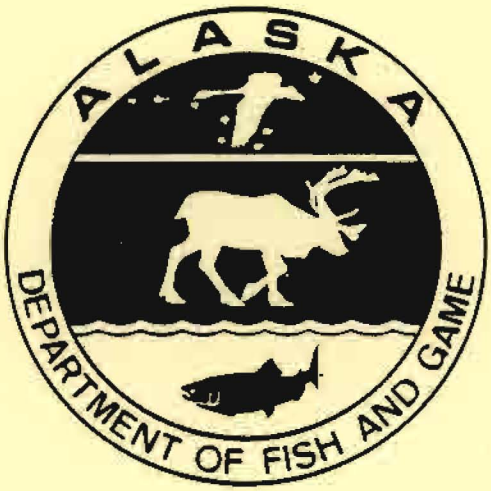
SUSITNA HYDROELECTRIC PROJECT

FINAL REPORT



BIG GAME STUDIES

VOLUME IX BELUKHA WHALE

Donald Calkins

ALASKA DEPARTMENT OF FISH AND GAME
Submitted to the Alaska Power Authority
April 1984

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PREFACE

In early 1980, the Alaska Department of Fish and Game contracted with the Alaska Power Authority to collect information useful in assessing the impacts of the proposed Susitna Hydroelectric Project on moose, caribou, wolf, wolverine, black bear, brown bear and Dall sheep.

The studies were broken into phases which conformed to the anticipated licensing schedule. Phase I studies, January 1, 1980 to June 30, 1982, were intended to provide information needed to support a FERC license application. This included general studies of wildlife populations to determine how each species used the area and identify potential impact mechanisms. Phase II studies began in order to provide additional information during the anticipated 2 to 3 year period between application and final FERC approval of the license. Belukha whales were added to the species being studied. In these annual or final reports, we are narrowing the focus of our studies to evaluate specific impact mechanisms, quantify impacts and evaluate mitigation measures.

This is the second annual report of ongoing Phase II studies. In some cases, objectives of Phase I were continued to provide a more complete data base. Therefore, this report is not intended as a complete assessment of the impacts of the Susitna Hydroelectric Project on the selected wildlife species.

The information and conclusions contained in these reports are incomplete and preliminary in nature and subject to change with further study. Therefore, information contained in these reports is not to be quoted or used in any publication without the written permission of the authors.

The reports are organized into the following 9 volumes:

Volume I.	Big Game Summary Report
Volume II.	Moose - Downstream
Volume III.	Moose - Upstream
Volume IV.	Caribou
Volume V.	Wolf
Volume VI.	Black Bear and Brown Bear
Volume VII.	Wolverine
Volume VIII.	Dall Sheep
Volume IX.	Belukha Whale

SUMMARY

Belukha surveys were flown in upper Cook Inlet between May 17 and August 27, 1982 and April 6 to July 20, 1983. A concentration area was identified nearshore from the mouth of the Little Susitna River to the mouth of the Beluga River. Use of the area increased in late May and lasted through mid-June. It is probable that this concentration was in part associated with calving and breeding although no calves were positively identified because of generally poor viewing conditions. The concentration appeared to involve 200 to 300 animals, however accurate counts were not possible because of, again, poor viewing conditions. The Belukha concentration near the mouth of the Susitna River appeared to coincide with the arrival of large numbers of eulachon which spawned in the lower Susitna River in late May and early June. This run of eulachon was estimated to total several million fish. King salmon are probably not particularly important to this concentration of belukhas although large male belukhas probably do take some king salmon. The only other salmon species from the Susitna River system available in sufficient numbers to be considered significant prey to the belukhas concentrated in late May and early June is the sockeye. No information is presently available which would allow conclusions on belukha predation on salmon smolts from the Susitna River.

Given the present state of our knowledge, we cannot accurately predict impacts on Cook Inlet belukhas from the proposed dams on the Susitna River. It is possible that the overall population could suffer reduction in numbers both directly by alterations in the habitat, particularly the concentration area near the mouth of the Susitna River and indirectly by reduction of available food species.

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INTRODUCTION

The belukha whale (*Delphinapterus leucas*) is a small, toothed whale, which inhabits arctic and sub-arctic waters. As adults, belukhas are all white in coloration, range from 3.1 to 4.4 m in length and weigh 480-1200 kg. Males generally are larger than females. Newborn calves are a dark gray color, shaded with blue or brown. This coloration is gradually lost as the animal approaches the age of maturity.

