# Program Work Statements

# Environmental Assessment of the Alaskan Continental Shelf

## Volume 1 – Marine Mammals

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

U. S. DEPARTMENT OF INTERIOR
Bureau of Land Management

CONTENTS - MARINE MAMMALS

WORK STATEMENT (Research Unit #13)

TITLE: Behavior and Reproduction of the Pacific Walrus

PRINCIPAL INVESTIGATOR: James A. Estes

GEOGRAPHIC AREA AND INCLUSIVE DATES: Bering Sea, late February through early April, 1976.

COST SUMMARY: No funds requested.

PROPOSED RESEARCH:

The Pacific walrus spends winter in the Bering Sea. Depending upon seasonal ice conditions, this species passes south from the Arctic Ocean through Bering Strait between October and December. During winter, walruses apparently segregate into two distinct areas of abundance; one located southwest of St. Lawrence Island and other located generally southeast of Nunivak Island in central Bristol Bay. The few data presently available suggest that the center of abundance southwest of St. Lawrence Island is generally comprised of females, juveniles, and breeding males. The concentration center southeast of Nunivak Island is apprently primarily adult males. At present, this contention is only speculation based on very meager data collected during ice-breaker expeditions in the Bering Sea. Although there have been several other attempts of document the distribution of sex and age classes of walruses from aerial photographs, these efforts have been generally unsuccessful. The peak period of walrus breeding activity probably occurs during February and March. The objectives of this study are to document the geographical distribution of walruses during this period, by sex, age, and reproductive status, and to document behavioral patterns associated with reproductive activity.

To fulfill this objective, it will be necessary to travel into the ice to make detailed observations and collections of walruses. The sex and general age class of walruses can be determined directly by observation from a vessel; the reproductive status of the animals can be determined by direct

observation and by selected collections.

These objectives can be fulfilled in part by September 30, 1976. Data on area specific distribution of walruses by sex and age can be made immediately available following winter, 1976. However, this effort will not be feasible in both the St. Lawrence and Bristol Bay areas during the same year, and thus the data collected during the first year must necessarily be from only one of these areas. Furthermore, a detailed analysis of reproductive biology from collected animals will not be available by September 1976.

METHODS:

Background information on this subject is limited. Primarily it is found in unpublished reports of federal and state agencies. This information is available in the U.S. Fish and Wildlife Service files at Anchorage.

Shipboard surveys will be required during at least two years to study each of the walrus concentration areas. Observers will record the location, group size, composition by age and sex, time of day, date, and weather and ice conditions. When conditions permit, individual groups will be observed for extended periods of time, perhaps as long as one week. During these periods of extended observation, activity patterns and group interactions will be recorded. Collections will be made to obtain specific information on reproductive conditions, which will be correlated with observed behaviors. Additional biological and ecological information will be obtained from these collected animals such as blood samples for hormonal analysis, selected endocrine organs, tissues for pesticide, heavy metal, and petrochemical analysis, and stomachs for food habits. Requests for additional samples or information will be solicited from other investigators.

Ideally, the survey should be conducted during an 8 week period between late January and early April. However, these dates are slightly flexible depending upon icebreaker availability and the needs of other investigators. The geographical areas to be surveyed, and the specific survey routes are not exactly predictable, but depend upon the distribution and quality of sea ice. Generally, the surveys in Bristol Bay will be with the area bounded by 159° to 168" W long. and 56° to 60° N lat. The sampling effort will not be evenly distributed, but will be allocated so that most time will be spent in the general area bounded by 160° to 162° 30' W long. and 57° to 58° 20' N lat., which from prior aerial surveys has been determined as the area of high walrus abundance in Bristol Bay. This area may be modified slightly, depending upon data collected during concurrent aerial surveys. Within the area of high walrus abundance, the survey route will be a zig-zag pattern, that will uniformily cover the entire high density area. Surveys of the area occupied by walruses south of St. Lawrence Island will be conducted in a similar ner. These surveys will be within the area bounded by 168° to 178° W long. and 61° to 64° N lat. The major sampling effort will be in the area bounded by 171° to 175° W long. and 61° to 63° N lat.,which has been determined as an area of high walrus abundance.

INFORMATION PRODUCTS:

From this study, I expect information which will help to answer the following questions:

1. What are differences between the two major geographical concentrations of walruses in the Bering Sea? In this regard, the factors to be analyzed are sex, age, and reproductive status.

2. What are the activity patterns of walruses during winter, and how is activity influenced by variable factors such as weather?

3. What social interactions among walruses are related to reproductive activity? What are their specific patterns?

4. What foods are consumed by walruses during winter in the Bering Sea? How does this vary by age, sex, and geographical area?

5. What are the demographic parameters of the walrus population at this time? How does these compare with data obtained during the native harvest?

6. How spatially homogeneous, with regard to group size and composition, is the distribution of walruses within the major areas of abundance? How large an area must be sampled to be representitive of walrus composition?

SCHEDULE:

A detailed schedule of sampling cannot be provided at this time. The sampling time schedule depends upon ship scheduling and encounter with walruses. A report, and preliminary analysis, of survey data will be provided by 30 September, 1976.

EQUIPMENT REQUIREMENTS: None.

LOGISTIC REQUIREMENTS:

The most important support requirement is a vessel with icebreaking capacity. Without such support, this program is not feasible. Furthermore, the schedule and travel routes of this vessel must be flexible because weather and encounter with walruses are not predictable. The vessel must be able to remain stationary in the ice for periods of up to 1 week. Thus, it is unlikely this mission can be successfully completed by accompanying other expeditions for which

the primary objectives require a rigid schedule. The work can be done in conjunction with other bird and mammal investigations of a similar nature, or in conjunction with other investigations which have no specific scheduling requirement.

Indoor wet and dry laboratory space is required. This space need not be excessively large. Helicopter support is requested, but is not imperative. The helicopter will be used primarily to transport investigators and specimens to and from the shop. Bunk space aboard ship will be required for 4 to 6 persons. In addition, one stateroom will be required.

COST:

All salaries and equipment will be paid by the U.S. Fish and Wildlife Service. No additional funds are requested.

WORK STATEMENT (Research Unit #14)

TITLE: Distribution of the Pacific Walrus

PRINCIPAL INVESTIGATOR: James A. Estes

GEOGRAPHIC AREA AND INCLUSIVE DATES: Bering Sea, January through April, 1976

COST SUMMARY: $24,000

PROPOSED RESEARCH:

A primary task stated by the draft study plan for environmental assessment of the Gulf of Alaska, Southeastern Bering, and Beaufort Seas, requires information on seasonal density distribution, critical habitats, migratory routes, and breeding locales of marine mammals. An ongoing program of the U.S. Fish & Wildlife Service will provide some of this information on walruses in the Bering Sea. Between 1958 and 1972, aerial surveys were conducted during winter months to estimate the abundance and distribution of walruses and other marine mammals in the Bering Sea.

From data obtained during these aerial surveys, as well as from surface observations made from icebreakers operating in the Bering Sea, the approximate distribution of walruses during winter in the Bering Sea has been determined. Generally, walruses occur in two areas of high abundance; one located approximately southwest of St. Lawrence Island, and the other located southeast of Nunivak Island in Bristol Bay.

I propose to document the pattern of walrus distribution between January, when walruses have recently arrived at wintering areas in the Bering Sea following their southerly migration, until April, when the walrus population is again beginning its spring migration north. In addition, I propose to document group size and composition of walruses to the extent feasible. I should point out that prior efforts in this later area have been largely unsuccessful, and the expected data return for this effort is not great.

The field work will be completed and a preliminary report will be available by September 30, 1976. These data however, will represent only a single year, and thus will be of limited predictive value.

Aerial surveys are planned by principal investigators from Alaska Department of Fish & Game and National Marine Fisheries Service of other ice-related Pinnipeds and Cetaceans. The general survey methods of these various studies will be similar, and although areas of interest may differ slightly, a coordinated effort will be feasible.

METHODS:

Background information for this investigation is limited. Primarily, it is found in unpublished reports of the U.S. Fish & Wildlife Service, and unpublished data collected during icebreaker cruises in the Bering Sea. These reports and data are currently in U.S. Fish & Wildlife Service files in Anchorage, and they will be referred to and integrated in the final product of this investigation.

Four aerial surveys will be conducted, once each month from January to April. The sampling effort will consist of line transects, randomly determined within the known areas of walrus distribution between Bering Strait and the southern ice edge. Transects will be flown at 500 feet altitude. Species and numbers of marine mammals will be recorded, and their approximate distance from the aircraft will be estimated by estimating their angle from the vertical. Photographs will be taken of selected groups of walruses. Each month, 20 hours will be allocated to this effort. By this method, the general pattern of distribution, and areas of high abundance of walruses will be determined, and significant patterns of change in this distribution will be noted through the winter.

INFORMATION PRODUCTS:

A crude description of the pattern of walrus distribution during the winter months will be the product of this effort. The form of this product will be a series of maps showing the general distribution and areas of walrus abundance, on a monthly basis, throughout the mid-winter and early spring months. Additional information may be obtained on the sex and age composition of walruses by geographical area.

LOGISTIC REQUIREMENTS:

There are no logistic requirements other than the services of a suitable survey aircraft for 20 hours during each month, between January and April, 1976. All other support will be arranged through U.S. Fish and Wildlife Service.

COST SUMMARY:

FY 1975 - None

FY 1976 - $24,000 for aircraft charter.

RESEARCH UNIT #34

WORK STATEMENT

I. TITLE: Analysis of Marine Mammal Remote Sensing Data

II. PRINCIPAL INVESTIGATOR

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III. GEOGRAPHIC AREA AND INCLUSIVE DATES

Bering, Chukchi and Beaufort Seas
1 July 1975 - 30 September 1976

IV. COST SUMMARY

| | | |
|---|---|---|
| A. Salaries | $0,000 | |
| B. Equipment | 1,100 | |
| C. Services | 3,700 | |
| D. Supplies | 400 | |
| E. Travel | 4,800 | |
| TOTAL - | | $10,000 |

V. PROPOSED RESEARCH

A. Background and Objectives

Tasks: We will analyze remote sensing data obtained from aerial surveys of walrus populations in the Bering, Chukchi and Beaufort Seas with particular emphasis on: (1) walrus presence in an area and the ice characteristics; (2) the degree to which walrus movements are influenced by ice dynamics; and (3) the behavioral, ecological and meteorological conditions influencing walrus hauling-out behavior. Walrus can only be sensed when they are hauled out.

The remote sensing data will come from two sources: (1) Bering Sea Marine Mammal Experiment (BESMEX) flights conducted with NASA aircraft (2) flights of USGS aircraft under the OCS program. Information already obtained during the 1972 walrus survey conducted by the U.S. Bureau of Sport Fisheries and Wildlife (USBSF&W) as well as previous aircraft surveys are available to us for comparative analysis. Ground truth will be obtained from: (1) studies conducted by Mr. T.J. Eley, Jr. under another program (see related research below)

employing native skin boats; (2) previously collected data from icebreaker cruises; and (3) anticipated icebreaker cruises during the OCS program.

Our data analysis program will contribute to the fulfillment of the following tasks in the manner indicated.

A-1: We will summarize and analyze some of the existing literature and unpublished data on the distribution and abundance of one species of marine mammal, walrus.

A-2: The analysis of remote sensing data will provide information on seasonal density distributions of walrus.

A-3: We will compare the presence or absence of walrus with as many parameters of the ice (type, thickness, surface characteristics and roughness) as can be reliably remotely sensed in an attempt to assess the relationship of walrus to the ice environment.

State of Knowledge: Aerial surveys of marine mammals have been conducted for many years (see Kenyon, 1972). These surveys have relied primarily on visual sensing of the animals. In some cases hand-held cameras have been used to supplement visual observations. The adequacy of these photographs has, however, been questioned (Fay, 1973). The use of photographic techniques in censusing free-ranging animals has been explored most extensively in assessing ungulate populations. In these studies the conclusion has been drawn (Graham and Bell, 1969) that photographic techniques are necessary for any species which occurs in groups of over 100 or where the density is such that at the censusing altitude and speed the animals will be encountered at a rate in excess of 1 per second. Walruses exhibiting thigmotactic behavior occur in spotty distributions with the high density areas falling under the conditions in which photographs are required. No previous studies of which we are aware have combined a variety of sensors to simultaneously sense both the animals and their environment as we have done and will continue to do in obtaining the BESMEX data which will be analyzed under this work statement.

Information required: In order to determine the abundance of walrus in different areas, high-resolution photographs are the primary criterion. Obviously for distributional considerations the location of each photograph must be available. In addition the time of the photograph, ice

surface temperature, animal surface temperature and surface wind conditions are required in order to go beyond just counting animals and to start to formulate a model of walrus hauling-out behavior under different temporal and environmental conditions. Furthermore, since we are working toward a model which will relate walrus presence in an area to ice characteristics, certain parameters of the ice must also be recorded. The important ones are the ice type, thickness, surface characteristics and roughness.

The high-resolution infrared mapper used to measure walrus surface temperatures is also an important tool for detecting the animals due to their high thermal contrast with the background. The mapper can be operated continuously at low cost and covers a greater track width then all but the widest angle photography. Validation of numbers within groups detected by IR mapping is provided by wide angle photoraphy, details of group structure are potentially provided through telephoto photography.

Meeting the requirements: We have assurance through our BESMEX Project Plan with NASA/ARC that we will have two more sets of flights aboard the Convair 990 during the remainder of this calendar year. An additional series of flights in 1976 is tentatively scheduled. During these flights, systems will be on board to sense the animals and their environment which will provide all the information outlined above. We have already conducted one flight series on the Convair 990 during April 1975 and we will soon be receiving the results from that flight. Additionally we have data from flights of the NASA/JSC NP-3 aircraft during September 1974.These flights provided visual and infrared information but did not have sensors to provide the suite of ice characteristics which should be forthcoming from the Convair 990 flights. We anticipate the use of the two USGS aircraft involved in the OCS program to provide additional photographic, infrared, radar and profilometer data. Therefore with the reservations that the sensors work and that the weather is favorable for the flights within the timeframe allowed,we will have the necessary data to provide information for the fulfillment of tasks A-1, A-2 and A-31 as indicated above.

Related research: Walrus surveys using visual and photographic methods are planned by the U.S. Fish and Wildlife Service provided the aircraft they anticipate using (P2V) is repaired in time. We are in contact

with them and plan to compare and share data and results. Also, subject to logistics, we understand that the Northwest Fisheries Service, NMFS, will be conducting bowhead whale surveys in the Chukchi and Beaufort Seas and we will likewise compare data and coordinate flights with them as much as is possible.

Our major interface with other programs will be a continuation of the ongoing collaboration between BESMEX and AIDJEX (Arctic Ice Dynamics Joing Experiment). The principal investigators for remote sensing in the AIDJEX program, Drs. W.J. Campbell and W.F. Weeks, are also the principal investigators for ice remote sensing in the OCS program. Thus we will continue to share aircraft with them and look to them to provide the necessary remote sensing information regarding ice characteristics. We will be coordinating with them the use of the USGS aircraft for marine mammal survey work

We are aided in planning of flights where matters of assessment techniques are concerned by Drs.Douglas Chapman and James Gilbert of the University of Washington.

Last, a graduate student at The Hopkins, Mr. Thomas. J. Eley, Jr., is working on walrus hauling-out behavior under the support of the ONR (Oceanic Biology) and the Marine Mammal Commission (proposed). A model will be developed reviewing the proportion of animals in the water under differing behavioral, temporal, and meteorological conditions.

B. Methods

Use of published and unpublished material: Data already collected which will be used in this study include: (1) the USBSF&W 1972 walrus survey; (2) the September 1974 NASA/JSC NP-3 and April 1975 NASA/ARC CV-990 flight data; (3) field notes from the 1971 USCGC Glacier and 1972 USCGC Burton Island cruises in the area (4) NOAA-2, 3,4 and DAPP satellite visual and infrared photographs of sea ice; and (5) Weather Bureau data on meteorological conditions at the times and places where data collection in items 1-3 above occurred.

The satellite photographs will provide a synoptic view of the ice conditions in the Bering, Chukchi and Beaufort Seas at the time data were obtained during the flights and cruises listed above. The locations of animal concentrations observed will be correlated with this overview of ice conditions. The icebreaker cruise notes will provide ground truth data to help interpret the satellite photographs. It is realized

that the satellite photograph resolution is not adequate to detect small-scale variations in the ice type which are important to the distribution of marine mammals. Nevertheless the large-scale variations which are also important can be detected.

