

BELUKHA WHALES IN LOWER COOK INLET

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Distribution and Abundance

The Cook Inlet belukha population has been estimated by Klinkhart (1966) at 300 to 400. Recent survey conducted in the Inlet to determine distribution and abundance have not changed this estimate. Most surveys have involved shoreline observations and have not been intensive surveys of the open water areas of the Inlet. Accurate counting methods need to be developed so that a better population estimate will become available.

Fay (pers. comm.) feels the Cook Inlet belukha population could be a separate stock. A preliminary investigation of comparative crainial morphology indicates that the Cook Inlet belukhas may be taxonomically distinct from all other populations, perhaps as a consequence of long-term isolation in this area.

The Cook Inlet belukha population is thought to be resident in the Inlet year-round (Fay 1971; Klinkhart 1966; Scheffer 1973). Sighting data from 1976-1979 confirm that belukhas are present in all seasons in the Inlet.

Belukhas are seasonally distributed in the different regions of the Inlet. They have been sighted in the Upper Inlet primarily in late spring and summer. Belukhas are seen throughout the year in the central

and lower areas, with heaviest use occurring in the central Inlet area (Fig. 13).

Within the Inlet, numbers appear to fluctuate seasonally, with the greatest number seen in mid to late summer and the fewest in winter. Ice conditions may have a strong correlation with winter abundance. In a winter of warm temperatures (1978) with little ice cover, belukhas were found in the central and lower Inlet. Whereas, in a winter of normally colder temperatures (1979) and extensive ice conditions, few belukhas were observed. The location to which the belukhas go when and if they leave the Inlet in winter has not been determined. No belukhas were sighted on an aerial survey in March, 1979 in the neritic waters from Chignik Bay on the Alaska Peninsula to the mouth of Cook Inlet to the eastern extremity of Prince William Sound. Belukhas have been sighted in Yakutat Bay which are presumably from Cook Inlet.

There is a paucity of information on breeding, calving and feeding concentrations of belukhas in Cook Inlet. Breeding whales have not been observed in the Inlet. Calving areas are not known; however, on aerial surveys in 1978 calves were observed at the Beluga River and in Trading and Redoubt Bays in mid-July. No calves were seen on the mid-June survey. Consequently, it appears that calving begins between mid-June and mid-July and may occur at the large river estuaries in the western upper Inlet. Calves were also observed in mid-August in the central Inlet between Kalgin Island and the Kasilof River and in mid-October in Tuxedni Bay.