Belukhas range throughout Cook Inlet, concentrating in the upper Inlet in the spring and summer, and moving to the lower Inlet during the winter. There is some evidence which suggests that during some years some of the belukhas may leave the Inlet entirely and move across the north Gulf of Alaska to as far away as Yakutat Bay (Calkins 1979). In the north Gulf of Alaska, belukhas have been sighted in Shelikof Strait, near Kodiak Island, in Prince William Sound, and in Yakutat Bay (Fiscus, Braham and Mercer 1976; Harrison and Hall 1978; Calkins and Pitcher 1978; Calkins 1979; and Calkins, unpub. data). Some parts of these areas probably had large numbers of belukha, at least seasonally, but now the population appears reduced (Calkins, unpub. data). Recent sightings indicate either these animals range outside of Cook Inlet during summer or more animals exist than we know about.

The Cook Inlet stock of belukha whales was estimated at 300 to 400 animals by Klinkhart (1966). Recent surveys in the Inlet have shown that the population exceeds 400 animals (Calkins unpub. data). However, all surveys of belukhas in Cook Inlet have consisted of aerial counts of shoreline areas. No complete systematic census of Cook Inlet belukhas has been completed, therefore, no accurate estimate of the stock can be made. The best information we presently have is that there are over 400 whales which inhabit Cook Inlet in the summer.

Some evidence exists which suggests that the Cook Inlet stock is genetically isolated from other belukha whale stocks. The next nearest stock of belukhas is the population which inhabits Bristol Bay. We know of no instance where any interchange has taken place between these two stocks although the only true limitation is the distance of miles between. Fay (pers. comm.) suggests that some morphological differentiation has taken place in Cook Inlet. He was able to examine a limited series of skulls from Cook Inlet and compared them to other areas. However, the Cook Inlet sample was too small to conclude that craniological morphology has actually changed in this stock.

Belukhas are known to feed on a broad assortment of fishes and invertebrates in other areas, however no direct information is available on prey selection by belukhas in Cook Inlet. In Bristol Bay, belukhas concentrated on rainbow smelt (*Osmerus mordax*) in May and shifted to downstream migrating salmon smolts by June 1. By late June, the Bristol Bay belukhas were concentrating on adult salmon (Brooks 1954). Other food species utilized by belukhas in Bristol Bay were flounders (*Pleuronectidae*), lamprey (*Lampetra* sp), shrimp (*Crangon* sp.) and sculpins (*Cottidae*) (Brooks 1954). In Escholtz Bay, belukhas ate safron cod (*Eleginus gracilis*), sculpins (*Cottidae*) and small amounts of shrimp (*Crangon* sp.), isopods (*Saduria* sp.), snails (*Polinices* sp.), polycheatas (unidentified) and octopus (*Octopus* sp.) (Seaman *et al*. 1982).

Very little information is available on the belukhas' ability to tolerate perturbations in its environment. We know nearly nothing about the consequence of reducing the food supply or changing the heat budget of the river, however slight these changes might be. We do know that belukhas will abandon areas if the environmental perturbations are great enough as was the case in the St. Lawrence River where belukhas quit using the Manicouagan and Outardes Rivers after they were damned for hydroelectric purposes (Sergent and Brodie 1975).

METHODS

Shoreline aerial surveys of upper Cook Inlet (Fig. 1) were conducted periodically from May 17 through August 27, 1982 and April 26 to July 20, 1983, using single engine aircraft with water landing capability. The surveys were generally flown at an altitude of 50 to 100 meters and approximately 500 meters off-shore from the immediate tide water line. When groups of belukhas were sighted, the altitude was increased to 200 meters and the groups were circled while two observers counted as many belukhas sighted as possible.

Turbid water conditions along with short surface times for the belukhas prevented accurate and complete counts of all belukhas present. The numbers of belukhas counted represents a minimum number of animals which were present at the time of the count. An attempt was made to identify calves in all groups observed by circling and observing at lower altitude.