The Weather Bureau information should include surface, 950 millibar or 900 millibar pressure charts from which the wind velocity at the top of the Ekman (spiral) layer can be obtained. This information is needed to predict the movements of the ice from one day to the next which will be correlated with the locations of walrus on succeeding flights. Also Weather Bureau data will be used to estimate the wind-chill factor on the days of observation to investigate the extent to which thermoregulatory considerations influence walrus hauling-out behavior. Predictions on ice movement, surface wind and temperature made from the Weather Bureau data will be compared with ground truth data obtained during the icebreaker cruises.

Sampling scheme: The NASA flights have been scheduled to cover the most important times and locations in the yearly cycle of the walrus. The September 1974 flights were near the end of the summer activity in the Chukchi Sea just prior to the start of the fall migration southward with the advancing ice edge. The April 1975 flights, although a little later than optimal, still surveyed the animals while they were in the breeding area south and west of St. Lawrence Island in the Bering Sea. The August 1975 flights will be during the height of summer activity in the Chukchi Sea. The October flights should be about the time the animals are passing through the Bering Strait on their southward migration. We hope to be able to add additional temporal and spatial coverage through the use of the USGS aircraft during the OCS study.

There is no question that a single year's sampling program as outlined above is inadequate to provide sufficient data to develop highly reliable models of either walrus hauling-out behavior or walrus-ice interactions. The environmental, physiological and behavioral conditions are different for each of the sampling times and locations. Therefore, as we have clearly indicated in the BESMEX Project Plan, we contemplate a project of several years duration. Nevertheless, the most important steps are the first ones which will be taken this year providing the first year-round remote sensing data of the animals and their environment. The analysis of these data as conducted under this work statement will provide the first-generation models upon which future years' endeavors will build.

Species studies: Our primary species of emphasis under the objectives of this work statement is the walrus. BESMEX addresses itself to two target species, walruses and bowhead whales. However, there are several other species of marine mammals which are associated with sea ice in the Bering Sea region and whenever we are able to remotely sense them, we will also try to correlate their distribution and abundance with meteorological and ice characteristics sensed simultaneously. The species we may encounter in our remote sensing program include:

Species of primary interest

Walrus, Odobenus rosmarus
Bowhead whale, Balaena mysticetus

Species of secondary interest

Harbor seal, Phoca largha
Ringed seal, Phoca hispida
Ribbon seal, Phoca faciata
Bearded seal, Erignathus barbatus
Polar bear, Ursus maritimus
Belukha whale, Delphinapterus leucas

Methods of analysis: The sensors employed and the data obtained from BESMEX (CV-990) flights to date have been as follows:

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|---|---|
| Color photography | 9 inch format 73° field of view-detection and counts of animals.<br>5 inch format 21° field of view-counts of animals, po possibly sex discrimination. |
| Infrared mapping | 1 and 5 milliradian spatial resolution 1 and 0.1 degree Centigrade thermal resolution --- detection of animals, surface temperatures, temperature profiles within groups. |
| L Band Radar | field of view from 5-45° to the right of the aircraft-ice surface characteristics. |
| Microwave radiometer (19.35 GHz) | brightness temperatures of ice and water from which ice type can be determined. |

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|---|---|
| Laser profilometer | 2° field of view-profile of surfaces, detection of pressure ridges, possibly a means to calculate ice thickness from measured ice freeboard. |
| Untraviolet Photography | field of view from 15° to horizion on left of aircraft-detection of seals, polar bears and possibly enhanced walrus: background contrast. |
| Aircraft data system | time, latitude, longitude, air speed, wind speed, ground speed, pitch, roll, static air temperature, ground surface temperature. |

The analysis will consist first of examining all of the visual and ultraviolet photographic and infrared mapping films for any animals. The locations of all animals detected will be plotted on charts of the area and the times of detection will be noted. The output from the microwave radiometer, the L band radar, and the laser profilometer will be divided into three categories: data from locations where animals were detected in high densities, from areas of low density, and data from areas that are not associated with animals. The three categories of data will be compared and all differences noted. Ice thickness will be estimated for areas with and without animals from the laser profilometer ice freeboard measurements and from heat flux calculations based on the measured ice surface temperature, ambient air temperature and sea water temperature. Attempts will also be made to correlate observed ice differences with the synoptic satellite photographs of the area.

Counts of the animals will be made from the visual photographs, in conjunction with IR. The only walruses that can be counted are those which are hauled-out on the ice. BESMEX envisions flights on successive days to a given area where walrus are located so that hauling-out behavior can be studied relative to changes in wind chill, time of day, and short-term hauling-out history, i.e., if the animals have experienced many successive days of weather unfavorable for hauling-out is there a greater number hauled out when conditions become favorable than under similar conditions after a period of good weather? All of these variables will be coded for each occurrance of the walrus on the ice. Group sizes will also be correlated with meteorological conditions and ice characteristics.

Accurate counts are also necessary for investigating the relationship of walrus with sea ice. Identifiable groups of animals associated with identifiable ice structure will be located on visual photographs from successive flights to compare the tightness of the coupling of walrus with the ice and the extent to which walrus movements are dictated by ice dynamics. Whenever identifiable ice structures are observed on successive flights the actual movement of the ice will be compared with that calculated form the wind stress field at the top of the Ekman layer in an attempt to determine the accuracy of predicted ice movements.

Isotherms will be constructed for walrus herds from the infrared mapping data. The maximum temperatures as well as the temperature gradients within the herd will be correlated with group size and meteorological conditions. From previous knowledge of walrus thermoregulation (Ray and Fay, 1968) we will be able to estimate the minimum time the animals have been hauled-out. This is important in detecting circadian patterns in hauling-out behavior.

## VI. INFORMATION PRODUCTS

The products of the study conducted under this work statement will be two first-generation, tentative models. The first will be a model of the relationship of walrus with sea ice. This model will have two major components. The first is the correlation of walrus presence in an area with ice characteristics such as type, thickness, and surface structure and roughness. The second component will deal with the interactions between walrus movements and ice dynamics. The other model will be one of walrus hauling-out behavior. This is essential to know since walruses can only be detected when they are hauled out. Factors which will enter this model include meteorological conditions, and circadian and seasonal behavioral patterns.

## VII. DATA OR SAMPLE EXCHANGE INTERFACES

We will continue our ongoing BESMEX/AIDJEX data exchange program whereby we obtain the necessary information on ice characteristics from AIDJEX personnel. We would, of course, appreciate any input from other associated OCS programs which can provide information on walrus location and the suite of meteorological and ice parameters we are investigating.

No raw data as such will be generated under this work statement; rather, data collected under other programs will be analyzed under this work statement. The analysis of these data will be published as well as being forwarded to the Environmental Data Service/ National Oceanographic Data center.

The project will provide, without additional cost to the investigator, the following information products:

1. 900 or 950 mb charts with nomograms and satellite visual and infrared (if available) photographs of the Bering Sea for the time of Karl Kenyon's walrus survey flights in 6-16 April 1972.

2. 900 or 950 mb charts with nomograms and satellite visual and infrared (NOAA-4; ERTS) photographs of the Bering Sea for 1-8 April 1975; of the Beaufort and Chukchi Seas for 15-29 August 1975; of the Bering, Beaufort and Chukchi Seas for 8-29 October 1975 and for the Bering Sea in the late winter of 1976 (exact dates to be specified later).

3. Charts giving monthly maximum, minimum, mean maximum and mean minimum temperatures for the Bering, Chukchi and Beaufort Seas and the Gulf of Alaska.

4. Up to ten literature searches and up to 50 documents relative to remote sensing of animals and environments from the Environmental Sciences Information Center and the National Technological Information Service.

VIII. SAMPLE ARCHIVAL REQUIREMENTS

We will require no facilities for archiving of samples or materials acquired under this work statement

IX. SCHEDULE

The remaining scheduled BESMEX flights are as follows:

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|---|---|
| 15-29 August 1975 | Chukchi-Beaufort Seas |
| 17 October-7 November 1975 | Bering-Chukchi Seas |
| February-March, August, October-November 1976 | Bering, Chukchi and Beaufort Seas (tentative) |

The schedule for any flights using USGS aircraft in the OCS program is not known at present. The data analysis of each flight will be completed within three months of the completion of the flight although it will require the entire series of flights before model formulation can be seriously undertaken. Since the information products of this work statement are the two models described, the only milestone that can be identified is the submission of a final report on the data analysis and the models at the termination date for this work statement, 3 September 1976.

X. EQUIPMENT REQUIREMENTS

No special equipment will be required.

XI. LOGISTICS REQUIREMENTS

Since this work statement covers only data analysis, no logistics support is required. BESMEX will interface with OCS ice remote sensing principal investigators in the use of USGS aircraft for marine mammal sensing. Supporting ground truth data will be obtained from any OCS-sponsored icebreaker cruises.

XIII. LITERATURE CITED

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Ray, G.C. and D. Wartzok. 1974. BESMEX: Bering Sea Marine Mammal Experiment Project Plan. NASA/Ames Research Center Document TM X-62, 399. iv + 51 pp.

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**National Oceanic and Atmospheric Administration**
NATIONAL MARINE FISHERIES SERVICE

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# WORK STATEMENT

A-1 -- Summarize and evaluate existing literature and unpublished data on the distribution, abundance, behavior, and food dependencies of marine mammals.

A-2 -- Determine the seasonal density distribution, critical habitats, migratory routes, and breeding locales for marine mammals, Identify critical species, particularly in regard to possible effects of oil and gas development.

| | | |
|---|---|---|
| I RESEARCH UNIT 67 | | Baseline Characterization<br>Marine Mammals |
| II PRINCIPAL INVESTIGATORS | | Clifford H. Fiscus and<br>Alton Y. Roppel, NMFS, Seattle |
| III BERING SEA | | 10 June 1975 through 30 Sept. 1976 |
| IV COST SUMMARY | 26.5<br>139.5 | FY 1975 - through 30 June 1975<br>FY 1976 - 1 July 1975 - 30 Sept. 1976<br>(includes logistics 60.0K) |

V PROPOSED RESEARCH

A. Background and Objective

1. The proposed research program will devote primary emphasis to subjects A-1 and A-2.

2. Major concentrations of marine mammals occur in the eastern Bering Sea throughout the year. Fay (1974) lists 25 species of marine mammals which are found in the eastern Bering Sea at various times of the year, and relates that about one million marine mammals of 17 species are found in association with the Bering Sea ice pack. Sanger (1974) has estimated a summer and winter population of over one million pinnipeds representing seven species in the Bering Sea shelf area. Rice and Wolman (1971) estimate that the population of the California stock of gray whales is about 11,000 (± 2,000). A major portion of this stock migrate through the eastern Bering Sea twice each year in early summer and fall. Estimates are not available on the numbers of other cetaceans

found in the area. The Alaska Department of Fish and Game (1973) has some information on the numbers of belukha which summer in Bristol Bay.

3. To attain the elements of our baseline characterization objective we must identify the species of marine mammals occuring in the Bering Sea, determine seasonal distribution patterns, identify breeding and pupping rookeries, hauling grounds and feeding areas where oil spills may be critical to survival of species and obtain information on numbers and seasonal abundance of animals.

4. The seasonal distribution of some species in the Bering Sea is fairly well known. Two species, the walrus and largha seals, are objects of intensive study in other related OCS proposals and it is the intent of this baseline study to complement these studies by providing additional survey time to allow broader coverage on both a species and area basis.

   By 30 September 1976, we will have completed a literature search and compiled annotated bibliographies of published materials. The period of design, test and standardization of survey methods will be completed. One series of spring and fall survey flights will be completed, and preliminary reports prepared. Data from these flights will have been reduced to cards and placed in the data bank.

   Some data will be available on seasonal distribution, and the locations of those pinnipeds hauling out on land to pup and breed will have been found. Based on information and knowledge obtained in this period plans can be reexamined and redesigned if necessary to add to the data base. Over a five year period we will hope to obtain sufficient data to state when and where migrations of the various species occur and make some estimate of abundance.

5. Other programs which will be coordinated with research unit 67 are the aerial walrus study of Estes (RU 14) and the aerial largha study of Burns (RU 231) along and in the Bering Sea pack ice. Our proposed RU 69, Abundance and seasonal distribution of bowhead whales and belukha, extends the area of coverage north and westward into the approaches of the Gulf of Anadyr. The coastal survey of the Krenitzin Islands, and the north side of the Alaskan peninsula northward to Cape Newenham will be carried out cooperatively with sea lion surveys (RU 243) on the south side of the Alaskan peninsula.

B. Methods

1. Literature search will be intensified in July 1975, annotated bibliographies prepared and relevant published and unpublished reports examined and if pertinent, retained for inclusion in data base.

2. The design of a survey plan is currently in progress. Based on the experience of Principal Investigators Projects RU 14, 231, 243, 232, and in consultation with biometricians of the NWFC, NMFS and the University of Washington. Sampling strategy will be modifie as deemed appropriate during the progress of the survey flights.

3. Principal target species in the Bering Sea include the northern fur seal (study already in progress NMFS funded), gray whale, bowhead and belukha (RU 69), steller sea lion, ribbon seal, harbor seal, warlus (RU 14), bearded seal and the largha seal (RU 231).

4. During the first year we propose to design and test methods. Distributional data will be examined through computer programs by season and year. Sightings per unit of effort will be compared and displayed in a manner similar to that used in studies of pelagic fur seal distribution. Data will be collected and examined by the Post-stratified random sample method (Cochran, W. 1963, Sampling Methods. J. Wiley and Sons. N.Y. 413 p.) to develope population indices. Because weather conditions in survey areas will influence the success of surveys, we anticipate a need for approximately 5 years of sampling flights to provide an adequate data base.

VI INFORMATION PRODUCTS

The product resulting from this program through 30 September 1976 will include marine mammal sightings coded and carded. Data will include species, number, date-inc. hour, latitude, longitude, weather and other pertinent information. A narrative report will be prepared including charts showing monthly species distribtion. Several years of comparable data will be needed before statements re abundance and population estimates can be made.

VII DATA OR SAMPLE EXCHANGE INTERFACES

Data obtained on cooperative survey flights will be immediately shared with cooperating Principal Investigators. Marine Bird investigators will be supplied with appropriate information. Data will be supplied EDS in standard format within 120 days.

VIII. SAMPLE ARCHIVAL REQUIREMENTS

No special archiving required.

IX. SCHEDULE

1. Aerial surveys will be made in April 1976 of the ice front zone in the Bering Sea from Bristol Bay northwestward past St. Matthew Island and transects flown across the pack inside the ice front, to determine distribution and abundance of marine mammals. These flights can continue in to the northern Bering Sea and southern Chukchi Sea on bowhead-belukha surveys (RU 69).

   Counts will be made visually or from photographs taken during the survey flights, by experienced observers, transect lines to be determined after location of the ice front is known. Flights will be reflown in March-April 1977, if warranted. These aerial surveys are compatible with marine mammal research units 14, 231, 232, 243 and will use the same platform. Observations made on flights will be utilized by appropriate principal investigators. Sightings will be computerized for BLM data bank and other users. A marine bird observer can be accomodated on flights.

2. Aerial surveys will be made in June 1975 of the coasts of the Krenitzen Islands, Unimak Island, and the Alaskan Peninsula east and northward to Cape Newenham for harbor seals, Steller sea lions and gray whales.

   This survey will be accomplished cooperatively with ADF&G, Marine Mammal Research Unit 243, principal investigator Karl Schneider, to extend the Gulf of Alaska survey in to the eastern Bering Sea. Additional surveys may be made in FY 1976.

3. An aerial survey will be made in September-October 1975 in the northern Bering Sea to determine distribution and abundance of marine mammals. Gray whales are the primary target species.

   The land survey originally proposed for the same area as phase 2 above will now be carried out under research unit 243 in conjunction with a marine bird, vessel survey of the Krenitzen Islands. This research unit (67) can provide assistance if needed.

X. EQUIPMENT REQUIREMENTS

Major equipment needed -- a long range survey aircraft of P2V type or equivalent is needed. Forward visibility is essential for 2 observers and

side visibility for one observer on each side. Space for recorder and communications system is needed between recorder and observers independ of com system between pilots and crew. On track navigation system with provision for one instrument directly visible to recorder is needed, photographic ports are desirable.

Major survey aircraft and a reliable standby are essential if survey flights are to be accomplished. Loss of a plane during critical survey periods could negate accomphishment of a seasons work.

XI LOGISTICS REQUIREMENT

FY 1975 - Coastal (June 1975)

1 Widgeon or equivalent -- 30 hours including Krenitzen Islands, Unimak Island, northside Alaskan Peninsula, Walrus Islands to Cape Newenham. FY 1976 same as FY 1975 Coastal.

FY 1976 - (See number X) P2V or equivalent

Bering Sea Survey September-October 1975 -- 50 hours, OAS P2V or equivalent.

Bering Sea Survey March-April 1976 -- 50 hours, OAS P2V or equivalent compatible with other marine mammal research units.

