - Anchored Sinaru - 120°T
1750 - Underway 270°T
1800 - Passing through thinly scattered ice
1830 - Passed last ice
2000 - 71.03/158.12
2205 - C/C 235°T

August 11, 1934

0010 - C/C 255°
0110 - C/C 225°
0305 - Anchored Wainwright - 145°
1650 - Underway 300°
1824 - C/C 325°
2000 - 70.58/160.41
2200 - C/C 152° //No indication of ice//

August 12, 1934

0215 - C/C 90°
0250 - Anchored Wainwright - 120°
0950 - Underway 259°
1200 - 70.37/160.40
1556 - C/C 205°T
1643 - Icy Cape - 109°T, dist. 10.8 mi., C/C 208°
2000 - 70.02/162.53
2126 - C/C 192°
2205 - Anchored Pt. Lay - 123°, 2300 yds

August 13, 1934

2345 - Underway 229°

August 14, 1934

0430 - Cape Lisburne 238°, dist. 37 mi. C/C 238
0600 - C. Lisburne 240°T, 22 mi. C/C 242°
0653 - C. Lisburne 239°, 12 mi. C/C 262°
0756 - C. Lisburne abeam 3.6 mi., C/C 231°
0800 - 68.54/166.13
0828 - C/C 199°, C. Lisburne 90°, 5 mi.
1040 - Pt. Hope 184°
1120 - C/C 180°
1210 - Anchored Pt. Hope - 270°

August 15, 1934

1530 - Underway 145°
1630 - C/C 135°
1742 - C/C 125°
1800 - C/C 124°
1840 - C/C 142°
1915 - Anchored Cape Thompson - 105°

August 16, 1934

1910 - Underway 205°
1948 - C/C 135°
2000 - 68.02/165.48
2220 - C/C 122°
2322 - C/C 90°

August 17, 1934

0007 - C/C 126°
0025 - C/C 50°
0045 - Anchored
0640 - Underway 145°
0730 - C/C 140 °
0800 - 67.45/164.56
0845 - Anchored Kivalina -32°, 2300
1645 - Underway 180°
1750 - C/C 152°
2000 - 67.20/164.32
2105 - C/C 155°
2217 - C/C 142°

August 9, 1935

0000 - Anchored off Kotzebue
1300 - Underway 190°T
1315 - C/C 270°T, Cape Blossom bearing 90°T
1535 - C/C 328°T
1716 - Cape Krusenstern abeam to starboard 3 1/2 mi.

August 10, 1935

0000 - C/C 285°T
0050 - C/C 303°T
0335 - C/C 323°T
0700 - Anchored Point Hope - 20°T

August 11, 1935

Anchored Pt. Hope

August 12, 1935

0427 - Underway 250°T
0435 - C/C 320°T
0450 - C/C 10°T
0500 - Pt. Hope light 135°T, dist. 1 mi.
0800 - 68.49/166.20
0835 - Cape Lisburne abeam to starboard 5.1 mi.
0850 - C/C 54°T
1200 - 69.13/165.14
1641 - C/C 59°T
1700 - C/C 68°T
1742 - C/C 123°T
1810 - Anchored Pt. Lay, 123°T, 1850 yds

August 13, 1935

0710 - Underway 303°T
0800 - 69.50/163.20, C/C 31°T
1200 - 70.24/162.20
1300 - C/C 77°T
1615 - C/C 90°T
1735 - Anchored Wainwright - 133°T

August 14, 1935

0410 - Underway 330°T
0435 - C/C 44°T
0603 - C/C 64°T
0800 - 7058/158.37
0830 - Scattered ice
1000 - C/C Var. working NE along coast
1120 - Clear of ice. Sinaru bearing 145°T dist. 3 mi, C/C 37°T

August 14, 1935 continued

1200 - 71.21/157.10
1225 - Working scattered ice, approaching Barrow
1310 - Anchored Barrow - 67°T
2050 - Underway 242°T
2103 - C/C 220°T
2205 - Scattered Ice
2245 - Clear of ice
2305 - Sighted Sinaru shelter cabin 122°T dist. 4.2 mi.
2330 - C/C 235°T

August 15, 1935

0000 - C/C 275°T
0030 - C/C 285°T
0205 - C/C 245°T
0435 - C/C 223°T
0608 - C/C 132°T
0650 - Anchored Wainwright - 130°T
1755 - Underway 256°T
70.38/160.29
2338 - C/C 272°T

August 16, 1935

0008 - C/C 256°T
0115 - C/C 208°
0800 - 69.52/163.08, C/C 123°
0917 - C/C 218°
0927 - C/C 208°
0937 - C/C 198°
0950 - C/C 188°
1010 - C/C 120°
1012 - Sighted Naokok
1040 - C/C 1°
1113 - C/C 341°T Sighted Pt. Lay
1150 - C/C 2°T
1200 - 69.40/163.15
1300 - Anchored Pt. Lay - 111°T, 2300 yds

August 17, 1935

1810 - Underway 233°T
2000 - 69.37/163.37

August 18, 1935

0450 - C/C 198°
0500 - Cape Lisburne abeam to port, dist. 3 mi.
0754 - C/C 208°
0800 - 68.31/166.35
0906 - C/C 90°
0918 - Sighted Pt. Hope C/C 110°
0955 - Anchored Pt. Hope, 338°T

August 19, 1935

1705 - Underway 146°
1755 - C/C 132°
2000 - 68.07/166.10
2045 - Anchored Cape Thompson - 99°T

August 20, 1935

0640 - Underway
0655 - Anchored Cape Thompson - 123°T
1800 - Underway 205°
1824 - C/C 132°
2000 - 67.54/165.25, C/C 132°
2146 - C/C 85°
2252 - C/C 31° - heading to Kivalina
2350 - Anchored Kivalina - 31°T

NORTHLAND - 35 mm

August 7, 1936

0000 - Anchored Kotzebue
2100 - Underway 190°T
2129 - C/C 270°T
3210 - C/C 318°T

August 8, 1936

0302 - C/C 339°T
0656 - C/C 31°T
0735 - Anchored Kivalina - 30°T, 2400 yds
1135 - Underway 270°T
1200 - 67.50/164.45
1205 - C/C 300°T
1347 - C/C 312°T
1905 - C/C 0°T
1920 - Anchored Point Hope

August 9, 1936

0000 - Anchored Point Hope
2045 - Underway 18°T

August 10, 1936

0000 - Enroute Pt. Lay - 18°T
0105 - Cape Lisburne abeam 5.7 mi.
0140 - C/C 56°T
0800 - 69.33/163.53
0900 - C/C 70°T
0931 - C/C 60°T
0938 - C/C 49°T
1040 - Anchored Point Lay 115°T
1235 - 303°T
1315 - C/C 31°T
1818 - C/C 82°T
2245 - Anchored Wainwright 70.33/161.11

August 11, 1936

0045 - Underway 330°T
0100 - C/C 45°T
0202 - Cape Blake eastern 3.0 mi.
0218 - C/C 65°T (64°T)
0445 - C/C 74°T
0710 - C/C 43°T
0800 - 711.15 /156.53
0830 - Anchored Barrow - 23°T
2105 - 270°T Underway
2113 - C/C 244°T

August 12, 1936

0400 - C/C 224°T
0428 - C/C 159°T
0520 - Anchored Wainwright - 130°T
2100 - Underway 257°T

August 13, 1936

0154 - C/C 211°T
0640 - C/C 114°T
0730 - Anchored Pt. Lay - 115°T, 1800 yds.
2035 - Underway 236°T

August 14, 1936

0400 - C/C 197°T
0610 - Anchored Cape Lisburne - 272 1/2°T

August 15, 1936

1245 - Underway 330°T
1315 - C/C 275°T, Cape Lisburne bearing 245°T
1420 - C/C 90°T
1446 - C/C 95°T
1510 - C/C 155°T
1545 - Anchored Cape Lisburne - 272°T

August 16, 1936

0410 - Underway 330°T
0448 - C/C 275°T
0529 - C. Lisburne to port - 5 mi.
0551 - C/C 199°T
0605 - C. Lisburne abeam to port 4.5 mi.
0800 - 68.35 /166.35
0935 - C/C 140°T
0943 - C/C 70°T
0955 - Anchored Point Hope - Spit 270°T

August 17, 1936

0330 - Underway 146°T
0410 - C/C 132°T
0550 - C/C 113°T
0630 - Anchored Cape Thompson
2340 - Underway 205°T

August 18, 1936

0018 - C/C 132°T
0305 - C/C 117°T
0540 - C/C 30°T
0555 - Anchored Kivalina - 29°T, 2000 yds.
2110 - Underway 210°T
2127 - C/C 159°T

August 19, 1936

0235 - C/C 138°T
0653 - C/C 90°T
0745 - Anchored Kotzebue - Cape Blossom 91°T
1625 - Underway 154°T
1730 - C/C 153°T
1925 - C/C 156°T
2000 - 6617/162.05
2030 - C/C 128°T
2042 - C/C 88°T
2105 - Anchored Chamisso Is. - 147°T

USCGC NORTHLAND

August 5, 1937

1000 - 70.14N/162.47 - S.H. 190°T
1015 - N193°T, ice bearing 270°T to 65°T
1200 - 69°55'/163°13'

August 10, 1937

0001 - 70.12/1622.4
0700 - Underway On 22°T
0727 - C/C parallel to pack ice NE (050°T)
0800 - 050°T, Δ, approaching Icy Cape
0825 - Anchored Icy Cape at edge ice field Icy Cape (Starboard Chain) 104°
70.22/161.55
1240 - Clear drift ice
1:25 - Icy Cape bearing 73°T
1330 - 70.07/162.23
1755 - Heavy drift ice
1850 - Anchored clear of drift - Icy Cape 063°T

August 11, 1937

Ice observed to North and East (pack & drift)

August 12, 1937

0415 - Underway 38°T
0430 - Underway on 050°T - Scattered ice through Blossom Shoals
0515 - Heavy ice to north landing at Wainwright not possible because of ice buildup
0525 - 220°T out of ice
0600 - Anchored, Icy Cape 091°T
1720 - Manuevering to avoid ice Icy Cape 86°T

August 13, 1937

1240 - Underway 039°T, drift ice
1805 - Easterly thru drift ice
1930 - Anchored in ice, Icy Cape 245°T, Dist. 11 mi,
2000 - OS #148, 70.26/161/12. Ice moving E

August 14, 1937

0540 - Underway in drift ice, 080°T
0725 - Anchored, Icy Cape 240°T, Dist. 11 mi.
0830 - OS #150, 70.25/161.40

August 15, 1937

0410 - Underway through ice, 070°T drift & pack ice
0800 - 70.35/160.20
0920 - Anchored Wainwright, 170° (averaged)
1305 - Underway to Barrow, 315°T

August 15, 1937 continued

1315 - C/C 45°T
1435 - Point Belcher starboard 1.5 mi., C/C 65°T
1700 - C/C to Point Franklin, heavy ic
1730 - C/C 115°A, drift ice
1910 - C/C 285°T out of pack ice
2000 - 70.57/158.35, broken field ice

August 16, 1937

1800 - 70.30/160.28 - OS obsv.
1875 - 225°T - Scattered drift ice
1900 - Report poss. packed ice around Seahorse Is.
2000 - 225°T - Scattered Ice
2100 - Anchore Icy Cape bearing 260°T, distance 10 mi. (70.20/162.15)
Scattered ice.

August 17, 1937

0800 - Anchored, ice drift eastward
1050 - Underway 270°T
1145 - Ice to u/e/w. Off Icy Cape
1225 - Anchored, Icy Cape bearing 205°T (70.24/161.39)
1600 - Grounded ice - Icy Cape Shoal
2400 - Anchored - drift ice

August 18, 1937

0000 - Anchored - Ice Cape 208°T
0400 - Ground ice north and west
2000 - Anchored - ice in sight

August 19, 1937

0000 - Anchored - ice to north and grounded on shoal.
0400 - Scattered ice 3 mil to north
0855 - Underway 70°T in ice
1145 - 45°T
1200 - 70.33/160.18
1305 - Anchored Wainwright - 70°T
1410 - Underway - 225°T thru ice
1620 - C/C 250°T - drift ice
1730 - C/C 301°T - clear of drift ice
1830 - C/C 270°T
1720 - C/C 224°T
2000 - 70.26/162.11 - OS obsv.

August 20, 1937

0000 - Underway 224°T to Cape Lisburne
0015 - 69.56/162.37 - OS Obsv.
0028 - Underway 224°T
0435 - 69.28/164.55 - OS

August 20, 1937 continued

0455 - 224°T
0605 - C/C 218°T
0720 - C/C 175°T
0725 - 69.11/165.44 OS
0725 - 69.11/165.44 OS
0737 - 175°T
0800 - 69.07/165.43 - 175°T
0940 - Anchored Cape Lisburne - 274°
1000 - 68.54/165.40 - OS

August 21, 1937

0000 - Anchored Cape Lisburne - 274°T
0012 - Underway 353°T
0022 - C/C 315°T
0119 - C/C 224°T
0210 - C/C 194°T
0220 - 68.53/166.22
0237 - 194°T
0400 - C/C 197°T
0440 - 68.38/166.73
0646 - C/C 173°T
0700 - Anchored Point Hope - 177°T
1820 - Underway - 15°T
2000 - 68.26/166.31
2145 - Cape Lisburne to starboard - 4.3 mi.
2205 - Cape Lisburne bearing 142°T, 6.0 mi. C/C 44°T

August 22, 1937

0000 - 44°T
0800 - 70.03/163.10
0835 - C/C 70°T
0848 - C/C 44°T
0908 - C/C 264°T
0915 - C/C 280°T
0923 - C/C 10°T
0927 - C/C 340°T
0938 - C/C 50°T
1200 - 70.28/162.13
1230 - C/C 79°T
1330 - C/C 40°T
1430 - C/C 135°T to avoid cake ice
1530 - C/C 40°T
1636 - C/C 45°T
1721 - C/C 50°T
1745 - Anchored Wainwright - 125°T
1850 - Underway 315°T
1905 - C/C 45°T
2000 - 70.46/159.33
2025 - C/C 62°T
2125 - Scattered ice
2000 - Anchored 70.55/158.57
2400 - C/C 70°T - Heavy ice drifting to southeastward of vessel

August 23, 1937

0000 - Anchored 70.55/158.57
0150 - Underway 62°T
0220 - Working through ice
0248 - C/C 245°T - Ice too heavy to work through
0400 - Working through ice
0410 - Anchored 70.53/159.04
0455 - Underway 245°T
0505 - C/C 235°T to work 245°T
0602 - C/C 210°T to work 225°T
0655 - C/C 135°T
0705 - Anchored Wainwright
1350 - Underway
1415 - C.S. Homes reported that she had to move from anchorage 20 mi. north of Wainwright because of heavy ice closing in and drifting north.
1437 - C/C 256°T
1637 - 70.35/160.58
1655 - Underway 256°T
1750 - Scattered ice
1805 - C/C 315°T
1827 - C/C 270°T
1831 - C/C 224°T
1850 - Last drift ice observed
1835 - 70.22/162.15
1945 - C/C 270°T
2000 - C/C 224°T - 70.21/162.19

August 24, 1937

0122 - 64.42/164.12
0145 - Underway 224°T
0635 - Cape Lisburne bearing 182°T
0644 - C/C 200°T
0800 - 68.54/16615
0810 - Cape Lisburne abeam 5.4 mi., C/C 197°T
0815 - 68.53/166.15
1105 - C/C 180°T
1200 - 68.20/167.00
1230 - Anchored Point Hope - 265°T (Spit)
1320 - Underway 155°T
1351 - C/C 130°T
1618 - 67.58/165.47
1957 - C/C 30°T
2000 - 67.37/164.35
2030 - Anchored Kivalina - 29°T
2320 - Underway 161°T

August 25, 1937

0312 - Cape Krusenstern - 165°T, 9 mi. 67.06/164.00
0325 - 138°T
1532 - C/C 150°T
0620 - 66.43/163.15
0633 - 90°T
0752 - C/C 11°T
0810 - Anchored Cape Blossom - 108°T 66.45/162.45

Northland

August 3, 1938

CO held conference relative to Rogers Post Expedition.
6:25 p.m. 71°09' (08)? 158°00' W
7:06 C/ 242°T
7:31 encountered scattered broken ice VC following leads attempting to MGC 242°T
8:00 p.m. 71°01' 158°10'W steering thru scattered broken ice AMGC 242°T
8:41 C/C 257°T
10:08 C/C 246°T
11:00 C/C 230°T
11:30 C/C 212°T

August 4, 1938

1:00 a.m. anchored at Wainwright

Cutter Northland - 35 mm

July 10, 1938

0000 - Anchored Little Diomede
Little Diomede - 64 1/2° / Big Diomede - 285 1/2°

July 11, 1938

0620 - Underway 121°T
0700 - C/C 17°T
1800 - 65.50/168.41
1200 - 66.27/168.13 - C/C 16°T
2000 - 67.44/167.22 - C/C 32°T
2220 - Scattered ice, C/C 4°T
2300 - Sighted Point Hope, C/C 359°T
2350 - C/C 354°T, drift ice

July 12, 1938

0015 - Anchored Point Hope, ± 340°
0030 - 68.17/166.42
0513 - Underway 199°T
0600 - Maneuvering in vicinity of pack ice
0715 - C/C 180°T
0750 - C/C 0°T
0800 - 68.10/166.50
0825 - C/C 10°T
0915 - Anchored Point Hope - 360°T
1040 - Underway 199°T
1150 - C/C 269°T
1200 - 68.07/166.50
1450 - 67.48/167.08

July 12, 1938 continued

1758 - 67.21/167.35
1820 - C/C 195°T
2000 - 67.05/167.55
2120 - 66.52/168.05
2127 - 194°T

July 13, 1938

0040 - 66.24/168.23
0125 - C/C 180°T
0500 - Fairway Rock sighted
0510 - C/C 112°T, Fairway Rock 284°T, 8 min.
0615 - C/C 127°T
0745 - C/C 04°T
0800 - 65.21/167.40
0909 - C/C 103°T
0925 - Entered Port Clarence
1030 - Anchored off Teller village, Cape Riley 200°T, village 110°T
1045 - Underway 209°T
1110 - C/C 177°T
1200 - Port Clarence (Fox Creek)
1820 - Underway 275°T
2000 - C/C 221°T, 65.10/167.03
2104 - C/C 225°T
2245 - C/C 130°T

NORTHWIND 1948

July 19, 1948

0000 underway in Kotzebue Sd c/104°T
0017 C/C 050°T
0048 C/C 000°T
0100 VC into anchorage
0104 anchored off Cape Blossom
Kotzebue Bluff 005°T Cape Blosstim RT 050°T
0800 66°37' 162°41'
1200 Kotzebue Sd
1533 depart VCS
1600 C/ 270° page & T enroute Pt. Hope
1806 C/C 322° ______ & T
1900 C/C 340° ______ & T enroute Krolini
2000 66°58' 164°00'
2000 C/ 340°T
2040 White Pole on Cape Krustenstern abeam to starboard 6 miles
2351 C/C 020°T standing in to Krolini
2359 VCS to anchor

July 20, 1948

0003 anchored RT spit 084°T LT bluff 523°T
0325 depart VCS
0330 C/ 270°T enroute Pt. Hope
0342 C/C 293°T
0535 C/C 339°T
0704 Cape Thompson 335°T, 7.2 miles C/C 315°T
0710 determing average set? to be 275°, drift 2 1/3 knots
0800 58°06' 166°12'
0750 Pt. Thompson abeam to starboard 4.7 miles
0817 C/C 310!T
0945 VCS standing into Point Hope
1017 anchored
1200 Pt. HOpe
2000 Pt. Hope

July 21, 1948

0000 anchored 0/10 mile south of Pt. Hope
0800 68°19' 166°42'
0804 depart VCS
0822 C/270°T enroute Pt. lay
0930 Pt Hope 072°T, dist 11 miles C/C 000°T
1052 C/C 027°T
1200 68°35' 167°15'
1418 Cape Lisburne 064°T, 20 miles
1517 Cape Lisburne 073°T, 17 miles
1752 C/C 037°T
2000 69°10' 166°30'
2000 C/C 047°T
2114 O.C. have to
2120 underway
2289 C/C 060°T

July 22, 1948

0000 enroute Pt. Lay on base coun. 060°T
0606 C/C 090°T
0700 have to off Pt. Lay
0750 VCS standing in Pt. Lay Harbor
0800 69°45' 163°25'
0814 C/C 320°T
0829 anchored
1112 depart C/ 310°T
1142 C/C 026°T enroute Icy Cape
1200 69°56' 163°15'
1435 C/C 0700° (illegible)
1540 entered field of pack ice on VCS
1600 moveing in pack ice VCS
1617 C/C 000°T bound for Wainwright
1630 Hour to navigate station
1641 underway
1735 C/C 075°T
1900 OC have to
1914 underway
2000 70°30' 161°10'
2230 C/C 135°T standing into Wainwright
2246 anchored

July 23, 1948

0000 anchored off Wainwright
0800 70°45' 160°00'
1200 70°45' 160°00
1818 depart C 320°T enroute Pt. Barrow
1849 with Wainwright 140°T, 7 miles, C/C 042°T
2000 70°56' 159°50'
2030 C/C 068°T
2200 OCS have to
2320 underway

July 24, 1948

0008 OCS have to
0023 underway
0235 C/C 120°T
0241 C/C 090°T
0302 C/C 080°T
0309 C/C 070°T
0325 anchored off Point Barrow
0800 Pt. Barrow
1200 Pt. Barrow
2000 Pt. Barrow

July 25, 1948

0800 Pt. Barrow
1200 Pt. Barrow
2000 Pt. Barrow

July 26, 1948

0740 depart C/ 031°T
0758 C/C 035°T
0800 71°20' 156°425'   charts on land
0853 entered broken ice field
1010 changed base course 110°T
1136 have to OCS
1150 udnerway
course MG from 1010 085° dist 15 miles
1200 71°39' 155°22'
1224 changed base course to 070°T
1314 CBC/ 110°T
1527 CBC/ 180°T
1540 have to ice ob.
1200-1600 MGC 045°T, 11 miles
1600-2000 illegible
1818 underway in BL ________ illegible
2000 71°35' 155°03'
2000 underway as before on BC 270°T steering VC following leads between heavy ice floes
2140 CBC 180°T
2150 C/C to 310°T attempting to clear ice

July 27, 1948

0000 underway to Pt. barrow following leads between heavy ice floes BC 315°T
0140 CBC 270°T
0230 CBC 225°T
0425 CBC 180°T
0545 entered scattered ice floes C/C 245°T
0553 C/C 200°T
0603 VCS off Pt. Barrow
0673 anchored off Pt. Barrow
0800 71°21' 156°50'
1200 71°21' 156°50'
2000 71°21' 156°50'

July 28, 1948

0800 Pt. Barrow
1200 Pt. Barrow
2000 Pt. Barrow

July 29, 1948

0800 Pt. Barrow
1200 Pt. Barrow
2000 Pt. Barrow

July 30, 1948

0640 Large floe of ice heavy upon the bow. causing ship to drag anchor
0650 attempting to shake off ice floe
0710 clear of ice floe
0738 underway VCS steering clear of ice pack
0742 set course 315°T
0800 71°24' 156°55'
0822 C/C 020°T
0830 C/C 035°T
0850 C/C 075°T
0855 C/C 090°T
1003 C/C 115°T
1010 with Pt. Barrow spit 215°T, 10 miles
1100 have to OCS
1121 underway
1200 71°26' 155°28'
1205 C/C 290°T
1652 C/C 270°T
1712 C/C 225°T
1718 C/C 190°T
1730 stop OCS
1748 underway
1819 C/C 270°T
1845 C/C 240°T
1904 C/C 270°T
1915 C/C 220°T
1930 C/C 250°T
1937 C/C 270°T
1940 C/C 250°T
1946 C/C 305°T
1955 C/C 270°T
2000 71°30' 156°25'
2025 C/C 240°T
2047 C/C 230°T
2123 C/C 220°T
2129 C/C 218°T
2205 C/C 175°T standing into Pt. Barrow
2220 anchored Pt. Barrow

July 31, 1948

0800 Pt. Barrow
1200 Pt. Barrow
1501 preparing to get underway due to presence of large ice floes adrift in vicinity
1545 depart VCS moving to clear ice
1557 holding bow into shore fast ice 200°T
1653 backed off shore fase ice C/ 290°T at ______ ________ standing through pack ice field
1707 set BC 300°T
1814 have to for ice observation flie sea ice 8 meters thick (took samples)
1838 BC 260°T
1840 cleared slack ice C/ 246°T enrought Nome
1902 C/C 280°T

July 31, 1948 continued

1951 C/C 240°T
2000 71°20' 157°25'
2035 entered field of loose ice floes, VCS base course approx 240°T following leads between floes
2110 ice became more compact and commenced breaking from pool to pool (or 240°T)
2150 have to because of fog

August 1, 1948

0000 enroute Nome steeming through field ice
0021 Have to await fog to lift
0621 VCS moving through ice field
0635 set base course 325°T
0725 CBC 278°T
0730 C/C 275°T
0732 C/C 260°T
0735 C/C 258°T
0743 C/C 265°T
0800 71°30' 157°03'
0800 BC 240°T moving through ice to follow leads
0907 stopped OCS
0957 underway
0800-1200 MGC 240°T, 17 miles
1200 71°18' 158°38'
1200 standing through broken field ice BC 240°T
1231 C/C 230°T
1308 C/C 240°T
1329 have to OCS
1400 underway
1443 C/C 245°T
1453 C/C 210°T standing into broken field ice
1525 cleared ice C/C 230°T
1538 C/C 180°T
1600 C 185°T
1600 C/C 246°T
1630 have to OCS
1655 underway clear of ice field
1930 Have to OCS
2000 70°70' 161°25'
2003 underway C/246°T
2240 with Icey Cape 300°T, 19 miles C/C 320°T
2330 have to OCS
2353 underway C/C 246°T

August 2, 1948

0000 C/ 246°T
0200 C/C 220°T
0730 Stopped OCS
0753 underway
0800 68°38' 165°00'
0800 C/225°T
0955 C/C 224°T

August 2, 1948 continued

1050 C/C 228°T
1100 C/C 230°T
1130 have to OCS
1145 underway
1200 68°08' 166°05'
1203 C/C 220°T with Cape Lisburne 188°T, 12.5 miles
1333 Cape Lisburne 099°T, 9.5 miles, C/C 203°T
1530 OCS shove to
1548 underway
1700 C/C 189°T
1930 have to OCS
1949 underway
2000 67°50' 167°3_' (illegible) 33'? 31'?
2320 have to OCS
2345 underway

August 3, 1948

0510 C/C 202° petye - not (T)
0541 C/C 195°T
0600 C/C 190°T
0730 OCS have to
0755 underway
0800 66°07' 168°40'
0805 determine set? since 1200 Mon 8/2 to be 020°
1053 Fairway Rock ? 275°T, 9 miles, C/C 148°T
1100 OCS have to
1130 underway as before
1200 65°31' 143°13'
1415 C/C 160°T
1530 have to OCS
1555 underway
1600 underway as before on C/ 148°T
1722 C/C 160°T
1739 C/C 133°T
1800 C/C 325°T enroute Little Diomede
1922 C/C 320°T
2000 65°01' 167°32'
2300 sight Fairway Rock 336°T, 6.6 miles
2335 Fairway Rock abeam to starboard 1.7 miles.

August 4, 1948

0015 center of Little Diomede Is 030°T, 1.8 miles VSC into anchorage
0030 anchored
0246 depart VCS standing out of Little Diomede
0255 RT Little Diomede 080°T, 3/4 mile C/C 145°T
0344 with Fairway Rock abeam to port 9/10 miles C/C 140°T
0620 C/C 150°T
0713 C/C 155°T
1735 C/C 150°T
0800 65°02' 167°32'
0833 C/ 140"T

August 4, 1948 continued

0928 stopped to swith generators
0929 underway
1000 C/C 138°T
1132 C/C 149°T
1200 64°31' 166°27'
1200 underway on course 138°T as before?
1237 with Sledge Island 053°T, 3.4 miles C/C 085°T
1457 C/C 108°T
1507 anchored Norton Sound off Nome
2000 64°27' 165°24'

NORTHWIND - 1949

August 4, 1949

0000 underway in Bering Sea C/ 017°T enroute to Shismaref
0143 crossed Arctic Circle 160°03'
0210 C/C 110°T
0621 C/C 080°T
0640 C/C 065°T
0704 VCS standing into anchorage
0747 anchored off Shismaref
0800 Shismaref
1200 Shismaref
1927 VCS
1933 C/ 349°T enroute to meet USSB.I
2000 66°17' 166°10'
2033 C/C 348°T

August 5, 1949

0000 underway in the Chuiki Sea C/ 348°T enroute Pt. Barrow
0325 land sighted to starboard
0420 Pt. Hope 117°T, 15 miles C/C 030°T
0647 Cape Lisburne 133°T, 7 miles, C/C 043°T
0800 69°12' 166°00'
1200 69°55' 169°03'
1545 C/C 065°T
2000 70°57' 159°42'
2302 C/C 055°T
2341 C/C 060°T
2353 VCS into anchorage

August 6, 1949

0000 standing into Pt. Barrow
0123 depart VCS?
0224 C/ 108°T enroute eastward
0256 whift to pilot house control due to presence of broken field ice
0258 VCS through ice field
0500 VCS try MGC 108°T through broken ice field
1119 approximate course 070°T
1200 71°09' 156°55'
1200 apprximate C/ 080°T
1205 approximate C/090°T
1430 approximate C/100°T
1515 approx. course 110°T
1538 approx course 107°T
1600 VCS moveing through ice fields
2000 70°50' 151°00'
2000 approximate C/ 135°T
2224 approx C/ 090°T

August 7, 1949

0005 app. C/ 134°T
0048 app. C/ 070°T
0122 app. C/ 120°T

August 7, 1949 continued

0205 sighted USS Burten Island 12 miles 109°T approx C/ 109°T
0340 moving alonside USS Burten Island
0358 moored portside to starboard of USS B1
0800 70°23' 146°50'
0808 underway VCS
0817 anchored in Beaufort Sea Stordton Island 033°T, 4.5 miles
0910 depart VCS enroute to Barter Island
1200 70°20' 146°47'
1200 underway approx C/ 102°T
1330 app. C/ 145°T
1600 app. C/ 102°T
2000 70°15' 145°35'
2000 underway BC 102°T

August 8, 1949

0526 anchored off Barter Island
0800 Barter Island
1200 Barter Island
2000 Barter Isalnd

August 9, 1949

0239 depart VC enroute Pt. Barrow
0400 approx course 260°T
0415 AC 282°T
0800 70°11' 145°30'
1035 AC 310°T
1135 AC 280°T
1200 AC 282°T 70°19' 146°10'
1400 AC 300°T
1600 underway as before on VC, AC 282°T
2000 70°25' 147°13'
2100 AC 295°T

August 10, 1949

0104 AC 285°T
0245 stopped
0339 underway AC 285°T
0800 70°43' 150°58'
0930 C/C 292°T
1200 underway AC 292°T 71°07' 152°41'
1600 AC 300°T
1728 C/C 260°T
1752 C/C 230°T
1852 C/C 180°T
1847 anchored
1951 underway
2000 71°20' 157°49' VCS
2010 on station in coleman (anchorage) 800 yds, astern of CST 1110
C/ 250°T enroute Wainwright

August 11, 1949

0030 C/C 252°T
0112 C/C 250°T
0205 C/C 201°T
0245 C/C 221°T
0305 C/C 215°T
0420 VCS
0445 moored to USS George Clymen
0715 unmoored VCS standing into anchorage
0727 anchored off Wainwright
0800 70°42' 160°02'
1200 " "
2000 " "

August 12, 1949

0259 depart - VCS
0303 C/ 260°T - to ride out westerly gale
0615 C/C 170°T
0730 C/C 180°T
1745 C/C 201°T
0800 Icy Cape (Not given)
0800 anchored in the Arctic Ocean off Icy Cape
1200 Icy Cape
1553 underway on C/360°T to shift anchorage
1626 anchored 10 miles off Icy Cape
2000 Icy Cape

August 13, 1949

0800 anchored
0908 depart C/ 060° pye enroute Wainwright
1103 C/C 030° pye
116 C/C 045° pye
1158 C/C 133° pye, standing into Wainwright
1200 Wainwright
1214 anchored off Wainwright
2000 Wainwright

August 14, 1949

0800 Wainwright
1200 Wainwright
1552 depart C/ 300°T
1604 C/C 256°T
1958 C/C 208°T
2000 70°36' 162°15'
2200 C/C 215°T
2330 C/C 208°T

August 15, 1949

0005 C/C 200°T
0030 C/C 190°T
0050 C/C 180°T
0100 C/C 160°T

August 15, 1949 continued

0103 C/C 180°T
0117 anchored off Pt. Lay
0800 Pt. Lay
0940 depart VCS shifting anchorage
1040 anchored
1200 Pt. Lay
1425 underway VCS
1427 BC 239°T enroute Pt. Hope
2000 64°10' 165°50'
2013 C/C 222°T
2133 with Cape Lisburne 133°T, 8 miles, C/C 193°T

August 16, 1949

0024 C/C 200°T
0106 C/C 170°T
0114 anchored off Pt. HOpe
0800 Pt. Hope
1200 " "
1318 depart VCS shifting anchorage
1344 anchored
2000 Pt. HOpe
2021 depart C/ 320°T enroute Kivalina, AK
2145 C/C 210°T
2300 C/C 130°T

August 17, 1949

0630 C/C 090°T
0727 C/C 120°T
0738 C/C 138°T
0749 C/C 110°T
0800 67°46' 164°50'
0803 C/C 120°T
0835 anchored
1155 underway VCS moving to push up boat
1200 67°43' 164° 38' (37' or 32' ?)
1207 C/ 220°T enroute Nome
2000 66°32.5' 167°03'
2312 C/C 210°T

August 18, 1949

0012 C/C 190°T
0045 C/C 180°T
0220 C/C 150°T with Fairway Rock 285°T, 7.7 miles entering Bering Sea
0604 RT King Island 270°T, 8.5 miles C/C 135°T
0800 64°43' 167°02'
0933 C/C 125°T
1000 with Sledge Island 076°T, 6.5 miles, C/C 095°T
1038 C/C 087°T
1200 64°43' 167°02'
1234 with Nome Jetty 015°T, C/C VCS off Nome
1244 anchored
1757 depart
1830 anchored off Nome, 2 miles from shore (Jetty 016°T)

NORTHWIND - 1950

August 9, 1950

0000 anchored off Pt. Hope, 2600 yds to land
0800 Pt. Hope
1200 " "
1254 depart VCS shifting anchorage
1600 C/ 090°T
1615 standing into anchorage VCS
1634 anchored south Pt. Hope, 1000 yds toi land
1928 depart
1945 C/ 270°T, enroute Wainwright
1557 C/C 313°T
2000 68°17' 166°58'
2030 with Pt. Hope 105°T, 7.1 miles C/C 000°T
2046 C/C 024°T
2350 with Cape Lisburne 133°T, 8 miles, C/C 043°T

August 10, 1950

0800 70°07'
1200 70°38' 162°07' C/44°T
1432 commence moving on VC to bring ice berg to port
1515 C/ 198°T
1758 C/C 220°T
1846 C/C 230°T
1935 C/C 240°T
1949 anchored Icy Cape 253°T, 14.7 miles
2000 no points given (anchored)

August 11, 1950

0000 anchored off (Akoliakalat (sp?) Outlet) with Icy Cape 353°T, 14.7 miles
0605 depart VCS
1610 C/ 049°T enroute Wainwright
0800 70°38' 160°25'
0836 with Schoolhouse 133 pye, 4.4 mile C/C 141°T
0908 anchored 2600 yds to land
1200 Wainwright
2000 "

August 12, 1950

0800 Wainwright
1200 "
1521 depart C/ 315°T
1921 moveway at VCS in ice fields
2000 71°34' 161°30'
2000 underway in ice C/ 270°T
2005 C/C 210°T

August 13, 1950

0245 C/C 160°T
0413 C/C 200°T
0531 VCS app. anchorage off Pt. Lay
0631 anchored near land 1.6 miles
0800 Pt. Lay
1200 "   "
1611 depart c/270°T
1628 with Pt. Lay school   101°T, 3.2 miles, C/ 235°T enroute Shismaref
1649 C/C 270°T
1753 C/C 235°T
2000 60°28' 164°35'
2209 C/C 243°T

August 14, 1950

0001 with Cape Lisburne   133°T, 8.0 miles, C/C 210°T
0330 C/C 170°T
0800 67°33' 166°57'
1200 66°49' 166°57'
1305 155°T
1425 C/ 178°T
1542 anchored off Shismaref
1910 depart VCS
1926 with Shismaref   131°T, 4.3 miles, C/ 272°T enroute Nome
2000 66°15' 166°31'
2310 C/C 200°T, standing towards Bering Straits

August 15, 1950

0227 North T Little Diomed 265°T, 14 mile C/C 171°T
0454 with King Island 170°T, 25 miles, C/C 150°T
0724 with King Island 270°T, 8.0 miles, C/C 130°T
0800 64°55' 167°29'
1200 64°27' 166°18'
1206 LT Sledge Island 005°T, 2.8 miles C/C 085"T
1349 C/C 065°T standing off Nome
1406 VCS to anchor
1419 anchored
2000 Nome

August 2, 1951 only 1 port

2000 anchored as before? where?
2110 depart VCS
2127 C/ 250°T
2205 Cape York 030°T, 7 miles, C/C 304°T

August 3, 1951

0000 underway Bering St.
0018 Right tangent Cape Pr. of Wales 097°T, 13 miles C/C 330°T?
0130 Little Diomed Is bearing 270°T 4.0? miles C/C 009°T
0523 crossed Arctic Circle
0800 67°00' 168°15' enroute to Point Lay
1200 67°45.5' 167°55'
1258 C/C 022°T
1516 VS
1517 C/C 056°T standing off Pt. Hope
1600 VCS
1723 anchored - bluff 125.5°T
2000 Pt. HOpe
2205 Depart
2215 VCS
2220 C/ 350°T
2250 C/C 356°T

August 4, 1951

0000 enroute to Pt. Lay
0135 Cape Lisburne 112°T, 15 miles C/C 045°T
0630 C/C 082°T
0800 69°42' 164°12'
0855 C/C 070°T
0947 C/C 090°T
1020 anchored off Pt. Lay 5000 yds
1200 Pt. Lay
1636 depart C/ 305°T
1720 reduced speed due to shallowing water
1722 resumed speed
1735 Belfry at Pt. Lay 117°T, 11 miles C/000°T
1926 C/ 045°T
2000 70°15' 163°20'
2250 Icy Cape radar scare 127°T, 19 miles C/C 072°T

August 5, 1951

0000 underway to Wainwright
0054 C/C 105°T
0220 anchored
0800 standing off Wainwright
1200 standing off Wainwright
1539 underway C/ 285°T
1604 stopped engines and cont
1700 C/C 270°T
observed numerous whales this watch
2000 70°43' 162°35'

August 6, 1951

0205 fog .5 visibility
0235 visibility 3.0 miles
0309 C/C 000°T
0800 71°35' 166°40'
0940 ice sighted bearing 350°T distance 7.5 miles
0955 C/C 331°T
1000 shifted to pilot house control VSC in ice
1125 secured ice operations C/ 180°T
1200 71°55' 167°00
1322 C/C 270°T to investiage ice field
1343 C/C 180°T
1415 left ice field on starboard beam standing into clear water sir?
L D End?
2000 70°32' 167°12'

August 7, 1951

0000 C/ 180°T
0255 Cape Lisburne 25 miles 168°T C/202°T
0441 Cape Lisburne abeam to port 122°T 13.5 miles
0720 Pt. Hope 123°T dist 15.5 miles C/C 168°T
0795 Pt. Hope 126°T, 12.5 miles C/C 180°T
0800 68°24' 167°19'
0845 Pt. Hope 070°T; 11 miles, C/C 144°T
1030 Cape Thompson 68°T - 18.2 miles C/C 117°T
1200 67°57' 166°09'
1425 C/C 090°T
1510 C/C to VC standing into Kivalina
1557 anchored bluff 010°T
2000 Kivalina

August 8, 1951

0000 Kivalina
0447 depart VCS
0517 Kivalina 3.8 miles dist C/ 175°T
0800 67°17' 164°39'
1200 66°47' 164°30'
1208 C/ 108°T standing in to Cape Espenberg
1246 C/ 268°T enroute Shishmaref
1505 Devils Mt. 150°T C/ 239°T
1730 Shishmaref light 130°T, 17 miles C/C 180°T
1736 C/C 185°T
1745 VCS standing into Shismaref
1902 anchored Cape Lovensten 136°T
2000 Shishmaref

August 9, 1951

0000 anchored at Shishmaref
0800 Shismaref
1200 Shismaref
2000 Shismaref
2106 depart VCS
2110 C/ 000°T
2305 C/C 059°T

August 10, 1951

0000 underway C/ 059°T
0005 C/C 020°T
0300 fog visibility 0.5 miles
0320 visibility 10 miles
0355 fog
0616 VC standing off Kivalina
0703 anchored to Kivalina end of bluff 024°T
0800 Kivalina
1200 Kivalina
1420 depart VCS
1421 C/ 226°T enroute to Nome
2000 67°00' 166°33'
2331 C/C 211°T
2359 Crosses Arctic Circle

August 11, 1951

0155 C/C 224°T
0240 sighted ship in starboard bow 6.5 miles on course 031°T
0416 Little Diomede Island East tangent 211°T dist 11.5 miles C/C 163°T
0650 South tangent Cape Pr of Wales 068°T 11.5 miles C/C 152°T
0748 C/C 143°T
0800 65°16.5' 168°07'
1215 C/C 128°T
1325 C/C 123°T
1432 Sledge Island 020°T, dist. 2.2 miles C/C 089°T
1619 VCS standing into Nome
1653 anchored
2000 Nome
2400 Still at Nome