RESULTS AND DISCUSSION

Belukha surveys are summarized in Table 1 and 2. A total of 9 surveys were flown in 1982 and 5 in 1983. Each survey covered the same general area of upper Cook Inlet shoreline, including all areas north of a line between the North Foreland and Moose Point (Fig. 1). On the June 18th and June 22, 1982 and the July 20, 1983 surveys, the survey area was extended to the East and West Forelands. No neonates were positively identified on any of these surveys due to the turbid water conditions. However, on both the May 17 and the June 4, 1982 surveys, very dark, small belukhas were sighted. These could have been newborn calves although this was not determined because newborn calves and yearlings differ in length by approximately 30 cm (John Burns pers. comm.); determining 30 cm difference between animals from an aircraft at 100 to 200 m altitude and moving at an airspeed of approximately 80 kts with the belukhas in highly turbid water proved to be an impossible task.

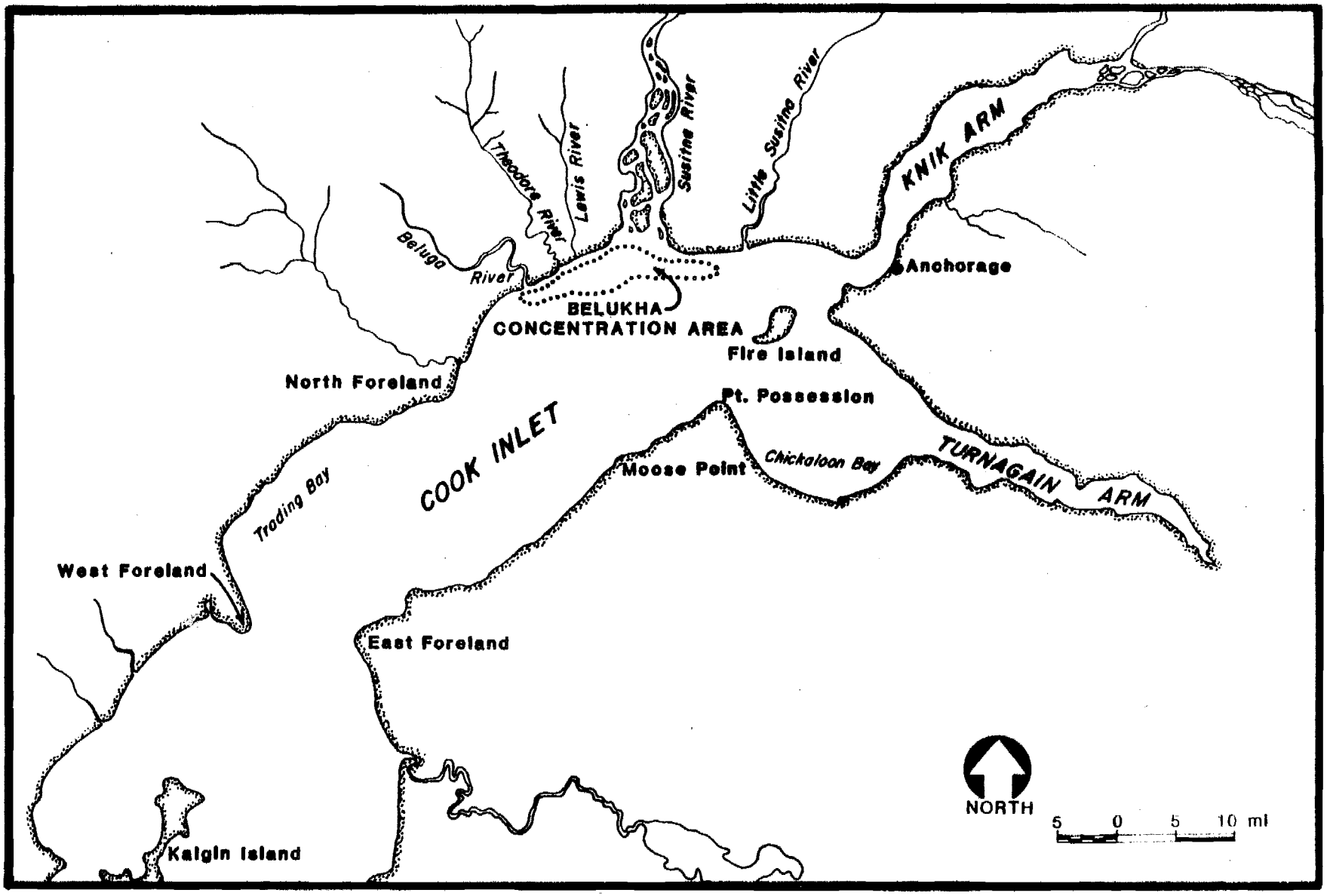

Figure 1. Upper Cook Inlet Belukha study area.