MMD, NWFC will arrange for Coastal survey flights through contract 1975-1976.

We request NOAA arrange for P2V or equivalent for survey flights.

LITERATURE CITED:

Fay, F. H.
1974. The role of ice in the ecology of marine mammals of the Bering Sea. In Hood, D. W. and E. J. Kelley, (ed). Oceanography of the Bering Sea, with emphasis on renewable resources. pp. 383-399. Univ. of Alaska, Fairbanks.

Sanger, G. A.
1974. A preliminary look at marine mammal-food chain relationships in Alaskan waters. NMFS, NWFC, Marine Mammal Division, processed report. 29 pp.

Alaska Department of Fish and Game.
1973. Alaska's wildlife and habitat. 143 pp.

Rice, D. W., and A. A. Wolman.
1971. The life history and ecology of the gray whale (Eschrichtius robustus). 142 pp.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NATIONAL MARINE FISHERIES SERVICE, NWFC
MARINE MAMMAL DIVISION
NAVAL SUPPORT ACTIVITY, BLDG. 192
SEATTLE, WA 98115

# WORK STATEMENT

A-1 -- Summarize and evaluate existing literature and unpublished data on the distribution, abundance, behavior, and food dependencies of marine mammals.

| | | |
|---|---|---|
| I RESEARCH UNIT 68 | | Abundance and Seasonal Distribution of Marine Mammals in Gulf of Alaska |
| II PRINCIPAL INVESTIGATORS | | Clifford H. Fiscus and George Y. Harry, NMFS, Seattle |
| III GULF OF ALASKA | | 1 July 1975 to 30 September 1976 |
| IV COST SUMMARY | -0- | FY 1975 - through 30 June 1975 1/ |
| | 55.0 | FY 1976 - 1 July 1975 - 30 Sept. 1976 |

V PROPOSED RESEARCH

A. Background and Objectives

1. The proposed researchprogram will include primary emphasis on subject Task A-1. Specifically the program will provide information on the species of marine mammals from the Gulf of Alaska, their seasonal distribution, migratory patterns, critical habitats, and some indication of abundance.

2. In 1974-75, NMFS through contract with ADF&G gathered data and will provide an account of the abundance and distribution of marine mammals in the Gulf of Alaska between Kodiak and Yakutat. The MMD NWFC provided data from their files and collected sighting records from NOAA vessels operating in the area. ADF&G provided data on inshore areas and harbor seal and sea lion rookeries and hauling grounds.

   Northern fur seals are probably found in the offshore areas in small numbers during most months of the year with population peaks occurring in November-December and in April-May-June. Most of the gray whale population passes through the area twice each year. Some northern sea lions are on the fishing banks in the gulf

1/ Program funded FY 1975 - NEGOA

throughout the year. Fin, sei and sperm whales are taken in the area by Soviet and Japanese whalers. Several other cetaceans are regularly seen in the area although very little is known of their seasonal distribution or abundance.

3. In the period 1 July 1975 to 30 September 1976, the MMD NWFC will continue to gather data on marine mammal distribution and abundance from NOAA vessels operating in the expanded area, Unimak Pass to Cross Sound, and from other vessels of opportunity. Ships officers will be trained to recognize and make sighting records of all marine mammals seen. Trained marine mammal observers may be placed on selected vessels cruising in areas of particular interest.

   We will place a trained marine mammal observer on all Marine Bird Survey Flights, or train marine bird observers in marine mammal recognition.

   A literature search will be made to provide historic data on whaling and sealing in the area, catch statistics will be summarized, and records of historic seasonal distribution and abundance of species will be compiled where possible.

4. We hope to produce a report by 30 September 1976 reviewing historic records of whaling and sealing in the area, modern whaling catch statistics, seasonal distribution of marine mammal species found in the area, and a bibliography listing all known published accounts of marine mammals in the survey area.

   Catch statistics of commercially taken species and sighting records from NOAA vessels may provide preliminary data on local and seasonal abundance of some species and an indication of critical habitat. These data, however, must be considered preliminary until sufficient records are accumulated in 3 to 5 years to provide a base to make estimates of marine mammal abundance. We hope to gain marine mammal records from Marine Bird Survey's when they resume and will provide training and assistance onsome flights. Reports from NOAA vessels will increase as more officers are trained and become experienced in identification of marine mammals.

5. The program relates only indirectly to other OCS projects, as it requires marine mammal sighting reports from all vessels involved in the OCS program. The marine bird aerial survey program is also

capable of providing marine mammal sighting reports and we will provide training sessions in marine mammal identification and on occasion a marine mammal observer.

B. Methods

1. Published records located through literature search and unpublished reports and data in MMD files will be summarized. Sighting location records will be coded and placed in data banks for eventual use in preparing seasonal distribution charts. Annotated bibliographies of marine mammals will be prepared.

2. The program is dependent on the availability of platforms of opportunity, both surface vessels and aircraft, and therefore we do not have primary control over area coverage and sampling (i.e. observing) intensity. As reports from observers are received and insight into distribution is obtained, trained observers may be placed on vessels in areas of importance. Plans provide for two observers to be available as needed for vessel and aircraft surveys.

3. A list of marine mammal species known or likely to occur in the Gulf of Alaska and adjacent regions is attached.

4. Distributional data will be examined through computer programs by month where sufficient sightings are available or by season (3 month periods). Sightings per unit of effort will be compared and displayed in a manner similar to that used in studies of pelagic fur se distribution. When sufficient data have accumulated it will be examined by the Post-stratified random sample method (Cochran, W. 1963. Sampling Methods. J. Wiley and Sons, N.Y. 415 pp.) to develope population indices. Since most ocean research is conducted in this area during late spring through early fall data on winter distribution and abundance will be minimal.

VI. INFORMATION PRODUCTS:

The product resulting from this program through 30 September 1976 will include: sightings coded and carded for species, number seen, location, behavior, direction of travel, weather and perhaps other information. Computer printout of the data, a narrative report, and charts indicating locationof sightings by month will be compiled.

## VII DATA OR SAMPLE EXCHANGE INTERFACES

On non-NOAA vessels we will in some instances request that the principal investigator obtain records of marine mammal sightings in critical areas. Time and areas cannot be stated at this time. When a list of vessels, sailing times, and area of investigations is available, then this project can program requests to Principal Investigators.

Products of this program will go into EDS Data Base, and be available to other Principal Investigators as needed.

## VIII SAMPLE ARCHIVAL REQUIREMENTS

No archival requirements expected.

## IX SCHEDULE

The Marine Mammal Division, through the Platforms of Opportunities Progra began acquiring marine mammal sighting reports in 1972. In CY 1974, through the cooperation of the Pacific Marine Center, identification guides and log books were placed on a NOAA vessel to test the feasibility of logging marine mammal sightings as a part of regular vessel operations. The test was completed satisfactorily and in CY 1975 all NOAA vessels sailing from PMC are recording marine mammal sightings and logging related data requirements.

Beginning July 1975, personnel assigned to the program will examine sighting logs, validate records, and reduce acceptable data to punch card format for analysis.

The Marine Mammal Identification Training Program will be increased in scope and we will provide training and instructions to all vessels sailing under OCS contracts.

We propose to cooperate with Fish and Wildlife Service Aerial Bird Surveys by providing instructions on marine mammal identification and providing a marine mammal observer on selected flights.

When a listing of vessel cruises and areas of operations becomes available, we may request space aboard for a marine mammal observer in areas deemed critical to our needs.

The success of the program depends on the interest and cooperation of ships officers and other project Principal Investigators.

## X EQUIPMENT REQUIRED

Identification Keys and Logbooks have already been developed for the program and are available. Camera gear and film will be purchased for use shipboard or aerial. Binoculars for Marine Mammal Division observers will be purchased.

## XI LOGISTICS REQUIREMENTS

No requirements. This project is dependent on platforms in use by other OCS projects.

Species to be expected (resident or seasonal):

Sea otter
(Enhydra lutris)

Northern sea lion
(Eumetopias jubatus)

Northern Fur seal
(Callorhinus ursinus)

Harbor Seal
(Phoca vitulina)

Northern elephant seal
(Mirounga angustirostris)

Black right whale
(Balaena glacialis)

Gray whale
(Eschrichtius robustus)

Minke whale
(Balaenoptera acutorostrata)

Sei whale
(Balaenoptera borealis)

Fin whale
(Balaenoptera physalus)

Blue whale
(Balaenoptera musculus)

Humpback whale
(Megaptera novaeangliae)

North Pacific white-sided dolphin
(Lagenorhynchus obliquidens)

Killer whale
(Orcinus orca)

Harbor Porpoise
(Phocoena phocoena)

Dall porpoise
(Phocoenoides dalli)

Sperm whale
(Physeter catodon)

Bering Sea beaked whale
(Mesoplodon stejnegeri)

Goosebeaked whale
(Ziphius cavirostris)

Risso's dolphin
(Grampus griseus)

Northern right whale dolpin
(Lissodelphis borealis)

Short-finned pilot whale
(Globicephala macrorhyncha)

Beluga
(Delphinapterus leucas)

Pacific giant bottlenose whale
(Berardius bairdi)

Preliminary

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NATIONAL MARINE FISHERIES SERVICE, NWFC
MARINE MAMMAL DIVISION
NAVAL SUPPORT ACTIVITY, BLDG. 192
SEATTLE, WASHINGTON 98115

# WORK STATEMENT

A-1 -- Summarize and evaluate existing literature and unpublished data on the distribution, abundance, behavior, and food dependencies of marine mammals.

| | | |
|---|---|---|
| I RESEARCH UNIT 69 | | Resource Assessment<br>Abundance and Seasonal Distribution of Bowhead and Belukha Whales - Bering Sea |
| II PRINCIPAL INVESTIGATOR: | | Clifford H. Fiscus, Dr. W. Bruce McAlister |
| III Bering Sea | | 15 March 1976 - 30 April 1976 |
| IV COST SUMMARY | -0-<br>31.0 K | FY 1975 through June 30, 1975<br>FY 1976 1 July 1975 - Sept. 30, 1976<br>(includes logistics 24.0 K) |

V PROPOSED RESEARCH

A. Background and Objectives

1. The proposed research program will devote primary emphasis to Task A-1. Some portions of A-2 may also be answered.

2. The bowhead whale and those belukhas that summer north of Bering Strait are thought to winter in northern Bering Sea along the ice front and in the open leads and broken ice associated with the front. Polynya's occur regularly in the northwest part of Bering Sea and may also be wintering locations for these species. Scammon (1874) in describing the bowhead fishery states that the whalers usually worked their way north about the first of May along the Siberian coast, staying near shore "in order to be on the best "whale-ground" and to avoid the ice." Townsend (1935) plotted from whalers log books, the locations where bowheads were taken each month of the season. As indicated on his chart most whales were taken in the western and northern Bering Sea in May and June. The numbers of bowheads comprising the Bering, Chukchi and Beaufort Seas stock is unknown. The size of the belukha population that winters in Bering Sea is also unknown, but according to the ADF&G may exceed 15,000 animals.

3. To attain the task objective we propose to make several late winter and early spring aerial surveys of the ice front zone and the persistant polynya westward of St. Lawrence Island. these flights may provide information on the wintering area of these species and perhaps some indication of numbers of animals comprising the wintering populations.

4. The survey flights will be carried out in the spring of 1976 in conjunction with projects listed in 5. The bowhead-belukha phase will examine an area northward and westward of other flight areas that would not otherwise be surveyed. Based on information obtained, we can make a decision to continue or end this survey. The 1976 survey may indicate the presence of wintering populations and provide some information on distribution.

5. This program will be carried out in cooperation with research units 67, 14, 23, and 248 and the same platform and aerial survey techniques with only slight modifications will be used. Project personnel will interchange and cooperate as needed.

B. Methods

1. Literature search will be intensified in July 1975, annotated bibliographies prepared and revelant published and unpublished reports examined,and if pertinent, retained for inclusion in data base.

2. Design of a survey plan is currently in progress. It will be based on the experience of the principal investigators projects 67, 14, 231, and in consultation with biometricians of the NWFC, NMFS and of the University of Washington. Sampling strategy will be modified as deemed appropriate during the progress of the flight.

3. Target species are bowhead whale (Balaena mysticetus) and the Belukha (Delphinapterus leucas).

4. During the first year we propose to design and test methods. Distributional data will be examined through computer programs by season and year. Sightings per unit of effort will be compared and displayed in a manner similar to that used in studies of pelagic fur seal distribution. Data will be collected and examined by the Post-Stratified random sample method (Cochran, W. 1963, Sampling Methods. J. Wiley and Sons, N.Y. 415 p.) to develop population indices. Because westher conditions in survey areas

will influence the success of surveys, we anticipate a need for approximately 5 years of sampling flights to provide an adequate data base.

VI INFORMATION PRODUCTS:

The product resulting from this program through 30 September 1976 will include sightings of the two species and other revelant data which will be coded and carded and a narrative report and charts showing spring of 1976 sightings and relationship to the sea ice will be prepared.

VII DATA OR SAMPLE EXCHANGE INTERFACES

Data obtained on cooperative survey flight will be immediately shared with cooperating Principal Investigators. Marine bird investigators will be supplied with appropriate information. Data will be supplied EDS in standard format within 120 days.

VIII SAMPLE ARCHIVAL REQUIREMENTS

No special archiving required.

IX SCHEDULE

Aerial surveys of this project will be carried out in April-May 1976 in conjunction with the survey flights of Research Units 67, 14, 231, and will extend the area of coverage northward towards Bering Strait and westward into the Gulf of Anadyr. Soviet colleagues will be advised of this project at the June meeting of the Marine Mammal Subgroup, Working Group on Endangered Species and Wildlife Conservation and Management of the US-USSR Environmental Protection Agreement in Lenningrad and their cooperation and participation solicited. Data analysis and delivery milestones are described in Sections VI and VII.

X EQUIPMENT REQUIREMENTS

Major equipment needed -- a long range survey aircraft of P2V type or equivalent is needed. Forward visibility is essential for two observers and side visibility for one observer on each side. Space for recorder and communications system is needed between recorder and observers independent of com system between pilots and crew. On track navigation system with provision for on e instrument directly visible to recorder is needed, photographic ports are desirable.

Major survey aircraft and a reliable standby are essential if survey flights are to be accomplished. Loss of a plane during critical survey periods could negate accomplishment of a seasons work.

XI LOGISTIC REQUIREMENTS

FY 1976 See Number X
P2V or equivalent
March-April 1976 40 hours
Flight time added to cooperative RU 67, 14, 231, flights.

We request NOAA arrange for P2V or equivalent survey flights.

Literature Cited:

Scammon, C. M.
1874 The Marine mammals of the northwestern coast of North America, together with an account of the American whale-fishery. p. 319. John H. Carmany & Co., San Francisco.

Townsend, C. H.
1935. The distribution of certain whales as shown by logbook records of American whaleships. Zoologica, Vol. XIX No. 1, p. 50, 4 charts.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NATIONAL MARINE FISHERIES SERVICE, NWFC
MARINE MAMMAL DIVISION
NAVAL SUPPORT ACTIVITY, BLDG. 192
SEATTLE, WASHINGTON 98115

Preliminary

# WORK STATEMENT

A-1 -- Summarize and evaluate existing literature and unpublished data on the distribution, abundance, behavior, and food dependencies of marine mammals.

I RESEARCH UNIT 70 — Abundance and Seasonal Distribution of Bowhead Whales and Belukha

II PRINCIPAL INVESTIGATORS — William M. Marquette and George Y. Harry, NMFS, Seattle

III BEAUFORT SEA, NORTHEASTERN CHUKCHI SEA
September 1975 through June 1976

IV COST SUMMARY
-0- FY 1975 - through 30 June 1975
85.0 FY 1976 - 1 July 1975 - 30 Sept. 1976

V PROPOSED RESEARCH

A. Background and Objective

1. The proposed program will contribute to objectives A-1 and A-2.

2. The bowhead whale and probably the Beaufort Sea stock of belukha's are thought to winter in the northern Bering Sea associated with the ice front or in polynya's. The number of bowheads that inhabit the Beaufort Sea is unknown but probably small and the belukha stock is estimated around 3500 $\pm$ animals.

   The bowhead, followed about a month later by the belukha, move northward from the Bering Sea in late March or early April as the leads begin to open up. By late April in the Chukchi Sea there is a shore lead (usually within 1 to 5 miles of the coast) of open water extending from Bering Strait northward to Pt. Hope and northeasterly to Pt. Barrow. Other leads open farther offshore but are usually not as persistant as the shore lead.

Leads develop later and farther offshore in the Beaufort Sea. The spring migration path of these two cetaceans and several species of ice seals through the Chukchi Sea to the Beaufort Sea should be examined concurrent with a Beaufort Sea survey.