NORTHWIND

July 18, 1953

0000	underway off Seward Pen. c/ 300°T
0028	with King Island Center - 248°T, 7.2 miles c/c 330°T
0303	with Farring Rock = 295°T, 7.8 miles c/c 000°T
0715	crossed Arctic Circle at 168°24'
0800	66°42' 168°24'
0800	c/c 012°T
1200	67°24' 167°55'
1730	c/c 030°T
1905	Cape Lisburne abeam to starboard - 114°T, 110.5 miles, c/c 040°T
2000	69°07' 166°30'
2044	c/c 040°T

July 19, 1953

0001	c/c 050°T
0205	c/c 049.5°T
0230	sighted several small floes and beryy sit (sp??) to port, 3 mile
0800	70°30' 162°04'
0806	w/by Cape = 166°T, c/c 070°T
0905	commence VC to determine limits of sea ice off shore
1200	70°39', 160°22'
1536	VS to maneuver thorugh ice.
1600	SBC 050°T
1720	c/c 048°T
1730	c/c 061°T
1921	BC 130°T
2000	71°01' 157°58'
2010	VC
2300	c/ 031°T

July 20, 1953

0000	VCS approaching Pt. Barrow
0030	c/c VC southwesterly direction w/Pt. Barrow Beacon - 030°T 8 miles, following shore level
0400	SBC 260°T
0755	c/B/C 277°T
0800	71°00' 158°04'
1120	SBC 240°T
1200	71°00' 158°29'
1527	SBC 250°T, enroute Icy Cape
1600	VC 240°T
2000	70°36' 161°41'
2246	c/c 140°T

July 21, 1953

0000	BC/ 141°T
0004	stop

July 21, 1953 continued

0017	underway c/271°T
0032	stopped drfting
0130	underway c/ 300°T
0423	entered field of scattered ice floes
0430	w/ Icy Cape - 107°T, 37.5miles, c/c 240°T using various heading in the ice
0547	c/c 046°T
0710	c/c 136°T
0800	70°31' 163°23'
0800	c/c 120°T
0850	Radar tower by Cape - 100°T, 13.2 miles
0901	c/c 100°T
0950	c/c 095°T
1014	anchored off Icy Cape
1200	anchored off Icy Cape
1310	(________________standoff ent. by Cape)?
1645	shift anchorage
1720	anchorage 2000 Ice Cape

July 22, 1953

0000	anchor radar reflects - 078°T, range pvl - 123°T
0800	Icy Cape
1200	"
2000	"

July 23, 1953

0800	Icy Cape
1200	"
2000	"

July 24, 1953

0800	Icy Cape
1200	Icy Cape
2000	Icy Cape

July 25, 1953

0800	Icy Cape
1159	depart c/ 317°T
1200	Icy Cape
1226	c/c 340°T
1350	Encounter scattered drift ice
1433	c/c 102°T
1453	c/c 092°T
1521	c/c 140°T
1531	c/c 092°T
1706	VC determining offshore limits of sea ice
2000	70°49' 159°55'

July 25, 1953, continued

2005 c/c 063°T
2124 VCS to skirt edge of sea ice maintaining base course of 063°T

July 26, 1953

0000 lying to off Sinaue ? AK, lower tower = 74°T, 12.1 miles
0005 underway standing toward vessel sighted it edge of ice pack
0045 lying to with MV Fort Heaner
0800? 71°03' 157°42' (lying to)
0930 underway VCS following a southerly lead
1115 set c/ 142°T
1135 VC
1200 71°00' 157°33'
1301 stop tower at Sinaree = 109°T, 4.8 miles
1848 underway VCS
2000 71°01' 157°38'
2140 commence following 10 fathom line rounding Point Franklin

July 27, 1953

0000 following the southern edge of the ice pack in a southwesterly direction.
0015 lying to in ice with Pt. Franklin's radar screen = 164°T 16,700 yds
0800 71°07' 158°40' lying to
0900 underway c/ 100°T
1200 71°04' 158°39'c/c 243°T
1304 maneuvering around drift ice on VC
1420 stop
1500 underway c/ 067°T
1509 c/c 078°T
1523 c/c 060°T
1709 c/c 076°T
1723 VCS following edge of ice pack
1910 maneurvering at VC off tower of Sinoinarre (sp)?
2000 71°04' 157°22'
2001 stop drifting
2010 c/c 217°T
2017 VC
2100 lying to
2235 underway VCS

July 28, 1953

0400-0800 underway VCS breading ice for USS Belle Grove
0800 71°24' 156°34'
1043 stopped?
1200 71°24' 156°34' lying to
1405 underway maneuvering to assist USS Belle Grove thru ice
1615 SBC 031°T
1620 VCS
1850 BC 225°T standing to anchor
1912 anchored LT sprt = 220°T, beear 249°T

July 28, 1953, continued

2000 Pt. Barrow
2242 depart c/ 116°T

July 29, 1953

0000 c/116°T
0030 commence maneuvering through ice VC (BC 116°T)
0400-0800 maneuvering in heavy ice
0800 71°12' 155°01'
0810 BC 125°T
0840 entered heavy ice
0915 stop
0950 underway BC - VCS
1200 71°05' 154°29'
1750 encountering heavier concentration of ice
1855 stopped?
2000 71° 12' 154°34' (lying to as before)
2232 underway VCS
2328 CBC 310°T

July 30, 1953

0000 BC/300°T - VCS thru ice
0250 lying to
0445 underway in westerly and northwesterly heading VS
0745 standing off Pt. Barrow
0800 Pt. Barrow
0811 anchored radar screen = 268°T beam = 250°T
LT of Pt. Barrow (sprt?) = 224°T
1126 depart VCS
1200 71°25' 156°14'
1337 encountering heavy ice
1735 VC on BC of 240°T
1735 sc/ 244°T
2000 71°17' 157°03'
2027 set BL 225°T
2145 MGC 230°T thru ice
2235 VCS to make good 300°T, made good 290°T, during last hr of watch

July 31, 1953

0000 off Pt. Franklin VCS through scattering ice, MGC 280°T
0330 MGC 252°T during watch
0400-0800 underway on southwesterly heading through scattered ice throughout the watch
0800 70°40' 159°43'
0958 c/c 100°T standing in to Wainwright
1008 stop
1200 70°38' 160°07' lying to
1246 VC maneuvering along edge of ice
1409 anchored Wainwright heading ? in LS = 076°T
2000 Wainwright

August 1, 1953

0000 anchored off Wainwright
0752 depart c/ 037°T
0800 Wainwright (Longtime-T.A.)?
0820 c/c 045°T
0910 commenced steering VC as "OTC leading Task limit 0.2.1 (Pt. Barrow Unit) through ice
1200 70°56' 158°57'
1400 rounded shoal off Pt. Franklin BC/100°T
1600 VC
2000 71°05' 156°26'
2114 put generator on line. proceeding to help USS Skagit and USS Electron through heavy ice floes

August 2, 1953

0000 VCS enroute Pt. Barrow proceeding through drift ice
0330 maneuvering to free USS Estes from ice off Pt. Barrow
0430 USS Estes free of ice
0800 71°25' 156°27'
0930 Rounded Pt. Barrow 3900 yds off Radar screen
1005 anchored radar screen = 271°T, 6,700 yds
1200 Pt. Barrow
2000 Pt. Barrow
2144 maneuvering for new anchorage
2211 maneuvering to avoid ice floe
2248 anchored 000°T 500 yds from H L ??

August 3, 1953

0001 depart VCS through ice
8000 Pt. Barrow
0804 anchored LT Pt. Barrow = 177°T LT Radar reflects = 242°T, 4,140 yds
0909 depart sshifting anchorage
0940 proceeding eastward VCS
1102 return to anchorage
1200 Pt. Barrow
1300 maneuver to assist USS Electra whose screw was fouled by heavy ice.
1355 Electra fee
1405 maneuvering to assit Electra anchoring in heavy ice.
1542 anchored Radar screed = 265°T, LT sprt = 176°T
2000 anchor Pt. Barrow

August 4, 1953

0000 anchor radar screed = 264°T (T spit- 174°T
0800 Pt. Barrow
1200 "
1215 USS Estes freed of ice by our power
1428 depart VCS proceeding to main Barrow anchorage
1634 escorting USS Estes around Pt. Barrow to west anchorage
1812 reduced ice coverage
2000 Pt. Barrow

August 4, 1953, continued

2020 Reverse course returning with Electro and Estes to east anchorage
2521 anchored LT spit = 224°T, radar screen = 270°T

August 5, 1953

0540 depart VC to assist USS Skagit, she is "being set on the beach by a large ice floe."
0645 Skagit free of ice floe w/o assistance
0721 anchored off Pt. Barrow Radar screen - 275°T, LT Deadman's island - 184.5°T
0800 Pt. Barrow
0822 depart to assist USS Electra
0947 returning to anchorage
0957 anchored
1008 depart
1050 anchored Radar reflector - 274°T, LT spit 234°T
LT deadman's island 186°T
1200 Pt. Barrow
2000 "
2112 between ice drift to be .53 KTS in a due northerly direction
2250 ice floe approx. 2500 feet caused anchor to drag 450 yds = 335°T

August 6, 1953

0000 Radar screen = 270°T, LT spit 238°T
0800 Pt. Barrow
0950 amount of set 340°T drift .4 kts.
0800-1200 used engine to stay clear of drifting ice floes
1200 Pt. Barrow
1546 Depart VCS in a westerly direction - proceeding to west anchorage
1746 lying to off west anchorage Pt. Barrow
2000 Pt. Barrow
2155 underway VCS for east anchorage
2338 anchored radar screen - 272.5°T, LT Deadman's Is. 187.5°

August 7, 1953

0800 Pt. Barrow
1200 "
1512 depart VCS in an easterly direction to assist USS Electra
1202-1600 MGC 280°T, 2 miles
1600-2000 NIG 0.0 miles ice breaking in anchorage
2000 Pt. Barrow
2033 lying to
2224 maneuvering in anchorage area to break up floes drifting down on vessels in company
2318 returned to position as at start of watch

August 8, 1953

0000 Lying to, standing by to aid ships when ice threatening
0218 Maneuvering VCS breaing up large floes which are drifting toward anchored ships.

August 8, 1953

0255	lying to
0405	VCS breaking up large floes which are drifting toward anchored ships
0530	lying to
0651	underway on VCS to break ice near Electra
0800	Pt. Barrow
1000	set course in easterly direction
1200	Pt. Barrow
1320	lying to off Pt. Christie
1400	underway VCS to seaward enroute Barrow
1800	standing into anchorage
1900	anchorage radar screen - 244.5°T East T Barrow Spit 181°T
2000	Pt. Barrow
2353	depart underway

August 9, 1953

0000	VCS through ice enroute USS Redfish
0052	alongside Redfish
0135	departed Redfish proceeding to East anchorage
0305	anchored Radar screen - 254°T, 5, 300 yds
0800	Pt. Barrow
1200	"
2000	"

August 10, 1953

0800	Pt. Barrow
1200	"
2000	"
2008	depart VCS
2040	anchored radar screen - 219°T, 9,500 yds
2310	anchor dragging due to gian floe
2355	anchor dragged (45 min) 500 yds, 085°T

August 11, 1953

0000	anchored radarscreen - 219°T, 9,500 yds
0006	up anchor maneuvering to shift anchorage one mile to southward because of heavy floes of ice and strong currents
0023	anchored radar screen - 232°T, 7,700 yds
0350	Current 070°T, drift, 6 kts
0000-4000	used engines as necessary to clear ice from bow
0800	Pt. Barrow
1134	underway VCS
1200	Pt. Barorw
1502	underway in a northeasterly direction to meet and assist Refish
1810	lying to near Redfish
1917	underway enroute Barrow VCS
2000	Pt. BArrow
2048	took Redfish in tow in heavy ice.
2143	towline parted when Redfish bow caught in heavy floe
2000-2400	MGC @220°T

August 12, 1953

0000 VCS enroute Barrow in westerly direction
0800 Pt. Barrow
0815 anchored in East Anchorage off Pt. Barrow
radar screen - 246°T, LT spit 198°T
1200 Pt. Barrow
2000 Pt. Barrow

August 13, 1953

0000 anchored radar screen 246°T
0800 Pt. Barrow
1121 depart VCS enroute Icy Cape with convoy.
1200 Pt. Barrow
1415 Maneuvering to rear of convoy to assist Grapple in Joy
1200-1600 MGC 220°T, 7 miles
2000 71°13' 157°05'
2234 copter airborne for ice recon in vincinity of Seahorse Island
2300 reversed course to 060°T, returning to Pt. Barrow

August 14, 1953

0000 VCS enroute Sinaru to Pt. Barrow
0355 MGC 035°T, 20 miles
0704 anchored off Point Barrow radar screen - 239°T, 6,200 yds
0800 Pt. Barrow
0813 moving to escort ships from east anchorage
0910 assumed OTC of convoy enroute Ice Cape
0800-1200 MG 17 miles
1200 71°15' 156°58'
1400 c/ in a westerly direction
1800 open water
2000 70°54' 158°40' ?? 159°10'(illegible)
2000 c/ 250°T
2010 c/c 245°T
2020 c/c 240°T

August 15, 1953

0124 execute 09 turn c/c 150°T standing into Icy Cape
0215 have to USS Kennede w/ Icy Cape Radar screen - 073°T, 7.0 miles
0640 underway to Estes
0710 moved to USS Estes
0800 Icy Cape
1200 Icy Cape
1200 Depart c/ 330°T
1242 w/ Icy Cape radar screen 117°T, 9 miles, c/c 047°T
1335 with radar screen - 177°T, 11 miles, c/c 064°T
2000 71°02' 158°27'

August 16, 1953

0000	VCS
0055	lying to in ice
0800	none given (Pt. Barrow? on noon column)
1140	Proceeding through ice, standby toward tip of Pt. Barrow on VCS
1237	lying to
1325	underway on VCS toward PT. Barrow
1335	beset
1420	underway as before, clear of ice
1516	lying to, to determine ? ice drift
1200-1600	MGC 263°T, 2.6 miles
1807	depart enroute Pt. Barrow on 10 fathom curve
1950	joined by Redfish 3 miles north of Pt. Barrow
2000	Pt. Barrow - underway in easterly direction

August 17, 1953

0000	enroute Barter Island VCS MGC ESE leading USS Redfish through scattered ice floes
0400-0800	MGC 112°T, 18.4 miles
0800	71°14' 155°06'
0801	c/ 110°T
0920	c/c 094°T
1115	c/c 103°T
1200	71°03' 152"46'
1200-1600	MGC 102°T, 43 miles
1600	underway in easterly direction VC
2000	70°48' 140°28'
2330	sharp decrease in soundings backed down 700 yds. stopped, lying to
2345	proceeding slowly - c/343°T

August 18, 1953

0000	VCS - MG ESE
0011	anchored off Jones Island
0800	70"36' 148"59'
0917	depart VCS
1016	manauvering to MGC 280°T
0800-1200	MGC 291°T, 6.8 miles crossed 10 fathom curve
1200	70°39' 149"08'
1425	lying to
1450	proceeding as before
1850	visibility dropped to 1 mile, stopped lying to
2000	70°42' 148°43'

August 19, 1953

0000	maneuvering to clear large floes on starboard
0015	lying to
0800	70°51', 149°58'
0800	underway VCS

August 19, 1953, continued

0810	lying to with bow up against a giant floe
1200	70°51' 149"58'
1245	moved 300 yds closer to Redfish
1655	underway VCS BC 100°T
2000	70°49' 149°30'
2200	encountered heavy ice MGC 120°T
	made good trail 134°T, 11 miles during watch

August 20, 1953

0000	enroute Barter distance VCS trying to MGC of 100°T
0405	lying to
0800	70°43.5' 149°04'
1200	70°49' 149°06'
1323	underway VCS BC 180°T enroute Jones Island shoal area
1559	MGC 180°T, 3.8 miles on watch
1600-2000	made no progress during watch in heavy ice Redfish unable to maneuver.
2000	70°43' 140°05'
2006	towline to Redfish
2125	underway

August 21, 1953

0000	underway with USS Redfish in tow heavy concentration of ice
0126	secured tow line, attempting to break a lead for Redfish through ice in a general direction of 230°T to reach what appears to be a huge lead running easterly - westerly, lying to
0800	70°40' 149°12'
0928	underway VCS headed for open water
1106	anchored with Bodfish Island - 201"T 7 miles
1200	Jones Islands
1282	___________great floe off port bow
2000	Jones Island

August 22, 1953

0000	anchored off Bodfish Island - Bodfish Is -216°T, 7.3 miles Berthemer Island = 218.5°T 7.5 miles
0800	Jones Island
1200	Jones Island
2000	Jones Island

August 23, 1953

0000	Beechey Pt. = 201°T, 8.9 miles
0800	Jones Islands
0955	depart, underway in an easterly direction VCS
1200	70° 39.5' 149°00'
1200-1600	MGC 066°T 7 miles
1600-2000	MGC 114°T 23.5 miles
2000	70°34' 147°44'
2000-2400	MGC 080°T, 9.5 miles

August 24, 1953

0400-0800 MGC 121°T, 27 miles
0800 70°15' 145° 17'
1145 lying to off Barter Island
1200 70°11' 143°40'
1512 underway on VCS along 10 fathom curve
1820 rendevous with Redfish c/ 078°T
1950 lying to
2000 70°10' 144°07'

August 25, 1953

0000 underway in an easterly direction
0000-0400 MGC 126°T, 10 miles
0535 revised course set running to open lead for Redfish
0737 lying to
0400-0800 MGC 135°T, 15 miles
0800 lying to 70°07' 142°50'
0800-1200 MGC 052°T, 6 miles
1200 70°09' 142°34'
1200 set northerly course
1200-1600 MGC 005°T, 27.5 miles
1903 proceeding in an easterly direction VCS
2000 70°45' 142°31'
2000-2400 MGC 112°T, 21 miles

August 26, 1953

0000 underway on BC 180°T
0238 lying to
0800 70°35' 141°26'
0840 underway c/ 080°T
1007 c/c 249°T enroute Barter Island Redfish proceeding east through heavie ice independently
0800-1200 MGC 227°T,20 miles
1200 70°21' 142°10'
1320 VCS
1510 lying to
1637 underway on a northeastern course
1710 c/c 072°T
1600-2000 MGC 065°T, 33 miles
2000 70°24' 142°09'
2317 sighted redfish altered course for rendezvous
2000-2400 MGC 072°T, 34 miles

August 27, 1953

0000 VCS easterly direction
0221 lying to
0800 70°22' 140°45'
1126 underway on c/ 200°T VS

August 27, 1953, continued

1200 70°22' 140°45'
1920 c/c 226°T
2000 westerly direction 70° 00' 141° 20'
2200 c/c 315°T

August 28, 1953

0242 stopped, lying to
0000-0400 MGC 316°T, 25 miles
0800 70°36' 143°30'
1200 70°36' 143°30'
1400 anchored
1620 depart c/ 000°T
1755 lying to
1200-2000 MGC 006°T, 6 miles
2000 70°46' 143°45'
2137 VCS underway BC 270°T
2000-2400 MGC 270°T, 17 miles

August 29, 1953

0000 BC 270°T making VS through scattered ice
0325 CBC 310°T
0000-0400 MGC 279.5°T 21.2 miles
0400-0800 MGC 302°T, 17 miles
0800 70°56'146°17'
1116 depart Redfish enroute Barter Island c/ 130°T
1200 70°53' 146°23'
1200-1600 MGC 128°T, 39 miles
1710 standing into Barter Island
1829 underway vCS BC 291°T rend. w/ Redfish
2000 c/b/c 310°T to avoid heavy ice pack
2210 resumed BC 291°T
2318 c/b/c 278°T

August 30, 1953

0545 rend. with Redfish
0652 underway w c/ 284°T ?
0400-0800 MGC 301°T, 25 miles
0800 70°30' 147°32'
0800-1200 MGC 290°T, 16 miles
1200 70°46' 147°54'
1200-1600 MGC 290°T, 16 miles
1605 CRC 265°T
1600-2000 MGC 270°T, 1.5 miles in heavy ice.
2000 70°51' 148°38'
2300 lying to

August 31, 1953

0000 lying to in heavy ice concentration
0241 underway VCS to assist Redfish
0737 Redfish ________w/ Northwind
0400-0800 no progress
0800 70°49' 148°46'
0828 Refish in tow
0800-1200 MGC 273°T, 5 miles
1200 70°50' 148"53'
1200-1600 MGC 255°T, 10 miles
1702 cast off towing line
2000 70°46' 149°47'
2218 lying to
2000-2400 MGC 271°T, 3 miles

September 1, 1953

0000 lying to with USS Redfish
0118 VCS closing on Redfish
0156 lying to
0245 VCS - westerly
0359 MGC 267°T, 1 mile
0400-0800 MGC 292°T, 8 miles
0800 70°49' 150°22'
0800-1200 MGC 260°T, 5 miles
1200 70°48' 150°33'
1200 underway as before in a westerly direction
1600-2000 MGC 295°T, 24 miles
2000 71°04' 152°55'
2000 set base course/ 330°T
2315 c/c 300T

September 2, 1953

0300 c/r/c 270°T in heavy ice concentration (5/10)
0400-0800 steering VC in northwesterly direction
0800 71°59' 154°38'
0800 underway in a westerly direction
1018 clear of ice set c/c 330°T
1150 stopped
1200 71°42' 155°11'
1540 underway proceeding northerly to edge of ice pack
1740 lying to off edge of main ice pack
2000 71°59' 154°38' (lying to as before)
2305 underway on c/ 180°T submarine exercise (?)

September 3, 1953

0210 underway w/ Refish (submarine) following c/235°T
0400 underway southwesterly heading VC
0720 sighted Pt. BArrow radar screen - 170°T, 8 miles

September 3, 1953 - condinued

0800 71°28' 156°45'
1200 71°18' 156°56'
1559 MGC 180°T, 10 miles
1600 underway on BC 240°T paralleling Skull Cliff shore line
1900 passed Linman ?Towers abeam to port 138°T, 7 miles
1600-2000 MGC 242°T, 7.5 miles
2000 71°03' 157°37'
2000 westerly direction
2340 lying to

September 4, 1953

0100 underway VCS
0215 steadied on c/ 253°T
0500 c/c 250°T
0800 71°06' 158°23'
0852 stopped w/Redfish
0949 depart c/ 067° enroute Pt. Barorw
1200 71°06' 158°23'
1205 VC through light ice concentration
1545 Pt. Barrow radar reflector - 049°T 11.0 miles
making various speeds in ice
1600 VCS
1620 maneuvering to military installation
1740 depart VCS, with Areo Beacon - 137°T, 1.1 miles
2000 71°27' 156°29'
2047 steadied on c/ 115°T

September 5, 1953

0000 B/C 115°T (VCS)
0127 c/c 090°T
312 VCS on BC/110°T
0712 c/B/c 095°T
0800 70°57' 151°35'
1045 change in easterly leading in shallowing water
1200 71°01' 150°42'
1200 underway in an easterly direction VCS
1600-2000 MGC 118°T, 13.4 miles
2000 70°54' 149°33'
2359 MGC 115°T, 11 miles

September 6, 1953

0000 Base course 105°T VCS in heavy ice
0345 depart area of heavy ice coverage MGC 105°T, 6.5 miles
0400-0800 MGC 105°T, 30 miles
0800 70°48' 148°0'
1025 c/c 110°T
1200 70°32' 146°27'
1507 c/c 090°T
2000 70°22' 142°00'
2124 VCS in heavy ice .4 = .8 coverages
MGC 101°T, 18.8 miles

September 7, 1953

0000 VCS easterly
0430 VC in a southerly direction because of heavy ice to the East.
0400-0800 MGC 163°T, 13 miles
0800 70°06' 140°11'
1140 c/c 073°T
1200 69°58' 139°24'
1200-1600 MGC 076°T, 17 miles
1600 BC 070°T
1600-2000 MGC 110°T, 32 miles
2000 69°55' 137°05' VCS east

September 8, 1953

0000 BC 070°T VCS in heavy ice 1/10 coverage
0000-0400 MGC 060°T, 6 miles
0445 lying to
0400-0800 MGC 022°T, 1 mile
0800 70°02' 136°38' lying to
1200 70°03' 136°36' lying to
1556 underway southwest MGC 260°T, 3.9 miles
1842 lying to
2000 69°47' 137°35'
2015 underway on c/ 000°T
2140 VCS ice coverage approx. 5/10 MGC 353°T, 18 miles

September 9, 1953

0000 underway in heavy ice, 10/10 coverage, lying to
0745 underway S heading follows the edge of ice pack
0800 69°58' 137°51'
1010 c/c to E in decreasing ice coverage
1118 c/c 033°T in open water
1130 set easterly heading along edge of main pack
1200 69°49' 136°29'
1402 underway in southerly direction
1642 moored to Benton Island
2000 69°52' 136° 19' lying to

September 10, 1953

0000 drifting in Beaufort sea
0730 unmoored VCS
0737 c/ 260°T
0800 69°52' 136°32'
1200 69°47' 138°36'
1317 c/c 287°T
2000 70°12' 142°40'
2106 reduced visibility and scattered ice floes
2115 c/c 255°T, standing towards BArter Island
2216 stop
2305 lying to off Barter Island - 181°T 7.3 miles

September 11, 1953

0000 Barter Island - 180°T 7.3 miles
0517 underway VC
0558 stop
0614 underway c/ 185°T
0700 lying to
0710 underway c/ 290°T
0800 70°14' 144°07'
1200 70°34' 145°35'
1430 c/c 275°T
1515 VCS through ice on BC 277°T
1540 contact BI and MHF ? voice at 254°T, 15 miles
1637 c/b/c 260°T
1902 c/b/c 270°T
1600-2000 MGC 262°T, 32 miles
2000 70°47' 150°56'

September 12, 1953

0000 BC 280°T VCS
0520 Hove to with bow in ice
0800 71°05' 153° 00'
0953 underway enroute Pt. Barrow BC 290°T
1200 71°14' 154°15'
1545 c/b/c 220°T
1600 westerly VCS
1806 anchored
2000 Barrow

September 13, 1953

0800 Barrow
0800 depart VCS come along side USS Burton Island
0813 moored
1200 Barrow
1332 unmoored VCS BC 250°T
1751 c/c 245°T
2000 70°51' 160°39'
2030 Wainwright = 118°T, 21 miles c/c/ 232°T

September 14, 1953

0100 c/c 209°T pstge
0500 c/c 220°T
0800 69°25' 165°52'
1020 Cape Lisburne = 145°T, 16 miles, c/c 296°T
1200 68°50' 167°03'
1558 c/c 191°T
1625 c/c 191°T
2000 67°38' 167°49'

September 15, 1953

0130	c/c 180°T
0554	Fairway Rock = 214°T, 14 miles
0634	King Island = 169°T, 44 miles
0709	Cape Pr. of Wales light = 068°T, 6.2 miles c/c 132°T VC heading into Wales
0800	Wales
0827	anchored off Wales RT Cape Pr. of Wales = 135.5°
1200	Wales
1334	depart for Little Diomede c/ 290°T
1337	steering 290°T
1515	maneuvering to anchor SW Little Diomede
1533	anchored LT Big Diom. = 277°T, RT 342.5°T
2000	Little Diomede

Septebmer 16, 1953

0000	anchored off SW tip of Little Diomede Fairway Rock - 143°T, 8.5 miles
0654	Depart VCS
0714	c/ 115°T, enroute Wales
0800	Bering Strait
0856	VCS off Wales
0915	lying to off Wales
1001	commenced maneuvering, curent ________
1200	Bering St.
1216	anchored Fairway Rock LT - 271°T
1510	depart c/200°T
1552	c/c 090°T
1600	VCS
1719	anchored RT Cape York = 116°T
2000	Tin City, Alaska

end

BURTON ISLAND

August 4, 1948

Anchored off Point Barrow
1250 VCS to investigate ice northeast - off Point Barrow

August 5, 1948

0041 VCS to Barter Island, maneuvering through loose ice pack
0639 C/C 112°T
0800 71°21' 154°43'W
1000 Underway on easterly course, maneuvering through ice pack
1200 71°00'00" 154°10'00"W
1200-1600 maneuvering thru loose ice pack on easterly course, VS
1926 C/C 102°T
2000 70°58'00" 151°31'00"

August 6, 1948

0000-4000 Underway - BC/092°T - maneuvering on easterly course to avoid ice
0800 70°43' 149°03'W
0828 VCS to avoid ice
0938 Stop - poor visibility
1200 70°38' 148°46'
1515 Underway BC/000°T, to clear shallows
1606 Stop
1932 Underway - easterly thru loose ice pack
2000 70°39'30" 148°45'W
2018 Stop - poor visibility
2104 Underway - easterly course, maneuvering thru ice pack
2239 Stop - dense fog

August 7, 1948

0456 Underway - maneuvering thru loose ice pack on easterly course at various speeds
0800 70°34' 147°52'W
1044 Stop - fog
1200 70°39'30" 147°39'W
1206 VCS maneuvering through ice pack
1417 Stop - fog
1508 Underway - VCS maneuvering through heavy ice pack
1936 Stop - fog
2000 70°26' 147°02'W

August 8, 1948

0620 Underway - maneuvering in heavy pack
0727 Stop - Fog
0759 Underway - maneuvering thru heavy ice pack on easterly course at various speeds
0800 70°26' 147°02'
1200 70°23' 146°44'
1241 Stop - fog
1303 Underway as before
1405 Stop - fog
1527 Underway
2000 70°20' 146°21'W
2200 Stop - fog

August 9, 1948

0000-4000 Enroute to Barter Island in loose pack ice (Stop)
0629 Underway VCS thru ice pack
0800 70°08' 143°58'
1200 70°12'30" 144°46'
1609 Anchored 3 miles north of Barter Island

August 10, 1948

1200 70°09' 143°58'
1549 Underway - maneuvering in ice pack
1929 Anchored - Barter Island
2000 70°22' 146°34'W

August 11, 1948

0800 70°23'30" 146°51'W
0911 Underway - enroute Barter Island to Point Barrow on Easterly (?) courses VS thru loose ice
1200 70°29'W 147°28'W
1600-1800 Underway as before - maneuvering in heavy ice
1834 Stop - fog
1922 Underway
2000 70°31'N 147°58'W
2045 Stop - fog

August 12, 1948

0000-0400 - Stopped in heavy ice pack due to dense fog. Two other ships in company - 040°T. 6-1/2 miles, shirting edge of ice pack

Burton Island Continued

August 12, 1948 continued

0220 VCS thru ice pack
0241 Stop - fog
0745 Underway - maneuvering thru heavy ice pack on westerly course
0800 70°23'00" 146°51'W
0942 Stop - fog
1024 Underway
1035 Stop - fog
1130 Underway
1200 70°29' 147°28'W
1800 Base course 290°T - maneuvering in heavy ice pack
2000 70°31' 147°58'
2144 BC/300°T
2213 C/C (BC) 245°T
2235 C/C 225°T

August 13, 1948

0000-0400 VC thru loose pack ice
0800 70°46' 151°41'00"
1200 71°04'00" 153°02'
1800-2000 VCS in a westerly direction to evade ice
2000 71°27'15" 156°50'
2053 Lying to - one mile off Point Barrow

August 1, 1950

1200 Anchored at Point Barrow
1401 Underway for Barter Island
1408 BC/358°T
1424 C/C 053°T
1450 Entered field of floe ice
1511 C/C 088°T
1833 Maneuvering at VCS to avoid floebergs and pack ice

August 2, 1950

0800 70°47.5' 149°48'
0834 C/C (BC) 088°T - working heavy ice pack
0839 Helicopter on ice Recon
1200 70°36' 148°20'
1635 VCS - working heavy pack ice
1708 C/C 098°T
2000 70°20' 145°32.2'
2305 sighted Barter Island - 123°, 7.5 miles

August 3, 1950

0000 VCS to avoid ice (Base course 098°T)
0048 Anchored 1.3 miles north of Barter Island
0843 Underway for Tigvariak Island, Alaska - C/280°T
1200 70°16' 144°55'
1516 C/C 280°T
1530 Commenced maneuvering VCS while working thru floe ice
1548 C/C 244°T
1610 Stop
2000 70°21.5' 147°03.5'W
2337 Underway - VCS thru ice floes

August 4, 1950

0000 Underway - various westerly courses thru heavy ice floes
0004 Stopped in heavy ice floe
0246 Underway - on westerly headings thru heavy ice floe
0404 Maneuvering on westerly courses, skirting edge of ice pack
0558 C/C 309°T
0626 C/C 179°T
0628 Maneuvering on westerly courses, working thru ice pack
0800 70°36' 148°44' (Hull plating "dished in" 2 inches!) - presumed to have occurred about 0645 in heavy ice
0909 Lying to in heavy loose pack ice
1200 70°32' 148°38'
1234 Underway on northerly courses working thru heavy pack ice
1812 C/C 269°T
2000 71°07.5' 150°02'W
2358 Anchored 16 miles north of Pitt Point

August 5, 1950

2002 Underway C/295°T
2232 Commenced maneuvering VCS thru ice floe

August 12, 1950

0000 Hove to at OCS - 32 miles north of Point Barrow
0054 C/000°T
0233 Set course 000°T to enter ice pack
0235 Stopped in ice pack
0800 72°01' 156°49'W
0801 Underway C/000°T
0825 OCS
1040 Set BC/040°T - proceeding through heavy ice pack
1136 OCS (Oceanagraphic Station)

August 12, 1950 continued

1200 72°11.5' 156°29'W
1303 Underway C/040°T
1405 OCS
1745 Underway - on north-northeasterly courses thru floe ice
1835 OCS
2000 72°26' 155°08'
2006 Underway VCS to clear ice
2152 Set course - 062°T
2205 C/C 032°T
2206 C?C 027°T
2248 Set course - 000°T
2308 Stopped

August 13, 1950

0000 Stopped OCS 75 miles north of Point Barrow
0800 72°40' 155°30'W
Steering VCS proceeding to open water
0822 OCS
1043 Underway - on base course - north-northeasterly thru leads in ice floes
1200 72°33' 155°16'
1232 C/C (BC) 000°T
1338 OCS
1622 Set course, 347°T
1645 C/C 002°T
1728 Set C/002°T
2000 72°33' 155°16'W
2030 OCS
2224 Underway VCS - shifting to open water
2356 Shifted to open water

August 14, 1950

0000 OCS - 127 miles north of Barrow
0101 Underway - C/000°T
0238 Underway C/000°T through pack ice
0800 73°57.4' 155°45'
0900 maneuvered VCS to clear ice
0909 Stop - lying to
1200 73°48' 155°10'W
1241 Maneuver VCS to clear heavy pack ice
1325 Stop - fog
2000 73°47.5' 155°12'W
2043 Underway - set course 225°T
2218 C/C 247°T

August 15, 1950

0000 Underway with no way - 127 miles north of Barrow
0013 set course C/247°T
0205 Stop OCS
0528 Commenced steering base course 247°T thru loose pack ice
0626 Stop
0650 Commenced steering BC/247°T thru loose pack ice
0800 73°15.2' 158°37'
0802 OCS - lying to in large open lead
1020 Moved to open water
1113 Commenced steering BC/247°T
1200 73°13' 159°06'
1215 OCS - lying to in large open lead
1358 Commenced steering BC/247°T thru open leads in pack ice
1450 OCS - lying to in large open lead
1609 Commenced steering BC/247°T thru medium pack ice
1720 Entered open water
1853 Commenced steering BC/247°T
2000 73°02' 162°00'
2036 OCS
2231 Commenced steering course 272°T

August 16, 1950

0016 OCS
0056 Set BC/000°T
0300 OCS
0420 Commenced steering BC/000°T thru heavy pack ice
0618 OCS
0800 73"35' 163°39'
0830 Underway - easterly course - thru occasional ice floes
1200 73°37' 161°22'
1250 OCS - getting ice samples
1544 Underway - 215°T
1822 Set course 217°T
1925 C/C (BC) 213°T
2000 73°02' 162°13'W
2030 Left the ice pack
2035 OCS
2129 BCS - sounding grid
2246 Commenced BC/137°T

August 17, 1950

0208 Entered ice field with widely scattered ice floes
0333 Entered open water
0800 71°22.8' 157°54.5'W
1531 Set base course 100°T
2000 71°18.7'N 152°44'W

August 18, 1950

0030 Maneuvering VCS to clear heavy pack ice
0103 Still proceeding thru heavy pack ice
0220 C/BC 110°T
0419 C/BC 115°t
0504 C/BC 090°T
0519 Noted Fata Morgawas to south, along the horizon
0536 C/BC 120°T
0740 C/BC 110°T
0758 C/BC 120°T
0800 70°35' 145°20'W
1030 Abeam Barter Island
1034 C/C 80°T
1200 70°17' 142°45'
1359 OCS
1455 Set course 100°T
1527 Stopped in area of concentrated ice
1731 Underway - BC/090°T
2000 70°18' 139°48'

August 24, 1950

0800 71°42' 137°43' - maneuvering on various westerly courses to skirt edge of large ice pack
1200 71°54' 141°12'W
1225 OCS
1517 Commenced maneuvering VCS to clear loose pack ice
1614 Set course 270°T
1747 C/C 247°T
1810 Commenced steering various westerly courses following edge of ice pack
2000 71°47'N 142°55'W
2025 Stop

August 25, 1950

0000 Stopped on OCS in loose pack ice - approximately 100 miles north of Barter Island
0005 Commenced maneuvering into loose ice pack
0025 Lying to
0800 71°47' 142°51'
1200 71°47' 142°51'
1734 Maneuvered to adjust position in ice
2000 71°47' 142°51'

August 26, 1950

0000 Lying to in loose pack ice - approximatley 100 miles north
of Barter Island
0417 Commenced steering NE course into ice pack to reduce rolling
0502 Stopped in ice pack
0800 71°47' 142°51'
0830 Set northerly course
1002 Stopped in soft ice
1200 71°59.2' 142°44'W
1500 VCS to adjust position in ice floe
1529 Lying to in pack ice
2000 71°59.2' 142°44'

August 27, 1950

0000 Lying to in loose pack ice - approximately 100 miles north
of Barter Island
0800 72°10' 144°05'W
0802 Commenced maneuvering generally northward on VCS thru loose
pack ice
1200 72°13.3' 145°16'W
1217 Set course 180°T thru heavy pack ice
1443 Cleared pack ice
1545 OCS
1800 Set course 180°T
2000 71°37' 145°00'W

August 28, 1950

2000 70°39' 148°29' - on a course of 300°T
2200 C/C 280°T

August 29, 1950

0000 Underway in Beaufort Sea between Cross Island and Pitt Point
on C/280°T
0200 Entered loose pack ice field
0217 Left ice field
2000 71°48.5' 151°13'W on BC/010°T
2254 OCS

August 30, 1950

0121 Underway - course 010°T
0150 C/C 340°T
0156 C/C 330°T

Burton Island Continued

August 30, 1950 continued

0200 C/C 320°T
0212 C/C 300°T
0214 C/C 290°T
0215 Lying to - two miles off Polar Pack
0655 Commenced course (BC) 243°T
0800 72°13' 152°03'W

August 1, 1952

0000 Steaming between Point Barrow and Point Franklin on a north-northeasterly course - skirting the ice to outline its limits
0025 At a point - opposite the beaches of Point Barrow - C/C 227°T - steered VC in a southwesterly direction following the ice pack
0200 Commenced westerly courses
0303 Reversed course to 107°T - the ice appears to be setting in a north-easterly direction
0410 Making a good northeasterly course scouting ice pack towards Point Barrow
0517 W/Point Barrow beacon - 150°T, 3-3/4 miles, C/C 222°T
0636 Making good a course of 235°T, scouting ice pack
0658 C/C 032°T - ice pack appears to be moving in a northerly direction - at Bet 1 and 2 knots
0712 C/C 322°T - steaming in open water
0727 C/C 197°T
1035 Sighted Point Franklin (17.5 miles) - underway on course 247°T
1349 C/C 067°T
1551 C/C 060°T
1703 Commenced maneuvering VCS while passing thru close pack ice
1811 Point Barrow village sighted - 075°T, 12 miles
1850 C/C 047°T
1903 Passed Barrow village abeam to starboard, 3.5 miles
1923 C/C 002°T
1938 C/C 317°T
1948 Commenced following the edge of the ice to the southwest - C/C 222°T

August 2, 1952

0000 Steaming westward and southwestward from Point Barrow on course of 257°T
0047 C/C 261°T
0058 C/C 267°T
0059 Maneuvering VCS to attain position bearing 000°T, 10 miles from Point Franklin
0115 Lying to - with Point Franklin - 000°T, 10 miles

August 2, 1952 continued

0532 Regain position - with Point Franklin - 180°T, 10 miles (?)
0709 Underway for ice recon.
0711 C/077°T
0800 71°06.2' 158°24.4'W
0843 C/C 127°T
0900 C/C 042°T - having determined the extreme southern limit of the ice to be 11 miles from the beach
1119 Commenced VC thru the ice
1159 C/C 207°T, heading towards Skull Cliff
1200 71°26.8' 156°52.0' - steaming as before - scouting ice from Point Barrow to Point Franklin
1720 C/C 075°T
1832 C/C 000°T
1905 Maneuvering on various northeasterly courses scouting edge of loose ice
1946 Set C/205°T
2000 71°09.8' 157°58.2'
2006 C/C 225°T
2007 C/C 205°T
2106 C/C 050°T
2147 C/C 075°T
2300 C/C 040°T
2345 Commenced steaming as ice breaker for 8 other ships
Anchored at Point Barrow

August 3, 1952

1006 Underway from Point Barrow on ice recon
1009 Set C/260°T
1039 VCS to check ice drift
1132 Completed
1200 71°23.1' 156°52.0' on C/087°T
1202 Maneuvering on VC north and south to check ice drift
Drift - 035, set 2.0 knots
1300 Commenced maneuvering in northerly direction on ice recon.
Scattered ice 8 miles north of Point Barrow
1344 Commenced maneuvering in southerly direction
1440 Observed ice floes near USS Talvga
1510 Steady on C/225°T
1540 C/C 299°T
1548 C/C 043°T - anchored at Point Barrow
1946 Underway on local ice recon on C/223°T
2000 71°21.5' 156°10.0' - many course changes

August 4, 1952

0000 On ice patrol between anchorage "George" off Point Barrow - and the edge of the loose ice. About six miles, bearing 310°T - base course 238°T
0015 Reached edge of ice and reversed course
0108 Approaching anchorage "George" and reversed course
0148 Edge of ice - reversed course
0222 "George" - reverse
0254 Ice - reverse
0324 "George" - reverse
0351 Ice - reverse - C/C 143°T
0416 C/C 343°T
0436 C/C 303°T
0440 VC to avoid ice
0459 Steady on course 143°T
0521 C/C 303°T
0551 Commenced maneuvering on VCS to avoid ice floes
0610 Steady on course 143°T
0637 C/C 043°T
0658 Anchored
0800 71°21.9' 156°42.1'
1200 71°20.9' 156°42.1'
2000 71°24.3' 156°34.5'
2033 Underway to Pitt Point - on VCS
2044 C/C 047°T
2120 C/C 112°T
2307 Stopped to allow other ships to close up for passage thru broken ice
2330 Proceeding on VC thru the ice

August 5, 1952

0000 Base course - 114°T
0143 C/BC 100°T
0355 C/BC 119°T
0588 Anchored - Pt. Pitt
0800 70°58.5' 153°07.8'
1200 Same
1449 Underway - to Barter Island
1455 Set course - 105°T
1645 Base course - 107°T - maneuvering thru scattered ice floes
1823 Commenced maneuvering at VS on base course 107°T to steer thru leads in ice. Ice conditions: scattered and broken floes and brash - made good course 106°T; 13.5 miles
2000 70°54.3' 151°25.9' - maneuvering on VCS to proceed thru broken floes and brash to MGC of 107°T
2203 Ice conditions are broken ice with .5 to .7 coverage
2000-2400 MGC 130°T; 18.2 miles
(MGC = made good a course)

August 6, 1952

0000 Escorting ships thru ice VCS
0430 Sighted Pingok Island - 120°T, 9 miles
0534 With Pingok Island - 180°, C/C 052°T
0609 With Pingok Island - 121°, C/C 107°T
0630 Maneuvering thru heavy ice
0800 70°36.2' 148°28.9'
1200 70°32.4' 147°54.5'
1345 Hove to with Narwhal Island beacon - 139°45' (Gyro)
Cross Island beacon - 220°45' (Gyro)
Midway Island beacon - 254°30'
1406 VCS underway
1600 Standing on various course thru heavy ice floes attempting to MGC of 115°T
1700 Ice floes closer together with less water between
1800 VC thru heavy ice floes attempting to MGC of 115°T
2000 70°25.3' 147°05.1' - on VCS thru heavy ice floes attempting to MGC 115°T
2000-2400 MG distance at 10 miles, on 119°T

August 7, 1952

0000 Steaming on VCS to maneuver thru ice pack
0324 VCS to maneuver thru the ice. Ice conditions: moderately heavy floes rotting with less than half coverage
0000-0400 MGC 112°T, nine miles
0400 VCS thru ice conditions: moderately heavy broken ice, rotting. Thin ice being frozen on surface of water
0400-0800 MGC 111°T, 4.5 miles
0800 70°14.2' 145°58.0'
0800-1200 MGC 098°T, 6 miles thru 50% coverage
1200 70°13.4' 145°42.8'
2000 70°07.3' 144°35.5' - BC/70°T

August 8, 1952

0000 Lying to approximately 2 miles north of Barter Island
0413 Commenced maneuvering on various easterly courses at VS to move clear of heavy ice and shallow water
0507 Stopped - lying to approximately 2.5 miles off Barter Island
0800 70°10.4' 143°40.8'
1200 70°10.7' 143°36.8'
2000 70°10.7' 143°39.8'

August 9, 1952

0000 Lying to approximately 2 miles off Barter Island
0707 Report - underway to Barrow on BC/272°T. Commenced maneuvering thru the ice. Ice conditions: scattered and broken floes, ice rotten with 1/4 coverage
0400-0800 MGC 272°T, 5 miles
0800 70°11.1' 143°51' - man thru ice
0800-1200 Ice conditions: scattered small floes, block and brash ice with .3 coverage. MGC 264°T, 29.8 miles
1200 70°07.8' 145°18'
1503 Commenced maneuvering on VCS to MGC 290°T
1200-1600 MGC 290°T, 14 miles
2000 70°20.0' 146°40'
2345 MGC 305°T, 8 miles

August 10, 1952

0000 VCS to MGC 290°t thru heavy ice floes
0800 70°33.2' 148°05.0' - steaming thru broken ice with approximately 5/10 coverage - on BC of 228°T
1127 C/BC 267°T
0800-1200 Throughout this watch ice conditions improved. Ice coverage at 1200 is less than 1/10. MGC 285°, 32.0 miles
1200 70°34.8 149°33.2'
1600 Ice conditions: open water with less than 1/10 coverage. MGC 290°T, 54.5 miles
1618 C/C 268°T
1649 C/C 298°T
1800 Ice conditions: open water
1948 C/C 298°T
2000 71°26.6' 154°50.3'
2153 C/C 227°T
2222 C/C 232°T
2325 Anchored - Point Barrow

August 11, 1952

0343 Depart - Point Barrow - enroute 71°41'N 156°W for rendevous, on C/028°T
0357 C/C 038°T
0500 Commenced maneuvering thru scattered ice floes
0505 C/C 358°t
0610 Arrived at 71°45' 156°W
0800 71°45' 156°W
1200 71°43' 156°26'
2000 71°29.9' 156°414.'