Table 1. Belukha surveys of upper Cook Inlet 17 May 1982 through 27 August 1982.

Date	Number Sighted	Location Sighted
May 17	15	South of Little Susitna R.
	10	North of Beluga R.
	15	W. pt. Fire Island
June 4	150-200	Between Susitna R. and Lewis R.
	100	Lewis R. to Beluga R.
	15	SW side Chickaloon Bay
	20	Chickaloon R. Mouth
June 11	200-300	Lewis R. to Beluga R.
June 18	108	Susitna R. Mouth
	39	Ivan R. to Beluga R.
	50-75	Beluga R. and Mouth
	78	Beluga R. to Tyonek village
	30	Chickaloon Bay
June 22	15	Boulder pt. (N. of Kenai)
	4	Mouth of Susitna R.
	50-75	Lewis to Theodore R.
	40	Beluga R. and Mouth
	25	McArthur R. and Mouth
July 2	46	Susitna R. to Beluga R.
	7	
July 8	7	Beluga R. area
Aug. 5	63	Susitna R. Mouth to Beluga R.
	62	McArthur R. area
	30	Chickaloon Bay
	21	Potter Marsh
Aug. 27	15	Mouth of Beluga R.

Table 2. Belukha surveys of upper Cook Inlet 6 April through 20 July 1983

Date	Number Sighted	Location Sighted
April 6	1	Knik Arm
	1	Mouth of Theodore R.
	4	Mouth of Beluga R.
	4	Chickaloon Bay
April 28	5	Little Susitna R.
	1	W. side Susitna R.
	6	Mouth of Beluga R.
	25	Off Pt. Possession
May 27	173	Mouth of Beluga R.
	83	Mouth of Theodore R.
	6	Chickaloon Bay
June 24	1	Knik Arm N. of Anch.
	4	Off mouth of Theodore R.
	1	Off Pt. Possession
	7	S.W. of Fire Island
July 20	20	S.E. Susitna R. mouth
	16	Lewis R. mouth
	10	Theodore R. mouth
	10	Beluga R. mouth
	20	3 mi E. of West Foreland
	100	Off E. Foreland

During the 1982 surveys, one area was identified as a concentration area. This area was just offshore from the water line and extended from the mouth of the Little Susitna River to just south of the mouth of the Beluga River (Fig. 1). Figures 2 through 4 show groups of belukhas larger than ten which were recorded between 1974 through 1979 for May, June and July (numbers in circles indicate size and location of groups). The general pattern shows few large groups in the upper inlet during May; a concentration of groups from the mouth of the Susitna River to Beluga River area during June; and groups scattered throughout the upper inlet during July.

Use of this area appears to begin with a build-up of belukhas near the mouths of the Susitna River, the Lewis River and the Beluga River about mid-May which lasts through about mid-June.

The belukhas had begun to concentrate in the area in 1982 by the first survey, May 17 (Table 1). In 1983, large numbers were not observed until the May 27 survey (Table 2). The concentration had broken up, and belukhas were sighted throughout the Inlet by June 22 in 1982. This was also the case in 1983, when few belukhas were sighted in the concentration area by June 24.

There are several possible explanations which are immediately apparent for belukhas concentrating in the area near the mouths of the rivers in the northwest part of Cook Inlet. Concentrations in areas of river mouths in the spring is common to many belukha whale populations. Sergent and Brodie (1975) considered the primary reason for whales gathering at this time of year was calving and breeding while Fraker *et al*. (1978) felt that taking advantage of warmer estuarine temperatures in the spring was important to all segments of a belukha population, not just the reproductive age classes. They hypothesized that the thermal advantage to all age classes was the primary reason for spring