These two cetaceans will be most vulnerable to oil pollutants in the restricted confines of the shore lead during spring migration and, depending on how the pack ice moves in, in the fall between the pack ice and shore.

3. To determine the effect oil spills might have on these species during critical periods we must determine if their spring migration is restricted, in the main, to the shore lead or if there are considerable numbers passing northeastward in offshore leads. Information on the numbers of animals comprising these stocks is needed, and data on the migratory patterns both in spring and fall are necessary to determine times when the movement of vessel traffic and attendent dangers of oil spills will be the least dangerous to bowheads and belukha's.

4. During the first year we will design and test the program and gain some data on migratory patterns and timing. Four surveys can be flown, with perhaps one additional in September 1976. Weather conditions in the survey areas will influence the success and value of the flights. We anticipate a need for 5 years of survey flights, coupled with several years of observations from the fast ice at the edge of the lead, to provide data on the numbers of animals comprising these stocks. Even then, reliable population estimates may not be possible. Knowledge gained in the first years will be used to develop programs in succeeding years.

5. This project can share the same platform of Burns-Fay-Shapiro for the project "The relationships of marine mammal distributions, densities and activities to sea ice conditions in the Beaufort Sea."

B. Methods

1. Literature search and annotated bibliography will be prepared. Published and unpublished data will be gathered of catch statistics, distribution, abundance, and timing of migration.

2. Techniques and methods used for the survey will be standardized where possible with those of other investigations.

3. Bowhead - Balaena mysticetus

   Belukha - Delphinapterus leucas

4. Several methods of data analysis are planned for this program, and through consultation with NWFC biometricians and outside consultants, the most suitable will be selected. Statistical analysis of the data obtained will be carried out by a staff biometrician and by others if necessary,

VI INFORMATION PRODUCTS:

The numbers and location of all species of marine mammals sighted during the surveys will be available on cards. Charts showing location of sightings will be prepared for inclusion in a report which will describe the results of the survey. An annotated bibliography of bowhead and belukha literature will accompany the report.

VII DATA OR SAMPLE EXCHANGE INTERFACES:

The investigators involved in OCS research programs are in contact with each other, and in most cases several programs will use the same platform and perform the research cooperatively. Raw data obtained on transects will be available on work sheets almost immediately upon conclusion of a flight, and on punch cards within 2-3 months.

Sighting reports of species other than bowheads and belukha may be needed by other principal investigators, i.e. Estes RU 14, and can be made available within a short time of each flight.

VIII SAMPLE ARCHIVAL REQUIREMENTS:

No archival requirements expected.

IX SCHEDULE:

The uncertainties of arctic flying conditions preclude establishing exact dates for flights. Aerial surveys will be flown, weather permitting, during these approximate periods.

| | | |
|---|---|---|
| 5 days | September 10-25, 1975 | Beaufort Sea |
| 5 days | October 10-25, 1975 | Beaufort/Chukchi Seas |
| 5 days | May 10-25, 1976 | Beaufort/Chukchi Seas |
| 5 days | June 10-26, 1976 | Beaufort/Chukchi Seas |

Preliminary reports of each flight will appear within 3 months of flight. Selected sighting reports can be made available to cooperators within 1 month of flight.

This project interfaces with RU 248 (Burns, Fay, Shapiro).

X EQUIPMENT REQUIREMENT:

Medium range aircraft needed, Mohawk or equivalent, 10 hours flight time, suitable for low level 500 ft flights of 6-8 hours duration, with good visibility, photo port in deck desirable, carrying capacity 4-5 observers, with on track navigation or comparable system. For scheduling see IX.

XI LOGISTICS REQUIREMENTS:

Aircraft GS Mohawk or equivalent for the following periods:

September 1975 -- 15 days
October 1975 -- 15 days
May 1976 -- 15 days
June 1976 -- 15 days

Base NARL, Barrow, Alaska

Lodging
Aircraft Support

Aircraft Requirement: NOAA -- Aircraft should be judged suitable and tested summer 1975 by MMD staff representative.

Observers and lodging NWFC, NMFS

June 30, 1975

ALASKA MARINE ENVIRONMENTAL ASSESSMENT PROGRAM
WORK STATEMENT (Research Unit #194)

I. TITLE: Morbidity and Mortality of Marine Mammals

II. PRINCIPAL INVESTIGATOR: Francis H. Fay, Associate Professor
Institutes of Marine Science and
Arctic Biology
University of Alaska
Fairbanks, Alaska 99701
(907) 479-7027
SS#: 030-20-7749

III. GEOGRAPHIC AREA AND INCLUSIVE DATES:

Bering Sea 1 June 1975 to 30 Sept 1976

IV. COST SUMMARY:

| FY 1975 through June 30, 1975 | FY 1976 July 1, 1975-Sept 30, 1976 |
|---|---|
| $7,442 | $83,787 |

V. PROPOSED RESEARCH

A. Background and Objectives

Some 3 million marine mammals of 25 species inhabit the Bering Sea, mostly on a part-time basis, their average term of residence being about 6 months per year (Fay, 1974; Bartonek et al., 1974). The crude birth and death rates of these populations are probably all within the range of 10 to 20 per cent per year (e.g. see Burns, 1965, 1967; Kenyon, 1969; Smith, 1973; Chapman, 1961; Rice and Wolman, 1971; Kleinenberg et al., 1964), and about half of the deaths are directly attributable at present to man's activities (i.e. 30-50,000 in the fur seal harvest; 90-100,000 by native subsistence hunting; 50-70,000 by the Soviet sealing fleet; 10-20,000 by accidental entanglement in fish nets). The other half dies from causes that are largely unknown and are nebulously referred to as "natural". Probably at least half of that natural mortality takes place in the Bering Sea, due to the extenuating circumstances imposed by crowding, concentrations of predators, severe weather, and the presence of pack ice.

The majority of marine mammals that die in the Bering Sea each year is consumed or otherwise removed from view at once by man or other predators and scavengers. The remainder is pushed by currents of wind and water and, in part, drifts ashore on the coasts of Alaska and Siberia. It is that visible fraction which we propose here to sample. In addition, we propose to determine some of the major causes of that visible mortality through autopsy of stranded carcasses and through selective collection and study of sick and moribund animals. The

strategy of these activities for the purposes of the OCS program is simply to provide baseline information, for it will be advantageous some years hence to be able to differentiate quickly between a normal variation in number of stranded carcasses and a significant increase or decrease in number, and to distinguish between old and new causes of morbidity and mortality, particularly insofar as the latter may be related to human perturbation or pollution of the environment.

Thus, the primary emphasis of the proposed project will be in relation to Task No. A-28, to "determine by field and literature studies the incidence of diseases presently existing in mammals for use in evaluating future impacts of petroleum-related activity," and it is likely to contribute some information also to Task A-3, concerning the mortality aspect of "population dynamics for selected species." More specifically, the objectives will be: (1) to determine the number (by species, sex, and age) of stranded marine mammals on selected segments of the Alaskan Bering Sea coast, (2) to determine insofar as possible the pathological conditions and agents that caused or contributed to the death of those mammals, and (3) to determine the major causes of natural morbidity of certain species through selective collection and study of sick and moribund animals.

At present there is very little knowledge in this area. While a few isolated strandings have been reported in the past (e.g. by Hanna, 1920, 1923; Murie, 1936; Jellison, 1953; Schiller, 1954, Geist et al., 1960), there have been no data on their rate of occurrence or their sex and age characteristics, except in the case

of the sea otters, Enhydra lutris, at Amchitka Island (Kenyon, 1969) and of walruses, Odobenus rosmarus, at St. Lawrence Island (F.H. Fay, unpublished). In the Bering Sea region, the species that have been most intensively studied, as regards the causes of natural morbidity and mortality, are the sea otter (e.g. by Barabash-Nikiforov, 1947; Rausch, 1953; Kenyon, 1969) and the northern fur seal, Callorhinus ursinus (e.g. Eddie et al., 1966; Kim, 1972; and see review by Keyes, 1965). Some others, such as the gray whale, Eschrichtius robustus (Rausch and Fay, 1966; Kasuya and Rice, 1970; Akers et al., 1974), and the walrus (Brooks, 1954; Fay, 1960 and unpublished), have been investigated to a minor extend; most have not been investigated at all.

It is not presently feasible to "meet the task objective" fully since this would require an enormous and excessively costly sampling program to obtain the baseline data and an equally costly one later to measure any change. Our approach, of sampling only the dead and dying, must suffice for the present. While it may tell us nothing about the rates of occurrence of each disease in each population, it should at least provide for the identification of the most important agents and of the population components that are most affected by them. For the purpose of subsequent detection of any effects of oil development, these will be the more useful and manageable "yardsticks".

We predict that neither the stranding surveillance nor the selective collections will yield enough information by 30 September 76 to be definitive. This is, in part, because the year-to-year rates of

occurrence of strandings, though not well documented are well known to vary widely, and, in part, because the intensive processing of selectively collected animals is very costly in both professional time and materials, and it will simply not be feasible to collect enough of them for adequate replication within the limits of time and funds available. For these reasons, we expect that at least 4 or 5 years will be required for completion of a reasonable sampling program.

To the best of our knowledge, the only closely related research of this kind in Alaska at present is that of M.C. Keyes and co-workers in the fur seal program (NMFS) on the Pribilof Islands. We would expect to coordinate with that activity, as well as with other, less closely related projects, especially several in the OCS program (e.g. #241. K. Schneider: Bristol Bay sea otters, #248. Burns et al: Marine mammals and ice, #14. J. Estes: Walrus numbers, etc.). Our coordination with these will involve not only joint use of logistic facilities but mutal participation in many phases of the field work, where the specimens and data obtained can serve the purposes of more than one project.

We shall be in communication also with other workers who are dealing with diseases and mortality of marine mammals in other geographical regions (e.g. J. Mead and R. Brownell, Smithsonian Institution, Washington; S. Ridgway, Naval Undersea Center, San Diego; R. Rausch, Western School of Veterinary Medicine, Saskatoon), and may call on them occasionally for assistance in a "consultant" capacity.

B. Methods

All of the published material available on the subjects of morbidity and mortality, primarily of the species that inhabit the Bering Sea and secondarily of related species, will be reviewed and summarized in the first half of FY 76. This will provide at least a qualitative synthesis of known and potential pathological conditions and causative agents, and will help us to establish a standard protocol for field autopsies by personnel of other projects as well as by our own personnel. Such quantitative data as is available (mostly unpublished), including that from our first summer's standing surveys, also will be reviewed.

The first and second field objectives, i.e. the enumeration and examination of beached carcasses, will be undertaken by all project personnel, working mainly in pairs. Obviously, it is not reasonable to even consider surveillance of the entire Bering Sea coast of Alaska for stranded marine mammals, for that coast is some 6 to 8 thousand miles in length. Instead, taking into account the surface currents and our long-time acquaintance with areas where the number of carcasses tends to be high, we have selected three segments totaling about 600 miles, for intensive surveillance. (We may investigate some others in this first year if the opportunity permits.) First, we have chosen the southern shore of Bristol Bay, since (1) it samples the mortality of some of the most abundant and varied populations as far west as, at least, Unimak Pass, and (2) it is one of the longest stretches in Alaska of low, firm beaches, suitable for landing light aircraft. Our

second choice, St. Lawrence Island, was made because of (1) a long acquaintance with it (Fay - 24 years) and, consequently, (2) an already long series of baseline stranding data on two species, walruses and gray whales, (3) the fact that it is an island and, therefore, lacks some of the large scavengers (bears, eagles) that affect the quality of the stranded carcasses, and (4) its large size and choice location, at the northern (outflow) end of the Bering shelf circulation. Our third choice, the northern shore of Kotzebue Sound, is outside of the Bering Sea proper but an important indicator of its "health", for it is the recipient of much that flows out of it through Bering Strait.

Each of these areas will be surveyed thoroughly, once per year, at a regularly scheduled time in spring or soon after the disappearance of the pack ice. We do not necessarily expect the results of those surveys to be representative of the Alaskan coast as a whole, for this is not intended as an aliquot sampling program. Rather, we have selected these segments of the coast because they sample areas of high abundance and therefore provide more sensitive indeces of the status of the major populations by yielding larger samples of animals per linear unit of coast than would be derived from aliquots.

The third project objective, the selective collections of sick and moribund animals, will be done on a more opportunistic basis, preferably in late winter-early spring or in late summer, depending mainly on the availability of ship logistic support. We envision at least one or two expeditions per year via ship to collect animals that are identifiable as being either sick or injured. These collections

will be our principal source of fresh material from which potential pathogens may be isolated. The first such expedition will be on a Soviet research vessel in the summer of 1975; the second will be on a Coast Guard icebreaker in winter '76; and the third will be on a smaller, ice-worthy ship in the spring of '76. These will be joint expeditions with investigators from other marine mammal and marine bird projects.

A fourth function of this project that is not expressable as an objective is simply to be "on-call" at all times to respond to reports of mass strandings. We would make it widely known to biologists and other interested persons that we are anxious to receive reports of any strandings and, especially, those involving large numbers of animals. Provided that the reports are received soon enough, we would then travel to the site and thoroughly investigate the event.

We expect that the larger, bulkier animals will be best represented in these coastal samples, simply because they are less often consumed entirely by predators or carried off by scavengers. Thus, most of the strandings will probably be of Steller sea lions (Eumetopias jubatus), walruses, belukhas, (Delphinapterus leucas), and gray whales. Our selective collections probably will also be mainly of sea lions, walruses, and belukhas, the first two because they are most easily approached and observed in large numbers, greatly increasing the probability of finding among them some sick and moribund individuals; the belukhas will be available in connection with a non-OCS project of the Alaska Department of Fish and Game. Should other species be

well represented in the stranding record, we shall attempt to collect selectively from their populations as well, provided that we can obtain the permission to do so.

VI. INFORMATION PRODUCTS

The information derived from the stranding surveys can be provided as a tabulation from each of the three coastal segments of the number of carcasses per mile by species, sex, age, and pathological condition. Information from the selective collections and mass stranding will be similar but more detailed for each individual, including weights, measurements, and descriptive pathology, identifications of agents.

VII. DATA OR SAMPLE EXCHANGE INTERFACES

The only information needed from other investigators will be any reports, no matter how fragmentary, of observations of illness, injury, morbidity, or death of marine mammals at anytime, in any part of the Bering Sea.

VIII. SAMPLE ARCHIVAL REQUIREMENTS

No archiving required.

IX. SCHEDULE

10-30 June 75 -- Stranding survey, south shore Bristol Bay and acquisition of material from belukhas (Fay & Shults)

| | | |
|---|---|---|
| 20 June-10 July 75 | -- | Stranding survey, St. Lawrence Island (Fay) |
| 10-30 July 75 | -- | Stranding survey, north shore Kotzebue Sound (Dieterich & Shults) |
| Aug-Sept 75 | -- | Selective collections of walruses, from Soviet vessel (Fay) |
| | -- | Processing of stranding materials and data (Shults) |
| Oct-Nov 75 | -- | Probable mass stranding of whales, walruses (Staff) |
| Feb-March 76 | -- | Selective collections of sea lions (Unimak Pass or Bogoslov) and walruses (Pack ice) from icebreaker (Fay & Shults) interface w/other OCS, FWS, ADF & G projects |
| April-May 76 | -- | Selective collections of seals, sea lions, walruses from iceworthy ship (Shults & consultant) interface w/other OCS, FWS, ADF & G projects |
| 10-30 June 76 | -- | Stranding survey, so. shore Bristol Bay (Dieterich & Shults) |
| 20 June-10 July 76 | -- | Stranding Survey, St. Lawrence Island (Fay & consultant) |
| 10-30 July 76 | -- | Stranding survey, Kotzebue Sound (Fay & Shults) |
| 1 Aug-30 Sept 76 | -- | Processing of stranding material, data (Shults) |
| | -- | Analysis, synthesis, delivery of results (Fay, Dieterich) |

X. EQUIPMENT REQUIREMENTS

No special equipment required.

XI. LOGISTIC REQUIREMENTS

10-30 June -- Approximately 30 hours flying time of a small, single-engined aircraft (Supercub-

10-30 June -- Approximately 30 hours flying time of a small, single-engined aircraft (Supercub-type) for transportation, re-supply, and retrieval of collected materials during Bristol Bay stranding survey. Preferably, based at Port Heiden, Port Moller, or Cold Bay.

10-30 July 75 -- Same. Kotzebue Sound stranding survey. Based in Kotzebue

Feb-March 76 -- Coast Gurad Icebreaker, Bering Sea, 4 to 6 weeks, coordinated with other bird, mamma mammal projects; accomodations for 2 to 3 personnel; exclusive use of one laboratory for dissection and preparation of tissues; small boat w/outboard engine for selective collections of sick and moribund sea lions, walruses.