August 12, 1952

0000 Ice drift 050 pgc (?), 1.7 knot
0800 71°20.9 156°41.4'
2000 same
2234 Underway - enroute Icy Cape - on course 242°T
2310 Encountered brash ice with much open water
2359 Encountered small floe ice

August 13, 1952

0026 Maneuvering on various southwesterly courses to pass along landward fringe of ice pack. Ice conditions: widely scattered floes and separated pieces, MGC 239°T, 20 miles
0225 C/C 272°T having cleared ice pack to the northwest
0325 C/C 212°T to skirt by edge of ice pack
0417 C/C 252°T
0508 C/C 272°T
0800 70°45.3' 160°22'
1200 70°49.2' 159°57.5'
2000 71°40' 154°46.3'
2011 Slowed to enter ice field - VCS - waiting for rendevous

August 14, 1952

0136 Underway on C/277°T to maintain position ?
0308 Commenced maneuvering on VCS to avoid large ice floes
0334 C/C 007°T
0422 C/C 241°T
0443 C/C 206°T
0552 Stop - lying to Rendy
0800 71°52.8' 153°14.2'
1200 71°51' 157°17'
2000 71°59' 152°53.7'

August 15, 1952

0800 72°18' 152°18'W
1010 Maneuvering VCS around ice floe
1020 Lying to
1200 72°21.4' 152°10.5'
1324 - Underway - BC/000°T - maneuvering thru light ice floes
1400 Entered field of ice with 60% of puddling (sic). Puddles not burned through.
1400 Ice coverage is 90%
1456 Lying to in ice
1540 Underway on C/154°T - thru puddled ice
1200-1600 MGC 340°T, 7-1/4 miles
1600 Maneuvering thru ice as before
1800 Maneuvering thru ice as before
1900 Lying to
2000 72°22.3' 152°09.8'

August 16, 1952

0000 Lying to - ice coverage about 5/10 of surface
0800 72°31.5' 151°11.5' - lying to
1200 72°34.5' 150°50' - lying to in 90% coverage of light ice floes
2000 72°32' 151°05'

August 17, 1952

Lying to
0800 72°27' 151°53'
1200 72°37.5' 152°08.0'
2000 72°38.8' 152°27.5'

August 18, 1952

0000 Lying to in medium and giant floes of winter ice with pools of water on its surface, some new ice is forming in the pools
0725 Underway on VC to free submarine from ice
0800 72°44.5' 152°47' - underway on VCS to MGC 045°T
1121 Helicopter made forced landing on ice due to broken fan belts - 082°, 3.5 miles
1143 VCS to assit helicopter. Ice conditions: moderate heavy winter ice with 50% puddling
1200 72°46.7' 153°06.3'
1432 Commenced moving in southeasterly direction
1746 Stopped
1756 Lying to in a lead (polyna)
2000 72°41.5' 153°06.8 - lying to

August 19, 1952

0000 lying to in large open lead
1800 72°41.2' 153°34'
1200 72°41.1' 153°45'
1359 Commenced maneuvering on various SE courses
1547 Commenced maneuvering on various southerly courses. Ice conditions: light with large open water areas
1633 Lying to
1710 Commenced maneuvering to maintain instr. free of ice
2000 72°31' 153°52'
2000-2400 During watch - ship drifting to SW

August 20, 1952

0000 Lying to in small open lead at 72°31' 154°06'

Burton Island Continued

August 21, 1952

1200 72°06.3' 151°43.5'
1345 Underway on C/105°T
1420 Helicopter landed on ice due to broken fan belt
1505 Hove to - 2,500 helicopter - 090"T
2000 72°02.8' 150°57.0' - moving in various east-southeasterly courses
2220 Stopped OCS

August 22, 1952

0000 Hove to in 30% ice
0800 71°41' 149°22'
1200 71°43.4' 149°12'
2000 71°39.5' 146°32'
2321 Underway on various east-southeasterly courses

August 23, 1952

0000-0400 MGC 111°T, 17.4 miles. Ice Conditions: moderate heavy ice with surface pools, coverage 80%
0800 71°29.4' 144°20'
0937 OCS
1200 71°28.4' 144°00' - lying to
1522 Underway on various west-southwesterly courses
2000 71°19.5' 145°35.0'

August 24, 1952

0000 Steaming on base course 259°T - maneuvering to avoid small scattered floes of ice with less than 10% coverage
0100 Entered an area of small to large floes of winter ice - coverage is 30%
0245 Ice conditions change to small to medium floes of rotten ice. Coverage is 40%
0315 Ice coverage decreasing
0000-0400 MGC 261°T, 22.5 miles
0400 Steaming as before in rotten ice
0400-0800 Ice conditions: moderately heavy broken ice with about 40% coverage. MGC 265°T, 15-1/2 miles
0800 71°07.0' 149°11.5' - steaming as before in rotten ice
0800-1200 MGC 349°T, 35 miles
1200 71°53.8' 150°44'
2000 70°52.9' 150°46' - on course 145°T
2022 C/C 344°T
2353 C/C 049°T
2300 OCS

August 25, 1952

0800 70°46.8' 151°17'
0815 Underway on various north-northeasterly courses to rendy pt.
1030 At rendy - commenced docking exercises in area, using small ice floes to dock
1200 71°03.4' 150°59' - continued docking exercises on small ice floes
2000 71°04.5' 151°40'
2047 Underway to Point Barrow on C/287°T

August 26, 1952

0000 Enroute to Point Barrow BC/287°T. Ice conditions: broken floes with 60% coverage
0400 Maneuvering to avoid occasional floebergs
0722 Anchored Point Barrow
0800 71°21.6' 156°42'
1200 Same position
1457 Underway - enroute Barter Island C/046°T
1548 C/C 068°T
1603 C/C 107°T
1830 Maneuvering VCS to avoid ice
2000 71°17.1' 153°42'
2000-2400 Steaming as before in scattered ice of 35% coverage

August 27, 1952

0000 BC/107°T, VCS to avoid heavy ice
0615 C/C 109°T
0800 70°55.8' 149°27'
1200 70°39.0' 148°07.0'
1209 Ice becoming sparser with more open water
1220 C/C 108°T
1852 Anchored 2 miles north of Barter Island
2000 70°10.2' 143°41.2' - anchored
2056 Underway on course 066°T

August 28, 1952

0223 Maneuvering to avoid ice
0247 C/C 070°T
0349 C/C 250°T to return to Barter Island (?)
0412 Commenced VCS to avoid ice
0500 C/C 246°T
0800 70°27.6' 141°51.5'
1040 C/C 337°T
1056 Stopped - lay to - 1.5 miles north of Barter Island
1200 70°10' 143°34'
1203 Underway for Banks Island on C/066°T

August 28, 1952 continued

1651 Sighted ice floes ahead of ship - 062° (Gyro)? [not true], 5 miles
1701 C/C 070°T
1800-2000 No ice
2000 70°53.0' 138°28.5'

September 9, 1952

2000 76°12.6' 137°01' - on base course at 270°T
2035 Commenced maneuvering to avoid ice
2055 OCS
2130 Underway
2148 C/C 273°T
2223 Commenced maneuvering to avoid ice

September 10, 1952

0009 C/C 262°T
0025 C/C 310°T
0053 C/C 273°T
0130 OCS
0254 Underway on C/270°T
0315 Commenced maneuvering VC to avoid ice
0400 Steaming in westerly direction to avoid ice
0726 Lying to
0740 Underway on course 275°
0800 70°19.9' 141°06.0'
0809 C/BC 270°T
0830 Lying to
1012 Proceeding on course 270°T, maneuvering to avoid heavy ice
1200 70°19.8' 141°49'
1524 Stop
1559 Underway on C/245°T
1705 Commenced maneuvering through block and brash ice
1740 Sighted land 3 miles ahead and C/C to north
1816 Sighted Barter Island - 215°T, 11.5 miles
1906 Lying to - fog
2000 70°10' 143°22' - lying to as before
2235 Underway to Point Barrow on base course of 358°T
2343 Commenced maneuvering at VS through ice

September 11, 1952

0000 BC/284°T - maneuvering VCS thru ice
0210 Commenced maneuvering thru ice with USS Redfish following close
astern; ice prevented Redfish from making greater than 3 knots

September 11, 1952 continued

0000-0400 Ice conditions: 40% brash and small floes; MGC 2275°T, 12 miles
0416 Maneuvering on various westerly courses to avoid ice
0400-0800 Ice conditions: 20% coverage, brash small floes; MGC 291°T, 17.5 miles
0800 70°23' 145°34.5', C/C 289°T - Maneuvering on VC to avoid ice
0900 C/C to north for firing drill
1106 Stop - lying to
1126 Underway in northerly direction in an attempt to find penetrable ice to the west
0800-1200 Ice conditions: scattered 30% coverage until 1106 when a very large floe made a westerly course, hazardous. MGC 296°T, 19 miles
1200 70°30.3' 146°25.2' - steaming in a westerly direction - on VCS to avoid heavy ice
1956 C/BC 260°T
2000 70°42.8' 147°01.0' - Maneuvering thru brash, block and small ice floes on VCS
2130 C/BC 284°T

September 12, 1952

0800 70°47.5' 148°23.5'
1200 70°49.7' 148°40.5'
2000 71°00' 149°00' on BC/285°T
2132 Lying to

July 21, 1953

1321 With Point Hope - 097°, 13 miles, C/C 025°T
1540 C/C 041°T

July 22, 1953

0145 Commenced steering VCS thru numerous small ice floes
0235 C/C 060°T
0400 Maneuvering to clear ice floes on base course 069°T
0800 71°03.4' 158°28.3'W
0904 Commenced maneuvering in brash and block ice
1055 Commenced maneuvering thru moderately heavy brash and block ice
1200 70°59.0' 157°58.0'
1243 Stopped waiting for pressure on ice to ease off
1320 Ship is drifting 1/4 knot, set 090°T
2000 71°01.4' 157°47.9' - lying to in ice as before

July 23, 1953

0000 lying to in heavy ice, small and medium floes, 9/10 coverage, off Sinarv Village, Alaska

July 23, 1953 Continued

0800 71°03.0' 157°43' - lying to
0800-1200 No change in ice conditions
1200 71°03' 157°42.5' - lying to
1947 Underway for Point Barrow - on BC/050°T
2000 71°04.2' 157°38.5' on BC/050°T - maneuvering on VCS to pass thru broken ice pack
2100 Lying to in ice - possible screw damage
2123 Lying to in ice waiting better ice conditions

July 24, 1953

0000 Lying to in ice approximately 21 miles southwest of Point Barrow
0800 71°08.9' 157°14.3'
0807 Commenced maneuvering on approximate course - 035°T
0920 Lying to
1045 Underway - approximate C/35°T
1200 71°18.2' 151°00'
1213 Lying to - waiting better conditions
2000 71°26.4' 156°32.2' - lying to
2045 Commenced maneuvering on VCS to work free of ice
2102 With progress thru ice very poor - all stop

July 25, 1953

0000 Lying to 7.5 miles northeast of Point Barrow
0800 71°28.5' 155°55.8' - lying to
1200 71°28.2' 155°44.2' - lying to
1403 Underway - VCS
1600 Base course 220°T
1612 Commenced maneuvering on VCS thru the ice, base course 270°T
1800-2000 MGC 270°T, 2 miles
2000 71°24.7' 156°03.0'W
2051 Anchored

July 26, 1953

0000 Anchored 4.5 miles west of the north tip of Point Barrow - in 1/10 concentration of brash and block ice. The edge of the consolidated pack is east and west about 1,000 yards north of the ship.
0800 71°23.5' 156°13.2'
1200 71°23.4' 156°13.0'
1353 Underway VCS
1416 Set base course 085°T, maneuvering to approximate base course shile piloting thru ice

July 26, 1953 continued

1438 C/BC 103°T - maneuvering to pass thru ice
1600-1800 Steaming as before to maneuver thru ice - MGC 100°T, 7 miles
1800-2000 Steaming thru ice as before - MGC 113°T, 8 miles
2000 71°18' 155°08.6' - thru ice
2000-2400 MGC 120°T, 5.5 miles

July 27, 1953

0000-0400 Base course 90°T - but making VCS thru ice
0800 71°13.6' 154°18.7'
0817 C/BC 103°T
1012 Stopped, lying to in 9/10 medium block ice - waiting improvement in ice conditions
1200 71°17.1' 154°40.7' - lying to in ice
2000 71°16.8' 154°31.2' - lying to in ice

July 28, 1953

0000 Lying to with Point Barrow - 281°T; at distance of 118 miles, from last known position (7/27/53 - 2000)
0800 71°18' 154°45.8' - lying to in ice
1200 71°16.8' 154°41' - lying to in ice
2000 71°16.7' 154°32.1' - lying to in ice

July 29, 1953

0800 71°17.7' 154°38.9' - lying to in ice
0813 Underway - VCS thru ice
1115 Keeping a steady speed against ice so as to gain a suitable position
1116 Lying to
1200 71°18.2' 154°26.8' - lying to as before
1225 Commenced maneuvering on VCS in heavy pressure ice
1306 Lying to in heavy pressure ice
2000 71°17.2' 154°06.6' - lying to in ice
2030 USCG Northwind - approached to a distance of 5 miles - on bearing 170°T and lay to in ice

July 30, 1953

0000 Lying to in ice - Point Barrow - 278°T, 37 miles (??)
0800 Lying to as before - 71°17.2' 154°07.6'
0854 Underway - VCS to Barter Island
1200 71°15.7' 154°24.1' - steaming as before in a southeasterly direction
1335 Set BC/103°T
1351 C/BC 100°T

July 30, 1953 continued

1500 C/BC 109°T
1710 C/C 090°T
2000 71°06.5' 152°39.5'
2000-2400 MGC 100°T, 24 miles

July 31, 1953

0800 70°52.8' 150°53.6'
1200 70°44' 149°38'
2000 70°32.8' 147°37' - BC/106°T
2158 Maneuvering on VCS thru ice - base course 107°T

August 1, 1953

0000 Maneuvering thru winter pack ice along north coast of Alaska on BC/107°T
0800 70°78.1' 145°05.0'W
1047 C/BC 056°T
1131 C/BC 089°T
1200 No position given (the 2000 position may really be 1200 position, but on chart 1200 was blank)
1203 Commenced maneuvering thru heavy pack ice on base course 089°T
1525 Anchored off Barter Island
2000 70°32.8' 147°37' - and hoped

August 2, 1953

0258 Commenced maneuvering to miss floating ice
0800 Anchored as before - no position given
1200 Anchored as before - no position given
1416 Commenced maneuvering the ship about the anchor to avoid several threatening ice floes
1710 Underway on VCS - maneuvering thru ice, on base course 072°T
1748 C/BC 088°T
1845 C/BC 120°T, continued maneuvering on the edge of the pack
2000 70°05.1' 142°44'
2227 Set BC/096°T

August 3, 1953

0000 Steaming to Herschel Island on BC/099°T (sic), VCS to maneuver ship thru ice floes
0352 (sic) C/C 100°T
0245 (sic) C/BC 090°T, C/BC 080°T
0408 Stopped - lying to in heavy pressure ice

Burton Island Continued

August 3, 1953 continued

0544 Commenced maneuvering to pass thru pack ice
0632 Lying to in heavy pack ice waiting improved ice conditions - Demarkation Pt. - 183°T, 5 miles
0800 69°45.5' 141°10.5' - lying to
1200 69°46' 141°10.5' - lying to
1325 Underway in heavy ice, base course 096°T
1600 Underway in heavy ice
1700 Entered Canadian Territorial Waters

September 10, 1953

0800 Lying to in Mackenzie Bay - Herschell Island - 070°T
0833 Underway VCS
0918 Passed through patches of brash, block ice 1/10 coverage
1200 BC/275°T
1600 Retarded ships clocks - one hour to conform with time zone (Amer. border?)
2224 Stop. With Barter Island - 186°T, 13,600 yards
2240 Underway - C/287°T

September 11, 1953

0000-0400 BC/287°T, maneuvering to approximate BC while passing thru ice 1/10 - 2/10 coverage
0800 70°39.2' 147°19' - maneuvering on VCS to avoid ice
0915 C/BC 283°T
1031 C/BC 282°T
1150 C/C 284°T
1200 70°44' 148°28'
1200-1600 Ice coverage - 1/10 brash and large floes
1600 Maneuvering to approximate 10 fathom curve while avoiding scattered ice along edge of pack
1745 Came to course 280°T
1900 C/C 300°T
2000 70°57' 151°31'
2100 C/BC 277°T
2115 Ice coverage increased to 5/10
2148 Commenced lying to wainting for daylight

September 12, 1953

0000 lying to
0029 Underway on VCS
0033 Set BC/290°T, progressing slowly through 10/10's pack ice under heavy pressure
0516 Entered open water and lay to

September 12, 1953 continued

0613 Lying to along ice pack
0800 70°59.5' 152°18' - lying to along ice pack
1200 same as 0800
1236 Underway BC/289°T
1455 Commenced maneuvering on VCS thru ice. Ice coverage increased to 3/10 with freshly frozen ice
1600-1800 Ice coverage 1/10 new and small floes
1800 Ice increased to 3/10 block, small floes, and new ice
1935 Emerged into open water
2000 71°24.6' 155°25.5'
2230 Anchored off Point Barrow

August 3, 1954

2000 71°06.0' 158°29' on course 055°T
2008 C/C 066°T
2011 Maneuvering at VCS in brash ice
2720 Anchored Point Barrow

August 4, 1954

1200 Anchored as before
1320 Underway - maneuvering on VCS to round Point Barrow
1511 C/C 105°T
1857 Stopped Northwind stuck in ice floe - lying to
2000 71°15.5' 154°36' - lying to "in company" with USCG Northwind

August 5, 1954

0035 Underway
0340 Passed Cape Halkett abeam - 9.5 miles
0800 70°55.5' 150°53.5'

August 6, 1954

1200 70°15.8' 145°22'
1200-1600 maneuvering astern of Northwind thru scattered ice floes varying from 1/10 to 6/10 coverage
2000 70°12.5' 143°17.5'
2330 Lying to - fog

August 7, 1954

0000 Lying to in heavy fog and scattered ice 3/10 coverage, 6 miles east of Griffin Point, Alaska

August 7, 1954 continued

0800 69°58.5' 142°14.5' - lying to as before
0930 Underway on VCS
1125 Maneuvering to avoid ice
1200 69°54.1' 142°05.0'
1200-1600 Maneuvering VCS thru ice
2000 69°44.0' 139°40.0'

July 31, 1956

1200 70°tl' 159°51'
1235 C/C 069°T
1312 C/C 065°T
1347 C/C 104°T
1351 C/C 029°T
1353 C/C 044°T - encountered ocean rotten ice steaming VCS thru ice
1825 Lying to in the ice
2000 71°03.3' 157°54'

August 1, 1956

0000 Lying to in ince on following bearings:
Point Barrow radar reflect - 056°T, 34 miles
Point Franklin radar reflect - 242°T, 22 miles
Nearest land - 127°t, 10 miles
USS Atka - lying to in ice 150 feet off starboard beam
USCGC Northwind - lying to in ice - 282°T, 2,800 yards
0800 71°04' 157°54' - lying to as before
0825 Underway on BC/060°T - thru 9/10 - 10/10 ice
1200 71°04' 157°50' - steaming as before
1345 C/C 245°T
1847 Lying to
2000 71°06.2' 158°25' - lying to
2222 Underway BC/245°T

August 2, 1956

1200 Anchored as before at Wainwright
1650 Underway - enroute polar pack
1708 Set C/000°T
1755 C/C 334°T
1805 C/C 354°T
1816 Entered ice field - 6/10 concentration (steering VCS for Newsreel camera fro MOVIETONE NEWS)

August 2, 1956 continued

1916 C/C 170°T
1920 Left ice field to return to anchorage
2000 70°47' 160°30.8'

August 4, 1956

1200 Anchored at Wainwright
1255 Underway VCS
1703 C/C 090°T
1930 C/C 090°T
2000 No position given - steaming as before - VCS

August 5, 1956

0530 Approached USS Elkhorn to take her in tow
0548 Commenced towing Elkhorn thru 9/10 ice coverage, Base course 180°T
0710 Cast off line to Elkhorn. Elkhorn lying to in ice
0711 Proceeding thru heavy pack ice to find a lead
0800 No position given - lying to in ice
1200 No position given - lying to in ice
1200-1600 Lying to in heavy ice field
2000 Lying to in heavy ice field
2022 Underway
2357 This vessel enroute U.S.N.S. Cape May county for escort thru ice

August 6, 1956

0000 Ice concentration 10/10 including polar pack ice in various areas
0800 No position given
0854 Set C/235°T (other course change)
1200 71°28' 156°13'
1218 C/C 243°T
1225 C/C 246°
1228 C/C 251° (OCE)
1400 Steering VCS while maneuvering thru ice
1600 Making approach to moor alongside USS Atka - lying starboard side to ice pack
1610 moored
1700 Lead in ice closed in on our port side to 8/10 concentration
1817 Underway - VCS thru 8/10 ice concentration
2000 71°32' 156°27.2' - steaming as before

August 7, 1956

0000 VCS thru ice
0321 C/C 240°

Burton Island Continued

August 7, 1956 continued

0415 Maneuvering on VCS upon entering ice pack with 8/10 concentration
0458 C/C 284°T
1800 70°04.2' 158°02.0' (?)
0950 C/C 274°
1031 C/C 284°
1059 C/C 244°
1200 70°56.3' 159°09.7'

July 11, 1957

2000 70°05' 163°40', C/33°T
2237 C/C 063°

July 12, 1957

0037 C/C 073°
0042 Sighted scattered patches of ice, distance 5 miles
0210 Commenced VC to avoid ice
0210 Set C/065°
0220 Passed Wainwright radio tower abeam to starboard - 13.8 miles
0857 Anchored off Point Barrow
2000 Anchored
2004 Underway - escorting some ships thru ice - VCS thru 3/10 to 8/10 ice

July 13, 1957

0000 Present C/120°
0232 VCS breaking ice for task force
0618 Lying to in ice
0746 Commenced VCS breaking ice
0800 71°17.5' 155°28' - steaming in ice as before
0852 Entered ice and free water - set course 110°
1200 71°06' 153°41.5'
2000 No position given - steaming on VC seeking leads thru the ice fields

July 14, 1957

0000 C/110°
0052 Commenced VCS while transiting 1/10 to 5/10 ice
0420 Steaming as before - maneuvering thru ice floes
0658 C/115°
1145 C/C 96°T
1200 70° 20.1' 146°06.0'
1645 Lying to
1847 Underway VCS in an easterly direction thru ice fields
1936 C/110°T
2000 70°14.5' 142°51.5' - proceeding on VC thru ice, BC/110°

July 15, 1957

0341 Arrived in vicinity of Herschell Island
0800 N.P.G.
0802 Underway on C/025°
0839 C/C 050°T
0915 Encountered scattered ice - maneuvering on VCS to conform with ice
1200 71°32' 154°43'
1302 Lying to
1330 Commenced VCS
1600 Lying to in fog
1618 Underway
1825 Lying to in fog
2000-2400 Lying to as before
2000 71°26.5' 154°08'

July 16, 1958

0000-0400 Lying to in ice
0200 71°26.3' 154°28.9'
0520 Commenced VCS to conform with ice
0625 Lying to
0800 71°26' 153°49.8'
0931 Underway - C/113°T
1030 Lying to
1108 Underway - C/073°T
1200 71°25' 153°09'
1950 Clear of ice - set course 110°T
2000 71°16.5' 150°21'
2053-2133 Five course changes

July 17, 1958

0000-0310 Six course changes
0310 Commenced VCS to conform with ice
0400 Steaming as before - VCS to conform with ice
0800 No position given
0916 Lying to alongside Storis
1200 No position given
1453 Underway to Barter Island on C/188°T
1615 Anchored vicinity of Barter Island
2000 No position given

July 19, 1958

0000 Anchored as before - approximate position 71°16.5' 150°21'
0150 Underway for Point Barrow
0200 Set C/002°T
0334 C/C 290°T

July 19, 1958 continued

0800 C/C 290°T
1200 No position given
1500 C/C 280°T
1600 Maneuvering at VCS in ice
1929 Lying to in fog
2000 No position given

July 20, 1958

0000 Lying to approximately 36 miles north of Junes Island
0800 71°05.0' 148°49'
0815 Underway - C/280°T
1100 C/C 295°T
1133 Commenced steaming on VCS in ice
1200 71°16' 151°04' - proceeding on VCS thru scattered ice, BC/280°T
1708 Lying to
2000 71°16.8' 152°59'
2006 Underway - BC/282°T
2007 Commenced steering VCS in ice
2304 Lying to

July 21, 1958

0000 Lying to north of Smith Bay - in fog
0800 No position given
0758 Underway
0759 Commenced steering VCS in ice
1200 No position given
1954 Anchored Point Barrow - range to Point - 25,700 yards
2000 No position given
2205 Drifting ice endangered anchor
2211 Underway - VCS in scattered ice in vicinity of Point Barrow
2325 Lying to in drifting ice

July 22, 1958

0234 Underway - VCS to conform with ice
0405 Lying to
0717 Underway VCS
0800 N.P.G. (No position given)
0859 Lying to
1200 N.P.G.
1330 Underway - VCS in scattered ice
1854 Lying to
2000 N.P.G.

July 23, 1958

0000 Steaming in scattered ice - VCS
0035 Lying to, drifting in ice
0800 N.P.G.
0931 Underway VCS in scattered ice
1121 Lying to
1200 N.P.G.
1606 Underway - commenced VCS in ice
1725 lying to

[From 1500 hrs. -7/20/58 - 0300 hrs. - 7/24/58 - on waves chart is written ice].

July 24, 1958

0000 Steaming VCS in scattered ice
0208 Lying to
0800 N.P.G.
0804 Underway
0904 Anchored - Point Barrow - 056°
2000 Anchored (N.P.G.)
2255 Underway - VCS in scattered ice

July 25, 1958

0000 Steaming VCS in scattered ice
0017 Lying to
0628 Underway on VCS in scattered ice
0826 Lying to
1200 N.P.G.
1403 Underway in scattered ice on ice
1752 Lying to in vicinity of Point Barrow
2248 Underway VCS in scattered ice

July 26, 1958

0000 Steaming in vicinity of Point Barrow on C/231°T thru scattered ice
0410 Lying to
0730 Underway - VCS in scattered ice
1800 N.P.G.
0952 Anchored off Point Barrow - range - Memorial, 5.4 miles, Point Barrow 12.9 miles

August 4, 1958

2000 70°24' 164°09'

Burton Island Continued

August 5, 1958

0013 C/C 055°T
0246 VCS in scattered light ice
0319
Lying to in ice
0800 71°22.8' 161°52' - lying to as before
0948 Underway VCS to conform with ice on base course 045°T
1004 C/C 048°T
1155 Lying to
1200 71°31' 160°52'
1455 Underway - VCS to conform with ice - base course 152°T
2000 69°54' 160°01' (?)

August 6, 1958

0508 Anchored at Point Barrow
1423 Underway for Point Hope on C/264°T
1712 Commenced steering various courses to conform with ice
Base course 215°T
2000 70°59.5' 158°52.5'
2001 C/C 278°T
2301 C/C 225°T

August 14, 1958

0000 Lying to 50 miles northeast of Point Barrow
0143 Underway - set course 017°T
0243 Lying to
0458 Underway on course 017°T
0520 C/C 000°T
0530 Steering VCS to conform with ice
0620 Lying to
0750 Underway - on course 345°T
0800 72°47' 154°48'
0820 Steaming VCS to conform with ice
0853 Lying to
1435 Underway on course 017°T
1439 Commenced steering VCS to conform with ice
1539 Lying to
1817 Underway on C/200°T
2000 N.P.G.
2038 C/C 180°T - C/C 175°T
2129 Steering various courses and speeds to conform with ice
2201 C/C 080°T (Other course changes)

August 17, 1958

2000 72°57' 138°43' (over border)
VCS to conform with ice

August 21, 1958

1200 72°25' 141°06' - lying to
1706 Underway on course - 081°T
1720 Stopped
1750 Underway on C/001°T
1755 Commenced steering VCS to conform with ice
1808 C/C 317°T
1810 C/C 001°T
1830 C/C 356°T
1929 C/C 001°T
2000 72°55' 142°03' - steaming on VC to conform with ice
2342 Lying to

August 22, 1958

0000 Lying to Beaufort - "making Hydrographic observations in ice"
0449 Underway on VC in scattered ice
0800 N.P.G.
0803 C/C 231°T
0807 C/C 261°T
0811 C/C 331°T
0820 Lying to
1006 Underway on C/299°T
1017 C/C 301°T
1058 C/C 271°T
1137 C/C 301°T
1139 C/C 260°T
1200 73°08' 144°35' - proceeding on various courses to conform with ice
1227 Lying to
1303 Underway on C/216°T
1332 C/C 183°T
1336 C/C 216°T
1343 C/C 181°T
2000 71°50' 144°44'

September 6, 1958

2000 71°43' 159°03.5' on C/295°T
2207 Sighted ice usually bearing 312°T, 3.4 miles
2208 All stop
2220 C/C 296°T
2230 Steering VC to conform with ice
2316 C/C 265°T
2345 Stop - OCS

September 7, 1958

0038 Underway on C/209°T
0112 C/C 199°T
0200 Entered scattered ice area - proceeding on various courses
0257 Lying to
0623 Underway on C/344°T
0625 Steering VC to conform with ice
0737 Stop
0800 71°53' 162°10' - lying to as before
0824 Underway on VCS to conform with ice
1045 Clear of ice, set course 302°T
1200 72°16' 163°46'

August 3, 1960

0000 Lying to in 8/10 to 9/10 ice
0915 Underway to Point Barrow
1200 VCS to conform with ice
1452 Set BC/130°
1705 Anchored off Point Barrow
2100 Report - for Ice Island T-3
2104 C/C 260°
2113 C/C 255°
2156 C/C 235°
2159 C/C 245°
2231 C/C 260°
2330 C/C 265°

August 4, 1960

0026 C/C 255°
0033 C/C 235°
0050 C/C 220°
0110 C/C 255°
0112 C/C 265°
0251 C/C 105°
0300 C/C 180°
0315 C/C 270°
0334 C/C 115°
0400 Steaming on VCS to conform with ice
0427 C/C 125°
0446 C/C 180°
0454 C/C 270°
0535 C/C 240°
0537 C/C 270°
0624 C/C 310°
0800 71°02.2' 161°09'
0852 C/C 014°
0926 Set ice breaking condition one - all stop
0958 Underway - C/025°
1105 Entered ice pack, coverage 6/10 to 8/10 VCS on base course 017°

August 4, 1960 continued

1147 All Stop
1154 Underway
1200 71°13' 160°55.8' - set BC/015°
1405 Lying to - fog
1705 Underway - VCS to conform with ice
1911 Lying to
1941 Underway on VCS to conform with ice
2000 71°19' 160°55.5'
2051 C/C 340°
2233 Change BC to 000°

August 5, 1960

0000 Steaming in heavy pack ice 7/10 to 9/10 coverage - steering VCS, BC/000°
0026 All stop - lying to - making 45 RPM on each shaft to keep screws clear of ice - but ship has no obvious movement
0715 Underway - commenced heeling operation to free ship from ice - Steering VCS to conform with ice
0800 71°33' 161°04'W
1200 71°50.2' 160°22'W
1357 Commenced lying to at Ice Island T-3
2000 71°51.2' 160°22'
2100 Commenced heeling - shifting position
2111 Lying to in ice

August 6, 1960

0800 71°50.8' 160°18.4' - lying to
0949 Underway
0954 Set BC/250° - commenced steering VCS to conform with ice
1200 71°44.5' 160°52.5' BC/250°
1302 Lying to
2000 71°44' 160°57'W - lying to as before in ice

August 7, 1960

0025 Underway on course 230°
0155 C/C 300°
0157 C/C 280°
0213 C/C 230°
0445 C/BC 180°
0654 Lying to - fog
0800 71°24' 161°40' - lying to as before in ice
1200 71°22.3' 161°39.5' - lying to as before in ice
1215 Set ice breaking condition one
1225 Underway - steering VC thru ice - BC/180°
1251 Stop - lying to in ice
2000 71°22.3' 161°39.5' - lying to in ice

August 8, 1960

0000 Lying to in ice - proceeding from Ice Island T-3 to open water for OCS
0424 Underway VCS to conform to ice, BC/180°
0800 71°08.4' 161°43.2' - lying to as before (?)
1027 Set ice breaking condition one - underway on VCS to penetrate ice pack - BC/180°
1200 71°02.5' 161°40.8'
1333 Lying to for OCS (open water?)
1348 Underway - VCS to conform with ice - BC/180°
1409 Secured from ice breaking condition - C/180°
1436 Lying to OCS
1551 C/BC 240° - lying to
1642 Underway - C/240°
1754 C/C 260°
1852 C/C 290°
1952 Lying to - OCS
2000 70°40.2' 162°08'W
2103 Underway on C/260°
2111 C/C 070°
2129 C/C 100°
2204 C/C 130°
2214 C/C 120°
2222 C/C 100°
2246 C/C 060°

August 9, 1960

0105 Commenced VCS to conform with ice conditions
0406 C/BC 070°
0451 Lying to
0510 Underway BC 070°
0756 C/BC 000° PSTGC (?)
0800 71°09.8 157°24.1'
0857 C/BC 005° PSTGC - many course changes
0958 Anchored Point Barrow
1200 71°20.9' 156°42.7' - anchored as before
2000 Same
2250 Underway to clear ice pack on BC/315°

August 10, 1960

0000 Lying to in ice off Point Barrow
0721 Underway on VCS to conform with ice
0800 71°34.4' 156°08.9' - VCS
0806 C/BC270°
0816 C/BC 245°
0843 C/BC 270°
0849 C/BC 230°
0937 C/BC 235°
0950 C/BC 210°

August 10, 1960 continued

0955 C/BC 205°
0959 C/BC 195°
1000 C/BC 290°
1004 C/C 190°
1005 C/C 192°
1006 C/C 200°
1007 Anchored off Point Barrow
1200 71°31' 156°05' - anchored as before
1244 Commenced VCS to conform with ice
1347 Anchored
1651 Underway - on C/218°, VCS to conform to ice conditions
2000 71°37.3' 155°47.2'
2045 Stop
2117 Looking for floe to nose into for the night
2139 C/C 315°, VCS to conform to ice
2258 Commenced lying to in ice

August 11, 1960

0000 Lying to 5 miles northwest of Point Barrow
0453 Underway on BC/237° to lie to off Point Barrow airport - VCS to conform to ice
0600 C/BC 250°
0800 71°31' 156°05'
0928 Commenced lying to due to lack of progress with four engines
1200 71°32.5' 155°47.2' - Lying to as before
1736 Set ice breaking condition No. 1
1752 Underway for Point Barrow, BC/255°
1825 Steering VCS to conform with ice BC/270°
2000 71°33' 155°31'

August 12, 1960

0055 C/C 200°
0200 C/C 165°
0320 C/C 145°
0522 Lying to off Point Barrow
0800 71°24.6 156°37.6' - lying to as before
0830 Underway to anchorage
0947 Lying to off Point Barrow
1200 71°20.8' 156°44.7'
2000 71°20.7' 156°43.1' - anchored
2253 Underway for Lat 70°14' Long 146°06'W to assist tug - C/107°

August 13, 1960

0000 Base course 040° - VCS to conform with ice
0009 C/BC 090°
0246 C/BC 105°

August 13, 1960 continued

0707 C/BC 107°
0800 71°15.1' 153°05'
1200 71°10' 152°08'
2000 70°58.5' 150°33'

August 14, 1960

0800 70°50.3' 149°00'
1200 70°46.3' 148°10.1'
2000 70°12.5' 144°43'
2043 C/C 270°
2205 275°
2311 300°
2332 Lying to OCS

August 15, 1960

0001 Set course 000°
0120 Stop - lying to
0207 Set C/000°
0359 Stop - lying to
0451 Underway - C/000°
0540 C/C 180°
0550 C/C 080°
0605 C/C 180°
0608 Commenced steering VCS to conform with ice - BC/130°
0708 C/BC 120°
0717 C/BC 090°
0756 Lying to
0800 70°46.2' 144°59.5'
0855 Underway VCS - many course changes
1200 70°41.5' 143°58'
1202 C/C 080°
1235 C/C 073°
1254 C/C 000°
1334 Lying to
2000 70°56.9' 142°12.6'
2005 C/C 021°
2008 C/C 020°
2016 C/C 015°
2020 C/C 354°
2021 C/C 352°
2022 C/C 350°
2026 C/C 343°
2032 C/C 340°
2041 C/C 330°
2046 All stop - lying to

August 16, 1960

0115 Underway - steering VCS to conform with ice, BC/115°
0330 C/C 205°
0347 C/C 160° - many course changes
0800 70°32.6' 140°16.5'