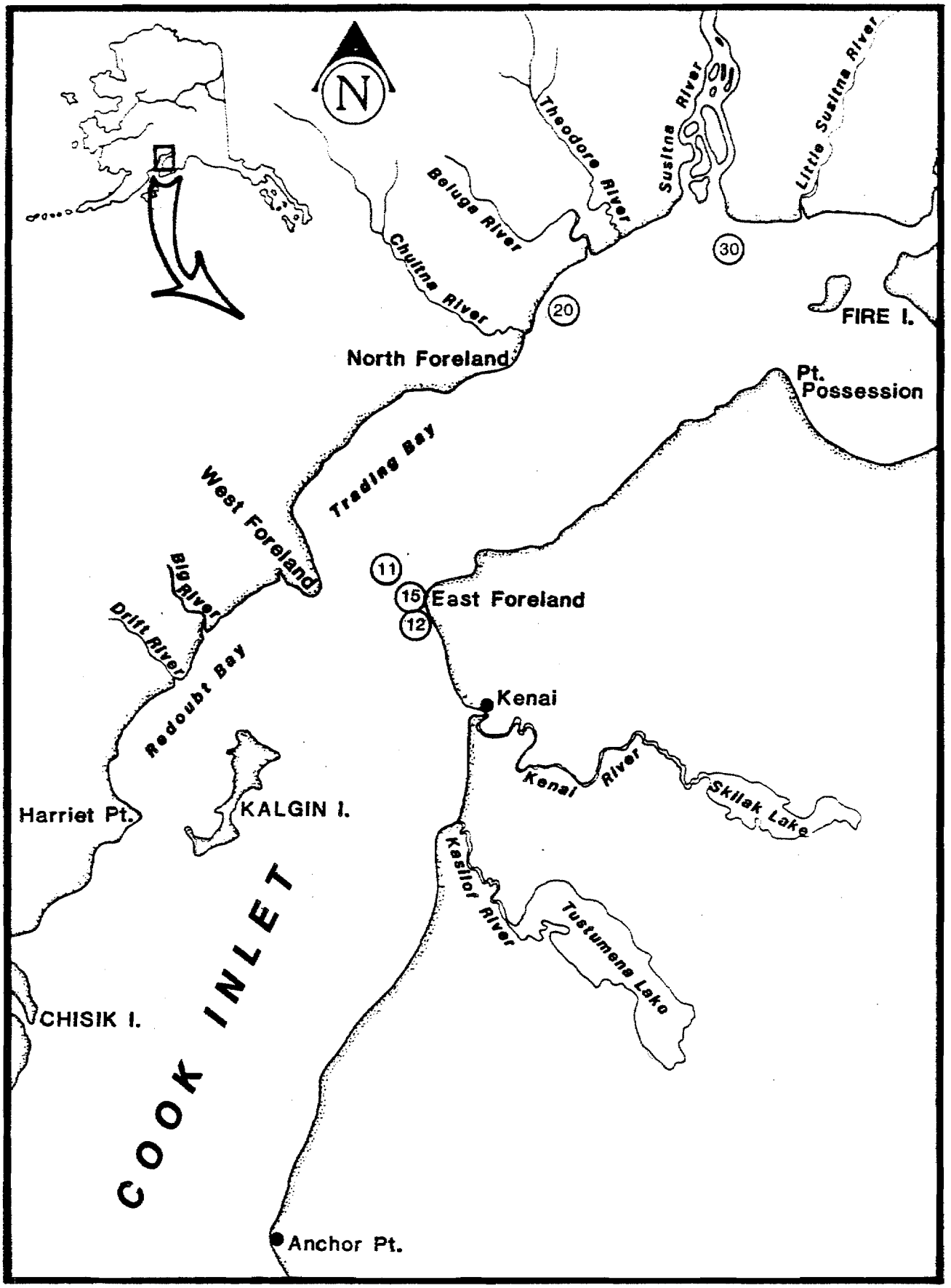

Figure 2. Locations in Upper Cook Inlet where beluka whales were sighted in groups of 10 or more for the month of May 1974 - 1979.