April-May 76 -- Iceworthy research ship, Bering Sea, 4 week weeks, coordinated with other marine mammal-bird projects; accommodations for 2 or 3 personnel; use of one lab for dissection and preparation of tissues; small boat w/outboard engine for selective collections of sick and moribund seals, sea lions, walruses.

10-30 June 76 -- As above, for June 75

10-30 July 76 -- As above, for July 75

The University of Alaska probably could arrange for the samll aircraft time (if funding for this is provided: estimated $60/hr), but the ship time must be arranged by NOAA.

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July 18, 1975

WORK STATEMENT (Research Unit #229)

Title: Biology of the harbor seal, *Phoca vitulina richardi* (OCS proposal No. 229).

Principal Investigator: Kenneth W. Pitcher
Alaska Department of Fish and Game
333 Raspberry Road
Anchorage, Alaska 99502
333-0541

Geographic Area and Inclusion Dates

Gulf of Alaska
July 1, 1975 to September 30, 1976.

Cost Summary

| FY 75 | FY 76 |
|---|---|
| None | 65,000 |

Proposed Research

A. Background and Objectives

The land breeding harbor seal, *Phoca vitulina richardi*, is the most abundant marine mammal in the coastal areas of the Gulf of Alaska. There is virtually no area along the Gulf Coast where harbor seals are not found and remarkably large concentrations occur in certain areas e.g. Icy Bay, the Copper River Delta and Tugidak Island. Basic information on ecology, life history, population dynamics and trophic relationships is incomplete.

This proposal deals basically with two important phases of harbor seal biology: (1) Food habits and place of the harbor seal in the food web, and (2) reproductive biology with emphasis on population productivity. Maximum use of collected animals will be made with ancillary data collected on a number of phases of harbor seal biology including; growth and development both pre and postnatal, disease and parasite loads, heavy metal and pesticide loads, population composition, segregation, behavior and use of critical habitat.

This proposal is similar to a harbor seal project now underway in the Prince William Sound area which is funded by the Marine Mammal Commission. The basic research techniques have been developed and are now being used. Expansion of the program into the Gulf of Alaska would greatly increase knowledge of the biology of harbor seals.

Study Objectives

1. To investigate population productivity of the harbor seal in t Gulf of Alaska with emphasis on determining age of sexual matu age specific birth rates, age structure of the population and survival rates for various sex and age classes (Task A-3).

2. To determine food habits of the harbor seal in the Gulf of Alaska with emphasis on variation with season and habitat type. An effort will be made to relate food habits with prey abundance and distribution (Task A-3).

B. Methods

Harbor seals will be collected from designated areas periodically throughout the year. The collecting program will be closely coordinated with that of project 243 (sea lions).

Studies on population productivity will be based on the analysis of reproductive tracts from collected animals. By the use of standard techniques (Bishop 1968, Bigg 1969 and numerous others) at least partial reproductive histories of individual animals can be reconstructe By combining this with age determination techniques (Klevezal and Kleinenberg 1967) a number of reproductive parameters will be established including; pregnancy rates, age specific birth rates, age of sexual maturity, reproductive duration and frequency of breeding.

Stomachs and intestinal tracts from collected seals will be analyzed for identification, volume and occurrence frequency of prey species. Prey species will be identified from external characteristics when possible. Otoliths and other skeletal parts of diagnostic value will be used when necessary. A reference collection of prey species is being compiled in conjunction with a harbor seal project. The Department has in-house capability for the identification of piceform food items resulting from extensive and continuing fisheries investigations. Invertebrate identification is more of a problem. Invertebrate remains would have to be sent to appropriate experts for identification. However, the seriousness of this problem is perhaps not very great because seals in many areas are essentially piciverous, although occasionally significant proportions of invertebrates are consumed.

Collected animals will be from specific areas and time periods to determine if variations occur with season and habitat. Daily feeding patterns will be determined by occurrence of full and empty stomachs. Whether seasonal fasting occurs such as during the breeding season will be determined.

All collected animals will be measured and weighed to establish growth rates and assist in calculations of biomass. Parasite and disease specimens will be routinely collected and sent to the Department pathologist. Tissue samples will be collected for analysis of environmental contaminants on either a cooperative or contractual basis.

While no satisfactory census technique has been found for land breeding harbor seals we will be able to monitor seasonal changes in distribution and abundance and delineate pupping areas by observations made in conjunction with the collecting program and projects 240 and 243. By recording specific times and locations of collection we will be able to determine if any form of segregation by sex and age class occurs.

From these investigations we plan to compile baseline data on reproductive rates, food habits, trophic relationships, growth and environmental contaminant loads.

Information Products

Data from collected seals will be recorded in a standard format which will probably be the same as that for projects 230, 232 and 243. A separate file will be created for each animal and data will be entered as the analysis of each sample is completed. Data will include an accession number, date, location, sex, body measurements, age, reproductive status, stomach contents, etc.

Data or Sample Exchange Interfaces

Sightings of marine mammals made during collecting trips will be sent directly to investigators of projects 240, 243 and 68.

There will be an opportunity to collect samples for other projects. These would include such things as tissue samples for monitoring levels of environmental contaminants. At this time we do not know who will be conducting such studies, but before the project begins we will arrange a procedure for providing the proper investigators with material they desire.

Sample Archival Requirements

None

The number of seals to be collected will be determined by hunting success but will probably be about 200 animals collected in groups of about 25 at various times throughout the year. A file for each animal will be created and submitted to the archives shortly after collection. The initial entry will include the date, location, sex and body measurements. Subsequent entries of reproductive status, age, stomach contents, etc. will be made as specimen material is processed and analysed.

Schedule

Collecting trips will be conducted at intervals throughout the entire year. Whenever possible these trips will be combined with those of project #243. The exact timing of trips will be determined in part by data collected on previous trips and by manpower commitments to other elements of projects 240 and 243.

Equipment Requirements

1 85HP outboard motor.

This motor will be mounted on a boat owned by the Alaska Department of Fish and Game and used for collection of seals throughout the year.

All other major equipment will be either provided by the Alaska Department of Fish and Game or will be purchased under the budget for project #243.

Logistic Requirements

Thirty days small vessel charter (50-80 feet). Periodically throughout the study period.

We plan to closely coordinate this vessel time with that of the sea lion collecting program (proposal 243). (See comments under logistic requirements of proposal 243).

This vessel use will generally not be compatible with that of projects other than 243 but we will make observations that will provide ground truth for sea otter surveys (proposal 240) and provide sightings of other marine mammals for proposal 68. It is possible that some sea bird work might be accomplished on some trips. We will coordinate this with U.S.F.W.S., A.D.F.&G. and other interested personnel whenever possible. We are capable of arranging this support ourselves.

July 18, 1975

WORK STATEMENT (Research Unit #230)

I. Title: The natural history and ecology of the bearded seal, Erignathus barbatus, and the ringed seal, Phoca (Pusa) hispida.

II. Principal Investigator:

John J. Burns
Marine Mammal Biologist
Alaska Department of Fish and Game
1300 College Road
Fairbanks, Alaska 99701

III. Geographic Areas and Inclusive Dates:

Bering Sea and Beaufort Sea. July 1, 1975 through September 30, 1976. Field work in the Beaufort Sea area (including northern Chukchi Sea) is tentatively scheduled for July, August and September 1975 and July-August 1976. Field work in Bering Sea will be during the period October 1975 through June 1976. Field activities will be intermittent (i.e. several sampling periods throughout the duration of this project).

IV. Cost Summary:

| FY 1975 through June 30, 1975 | FY 1976 July 1, 1975-September 30, 1976 | |
|---|---|---|
| -0- | 1) Exclusive of logistics | $99,041 |
| | 2) Logistics | 28,000 |
| | Total | $127,041 |

V. Proposed Research:

A. Background and objectives

Bearded and ringed seals constitute two of the five pinniped species associated with the ice dominated habitat of the Bering, Chukchi and Beaufort Seas. By virtue of numbers and distribution they are of great significance to coastal residents of northern Alaska and Siberia; providing reliable sources of food and usable byproducts. Their importance as significant, functioning elements of the marine environment is not adequately known. Both species occur throughout the seasonally ice covered regions. However, differences in habitat requirements (including food habits) result in an ecological partitioning of the marine system in question. Proposed OCS lease areas in the Bering and Beaufort Seas fall directly within the habitat of these two species.

Primary emphasis of the proposed ecological studies respond to tasks A-1, A-2 and A-3. Information required for accomplishment of objectives A-6, and A-31 will also be obtained. In our opinion, this proposed study (as well as many others) are required in order to eventually achieve objective E-1.

A considerable amount of general background information concerning bearded and ringed seals is presently available. Almost all of this information relates to general understanding of aspects such as reproduction, age and growth, gross physical characteristics, general seasonal movements, general distribution and food habits.

However, the knowledge presently available remains inadequate for purposes of understanding the dynamic processes of these two species, their impact on and role in the northern marine environment and the probable effects of disturbance both to the species themselves and the environment on which they depend.

Information required to meet the task objectives include, but are not limited to, such things as natality, mortality, population size, population structure, trophic relationships, detailed understanding of factors determining density, distribution, seasonal movements, critical habitat requirements, relationship to ice habitats, behavior and other biological processes. Historical events indicate that marine mammals, as intelligent, irritable (in the physiological sense) and ecologically specialized organisms have almost always been adversely affected by the activities of man. The proposed exploitation of outer continental shelf resources poses the real threat of habitat alteration. Adverse impacts can be lessened if there is an adequate understanding of the ecosystem and its component parts and the types of pertubation that can be anticipated.

The ecological study proposed here is one of moderate duration which would require about five years to complete. During fiscal year 1976 the following can be accomplished and reported on by September 30, 1976.

1. Summarization and evaluation of existing literature and available unpublished data on reproduction, distribution, abundance, food habits and human dependence on bearded and ringed seals in the target areas.
2. Acquisition of large amounts of specimen material required for an understanding of food habits in these two species.
3. Identification of the major food items utilized by ringed and bearded seals in the Beaufort Sea.
4. Initial assessment of regional differences in density and distribution of ringed and bearded seals in relation to geographic areas and, to a lesser extent, in relation to major habitat conditions.
5. Determination of population structure of bearded and ringed seals as indicated by composition of harvest taken by Eskimo subsistence hunters.
6. Acquisition of additional data on productivity and fetal growth rates.
7. Acquisition of additional information on seasonal migrations.

B. Methods:

The summarization of existing literature and available unpublished data will be accomplished in the traditional manner including abstracting pertinent papers and reports, analyzing data already in hand and preparing pertinent reports relating to bearded and ringed seals.

This project is dependent upon a sampling program which will continue, intermittently, throughout the year involving the acquisition of biological specimens for laboratory analysis and field observation of undisturbed seals. In anticipation of project approval a major sampling program is presently underway at Eskimo

hunting sites in the Yukon-Kuskokwim region, St. Lawrence Island and Bering Strait (funded by the Alaska Department of Fish and Game). The sampling strategy of proposed work involves acquisition of necessary specimens from coastal Eskimo settlements in the Bering Sea (November through June) and the Beaufort Sea (July through September). This will be augmented by shipboard work in both seas, on a time schedule yet to be arranged. Shipboard and aircraft surveys will provide the major source of data on geographical distribuiton and density of bearded and ringed seals. Measures of sampling adequacy include the number, sex and age of seals autopsied and the aerial coverage of shipboard and aircraft surveys. Sampling variance, relative to ecological aspects of this study cannot be adequately addressed at this time because of uncertainties with respect to potential success of the sampling program in Eskimo villages, nor the unknown status of adequate research vessels.

The decision as to which species of marine mammals are to be studied in this project has obviously been reached. They include bearded and ringed seals. These target species, have been chosen based upon criteria including timeliness, feasibility and applicability to OCS requirements. Other marine mammal species of the region are either currently subjects of investigation (i.e. walrus, spotted seal, bowhead whale) or offer a lower probability of success (i.e. ribbon seal and grey whale). No marine mammal species will be excluded from certain kinds of analyses such as observations of species distribution. However, no major effort will be made to process biological specimens from other than bearded or ringed seals. Time, money and manpower do not permit it.

Methods of analysis during the first project year will be as follows:

1. Food habits of bearded and ringed seals. The major effort will be on the acquisition of adequate samples. As far as possible, preliminary analysis will involve volumetric measurement of total stomach contents, separation and identification of major items, determination of frequency of occurrence and volume of major prey species. Remains of prey species of apparently minor importance or low frequency will be identified at a later date.
2. Assessment of regional differences in seal density and distribution will be accomplished through shipboard and aerial survey. These data, so far as possible, will be correlated with biological and physical factors in the survey areas.
3. Population structure of ringed and bearded seals, of necessity, will be determined through age determination of samples obtained at coastal hunting sites and in the course of shipboard work. Notation of sex will be included with all specimens.
4. Species productivity will be determined through laboratory examination of all female reproductive tracts. Correlation of these data with age of each specimen will provide information on age specific productivity. Fetal growth will be based on size correlated with time when samples are collected.
5. Seasonal migration patterns will be determined through observation at coastal hunting sites, shipboard and aerial survey.

VI. Information Products:

The product of work conducted during the first year of this project will be a report including compilations of results in narrative, tabular and graphic form, depending upon the subject material in question (i.e. distribution maps, life tables, graphs of age composition, narrative of pertinent findings, etc.

VII. Data or Sample Exchange Interfaces:

This proposed project is part of an overall marine mammal research effort involving several institutions and several sources of funding. Institutions include the Alaska Department of Fish and Game, University of Alaska, U. S. Fish and Wildlife Service, National Marine Fisheries Service, Marine Mammal Commission and the U. S. Marine Mammal working Group of the USSR-US Environmental Protection Agreement. The principal investigator is in contact and works directly with scientists of these institutions or agencies. Exchange of information regarding marine mammals continues on a timely basis.

Environmental correlates such as oceanographic and atmospheric data will be obtained through personal contact and presently established channels. Concurrent programs such as sea ice studies will provide data on a timely basis. Some time lag is anticipated in acquiring base line data on such things as primary productivity, oceanographic characteristics, results of studies of benthos and pelagic fishes as these data must first be acquired, interpreted and reported before they are available for the study.

The products of this research will be required by resource managers, persons involved in the preparation and evaluation of environmental impact statements and persons involved in the decision making processes relating to when, where and how offshore development is to proceed. It is also anticipated that information will have intrinsic scientific value as well as use in the construction of ecological models.

VIII. Sample Archival Requirements:

It is anticipated that no material, other than reports and publications will be archived. Important biological specimens are presently turned over to museums for use by other investigators.

IX. Schedule

As stated previously, acquisition of specimens from bearded and ringed seals is presently underway (funded by ADF&G), in an attempt to insure that adequate material will be available to meet these project objectives. The overall anticipated schedule, starting July 1, 1975, is as follows:

Field work from coastal hunting sites

A. Bering Sea
   1) April, May, June 1975 (funded by ADF&G)
   2) December 1975, St. Lawrence Island
   3) September-May, Norton Sound
   4) April, May, June 1976 - Kuskokwim Region and Bering Strait

B. Beaufort (and northern Chukchi Sea)
   1) August, September, October 1975 (funded in part by ADF&G) Barrow and Barter Island
   2) June, July 1976 - Barrow and Wainwright

Field work from research vessels (no schedule presently available) Request the following, pending compatability with other projects.

A. Bering Sea
   1) Two months ship time in the period April through June 1976 (earlier if the above is not possible) Type - Ice reinforced i.e. Hero or icebreaker suitable for in-ice work.
   2) One month ship time in northern Chukchi or Beaufort Sea, September 1975. Type - Ice reinforced i.e. Hero or icebreaker. Must be available for marine mammal research in the ice edge.
   3) Same as (2) above but in August or September 1976.

Aerial Assessment

The use of helicopter surveys (or suitable fixed-wing aircraft) will be intermittent, mainly during the period April-July 1976.

Major interfaces will be among all compatible programs which can be simultaneously accommodated on research vessels, shared use of field facilities and the acquisition of "ground truth data" for other projects such as sea ice studies. As part of a much larger marine mammal research effort, many opportunities exist for the acquisition of corroborative data and the sharing of facilities.

X. Equipment Requirements

Most of the specialized equipment will be provided by ADF&G. The major exception is a snow machine, to be purchased with project funds.

XI. Logistic Requirements

Indicated under section IX (above) relating to scheduling of research vessels and aircraft support.

ADF&G will arrange for all lodging, special facilities and specialized logistic support although requested project funds will be used to cover costs (i.e. use of facilities at NARL and in coastal villages).