August 22, 1960

0800 70°57.3' 148°54.7' - moored to Mohawk
0945 Underway for Point Barrow - steering VCS to conform to ice conditions BC/345°
1022 C/C 335°
1026 C/C 310°
1200 71°10.7' 149°35'
1255 Stop
1435 Underway on C/310° for Point Barrow
1505 C/BC 320°
1558 C/BC 280°
1744 Took tug Mohawk in close tow for better maneuverability in ice
1813 Underway BC/285°
1914 Lying to
1927 Underway - steering VCS to conform with ice, BC/285°
2000 71°29.2' 151°13'
2040 Lying to
2135 Underway - C/285°
2220 Stop
2245 Underway - C/285°

August 23, 1960

0000 Underway on course 285° - proceeding thru heavy ice
0020 Lying to
0246 Underway C/285°
0307 Commenced backing and ramming to break thru heavy ice
0410 Lying to
0800 71°28.9' 154°47' - lying to as before - attempting to twist tug Mohawk free of an ice floe by piloting the ships
0948 Commenced working ship free of ice - VCS
1108 Lying to
1200 71°28.6' 151°47.1'
1309 Underway - steering VCS to conform with ice
1505 Lying to
1607 Underway - C/285°
1754 C/C 270°
1952 Commenced lying to in ice - fog
2000 71°35' 154°21'

August 24, 1960

0520 Underway for Point Barrow - penetrating the ice very slowly
0545 Stop
0645 Underway for Point Barrow - penetrating the ice very slowly
0800 71°34.2' 154°38'
0818 Lying to
0837 Underway VCS to conform with ice, BC/270°
1054 Underway VCS
1200 71°33.8' 155°00'
1645 C/C 330°
1805 C/C 220°
1911 Lying to
1919 Underway
2000 71°39' 155°55.4'
2054 Lying to - break off tug
2224 Underway - C/235°

August 25, 1960

0000 Leading Mohawk - breaking channel thru ice so Mohawk can follow - VCS
0143 Stop
0230 Set BC/220°, steering VCS while maneuvering thru ice
0525 C/BC 040°
0800 71°42.5' 155°55'
1121 Lying to
1200 71°46.2' 155°53.6'
1229 Underway - commenced to break Mohawk from the ice and provide maneuvering room to back the shop onto her bow
1500 Mohawk in position - commenced making up tow
1646 Underway - VCS
1924 Commenced lying to in order to place demolition to blow out heavy ice
2000 71°46.8' 156°02' - lying to as before
2039 Set off 3-4 lb charges TNT in attempt to break ship free from ice. No casualties - Captain's window broken!
2040 Attempted to maneuver clear of ice but did not succeed
2043 Lying to
2215 Set off 3-50 lb. charges TNT in attempt to break ship free
2216 Attempted to maneuver clear of ice
2218 Unable to maneuver clear - all stop
2244 Made another attempt
2253 Stop
2320 Underway VCS to clear channel thru ice for Mohawk

August 26, 1960

0000 Steering VCS to maneuver free of cie
0100 Lying to waiting for ice conditions to improve
0608 Underway VCS
0800 71°51.8' 156°03'
0820 Lying to

August 26, 1960 continued

0906 Commenced VCS in attempt to break free of ice
0910 Lying to
0929 Underway - VCS to conform with ice
1140 Set BC/260°
1142 C/BC 240°
1155 C/BC 205°
1200 71°48.5' 156°08.1'
1851 Commenced lying to - nosed into ice and making many R.P.M. in effort to get maneuvering room
2000 71°46.5' 156°09.2' - Lying to

August 27, 1960

0000 Lying to in heavy ice awaiting favorable change in ice condition
0800 71°46.5' 156°09.2'
0824 Underway
1200 72°03.8' 157°50'
1259 Lying to
1353 Underway - pulling tug attempting to set thru very heavy ice to open water
1408 Lying to - progress very difficult due to heavy ice - lack of space to back for runs
1628 Underway VCS to conform with ice
1640 Lying to
1745 Underway VCS to conform to ice
1847 Lying to
1918 Underway on C/188°
1931 C/C 169°
1954 C/C 192°
2000 72°00.6' 158°19.5' - VCS to conform with ice

September 5, 1960

0800 70°15.9' 142°07.5' on C/090°
0938 Commenced VCS to conform with ice conditions
1200 70°08.8' 139°32'

September 19, 1960

1200 69°55' 140°12.8' - lying to
1335 Underway in BC/295°
1557 C/C 305°
1719 Commenced VCS to conform to ice
1745 Resumed base course 295°
1857 C/BC 257°
2000 70°23.2' 144°03'

September 20, 1960

0800 71°04' 150°07' on C/285°
0805 Commenced steering VCS to conform with ice conditions
0841 Returned to BC/285°
1200 71°14' 152°00' on C/285°
1426 Lying to OCS
1501 Underway - C/290°
1653 C/C 245°
1655 Steering VCS to conform with ice, BC/245°
1733 C/Base course 300°
1838 C/C 240°
1854 C/C 220°
1924 C/C 210°
1929 C/C 205°
1935 C/C 206° (other C/C)
2007 Anchored off Point Barrow

September 23, 1960

0000 Steaming on C/171°
0015 Reduced speed to ahead 2/3 rds due to ice conditions
0024 Resumed standard speed
0109 C/C 315°
0215 Reduced speed to 2/3 due to ice conditions
0220 Resumed standards spped
0252 C/C 166°
0800 70°20.1' 162°59'W on C/193°
0824 C/C 200°
0840 C/C 324°
0845 Lying to
0921 Underway C/327°
1115 Commenced steering VCS to avoid brash ice and small floes
1145 Lying to
1200 70°37' 163°54' - lying to
1217 Underway on C/170°
1200 (Sic) - (1300?) Steering southerly courses to conform with pack ice
1251 (Sic) - (1351?) Steering southwesterly courses to conform with ice
1305 (Sic) - (1405?) Steering westerly courses to conform with ice
1403 (Sic) - (1503?) Steering northerly courses to OCS
1631 Lying to
1704 Underway on BC/170°
1720 Commenced steering VCS in northwesterly direction to conform with ice
2000 71°07' 165°38'
2015 Commenced VCS to conform to ice conditions
2026 Lying to

September 24, 1960

0800 71°06' 166°02' - lying to as before
0845 Underway on C/070°
0900 VCS
1200 71°09.8' 165°03.9'
1217 Lying to OCS
1303 Underway on BC/180° - VCS to conform with ice conditions
1555 C/C 150°
1619 C/C 123° - commenced steering VCS to conform with ice conditions
2000 70°36.6' 163°53' - steaming as before VCS while maneuvering thru the ice, BC/075°
2308 Set BC/090°

September 25, 1960

0800 70°56.5' 160°19'
1200 71°13' 158°02'
1211 Point Barrow - radio tower - 082° - 23.5 miles
1323 C/C 090°
1326 C/C 100°
1341 C/C 097°
1427 Anchored - Point Barrow?
1534 Underway to Colville River
1627 Set course 070°
1806 B/C 093° - deviating as necessary to conform with ice
1950 Set BC/102°
2000 71°26.5' 154°58' - C/BC 110°

September 26, 1960

0800 70°46.3' 148°12'
1200 70°50' 148°25'
2000 70°45' 148°15'
2008 C/C 020°
2020 C/C 000°
2026 C/C 335°
2030 C/C 350°
2034 C/C 300°
2055 C/C 310°
2101 C/C 350°
2116 C/C 330°
2119 C/C 300°
2144 C/C 288°

September 27, 1960

0000 BC/288°
0123 C/C 318°
0208 C/C 288°
0408 Commenced lying to to await tugs to clear ice

September 27, 1960 continued

0505 Underway 290°
0507 C/C 288°
0800 71°13.5' 151°43' - steaming as before VCS while maneuvering thru light ice
1022 C/C 290°
1029 C/C 270°
1200 71°12.9' 153°26.5'
1306 C/C 280°
1430 C/C 230°
1438 C/C 295°
1440 C/C 290°
1501 C/C 295°
1543 C/C 310°
1545 C/C 300°
1559 C/C 285° - many more course changes
2000 71°21.1' 155°13', C/015°
2001 C/C 030°
2003 C/C 045°
2020 Commenced VCS to conform with ice conditions
2230 BC/280°

September 28, 1960

0022 C/C 230°
0043 C/C 235°
0044 C/C 240° to avoid ice floes
0049 Resumed BC/230°
1309 Anchored off Point Barrow, Alaska
1731 Underway for Kodiak, BC/272°
1840 C/C 269°
2001 Stop - OCS
2027 Underway
2046 Commenced steering VCS to conform to ice
2108 Commenced lying to due to ice conditions
2120 Underway C/090°
2144 C/C 110°
2151 C/C 210°
2220 C/C 243°
2236 C/C 255°

July 25, 1961

0800 71°44.8' 155°50' on base course 320°
0919 Ship fast in ice - commenced heeling
0930 Ship free of ice
0953 Ship fast in ice - commenced heeling
0957 Ship free of ice
1118 Ship fast in ice - commenced heeling
1123 Ship free of ice
1200 71°40.0' 156°12' - steaming as before - BC/320°
2000 no position given

July 25, 1961 continued

2001 Ship fast in ice - commenced heeling
2025 Ship free of ice
2300 Ship fast in ice - heeling
2311 Ship free from ice

July 26, 1961

0000 Steaming in heavy ice on BC/320° - VCS
0800 71°48.9' 156°00.9'
1200 71°56' 156°13'
2000 72°02.1' 156°16'

July 27, 1961

0000 Steaming in heavy ice, BC/330° - VCS to conform to ice
0035 Ship fast in ice
0157 Ship free from ice - VCS to conform with ice
0800 72°04.5' 156°10'
1200 72°06.0' 155°17.0'
1440 Commenced lying to in ice - waiting favorable increase in wind velocity or ice movement
2000 72°06.0' 155°17.0' - lying to as before

July 28, 1961

0000 Lying to in heavy ice
0800 72° 07.5' 154°54.5' - lying to as before
1200 72°08' 154°46' - lying to as before
2000 72°06' 155°17.0' - lying to as before

July 29, 1961

0000 Lying to in heavy ice
0800 72°06' 155°17'
1200 72°11' 154°39.7'
1800 Underway - to Point Barrow (give up trying to reach Arlis II), steering VCS to conform with ice conditions - BC/221°
2000 72°11' 154°39.7'

July 30, 1961

0000 Steering VCS to conform with ice, BC/221°
0745 Commenced lying to - rudder jammed (in ice?)
0752 Rudder free - underway VCS
0800 71°58' 155°10'
0918 Lying to - poor weather
1220 71°59' 155°10' - lying to as before
1553 Underway - VCS to conform with ice, BC/221°

July 30, 1961 continued

1664 Sufferec casulty to steering gear while backing down in ice, lying to
2000 71°59' 155°10' - lying to as before

July 31, 1961

0000 Lying to in heavy ice - awaiting favorable change in wind and ice conditions and repair damage.
0800 72°02.1' 154°55' - lying to as before
1200 72°02.3' 154°49.5' - lying to as before
2000 72°02' 155°23' - lying to as before
2048 Detonation 6 charges of TNT - around ship
2133 Underway enroute Point Barrow, BC/210°

August 1, 1961

0000 VCS to conform with ice, BC/220°
0456 Lying to
0800 71°47.8' 155°43' - lying to as before
1200 71°47.8' 155°43' - lying to as before
1225 Underway - BC/210°
2000 No position given

August 2, 1961

0040 Lying to
0111 Underway - BC/250°
0349 Anchored off Point Barrow
0800 71°25.5' 156°16' - Anchored as before

August 4, 1961

Shifted Anchorage
2000 71°20.8' 156°41.9'

August 15, 1961

2000 70°33.8' 162°21' on course 67°
2127 C/C 070°
0515 Commenced steering VCS to conform with ice
0543 Anchored due west of ARL-Point Barrow
0693 Maneuvering around drifting ice floe

July 27, 1962

0800 71°11' 152°52' on course 060°
0839 C/C 070°
0907 Steaming thru ice
0925 C/C 050°
0927 C/C 020°
0950 Commenced VCS to anchor
1009 Anchored north of Point Barrow in roadstead
1035 Underway to shift anchorage due to heavy drifting ice - VCS
1154 Anchored northeast of Point Barrow - due to heavy drifting ice, keeping steaming watch on bridge
1200 71°24' 159°17' - anchored
2000 (Same) - anchored Point Barrow

July 28, 1962

0000 Keeping steaming watch due to heavy drifting ice
0800 No position given - anchored as before

July 29, 1962

0000 Still heavy drifting ice - anchored as before

July 30, 1962

0000 Anchored as before - heavy drifting ice
1158 Underway to clear anchorage
1205 Set BC/060°
1220 C/C 106°
1242 Commenced steaming VCS to conform with ice
2000 71°07' 152°31'

July 31, 1962

0000 Steaming VCS to conform with ice conditions
0033 C/BC 090°
0131 C/BC 106°
0415 C/BC 117°
0800 70°49' 148°20'
1200 70°43' 147°49'
1356 C/BC 106°
1443 C/BC 100°
2000 70°22' 145°42'

Burton Island Continued

August 1, 1962

0000 VCS to conform with ice
0800 70°10' 143°49'
1026 C/BC 115°
1200 70°10' 143°42'
2000 69°44' 141°15'
2250 C/BC 078°

August 2, 1962

0000 VCS to conform with ice
0300 Commenced lying to 3.5 miles due north of Herschel Island

August 15, 1962

2000 70°42' 137°37', BC/225°
2058 C/BC 170°
2138 Set course 180°
2239 C/C 200°
2303 C/C 215°
2332 C/C 240°

August 16, 1962

0020 C/C 260°
0111 C/C 282°
0125 C/C 250°
0141 C/C 214°
0158 C/C 205°
0211 C/C 219°
0318 C/C 291°
0740 Commenced steering VCS to conform with ice
0800 70°05' 141°55'
1048 Sighted Barter Island - 278°, 26.8 miles
1137 C/BC 235°
1200 70°08' 142°35'
1400 C/BC 305°
1508 C/BC 280°
1630 C/BC 250°
1642 C/BC 210°
1653 C/BC 175°
1700 Steaming on VCS to conform with ice
1713 Lying to off Barter Island - 149°, 1.4 miles
1914 Underway - commenced steaming on C/287°
1920 Commenced VCS to conform with ice conditions
2000 70°12 143°53'

August 17, 1962

0000 VCS to conform with ice
0346 C/BC 292°
0800 70°48' 149°17'
1200 71°04' 152°04'
2000 71°25.7' 156°38.2' on C/220°
2038 VCS to anchor Point Barrow

August 19, 1962

1200 Anchored as before
1258 Underway to assist M.V. Agnes Foss beset in ice approximately 30 miles northeast of Stockton Island, C/000° (course changes)
2000 71°21' 153°08'

August 20, 1962

0000 Steaming on VCS to conform with ice, BC/107°
0738 Tug - 055°, 11 miles
0800 71°34' 146°51'
0912 Rendevous with tug
0918 Proceeding toward open water with tug following
0922 Lying to
1000 Barge in tow
1155 Commenced VCS to conform with ice conditions, BC/180°
1200 70°42' 146°31'
1414 C/BC 140°
1636 C/C 115°
2000 70°08' 145°15'
2225 C/BC 050°
2300 C/BC 080°

August 21, 1962

0000 Enroute Barter Island - VCS to conform to ice, BC/085°
0025 Stop
0038 Tug alongside to take barge
0104 Cast off barge and tug (open water)
0106 Underway Cape Lisburne, BC/265°
0345 C/BC 298°
0800 N.P.G.

September 1, 1962

0000 Steaming on base course 000° - VCS to conform with ice
0220 C/BC 090°
0335 Ship fast in ice
0345 Heeling

September 1, 1962 continued

0400 Ship fast in ice as before
0420 Ship free
0445 Commenced steaming VCS to conform with ice conditions, BC/090°
0759 C/BC 000°
0800 73°21' 179°38'W
0820 Ship fast in ice
0827 Heeling
0847 Ship free of ice
1006 Commenced steaming on VCS to conform with ice, BC/090°
1200 73°25' 178°25'
2000 73"25.5' 175°02'

September 2, 1962

0000 VCS to conform with ice, BC/090°
0525 C/BC 000°
0745 C/BC 270°
0800 73°45.7' 170°14'
1200 73°46.5' 172°06'
2000 73°46' 174°40'
2200 Ship fast in ice
2300 Ship free from ice - commenced VCS to conform with ice conditions, BC/270°

September 3, 1962

0000 Steering VCS to conform with ice, BC/270°
0800 73°47' 177°56'W (Cross Date Line)
1200 73°46.5' 179°20'E
1304 C/BC 000°
1604 C/BC 090°
2000 74°05' 178°06' W

September 4, 1962

0000 Steering VCS to conform with ice conditions
0800 74°06' 172°48'W
1200 74°05' 170°36'
1251 C/BC 225°, enroute Point Barrow
2000 73°03' 172°05'W
2142 Set C/180°

September 8, 1962

2000 70°43.3' 167°25.5', C/329°
2150 C/C 000°

September 9, 1962

0657 Commenced steering VCS to conform with ice conditions
0800 73°13' 170°04'W
1200 73°53.5' 170°00'
2000 75°18' 170°00'W

September 10, 1962

0800 75°51' 171°14'W - lying to
0805 Commenced steering VCS to conform with ice, BC/000°
1200 70°17' 170°00'
2000 77°22' 168°50'W

September 11, 1962

0000 Steering VCS to conform with ice
0015 C/BC 035°
0800 79°07' 164°07'
0930 Maneuvering VCS to moor at Ice Island T-3
1200 79°11'W 163°49'W
1305 Moored - T-3 Ice Island
2000 79°11' 163°49'W - moored as before

September 12, 1962

0800 T-3
1200 79°11' 163°47' - T-3
2000 T-3 - Underway to clear mooring
2320 Ship fast in ice, heeling

September 13, 1962

0000 Heeling to free ship from heavy ice
0301 ignited 5-45 lb. charges of TNT, ship free, commenced VCS to conform with ice to clear Ice Island
0421 Set base course 225°
0800 78°44.5' 165°38'
1200 78°19' 167°14'W
1310 Put party on ice for OCS
1437 Recovered ice party
1512 Ship is beset in ice
1524 Ship is free of ice - commenced VCS to conform with ice - BC/215°
1715 Lying to - to put party on ice
1823 Underway - set course 210°
1950 Lying to - put party on ice
2000 77°47.2' 172°48'W - lying to as before
2048 Underway - commenced BC/210°

Burton Island Continued

September 14, 1962

0800 76°32' 175°52'W
0835 C/BC 180°
0944 C/BC 195°
1140 C/BC 219°
1200 75°56' 178°02'W
1536 C/BC 205°
2000 75°11.5' 179°35'E
2022 C/C 135°

September 15, 1962

0000 Underway on BC/135° - at best ice speed
0024 Commenced lying to in lead
0800 75°00' 179°58'W
0822 Underway - commenced VCS to conform with ice conditions, BC/135°
0900 C/BC 090°
1200 78°47' 178°18'W
2000 74°59.3' 173°08.0'W
2331 C/BC 180°

September 16, 1962

0000 Steaming on VCS to conform with ice, BC/180°
0219 C/BC 270°
0449 Lying to
0800 74°33.5' 172°53'W - commenced VCS to conform with ice, BC/270°
1120 C/BC 180°
1200 74°21.5' 174°56'W
1232 Lying to
1333 Underway - VCS - on BC/180°
1538 Lying to
1605 Underway on VCS to conform with ice on BC/180°
2000 73°15' 174°58'W

September 17, 1962

0000 Steaming VCS to conform with ice, BC/180°
0052 Commenced lying to at edge of ice pack
0800 72°23.5' 175°13'W - lying to as before
1052 Underway - on C/90°
1139 Lying to
1200 72°24' 174°16'
1300 Underway - on C/180°
1313 C/C 162°
1602 C/C 161°
1605 C/C 174°
1845 C/C 187°
2000 71°02' 174°50'W

September 18, 1962

0000 Underway on C/187°
0528 Commenced VC to avoid ice floe
0623 Set C/187°
0800 68°30' 175°51'W
0950 C/C 325°
1200 68°28' 177°34'W
1601 Commenced VCS to conform with ice, BC/325°
1710 C/BC 308°
2000 69°29' 178°54'W
2131 C/BC 217°
2331 C/BC 306°

September 19, 1962

0000 Steaming VCS to conform with ice, BC/306°
0525 C/BC 292°
0800 69°47'N 178°05'E
1020 C/BC 300°
1200 70°02.7' 176°44'E
1259 C/BC 290°
1322 C/BC 275°
1352 Commenced lying to at edge of ice pack
2000 No position given - lying to as before

September 20, 1962

0000 Lying to at edge of ice pack - 15 miles north of Mys Billings, Siberia
0111 Maneuvered in ice field to remain outside 12 mile limit
0223 Commenced lying to in ice
0800 70°02' 176°43'E
0812 Underway - C/292°
1044 C/C 280°
1200 No position given
1241 C/C 100°
1248 Lying to in polynya
1348 Commenced C/080°
1351 C/C 090°
1355 C/C 060°
1400 Sighted 4 USSR ships at 70°08.5' 175°39.0'E
1403 C/C 110°
1408 C/C 090°
1411 C/C 106°
1420 C/C 100°
1421 Lying to in polynya
1446 Underway - C/080°
1513 C/C 090°
1535 C/C 110°
1542 Lying to

September 20, 1962 continued

1600 Set C/110°
1634 Lying to
1658 Set C/110°
1715 C/C 281° - helicopter landed on ice floe due to low fuel
1803 C/C 255°
1808 C/C 110°
1812 C/C 095°
1858 C/C 110°
1954 Lying to
2000 70°05.5' 176°23'E
2318 C/110°
2328 C/C 115°

September 21, 1962

0732 C/C 130°
0800 69°36' 179°31'E
1200 69°05' 178°55'W
1218 C/C 125°
1613 Lying to
2000 68°30' 177°00' - lying to as before
Underway on C/020°
0817 (sic) C/C 000°
2117 Lying to

September 22, 1962

0000 Lying to 15 miles off Siberian coast - long 177°00'W
0052 Commenced C/340°
0138 C/C 330°
0219 Lying to at long. 177°05'W - 15 miles off Siberian coast
0427 Underway C/005°
0445 C/C 008°
0534 C/C 000°
0538 Lying to at long. 177°00'W - 18 miles off Siberia
0800 68°27.8' 177°01'W

STORIS - 1952

August 14, 1952

0000 anchored Shishmaref - 2600 yd from beach
0800 Shishmaref Bering St
1200 Shisharef
1835 depart VC/VS enroute to Kivalina
1850 C/ 047°T
1935 C/C 062°T
2000 66°27' 165°32'
2140 C/C 080°T
2250 C/C 064°T

August 15, 1952

0118 C/C 302°T
0313 Cape Thompson abeam to starboard 5 3/4 miles C/C 337°T
0550 C/C 247°T
0642 C/C 068°T
0725 C/C 021°T
0758 VC standing into Kivalina Village
0800 67°30' 165°45'
0805 VC off Kivalina
0835 anchored Kivalina 1525 yds to beach
1200 anchored

August 16, 1952

0000 Kivalina
0800 Kivalina
0816 C/ 290°T
0850 C/C 309°T
1030 C/C 300°T
1111 Cape Thompson to starboard 6,700 yards, C/C 309°T
1200 68°20' 166°10'
1305 VC VS approach Pt. Hope
1332 anchored off Pt. Hope 1250 yds to beach
2000 Pt. Hope

CUTTER STORIS

August 1, 1952

0000 Anchored Etolin Strait, Nunwak Is. Snow Mt. 208°T
0800 Etolin St. Nun Is.
1200 " " " "
1759 enroute on V/C to St. Lawrence Island
1922 Set course 339°T

STORIS

August 17, 1952

0000	Pt. Hope
0800	Pt. Hope
1200	Pt. Hope
1727	depot VC VS standing out from Pt. Hope
1733	starboard 0.5 miles (Pt. Hope) c/ 016°T, enroute to Cape Lisburne
1738	c/c 018°T
1831	stopped engine ____________
1832	proceed
2000	68° 49' 166°30'
2010	VCS off Cape Lisburne
2202	c/ 052°T
2210	c/c 053°T enroute to Wainwright

August 18, 1952

	0000	underway enroute to Pt. Barrow c/053°T
	0422	c/c 030°T
(sic)	0420	c/c 018°T
	0545	c/c 030°T
	0731	c/c 041°T
	0800	70°16' 162°21'
	0811	c/c 032°T
	0900	c/c 069°T
	0955	c/c 071°T
	1200	70°34' 160°55'
	1320	VC passed Wainwright
	1332	c/ 038°T
	1540	Pt. Belcher Bay (sic)?beaning? 208°T range 5,100 yards c/c 063°T
	2000	70°07' 157°55'
	2143	c/c 056°T
	2220	VC standing off Barrow
	2237	anchored off Barrow 1150 yds to beach

August 19, 1952

0000	anchored at Barrow 1150 yds to beach
0800	Barrow
1200	Barrow
2000	Barrow

August 20, 1952

0000	anchored Barrow
0800	Barrow
1200	Barrow
1415	depart VC VS
1430	c/ 000°T
1700	VC test gryoron?
1800	entering drift ice, searching for ice pack
1810	VC VS

August 20, 1952 continued

1840	c/ 180°T enroute Barrow
2000	71° 44' 157°58'
2055	c/c 165°T
2155	VCS standing off Barrow
2240	proceeding to Wainwright c/ 243°T
2250	maneuvering on various courses to stand clear of ice floes

August 21, 1952

0000	enroute to Wainwright c/ 243°T
0433	Pt. Belcher @ to port 5500 c/c 226°P.G.C.
0600	anchored off Wainwright bearing 196°T to Village
0800	Wainwright
1200	Wainwright
1315	underway VCS to meet boat
1355	anchored off Point Niarsh
1448	VCS enroute to Wainwright
1558	anchored W.W. 1700 yds from beach?
2000	Wainwright

August 22, 1952

0000	Wainwright bearing 186°T (Point Collin 124°T)
0037	underway VCS to Barrow
0100	c/ 010°T
0130	c/c 038°T
0242	Pt. Belcher abeam starboard 6500 yds c/c 062°T
0800	71°03' 158°30'
1020	stopped
1031	c/ 065°T
1035	VC proceeding through ice
1105	c/ 065°T
1200	71°03' 157°25'
1325	c/c 045°T
1410	VCS standing off Barrow
1553	anchored off Barrow 1400 yds from land
2000	Barrow
2125	depart VCS standing off Barrow
2130	c/ 244°T enroute to Point Lay

Augsut 23, 1952

0000	enroute to Pt. Lay
0300	c/c 221°T
0410	Wainwright - 097°T, 6600 yds c/c250°T
0730	Icy Cape - 151°T, 1100 yds c/c 216°T
0800	70°21' 162°17'
1104	Point Lay to port(?) 3000 yds c/c 203°T
1125	c/c 306°T
1200	Point Lay Village
1250	VCS approach Pt. Lay village
1349	anchored 1900 yds to beach

STORIS

August 27, 1953

0000	c/ 048°T to Kotzebue
0158	c/c 060°T
0630	c/c 090°
0800	66°43'N 165°26'W
0950	c/c 090°T
1038	c/c 085°T
1150	c/c 095°T
1200	66°40' 163°45'
1351	c/c 000°T
1443	Kotzebue Sound to Cape Blossom - 089°T
2000	66°40' 163°45'
2113	to Pt. Hope c/ 178°T
2200	c/c 270°
2343	Cape Espenburg - 220°T c/c 322°T

August 28, 1953

0000	c/322°T
0741	c/c 326°T
0800	67°55' 166°01'
0955	c/c 318°T
1052	anchored Pt. Hope, Cape Thompson bearing 121°T
1200	Pt. Hope
2000	Pt. Hope

August 29, 1953

0800	Pt. Hope
1200	Pt. Hope
1914	VCS Swinging Ship
2000	68°18' 166°55'
2002	c/c 271°T swinging complete, enroute to Point Lay
2048	c/c 000°T
2148	c/c 021°T

August 30, 1953

0103	c/c 034°T
0800	69°35' 164°23'
0955	c/c 090°T
1010	c/c VCS for anchorage
1103	anchored Pt. Lay - 024° (Beach 082° 1300 yards)
1200	Pt. Lay
2000	Pt. Lay
2202	enroute to Wainwright c/270°T
2257	c/c 028°T

August 31, 1953

0000	underway in Chucki Sea
0123	c/c 003°T North Star passed abeam 3.5 miles

August 31, 1953, continued

0226	c/c 042°T
0454	c/c 082°T
0510	VC through ice floes
0728	c/c 077°T
0800	70°38' 160°20'
0807	c/c 050°T
0813	c/c 127°T anchored at Wwinwright AK 1600 yds off beach
1200	Wainwright
1902	c/ 310°T underway
1918	Tracking 035°T VC through ice
2000	lat & long not given and ditto for Wainwright ?
2003	VCS standing into anchorage
2013	anchored 3600 yards from beach

September 1, 1953

	0000	8800 yds off Wainwrihgt 015°T
	0325	underway to Barrow, various course, field ice
	0400	underway as before
	0800	71°00'N - 159°35' west - maneuvering to avoid ice
	0830	c/c 060°T
	0950	c/c 045°T
	1115	c/c 065°T
	1125	c/c anchorage
	1200	Barrow
	1930	enroute to Pt. Hope c/270°T
	1940	c/c 235°T
	2000	71°21' - 156°47'
	2202	c/c 275°
(sic)	2050	c/c 242°T
	2320	c/c 230°T

September 2, 1953

0000	c/ 230°T
0205	c/c 242°T
0245	c/c various through field ice
0400	tack-? 270°T - field ice
0800	71°07' 158°18' VCS field of ice flows
1200	71°04' 159°00' VCS ice fields
1600	VCS ice fields
1710	cleared ice field c/c 215°T
1815	c/c 220°T
1852	c/c 257°T Wainwright ABEAM to Port
2000	70°39' 160°61'
2220	c/c 225°T
2245	c/c 255°T
2330	c/c 225°T

September 3, 1953

0010	c/c 228°T
0255	c/c 225°T
0800	69°41' 165°43'
1200	69°10' 166°13'
1245	c/c 203°T
1250	c/c 160°T
1420	c/c 210°T
1555	c/c 236°T
1605	c/c 125°T Investigate vessel M/S Northstar
1618	VCS - Pt. Hope
1745	c/c 205°T
1820	c/c 130°T
1855	VCS
1929	Pt. Hope 290°T
2000	Pt. Hope

September 4, 1953

0800	enroute to Nome c/ 196°T 68°13' (or 18') 166°50'
1200	67°29' 167°28'
2000	66°15' 168°22'
2252	c/c 152°T

September 5, 1953

0127	c/c 115°T
0142	c/c 105°T
0152	King Island abeam to Starboard 3300 yds
0207	c/c 115°T
0342	c/c 118°T
0530	c/c 128°T
0638	c/c 086°T Sledge Island beaming 030°T 3 miles
0800	64°27' 165°35'
? 0850	c/c 000° pge
0912	Nome
1200	Nome
1832	enroute to Adak - c/ 225T°
2000	64°28' 165°55'
2145	c/c 330°T
2220	c/c 214°T

STORIS

August 19, 1954

2000-2400
2013 VCS hold position
2016 anchored Pt. Belcher? 66°58' 162°39' Cpae Blossom 24,500 yds,
Shesvalik? 08,500 yds
2220 under on c/ 270°T enroute Pt. Hope

August 20, 1954

0111 c/c 323°T
0800 (none given)
0830 c/c 336°T
1130 VC
1200 68°17' 166°45'
1252 anchored Pt. Hope Light - 308.5°T, Range to Pt. Hope 700 yds
1720 depart VCS to new anchorage off North shore of Pt. Hope
1743 Pt. Hope Light = 350°T, 5000 yds c/c 298°T
1819 Pt. H. Light = 106°T 15,400 yds c/c 056°T
1855 Pt. H. Light = 140°T 15,200 yds c/c - VCS
2000 none given
2003 anchored PHL = 202°T Pt. Hope = 182°T, 1100 yds to beach

August 21, 1954

0800 Pt. Hope
1200 "
2000 "

August 22, 1954

0800 Pt. Hope
1200 "
1633 depart for Wainwright
2000 no position given
2011 west LT Cape Lisburne = 117°T, 20,800 yds, c/c/ 043°T

August 23, 1954

0440 c/c 053°T
0800 NPG
0810 _______Icy Cape - 167°T, 26,700 yds c/c 078°T
1138 VCS
1200 Wainwright
1331 anchored 1650 yds to beach
2000 NPG

August 24, 1954 - seems to be missing

August 25, 1954

0800 Wainwright

August 25, 1954 - continued

1007 underway VCS new anchorage
1037 anchorage off Wainwright Lagoon
1200 Wainwright
1928 depart Pt. Barrow 000°T
2000 NPG
2022 c/c 064°T

August 26, 1954

0145 stopped engine drifting 10 miles west of BArorw
0647 under VCS for drift ice boundary locator 10 miles northwest of Barrow
0800 NPG
0819 VCS maneuvering in ice field vicinity off Pt. Barrow
1200 71°32' 156°29'
1504 c/c VCS enroute anchor off Barrow
1744 c/c VC
1818 anchored at Pt. Barrow, areo beam - 076°T, 2700 yds to beach
2000 Pt. Barrow

August 27, 1954 - Thursday

0800 Pt. Barrow
1200 "
2000 "

August 27, 1954 - friday

0000 anchored 1 1/2 miles west of Barrow
0652 depart for Teller
0800 NPG ?
1010 c/c 260° PGC 230° PSC (260°T)?
1025 maneuvering to VCS off ice pack
1200 71°20' 159°14.5'
1320 entered ice field maneuvering VCS
1515 departed from ice field
1535 set c/ 216°T
2000 NPG c/c 224°T (226°PGC)
2038 c/c 270°T
2200 c/c 224°T
2224 c/c 270°T
2345 c/c 220°T

August 28, 1954

0800 NPG c/c 222°T
1038 c/c 208°T
1137 c/c 210°T
1200 69°00' 166°35'
1540 c/c 192°T
2000 NPG
2002 Maneuvering VCS in ice. ice locater approximately 67°42' 168°06 consisting of a total concentration of less than 1/10 of brask ? and block and some hummock, ave thickness 6-8 feet

August 28, 1954, continued

2017	c/ 116°T
2103	c/c 189°T

August 29, 1954

0800	NPG
1045	c/c 217°T
1200	66°23' 168°23'
1245	anchored
2000	NPG anchored

August 30, 1954

0000	anchored 168°23' 66°231
0308	depart c/ 206°T
0654	entered Bey Sea c/c 136°T
0800	NPG
0819	c/c 180°T
0935	c/c 210°T
1005	c/c 180°T with Cape Pr. of Wales = 122°T
1038	c/c 126°T
1200	65°29' 168°00'
1332	c/c 099°T
1517	c/c 103°T
1605	Teller ______= 021°T, 5,500 yds c/c 021°T
1609	c/c VCS
1637	VCS
1637	anchored in Port Clarence Cape Riley = 171°T Teller ______023°T
2000	NPG

end?

Storis

July 17, 1956

0800 66°41.5' 168°00.0'w - C/010°
0933 C/C 015°T
0935 C/C 020°T
0937 C/C 000°T
0945 resumed C/010°
1050 commenced VCS entering ice field
1116 passed thru ice field - resumed C/010°
1200 67°31' 167°38'
1340 C/C 340°T to clear ice floe
1406 C/C 000°T
1421 C/C 030°T
1519 C/C 000°T to clear ice floe
1609 C/C 335°T
1654 C/C 005°T
1707 C/C 020°T
1741 C/C 045°T
1750 commenced VCS maneuvering thru ice
1943 stopped
2000 68°37' 167°10'W - hove to as before
2135 underway - VCS

July 18, 1956

0000 underway as before - in column with Staten Island and Requisite.
This vessel following at VCS - maneuvering thru ice field base C/040°T ?
0642 stop - lyms to while Staten Island investigated ice pack
0647 underway - VCS - navigations thru ice in wake of accompanying ships
0800 69°32' 165°10'W
1200 69°56.6' 164°08.3'
1340 C/C 043°
1457 C/C 010°
1514 stopped in vicinity of USS Requisite off ice pack in area of
Icy Cape
2000 70°23' 162°56' - drifting as before

July 19, 1956

0325 drifting into ice - making preparations to stand clear of ice
0530 stopped in clear water - 2.5 miles from USS Staten Island (and
in ice pack?)
0800 70°21' 162°29'
0805 underway VCS to Staten Island

July 19, 1956 continued

0837 moored to S.I.
1200 70°25.3' 162°54'
1429 underway VCS
1438 stopped, drifting
2000 70°13.6' 162°46.0' - drifting as before

July 20, 1956

0000 drifting at 70°15' 162°56', 21 miles WSW of Icy Cape, awaiting favorable ice conditions
0800 70°33.5' 162°37.7'
0951 underway - C/080°T, proceeding towards Staten Island
1003 C/C 065°T
1100 commenced VCS thru ice
1200 70°13.6' 163°03'
1339 reduced speed in preparation for entering ice field - proceeding on VCS thru ice field north of Icy Cape
1845 VCS following Staten Island enroute Pt. Franklin
2000 70°44.9' 160°04.0'
2019 VCS - moving to lay to SW of Point Belcher
2133 underway on VCS proceeding to clear water
2150 stop - drifting in clear water
2235 underway VCS to clear water anchorage
2255 anchored off Pt. Belcher - 8,200 yards to the beach

July 21, 1956

0200 preparing to get underway to avoid ice floes
0226 underway VCS
0249 set course 067°T
0410 anchored 21,000 yards from Pt. Franklin - radar tower at - 081°T
0720 put engine on line attempting to push medium ice floe away from bow
0753 stop
0800 70°53' 159°23'
1200 same position
2000 same position

July 22, 1956

0000 anchored as before northwest of Pt. Franklin, off Antanik, Alaska
0800 70°53' 159°24' - anchored as before
0905 underway - to rendevous with S.I. northeast of Pt. Franklin
1035 stop
1110 commenced steering VCS thru ice - proceeding to Pt. Barrow

July 22, 1956 continued

1200 70°57.1' 158°27'
1307 commenced VCS transiting ice
1603 entering ice pack - sea ice watch
1710 clear of ice pack
1745 secured ice watch - steering C/035°T
1912 stopped off Barrow
2000 71°20.3' 156°43.4' - drifting as before

July 23, 1956

0010 anchoring off Pt. Barrow - 3,250 yards to beach
0130 engine on line - steering VCS to steer ship clear of ice
0150 stop
0740 underway - VCS to avoid ice floes
0800 71°23' 156°40.8'
0822 stop
0826 underway - on BC/040°T
0925 - stopped - lying to in ice
0941 SE and ice watch - steering VCS proceeding eastward around Pt. Barrow
1200 70°69' 156°03.4'W
1536 maneuvering thru ice
1740 lying to
1747 maneuvering to stay against ice
1912 stop - drifting
1929 underway to clear water
1956 stop - drifting
2000 71°30.5' 155°55.8' - drifting as before
2040 underway on VCS to avoid ice floe
2113 stop - drifting
2214 underway on VCS to avoid ice floe
2255 drifting

July 24, 1956

0000 drifting 10.5 miles northwest of Pt. Barrow using one engine
to prevent ship from being beset by ice
0339 set the ice watch
0342 underway on VCS leading US Requisite thru lead in ice field
enroute vicinity of USS Staten Island - had been scouting for leads
0800 71°19.5' 155°49.5'
0823 stop - drifting illegible finding lead in ice
0906 underway - VCS maneuvering thru ice
1200 71°22.1' 155°27.1' - VCS
1737 set ice watch
2000 71°09.7' 154°20.0'
2101 underway ?