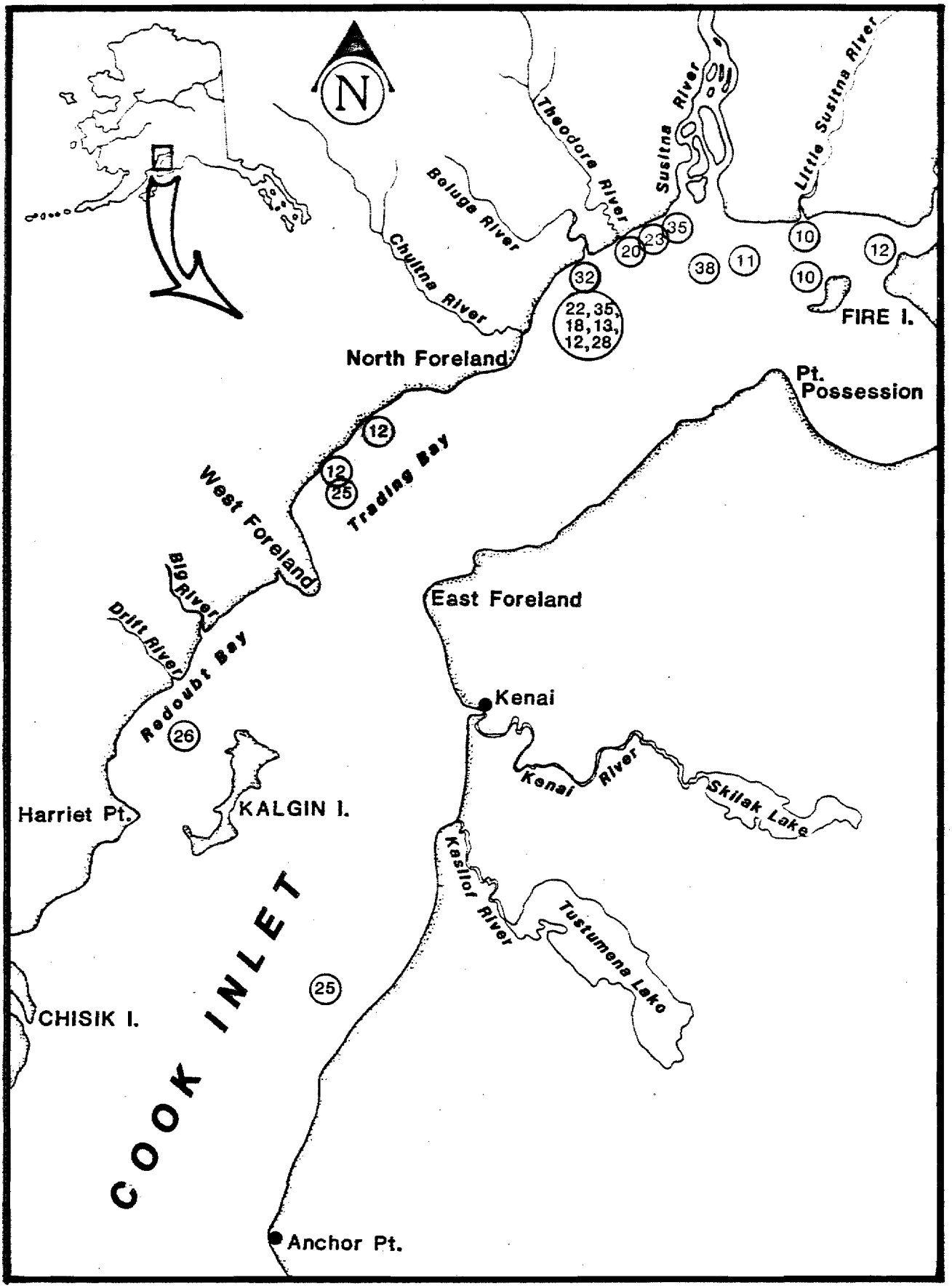

Figure 3. Locations in Upper Cook Inlet where belukha whales were sighted in groups of 10 or more for the month of June 1974 - 1979.