XII. Cost

See attached budget.

231R,

WORK STATEMENT

I. Title: An aerial census of spotted seals, Phoca vitulina largha.

II. Principal Investigator: John J. Burns
Marine Mammal Biologist
Alaska Department of Fish and Game
1300 College Road
Fairbanks, AK 99701

III. Geographic Areas and Inclusive Dates:

Ice front, Bering Sea from Bristol Bay to the territorial waters of the USSR. Aerial surveys will be undertaken during April 1976 and results reported by September 30, 1976. It should be noted that work planned for April 1975 was not initiated due to problems of funding and logistic requirements.

IV. Cost Summary:

| FY 1975 through June 30, 1975 | FY 1976 July 1, 1975-September 30, 1976 | |
|---|---|---|
| -0- | 1) Exclusive of Logistics | $17,997 |
| too late to initiate work during FY 1975 | 2) Logistics | 48,000 |
| | Total | $65,997 |

V. Proposed Research:

A. Background and Objectives

Spotted seals are one of five major pinniped species associated with the ice dominated habitat of the Bering Sea. Studies of the natural history of this species are presently in progress. However, adequate assessment of the spotted seal population has, so far, not been attempted. This project, directed at such an assessment, responds to tasks A-1, A-2, and A-6.

To date, adequate assessment of the population levels of phocid seals in the Bering Sea has not been achieved. There have been many problems the most important of which include cost, remoteness of the regions in which seals occur, inadequate knowledge of species life history, ecology and seasonal spatial distribution. Recent and continuing studies of spotted seals, Phoca vitulina largha, have revealed that these seals are concentrated during the periods of birth and nuture of pups in the edge zone of the seasonal pack ice. These seals pair prior to birth of the pup and remain in pairs through the pupping season. Several pairs with pups may be found in the same vicinity, but they are rarely closer than 0.25 kilometer to each other.

Ship expeditions in 1968, 1971 and 1972 indicate that adult pairs with pups spend a great deal of time on the ice where they are visible, and all pairs observed and closely checked invariably had a pup. From the standpoint of the presence of these seals on top of the ice, it appears that weather conditions have less influence than on seals not accompanied by pups (i.e. primarily sub-adults).

Therefore, within the restricted period between birth and weaning of pups it appears that a census of adults and pups can be accomplished. Additionally, the geographical regions of seal concentrations can be delineated and the affinity for particular conditions within the ice front determined. The objective of this project is to undertake such an assessment.

Supporting programs greatly enhance the probability of estimating the total population of largha seals within specific areas. These programs include the ERTS satellite program which is providing imagry suitable for determining the areal extent of particular ice types, and the spotted seal life history study (funded by ADF&G and Alaska Sea Grant) which will provide information on age structure of the population (i.e. the proportion of sub-adults and non-breeding adults which would likely not be observed during aerial surveys at this time of the year).

B. Methods:

As indicated above, ongoing life history studies together with information obtained through shipboard surveys in restricted areas of the ice front indicate a high probability of success with respect to population assessment of this important species. Previous information from these surveys will be incorporated into the design of the aircraft surveys contemplated. All available published and unpublished data (comparatively limited) will be reviewed and summarized.

An aerial census of spotted seals will be accomplished by survey flights over the appropriate regions of sea ice, initially determined by analysis of ice reconnaissance photographs. As many survey flights as possible will be accomplished during the period 5 April to 30 April 1976. Replicate counts will be accomplished during this period as time and weather conditions permit. Ice conditions and the extent of different ice zones will be determined by both aerial survey and ERTS satellite photography. Marine weather conditions can be obtained from ice breakers in Bering Sea during time of the surveys. Our survey procedures require a minimum sample coverage of 20 percent of the ice front. Currently available navigational equipment will provide for pinpoint location and the ability to survey predetermined tracks.

This assessment effort will be directed specifically at spottted seals although the distribution of all other marine mammal species encountered will be recorded and reported on. Statistical analysis of survey results will be accomplished employing facilities at the University of Alaska, by the principal and co-principal investigators, (one of whom is a biometrician) and a completion report prepared. It should be pointed out that the survey aircraft scheduled for use during April 1975 was unavailable due to mechanical difficulties. No suitable alternate aircraft was (or apparently will be) available.

VI. Information Products:

The information product will be a final report summarizing results of the surveys and an estimate of the total population of spotted seals in Bering Sea. Distribution maps indicating seal density in relation to ice type and geographical area will be especially useful with regard to OCS planning.

VII. Data or Sample Exchange Interfaces:

These proposed projects are part of an overall marine mammal research effort involving several institutions and several sources of funding. Institutions include the Alaska Department of Fish and Game, University of Alaska, U. S. Fish and Wildlife Service, National Marine Fisheries Service, Marine Mammal Commission and the U. S. Marine Mammal Working Group of the USSR-US Environmental Protection Agreement. The principal investigators are in contact and work directly with scientists of these institutions or agencies. Exchange of information regarding marine mammals continues on a timely basis.

Environmental correlates such as oceanographic and atmospheric data will be obtained through personal contact and presently established channels. Concurrent programs such as sea ice studies will provide data on a timely basis. Some time lag is anticipated in acquiring base line data on such things as primary productivity, oceanographic characteristics, results of studies of benthos and pelagic fishes as these data must first be acquired, interpreted and reported before they are available for the study.

The products of this research will be required by resource managers, persons involved in the preparation and evaluation of environmental impact statements and persons involved in the decision making processes relating to when, where and how offshore development is to proceed. It is also anticipated that information will have intrinsic scientific value as well as use in the construction of ecological models.

VIII. Sample Archival Requirements:

No special archival requirements are anticipated.

IX. Schedule:

For reasons stated previously, the scheduling of aircraft surveys is critical. They must be accomplished during the period when new born seal pups are dependent on their mothers. This period is 5 through 30 April, with 15-30 April being the optimal time. Since the relationship of spotted seals to the ice front region of Bering Sea has been generally established, we propose to examine this relationship in detail by correlating seal distribution to that of sea ice conditions as determined through analysis of ERTS imagery and "ground truth" consisting of shipboard work at "ice level" as well as the survey flights themselves.

These surveys will constitute a major effort of the sea ice studies by providing "ground truth" necessary for interpretation of satellite imagery.

X. Equipment Requirements:

Major equipment requirement is for the P2-V survey aircraft or suitable alternate capable of long range, sustained, low level flight. The aircraft must have good forward visibility characteristics, be capable of accommodating aerial photographic equipment and be equipped with suitable navigation equipment.

Flights will be undertaken on every suitable day between 5 and 30 April, until an adequate survey is completed.

XI. Logistics Requirements:

See section X, above.

XII. Cost:

(See attached)

July 18, 1975

WORK STATEMENT (Research Unit #232)

I. Title: Trophic relationships among ice inhabiting phocid seals.

II. Principal Investigator: John J. Burns
Marine Mammals Biologist
Alaska Department of Fish and Game
1300 College Road
Fairbanks, AK 99701

III. Geographic Area and Inclusive Dates:
Bering and Beaufort Seas; July 1, 1975 to September 30, 1976.

IV. Cost Summary:

| FY 1975 through June 30, 1975 | FY 1976 July 1, 1975-September 30, 1976 | |
|---|---|---|
| -0- | 1) Exclusive of logistics | $59,041 |
| | 2) Logistics | 1,000 |
| | Total | $60,041 |

V. Proposed Research:

A. Several important aspects of the comparative biology of ice inhabiting phocids of the Bering, Chukchi and Beaufort Seas are presently inadequately known. These phocids include the ringed seal, Phoca (Pusa) hispida; bearded seal, Erignathus barbatus; ribbon seal Phoca (Histriophoca) fasciata; and spotted seal, Phoca vitulina largha. The range of these seals includes the Beaufort and Chukchi Seas and the seasonally ice covered parts of Bering Sea. Limited information is available about the food habits of these seals in restricted areas during certain periods of the year. However virtually nothing is known about the rate of food consumption or the species composition of prey in relation to spatial or temporal variation in distribution of each seal species. What are the major food items consumed by each seal species in the Bering, Chukchi and Beaufort Seas? How important are alternate prey species? Which of the seal species are specialized with respect to dietary requirements? Which are more generalized? What is the distribution of prey species; of other marine invertebrates and fishes? With respect to food habits, how do seals partition the marine environment in question? What is the impact of seals on prey species? To what extent is man a competitor? How is he a competitor? What are the critical habitats for production of prey species (i.e. Alaska pollock in the St. George Basin, salmon in Bristol Bay)? Will OCS development occur within the critical or important habitat of either the seals or their prey?

It will require a considerable effort to answer these important questions and the proposed project will constitute an initial attempt. This research is directed primarily at tasks A-1, A-2, A-3, A-4, and A-6. However, as a study of trophic relationships it will be essential to synthesize available data concerning the ecology of prey species.

It is planned that by September 30, 1976, all presently available information concerning the food habits of seals in the study area will be summarized. Extensive collections of stomach samples from the four seal species will be obtained, outside of areas from which data is presently available, the major food items identified and reported on. Identifications of food items occuring in comparatively low frequency will have been initiated and, in-so-far-as they are completed, will be reported on. Available information on the natural history of major prey species will be synthesized and reported and a comparison of food habits among the four seal species initiated.

This study will require at least four years to complete as much of the initial field work, especially in off-shore areas, will not be initiated until suitable research vessels are available. A sampling program in coastal areas not previously sampled is presently underway (funded by ADF&G) as an initial contribution to this study.

Since the ultimate objective of this study is an understanding of trophic relationships, it is obvious that a number of related research programs carried out by others will have a bearing on this study. Some will be directly coordinated through working arrangements of principal investigators. Others will provide useful data pending availability of records, reports and publications.

B. Methods:

The summarization of existing literature and available unpublished data will be accomplished in the traditional manner including abstracting pertinent reports, analyzing data presently in hand and reporting on the results of this synthesis.

The proposed study on biology of ringed and bearded seals will provide considerable opportunity for joint field activities and for the acquisition of some necessary specimen material. However, although it may not be readily apparent, this study goes far beyond an analysis of food habits. Knowledge of food habits of these and the other seal species is only the initial step in obtaining an understanding of trophic relationships.

This project is dependent upon a sampling program which will continue, intermittently, throughout the year and involves both "test fishing" and sampling of seal stomachs. Specimens obtained from both will be identified, and the availability of fishes and invertebrates compared to their utilization by the four seal species. The utilization of prey species by seals will be correlated with species of seal, its sex, age, weight and the season and geographical area in which it was taken.

In addition to determining the spectrum of prey items utilized by seals, we will attempt to quantify the frequency of feeding and biomass of food items consumed.

Available information concerning the distribution and abundance of benthidcorganisms will be compiled and compared with information concerning seasonal abundance and distribution of marine mammals, regional bottom stratigraphy, and surface ice conditions in the areas of interest.

Specimens and data necessary for updating life history investigations of all seal species will be obtained when possible, for inclusion in future studies.

This project is especially dependent upon the availability of suitable research vessels capable of working within the ice. We plan to place investigators aboard such vessels at all times when such ships are in the ice of the Bering, Chukchi and Beaufort Seas.

VI. Information Products:

The product of work conducted to 30 September 1976 will be a report including compilation of results in narrative, tabular and graphic form concerning the distribution and relative abundance of prey species important to seals and the utilization of prey by each of the seal species in relation to age, sex, season and geographical area.

VII. Data or Sample Exchange Interfaces:

This project involves a large number of data and sample exchange interfaces. Some will involve little if any difficulty as the principal investigator is in contact and works with marine biologists from the University of Alaska, U. S. Fish and Wildlife Service and marine mammal biologists of the National Marine Fisheries Service. Numerous studies relating to primary productivity, pelagic and demersal fishes, benthos and other marine organisms are planned or currently underway, which will have direct bearing on this one. Arrangements for data and sample exchange have not been made and should be coordinated. This perhaps should be done thorugh the Environmental Data Service.

VIII. Sample Archival Requirements:

This project will produce and require a large amount of comparative specimen material for use as reference. Storage of material during the course of this study will be at facilities of ADF&G and the University of Alaska. Special requirements are for proper preservatives, containers and cabinets.

IX. Schedule:

A seal sampling program is presently underway in the Yukon-Kuskokwim Area, St. Lawrence Island, Norton Sound and Bering Strait (funded by ADF&G and the University of Alaska). The schedule of field activities after July 1 (funded by this project) will be:

Shore based sampling:
- Barrow area - intermittent, throughout FY76
- Bering Strait - Fall and winter 1975-76
- St. Lawrence Island - November 1975
- Yukon-Kuskokwim region - May-June 1976

Ship based sampling:
- Beaufort Sea - August 1975 and August 1976
- Bering Sea - February-June 1976, depending on availability of suitable vessel for work in the ice.

Synthesis of Data:
- Continuous throughout the study period.

X. Equipment Requirements:

No requirements for special equipment beyond that presently available through ADF&G.

XI. Logistics Requirements:

Suitable ice reinforced vessels as indicated in Section IX (above) and a request for three hours of non-compatible helicopter support.

XII. Cost:

See attached budget summary.

July 18, 1975

WORK STATEMENT (Research Unit #240)

Title: Assessment of the distribution and abundance of sea otters along the Kenai Peninsula, Kamishak Bay and the Kodiak Archipelago. (OCS Proposal No. 240)

Principal Investigator Karl Schneider, Research Coordinator
Alaska Department of Fish & Game
333 Raspberry Road Anchorage, Alaska 99502
344-0541

Geographic Area and Inclusive Dates

Gulf of Alaska - Specifically the area from Cape Puget to Kachemak Bay, Kamishak Bay, and the Kodiak Archipelago from the Barren Islands to Chirikof Island.

July 1, 1975 to September 30, 1976

Cost Summary

| FY 75 | FY 76 |
|---|---|
| None | $11,075 |

Proposed Research

A. Background and Objectives

The expansion of sea otter populations has been monitored over the last 20 years by the U. S. Fish and Wildlife Service and the Alaska Department of Fish and Game (Lensink 1960, Kenyon 1969, Schneider unpublished data). In general the pattern of repopulation of Alaskan waters is well understood. In recent years information has been gathered on the effectiveness of survey techniques (Schneider 1971, Estes and Smith 1973) permitting more realistic estimates of sea otter abundance (Alaska Department of Fish & Game 1973).

Most sea otter studies have been concentrated in the Aleutian Islands. Quantitative information on populations bordering the Gulf of Alaska has been extremely limited. The status of these populations has been monitored through a haphazard series of fragmentary surveys and isolated sightings. The Alaska Department of Fish and Game started to fill the need for better data by conducting a series of surveys in Prince William Sound (Pitcher in prep.).

Sea Otters are known to be particularly susceptible to direct exposure to oil on the water's surface. In many areas a catastrophic oil spill would only have short term effects on a sea otter population. However much of the sea otter habitat adjacent to the Gulf of Alaska is either vacant or under-populated. Repopulation of these areas will occur by the expansion of several nucleus populations that are currently concentrated in limited geographical areas. The effects of an oil spill could be considerably greater and of longer duration in these areas.

Sea otters exert a profound influence on nearshore plant and animal communities (Faro 1969, Estes and Palmisano 1974 and others). A knowledge of the history of occupancy of an area by sea otters is necessary for studies of changes in the composition of marine invertebrates that are included in the sea otter's diet. It is assumed that such studies will be initiated under the OCS program.

This proposal is for a simple assessment of sea otter distribution and abundance addressing Task A-2. It would extend the work started in Prince William Sound to the Kenai Peninsula, Kamishak Bay and the Kodiak Archipelago. The primary technique would be a shoreline helicopter survey. However it is anticipated that additional information would be gathered through boat and shore counts if funds for this study can be used in conjunction with those for the proposed Gulf of Alaska sea lion study.

B. Methods

The primary technique will be a helicopter survey. A 5-place jet helicopter (eg. Bell 206A, FH1100, Alouette II) is flown at an altitude of 200 - 400 feet about 200 yards offshore. The contour of the shoreline is followed. Offshore rocks and islets are circled. Airspeed is usually about 80 knots but when concentrations of animals are found, speed is reduced. Two observers and one recorder-observer are used. One observer is seated in the front and the helicopter is always flown so he was on the shore side. The recorder-observer is seated directly behind the front seat observer and helps with observations when not recording. The third observer is in the back, on the offshore side of the aircraft. The pilot also assists in making observations. All observations are called out to the recorder who was equipped with large scale (1:80,000) nautical charts and notebooks in which all data are recorded in a standardized method. In some instances, visual counts are supplemented with photographs to provide a more accurate estimate of numbers. A 35mm camera with 50 or 105mm lens and a medium speed, black and white film is used.