July 25, 1956

0000 underway on VCS following leads in ice
0205 secured ice watch
0345 set ice watch
0435 heavy ice floe - stopped - commence drifting - USS Staten Island scouting ahead for leads
0457 underway
0800 71°07.0' 150°37.0'
1200 71°01.0' 149°13'
2000 70°58.3' 150°20'

July 26, 1956

0000 underway as before - approx. 19 miles NNW of Jones Island - enroute Barter Island - proceeding thru ice field
0315 proceeding with USS Recq to rendevous with USS Staten Island at Newport Entrance on BC/110°T
0610 C/C 087°T - passed Midway Island abeam to port, 5,000 yards
0655 stop
0703 C/C 119°T
0739 C/C 120°T
0800 70°18' 147°43'
1013 course changes - anchored
1200 70°10.4' 144°13.6' - anchored as before
1907 underway - VCS to Newport Entrance
2000 70°19.8' 147°10.3'
2100 VCS

July 27, 1956

0000 underway on VCS following USS Staten Island through ice
0800 70°10.8' 144°30.8'
1158 set the ice watch
1200 70°10.4' 144°13.6'
1632 drifting
1817 underway VCS maneuvering thru ice
2000 70°60.9' 143°27'
2300 set BC/120°T

July 28, 1956

0000 maneuvering thru ice to MGC/120°T leading USS Requisite thru ice. The USS Staten Island is on a parallel course in deeper water and heavier ice
0302 maneuvering in ice to join USS Staten Island
0800 69°40.6' 140°55.9'

August 28, 1956

0800 70°47.5' 149°09.0' on course 284°T
0945 commenced steering VC thru scattered ice
1200 70°45' 150°54'

August 29, 1956

0800 Pt. Barrow
2000 70°47' 160°42.0'

Storis

July 11, 1957

2000 70°21' 162°50' - c/043°T
2210 c/c 065°T

July 12, 1957

0001 c/c 090°T to avoid pack ice at approximately 11 mile WNW of Wainwright
0005 c/c 100°T
0045 clear of ice - c/c 065°T
0413 commenced vc to steer clear of brash floes
0450 set BC/065°T
0636 c/c 048°T
0800 71°25.5' 156°35'W
1200 71°28' 156°12' - c/073°T - ?? maybe
1632 underway - enroute shoal area at 71°21'20" 156°15' - maneuver - VCS to avoid ice
2000 71°27.5' 156°15'
2346 column maneuver for best ice transit

July 13, 1957

0000 underway following ice breaker
0800 71°16' 155°29.5'
1200 71°16.5' 154°14'
1302 set c/100°T
1311 c/c 085°T
1515 VCS thru ice floe
1530 stopped
1715 underway VCS
1733 stopped
1844 underway VCS
2000 71°04' 150°15'W

July 14, 1957

0000 column - as VS for safe ice transit
0500 70°41' 147°17'
1110 commend VC
1200 70°19' 145°31'
1219 set c/120°T
1239 c/c 095°T

July 15, 1957

0010 entered Canadian water

Storis

July 14, 1959

0000 underway on C/044°T
0707 VCS to maneuver around ice
1007 C/B/C 066°T - continued maneuvering on various courses in ice
1948 set course 058°T
2101 anchored off Pt. Barrow

July 15, 1959

2000 71°34' 157°29' - C/052°T
2020 C/C 075°T
2110 C/C 091°T
2230 commenced VCS thru ice
2340 C/C 095°T

July 16, 1959

0000 BC/095°T - maneuvering VCS in .3 coverage ice
0015 C/B/C (changed base course) 110°T
0545 BC/090°T
0650 stopped
0745 maneuvering VCS to "change location of ship in water area"
0800 71°43.5' 181°17.0'W
0908 VCS - underway
0920 lying to
1000 underway - VCS- maneuvering in ice
1200 71°51' 152°17'W
1776 stopped
2000 71°21' 153°03' hove to

July 17, 1959

0130 maneuvering VCS - set BC/100°T maneuvering VCS through ice
0800 71°12' 151°55'W underway as before
0900 stopped
0930 underway C/324°T
0940 maneuvering in ice
1030 drifting - using engines as necessary to avoid ice
1113 underway FCS thru ice
1200 71°23' 151°36'
1305 stopped due to heavy ice conditions
1600 hove to - as before - waiting improvement in ice conditions
1635 underway - on BC/090°T - on VCS in ice

July 17, 1959 continued

1857 hove to in ice
1928 underway - VCS
1949 hove to
2000 71°20.5' 151°12'
2011 underway VCS in ice - BC/090°T
2250 stopped - hove to in ice

July 18, 1959

0000 hove to in ice at 71°23' 149°40'W with VSS.St~~o~~a~~l~~en Is - also in
ice on 125°T - 150 yards
0800 71°22' 149°40' hove to as before
1120 underway - vcs - BC/090°T
1200 71°21' 149°28'
1850 stopped
1915 maneuvering VCS on BC/090°T in cie
2000 70°53' 149°21'
2232 stopped
2255 VW (underway) VW on VCS in ice - BC/120°T

July 19, 1959

0010 hove to
0045 underway - VCS - on BC 300°T
0244 stopped hove to in ice
0800 70°47' 148°58' hove to as before
0942 underway - on VCS in ice seeking on open water lead in a general
northeasterly direction
1148 hove to
1200 70°56' 149°07' - underway as before
1408 stopped
1435 maneuvering VCS to change position in ice
2000 71°03' 149°11'W
2236 underway on VCS hunting better area to heave to
2319 hove to

July 20, 1959

0000 hove to in ice
0010 commenced maneuvering to maintain position in the ice
0226 commenced maneuvering to locate a lead in ice
0245 stopped trying to find a lead , commenced trying to locate better
ice conditions to the south
0400 VCS in ice as before
0502 hove to
0800 70°53' 149°06' hove to as before
0835 VCS to change position in ice
1200 70°51' 149°04' hove to as before

July 30, 1959 continued

1332 underway
1437 mooved to USS Stolen Is.
2000 70°51' 149°04'
2145 underway VCS to find a suitable location to lie to in ice
2255 hove to in ice
2325 underway - VCS to find a better location in ice to heave to
2350 hove to

July 21, 1959

0800 70°53' 149°26' hove to as before in ice
1200 70°53' 149°26W hove to as before in ice
2000 70°58' (sic) 149°33'W hove to as before in ice

July 22, 1959

0322 commenced maneuvering VCS in SE (Southeast) direction
0433 hove to in ice
0544 underway - VCS in ice
0625 hove to
0800 70°55' 149°45' hove to as before
0901 underway VCS - in ice
0921 stopped
1200 70°50' 149°47' hove to as before
1202 VCS to take position astern of VSS SI (Staten Island) while following a lead in the ice to the southeast
1404 hove to in ice
1844 underway on VCS in ice astern of VSS-SI
2000 70°43' 149°20'

July 23, 1959

0000 underway in ice - VCS
0800 70°34' 147°47' - underway as before VCS in icd
1200 70°26.5' 146°41'
2000 70°11' 144°47'W underway as before
2001 set base course 076°T

July 24, 1959

0000 underway in the ice - BC/076°T
0543 mooved
0800 70°11' 142°40'W moored as before
0945 underay - VCS in ice
1127 hove to
1200 70°11' 142°55'W - hove to as before

July 24, 1959 continued

1540 underway VCS in ice
2000 70°13.5' 141°26' - base course 082°T
2245 VCS - maneuvering thru ice - on base course 082°T

July 25, 1959

0200 advanced ships clocks one hour to conform wtih T9 time zone
(crossed the Canadian border?)

BALSAM

July 28, 1957

2000 anchored off Icy Cape
2328 underway - enroute Pt. Barrow - on C/325°T

July 29, 1957

0030 C/C 040°T
0103 C/C 050°T
0320 C/C 090°T - sighted brash ice
0455 C/C 075°T
0530 C/C 060°T
0800 71°04' 158°30'
0830 ice concentration 1/10 - growlers (?) - heavy blocks ? and brash ice field to port - 1,500 yards - maneuvered VCS to MGC (make good a course) of 000°T
1030 ice concentration increased to 6/10 C/C to MGC 055°T
1130 ice concentration increased to 7/10, consisting of small floes, growlers and brash
1200 71°14' 155°16'W
1300 ship suffered ice damage
2000 71°14' 155°16'
2210 C/C 125°T
2304 C/B/C 100°T - vessel proceeded between ice field and shore throughout watch in 25-45 feet of water. Ice concentration throughout watch less than 1/10, consisting of growlers, small floes and brash

July 30, 1957

0000 underway on C/100°T
0020 C/C 090°T
0330 C/C 115°T
0705 maneuvering to extricate vessel from floe
0720 resumed C/115°T
0800 70°45' 157°20'W
0831 C/B/C 120°T
0924 ice concentration reduced to less than 1/10 consisting of occasional growlers - C/C 110°T
1137 C/B/C 090°T
1200 70°36" 149°37'W
2000 70°25' 147°38'
2037 BC/115°T
2210 C/B/C 105°T - ice concentration diminished throughout watch - from a maximum of 2/10 to less than 1/10 consisting of small floes and growlers

July 31, 1957

0000 underway on C/105°T
0120 C/C 095°T
0220 C/C 085°T - ice condition varied from 2/10 to 3/10 coverage - consisting of small floes and growlers
0428 C/C 080°T
0523 C/C 123°T
0800 69°57' 142°12'
1100 C/C 100°T - ice concentrations varied from 2/10 to less than 1/10 - throughout the watch - encountered several large floes and brash noted ice field to north of track line
1200 69°38' 140°33' - C/105°T - ice consisting of growlers and small floes

August 28, 1957

0000 anchored off Point Barrow
0526 underway on VCS enroute to Little Diomede
0530 set C/320°T
0605 sighted ice pack vicinity - maneuvering at VCS to view ice pack
0800 71°40' 156°50'
0900 set course 244°T
1111 C/C 250°T
1200 71°05' 158°02'

August 29, 1957

1200 66°05' 168°40'
1225 C/C 170°T
1230 VCS through ice
1417 anchored off Little Diomede - left tangent of Big Diomede - 267.5° right tangent of Big Diomede - 241°
1600 underway - on VCS standing out of anchorage - avoiding ice off Little Diomede
1759 set BC/154°T
1824 C/C 145°T
2000 65°23.5' 168°27'W

STATEN ISLAND

August 12, 1967

2000 70°40'N 162°09'W - c/008°T
2045 sighted outer edge of arctic pack ice
2150 commenced VCS to effect transit of pack ice

August 13, 1967

0000 underway - on BC/060°T - making way through the ice
0400-0800 ice coverage 9/10 to 10/10 old winter ice
0800 71°07' 159°00'
0800-1200 ice coverage 9/10 to 10/10 old winter ice
1200 71°14.7' 158°14.8'
2000 71°20' 157°25' - underway in 10/10 coverage close pack ice

August 14, 1967

0000 underway - VC - thru 10/10 coverage old winter ice
0315 hove to five miles off Barrow awaiting more favorable ice conditions
0800 71°22' 156°56' hove to as before - drifting in 10/10 concentration as before
0815 underway - enroute Barrow vicinity to investigate open water areas
1045 hove to 3,000 yards off Airport runway
1200 71°22' 156°41'
1756 underway to maintain position
1856 hove to 3 miles off Barrow
2000 71°21' 156°44'

August 15, 1967

0000 drifting on close pack of 10/10 concentration as before
0000-0400 ice pack opened to open pack of 6/10 concentration
0400 drifting on 6/10 concentration - favorable easterly wind blowing pack away from beach
0718 underway
0800 71°22' 156°42'
1200 71°21' 156°43'
2000 71°20.5' 156°44.1' - anchored - 2,800 yards from land

August 19, 1967

0000-0400 anchored Pt. Barrow - 2,500 yards from Pt. Barrow ice coverage increased during the watch from 0/10 - 5/10 old winter ice - which was very rotten

August 19, 1967

0400 anchored as before in 3/10 to 5/10 ice
0500 ice concentration 5/10 - 8/10
0718 depart - VCS
0800 71°20.5' 156°44'
1200 no position - enroute vicinity - 4,000 yards off airport beacon
1751 commenced drifting in 1/10 open pack ice

August 20, 1967

0000 making VCS to remain in safe area - 5,000 yards from beach - ice coverage 1/10 to 3/10 rotten small floes and brash
0442 practicing ice landings
0743 anchored
0800 71°20.6' 156°42.9' anchored as before
1200 71°20.6' 156°42.9' anchored as before
2000 71°20.6' 156°42.9' anchored as before

August 22, 1967

0800 71°20.6' 156°42.9' - anchored
0810 underway - VCS in 3/10 coverage old winter ice
0842 anchored
1120 depart
1200 no position

August 23, 1967

0000 underway VCS to maintain position off Point Barrow - 8/10 ice coverage
0210 drifting
0345 underway VCS to reopen position off Arctic Research Laboratory
1507 anchored 2,500 yards off ARL
2107 depart
2140 VCS to maintain position
2310 hove to

August 24, 1967

0000 underway with no way on - 2.5 miles off Barrow
0250 underway - c/218°T
0833 anchored off ARL

August 25, 1967

0000 anchored 1.5 miles off ARL
0800 71°21.5' 156°44.5'
1400 depart - proceeding southwest along the Alaskan coast
2000 71°03' 159°17'W

August 27, 1967

2000 68°57' 178°00' - VCS

August 28, 1967

0000 underway - bare course 320°T - maneuvering in 6/10 coverage ice
0400-0800 various ice coverage ranging from 2/10 to 8/10
0800 61°35' 179°15' - underway in 8/10 to 9/10 SMF (?) winter ice
1200 65°40' 179°24'
2000 69°42' 179°48'W (Crossed date line)

August 29, 1967

0000 underway - on c/280°T - encountering 10/10 coverage old winter ice
0800 69°48' 179°28'E (East!)
1045 ship beset by ice
1200 69°49' 179°00.5'E - beset as before
1210 underway - VCS
2000 69°55' 178°58'E

August 30, 1967

0000 underway - VCS in 10/10 coverage SMF (?) winter ice
0555 stopped - drifting in 5/10 ice coverage
0800 69°54'N 178°20'E
1200 69°54' 178°13'E
2000 71°01' 178°15'E

September 21, 1967

2000 69°34.5' 179°40'E - c/316°T
2215 entered area of scattered ice 2/10 to 4/10 concentration

September 22, 1967

0000 underway - on BC/294°T - maneuvering in 2/10 ice
0400-0800 underway as before in 6/10 - 9/10 young polar ice
0800 70°13' 175°53'E
1200 70°11.7' 174°45'E
2000 70°09' 174°11'E

September 23, 1967

0000 underway - BC/090°T in open water to 1/10 ice coverage
0800 70°01'N 176°53'E
1200 70°05'N 176°34'E
1405 taking in fresh water from ice floe - hove to
2000 70°04.5' 176°44'E hove to as before

September 28, 1967

0800 70°49' 165°52' - on c/023°T
0914 entered new frozen ice crystals
1200 71°27' 165°33'W
1220 steering out of very light pancake ice
1455 entered light pancake ice 8/10 coverage
1745 steering through 5/10 to 10/10 pancake ice and grease ice
2000 72°40' 167°00'W

September 29, 1967

0000 underway in Arctic Ocean on c/000°T behind icebreaker
0047 entered the Arctic pack ice - concentrations varying from 3/10 to 9/10 on VCS
0343 encountered 10/10 coverage old winter ice - hove to
0701 underway - on VCS
0800 73°44' 169°10'W
1200 74°07' 169°00'
2000 74°51' 169° 14'
2203 hove to

September 30, 1967

0000 hove to at position 75°09.3' 169°01' in 9/10 - 10/10 coverage ice
0700 underway
0800 75°15' 169°03'W
1200 75°50' 169°36'W
2000 76°24' 168°50'
2124 hove to in 10/10 ice concentration

October 1, 1967

0000 hove to in 9/10 ice coverage
0718 underway
0800 76°27' 169°36'W
1200 76°41' 169°22'W
1847 hove to in 10/10 ice concentration
2000 76°51' 168°58' hove to as before

October 2, 1967

0000 hove to as before in 10/10 concentration - thick polar ice
under pressure
0800 76°51' 168°58'
1000 underway following ice breaker thru 10/10 old winter ice
1200 77°36' 168°56'
2000 78°20' 166°45'W

October 3, 1967

0000 underway in 10/10 coverage ice
0030 Rendevous with OSCGC Northwind at 78°42.2' 166°50'
assumed BC/210°T
0745 underway out of the ice pack behind ice breakers
0800 78°34' 166°57'
1200 78°20' 167°34'
2000 77°45' 168°08'
2050 moored to ice breaker

October 4, 1967

0800 77°45' 168°13.5'
1200 77°40' 168°20'
2000 77°14' 168°08'

October 6, 1967

2000 75°50' 166°35'

October 7, 1967

0000 hove to in center ocean in 9/10 polar ice
0800 75°50' 166°35'W - hove to as before
0806 underway - VCS behind ice breaker
1200 75°34' 166°00'
2000 74°40' 166°02'

October 8, 1967

0000 underway - VCS
0120 hove to
0745 underway - behind ice breaker
0800 74°23' 165°45'
1200 74°14' 165°53'
1236 74°12.6' 165°58' - Rendevous with USCGC - Glacier
1516 standing out of ice pack
2000 73°16' 165°30'

October 9, 1967

0000 underway on BC/165°T

October 12, 1967

0000 moved to USCGC Northwind in position 71°20.5' 156°44.0' - 2,500 yards off Point Barrow in 9/10 grease and pancake ice
0823 depart
1200 71°12' 158°15'
1455 entered area of small ice floes of less than 1/10 coverage with frozen pancake ice of 9/10 coverage
1525 encountered small floes of 7/10 coverage
2000 70°45' 161°10'

October 14, 1967

0400 underway as before on C/217°T
0800 69°21' 166°22'W

Glacier

October 1, 1970

0000 hove to
0005 V/C/S on BC/36°T
0210 hove to in ice at 70°31.5' 163°06.0'
0800 70°25' 163°52.5'
1000 beset in ice
1200 stuck in the ice
post 70°25'.4 162°53.5'
1205 broke free of ice - V/C/S following leads in the ice making headway northest
1230 breaking medium ice
1400 VCS in medium ice
1450 have to an ice at 70°34.5' 163°16.0'
2000 70°19.7' 163°11.6'

October 2, 1970

0800 drifted overnight to 70°17.5' 163°16'W
0835 VW - on VCS attempting to reach as far to the notheast as possible.
1048 hove to on the ice pack at 70°22.6' 163°24'W
1200 70°23.2' 162°24.4'W hove to as before
2000 70°05.0' 163°24' VW on BC/250°T
2105 post 70°07' 163°14' on BC/40°T

October 3, 1970

0000 VW enroute edge of the ice pack to hove to for the night BC/245°T making VCS to avoid block and broken floes of ice
0006 hove to in large ice floe post: 70°08.5' 163°21.4'
0800 70°12.4' 163°00' underway to northeast
1200 70°11.2' 162°51.1' anchored
1930 VW C/270°T
2000 70°08.3' 163°58.2' MVC to avoid scattered ice floes
2045 MVCS/to avoid ice
2100 hove to at 70°10.9' 163°19.2'

October 4, 1970

0000 hove to in the ice 70°11' 163°18'
0035 VW attempting to MGC (make good a course) of 205°T while on VCS to avoid ice
0243 hove to in the ice
0600 VW on VCS thru ice pack
0800 69°58.9' 163°17.5'
0815 anchored at 69°58.9' 163°17.5'

October 7, 1970

1200 70°11' 167°00.8'W on BC/020°T
1230 making VCS thru ice
1335 hove to with bow in ice pack
1730 at post 70°18.8' 167°15.0'W - VCS to SE
1800 set BC/180°T
2000 69°54.2' 167°15.9'

October 8, 1970

1200 70°09.5' 169°50.2' c/300°T
1230 c/c 000°T at 70°12' 169°04'
1240 VCS to make position in ice
1320 hove to at 70°12' 169°05'
1652 VW - on C/ 124°T with minor changes in C & S to avoid ice floes
1900 hove to at 70°00' 168°26'

October 13, 1970

0050 hove to at 69°24.0' 166°53.0'
0143 VW on BC/028°T
0305 hove to 69°31' 166°47.0'
0335 VW on BC/037°T
0409 C/C 045°T
0415 MVCS due to ice floes
0433 C/C to avoid ice
0725 VW on C/ 315°T
0800 69°39.1' 167°01.5'
1315 post: 69°38' 166°13.5' BC/ 106°T
1445 maneuvering VCS to maneuver through ice
1600 underway as before - maneuvering VCS through ice
1800 enroute to area of "open ice" (?) on VCS through ice
2000 69°18.1' 167°12.1'
2015 60°16' 167°14' on BC/ 240°T on VCS to avoid ice floes - broken and scattered

October 15, 1970

0235 hove to 69°34.2' 164°48.2'
0327 underway BC/300°T
0405 maneuvering VCS to miss ice
0415 hove to 69°35.8' 165°09.9'
0610 maneuvering VCS along pack ice BC/220°T
0643 C/C 040°T
0708 C/C 050°T
0730 stop - 69°35.7' 165°11.2'W
0800 stop - 69°35.7' 165°11.2W
0818 VW - maneuvering VC around ice

October 15, 1970 continued

0948 hove to on ice 69°26.8' 166°38.2'
1200 69°24.9' 165°42.9' hove to on ice as before
1233 assumed BC in ice free water of 087°T
1525 making VCS through young ice floes at post: 69°27' 164°22'
1530 MVCS to avoid ice
1600 MVCS to avoid ice
1620 anchored at 69°27.5' 164°08.5'W

October 17, 1970

1200 68°54.1' 166°43.1' anchored
1237 underway - BC/270°T
1410 hove to 68°54.7' 167°27.9'
1728 underway - C/200°T
1735 maneuvering thru ice - VCS
1800 C/C 185°T
2000 68°34.8' 167°36.2'

NORTHWIND

March 14, 1970

0000 hove to 66°23' 167°27' - 'demolition crews on the ice'

March 15, 1970

0000 underway at position 66°24.4' 167°39'W
0120 nipped in the ice at 66°25' 161°40'W
0620 underway to avoid ice movement
0800 66°26' 167°35'
1200 66°26' 167°35'
1500 beset in ice at 66°26' 167°35' - in moving ice floes
2000 nipped at position 66°21' 167°50'

March 16, 1970

0000 nipped in ice as before at 66°21.5' 167°50'
1200 nipped as before at 66°13' 168°00'
2000 nipped as before at 66°07.6' 168°00'

March 17, 1970

0800 66°06.8' 167°58' - nipped as before
1200 66°06.8' 167°58' - nipped as before
2000 66°06.8' 167°58' - nipped as before

March 18, 1970

0000 nipped at 66°06.5' 167°59'
0800 66°06.7' 167°58' - nipped as before
1200 66°06.7' 167°58' - nipped as before
2000 66°06.7' 167°58' - nipped as before

March 19, 1970

nipped all day as before

March 20, 1970

nipped all day as before

March 21, 1970
nipped all day as before

March 21, 1970 continued

1010 the thickness of the ice about the ship is in excess of 55 (fifty-five) feet thick beneath the keel - forward of the bow 65 feet thick at a point 100 yards dead ahead - at a point 130 yards bearing 340° relative five feet thick - at a point nine yards off port bow 30 feet thick.

March 22, 1970

1045 underway in ice
1200 66°07' 167°59'
1307 hove to at 66°07' 167°59'
1800 underway backing and filling in heavy ice
2000 66°07' 167°59'
2001 nipped in 66°07' 167°59' position
2055 underway breaking ice about the ship
2110 hove to at 66°06' 167°59'
2115 underway breaking up ice about ship

March 24, 1970

0800 66°07' 168°01' - underway as before
1200 66°07' 168°01'
1355 hove to 66°07' 168°00'
1410 underway
2000 66°07' 168°01'

March 25, 1970

0000 underway at 66°07' 167°58'
0800 66°09' 168°02'
0915 beset in ice at 66°09' 168°02'
1200 66°09' 168°02'
2000 66°09' 168°02'
2005 beset in position 66°09' 168°04'
2055 underway

March 26, 1970

0800 66°06.4' 168°02.5'
1200 66°05' 168°04'
2000 66°05' 168°04'

March 27, 1970

0800 66°06.5' 168°04'
1200 66°06.5' 168°04'

March 27, 1970

1417 beset in ice at 66°06.5' 168°04'
1754 underway
2000 66°06.5' 168°04'
2215 nipped at 66°05.7' 168°04.5'

March 28, 1970

0800 66°06.5' 168°04' - nipped as before
0840 underway
1116 hove to at 66°06.5' 168°04'
1137 underway
1200 66°06.3' 168°04'
2000 66°05' 168°04'

March 29, 1970

0304 nipped at 65°05' 168°10'
0800 65°57.4' 168°08.2' - nipped as before
0845 underway
1200 65°57.4' 168°08.2'
1248 nipped 65°57.5' 168°03.5'
1328 underway
2000 66°01'168°07'

August 25, 1970

0000 hove to 68°49' 175°25'
0755 underway - set BC/175°T - making VCS to avoid ice
0807 resumed base course
0812 M/V/C/S about base course to avoid ice
0847 C/C 284°T
0935 entered area of medium size ice floes - on VCS
1036 hove to 68°40.2' 175°56'
1305 underway on BC/144°T - maneuvering to avoid ice
1616 M/V/C/S avoiding ice
1756 C/C 159°T
1840 made radar landfall on Mt. Bentat range 38.5 miles - bearing 193°T
2001 hove to at 68°04' 174°53'

August 26, 1970

0000 hove to 68°04' 174°53'
0538 underway - VCS
0647 entered area of scattered ice
1645 set BC/305° PGC (?)

August 26, 1970 continued

1654 C/B/C 295° PGC
1823 M/V/C/S in area of brash ice
2045 hove to in brash ice in position 69°05.3' 178°43'W
2130 underway - M/V/C/S in brash ice
2314 hove to at 69°15' 178°33'W

August 27, 1970

0000 hove to at 69°15' 178°33'
0934 underway - VCS - on BC/029°T
1335 set BC/029°T
1430 C/C 019°T
1535 drifting at 70°00' 177°10'

PART IV

SHORE OBSERVATIONS FROM BARROW, 1891-1896

U.S. Revenue Cutter Service - Alaska File of the Revenue Cutter Service, 1867-1914. Point Barrow Station, 1891-1896 (Shore Observations)

Aug. 16, 1891

Moderate winds and cloudy all day. Ice breaking up and leads off shore opening. Still ice on the bar remains piled up high - prospect for ships arriving this season looks slim.

Aug. 17, 1891

Ice seems opening a little. Everybody having business with the ships have either gone down or are going to meet them. Apparently ships are at Pt. Belcher.

Aug. 21, 1891

Ice opening - a good deal of open water in sight.

Aug. 22, 1891

A number of steamers anchored off station. At 2 p.m. all three ships got underway to go round the Point for shelter from ice.

Aug. 24, 1891

Ice setting in upon the shore - One sail well to the S.W. in sight, underweigh.

Aug. 25, 1891

Plenty of ice in every direction but rather loose.

Aug. 27, 1891

All 5 steamers still at anchor in sight of the Station - Ice closing in - but little water in sight - In the p.m. Narwhale got so jammed in by the ice that the Balena came to her assistance. After considerable labor the N. was got out of her precarious situation when she went about a mile further N. and anchored.

Aug. 29, 1891

Ice closing in on the shores.

Aug. 30, 1891

Ice holds quite compact with but little open water, but ice moving north rapidly.

Sept. 1, 1891

Ice closing in from the shores.

Sept. 2, 1891

Heavy ice closing in upon the shores and heavy as seen in every direction-but little open water to be seen and only inside the ridge of ice lying along on the bar where the Orca and Narwhale are now lying. Everywhere else seaward, compact broken ice.

Sept. 3, 1891

Ice very compact - No open water to be seen except a little along inside the bar where the two steamers are now lying.

Sept. 4, 1891

This morning report from the Point says 2 steamers lying there direct from Mckenzie Bay with 21 whales, bound to S.F. direct as soon as ice opens. Ice still heavy and compact off this station - no chance for the ships to get out.

Sept. 5, 1891

In the night heavy showers of rain, 13 in. fell. Wind changing suddenly from S.E. to S.W. in heavy squalls. Ice leaving the shores.

Sept. 6, 1891

Word came from down the coast this noon that 4 schooners, Rosario, Nicoline, Alton and Silver Wave were jammed in by ice in Pearl Bay, and were in a critical position. As far as can be seen all the steamers are around the Point at anchor in clear water.

Sept. 9, 1891

A storm threatening - water outside ridge ice, opening, from appearances ships might get out.

Sept. 11, 1891

Clear water to the S & W - Ice remains on the bar but open water inside.

Sept. 12, 1891

Ice still remains on the bar, open water outside with floating ice.

Sept. 13, 1891

Moderate gale with fog from E, NE. Ice rapidly disappearing.

Sept. 17, 1891

Weather thick and foggy, with a fresh breeze and heavy swells setting in from the S.

Sept. 19, 1891

Sea quite clear of ice.

Sept. 21, 1891

Little or no ice in sight - but little change during the day.

Sept. 22, 1891

Strong breeze and misty weather. No ice.

Sept. 23, 1891

No ice in sight - ships reported cruising off the Point.

Sept. 24, 1891

Little snow in the morning with mist all day - no ice in sight.

Sept. 24, 1891

Moderate winds and foggy weather - no ice nor vessel in sight. Continues the same through the day.

Sept. 27, 1891

Much calm weather during the day.

Sept. 28, 1891

Cold, raw wind with veins of fog - no ice in sight.

Sept. 30, 1891

No ice nor sail in sight.

Oct. 1, 1891

No sail nor ice in sight.

Oct. 2, 1891

No ice nor sail in sight.

Oct. 3, 1891

No ice nor sail in sight. Heavy swell setting in on the shore - a blizzard prevailing.

Oct. 4, 1891

Blizzard continues with an increased swell setting on shore - wind backing to the N.

Oct. 5, 1891

In the morning clearing weather but still cloudy. Plenty of heavy pack ice drifting down.

Oct. 7, 1891

No ice but a few drifting pieces in sight.

Oct. 8, 1891

No ice in sight but a few drifting pieces.

Oct. 9, 1891

Pack ice in sight - drifting in toward the shore.

Oct. 10, 1891

Pack ice setting in on shore. At night a heavy swell setting on shore.

Oct. 11, 1891

Strong winds and a heavy swell setting on shore - no ice, except a few floating pieces in sight.

Oct. 13, 1891

Light winds - some floating ice in sight.

Oct. 14, 1891

Fresh winds and clearing weather - floating ice coming down rapidly from N. In the p.m. young ice making fast.

Oct. 15, 1891

In the morning light winds and clearing weather - ice making at sea quite fast. In the p.m. the sea covered with ice.

Oct. 16, 1891

Sea frozen over.

Oct. 17, 1891

Ice in the sea broken up. Pack in sight six miles off shore.

Oct. 18, 1891

Ice in the sea broken up.

Oct 21, 1891

No open water in sight. Ice piling up in the open sea.

Oct 23, 1891

A.M. - sea all frozen over.

P.M. - some open water in sight, ice broken up and rough.

Oct. 26, 1891

Ice broken up outside the bar - plenty of open water.

Oct. 27, 1891

In a.m. fair weather with wind W. having shifted in the night from S.E. Much open water and the winds from it quite warm.

Oct. 29, 1891

In the a.m. light winds and fair weather - but little open water in sight. No open water in sight at sundown.

Oct. 30, 1891

Some open water in sight - many Bears have been seen lately prowling about on the ice. Two seen yesterday - one shot and wounded.

Nov. 1, 1891

In a.m. overcast with light variable winds - plenty of open water.

Nov. 2, 1891

In a.m. some open water in sight. In p.m. and at night clear. No open water in sight.

Nov. 13, 1891

No open water in sight.

Nov. 16, 1891

No open water in sight.

Nov. 23, 1891

Considerable open water in sight. At 10 clear except a bank of mist at the N.W. hanging over the open water.

Nov. 24, 1891

In the morning light winds and clear weather. A bank of mist lying over the open water at the N.W.

Nov. 25, 1891

In the a.m. fresh winds and clear weather with the exception of a heavy bank of mist over the open water in the N.W.

Nov. 26, 1891

In the a.m. fresh winds and clear weather with the exception of a bank of mist lying over the open water in the N.W.

Nov. 29, 1891

In the p.m. and evening clear excepting a bank of mist over the open water in the N.W.

Nov. 30, 1891

Ditto.

Dec. 1, 1891

In the a.m. clear and cool. A bank of mist lying over the water in the N.W. otherwise not a sign of a cloud to be seen.

Dec. 2, 1891

Bank of mist over the water in the N.W.

Dec. 3, 1891

A bank of mist in the N.W. In the a.m. thick mist - frozen - driving in from the open water making a perceptible deposit similar to frost or snow.

Dec. 4, 1891

Same mist from open water.

Dec. 6, 1891

No water and but little mist to be seen.

Dec. 14, 1891

No open water in sight - no mist.

Dec. 24, 1891

No open water in sight but the ice can be heard grinding and crushing together.

Jan. 3, 1892

Ice grinding in the offing with open water beyond.

Jan. 8, 1892

In p.m. plenty of open water.

Jan. 9, 1892

Plenty of open water in sight.

Jan 13, 1892

A low bank of mist lying over the open water offshore.

Jan. 14, 1892

A low bank of mist extending half way round the horizon from N.E. to S.W. over the open water, indicating a large amount of open water in those directions.

Jan. 15, 1892

Mist bank over the open water extending from S.W. to N.E.

Jan. 17, 1892

Bank of mist lying steadily over the open water extending from S.W. round W to the N.E.

Jan. 19, 1892

At 9 a.m. a light mist came in from the open water and continued until about 2 p.m. when it cleared up.

Jan 21, 1892

Much open water with a bank of mist lying over it in the W.

Jan 27, 1892

In the a.m. frozen mist continues falling. This mist undoubtedly arises from the open water in the sea as the bank of mist is always seen in clear weather having the appearance of a low fog bank.

Feb. 4, 1892

Plenty of open water with a bank of mist lying over it.

Feb. 5, 1892

No open water in sight - the pack ice having closed in.

Feb. 6, 1892

No water in sight.

Feb. 8, 1892

Some sight of open water in the W.

Feb. 10, 1892

No open water in sight.

Feb. 11, 1892

Ditto.

Feb. 18, 1892

Plenty of open water in sight.

Feb. 14, 1892

The ice floe seems to be breaking off and floating away (a.m.) At 12 mist had lifted and ice pack had closed in - no open water in sight.

Feb. 15, 1892

Ice grinding and piling up in ridges - no open water.

Feb. 17, 1892

No open water in sight but the ice in the offing moving crunching and grinding fearfully.

Feb. 18, 1892

A bank of mist lying over the open water in the W and N.W.

Feb. 19, 1892

Some open water in sight.

Feb. 24, 1892

No open water to be seen - ice pack closed in.

Feb. 25, 1892

No open water in sight.

Feb. 27, 1892

No open water in sight.

Feb. 28, 1892

Ditto.

March 1, 1892

Ditto.

March 4, 1892

Ditto.

March 5, 1892

Ditto.

March 7, 1892

Ditto.

March 9, 1892

Ditto.

March 10, 1892

Ditto.

March 11, 1892

Ditto.

March 13, 1892

In the a.m. light winds and clear weather - heavy mirage over the ice no open water.

March 15, 1892

No open water in sight. Native can catch no seal. All the women and children obliged to go out on the ice to obtain tomcod for a precarious living.

March 17, 1892

No open water in sight.

March 23, 1892

Ditto, but natives report open water 6 miles out.

March 25, 1892

Some mist lying over the water to the W and N.W. indicating open water in that direction.

March 29, 1892

Mist hanging over the ice to the N.W. indicating open water in that direction.

March 30, 1892

No open water in sight.

March 31, 1892

No open water in sight.

April 2, 1892

Lead of open water in the N.W.

April 3, 1892

Ditto.

April 4, 1892

Weather warmer - open water in sight some four miles out.

April 8, 1892

In a.m. fresh winds and clear weather except a light mist near the horizon. Indications of much open water.

April 9, 1892

Mist bank lying over the open water in the W and N.W.

April 10, 1892

Ditto.

April 12, 1892

In the a.m. - open water about three miles out.

April 16, 1892

Open lead of water some three miles out.

April 17, 1892

No water in sight.

April 20, 1892

Open lead of water all along the shore about five miles out.

April 22, 1892

No open water in sight, the pack ice having set in and filled the lead.

April 24, 1892

No open water in sight.

April 29, 1892

No open water in sight.

April 30, 1892

No open water in sight, report from whalemen on the ice read that the pack ice has closed the lead.

May 1, 1892

Ditto.

May 2, 1892

Ditto.

May 3, 1892

Ditto.

May 4, 1892

Ditto.

May 6, 1892

Ditto.

May 7, 1892

No open water in sight - lead closed - most of the natives out on the ice - no whales but plenty of ducks coming along in large flocks.

May 10, 1892

No open water in sight.

May 11, 1892

Ditto.

May 13, 1892

Ditto.

May 14, 1892

Ditto.

May 16, 1892

Open water in sight from top of the house. In the p.m. overcast, no changes in the ice.

May 17, 1892

Natives report another large whale, making four taken by them this season.

May 18, 1892

No open water in sight. Natives report two more whales taken.

May 20, 1892

Natives report two more whales killed today and two yesterday (19th).

May 23, 1892

Ice floe broke off about one mile from shore leaving all the boats of the village out on the ice, but near night three or four boats came across the ice, then crossed the open lead and landed on the shore floe.

May 26, 1892

Lead filling with ice - no whales - plenty of ducks.

June 2, 1892

Much open water.

June 3, 1892

Much open water - ice moving off shore with the winds - current setting strong to the N.E.

June 4, 1892

Ice closing in and filling the lead.

June 5, 1892

Ditto.

June 7, 1892

Ice closed up the lead - no movement in the ice.

June 8, 1892

Lead of open water making something like a mile off shore.

June 9, 1892

Lead of open water about one mile out.

June 10, 1892

Wide lead of open water about one mile from shore.

June 11, 1892

Lead well open off shore - no ice in sight beyond the lead.

June 12, 1892

Plenty of open water.

June 13, 1892

Ice from the floe constantly breaking off in small parcels and drifting away. Plenty of open water off shore.

June 15, 1892

Floe ice breaking off and drifting away constantly.

June 19, 1892

No ice in sight except along on the bars, and between the bars and shore.

June 23, 1892

No ice except along the shores in sight.

June 26, 1892

8 a.m.: Wind E steady, 18 miles an hour.

Noon: Wind E steady, 24 miles an hour.

No ice in sight except along shore.

June 28, 1892

8 a.m.: Wind N.W. variable, 3 miles an hour.

Noon: Wind N.W. steady, 4 miles an hour.

8 p.m.: Wind N variable, 4 miles an hour.

In the a.m. light winds and part cloudy with warm weather - ice pack in sight gradually working inshore.

June 29, 1892

8 a.m.: Wind N steady, 3 miles an hour.

Noon: Wind N steady, 5 miles an hour.

8 p.m.: Wind E variable, 9 miles an hour.

Ice pack remains the same as yesterday in the a.m.

In the p.m. baffling winds and mostly overcast - but little ice excepting along the shores in sight.

July 1, 1892

8 a.m.: Wind E steady, 14 miles an hour.

Noon: Wind E steady, 19 miles an hour.

8 p.m.: Wind E steady, 15 miles an hour.

In the a.m. moderate winds and partly cloudy. But little ice in sight. In the p.m. clearing, warmer.

July 5, 1892

8 a.m.: Wind N.W. steady, 25 miles an hour.

Noon: Wind N.W. steady, 23 miles an hour.

8 p.m. Wind N.W. steady, 16 miles an hour.

At 10 a.m. snowing occasionally in light flurries - and continues through the day. Ice pack closing in.

July 6, 1892

8 a.m.: Wind N.W. steady, 5 miles an hour.

Noon: Wind N variable, 4 miles an hour.

8 p.m.: Wind E variable, 19 miles an hour.

Ice pack in and the beach closed, the first time since it opened on the 22nd of May. In the p.m. wind changed to the E with warmer weather. Ceased snowing and threat of rain.

July 7, 1892

8 a.m.: Wind S.E. variable, 23 miles an hour.

Noon: Wind S.W. variable, 6 miles an hour.

8 p.m.: Wind W variable, 19 miles an hour.

In the a.m. fresh winds from S.E. and overcast with drizzling rain, .023 of an inch fell during the night. No ice in sight except shore ice and a few floating pieces drifting to the N.E.

July 8, 1892

8 a.m.: Wind W steady, 5 miles an hour.

Noon: Wind S. W. variable, 7 miles an hour.

8 p.m.: Wind S.W. steady, 12 miles an hour.

In the a.m. light winds and cloudy threatening rain. Floating ice setting N.E. P.M. - clearing, lead filled with floating ice setting rapidly to the N.E.

July 9, 1892

8 a.m.: Wind S.W. steady, 18 miles an hour.

Noon: Wind S.W. steady, 25 miles an hour.

8 p.m.: Wind S.W. steady, 11 miles an hour.

In the p.m. clear weather except a few S clouds - no open water in sight.

July 10, 1892

8 a.m.: Wind E variable, 4 miles an hour.

Noon: Wind E steady, 19 miles an hour.

8 p.m.: Wind E steady, 9 miles an hour.

In the a.m. light winds and cloudy. Ice scattering and drifting N Considerable open water off shore, weather warm.

July 12, 1892

8 a.m.: Wind W steady, 15 miles an hour.

Noon: Wind W steady, 13 miles an hour.

8 p.m.: Wind S.W. variable, 7 miles an hour.

In the a.m. moderate winds and overcast with fog - no open water in sight.

July 13, 1892

8 a.m.: Wind N.E. variable, 4 miles an hour.

Noon: Wind N.E. steady, 11 miles an hour.

8 p.m.: Wind E variable, 8 miles an hour.

No open water in sight - ice drifting to N.E. with plenty of walrus on it.

July 14, 1892

8 a.m.: Wind E steady, 4 miles an hour.

Noon: Wind E steady, 8 miles an hour.

8 p.m.: Wind E steady, 8 miles an hour.

Ice leaving the shore - floating ice in every direction as far as the eye can reach.

July 15, 1892

8 a.m.: Wind S variable, 18 miles an hour.

Noon: Wind W variable, 5 miles an hour.

8 p.m.: Wind E variable, 9 miles an hour.

Ice scattering and drifting rapidly to the N.

At 11-1/2 p.m. St. Balena Norwood, S.F., four days from Port Clarence, came to anchor off the Station. First vessel of the season.

July 19, 1982

8 a.m: Wind W variable, 24 miles an hour.

Noon: Wind W variable, 25 miles an hour.

8 p.m.: Wind S varible, 15 miles an hour.

In the a.m. fresh winds and cloudy with fog. Ice pack closing in.

July 20, 1892

8 a.m.: Wind W variable, 32 miles an hour.

Noon: Wind W steady, 32 miles an hour.

8 p.m.: Wind S.W. variable, 16 miles an hour.

In the a.m. fresh breeze from W with cloudy weather. At 9 last night wind changed suddenly to S.W. blowing a gale. Heavy ice piled up along the shores. This a.m. one sail in sight to the S.W. in clear water. In the p.m. ice closed in - no movement in the ships, except one bound to the E.

July 21, 1892

8 a.m.: Wind N.W. variable, 10 miles an hour.

Noon: Wind W variable, 17 miles an hour.

8 p.m.: Wind W steady, 30 miles an hour.

All day cloudy with fresh winds. Ice quite compact as far as eye can reach.

July 22, 1892

8 a.m.: Wind W steady, 30 miles an hour.

Noon: Wind W steady, 25 miles an hour.

8 p.m.: Wind N.W. variable, 25 miles an hour.

In the a.m. fresh winds and cloudy. Ice pack in heavy resting upon the shore. No open water in sight. No change in the p.m., ice compact.

July 23, 1892

8 a.m.: Wind N.W. steady, 21 miles an hour.

Noon: Wind N.W. steady, 19 miles an hour.

8 p.m.: Wind N.W. steady, 7 miles an hour.

In the a.m. fresh winds and cloudy, flitting snow occasionally. Ice compact - no open water in sight - same in p.m.

July 24, 1892

8 a.m.: Wind E variable, 6 miles an hour.

Noon: Wind N.E. variable, 18 miles an hour.

8 p.m.: Wind N.E. steady, 22 miles an hour.

a.m. - ice still compact, no opportunity for ships to arrive. In the p.m. ice beginning to open.