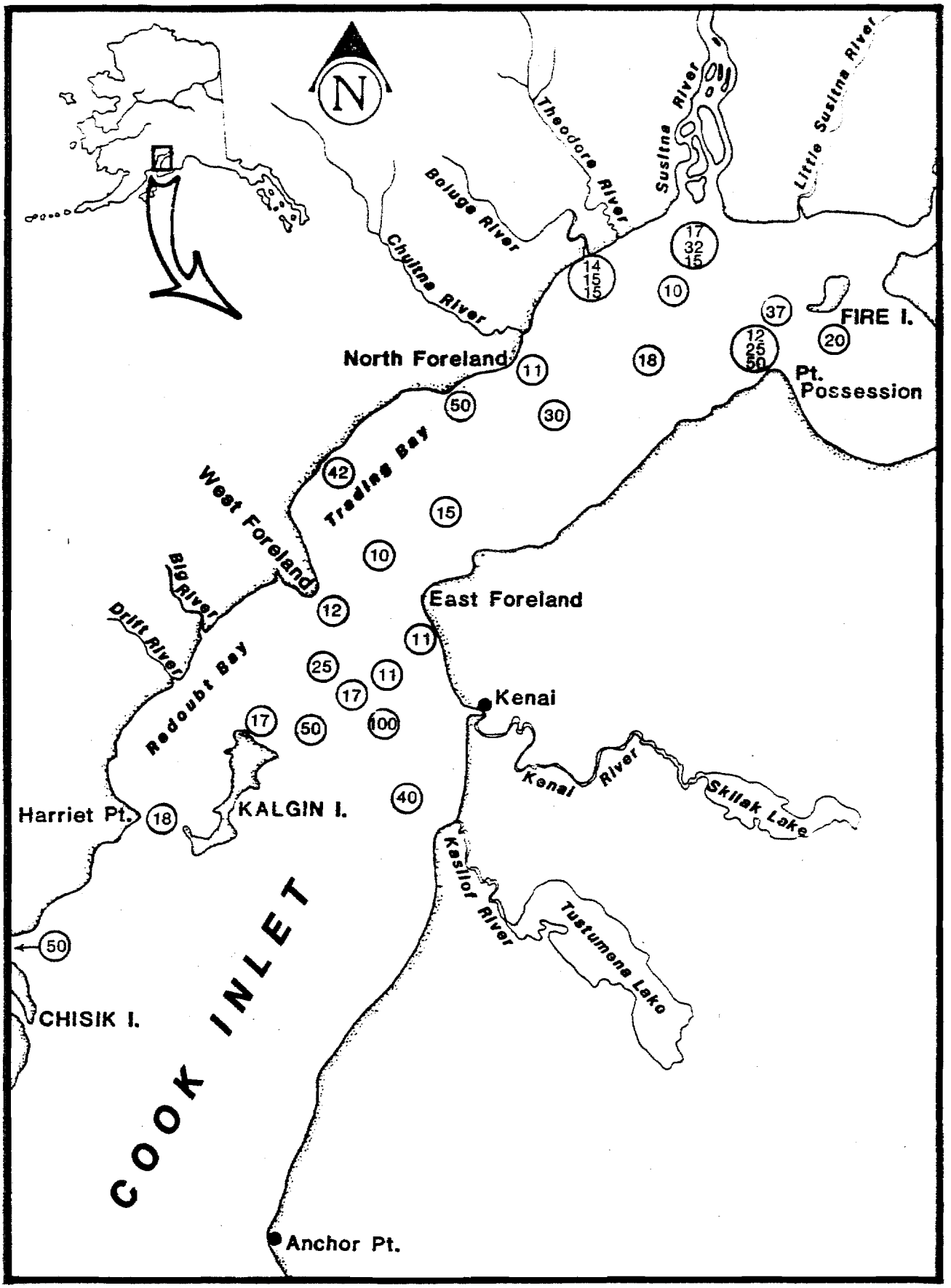

Figure 4. Locations in Upper Cook Inlet where belukha whales were sighted in groups of 10 or more for the month of July 1974 - 1979.

estuarine aggregations of belukhas, and secondarily, the concentration areas may afford some shelter from storms. Fraker *et al*. (1978) felt that availability of an important food source was not a major factor for belukhas concentrating in the MacKenzie estuary because most whales harvested by natives had empty stomachs. However, this may be a significant difference from the Cook Inlet stock of belukhas as well as the Bristol Bay stock. We know from Brooks (1954) and Lensink (1961) that belukhas do feed in the estuaries in the spring in Bristol Bay and may be primarily attracted to the area by both downstream migrating smolts and returning adults of several species of salmon as well as an early run of smelt.

Belukha feeding in estuaries in Cook Inlet in the spring has not been positively determined. However, the presence and timing of several species of anadromous fish, similar to the conditions in Bristol Bay, suggest this to be the case. Probably the single most important fish species to the belukhas in Cook Inlet in the concentration area in the spring is the eulachon (*Thaleicthys pacificus*) which arrives in the Susitna estuary and enters the river for spawning in two major migrations. In 1982, the first was detected in the river when sampling began on May 16 and lasted until approximately May 30. The second migration of eulachon followed from June 1 until June 8 in 1982. In 1983, the first migration occurred in mid-May from May 10 through May 17 and the second migration occurred from May 19 through June 6 (Barrett et al. 1984). In both years, the escapment was considered to be several hundred thousand fish for the first migration, while the second migration was estimated to total several million fish (Barrett et al. 1984) Brooks (1954) found that smelt (*Osmerus dentax*) were important in the diet of belukhas in Bristol Bay very early in the spring, shortly after breakup. Eulachon are similar in size and habits to smelt and probably are analogous in the diet of Cook Inlet belukhas.