Weather conditions affect the efficiency of marine mammal surveys and any factors which reduce visibility will be detrimental. Kenyon (1969) used the following criteria to subjectively describe sea otter survey conditions.

Excellent - no wind, high overcast (water glassy) and no glare.
Good - light wind (to 6 or 8 knots) and overcast, or no wind (glassy water) but sun glare present.
Fair - light wind to 10 knots and surface glare, or wind 8 to 15 knots and sky overcast.
Poor - winds over 10 knots and glare on water, or wind over 15 knots regardless of sky cover.

Where large areas of shallow water occur, surveying will be done from a twin engine aircraft. The basic technique will be the same but airspeed will be somewhat faster.

We anticipate surveying the area from Cape Puget, where a series of similar surveys made in 1973 and 1974 stopped, to Kachemak Bay from a helicopter chartered in either Anchorage or Kenai. The area from Tuxedni Bay to Hallo Bay will be surveyed by fixed wing aircraft from Anchorage. If a significant change in sea otter numbers since our 1970 survey is apparent we may extend this survey further. The north side of Kodiak Island, Afognak Island, Shuyak Island and the Barren Islands will be surveyed by helicopter chartered in Kodiak. The southern portion of Kodiak out to Chirikof Island will be surveyed by fixed wing aircraft.

While this is primarily a sea otter survey, we will record detailed information on harbor seals, sea lions and whales. This will contribute a great deal of information to marine mammal projects 229, 243 and 68.

Background information on sea otters in these areas is currently being compiled under a NEGOA contract. With the information gathered during this project we should be able to describe the pattern of repopulation and make some predictions about future expansion.

## Literature Cited


Alaska Dept. Fish and Game, 1973. Alaska's wildlife and habitat. 144 + 563 maps.

Estes, J. A. and J. F. Palmisano, 1974. Sea otters: their role in structuring nearshore communities. Science 185:1058-1060.

Estes, J. A. and N. Sm. Smith, 1973. Amchitka bioenvironmental program: Research on the sea otter, Amchitka Island, Alaska. USAEC Res. Dev. Rep. NVO 520-1.

Faro, J. B. 1969. A survey of subtidal sea otter habitat off Point Pinos, California. Unpubl. M. S. Thesis Humbolt State College.

Kenyon, K. W. 1969. The sea otter in the eastern Pacific Ocean. U. S. Fish and Wildl. Serv. North Am. Fauna No. 68. 352 pp.

Lensink, C. J. 1960. Status and distribution of sea otters in Alaska. J. Mammal. 41(2):172-182.

Pitcher, K. W. 1975. Seasonal distribution and abundance of sea otters, sea lions and harbor seals in Prince William Sound, Alaska. Alaska Dept. Fish and Game. Anchorage.

Schneider, K. B. 1971. An evaluation of sea otter survey techniques. Alaska Dept. Fish and Game, Anchorage 21 pp. typewritten.

Information Products

Information will be in the form of counts of sea otters observed along shorelines. These counts will be presented graphically on standardized maps.

Data or Sample Exchange Interfaces

Pertinent data may be collected in conjunction with projects 229, 243 and 68. And information collected incidentally during this project may be useful to these projects. The first two projects will be conducted by the same research team. Therefore data exchange is no problem. Exchanges of information with the investigators of project 68 will be accomplished by a direct exchange on their standardized recording forms.

Sample Archival Requirements

None

Data provided for archiving will be presented graphically on standardized maps.

Schedule

Because the timing of sea otter surveys is not critical as long as weather conditions are suitable, we will schedule flights to provide the best information on sea lions (project 243). In turn sea otter numbers, distribution of pups, etc., will be recorded during all phases of work on projects 229 and 243. This will provide ground truth information for evaluating the aerial surveys.

The surveys will probably be conducted in several distinct parts. Because we are attempting to combine losistics and manpower needs with projects 229 and 243 for maximum efficiency, specific dates for the surveys cannot be listed. Counts will be submitted for archiving within 120 days of each survey.

Equipment Requirements

None

Logistic Requirements

25 hr. - helicopter (Bell 206 or FH-1100)
15 hr. - Twin engine aircraft (Grumman Goose, Widgeon, Aero Commander or equivalent)

Timing to be determined by requirements of the sea lion study (proposal 243). This use is not compatible with any projects other than marine mammal projects 229, 243 and 68 as we will occupy all available space on each platform. We recommend direct short term charter of local aircraft to reduce standby and deadhead costs. See comments under Logistic Requirements in proposal 243 (Sea lions). We are capable of arranging this support and prefer to do so.

Cost

Personnel costs to be covered under proposals 229 and 243 or by the Alaska Department of Fish and Game.

| | |
|---|---|
| 25 hours helicopter @250 | $ 6250 |
| 15 hours twin engine aircraft @ 180 | 2700 |
| Per diem and travel | 1125 |
| Total direct costs | $10,075 |
| Indirect costs | |
| (10 % of direct costs) | 1,000 |
| Total request | $11,075 |

July 18, 1975

WORK STATEMENT (Research Unit #241)

Title: Distribution and abundance of sea otters in southwestern Bristol Bay. (OCS Proposal No. 241)

Principal Investigation: Karl B. Schneider, Research Coordinator
Alaska Department of Fish & Game
333 Raspberry Road
Anchorage, Alaska 99502
344-0541

Geographic Area and Inclusive Dates

Bering Sea - Specifically that portion of southwestern Bristol Bay from Egigik to Unimak Pass within about 40 miles of shore.

July 1, 1975 to September 30, 1976

Cost Summary

| FY 75 | FY 76 |
|---|---|
| None | $9,980 |

Proposed Research

A. Background and objectives

A large, and in many respects unique, population of sea otters occupies the shallow waters north of the Alaska Peninsula and Unimak Island. Most populations of sea otters reside close to shore, concentrating in areas with offshore rocks and kelp beds. In contrast otters in this population range widely in offshore waters. While at times they concentrate within a mile of the adjacent sandy beaches, they frequently scatter out to the vicinity of the 40 fathom curve, 30 or more miles from shore.

The range of this population has been monitored fairly closely in recent years. Seasonal sea ice has been found to periodically restrict its northeastward expansion (Schneider 1975).

Because potential range of the population covers over 3000 square miles of open water, traditional survey methods have not been adequate to estimate the size of the population. Kenyon (1969) estimated that the population was over 3,800 in 1965 but more recent information indicates that his survey did not cover the entire range of the population and there has been considerable expansion of the range since that time. In 1970 a total of 2157 sea otters was counted in photographs of

several pods clustered southeast of Amak Island. One of these pods was the largest ever recorded, containing over 1000 sea otters. No pups were visible in the photographs, indicating that all segments of the population were not represented. Crude estimates made from aerial surveys indicate that this population contains on the order of 8,000 to 10,000 sea otters (Alaska Department of Fish and Game 1973). These estimates would not stand up to statistical scrutiny however.

This population appears to be vulnerable to oil spills. It is bounded by the proposed Bristol Bay OCS lease area and by Unimak Pass, a potential hazard area for tankers. The population periodically concentrates making it possible for a small spill to directly kill large numbers of otters. This population appears to be the most likely source of otters that will repopulate the Fox and Krenitzin Islands, the largest area of unpopulated sea otter habitat remaining in Alaska. A severe reduction of the Unimak-Alaska Peninsula population could delay repopulation of these islands for many years.

B. Methods

The objective of this project is to estimate the size of the Bristol Bay sea otter population. It addresses Task A-2. The Final report will summarize existing data and literature and therefore will also address Task A-1.

This proposal is to conduct a systematic aerial count of sea otters north of the Alaska Peninsula and Unimak Island to estimate the size of the sea otter population. The area would be stratified by sea otter density and then predetermined transects would be flown with a multiengine aircraft. Because of the similarity between this technique and that used for sea bird surveys, an attempt would be made to coordinate the flights with those surveys. This survey will provide information applicable to proposal 67. We will work closely with NMFS personnel to insure maximum benefits, however actual design of the survey must be dictated by the needs of this project.

## Literature Cited

Alaska Dept. Fish and Game 1973. Alaska's Wildlife and Habitat. 144 pp + 563 maps.

Kenyon, K. W. 1969. The sea otter in the eastern Pacific Ocean. U. S. Fish and Wildl. Serv. N. Amer. Fauna No. 68. 352 pp.

Schneider K. B. 1975. The effects of sea ice on sea otters (*Enhydra lutris*) J. Mammal. 56(1): 91-101.

Information Products

Information will be in the form of counts of sea otter numbers along prearranged transects. These counts will be statistically expanded to estimate the number of sea otters inhabiting the entire area.

Data or Sample Exchange Interfaces

No data are needed from other researchers. Our data may be of some value to proposal No. 67 and will be sent directly to C. Fiscus.

Sample Archival Requirements

None

Data provided for archiving will probably consist of numbers of sea otters counted tabulated with date and location (latitude and longitude).

Schedule

The actual work should not take more than one week. Scheduling is not critical however the chances of good weather are better in summer. Specific dates will depend on aircraft availability and commitment to other projects.

All data will be delivered at one time within 120 days after completion of the survey.

Equipment Requirements

None

Logistic Requirements

15 hours multiengine aircraft (P2V or equivalent).

This project is not completely compatible with any other. It is anticipated that it can be done in conjunction with sea bird surveys however. It is assumed that the aircraft would be in the area for bird surveys and that stratification could be accomplished during flights designed for sea birds. The above hours are for the sea otter census itself and would be required in addition to those needed for bird surveys. Any extra observation seats would be made available to other projects.

Cost

Personnel costs to be carried under project 243 and by the Alaska Department of Fish and Game.

| | |
|---|---|
| 15 hours P2V or equivalent (@600) | $9,000 |
| Per Diem | 980 |
| Total | $9,980 |

July 18, 1975

WORK STATEMENT (Research Unit #243)

Title: Population assessment, ecology and trophic relationships of Steller sea lions in the Gulf of Alaska. (OCS proposal 243)

Principal Investigators: Karl B. Schneider, Research Coordinator
Kenneth W. Pitcher, Marine Mammal Biologist
333 Raspberry Road
Anchorage, Alaska 99502

Geographic Area and Inclusive Dates

Gulf of Alaska - Survey work will cover all rookeries and hauling areas from Cape Fairweather to Sanak Island. Other phases of the work will be concentrated in the northeastern Gulf of Alaska. July 1, 1975 to September 30, 1976.

Cost Summary

| FY 75 | FY 76 |
|---|---|
| None | 157,100 |

Proposed Research

A. Background and Objectives

Steller sea lions, *Eumetopias jubata*, are abundant and conspicuous mammals along much of the Gulf coast of Alaska. With a population estimated at 50,000 animals (Alaska Department of Fish and Game 1973 and Pitcher in prep.) they are an important component in marine ecosystems of the Gulf. There are at least 45 rookeries and hauling grounds in the area with others probably used on at least a casual basis. While restricted to land for breeding and haul out activities, sea lions are known to be somewhat pelagic in feeding habits (Fiscus and Baines 1966). They have been reported at distances of 70 and 85 miles from land (Kenyon and Rice 1961) and have been seen in many localities offshore in the northern Gulf of Alaska (Fiscus and Baines 1966).

With the exception of the Prince William Sound area, population assessment studies have not been carried out in the Gulf since 1956-1958 (Mathisen and Lopp 1963). Changes in seasonal distribution are only partially known. In general, it appears there is considerable movement from exposed summer rookeries to more sheltered wintering areas. There is no information about the proportions or composition of animals involved in such movements, nor the direction, rate or extent of movement. Large scale movements of Steller sea lions in

Oregon have been noted by Mate (1973). Bartholomew and Boolootian (1960) suggest seasonal migratory movements correlated with age and sex in California. Seasonal movements are known to occur in British Columbia although they are not fully understood (Spalding 1964 and Smith 1972).

Composition of animals using the various rookeries and hauling grounds in the Gulf of Alaska is unknown although some degree of sex and age segregation obviously takes place. A knowledge of the degree of segregation is important so that any localized disturbance or kill of animals can be evaluated in terms of importance to the total population. Data collected from various sea lion rookeries in Prince William Sound suggested that they were not a discrete population but that there might be considerable interchange with other areas, possibly from the large rookeries of the Kenai Peninsula and Kodiak area (Pitcher and Vania 1973).

Adequate information is lacking on reproduction and growth in the Steller sea lion. Data from other species of marine mammals (Sergeant 1966, 1973) suggest that population productivity may be a good indicator of relationship to carrying capacity. Law (1959) showed that seals with plentiful food supplies grew faster and became sexually mature earlier, thus increasing population productivity. There are some indications that reproductive rates of sea lions in Alaska are lower than in other portions of their range (Brooks 1957, Pike and Maxwell 1958 and Thorsteinson and Lensink 1962). Why is this so? Have populations in some areas reached carrying capacity? There is some evidence that this is the case. Recent studies in Prince William Sound indicate that numbers are much the same now as they were 18 years ago (Pitcher in prep.). What are the various biological parameters exhibited by a stable (?) population of marine mammals.

The role of sea lions in the Gulf of Alaska and their impact on the marine system cannot be overlooked. For the sake of general discussion it is useful, using conservative values, to estimate the annual food requirements of these animals. Assuming a population of 50,000 animals (excluding pups), a mean weight of 700 pounds, a daily food intake of 6 percent of body weight (Richardson 1973 and Sergeant 1973) for 300 days per year, sea lions in Gulf waters of Alaska would consume 2,100,000 pounds of food per day, or 630,000,000 pounds per year. Fiscus and Baines (1966) found that the food contained in the stomach of a noncaptive Steller sea lion amounted to 9.4 percent of its body weight. Food habits of sea lions in the Gulf of Alaska remain essentially unknown.

Previous studies of food habits have mostly been incidental in nature and nearly all during summer months (Mathisen, et al. 1962, Spalding 1964, Imler and Sarber 1947, Fiscus and Baines 1966 and Pike 1968).

The importance of establishing trophic relations in the Gulf of Alaska prior to development is evident. With data now being collected in a number of O.C.S.-Gulf of Alaska biological studies it should be possible, with extensive food habit studies, to establish the role of the sea lion in the food web.

Baseline data on heavy metal loads should be established prior to development. Environmental contaminants are concentrated in top level predators such as the sea lion. Tissue samples from sea lions collected during this study would compliment a heavy metal assessment project already in progress.

Research activities are not presently being conducted on sea lions in the Gulf of Alaska. A harbor seal research project concentrating on food habits and reproductive biology has been funded by the Marine Mammal Commission and is scheduled to begin in 1975. The same Department biologists conducting that study will conduct the sea lion research if it is funded. Many of the techniques for food item identification and reproductive analysis are similar and the two studies would compliment each other.

The Department of Fish and Game is a research and management agency. As such, this project would be accorded the support of existing laboratory and field facilities in Cordova, Seward, Homer, Kodiak, Anchorage and Fairbanks. A full time pathologist is on the staff as are several people with considerable experience with a variety of marine mammal species and scientific approaches. Additionally, all biological investigations undertaken by the Department are subject to continuous review of the Department's Program Review Committee; essentially responsible for quality control.

The Department has the capability of undertaking the difficult offshore work necessary for conducting a project of this nature. In house aircraft and vessel support are essential.

Marine mammal programs of ADF&G although independent and traditionally funded from other sources, constitute an integrated part of the Sea Grant marine mammal effort in the state. We contribute to and benefit from mutual, multi-species studies, in the form of logistic support, working facilities, direct supervision of graduate programs, and joint University-State studies. Specific collaborative efforts involve such agencies

and institutions as the U. S. Navy, U. S. Geological Survey, University of Alaska, U. S. Atomic Energy Commission, U. S. Department of Health, Education and Welfare, U. S. Marine Mammal Commission, Sea Grant Program and others.

The Department of Fish and Game has in possession a collecting permit from the U.S. Department of Commerce which allows the taking and marking of Steller sea lions for scientific purposes.

Objectives

To determine numbers and biomass of Steller sea lions in the Gulf of Alaska. To establish sex and age composition of groups of sea lions utilizing the various rookeries and hauling grounds. To determine patterns of animal movement, population identity and population discreteness of sea lions in the Gulf. To determine changes in seasonal distribution (Task A-2).

To investigate population productivity and growth rates of Steller sea lions in the Gulf of Alaska with emphasis on determining; age of sexual maturity, overall birth rates, age specific birth duration of reproductive activity and survival rates for various sex and age classes (Task A-3).

To determine food habits of Steller sea lions in the Gulf of Alaska with emphasis on variation with season and habitat type. An effort will be made to relate food habits with prey abundance and distribution. Effects of sea lion predation on prey populations will be examined (Task A-3).

To incidentally collect information on pathology, environmental contaminant loads, critical habitat and fishery depredations.