July 30, 1892

8 a.m.: Wind W steady, 19 miles an hour.

Noon: Wind W steady, 19 miles an hour.

8 p.m.: Wind W steady, 18 miles an hour.

In the a.m. fresh winds and fog and clouds with occasional showers of rain - ice setting in from off shore. In the p.m. rain.

July 31, 1892

8 a.m.: Wind calm

Noon: Wind E steady, 9 miles an hour.

8 p.m.: Wind E steady, 18 miles an hour.

In the a.m. ice closed in upon the shores. In the p.m. drizzling rain - ice opening.

Aug. 1, 1892

8 a.m.: Wind S.E. variable, 10 miles an hour.

Noon: Wind N.E. variable, 12 miles an hour.

8 p.m.: Wind N.E. steady, 12 miles an hour.

In the a.m. moderate winds and thick fog. Ice leaving the shores.

Aug. 20, 1893 (Record keepers changed Aug. 1)

Strong N.N.E. wind with heavy rain. Plenty of ice in sight in the a.m. moving south.

Aug. 23, 1893

A.M. wind S.E. light with some fog until nearly noon, then clearing with wind S. P.M. fine, light air from S. No ships and but very little ice in sight. This is the first southerly wind there has been for 60 days and the clearest since I have been here - E. Akin, Keeper.

Aug. 24, 1893

Have part fine, clear and warm light air. The Doctor and I went up to the duck station. Shooting started 2 a.m. Quite a number of whales went south this morning.

Aug. 25, 1893

A.M. strong breeze N.E. with some rain and fog. The Doctor and I got back from shooting at noon with 61 ducks.

Aug. 31, 1893

A.M. strong breeze N.E. with fog. P.M. strong breeze with some snow and fog. No ice in sight.

Sept. 2, 1893

The Schooner Jane Grey anchored off the station and sent in a boat with a letter for me to send down. Reported the ice all gone along the East shore. Steamers all gone East. She had been as far as Harrisons Bay.

Sept. 5, 1893

A.M. wind N.N.W. quite strong. P.M. good weather, wind N.N.W. Could see the ice pack today at 3 p.m. The Steamer Jeanie came to anchor off the station from Hershel Island with 130 heads of bone from the fleet at the Island, reports 140 whales taken this season off the Island.

Sept. 6, 1893

A.M. wind N light with some flurries of snow. Some scattering ice to be seen.

Sept. 8, 1893

A.M. light wind N.E., some scattering ice to be seen.

Sept. 10, 1893

A.M. wind N quite strong with fine snow.

P.M. snowing, quite fast wind N, heavy scattering ice two miles off shore as far as can be seen.

Sept. 13, 1893

Fine weather, light breeze N. At 2:30 p.m. the steamer Belvedere came to anchor off the station with 17 whales all told, from Herschel Island.

Sept. 15, 1893

At 8 a.m. steamer Beluga came to anchor off the station. She had taken 18 whales, 17 at Herschel Island.

Sept. 18, 1893

A.M. blowing a gale from S hauling by noon to the S.W. P.M. still blowing heavily from S.W. to W with a heavy surf on the shore.

Sept. 26, 1893

P.M. nearly calm airs from N.E. Some ice in sight in the N.W.

Oct. 22, 1893

A.M. moderate wind S.W. with snow. P.M. light air from S.E., no snow. A few pieces of heavy ice.

Oct. 30, 1893

A.M. light breeze N.E., clear and cold. P.M. nearly calm, airs from E, all of the young ice started off from shore this afternoon.

Nov. 1, 1893

A.M. light breeze N, quite a pack of young ice on the shore extending off to the ridge.

Nov. 4, 1893

A.M. light wind S.E., good weather, quite a pack of young ice in shore moving N.

Nov. 5, 1893

A.M. wind light S.W. with young ice so the Natives are out sealing for the first time. P.M. wind W quite strong and more ice.

Nov. 12, 1893

A.M. wind N.E., all clear water outside the ridge.

Nov. 19, 1893

A.M. airs from N.E., P.M. airs from E, some of the ice has broken off from the ridge and gone, all open water outside the ridge (or bank).

Nov. 23, 1893

A.M. calm, fine weather. P.M. airs from N.E., the ice from shore extends off a miles with open water beyond.

Dec. 16, 1893

Last night the ice broken off from the ridge, and clear water from the ridge as far as I can see.

Dec. 30, 1893

A.M. airs from N.W. cloudy, P.M. nearly calm, airs from N.W., quite a number of seals taken by the Natives today.

Jan. 5, 1894

A.M. wind W quite strong, clear. P.M. wind W.S.W. cloudy. Today the ice has come in so there is but little water to be seen. Seals quite plentiful and quite a number taken today.

Jan. 6, 1894

A.M. wind N.W., clear. P.M. strong breeze W, clear, no water to be seen.

Jan 22, 1894

A.M. blowing a gale N.E., P.M. strong breeze N.E., clear water beyond the ridge.

Jan. 28, 1894

A.M. strong breeze W.N.W., cloudy. P.M. same, no water to be seen.

Jan. 31, 1894

A.M. wind light N.E. P.M. wind light N.W. Thick weather, foggy or frozen fog. The ice is all gone from the ridge.

Feb. 3, 1894

Weather fine, clear and calm. I think the coldest we have had it yet. P.M. same, no water to be seen.

Feb. 7, 1894

A.M. calm, clear and cold. P.M. light air from N.N.E., no water to be seen.

Feb. 17, 1894

A.M. strong breeze N.E., clear. P.M. strong breeze E.S.E., clear, plenty of water in sight from 3 to 4 miles off shore.

Feb. 18, 1894

Last night the ice crushed in and formed a ridge about two hundred yards from the shore. Plenty of water there off shore.

Feb. 19, 1894

A.M. blowing strong S.S.W., ice a packing up, but not coming any closer to the shore. P.M. blowing a gale S.W., some snow, and drifting badly. No water to be seen.

April 10, 1894

Getting ready for whaling. No lead yet or water to be seen.

April 12, 1894

A.M. strong breeze N.E., overcast. P.M. blowing strong N.E., snow drifting, a disagreeable day. Four more canoes went off today from Mr. Kelly's whaling, quite a lead open today from 3 to 5 miles offshore.

April 15, 1894

A.M. light wind N.E., clear. P.M. light airs from N. Clear, fine weather. Three canoes went out from Mr. Kelly's today whaling.

April 16, 1894

A.M. fine weather, wind light N.E. P.M. same. The first whale reported seen this morning going North.

April 20, 1894

A.M. wind W.N.W. quite strong, P.M. strong breeze N.W., clear. The lead is closed, has been for two days, no whales seen for the past two days. Five seen all told so far.

April 21, 1894

A.M. fine weather, air from S and W mostly, clear. P.M. calm or nearly so, clear. Reports from the lead say a few whales seen today in holes.

April 30, 1894

A.M. fine weather, nearly calm, air from N, clear. P.M. the same. Mr. Kelly came in from the ice and reports no water, young ice as far as can be seen from four miles out (to the edge of the flow ice). The first ducks were seen today going North.

The average temperature for April was 11-1/4 degrees below zero.

May 2, 1894

A.M. light wind from N.W., cloudy with fine, light snow. P.M. air from N.W. to N.E., partly cloudy, no sign of water.

May 3, 1894

Reports from the flow no whales. No water.

May 7, 1894

A.M. airs from N.E. to N.W., clear, fine weather. P.M. light airs from N, clear. No lead, and no whales seen for the last week.

May 17, 1894

A.M. blowing strong N.E., overcast, snow drifting badly. P.M. same. The first whale reported killed today but the Cape Smythe Trading and Whaling Co., quite a large one 10 ft. 6 inches bone.

May 18, 1894

A.M. blowing strong N.E., partly cloudy, snow drifting, same in P.M. The CST&W Co. captured another whale today (small one).

May 19, 1894

A.M. Blowing a gale N.E., clear, snow drifting badly, same P.M. The CST&W Co. station captured 3 whales today.

May 20, 1894

A.M. still blowing a gale N.E., clear, snow drifting badly, same in P.M. Another whale taken by the CST&W Co.

May 21, 1894

A.M. blowing still N.E. strong, clear. P.M. fine, light wind N.E., clear. More whales. One for the SWCo. and two for the CST&W Co. and two reported taken from Point Barrow, and two taken from the village.

May 22, 1894

A.M. blowing again strong N.E., clear, P.M. the same. SWCo. one whale.

May 23, 1894

A.M. blowing a gale N.E., clear, P.M. still blowing N.E., partly overcast. Three more whales taken yesterday by the SWCo. Village one. Latter one SWCo.

May 25, 1894

A.M. blowing strong N.E., cloudy, P.M. wind N.E. quite strong, cloudy. Quite a flight of ducks yesterday. Two whales for the CST&W Co. today, three for the SWCo., two for the village. 28 all told.

May 26, 1894

A.M. wind N.N.E. quite strong, clear, fine weather, same in P.M. Three more whales for SWCo.

May 28, 1894

A.M. strong breeze N.E., clear. P.M. strong breeze N.E., partly cloudy. The lead is closed but a few whales seen in the last two days.

June 5, 1894

A.M. fine weather, wind N.N.E. light, clear. P.M. wind N, cloudy. Last night the ice broke off within three miles of the shore with all the whalemen on it, but all got in safe with the loss of some dogs and sleds and one or more canoes.

June 17, 1894

A.M. wind N.E. with some snow, P.M. same. All the whalers came from the ice today.

July 20, 1894

A.M. blowing a gale N.E., clear, P.M. blowing strong N.E., cloudy. Today the ice has broken off about one mile from the shore and is going off for the first time in a month.

July 21, 1894

A.M. strong breeze N.E. with rain. This morning the steamers came in sight, eight of them. All made fast to the ice, but the wind going the pack ice came in so they all steamed North. P.M. nearly calm with thick fog, air from S.W.

July 22, 1894

A.M. calm, clear, fine weather. P.M. light breeze from N to N.E., clear most of the time. See all the steamers laying off the shooting station. The man, woman, and boy that was suppose to be lost on the ice May 24th got ashore at Point Lay after being on the ice 61 days. They came up on one of the steamers yesterday.

July 26, 1894

A.M. light wind N, partly cloudy, fine weather, the same in p.m. Several sailing vessels have passed going N, some have come to anchor off the duck station. No steamers in sight, suppose they have all gone Eastward.

July 31, 1894

A.M. strong breeze S.W., some fog, p.m. light wind W with fog. Lots of ice came in along shore and as far as can be seen off shore.

Aug. 1, 1894

A.M. wind light N.W., some frozen fog but clear overhead. P.M. light air N.W., partly cloudy, no water to be seen off shore.

Aug. 2, 1894

A.M. light breeze N.E., partly cloudy. P.M. strong breeze, N.E., partly cloudy. The ice is leaving fast.

Aug. 3, 1894

A.M. wind N.E. strong, cloudy. P.M. the same. The ice all out of sight but part of the ridge.

Aug. 5, 1894

A.M. strong breeze S.W. to W with some fog. P.M. strong breeze W with some fog. At noon the Revenue Cutter Bear came in off the Station and made fast to the ice.

Aug. 8, 1894

A.M. airs from N.E., clear of fog. P.M. light wind N.E., partly cloudy. The ice came in last night quite heavy, but afternoon was off all clear of the shore.

Aug. 10, 1894

A.M. strong breeze N.E. with rain. P.M. wind S.E. with rain and fog. This morning 12:30 a.m. a part of the crew of the Bark Reindeer came to the station, two boats with 16 men. Reported the loss of the Reindeer on or near Return Reef on the 4th of August 1894. The vessel full of water and mast cut away. Was laying at anchor in 4 fathoms of water when the ice came in and pushed her ashore in 10 feet of water.

Aug. 19, 1894

A.M. light breeze N.W. with some fog. Quite a lot of ice in sight. Current running south strong. P.M. the same.

Aug. 24, 1894

A.M. wind south, cloudy with some rain. P.M. wind S.W. with some heavy rain, until 6 p.m. then fine weather. Some scattering ice came in.

Aug. 25, 1894

A.M. nearly calm airs from N to N.E., clear fine weather. P.M. fine weather, light wind N.E. partly cloudy. Six vessels in sight off the Point.

Sept. 16, 1894

A.M. wind N.E. with snow. P.M. strong breeze N with snow. The steamer Belvedere came to anchor off the Station. Capt. Slocum gave us a call. She had taken two whales.

Oct. 8, 1894

A.M. fine weather, light wind N to N.N.E., partly cloudy. P.M. the same. A few pieces of ice in sight, the lagoon froze all over last night.

Oct. 15, 1894

A.M. light wind N.E., cloudy. P.M. the same. Some quite heavy ice (scattering) in sight today.

Oct. 16, 1894

A.M. fine weather, light airs from N.E., overcast. P.M. the same. One whale seen from the Station and several was [sic] heard last evening from the other Station.

Oct. 18, 1894

A.M. light breeze N.E. cloudy, P.M. the same. No ice in sight.

Oct. 19, 1894

A.M. light wind N.N.E., cloudy P.M. strong breeze N.N.E. with some snow. Quite a pack of heavy ice in sight.

Oct. 20, 1894

A.M. wind N.N.E. with snow squalls. P.M. wind light N, no snow but cloudy. Plenty of heavy ice in sight to the N & W.

Oct. 21, 1894

A.M. light wind N, partly cloudy. P.M. the same. Young ice made last night a mile from shore, and quite a pack off two miles.

Oct. 27, 1894

A.M. blowing strong N.E., cloudy. P.M. the same. The young ice broke off from the shore last night. All clear water.

Average temperature for month of October 14-1/5 above zero.

Nov. 3, 1894

A.M. fine weather, clear and cold. P.M. air from S. E., clear and cold. Quite a number of seal killed today.

Nov. 5, 1894

A.M. clear, calm, fine weather. P.M. the same. Young ice formed two miles off shore so they [natives] are out sealing.

Nov. 9, 1894

A.M. strong breeze N partly cloudy. P.M. wind N.W. quite strong. Quite a number of seals taken.

November average temperature 6-5/6 degrees below zero.

December average temperature 11-2/7 degrees below zero.

January average temperature 17-1/5 degrees below zero.

February average temperature 23-1/4 degrees below zero.
Coldest 43 below, warmest 0 degrees.

March average temperature 15-1/7 degrees below zero.
Lowest 32 below, highest 0 degrees.

April 8, 1895

A.M. strong breeze N.E., clear. P.M. light wind E, clear. Mr. Kelly sent out another canoe today. About 2 p.m. the ice broke off about a mile from the shore.

April 9, 1895

A.M. fine weather, calm, clear. The same in the p.m. No water in sight.

April 18, 1895

A.M. calm, cloudy, fine weather. P.M. airs from N.E., partly overcast. Whales were reported the 16th and more today.

April 23, 1895

A.M. wind S to S.E., quite strong, snowing, p.m. blowing strong S, some snow. The ice broke about one mile off shore then came in.

April 27, 1895

A.M. fine weather, light wind S.W. P.M. fine, airs from S.W., clear. Quite a number of flocks of ducks reported today bound North. The first of the season, spring is coming.

April 28, 1895

A.M. wind light N.W., partly cloudy. P.M. airs from N, clear. No water to be seen.

April 30, 1895

A.M. fine, airs from S to S.E., clear. P.M. the same. No water to be seen since the blow. Whalemen all ashore.

April average temperature 6° below. Lowest 20° below, highest 17° above.

May 3, 1895

A.M. strong breeze N.E., clear. P.M. the same. The ice is cracked but don't go off, about a mile from shore. P.M. the ice is going and the canoes are all going out tonight.

May 7, 1895

A.M. light wind N, clear. P.M. airs from N, clear. The first whale of the season was killed today by the P.S.W. Co. up off the Point (Barrow) 4 seen up there.

May 10, 1895

A.M. light wind N.E., overcast. P.M. wind N.E., cloudy with some snow. Quite a number of whales were seen last night but none taken. Nearly all of the canoes are off Point Barrow as the ice is in better shape there for whaling.

May 11, 1895

A.M. strong breeze N.E., cloudy. The same in P.M. One small whale taken by the C.S.W.& T Co. today.

May 14, 1895

A.M. airs from S.E., overcast. P.M. calm, cloudy, with light snow. The C.S.W. & T Co. captured a whale today.

May 15, 1895

A.M. airs from S.E. to S, overcast. P.M. nearly calm airs from S.E. The PSCO. got a small whale today, a few seen.

May 19, 1895

A.M. fine weather, light breeze from N.E. to E, clear P.M. fine, wind E, cloudy. Two whales taken today, one by the C.S. Co. and one by the Natives. P.M. one more [whale] taken at Point Barrow by the Natives.

May 20, 1895

A.M. blowing strong, N.E. to E, cloudy. P.M. strong breeze E, cloudy. No ice to be seen outside the ridge. One whale taken by the P.S.W.Co.

May 21, 1895

A.M. fine and warm wind E, clear. P.M. airs from N.N.E., clear. The thermometer went up to 36° above, quite a flight of ducks today, the first of the season. The P.S.W. Co. got another whale today, all small so far.

May 22, 1895

A.M. light wind E, cloudy. P.M. airs from S.E. to S.W., foggy. PSCo. got another whale today.

May 23, 1895

A.M. calm with thick fog until 8 a.m., then clear and warm. P.M. airs from N, clear, nice weather. Quite a flight of ducks today. I got 22, the first this season.

May 24, 1895

A.M. fine weather, wind light E. P.M. light breeze from E to N.E., clear and warm. Quite a flight of ducks this afternoon. All water and no whale.

May 25, 1895

A.M. light wind N.E., clear, warm. P.M. the same. Plenty of ducks over the water.

May 26, 1895

A.M. light airs from N. to N.W., partly cloudy, fine weather. P.M. light wind N.W., thick fog. Killed 22 ducks on the ice this morning.

May average temperaturew 17° above. Coldest 8° below, warmest 40° above at 8 a.m.

June 1, 1895

A.M. fine, clear and warm. Airs from N.E. to S.E. P.M. fine, light breeze from E. A large flight of ducks today mostly over the lead.

June 3, 1895

A.M. strong breeze S.W., with some snow. P.M. the same. Ice coming in fast.

June 4, 1895

A.M. light wind E, partly cloudy. P.M. wind S.E., quite strong. The ice closed in last night. Very little water to be seen today.

June 5, 1895

A.M. strong breeze S.W., clear. P.M. the same. No water, the village canoes all hauled in this morning from the ice. I think given up whaling for this season.

June 6, 1895

A.M. fine weather, airs from E to S, clear and warm. P.M. airs from S.W., warm. No water in sight.

June 27, 1895

A.M. strong breeze E.S.E. with fog. P.M. wind E.S.E. strong with fog. The pack ice started off last night and this morning there was quite a lead of water. In the afternoon whales were sighted and all the canoes that could go out went.

June 28, 1895

A.M. wind light from S.E. to S, fog. The same in P.M. The canoes all came in today. See quite a number of whales but the pack ice came in and closed up the lead.

July 9, 1895

A.M. light breeze, N.W., cloudy. P.M. airs from N.E., cloudy. The ice inside the ridge is rotting away fast. The Lagoon back of Mr. Kelly's is clear of ice, fully a month sooner than last year.

July 10, 1895

A.M. light wind S to S.W., cloudy. P.M. light breeze S.W., clear. Quite a number of Ogourooks and two walrus and lots of seals in the few days killed by the Natives.

July 12, 1895

A.M. light wind S.W., cloudy. The same in P.M. No water to be seen outside the ridges.

July 14, 1895

A.M. wind W.S.W., clear, fine weather. P.M. wind W.S.W. quite strong with light fog. Most of the flat ice inside of the ridge has broken up and moved North. The pack still is closed in on the ridge outside. Quite a lot of eider ducks going South.

On July 25, 1895 at noon the thermometer stood at 68° above.

Aug. 3, 1895

A.M. wind N.W. with some fine snow. The same in P.M. No water in sight inside - outside the ridge.

Aug. 14, 1895

Report that the cutter Bear and the whaling all at Icy Cape.

Aug. 15, 1895

A.M. wind N.E. quite strong with some fog. The same in P.M. The pack of ice has left the shore and some holes has [sic] broken through the ridge.

Aug. 15, 1895

A.M. light breeze N.E. with some fog. P.M. light airs from N.W. to N.E., again clear but high fog. This afternoon the pack ice came in again and closed up tight.

Aug. 20, 1895

A.M. air from N with thick fog until 10 a.m., then clear. P.M. airs from the N, clear, fine weather. Two steamers were reported seen 40 miles down the coast yesterday and several canoes have gone down to meet them. P.M. - 8 p.m. four steamers have gone past to the North two miles off shore through the ice, I think trying to get around the end of the ridge.

Aug. 28, 1895

A.M. wind N.E., quite strong, cloudy. P.M. strong breeze N.E., clear. The ice is most all out of sight.

Sept. 9, 1895

A.M. wind S. to S.W., strong, some rain. P.M. wind S.W. strong, ice coming in. The steamers will have to leave.

Sept. 18, 1895

A.M. wind S.W. quite strong with snow. P.M. wind W partly cloudy, clearing. Mr. Smith, first mate of Schooner Rosario from Herschel Island bound home but is now ice bound at Point Barrow. The pack ice has been in for a week or more.

Sept. 20, 1895

A.M. airs from S to S.E., partly cloudy. P.M. light breeze S.E., overcast. Ice moving N fast but not off.

Sept. 22, 1895

A.M. wind E.N.E. with fog in squalls. P.M. wind E.N.E., some fog, some snow. The ice broke off at the ridge and opened quite a lead. The Rosario got underway this morning and stood out but it came in thick [fog] and we could not see whether she got out or not. Later reported going south.

Sept. 27, 1895

A.M. light breeze E.N.E., clear and cool. P.M. airs from S.E. with fog. The lagoon froze over last night and remained frozen all day. Quite a heavy strip of ice came from the south.

Oct. 1, 1895

A.M. airs from S.E. to E, cloudy. P.M. wind E.N.E., with thick fog. The ice has nearly all gone, only a few cakes of ground ice to be seen, ducks still flying quite plentiful at the duck station.

Oct. 4, 1895

A.M. wind N with snow. P.M. wind N.W., snow in squalls. No ice in sight.

Oct. 10, 1895

A.M. light breeze N.E., cloudy. P.M. the same. Quite a lot of young ice today and current running south strong.

Oct. 16, 1895

A.M. light breeze N.E., partly cloudy. Same in the P.M. Quite a number of bears killed at the Point in the last 4 days, 17 all told.

Oct. 20, 1895

A.M. strong breeze N.E., cloudy. P.M. light breeze N.E., cloudy. No ice to be seen now from the station but two or three pieces of old ice off shore.

Oct. 28, 1895

A.M. calm, airs from all quarters. P.M. light breeze N.W. clear and fine. The shore ice is out as far as the ridge, and looks as though it had come to stay.

Average temperature October 9-1/2 degrees above.

Nov. 5, 1895

A.M. airs from S & S.E., overcast. P.M. calm, fine weather, partly cloudy. The shore ice has made off. A mile clear water beyond. 44 bears have been killed, mostly at the Point and Eastward.

Nov. 12, 1895

A.M. wind N.W., clear, fine weather. P.M. strong breeze W. clear. About noon the ice began crashing in on the shore, it came within 60 yards of the Station piling up 20 ft high it commenced 100 yards, south of the house and how far North I can't tell, at the C.S.W. & T Co. station they packed up to move inland. The ice coming nearly up to the houses. The ice is 12 to 15 inches thick.

Nov. 21, 1895

A.M. blowing strong N.E., overcast. P.M. blowing a gale N.E., partly cloudy. The ice broke off at the ridge and went off with one village Native.

Nov. 23, 1895

A.M. strong breeze S.W. to W, cloudy. P.M. light breeze W, cloudy. The ice came today and with it the Native that went off on it.

Nov. 30, 1895

A.M. light breeze N.E., cloudy. P.M. blowing strong E, cloudy, snow drifting badly. The ice makes off about a mile from shore. Not much of an outer ridge formed yet.

Average November temperature 6-1/15 degrees below.

Dec. 16, 1895

A.M. strong breeze N.E., snow drifting. P.M. blowing strong N.E., snow drifting badly. Quite a number of seals taken last night. One Native caught 33, about 60 taken.

Average December temperature 24-1/2 degrees below.

Jan. 24, 1896

A.M. blowing strong N.E., snow drifting. P.M. blowing a gale N.E., overcast. Ice broke off and gone outside the ridge.

Average January temperature 32 degrees below.

August 1, 1978

FINAL REPORT

Research Unit 389

TASK TITLE: Transport, retention, and effects of the water-soluble fraction of Cook Inlet crude oil in experimental food chains.

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INTRODUCTION

General Nature and Scope:

The water-soluble fraction of crude oil contains components that are highly toxic to marine organisms. The fate and effects of chronic concentrations of this fraction in marine food chains are poorly understood and were investigated in this task. The general objective of this study was to determine the accumulation and passage of petroleum constituents in experimental marine food chains and the effects of petroleum exposures on the test organisms. The termination of funding did not allow the study of several contrasting food chains as originally intended.

Specific Objectives:

Initially, the specific objectives were as follows:

1. To determine the accumulation, retention and transfer of petroleum constituents in experimental food chains consisting of up to four trophic levels including primary producers, consumers and primary and secondary carnivores. Exposure was to the water-soluble fraction of petroleum in water and in ingested food, to distinguish the effectiveness of petroleum accumulation from food and water exposure pathways. Adult and larval food chains were to have been studied. (The initial study was to have contrasted plankton → clam → flounder against phytoplankton → clam → crab → flounder. Only the clam to flounder food chain study was completed).

2. To determine mortality of experimental animals under various exposure conditions including mortality in eggs and larvae from exposed adults.

3. To determine morphological and behavioral abnormalities caused by selected exposure conditions.

4. To predict potential effects of crude oil on populations and communities in terms of reproductive success, energy utilization and growth.

5. To recommend maximum allowable levels of petroleum components in the water column and fish food organisms and, if possible, to identify components of crude oil with the greatest potential for adverse biological effects.

Relevance to Problems of Petroleum Development:

In areas of proposed offshore oil development, the potential exists for damage to marine biota, both from chronic exposure to low levels of toxic petroleum components and from acute exposures during spills and blowouts. One direct way of forecasting damage to the marine biota, with the capability of developing *a priori* recommendations before development ensues, would be to first conduct a series of laboratory experiments as outlined here. By developing information on the physiological, histological and morphological effects at chronic concentrations of petroleum components, recommendations can be made for maximum allowable levels. Also, by exposing marine organisms at time of reproduction, estimates of effects on potential populations can be derived. Finally, by studying part of a benthic community food chain, some prediction of potential effects of food chain accumulation and effects at a community level is possible.

In addition to the capacity for making a priori decisions from such studies, information can be obtained for decisions on what organisms, and tissues to monitor for concentrations after oil development has begun.

Current State of Knowledge:

Very few studies have been done on biomagnification of petroleum through food chains, although the claim is often made that biomagnification of petroleum components does not occur. Some experiments have been done exposing organisms to petroleum by administering it through their diet (reviewed by Varanasi and Malins, 1977). Results varied considerably with the species and their relative capacities for metabolizing petroleum components and with the type of petroleum to which organisms were exposed. Considering the lack of information and the relatively few food chains, species and life history stages studied, it appears premature to state that no biomagnification of petroleum occurs.

METHODS

Apparatus:

All testing was made under continuous-flow conditions using a dosing apparatus developed by project personnel (see Benville et al., manuscript in preparation). This apparatus (Figures 1 and 2) produced a stable outflow of the water-soluble fraction (WSF) of Cook Inlet crude oil which could be easily diluted to desired concentrations.

Animals:

Starry flounder adults were taken in an otter trawl from inshore areas near Bodega Bay, California. These fish were acclimated to 12°C at the Tiburon Laboratory and were held at this temperature under a natural photo-period for at least 4 weeks prior to experimentation. Two weeks before experiments began, flounder were switched from a diet of squid and bay shrimp to one of littleneck clams (*Protothaca staminea* and *Tapes semidecussata*).

Japanese littleneck clams used as food items in these studies were transported in refrigerated trucks from Puget Sound, Washington and were held at the Tiburon Laboratory for 1-2 weeks prior to being fed to flounder. Littleneck clams (*P. staminea*) and Japanese littleneck clams (*T. semidecussata*) used in uptake experiments were taken in Tomales Bay, California. All clams were held without food at 12°C.

For the three spawning experiments, adult flounder were collected from areas near Bodega Bay, California, while in pre-spawning condition with maturing ovaries. They were acclimated to experimental conditions for at least two weeks prior to experimentation. The experiments were conducted at ambient levels at the time of testing. The flounder were fed a diet of squid and bay shrimp

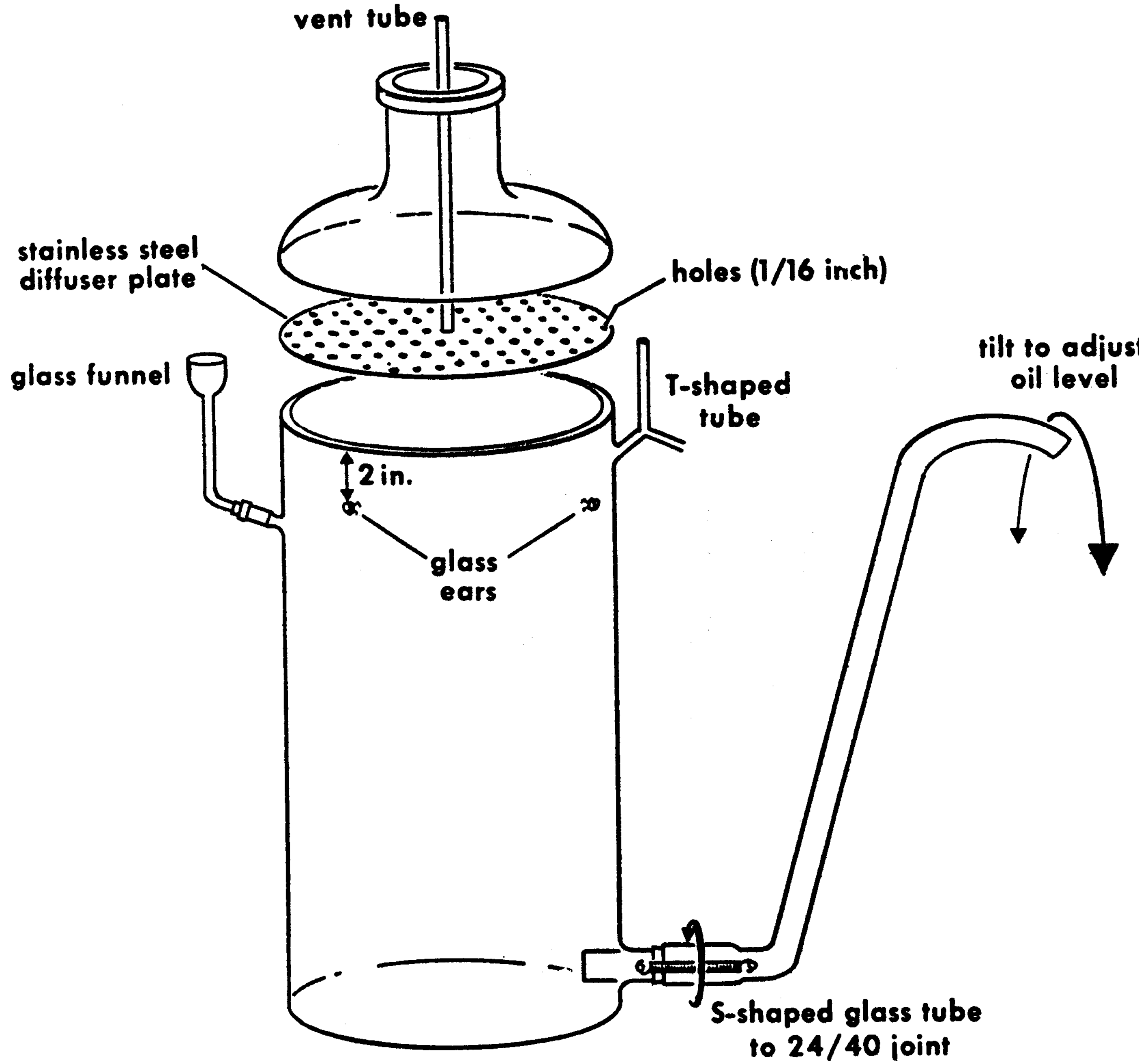

Figure 1. Apparatus (solubilizer) for continuously dosing flounder with the water-soluble fractions (WSF) of crude oil (from Benville et al., manuscript in preparation).

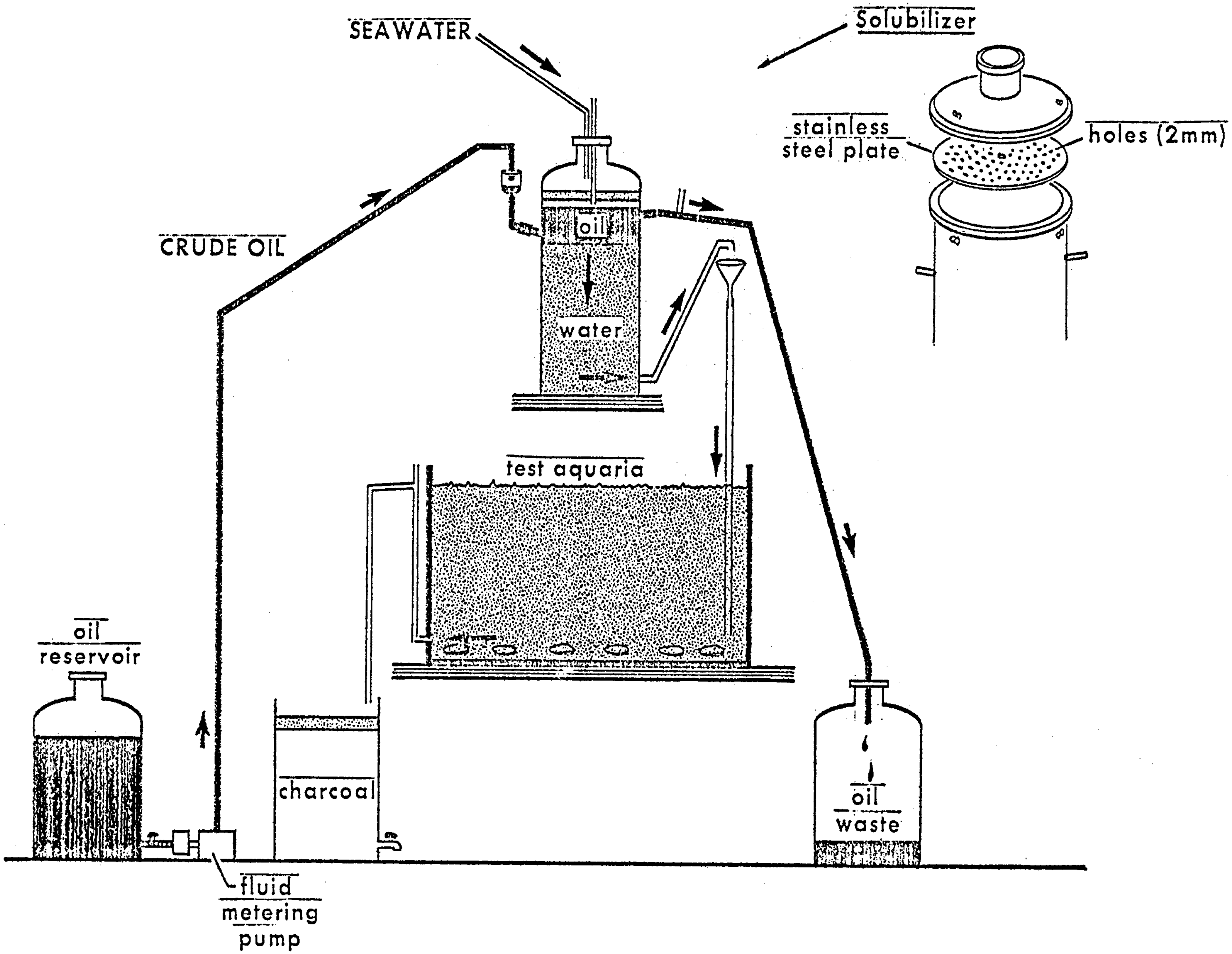

Figure 2. Apparatus for continuously dosing flounder or clams to the water-soluble fraction (WSF) of crude oil.

during acclimation. Because flounder do not feed during spawning and the exposure periods were relatively short in the first two experiments (5 and 7 days), flounder were not fed.

Littleneck clams in pre-spawning condition were taken from Tomales Bay, California, and were acclimated for 1 week at 17-18^{o}C and 21-32 ppt salinity. Clams were held without food during the 1-week acclimation and 4-day exposure periods.

Experimental design: Uptake, retention, and effects of low levels of the water-soluble fraction (WSF) of Cook Inlet crude oil to starry flounder exposed through food and through the water column.

Groups of 30 adult starry flounder were weighed, measured, and marked for identification and were placed in each of 4 fiberglass test tanks. Two of the test tanks received a continuous flow (6 liters/min) of the WSF in seawater at concentrations of 100 ppb. The other two tanks received 6 liters/min of uncontaminated (control) seawater (Figure 3). One tank receiving WSF and one receiving control seawater were fed Japanese littleneck clams (Tapes semidecussata) that had been exposed for 1-2 weeks to 100 ppb WSF in the water column. The remaining tanks received uncontaminated clams (Figure 3). Daily rations (clams without shells) to each tank weighed 4% of the wet body weight of the flounder in the tank. Flounder were continuously dosed by these methods for up to 2 weeks. Following this 2-week depuration, experimentation was concluded.

Water samples were taken and analyzed daily (gas chromatography) to determine the concentration of WSF in test tanks and in the solubilizer bottles feeding into the tanks. Every day temperature and salinity were measured and sub-samples of clams fed to flounder were taken for analysis of petroleum hydrocarbons.

On alternating weeks, three or six flounder were taken from each tank for analysis. These fish were weighed, measured, and identified. The liver, gonads, gall bladder, and a sample of muscle tissue were removed from each fish; after being examined for gross abnormalities, each tissue was placed in each of two pre-weighed glass culture tubes. These tubes were weighed, sealed tightly with teflon-lined screw caps, and frozen until they could be analyzed.

Experimental design: Comparative uptake and retention of the water-soluble fraction (WSF) of Cook Inlet crude oil by the common littleneck clam (Protothaca staminea) and the Japanese littleneck clam (Tapes semidecussata).

Clams were exposed to a continuous flow (1 liter/min) of the WSF of Cook Inlet crude oil at 100 ppb in two 133-liter aquaria; an additional aquarium receiving uncontaminated seawater served as the control. Sixty clams of each species were placed in each tank and were exposed to the WSF for up to two weeks. This exposure was followed by a one-week depuration period. Water was monitored daily for WSF concentration, salinity (32 ppt), temperature (12^{o}C), and oxygen (saturation). Clams were sampled from each tank every three days.

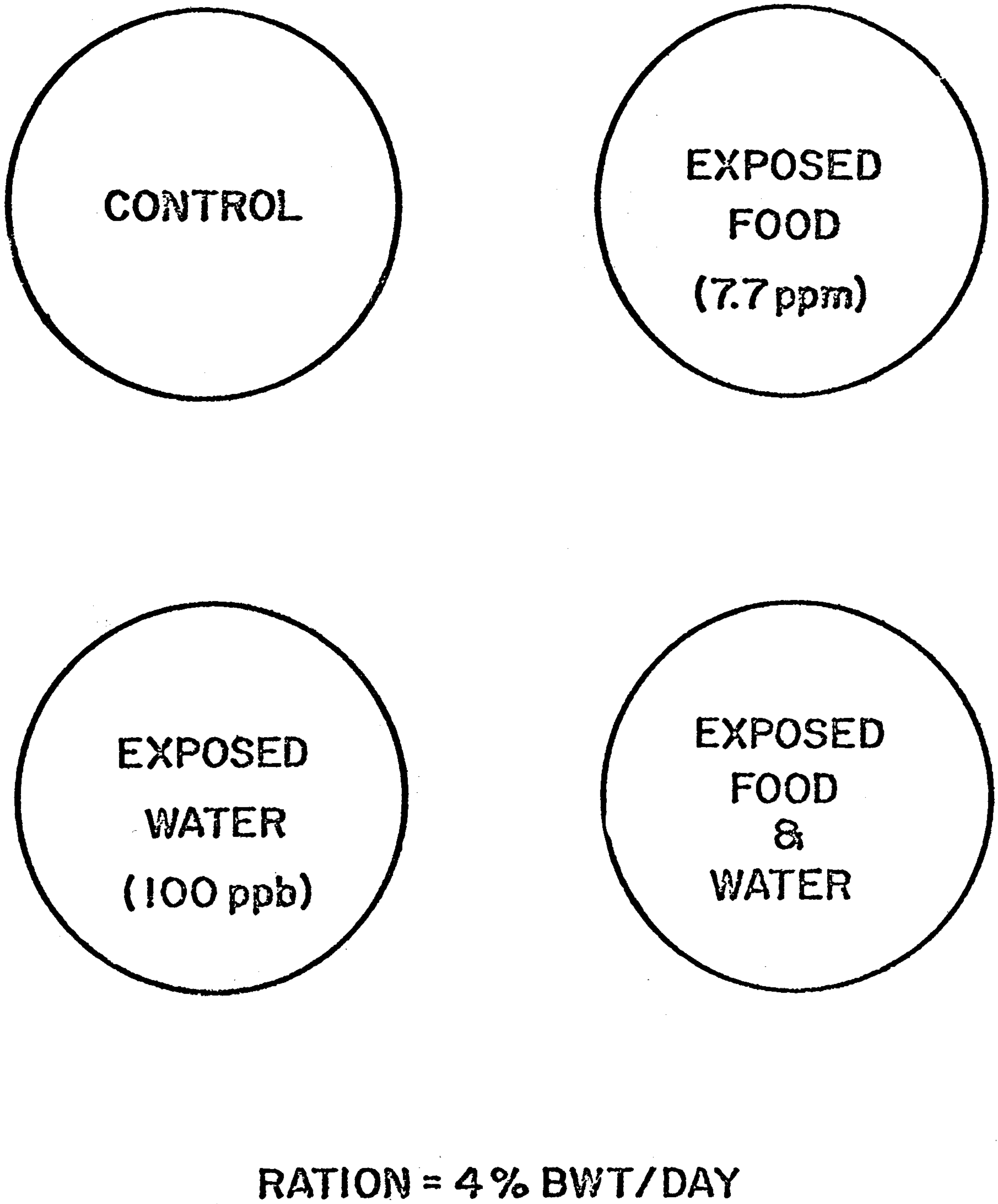

Figure 3. Dosing scheme for exposing starry flounder to the water-soluble fraction (WSF) of crude oil in water, food, or water and food.