After the smelt run decreased by the end of May, belukhas in Bristol Bay switched to downstream migrating salmon smolts (Brooks 1954). Lensink (1961) felt that as the smolts moved out of the estuary and into Bristol Bay, they apparently scattered and became much less vulnerable to predation. Thus of six belukhas taken between June 6 and June 15, none had eaten smolts. If this is also the case in Cook Inlet, then it is possible that salmon smolts from the Susitna River may not be an important food source. However, Cook Inlet is somewhat different from Bristol Bay. At low tide, extensive sand bars are exposed with the majority of the Inlet's water confined to channels and waterways, considerably smaller then Kvichak or Nushagak Bays in Bristol Bay. Although the belukhas apparently seldom enter the Susitna River, the salmon smolts may be concentrated enough at low tide outside the river mouth to allow the belukhas to feed on them. Certainly, no realistic estimate of belukha use of salmon smolts in Cook Inlet can be made without examining stomach contents of the belukhas.

Adult king salmon (*Oncorhynchus tshawytscha*) are available in the area of the Susitna River (ADF&G, unpub. data), from mid-April through August with a peak in June. However their value to belukhas as a food source is questionable. Brooks (1954) did not find adult king salmon to be a significant component of the diet of belukhas in Bristol Bay and speculated that only the smaller adult king salmon were taken by the largest adult male belukhas. If this is the case in Cook Inlet also, probably adult king salmon are taken only in small numbers.

All four of the other species of North American salmon enter the Susitna River to spawn but probably only the sockeye (*Oncorhynchus nerka*) would likely be present in numbers sufficient to provide a significant food source during the time period when the belukhas are concentrated near the mouth of the Susitna River. However, even sockeyes do not become abundant in upper Cook Inlet until after July 1, after the concentration of belukhas has dispersed.

POTENTIAL IMPACTS

Quantification of impacts of the Susitna hydroelectric project on belukhas at the present time is not possible. This type of development project has the potential for reducing the numbers concentrating near the mouth of the river by reducing the available food or by altering the heat budget of the river. However the overall effect on the availability of anadromous fish to belukhas is predicted to be small. There may be no alteration of the heat budget of the river realized by the belukhas at the mouth of the river, although very little data are available to prove this.

Approximately 5 to 8% of the total adult salmon returning to the Susitna River system spawn in the area from Talkeetna to Devil Canyon; the area which is predicted to be the most heavily impacted by dam construction. The slough habitat in this area is predicted to be reduced, thereby reducing the available habitat of the chum salmon from the system as well as a small number of sockeye. This means that a small amount of food in the form of adult chum and sockeye may no longer be available to the belukhas after dam construction. Since we have no quantitative measure of the importance of these species to the belukhas, no estimate of impact can be made except to guess that it will probably be slight.

Impacts on the eulachon runs which enter the Susitna River are assumed to be slight as they remain in the lower reaches of the river (Bruce Barrett ADF&G pers. comm.). This species may be extremely important to the belukhas and it is possible that <u>any</u> reduction of eulachon could severly impact the belukhas.

Although most impacts from either heat budget alteration or food reduction are likely to be slight, we cannot accurately predict the overall effect on the belukhas. If any environmental perturbations effect the belukhas in upper Cook Inlet, it is likely

these effects will take the form of a reduction in the population in Cook Inlet. Given our present state of knowledge, a reduction in the belukha population of upper Cook Inlet would not be detectable unless it were greater than a 50% to 75% reduction in the entire population. Even a reduction of this magnitude could go unnoticed for several years as no systematic monitoring of the population is planned.

RECOMMENDATIONS FOR FUTURE STUDIES

The most immediate information need for the Cook Inlet belukha population with respect to the Susitna hydroelectric project is a realistic population estimate. Generation of such an estimate would require development of a systematic aerial census of the belukhas in the entire Inlet from which a statistically sound estimate could then be derived. Beyond that, future studies should involve collections of skulls in order to determine the taxonomic status of this population; food habits studies to positively identify and quantify the importance of food species; and movement studies to define the geographical range and seasonal movements of the population.

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