B. Methods

Recent procedures for aerial surveys of sea lions have proven quite effective because of the considerable body of information available about sea lion behavior and seasonal and diurnal activity patterns (Orr and Poulter 1967, Sandegren 1970, Mate 1973, Bigg 1973, Fiscus 1969 and Fiscus and Baines 1966). Population assessment data will be collected through the use of hand held, motor driven 35 mm cameras. Helicopters will approach to within 75 yards of the rookeries and hauling grounds at an altitude of 500 feet. Overlapping photographs will be taken of the sea lions. After developing the photographs, a mosaic will be constructed and numbers of animals counted from the photos. Composition data will be collected by classification counts conducted on the rookeries and hauling grounds. Changes in seasonal distribution will be determined by a series of aerial surveys along the Gulf coast. Twin engine, fixed winged aircraft will be used with two observers.

Information on animal movements, dispersal, population discreteness and identity will be gathered in a marking and recovery program. Large number of sea lions will be marked using highly visible hot brands (Smith et. al. 1973). Distinctive brands will be used on each rookery and hauling ground. Recoveries will be made by ground crews who will visit the areas at periodic intervals.

Studies on population productivity will be based on the analysis of reproductive tracts from collected animals. By the use of standard techniques (Bishop 1968, Bigg 1969 and numerous others) at least partial reproductive histories of individual animals can be reconstructed. By combining this with age determination techniques (Klevezal and Kleinenberg 1967) a number of reproductive parameters will be established including; pregnancy rates, age specific birth rates, age of sexual maturity, reproductive duration and frequency of breeding.

Stomachs and intestinal tracts from collected sea lions will be analyzed for identification, volume and occurrence frequency of prey species. Prey species will be identified from external characteristics when possible. Otoliths and other skeletal parts of diagnostic value will be used when necessary. A reference collection of prey species is being compiled in conjunction with a harbor seal project. The Department has in-house capability for the identification of piceform food items resulting from extensive and continuing fisheries investigations. Invertebrate identification is more of a problem. Invertebrate remains would have to be sent to appropriate experts for identification. However, the seriousness of this problem is perhaps not very great because Steller sea lions in many areas are essentially piciverous (Imler and Sarber 1947, Spalding 1964, Fiscus and Baines 1966), although occasionally significant proportions of invertebrates are consumed (Mathisen et al. 1962).

All collected animals will be measured and weighed to establish growth rates. Parasite and disease specimens will be routinely collected and sent to the Department pathologist. Tissue samples will be collected for analysis of environmental contaminants on either a cooperative or contractual basis.

Some of the techniques used in this project will be the same as those proposed for sea lion work in the Bering Sea under marine mammal proposal #20. There is probably no biological reason for separating Bering Sea and Gulf of Alaska sea lion populations. Personnel funded under this proposal anticipate working closely with NMFS and will probably assist in work covered in proposal #20.

Information Products

Information will include numbers of sea lions hauled out on land and incidental sightings in water. Each rookery and hauling ground will be named and its location (latitude and longitude given). Successive counts of sea lions for each area will be entered with the date and time of day so that it will be possible to compare fluctuations in numbers for each hauling ground. Offshore sightings will be recorded in the format to be developed by the National Marine Fisheries Service under project #68.

A standard format for data from collected animals will be developed. This will probably be the same as will be used for projects #229, 230 and 232. Data from each sea lion will include an accession number, date of collection, location, sex, age, body measurements, reproductive status, stomach contents, etc.

Data or Sample Exchange Interfaces

Offshore sightings will be exchanged directly with the investigators on project 68.

There will be an opportunity for collection of samples for other projects from sea lions we collect. These would include such things as tissue samples for monitoring levels of environmental contaminants. At this time we do not know who will be conducting such studies, but before the project begins we will arrange a procedure for providing the proper investigators with material they desire.

Sample Archival Requirements

None

Data to be archived will be entered into a file that we will establish. There should be a minimum of three entries of counts for each of about 50 hauling areas and rookeries. These entries will be submitted periodically throughout the year but the largest series will probably be submitted in August 1976.

The number of sea lions to be collected will be determined by our hunting success but will probably be about 200 animals. A file will be created for each animal and submitted to the archives shortly after collection. The initial entry will include date, location, sex and body measurements, subsequent entries of reproductive status, stomach contents, age, etc., will be made as specimen material is processed and analyzed.

Schedule

Marking of pups will be conducted in July 1975 and July 1976.

A photocensus of rookeries and hauling grounds will be conducted in June 1976. Two other censuses are planned in winter and spring. Other counts and incidental sightings will be conducted throughout the year as the opportunity arises during other activities. Such opportunities should arise in conjunction with projects 229 and 240. Sea lions will be collected throughout the year.

Equipment Requirements

2 motor drive 35mm cameras
1 collecting skiff
Misc. collecting and marking equipment

All of this equipment will be used throughout the year but will be shared with project 229.

Logistic Support:

Helicopter - 80 hours, required intermittently throughout study period.

Twin Engine Aircraft - 15 hours, to be used primarily for transportation to such areas as Middleton Island.

Single Engine Aircraft - 20 hours, required periodically throughout study period.

Vessel Charter - 25 days, 80-90 foot boat with large area of free deck space for storing skiffs and processing sea lions and a good boom arrangement. Many crab boats would be suitable. Needed intermittently throughout the study period.

The nature of the logistic support for this project is such that co-ordination of platform use with other projects except 229 and 240 will be extremely difficult. Our vessel and aircraft use will be broken up into short time periods and may require last minute changes to compensate for changing conditions. Suitable platforms are available for short term charter throughout the study area. It is often possible to travel to the work area, wait for good weather, then charter for a short period of time and accomplish a piece of work. This saves the cost of standby and deadhead time. It also permits the occasional use of state and federal vessels which are less expensive but usually not available for long periods.

In our budgeting we have allowed for coordination of efforts between marine mammal projects 229, 240 and 243 and plan to contribute information to 68. We will maintain contact with personnel involved in sea bird work and provide assistance whenever possible. We expect to make use of all available space on each aircraft and vessel.

In order to make most efficient use of logistic platforms, we must have complete flexibility. Therefore we strongly request that logistic funds be included directly in our budgets for this project and projects 229 and 240 and that no attempt be made to combine the requirements of these projects with those of others.

We are capable of arranging all the above support ourselves and prefer to do so.

WORK STATEMENT (Research Unit 248/249)

I. Title: The relationships of marine mammal distributions, densities and activities to sea ice conditions.
Note: There are two projects: A) Bering Sea; B) Beaufort Sea.

II. Principal Investigators (both projects):

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III. Geographic Areas and Inclusive Dates:

A) Bering Sea - The seasonally ice covered regions within the area bounded in the west by 175°00'W, in the east by the Alaska mainland, in the north by Bering Strait and in the south by the southern edge of sea ice. The studies will continue from 1 May 1975 to September 30, 1976 at all times when sea ice is present.

B) Beaufort Sea (including northern part of Chukchi Sea) bounded in the east by approximately 141°00'W, in the west by 170°00'W, in the north by approximately 74°00'N and in the south by the coast of Alaska. This study will also continue from 1 May 1975 to September 30, 1976.

IV. Cost Summary:

| FY 1975 through June 30, 1975 | | FY 1976 July 1, 1975-September 30, 1976 | |
|---|---|---|---|
| Project - A) | 13,670 | Project - A) | 77,055 |
| B) | 7,152 | B) | 38,168 |

V. Proposed Research:

The proposed studies of the relationships of marine mammals to sea ice conditions respond to tasks A-1, A-2, A-30 and A-31. The actual relationships of ice inhabiting marine mammals to the variety

of ice dominated habitats which exist in the Bering and Beaufort Seas, is not understood. It is generally known that the distribution and activities of mammals in the study areas are related to and broadly in synchrony with the seasonal dynamics of sea ice; that each species occupies a different ecological niche within the ice dominated system; that a variety of ice "habitats" are present; and that the various species "utilize" sea ice in different ways (Burns, J. J., 1970. J. Mammal. 51:445-454). With respect to pinnipeds, sea ice is a solid substrate on which they haul out to rest, molt, mate, bear and suckle their young and which offers the advantages of isolation, space, habitat variety, access to food, transportation, sanitation and shelter (Fay, F. H. 1974. Oceanography of the Bering Sea. Univ. Alaska, Fairbanks).

Ice conditions in the Bering and Beaufort seas probably tend to follow some annually repetitive and predictable patterns to which the biota of those regions have become adapted. Superimposed on those predictable conditions are minor variations (particularly in the extent of ice) imposed by annual differences in weather patterns.

The relationships of marine mammals to sea ice, in almost all investigations to date, have focused attention on the species and its adaptations to the ice. This approach is understandable in that considerably more is known about the form, function and distribution of the animals than about the development and dynamics of sea ice. The dynamic processes of ice formation, movement and distribution have been extremely difficult to study in a broad enough perspective from land, from ships, or even from aircraft, though these have been useful for determining local, short-term conditions. The recent availability of high resolution satellite imagery has provided that greater perspective; one can now obtain broad views of sea ice distribution from which the processes of formation, deformation and movement can be determined. The chronological and spatial distribution of marine mammals can now be related to sea ice characteristics, conceivably to the degree that a predictive model can be developed. A continuing program for obtaining various kinds of "ground truth" will be employed as part of this project.

Preliminary work on the dynamics of sea ice in northern Bering Sea has been undertaken by Shapiro (University of Alaska) and Burns (Alaska Department of Fish and Game), and Muench (University of Alaska) during the past 18 months. The specific objectives of these studies were to evaluate the possibilities of using satellite imagery to examine and describe the dynamic processes of an annual sea ice cycle, regional differences in ice conditions, and physical factors which contribute to these regional differences. It has been demonstrated that ERTS imagery is an ideal tool for examining ice dynamics and in combination with other data sources such as DAPP and NOAA 2/3 imagery, provides repetitive, large scale overviews of the ice covered regions.

The data being acquired from the satellite imagery, particularly ERTS can now be correlated with information about the chronological and spatial distribution of marine mammals.

Project objectives are to determine the extent and distribution of the regularly occuring ice-dominated marine mammal habitats in the Bering and Beaufort seas; to type and describe these habitats; to determine the distribution and densities of marine mammals in these habitats; to determine how the dynamic changes in quality, quantity

and distribution of sea ice relate to major biological events in the lives of marine mammals (e.g. birth, nurture of young, mating, molt and migrations.

Information required to meet these objectives include: 1) a continuing source of satellite data, mainly ERTS imagery, for observation of prevailing conditions and, by comparison over time, as a means of determining short term changes and annual variation. At present, two years of ERTS data are available (August 1972 - August 1974); 2) historical and current information about the ecology, movements, distribution and areal density of the ice associated marine mammals; 3) "ground truth" information with which to verify the interpretation of both the satellite observations and conclusions concerning the relationships of marine mammals and sea ice habitats.

The proposed study is one of moderate duration which will require three to five years to complete. During the remainder of fiscal year 1975 and 1976, the following aspects can be accomplished and reported on by September 30, 1976.

1) Summarization and evaluation of existing literature and available unpublished data concerning relationships of marine mammals to sea ice conditions in the study areas.
2) Development of a preliminary classification of sea ice conditions which is meaningful in terms of marine mammal habitat, and can be determined directly from satellite imagery.
3) Evaluation of the physical and environmental factors prevailing in the Bering and Beaufort Seas which influence the annual occurrence dynamics and extent of these habitats.
4) Preliminary correlation of the chronological and spatial distribution of marine mammals in the study areas to sea ice conditions.

Partially related research in the Beaufort Sea is presently being conducted under the aegis of AIDJEX (mainly on the Polar pack ice), Alaska Sea Grant and the University of Alaska. These projects relate mainly to the physics and mechanics of sea ice. Recent, and/or continuing studies in Bering Sea include the joint US-USSR BESEX program, Sea Grant studies of surface circulation (also proposed a continuing OCS program), parts of the BESMEX program and continuing studies by ADF&G and the University of Alaska. The co-principal investigators of this proposed project are individually (or in some cases collectively) in communication with investigators from all of the above.

B. Methods:

The summarization of existing literature and available unpublished data will be accomplished in the traditional manner including abstracting pertinent papers and reports, analyzing data already in hand and preparing pertinent reports concerning marine mammals in relation to sea ice.

This project is dependent upon a sampling program involving the continuing acquisition and analysis of satellite imagery for characterization of ice habitats; the continuous acquisition of comparative "ground truth" information relative to both sea ice and marine mammals, acquired from Eskimo settlements along the coast; "ground truth"

acquired by shipboard and aircraft transects, away from the coast, to determine the distribution and relative densities of marine mammals under different ice conditions and in different geographical regions.

The shore-based sampling effort will continue throughout the year, mainly relying on personnel stationed at or working in coastal settlements (funded from other sources). Shipboard and aircraft surveys will, for the most part, be collaborative efforts involving a variety of related research programs sharing logistic platforms such as research vessels and large aircraft. Ship support is anticipated during spring 1976 (Bering Sea) and late summer 1976 (Beaufort Sea). Compatible aircraft surveys include the largha seal survey (April 1976, an OCS project) walrus survey (Fall, 1975, FWS project), whale surveys (summer and fall, 1976, OCS projects), and seal biology studies (intermittent, year round, OCS project).

Additionally, an observer can utilize commercial small aircraft flying on a regular, year round basis from Nome to St. Lawrence Island and the Bering Strait region. Such regular low level flights, which coincide with the schedule of ERTS passes in the study area and will provide invaluable data concerning both sea ice conditions and marine mammal observations.

Marine mammal species normally associated with and dependent upon sea ice in the study areas are included in the proposed study. These include the spotted seal, Phoca vitulina largha; ringed seal Phoca (Pusa) hispida; ribbon seal Phoca (Histriophoca) fasciata; bearded seal, Erignathus barbatus; Pacific walrus, Odobenus rosmarus; polar bear, Ursus maritimus; bowhead whale, Balaena mysticetus; and belukha, Delphinapterus leucas.

Analyses of data will include, but are not limited to the registration of recognizable features of pack ice in series of sequential images; density slicing and delineation of recognized ice habitats throughout the study period; preparation of satellite transect mosaics across the study areas; maps of displacement vectors of various ice features important to marine mammals; maps depicting marine mammal distribution and densities in relation to seasonal characteristics of sea ice; maps depicting the times and directions of marine mammal migrations in relation to changes in sea ice conditions; and statistical analyses of relationships between marine mammals and sea ice conditions.

VI. Information Products:

The product of work conducted to 30 September 1976 will be a report including compilation of results in narrative, tabular and graphic form concerning the activities, distribution and movements of marine mammals in relation to features and dynamics of the sea ice cover in the Bering and Beaufort Seas.

VII. Data or Sample Exchange Interfaces:

As indicated in the preceding section on Methods, there are several interfaces with other investigators. ADF&G personnel residing or working coastal stttlements have been informed of our data needs and will cooperate in supplying it. This also applies to a number of colleagues working on specific marine mammal projects for other

institutions and agencies. Mainly, our needs are for observations of mammal movements past coastal sites and results of shipboard or aircraft tracks in the study areas. By mutual agreement these data have been exchanged among cooperating investigators, (indluding Soviet colleagues) in the form of logs of marine mammal sightings, which can be plotted in relation to a number of variables.

VIII. Sample Archival Requirements:

The major archival requirement is for sattelite data. It is anticipated that this requirement will be satisfied through support of such a facility at the University of Alaska.

IX. Schedule:

Acquisition of sattelite imagery - continuous throughout the study period.

Acquisition of observational information from coastal settlements:

Norton Sound, continuous
Barrow, continuous
St. Lawrence Island, spring 1975 and 1976
Bering Strait, spring 1975 and 1976
Nunivak Island-Etalin Strait, spring 1975
Shishmaref, June-July 1975 and 1976
Nooiksuet, July-August 1975 and 1976

Shipboard transects of ice and marine mammals:

Icebreaker, Bering Sea, winter and spring 1976; Beaufort Sea, late summer 1975 and 1976.

Aircraft Surveys:

Commercial aircraft, northern Bering Sea, intermittent throughout seasons of ice presence.

Specific mammal and ice surveys. (cooperative efforts sharing logistic facilities) Bering Sea, spring 1976; Beaufort Sea, spring, summer and fall, 1976.

Preparation of report, August-September 1976

X. Equipment Requirements:

No special equipment requirements. However, it should be understood that we are planning on the compatible use of ships capable of working in the ice and suitable survey aircraft, with the exception of approximately 12 hours of budgeted (this project) aircraft support.

XI. Logistics Requirements:

Most logistics requirements are compatible with other programs. Suitable ships will be utilized at all times they are available.

XII. Cost

See attached budget sheets.

A) Bering Sea
B) Beaufort Sea