Whole clam tissues were pooled, if necessary, from each sampling to make up 10-gram samples for aromatic hydrocarbon analysis. All samples were placed in pre-weighed glass tubes, sealed with teflon-lined caps, and frozen until the time of analysis. Four tissue samples were taken at each sampling, two samples for analysis of monoaromatic hydrocarbons and two for dicyclic aromatic hydrocarbons.

Experimental design: Effects of chronic concentrations of the water-soluble fraction (WSF) of Cook Inlet crude oil in the water column on pre-spawning starry flounder.

Test groups of starry flounder were placed in fiberglass tanks, each containing approximately 866 liters (228 gals) of seawater. One tank received a continuous flow of WSF in seawater (6 liters/min) at a mean concentration from 115 to 221 ppb monocyclic aromatics (varying with experiment). The other tank received uncontaminated (control) seawater at the same flow rate. Exposure apparatus was similar to that described above (Figs. 1 and 2).

Flounder were continuously dosed for the experimental period. Water samples were taken and analyzed daily to determine the concentration of low-boiling-point hydrocarbons in the tanks and the dosing apparatus effluent. Temperature, salinity, oxygen, and flow rate were monitored daily. The mean temperatures and salinities for the three experiments were 10.7, 13.7 and 17.2^{o}C and 19.7, 29.1, 18.8 ppt, respectively.

Daily observations of behavior included ventilation rate (number opercular beats/min), estimation of ventilation volume, regularity of ventilation, estimation of swimming activity, "digging" or escape activity, and feeding behavior. Ventilation rate was measured; other parameters were ranked.

In two of the experiments, two flounder were taken daily from each tank (exposed and control) for autopsy and subsampling for chemical analysis and histology. In a third experiment, flounder were all autopsied at the end of a 3-week exposure. Fish were weighed, measured and dissected. Macroscopic examinations of all organs were made and the ovaries, testes, liver and gall bladder were removed. Gonads were weighed, measured and examined microscopically to determine general maturation stage, presence of opaque dead or necrotic eggs, and the gross appearance (color and deliquescense). Maximum egg diameters of 10 eggs from the ovary of each female were measured. Spermatozoa from ripe males were examined under the microscope for motility.

The ventral gonad, gall bladder and half of the liver were placed in clean, pre-weighed glass culture tubes or glass sample jars. The tubes were sealed tightly with teflon-lined screw caps, the bottles with foil-lined caps. All samples were frozen until they could be analyzed. The dorsal gonad and other half of the liver were preserved in 10% formalin in 1% calcium chloride for histological work.

Histological Technique:

Ovaries preserved in 10% formalin in 1% calcium chloride were prepared especially for examination of the lipid distribution in the eggs following the recommendation of Bucke (1972) and using the procedure in Humason (1972). Frozen sections (16 μ) were cut with a freezing microtome cryostat, because routine processing methods remove lipids. Sections were stained with an oil soluble dye, Oil Red O, counterstained with Harris' Hematoxylin and blued in Scott solution. Staining times were adjusted according to the maturation stages, which varied in stain affinities. One series of sections from each sample was stained with Oil Red O only, another series with Oil Red O and hematoxylin.

Livers were embedded in paraffin and 10 μ transverse and longitudinal sections made. Sections were stained with hematoxylin and eosin according to the procedure in Humason (1972).

Histological **Examination**:

Each slide was first examined under a low-power (4X or 10X objective) phase contrast microscope and searched for the presence of dead or abnormal eggs. One hundred eggs were counted and closely examined and the percentage dead or abnormal determined. The maximum diameter of the five largest eggs was measured, and the maturation stages ascertained after a complete assessment of all cytological structures occurring at that stage. The maturation stages determined by Yamamoto (1956) for eggs of the flounder, *Liopsetta obscura*, were found applicable and used in this analysis (11 stages in all). Photomicrographs were taken of control and exposed eggs.

Experimental design: Effects of chronic concentrations of the water-soluble (WSF) of Cook Inlet crude oil in the water column on spawning stages of littleneck clams.

Groups of 40 adult common littleneck clams were placed in each of 3 glass tanks. Each tank received a continuous flow (mean = 2 liters/min) of seawater. Two tanks were continuously dosed with mean concentrations of 90 and 100 ppb WSF in seawater; the third tank was a control. The dosing apparatus was similar to that described above (Figs. 1 and 2). Clams were not fed during exposure.

Clams were continuously dosed for up to 4 days; clams not removed for analysis during this period were allowed to depurate for up to 1 week after cessation of exposure. Water samples were taken and analyzed daily to determine concentration of aromatics in the WSF of the tanks and solubilizer effluent. Mean temperature was 17.5^{o}C; mean salinity was 32 ppt.

Four clams were taken from each tank daily. Clams were measured and autopsied. Gonads were cut open and a sample of eggs or sperm was removed for microscopic examination in ambient seawater. The entire body of the clam was removed, placed in pre-weighed test tubes, and frozen for analysis of tissue concentrations of aromatics. Other subsamples were taken daily and preserved for histological examination. Maturing eggs were examined under the compound microscope to determine maturation stage, presence of abnormal or dead eggs, and maximum diameter of 10 eggs from each female was measured. Spermatozoa were examined for motility.

Analytical Procedures:

Analysis of Water Samples. Water samples taken daily from exposure tanks were analyzed for monocyclic aromatic hydrocarbons by extracting one liter twice with 10 ml of TF-Freon and injecting 3.2 microliters of each extract into the gas chromatograph (column packed with 5% SP-1200 and 5% Bentone 34 on 100/120 supelcoport). Liter samples taken daily from solubilizer effluent flowing into the exposure tanks were extracted 3 times with 10 ml of TF-Freon and injected into the GC. The limit of detectability of monocyclics in water was 0.010 mg/L. In addition, one-liter solubilizer samples were extracted with 80 ml methylene chloride for analysis of dicyclic aromatic compounds.

Extracts were concentrated to about 10 ml and stored in a freezer. Subsequent preparation for analysis followed procedures of MacLeod et al. 1977. The limit of detectability for individual dicyclics was 0.00025 mg/L.

Alkyl cyclohexanes and dicyclics were undetectable in tank water column samples. For results reported here, the concentration was estimated from the concentration in solubilizer effluent and by calculating final tank concentrations with the dilution factor.

Analysis of Tissue Samples. Samples analyzed for dicyclic aromatic hydrocarbons and aliphatic compounds were processed according to MacLeod et al. 1977. Samples were analyzed for monocyclic aromatic and alkyl cyclohexane hydrocarbons using procedures developed by project personnel for these experiments (Table 1). In some samples, insufficient weight of tissue (particularly immature gonads and gall bladders) was available, and samples were pooled. In instances where sample weights were below the optimum 10 g, tissue concentrations may be underestimated, particularly of less abundant components. Also, in the case of a few liver samples, sample extracts were emulsified after digestion and could not be analyzed.

Additional Chemical Analyses.

The National Analytical Facility, Seattle, Washington, performed a number of analyses of water, tissue, and crude oil samples by gas chromatography (GC) or mass spectrometry (MS) to verify results obtained by in-house analysis and to positively identify unknown hydrocarbons in tissue and water extracts.

RESULTS

The general results of the experiments are summarized in this report. All water and tissue samples have been chemically analyzed, and data transferred to coding sheets for key-punching. Computer statistical analyses of data are

Table 1. Procedure for analysis of low-boiling-point hydrocarbons in animal tissues. (Benville et al, MS in prep.)

1. Place 10 grams of tissue in a clean, glass culture tube (with a teflon-seal screw cap).

2. Add 6 ml of 4N NaOH and 4 ml of TF-Freon and cap tightly.

3. Place tube in oven (or water bath) for 18 hours at 30°C. Shake tube 4 or 5 times during this time.

4. Remove tube from oven and shake vigorously for one minute.

5. Centrifuge tube (while still warm) for 10 minutes at 3000 rpm.

6. If freon layer is clear (not cloudy), draw off with pipette and store in a clean, glass vial with a teflon-seal screw cap until ready to inject on GC,

Emulsions:

If the freon layer is clouded, use following procedure:

7. Freeze clouded sample and recentrifuge while still frozen (20-30 minutes at 2000-3000 rpm).

8. If sample is still cloudy, repeat.

9. If sample has not cleared, add 1-2 ml of 20% H_2SO_4, shake, and recentrifuge. A 15-20% reduction in recovery will result if it is necessary to follow this step.

RECOVERY RATE = 90-96% if tubes remain tightly capped.

LEVEL OF DETECTION = 0.025 μg/g wet weight.

incomplete. The work on spawning flounder was completed and the results are presented in a paper (Whipple et al, in press). Other results also are being prepared for publication (see page 46).

Uptake, retention, and effects of low levels of the water-soluble fraction (WSF) of Cook Inlet crude oil to starry flounder exposed through food and through the water column.

Uptake of hydrocarbons from food:

Flounder receiving contaminated food (clams; Table 2) accumulated alkyl cyclohexanes in their livers during exposure, reaching an average concentration of 2.06 ppm after 5 weeks (Table 3). No other accumulation of any petroleum hydrocarbons was detected in any tissues during exposure or depuration. The mechanism by which alkyl cyclohexanes accumulated and aromatics did not is unknown; it is curious that monocyclic aromatics were not detected because they were present in substantial concentrations in the clams used as food (Table 2).

Uptake of hydrocarbons from water:

A. Liver Tissue

After 2 weeks of exposure (seawater, Table 2), the mean concentration of monocyclic aromatic compounds was 22 ppm in flounder livers (Table 3). After 5 weeks exposure, the mean level was 49 ppm. The concentration of alkyl cyclohexanes (compounds not also found in chromatograms of livers from control flounder) reached an average level of 157 ppm in 5 weeks. The total concentration of low-boiling-point compounds averaged 206 ppm in 5 weeks. In one flounder liver, this concentration exceeded 300 ppm (Figure 4).

The liver of one flounder exposed for only one week to 100 ppb WSF contained nearly 150 ppm of monocyclic aromatic compounds. This flounder had lost weight, was in poor shape (a condition not attributed to the WSF exposure), and, as a result, may not have been metabolizing hydrocarbons as efficiently as healthy flounder. However, the tissue concentrations were noteworthy because they represented remarkable accumulation of petroleum hydrocarbons. After one week, concentrations of monocyclic aromatics in the liver were between 860 (benzene) and 97,250 (p-xylene) times higher than the concentration in the water column.

Concentrations of higher boiling aromatics (C_3-benzene through C_2-naphthalenes) reached a maximum concentration of 58.79 ppm in livers of flounder exposed continuously to approximately 20 ppb of these components for 5 weeks; tissue concentrations were 2950 times higher than the concentrations of the same components in the water column.

Concentrations of naphthalene, 2-methyl naphthalene, and 1-methyl naphthalene reached maxima of 5.78, 4.49, and 4.39 ppm after 5 weeks exposure. These levels represent accumulation factors of 1032, 3455, and 3661 times the water concentration.

Table 2. Estimated exposure concentrations of monocyclic aromatic hydrocarbons and alkyl cyclohexane low-boiling-point hydrocarbons.

	CONCENTRATION (PPM) - μg/g Wet Weight							
SAMPLE	BENZENE	TOLUENE	EHTYL-BENZENE	P-XYLENE	M-XYLENE	O-XYLENE	TOTAL ALKYL CYCLO-HEXANES	TOTAL ALL
SEAWATER	0.041	0.043	0.002	0.00005	0.007	0.004	<0.01	0.100
CLAMS	2.23	1.43	ND	ND	0.30	ND	3.74	7.700

ND = Not detectable

Table 3. Mean concentrations of monocyclic aromatic and alkyl cyclohexane low-boiling-point hydrocarbons in livers of starry flounder exposed to the WSF of Cook Inlet crude oil from different exposure routes.

		CONCENTRATION (PPM) - µg/g Wet Weight								
SOURCE OF EXPOSURE	LENGTH OF EXPOSURE (Weeks)	BENZENE	TOLUENE	ETHYL-BENZENE	P-XYLENE	M-XYLENE	O-XYLENE	TOTAL MONO-CYCLICS	TOTAL ALKYL CYCLO-HEXANES	TOTAL ALL
FOOD	1	ND	ND	ND	ND	ND	ND	ND	0.47	0.47
	3	ND	ND	ND	ND	ND	ND	ND	0.76	0.76
	5	ND	ND	ND	ND	ND	ND	ND	2.06	2.06
WATER	2	3.09	9.50	2.15	0.93	4.44	1.94	22.05	158.26	180.31
	5	6.11	18.35	6.35	1.81	9.71	6.64	48.97	157.33	206.30
FOOD & WATER	1	5.61	17.01	3.95	1.16	7.76	5.50	40.99	76.85	117.84
	2	4.11	13.21	3.38	0.83	4.84	1.68	28.05	96.64	124.69
	5	6.54	14.28	5.45	1.30	8.85	6.13	42.55	238.42	280.97

ND = Not detectable

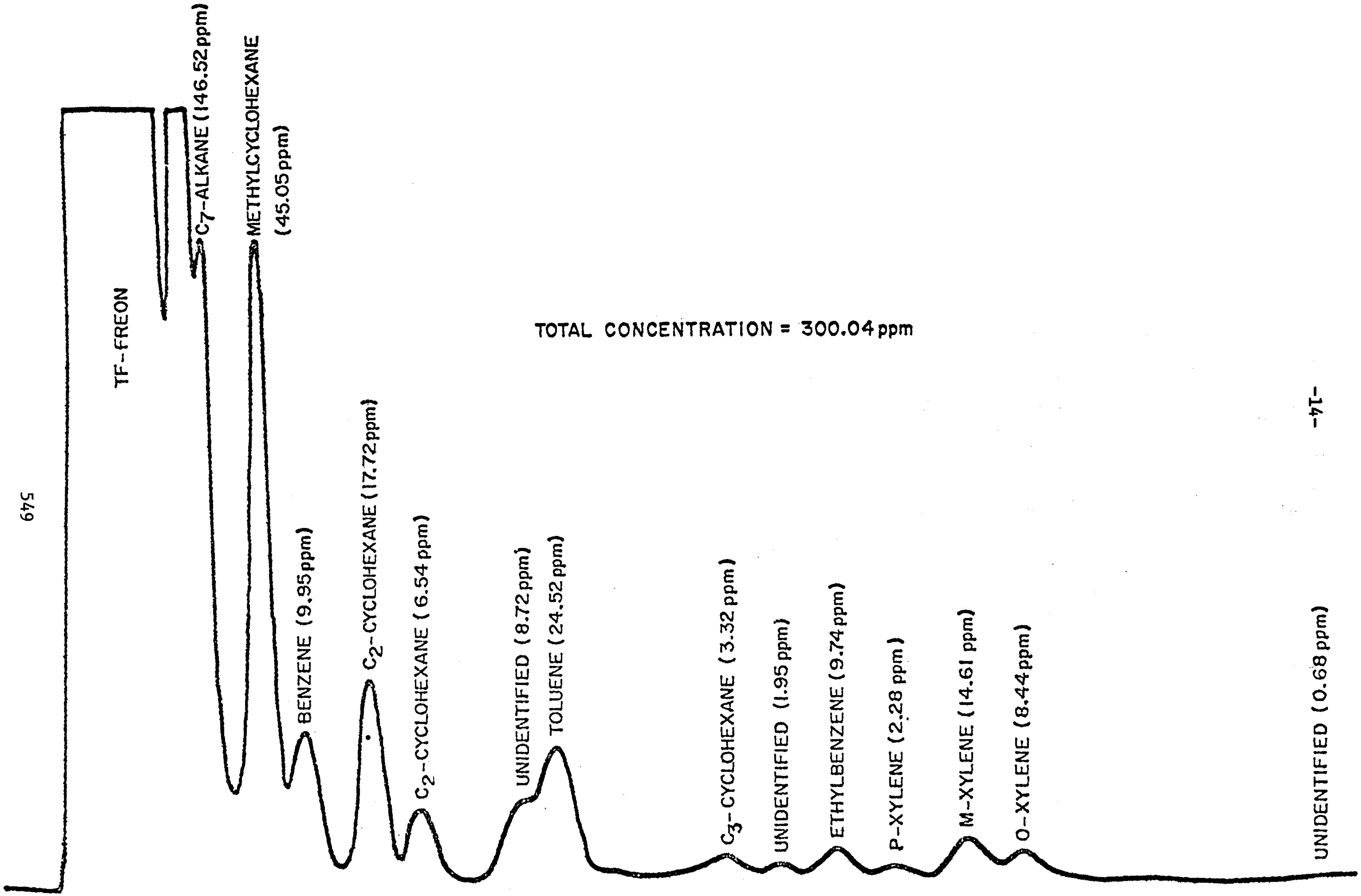

Figure 4. Chromatogram of low-boiling hydrocarbons detected in the liver of a starry flounder exposed 5 weeks to 100 ppb water-soluble fraction (WSF) of crude oil in the water column.

B. Muscle

The maximum concentration of monocyclic aromatics and alkyl cyclohexanes in muscle tissue was 3.37 ppm after 5 weeks exposure or roughly 34 times the concentration of these components in the water column. Only 5 compounds were detected in this range and of these, only benzene and toluene were aromatics. The remainder (2.90 ppm) was composed of alkyl cyclohexanes; the accumulation factors for the alkyl cyclohexanes were at least 100 times the concentration in the water column (as the minimum detectable amount in the tanks was 10 ppb for each component).

Higher boiling aromatic hydrocarbons (C_3-benzenes - C_2-naphthalenes) reached concentrations of 2.54 ppm after 5 weeks exposure (127 times their combined concentrations in the exposure tanks). Concentrations of naphthalene, 2-methyl naphthalene, and 1-methyl naphthalene reached levels of 407, 374, and 258 ppb respectively. These concentrations represent accumulations that were 73, 288, and 215 times the concentrations of these components in the exposure tanks.

C. Gonads

In many cases, flounder sampled in this experiment were immature and individual gonads weighed much less than the 10 grams necessary to adequately assess hydrocarbon content. As a result, most gonad samples were pooled without regard to sex in order to make a large enough sample to analyze. In a number of instances, the pooled samples were much less than 10 grams (2-5 grams) and concentrations of hydrocarbons for these samples were almost certainly underestimated (the larger the sample, the greater chance of detectability of hydrocarbons concentrated in solvent extracts).

Maximum concentrations of monocyclic aromatics (benzene - C_2-benzenes) and alkyl cyclohexanes were 14.34 ppm after 5 weeks exposure (143 times the water-column concentration). Methyl cyclohexane concentrations reached 4.51 ppm, at least 450 times higher than the concentration in the water column; no other component in this group was biomagnified as much.

Higher boiling aromatics accumulated to maximum levels of 398 ppb in 5 weeks (20 times the water-column concentration). Concentrations of naphthalene, 2-methyl naphthalene, and 1-methyl naphthalene were 102, 94, and 40 ppb representing accumulations 18, 72, and 33 times the water concentration of these compounds.

D. Gall Bladder

Accumulations of 3.36 ppm of monocyclic aromatics (benzene through C_2-benzenes) and alkyl cyclohexanes were found in gall bladders of starry flounder after 5 weeks of exposure (about 34 times the water concentration). Methyl cyclohexane (1.48 ppm) was biomagnified at least 148 times.

Uptake of hydrocarbons from water and food:

A. Liver

No significant differences were found between concentrations of monocyclic aromatics after 1-week and 5-weeks exposure (Table 3). However, the concentration of alkyl cyclohexanes increased continually during the exposure period. Chromatograms of livers from this exposure group were virtually identical to those from the water-exposure group with regard to kinds and numbers of compounds and relative concentration of components (Figure 5).

Maximum accumulations of over 300 ppm of monocyclic aromatics (benzene through C_2-benzenes) and alkyl cyclohexanes were found in some cases. Accumulations of over 50 ppm of methyl cyclohexane were found, representing a biomagnification of at least 5000 times (assuming a negligible contribution from the contaminated food).

Higher boiling aromatics (C_3-benzenes through C_2-naphthalenes) reached maximum concentrations of 77.88 ppm after 5 weeks of exposure (3900 times the water concentration assuming negligible input from contaminated food--see preceding section on uptake from food).

Accumulations of naphthalene (9.49 ppm), 2-methyl naphthalene (5.39 ppm) and 1-methyl naphthalene (4.47 ppm) were 1694, 4147, and 3724 times the concentrations of these components in the water column.

B. Muscle

Monocyclic aromatics (benzene through C_2-benzenes) and alkyl cyclohexanes accumulated to maximum concentrations of 4.46 ppm after 5 weeks of exposure. Although as many as 14 compounds had been detected in this boiling range in liver samples, only as many as 6 were detected in muscle samples; the components most prevalent were methyl cyclohexane (1.80 ppm) and toluene (1.23 ppm).

Higher boiling aromatics (C_3-benzenes through C_2-naphthalenes) reached maximum concentrations of 3.29 ppm in muscle tissue after 5 weeks of exposure. This concentration was composed of 19 detectable compounds (29 compounds were separated in liver samples, although we are aware from GC-MS that some of the chromatogram peaks were composed of more than one isomer of the same compound). The concentration of higher boiling aromatics was 164 times higher than their concentration in the exposure tank.

Accumulations of naphthalene (465 ppb), 2-methyl naphthalene (426 ppb), and 1-methyl naphthalene (293 ppb) were 83, 328, and 244 times higher than the water column concentrations of these components.

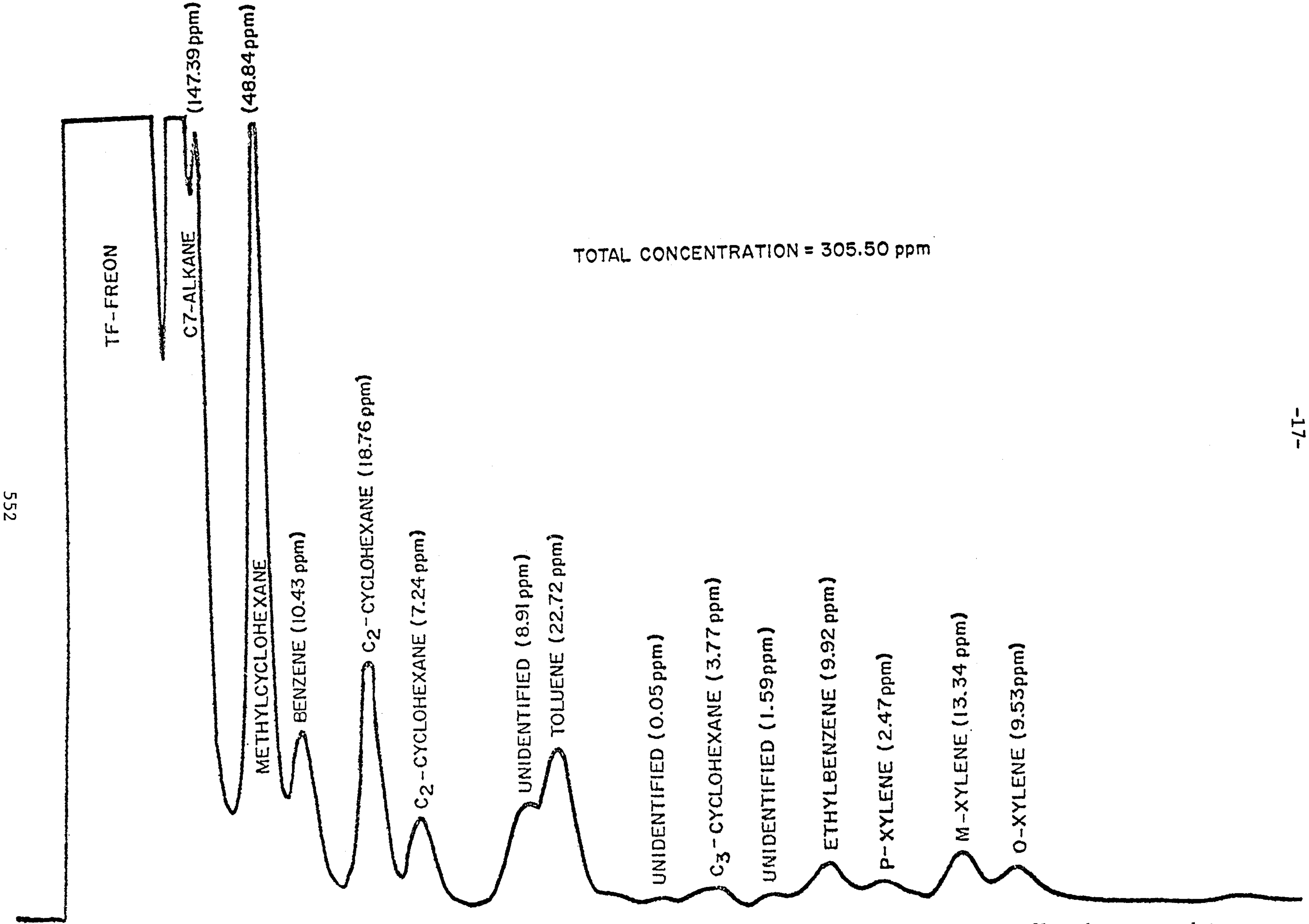

Figure 5. Chromatogram of low-boiling hydrocarbons detected in the liver of a starry flounder exposed to 100 ppb water-soluble fraction (WSF) of crude oil in the water column and fed WSF-contaminated clams for 5 weeks.

C. Gonads

A maximum concentration of 5.56 ppm of lower boiling aromatics (benzene through C_2-benzenes) and alkyl cyclohexanes was found in gonadal tissue of flounder exposed for 5 weeks to oil-contaminated food and water; as in the water exposure group, only 5 components were detected in gonads (benzene, toluene, and 3 alkyl cyclohexanes).

Higher boiling aromatics (C_3-benzenes through C_2-naphthalenes) accumulated to maximum concentrations of 0.971 after 5 weeks of exposure (49 times the water concentration). Concentrations of naphthalene (175 ppb), 2-methyl naphthalene (121 ppb), and 1-methyl naphthalene (67 ppb) were 31, 93, and 56 times higher in flounder gonad tissue than in the exposure tank water.

D. Gall Bladder

Lower boiling aromatic hydrocarbons (benzene through C_2-benzenes) and alkyl cyclohexanes were accumulated in gall bladders of flounder to levels of 6.35 ppm after 5 weeks of exposure. This concentration was composed of 6 detectable compounds (benzene, toluene, m-xylene, and 3 alkyl cyclohexanes). Methyl cyclohexane reached levels of 2.13 ppm in gall bladders, an accumulation at least 213 times higher than the water-column concentration.

Retention of petroleum hydrocarbons in flounder tissue:

Monocyclic-aromatic compounds were rapidly lost from flounder livers following cessation of exposure to WSF (Table 4). Within 48 hours, most of these six compounds had dropped to near or below detectable limits (less than 40 ppb). After 2 weeks, only alkyl cyclohexanes were detected in the low-boiling-point range, at concentrations far below maximum levels.

No monocyclic aromatics (benzene through C_2-benzenes) or alkyl cyclohexanes were detected in any tissues other than liver after 1 or 2 weeks of depuration.

Higher boiling aromatics were also rapidly lost from tissues following cessation of exposure. After 48 hours of depuration, maximum concentrations of these compounds in livers were 10.72 ppm (food and water exposure), 6.92 ppm (water exposure), and 0 ppm (food exposure). After one week of depuration these levels had dropped to 4.56 ppm (food and water exposure) and 0.19 ppm (water exposure). None of these components were detected after 2 weeks of depuration.

In muscle tissue, concentrations of higher boiling aromatics were 0.13 ppm (food and water exposure) and 0.04 ppm (water exposure) after 48 hours of depuration. No compounds were detected in muscle tissue after 1 or 2 weeks of depuration. No compounds were detected in gonad samples after any of the depuration periods.

Table 4. Mean concentrations of monocyclic aromatic and alkyl cyclohexane low-boiling-point hydrocarbons in livers of starry flounder exposed to the WSF of Cook Inlet crude oil for 5 weeks and then allowed to depurate.

		CONCENTRATION (PPM) - μg/g Wet Weight								
SOURCE OF EXPOSURE	LENGTH DEPURATION (Days)	BENZENE	TOLUENE	ETHYL-BENZENE	P-XYLENE	M-XYLENE	O-XYLENE	TOTAL MONO-CYCLICS	TOTAL ALKYL CYCLO-HEXANES	TOTAL ALL
FOOD	2	ND	ND	ND	ND	ND	ND	ND	2.46	2.46
	14	ND	ND	ND	ND	ND	ND	ND	0.50	0.50
WATER	2	ND	ND	0.17	ND	0.59	0.04	0.80	77.68	78.48
	7	ND	ND	ND	ND	0.04	0.05	0.09	11.98	12.07
	14	ND	ND	ND	ND	ND	ND	ND	5.19	5.19
FOOD & WATER	2	ND	ND	0.63	ND	0.82	ND	1.45	85.44	86.89
	7	ND	ND	ND	0.04	0.44	ND	0.48	20.06	20.54
	14	ND	ND	ND	ND	ND	0.04	0.04	9.69	9.73

ND = Not detectable

Growth rates of flounder in exposure and control groups:

Flounder grew well under all treatment conditions. No treatment group grew at rates significantly different from controls or other treatment groups. Test flounder remaining at the end of the exposure period had grown an average 4.6% (length) and were 19.5% heavier than at the start of the experiment.

Effects:

There were no obvious effects on exposed flounder. No mortality occurred nor was the behavior of exposed flounders significantly different from that of controls. At the low exposure level (100 ppb) no obvious effects were expected. However, more subtle sub-lethal effects were not measured and may have occurred as observed in the study of pre-spawning flounder discussed below.

Comparative uptake and retention of the water-soluble fraction (WSF) of Cook Inlet crude oil by the common littleneck clam (*Protothaca staminea*) and the Japanese littleneck clam (*Tapes semidecussata*).

All whole clam pooled tissue samples (120) and water samples have been analyzed for monocyclic and dicyclic aromatic and cyclohexane components. Computer analysis is in progress. The following is a preliminary summary of the major results.

Uptake of hydrocarbons from the water:

The mean water concentration of low-boiling-point components in the WSF in exposed tanks was 0.1512 mg/L (Table 5). The concentration of components from the solubilizer bottle averaged 1.43 mg/L (ppm).

The mean uptake of low-boiling point hydrocarbons in clam tissues is summarized in Table 5; a chromatogram of these compounds is shown in Fig. 6. There was considerable sample variation in data; as much as 7.0 μg/g between pooled clam sample replicates. Further analyses will be made to determine statistical validity of species and time differences. Data indicate a rapid uptake of aromatic hydrocarbons in both species, peaking after 12 days of exposure. There appeared to be a slight decline in total tissue concentrations in both species from 12 to 14 days. The mean total accumulation for both species ranged from 18 to 55 times the water concentration (Table 5). The maximum total concentrations and accumulations in any sample were 20.789 μg/g (137 X) in *P. staminea* and 13.881 μg/g (92 X) in *T. semidecussata*.

The two species of clams had similar uptake levels for monocyclic aromatics (Table 5), but *P. staminea* had a higher uptake of cyclohexanes and *T. semidecussata* a higher level of dicyclics at 12 days. There appeared to be species differences, *P. staminea* having a generally higher total accumulation than *T. semidecussata* of low-boiling-point components from the WSF (Table 5). After completion of computer analysis, we expect that

Table 5. Summary of mean concentrations of monocyclic and dicyclic aromatic and cyclohexane components in whole tissue samples of littleneck clams exposed to the WSF of Cook Inlet crude oil.

		CONCENTRATIONS (PPM) - µg/g Wet Weight				
LENGTH OF EXPOSURE (Days)	SPECIES	MONOCYCLIC AROMATICS	ALKYL CYCLOHEXANES	DICYCLIC AROMATICS	TOTAL	TOTAL ACCUMULATION[1]
7	*Protothaca staminea*	2.048	3.096	0.611	5.755	38 X
	Tapes semidecussata	NM	NM	NM	NM	-
12	*Protothaca staminea*	3.067	4.766	0.456	8.289	55 X
	Tapes semidecussata	3.200	1.662	1.109	5.971	39 X
14	*Protothaca staminea*	2.220	1.516	0.976	4.712	31 X
	Tapes semidecussata	0.852	1.213	0.692	2.757	18 X
	Mean Water Concentration	0.1480	Not detectable	0.0032	0.1512	
LENGTH OF DEPURATION (Days)	*Protothaca staminea* (No data)	NM	NM	NM	NM	-
7	*Tapes semidecussata*	Not detectable	0.209 (Cis 1,3 dimethyl cyclohexane)	Not detectable	0.209	-

NM = Not measured

[1]Total Accumulation = Total tissue concentration (µg/g)/Total water concentration (mg/L).

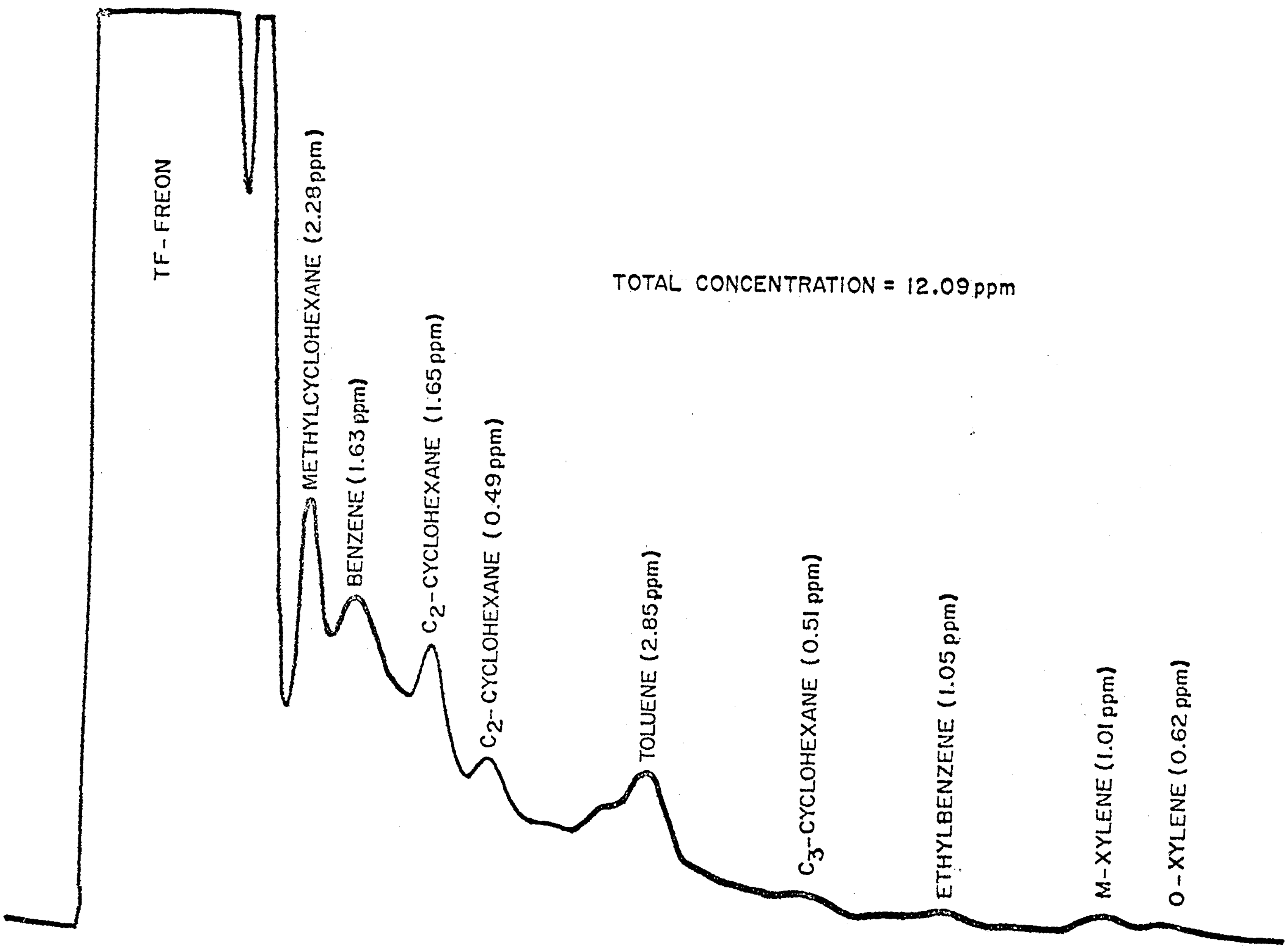

Figure 6. Chromatogram of low-boiling hydrocarbons in a sample of littleneck clams exposed for 1-2 weeks to 150 ppb water-soluble fraction (WSF) of crude oils.

T. semidecussata will have the highest accumulation of C_2 and C_5-benzenes and dicyclics, whereas P. staminea will have the highest monocyclic (benzene, toluene and the xylenes) and cyclohexane concentrations.

Depuration of all components to undetectable levels took approximately 5 days or less in T. semidecussata, except for Cis 1, 3 dimethyl cyclohexane which was still present after 7 days of depuration. Insufficient samples of P. staminea were available for depuration measurements.

Effects:

No mortality occurred in the experiments. There was no significant difference between weights of exposed and control clams. Observations were made of gaping and siphonal activity, but no significant differences between exposed and control clams were observed. Other potentially sub-lethal effects were not measured and may have occurred.

Effects of chronic concentrations of the water-soluble fraction (WSF) of Cook Inlet crude oil on pre-spawning starry flounder.

Starry flounder in pre-spawning condition were exposed to the WSF of Cook Inlet crude oil in three experiments. Samples have been analyzed and most data summarized for publication (Whipple et al, in press). The following gives a presentation of general results; further details are available in the publication.

Uptake of hydrocarbons from the water:

Mean concentrations of petroleum hydrocarbons (WSF) ranged from 115 to 221 µg/L (ppb) in the three experiments. Only monocyclic aromatic hydrocarbons were detectable in test tanks, although traces of alkyl cyclohexanes were seen in some samples.

Tissue concentrations and accumulations of components in ovaries, testes, livers and gall bladders were measured. Means and ranges of monocyclics, alkyl cyclohexanes and dicyclic components are summarized in Table 6.

Ovaries. Immature ovaries accumulated relatively low concentrations of monocyclics and alkyl cyclohexanes (mean total = 0.890 µg/g; Table 6). Mature ovaries, however, accumulated considerable concentrations of all components measured (mean total = 8.585 µg/g monocyclics and cyclohexanes; 12.976 µg/g all monocyclics, alkyl cyclohexanes and dicyclics; Table 6). Uptake of components was rapid, near maximum concentrations occurring after 24 hours of exposure (Figure 7). The maximum accumulation of components in any ovary was 14.618 µg/g.

From Figure 7, it is clear that the proportions of the components remained relatively constant throughout the experiment. The mean proportions in maturing ovaries (Table 6) were as follows: Monocyclics-1 (M-1) = 37%;

Table 6. Summary of mean concentrations of monocyclic and dicyclic aromatic and cyclohexane components in gonads of immature and maturing starry flounder exposed to the WSF of Cook Inlet crude oil during gonadal maturation. Experiment 2. No immature males in samples. Percentages of total concentrations in parentheses.
Total Accumulation = Total Mean Tissue Concentration (µg/g)/Mean Water Concentration (0.115 mg/L).

Treat-ment	Sex	Matu-rity	Tissue	No.	Mean M-1	Mean CH	Mean M-2	Mean D	Total Mean M-1+CH	Total Mean All*	Total Accumulation M-1+CH	Total Accumulation All *
					CONCENTRATIONS (PPM) - µg/g Wet Weight							
Exposed	M	Mature (Ripe)	Testis	5	ND	ND	-	-	ND	-	ND	-
			Liver	4	5.891 (70)	2.559 (30)	-	-	8.450	-	73.5X	-
	F	Im-mature	Ovary	2	0.181 (20)	0.709 (80)	-	-	0.890	-	7.7X	-
			Liver	2	1.346 (100)	ND (0)	-	-	1.346	-	11.7X	-
	F	Mature	Ovary	6	4.801 (37)	3.784 (29)	2.228 (17)	2.163 (17)	(8.585)	12.976	74.6X	112.8X
			Liver	5	9.708 (63)	5.827 (37)	-	-	15.535	-	135.1X	-
Control	F	Im-mature	Ovary	1	ND	ND	-	-	ND	-	0	0
			Liver	1	ND	ND	-	-	ND	-	0	0
	F	Mature	Ovary	2	ND	ND	-	-	ND	-	0	0
			Liver	2	ND	ND	-	-	ND	-	0	0

M-1 = Monocyclics-1 = Benzene, toluene, ethylbenzene, p-xylene, o-xylene, m-xylene.
CH = Cyclohexanes = Methyl cyclohexane, Cis 1, 3 dimethyl cyclohexane, 1, 2 dimethyl cyclohexane, C_3 cyclohexane and 3 unidentified compounds, also probably cyclohexanes.
M-2 = Monocyclics-2 = Isopropyl benzene, n-propyl benzene, total C_3 benzenes, total C_4 benzenes and total C_5 benzenes.
D = Dicyclics = Naphthalene, 2-methyl naphthalene, 1-methyl naphthalene, total C_2-naphthalenes.
*Monocyclics-2 (M-2) and dicyclics (D) measured only in mature ovaries.
ND = Not detectable.

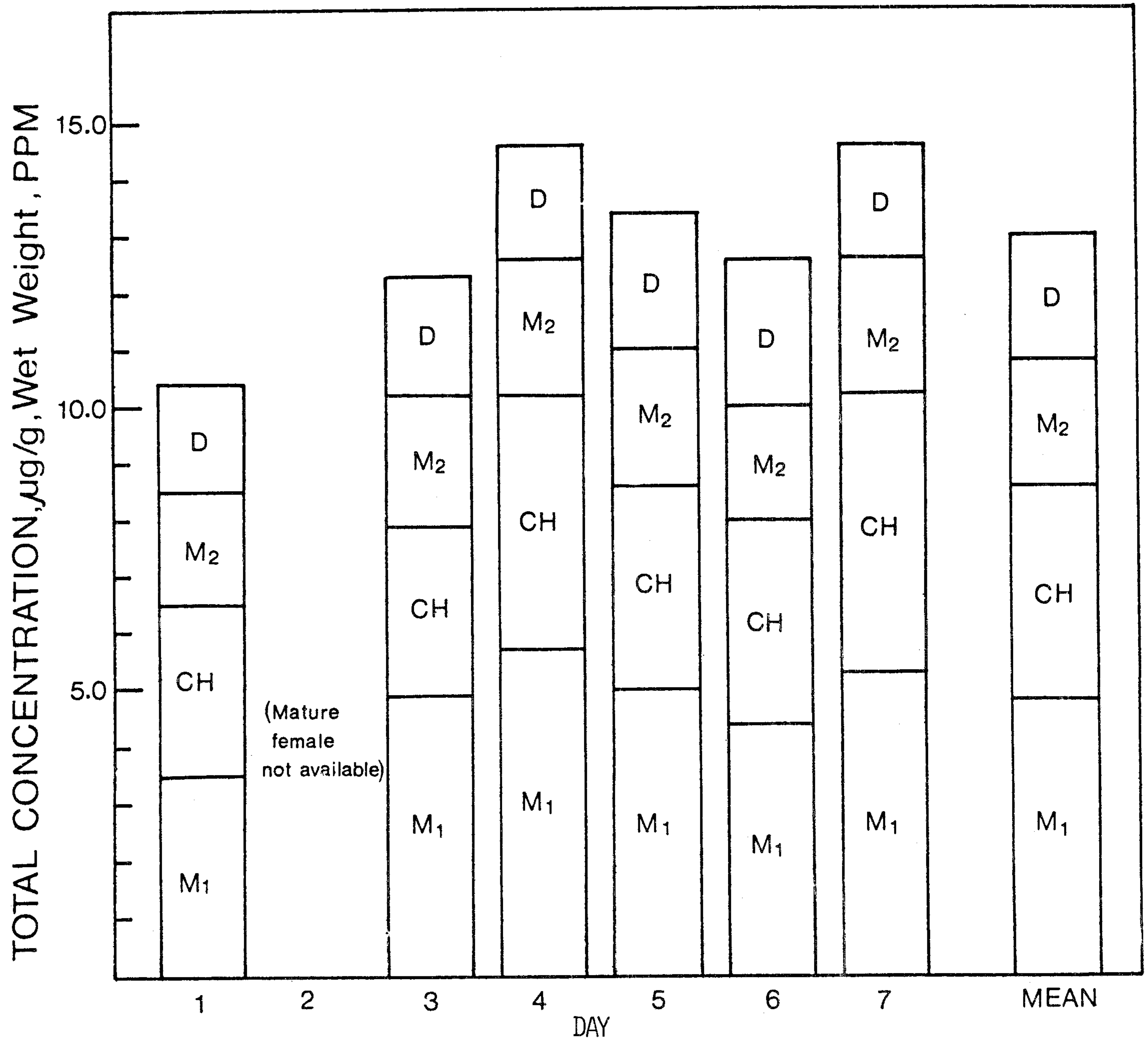

Figure 7. Concentrations of aromatics and alkyl cyclohexanes in maturing ovaries of stary flounder. M1 = Monocyclics 1; CH = Cyclohexanes; M2 = Monocyclics 2; D = Dicyclics.

alkyl cyclohexanes (CH) = 29%; monocyclics-2 (M-2) = 17% and dicyclics (D) = 17%. The accumulation of alkyl cyclohexane components was of some interest, since these components have not previously been identified as biologically active components of crude oil and yet appear in relatively high concentrations in both ovarian and liver tissues. A gas chromatogram of the freon extract of adult starry flounder ovary exposed for approximately 7 days is shown in Figure 8; individual monocyclic and alkyl cyclohexane components are labeled.

The maximum accumulations over water column concentrations are summarized in Table 6. The maximum accumulation was determined by dividing the tissue concentration by the water concentration. Maximum accumulation of all monocyclics, alkyl cyclohexanes, and dicyclics in mature ovaries was approximately 80 to 200 X (mean = 112.8 X) and of monocyclics (M-1 only) and alkyl cyclohexanes was approximately 50 to 160 X (mean = 74.6 X) the water concentration. In immature ovaries, the maximum accumulation of monocyclics (M-1 only) and alkyl cyclohexanes was approximately 3 to 10 X (mean = 7.7 X) the water concentration.

Testes. There were no immature males in the samples. Testes of mature males accumulated no detectable levels of components after 1 week of exposure (Table 6). However, after 3 weeks of exposure 0.313 to 1.361 μg/g of toluene accumulated in the testes. No other component was detectable. Uptake in the testes was low and much slower than in ovaries. The maximum accumulation of toluene after 3 weeks of exposure was approximately 3 X to 6 X the water concentration.

Livers. The concentrations of monocyclics (M-1 only) and cyclohexanes were determined after 1 week of exposure for livers of both males and females (Table 6). Mean concentrations of these components were 8.450 μg/g in mature males, 15.535 μg/g in mature females, and only 1.346 μg/g in immature females. Data over the 1-week test period indicate an increasing concentration with time, thus uptake does not reach a maximum level rapidly as in the case of the gonads. After 1 week of exposure mean maximum accumulations in mature adults were approximately 70 X (males) and 135 X (females) the water concentration. After 3 weeks of exposure, maximum monocyclic accumulations were approximately 200 X to 400 X (immature females) and 225 X to 290 X (mature males) the water concentration. Maximum accumulation of alkyl cyclohexanes was approximately 2600 to 8750 X the water concentration.

Gall Bladders. The weight of tissue available for component analysis in gall bladders containing bile was insufficient in most cases, but analysis of some gall bladders showed that the concentration was approximately the same in males and females and did not significantly increase throughout a 7-day exposure period (0.280-0.469 μg/g). Only toluene was present, no other monocyclics or cyclohexanes were detected. The maxim accumulation in gall bladders was approximately 2 to 4 X the water concentration of toluene.

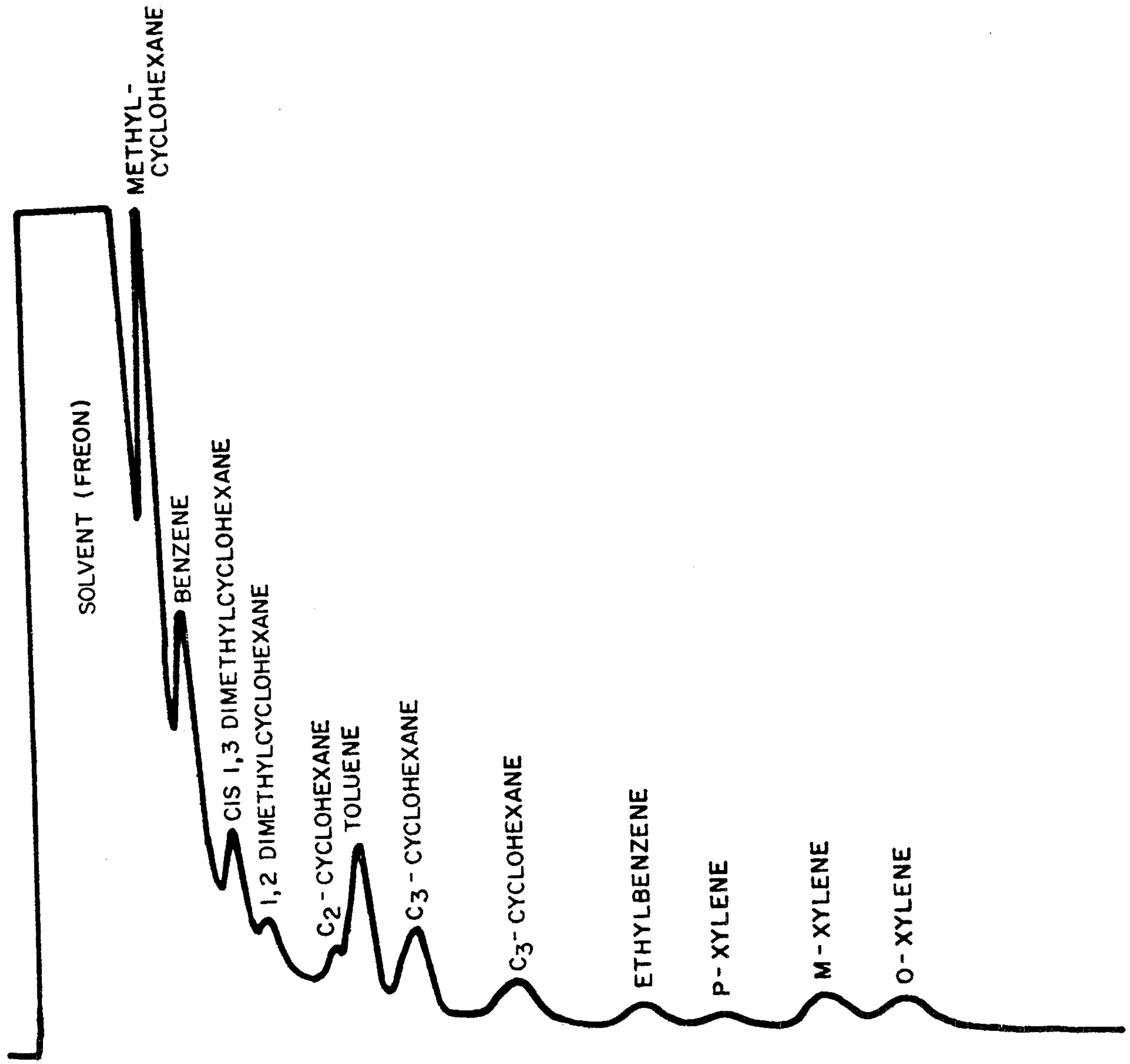

Figure 8. Chromatogram of low-boiling-point hydrocarbons detected in a maturing ovary of a starry flounder exposed to 115 ppb water-soluble fraction (WSF) of crude oil in the water column for 7 days. Total concentration = 8.43 μg/g (ppm).

All Tissues. Among the six monocyclics (M-1), the relative accumulation of toluene was the highest, generally followed by m-xylene, benzene, o-xylene, ethylbenzene and p-xylene, respectively. Of the alkyl cyclohexanes (CH), methyl cyclohexane reached highest concentrations, followed by cis 1, 3 dimethyl cyclohexane, and 1, 2 dimethyl cyclohexane. Among the more substituted monocyclics (M-2) the highest concentrations were of the C_3-benzenes, followed by C_4-benzenes and propylbenzenes, respectively. And finally, among the dicyclics (D), naphthalene was highest in concentration followed by 2-methyl naphthalene and 1-methyl naphthalene, respectively. These general proportions were approximately the same in liver tissues of both sexes. In mature ovaries, however, the relative abundance of monocyclics was slightly different than in livers, the concentration of benzene being higher than m-xylene.

Effects:

Mortality - Adults:

No mortality occurred at the low exposure concentrations, as expected. In other experiments with flounder, exposed with similar apparatus, mortality was observed at concentrations as low as 1.0 mg/L (ppm) (Yocom et al., manuscript in preparation).

Behavior:

Several behaviors were observed and measured. Usually, individual variation obscured significant treatment differences. In all experiments, however, there was an initial elevation of ventilation rate in exposed fish over that in controls for periods of 2 to 4 days. Eventually, exposed fish appeared to homeostatically adjust and the ventilation rates of exposed and controls were similar. In one experiment the mean ventilation rate of exposed after the first week was 45.1 beats/min and of controls was 35.7 beats/min. Irregular ventilation rates were also observed in exposed and not in control fish. In two of the experiments a consistently lower oxygen concentration was measured in exposed tanks, also indicating higher oxygen consumption in exposed fish.

Autopsies:

Liver. Some exposed fish showed gross effects in the appearance of the liver. After a few days of exposure, livers appeared to have hemorrhagic areas and were mottled.

Ovaries. Exposed fish showed some effects in the appearance of the ovary. Exposed ovaries were paler yellow than controls of equivalent maturation stage. These ovaries also contained some opaque white eggs, visible on the surface, appearing to be necrotic foci with several dead eggs when examined microscopically. The capillary network over the ovarian membrane of exposed fish contained blood, but the network appeared paler red than in controls. Microscopic examination indicated hemolysis of red blood cells had occurred, lending to the overall paler appearance of exposed ovaries. There were dead eggs seen in most of the maturing ovaries (Table 7). Dead eggs were not obvious in immature ovaries. Because the differences between control and exposed fish were subtle, further comparison was made histologically (see below).

Testes. No obvious differences were noted in the appearance of the testes. No difference in spermatozoan motility between control and exposed males was observed.

Histological Effects on Eggs: (Photomicrographs of effects are in Whipple et al, 1978, in press).

Abnormalities and Mortality. Summaries of the results of histological examination of female ovaries in one experiment are given in Table 7, together with lengths and wet weights of females and their ovaries and gonadosomatic indices (GSI). Other effects are summarized in Table 8.

Abnormal and dead eggs were first observed in immature and maturing ovaries of exposed females by day 2 of exposure. These abnormal and dead eggs were observed throughout the remainder of the experiment. Ovaries of fish examined 1 week after the cessation of exposure and depuration exhibited even more pronounced delayed effects, indicating that effects are not reversible. The mean percentages of abnormal eggs in exposed were 0.5% in immature and 13.0% in mature females. The mean percentages of dead eggs were 0.2% in immature and 15.0% in mature females (Table 7).

The commonest abnormality observed in both immature and mature eggs was the occurrence of clear vacuoles extruding through the cytoplasm of the egg, usually near the periphery. The vacuoles were colorless with Oil Red O staining, indicating that they are not lipid deposits. These vacuoles were never observed in control eggs. Dead eggs in immature ovaries occurred in necrotic foci, and appeared to be atresic. By the end of the exposure period, and particularly after the subsequent depuration period, reduced numbers of eggs appeared to occur in exposed immature ovaries compared to controls, possibly indicating resorption. Dead maturing eggs also occurred in necrotic foci. The eggs were disintegrating and appeared to have thicker cell membranes (zona radiata) than the intact controls.

Acceleration of Maturation:

Females. Another apparent effect is the acceleration of egg maturation in exposed flounder over that in controls (Table 7). The stages of Yamamoto (1956; 1-11) were used to assess maturation so that differences between controls and exposed attributable to different maturation stages would not be confused with the effects of exposure.

Table 7 summarizes the means of several parameters showing acceleration of maturation in ovaries of exposed flounder for one experiment. Ovaries of exposed maturing females not only had a higher frequency of more

Table 7. Means of ovarian and egg parameters showing acceleration of maturation in ovaries of exposed flounder. Mature females equally represented in control and exposed samples. Experiment 2.

			Ovaries			Eggs — Predominant Maturation Stage				Percentage	
Treatment	No. Fem. (n)	Maturity	Length (cm)	Wet Wt. (g)	GSI[1]	Stage No.	Ovaries (n)	Description	Max. Diam. (μ)	Abnormal (%)	Dead (%)
Control	3	Immature	5.1	2.5	0.30	3	3	Perinucleolus	110	0	0
Exposed	2	Immature	7.0	4.1	0.48	3	2	Perinucleolus	110	0.5	0.2
Control	8	Maturing	17.2	72.3	5.64	6	8	Secondary Yolk only	497 (410-460)	0	0
Exposed	9	Maturing	17.0	82.2	6.59	6.6 (6-8)	5	Secondary Yolk	570 (410-670)	13.0	15.0
							3	Tertiary Yolk			
							1	Migratory Nucleus			

[1] GSI = Gonadosomatic Index = Ovary Wet Weight X 100/Body Wet Weight.

Table 8. Summary of effects observed in immature and mature starry flounder exposed to approximately 100 ppb of the WSF of Cook Inlet crude oil for 7 days. Effects marked with asterisk also observed in flounder after 7 days of depuration. A (+) indicates an elevation of effect above controls; a (-) indicates a reduction of effect below controls. Other effects not observed in controls.

	Behavior-Adult		Liver		Gonads				
Stage-Sex	Activity	VR	Total Accum.[1]	Tissue Effects	Total Accum.[1]	Water Uptake	GSI	Gonad-Gametes Effects	Gametogenesis
Mature Male	+	+	73X	+Vacuolization* +Lipid deposition* +Disruption of hepatic muralia +Sinusoidal congestion	ND	+	+	None Obvious	+Spermiation
Immature Female	+	+	12X	As above	8X	+	+	Pale color Erythrocyte Destruction Vacuolization (0.5-13.2%)* +Nuclear disintegration* +Atresia or egg death (0.2-5.5%)*	-Oocytes-atresia*
Maturing Female	+	+	135X	As above	75X	+	+	Vacuolization (3-13%) +Thicker zona radiata Egg death (5.8-15.0%)	+Egg size +Maturation rate +Vitellinogenesis
Adult Female-Resting stage (Yocom et al., manuscript)	NM	NM	588X	NM	7X (Toluene only)	NM	NM	---------------	---------------

[1]Total Accumulation = Mean Tissue Concentration of Monocyclics (M-1) and Cyclohexanes (CH)/Mean Water Concentration of M-1 and CH.

ND = Not detectable; NM = Not measured; GSI = Gonadosomatic Index.

advanced maturation stages, but also that the mean maximum egg diameter was greater. These observations correlate with the higher GSI in exposed (6.59) than in control (5.64) females. Since the GSI is based on the ratio of ovary weight to body weight and because relatively small females contained advanced maturation stages, the indication is that acceleration in maturation was due to exposure and not a function of the size of the female.

Males. Histological sections of testes were not made. However, the GSI of males also indicated an acceleration of maturation due to exposure. Males exposed for 3 weeks had a higher mean GSI (0.387; n=5) than did controls (0.140; n=7). Further, 80% of the exposed males were ripe-running, while only 29% of the controls were ripe-running.

Histological Examination of Livers: (Photomicrographs in Whipple et al, in press).

Examination of liver tissue showed that, after 5 to 7 days exposure to 115 ppb WSF, livers were highly vacuolated and the hepatic muralia were disorganized in both male and female flounders. Cytoplasmic vacuolization increased with exposure time. Similar effects were also seen in livers of flounder allowed to depurate for 1 week after the 1-week exposure period, indicating the effects may not be reversible. In fact, the degree of vacuolization was even greater. These changes were not seen in livers of control flounder.

Effects of chronic concentrations of the water-soluble fraction (WSF) of Cook Inlet crude oil in the water column on spawning stages of littleneck clams.

Although several experiments were conducted with Japanese and common littleneck clams, this report includes only results from the exposure of pre-spawning common littleneck clams (*Protothaca staminea*). Common littleneck clams were exposed for 4 days perior to spawning. Female clams were not fully mature, but male clams were ripe with motile spermatozoa.

Uptake of hydrocarbons from water:

Concentrations of aromatic components in the water column averaged 0.093 ppm (mg/L) monocyclics and 0.0215 ppm (mg/L) dicyclics. After 4 days of exposure, the average concentration of monocyclic aromatics in whole clam tissue was 1.20 ppm (μg/g wet weight), and ranged from 0.36 to 2.51 ppm (Table 9). Highest accumulations occurred in female clams. Generally, the riper the eggs in the female, the higher the accumulation of monocyclics. The ripest female had tissue concentrations of monoaromatics that were 28 times higher than those in the water column (Table 9).

Other components were also measured in this experiment (Table 10) including higher-boiling-point monocyclics, dicyclic and polycyclic aromatics, alkyl cyclohexanes, and some alkanes. Data are not completely analyzed, but the summary shows that the lower-boiling-point components tend to be higher in females than in males and that the higher-boiling-point components may not differ significantly between sexes. There was bioaccumulation of all

Table 9. Concentrations of monocyclic-aromatic hydrocarbons in whole clam tissue samples (1-2 clams per sample) of common littleneck clams (Protothaca staminea) exposed to 93 ppb monocyclic aromatics in the water-soluble fraction of Cook Inlet crude oil prior to spawning.

SAMPLE	DAYS EXPOSED	N	CONCENTRATION (PPM) µg/g-wet weight						ACCUMULATION*
			BENZENE	TOLUENE	ETHYL-BENZENE	P-XYLENE & M-XYLENE	O-XYLENE	TOTAL	
Control male	1	2	ND	ND	ND	ND	ND	ND	-
Exposed female		2	0.414	0.749	ND	0.093	0.039	1.295	13.6
Exposed female		1	0.306	0.443	ND	ND	ND	0.749	7.1
Control female	2	2	ND	ND	ND	ND	ND	ND	-
Exposed female		2	0.639	ND	ND	0.073	ND	0.712	7.4
Exposed male		2	0.498	ND	ND	ND	ND	0.498	5.2
Exposed female	3	1	0.447	0.879	0.011	0.004	0.044	1.385	15.2
Control male	4	2	ND	ND	ND	ND	ND	ND	-
Exposed female		1	0.705	1.418	0.387	ND	ND	2.510	27.9
Exposed male		2	ND	0.661	0.042	0.011	ND	0.714	7.9
Exposed male		1	ND	0.363	ND	ND	ND	0.363	4.0

* ACCUMULATION = Tissue concentration/water-column concentration

N = No. clams in sample (pooled 2)
ND = Not detectable

Table 10. Summary of total concentrations of some water-soluble components in whole clam tissue samples (pooled) of common littleneck clams (*P. staminea*) exposed to the WSF of Cook Inlet crude oil (0.093 mg/L monocyclic and 0.0215 mg/L dicyclic aromatic hydrocarbons; other components undetectable). Eggs in females not fully mature

Sample	Days	Concentration (ppm); µg/g wet weight							
		M-1	CH	M-2	D	P	Alkanes (n-C_{10}-C_{18})	Total* Conc.	Total ** Accum.
Control Female	1	ND	ND	0.0209	ND	ND	0.0180	0.0389	None
Exposed Female		1.295	1.383	0.5634	0.5652	0.0187	0.0535	3.8788	34 X
Exposed Male		0.653	NM	0.1101	0.1577	0.0253	0.0197	(0.9658+)	(8 X +)
Exposed Female	2	0.712	0.505	0.3661	0.3705	0.0116	0.0129	1.9718	17 X
Exposed Male		0.498	1.472	0.4838	0.7443	0.0358	0.0776	3.3115	29 X
Exposed Female	3	1.385	2.421	0.7969	0.8494	0.0434	0.0489	5.5446	48 X
Exposed Male		0.714	0.664	0.3914	0.5915	0.0328	0.0464	2.4401	21 X
Exposed Female	4	2.510	4.757	0.4262	0.5955	0.0399	0.0300	8.3586	73 X

* Concentrations not corrected for % extraction efficiencies, therefore totals are minimum values.
M-1 = Monocyclics-1 = benzene; toluene; ethylbenzene; xylene isomers.
CH = Alkyl Cyclohexanes = methyl cyclohexane; Cis 1, 3-Dimethyl cyclohexane; 1,2-Dimethyl cyclohexane; other C_3 cyclohexanes.
M-2 = Isopropylbenzene; n-Propylbenzene; 1, 2, 3, 4-Tetramethylbenzene; other C_3-benzenes.
D = Didydlics - Naphthalene, 2-Methylnaphthalene, 1-Methylnaphthalene, 2, 6-Dimethylnaphthalene, 2, 3, 5-Trimethylnaphthalene.
P = Polycyclics = Fluorene, Phenanthrene, Anthracene and 1-Methylphenanthrene.
Alkanes = n-C_{10} through n-C_{18} only.
**Total Accumulation = Total tissue concentration/total water concentration.
ND = Not detectable.
NM = Not measured.

components; the maximum total accumulation in females was 73 times the water concentration, and in males 29 times the water concentration. Other alkanes above n-C_{18} were measured and although some contamination was present, concentrations were at levels considerably above the control clams.

Effects on adults and gonads:

No mortality occurred in adult clams, although adults were observed to have weakened adductor muscles following exposure. No mortality of eggs or spermatozoa was observed in clams autopsied during the exposure period. After 1 week of depuration, however, dead eggs and spermatozoa were found in the gonads of exposed clams only; there appears to be a delayed effect of WSF exposure on clam gametes. Since eggs were not fully mature, no spawning was induced and artificial fertilization was impossible. Additional experiments with riper adults were performed, but not successfully. Artificial fertilization was achieved, but due to difficulties in fertilizing this species artificially, insufficient larvae were available to complete the experiments.

Preliminary analyses of results from similar experiments with Japanese littleneck clams indicate that the common littleneck is more sensitive to petroleum hydrocarbons.

Histology of exposed and control clams from these experiments has not been completed.

INTERPRETATION OF RESULTS

Uptake, retention, and effects of low levels of the water-soluble fraction (WSF) of Cook Inlet crude oil to starry flounder exposed through food and through the water column.

Long-term exposure to low concentrations of water-soluble petroleum hydrocarbons caused no measured alteration in growth or behavior of starry flounder. However, high concentrations of hydrocarbons accumulated in tissues of flounder exposed to these compounds in the water.

Flounder accumulate low-boiling-point compounds much more rapidly through the water column than they do through molluscan food items. Monocyclic aromatic hydrocarbons are either metabolized into other compounds during digestive uptake or are not accumulated through that pathway. Alkyl cyclohexanes, however, accumulated from food to ppm concentrations.

Concentrations of monocyclic aromatics in flounder liver were maximum within a week, yet concentrations of alkyl cyclohexanes increased throughout the exposure period. The alkyl cyclohexanes were below detectable levels in the water column and in control tissue samples. It was unclear whether flounder had accumulated maximum concentrations of petroleum hydrocarbons (and metabolites) after 5 weeks of exposure. Further data analyses of tissues for monocyclic and dicyclic compounds must be made before further conclusions can be drawn.

From the results of spawning experiments, we assume that substantial tissue damage was caused by long-term exposure to petroleum hydrocarbons. Although depuration of hydrocarbons was rapid, we have no evidence to indicate that the tissue damage caused was reversible.

Alkyl cyclohexanes appear to be an important group of components in the water-soluble fraction of Alaskan crude oils. These compounds accumulated in tissues to high ppm concentrations from water concentrations that were undetectable and were the only compounds that accumulated in tissues through the food pathway. They were also the only compounds detected in tissues after 2 weeks of depuration. Future studies should include these compounds in analyses as their potential biological importance appears to be great.

Comparative uptake and retention of the water-soluble fraction (WSF) of Cook Inlet crude oil by the common littleneck clam (*Protothaca staminea*) and the Japanese littleneck clam (*Tapes semidecussata*).

As with adult flounder, exposures to low concentrations of water-soluble petroleum hydrocarbons did not obviously affect growth or behavior of littleneck clams although sublethal effects are possible. Components were accumulated above water concentrations. Comparison of clams to flounder tissues is difficult since whole homogenized tissues of clams were measured rather than individual organs.

Concentrations of petroleum hydrocarbons in both species did not reach maximum levels in two-week exposures. At low concentrations of WSF, it is probable that long-term exposures are necessary to reach maximum tissue accumulation; in littleneck clams, maximum tissue concentrations may be independent of water concentration.

Alkyl cyclohexanes were also accumulated to relatively high levels by clams, and were retained longer during depuration. These components may be important compounds in both fish and invertebrates.

For identical exposures, *P. staminea* accumulated aromatic hydrocarbons to concentrations about 3 times that found in *T. semidecussata*. Sublethal effects resulting from this differential uptake could have consequences to population structure and distribution of these clam species, since the species occupy similar habitats and are often sympatric.

Effects of chronic concentrations of the water-soluble fraction (WSF) of Cook Inlet crude oil in the water column on pre-spawning starry flounder.

Starry flounder exposed to approximately 100 ppb of the WSF of Cook Inlet crude oil exhibited several effects, including elevated activity and ventilation (respiration), erythrocyte destruction, abnormalities and necrosis in liver tissue and eggs, and acceleration of maturation in both males and females.

The results of these experiments indicate strongly that low levels of the WSF of crude oil, approximating chronic exposures, can result in deleterious effects that reduce the fecundity of flounder. The total reduction in survival through spawning, hatching and larval stages cannot be assessed, but results indicate a probable reduction in viable gonadal eggs of approximately 15-30%, assuming abnormal eggs will not survive. In herring, the reduction in survival through larval yolk absorption was estimated as 50% (Struhsaker 1977). These effects occur at concentrations two orders of magnitude less than the acute 96-hr TLMs. Further, if exposure to oil stimulates gametogenesis and spawning, spawning fish may be induced to release eggs in areas of high petroleum concentrations (e.g. oil spill), thus exposing relatively sensitive stages to the effects of the oil.

DISCUSSION

Flounder were exposed to WSF components in the water column and food. In the field, exposure also could occur from sediments. The exposure concentrations in these experiments (approx. 100-200 ppb) are probably higher than in the field. Measurements of aromatics in water are scarce, but available field data show that chronic concentrations of total aromatics in water may reach levels of 1-30 ppb offshore (Clarke et al. 1977b; Hiltabrand 1978). Concentrations are probably higher in polluted estuaries. In addition, exposures to 5 weeks are shorter than flounder would experience in a chronic field situation. Sediment concentrations of aromatic hydrocarbons (Clark et al. 1977b) are much higher, reaching levels of approximately 1,000-60,000 ppb (wet wt.). Flounder would also be exposed to aromatics in sediments in chronically polluted areas. Field measurements of alkyl cyclohexanes in water or sediments are not available.

Flounder could also be exposed to WSF components of petroleum through contaminated food in the field. These experiments showed that when nonspawning adults were fed contaminated littleneck clams (8.0 μg/g M-1+CH), they accumulated relatively low concentrations in the liver (1.72 μg/g; CH only) when compared to flounder exposed through the water column (0.100 mg/L M-1+CH) and fed uncontaminated clams, which accumulated much higher concentrations in the liver (180.8 μg/g M-1+CH). In later pre-spawning maturation stages, flounder do not feed (Orcutt 1950). If fish generally do not accumulate much of the toxic aromatic fraction through their food, this may partially explain the relatively few effects observed in rainbow trout exposed prior to reproduction to petroleum in their diet, as observed by Hodgins et al. (1977a). The major route of accumulation of the more toxic aromatics would appear to be through the water column and sediments. The exposure concentration in our experiments is probably a reasonable approximation to chronic exposure of flounder in the field.

Uptake and total accumulation of monocyclics (M-1) and alkyl cyclohexanes (CH) in gonads and livers of flounder varied with sex and maturity (Table 10). After 1 week of exposure, highest mean accumulation occurred in livers of adult females with gonads in the resting stage (2800 X) and lowest in immature females (12 X). Livers of mature males accumulated 74 X and mature females 135 X the concentration of M-1 and CH in the water. Concentrations increased with time in livers of all flounders, reaching much higher levels after 5 weeks than after 1 week of exposure.

Uptake and accumulation of M-1 and CH in gonads also varied with sex and maturity. Rate of uptake was much faster in mature ovaries than in livers, with maximum concentrations in about 24-48 hrs. Concentration levels of all components measured (M-1, CH, M-2, D) remained at an equilibrium level for the remainder of the exposure period. Maximum accumulation was highest in female ovaries (75 X), lowest in male testes (not detectable). Ovaries of immature females and resting ovaries of mature females accumulated comparatively low concentrations (7 X, 8 X respectively).

Variation in accumulation in the liver may be related to feeding and resultant metabolic rates. Adult flounders in the resting stage were fed clams and probably had a faster rate of metabolism and uptake than did sexually maturing male and female flounders and immature females which were not fed. The variation in accumulation of lipid-soluble components in gonads is probably a function of the amount of lipid; maturing ovaries containing far more lipid than immature ovaries and testes containing even less lipid.

Although tissue samples are available for analysis of alkanes and some analyses in clams were done, we have not completed these analyses. Anderson (1974) suggested that although alkanes and aromatic hydrocarbons are both accumulated, the aromatics are concentrated to higher levels and retained longer than the alkanes. Kuhnhold et al. (in press) found that winter flounder accumulated relatively low concentrations of alkanes from low ppb levels of No. 2 fuel oil after long exposures while accumulating higher levels of aromatics. Alkanes are believed to be less toxic than aromatics, although more recent work suggests they may have narcotic effects and cytotoxicity (Clarke et al. 1977a).

When the relative concentrations of components in both liver and gonadal tissues are compared to concentrations in the water, it is apparent that differential uptake has occurred. Many components are undetectable in the water column but accumulate to very high levels in the liver and gonads, particularly the alkyl cyclohexanes.

The high accumulation of alkyl cyclohexanes in ovaries and livers of flounder and in clams from undetectable levels in water is of interest since they have not been previously identified as biologically active components. The toxicity of the cyclohexanes is not well known. Some data indicate that they are as toxic to fish as are monocyclic aromatics (Pickering and Henderson 1966), but information is so incomplete that no definite statement can be made.

The alkyl cyclohexanes are also far more persistent in flounder and clam tissues during depuration. After 1 week of depuration, only alkyl cyclohexanes were detectable in ovaries of mature flounder and in clams. Most lower-boiling-point monocyclic aromatic hydrocarbons (M-1) were undetectable after 48 hours of depuration. Alkyl cyclohexanes persisted in livers of flounder for at least 2 weeks of depuration, monocyclics-2 and dicyclics were undetectable.

A recent review by Clarke et al. (1977b) shows that few laboratory experiments have been done on the accumulation of toxic WSF components in ovaries or testes of fish. Work by Zitko (1971) on the flounder, Pseudopleuronectes americanus, showed a total aromatic concentration of 622 μg/g wet weight in the "guts" of flounder exposed to Bunker C. Previous work at our laboratory, with herring exposed to 100 ppb benzene prior to spawning, showed a concentration of 1.2 μg/g wet weight benzene in mature ovaries after a 48-hr exposure. This is comparable to the uptake of benzene in mature ovaries of flounder (1.27 μg/g) after 48 hrs. In addition, few laboratory experiments measuring accumulation of monocyclics in specific tissues have been made. Korn et al. (1976, 1977) measured uptake of radioactive labeled benzene in several tissues (not mature ovaries) of northern anchovy, striped bass and Pacific herring. Residues of benzene and toluene in liver tissue of herring are comparable to those measured here in flounder, with toluene reaching higher concentrations than benzene. Clarke et al. (1977b) summarizes a few other laboratory studies on uptake in fish and invertebrates and tissue levels of other aromatics.

In the review of Clarke et al. (1977b), tissue levels of aromatics measured in field-captured fishes show that from 0.4 to 22 μg/g wet weight occurred in whole tissue. Zitko (1971) measured 21 μg/g aromatics in the "guts" of field specimens of P. americanus exposed to Bunker C. These data indicate that tissue levels of aromatics in field-captured flounder correspond to those measured in starry flounder exposed to 100 ppb of the WSF of crude oil in this study and that comparable deleterious effects may also occur.

Some effects of exposure on flounder are summarized in Table 10. Most effects are similar to those described by Couch (1975), Walsh and Ribelin (1975) and Smith and Cole (1973) for pesticide exposures and are probably generalized sublethal responses of fish to hydrocarbon exposure.

The WSF of Cook Inlet crude oil resulted in both direct and indirect effects on starry flounder and clams in the pre-spawning stages. There were direct effects on eggs (necrosis and abnormalities) which may have indirectly reduced subsequent fertilization, hatching, larval growth and survival. There also appeared to be an indirect effect on hormones promoting gametogenesis, with maturation accelerated in exposed flounder. The tissue-level effects in both flounder and clams seen at the end of the exposure period were also present after depuration, and appear to be irreversible.

The cause and effect relationships between the components of crude oil and their concentrations measured in these tissues and the physiological or histological effects observed cannot be ascertained definitely. It is difficult to demonstrate which components or interacting components are exerting the primary effects. That a single component can produce similar effects in herring has been discussed previously (e.g. benzene, Struhsaker 1977). Finally, it is not clear whether the toxic effects are caused by the unchanged components or their metabolites, as pointed out by Malins (1977).

Although sublethal effects of petroleum on individual organisms in small subsamples have been demonstrated readily in laboratory studies, evidence for these effects occurring in organisms in the field on a population level has been more difficult to provide. Natural variation in population sizes of most species often obscures variation due to a pollutant. Few "fish kills" have been irrefutably linked with a specific pollutant or spill event. A gradual decline in production of the population, however, may occur in reduced growth or in the inhibition of reproduction. The latter may occur if spawning years are missed, egg production is reduced, and egg viability decreased. An assessment of the reduction in survival of gonadal eggs by exposing organisms in the laboratory prior to spawning enables us to obtain a more direct estimate of the potential reduction in year-class survival attributable to a particular pollutant.

This work was only a beginning of studies on possible biomagnification of petroleum through food chains. Until several other species and life stages, varying in ability to metabolize and retain petroleum contaminants and their metabolites are studied, it would be premature to state that biomagnification does not occur. Finally, this study shows that the compounds with highest potential for biomagnification through food chains may be the alkyl cyclohexanes, components of crude oil, not previously identified as being accumulated by aquatic organisms.

SUMMARY OF RESULTS AND RECOMMENDATIONS

In the original work plan for this research, six expected results and recommendations were outlined as follows.

All food chains suggested for study were not completed. Recommendations are based on the work reported above and other research completed in-house (Eldridge et al, 1977, 1978; Korn et al. 1976, 1977; Struhsaker, 1977).

1. <u>Delineation in food chains studied, of the uptake, accumulations, translocation and depuration of toxic components through exposure from 1) water colum; 2) ingested food</u>.

   Research was completed for the exposure of starry flounder (<u>Platichthys stellatus</u>) from the WSF of Cook Inlet crude oil in the water column and from littleneck clams (<u>Tapes semidecussata</u>) used as food.

   The measurement of uptake, accumulation, translocation and depuration of most toxic components of the WSF was completed in both flounder and clams for the following major groups of components: Monocyclic aromatics, alkyl cyclohexanes, dicyclic aromatics. A total of 29 toxic components was measured and verified by MS-GC in the tissues of flounder (liver, muscle, gonads and gall bladder and 25 toxic components in clams (whole tissue). Data have been coded and will be stored in a computer data bank. Analyses of polycyclic aromatics and some alkanes were also completed for clams. Statistical analyses will be performed on data and results published. Manuscripts in preparation or in press are listed on page 46.

   High accumulation of components was observed in both flounder and clams from low water column exposures. Highest relative accumulation and persistence was of the alkyl cyclohexanes, previously unidentified as being bioaccumulated by marine organisms. These compounds also accumulated in flounder through ingested food (clams exposed to the WSF). Other compounds did not accumulate through the food. There was also high accumulation of other components, e.g. toluene, in flounder and clams at a relatively low exposure level (100-200 ppb toxic aromatics) approximating field chronic exposures. At 100 ppb, uptake continuously increased in many tissues and may not have been maximum at the end of the 5-week exposure. Higher levels may have been reached.

2. Delineation of associated behavioral, morphological and physiological effects at certain tissue levels of the toxic components studied.

Effects were observed at 100 ppb in pre-spawning flounders and clams. The effects were deleterious and apparently irreversible. The estimated reduction in fecundity of flounder was 15-30%. Further reduction in subsequent egg and larval survival is probable, as found in other experiments with herring (50% reduction; Struhsaker, 1977). Effects on non-spawning adults were not obvious, but sublethal measurements were not made and probably occurred.

3. Recommendation of sensitive benthic species and stages to be included in an environmental monitoring program.

We recommend monitoring organisms in the adult spawning stages, which are most likely the most sensitive to petroleum exposure. More food chains, species and stages should be studied. Some of our work with larvae suggests biomagnification of petroleum components through food (Eldridge et al, 1978) and larval food chains should be examined. Starry flounder are high accumulators, but also relatively hardy. Other benthic fish may be even more sensitive to low chronic levels. Other organisms apparently not able to metabolize petroleum components should be studied.

4. Recommendation of tissues and/or organs to be subsampled for hydrocarbon analyses and histological and morphological measurements, as indicated.

Liver tissue shows highest accumulation of components and should be monitored. For potential effects at very low levels, gonads, particularly ovaries of females, should be closely monitored prior to their spawning period.

5. Prediction of potential effects through food chains, and effects on populations and the communities in terms of reduction in reproductive success, efficient energy utilization and growth by focusing laboratory studies on organisms during reproduction and spawning.

More food chains need study.

Effects on egg mortality and maturation in flounder during reproduction were observed. Egg and spermatozoa death in clams was observed at low sublethal levels. We estimate the percentage reduction in fecundity as 15-30% in flounder, and 70% in clams, when they are exposed prior to spawning to approximately 100 ppb toxic WSF components.

6. <u>Recommendations of "safe" or "damaging" levels of petroleum and components in water column, sediments and organisms. Selection of a single component from which effects can be predicted, if possible.</u>

The reduction in fecundity in flounder occurs at two orders of magnitude less (100 ppb) than the acute level of non-spawning juveniles and adults (approx. 10,000 ppb). The acute level for spawning adults is lower, and adults at that stage appear more sensitive to oil (approx. 1,000 ppb). A "safe" level of total toxic aromatic and cyclohexane hydrocarbons in water should probably be < 10 ppb total when organisms are in spawning condition.

The effect of exposure through the water column appears to be greater than through food, but we recommend further study of the alkyl cyclohexanes and larval food chains before making this conclusion.

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Oral Presentations:

Seattle, Washington - June, 1977	Jeannette A. Whipple and Thomas G. Yocom Progress Report - OCSEAP.
Denver, Colorado June 14-17, 1978	Jeannette A. Whipple Conference on Assessment of Ecological Impact of Oil Spills Presented paper, see Whipple et al., in press. T.G. Yocom, D. Ross Smart, M.H. Cohen attended conference.

Reports:

Quarterly Reports:	Jan. 1, 1977; April 1, 1977; July 1, 1977; April 1, 1978.
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