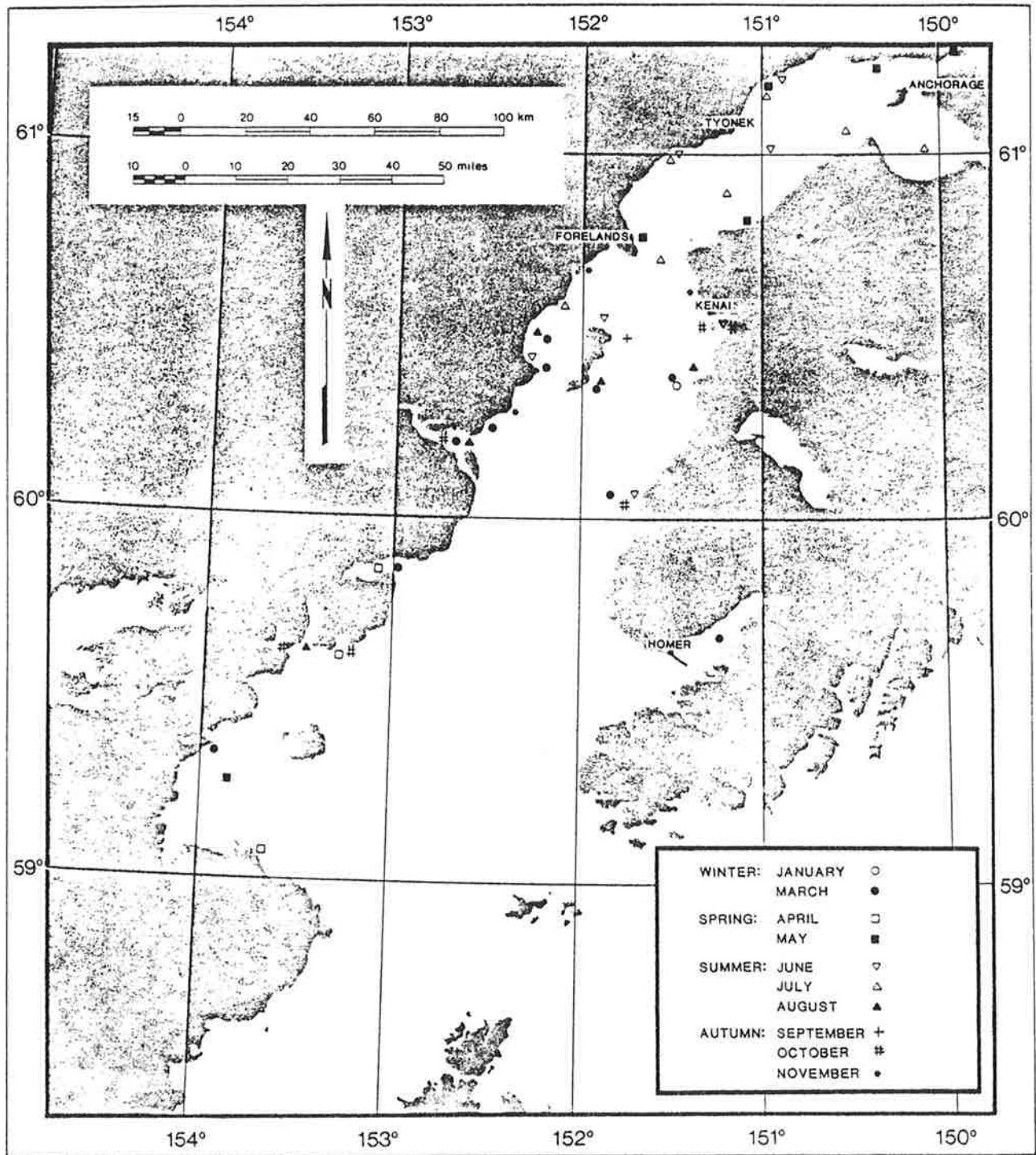


FIGURE 13. SEASONAL SIGHTINGS OF BELUKHA WHALES IN COOK INLET, 1976, 1977 AND 1978.

Concentrations were observed in mid-July at the mouth of the Beluga River and along the shoreline in Trading Bay, apparently feeding. The belukhas appeared to be eating fish caught close in to shore. These belukhas were in groups ranging from two to 25 animals. In mid-August a group of at least 150 whales was observed on three different days in the waters between Kalgin Island and the Kasilof River. The whales remained in this general area over at least a 4 day period. The whales were all aligned on the same directional heading with lead animals observed to break off from the front of the group. This behavior did not result in the remainder of the group changing its heading. Consequently, this type of large group formation most likely represents a feeding aggregation, although no feeding behavior (such as darting after a fish, etc.) or food source was directly observed.

Habitat

Studies have been conducted on various aspects of the biology of belukha whales in several major arctic and subarctic concentration areas, but no study directly addressing the problem of habitat requirements has been undertaken. The habitat types used by belukhas appear to fall into four categories: 1) migration routes, 2) feeding grounds, 3) breeding grounds, and 4) calving/ nursery grounds. Food resources may be the critical element determining the interrelationship of habitat requirements. The habitat requirements vary seasonally and with the age and sex of the whale. The seasonal variations are dynamic and introduce difficulties in determining simple habitat requirements.

Migrations, whether extensive or localized, can be influenced by abiotic and biotic factors. Some authors consider ice dynamics to be of primary importance, while others contend that availability of food resources dominates. Kleinenberg et al. (1964) held that these factors act in combination. Ice conditions have a definite impact on the direction and timing of movements. Both the pattern of distribution and the abundance of whales are dominated by ice (Fay 1974; Fraker 1977). Although migratory patterns along the Alaska coast are poorly known, the movements of belukhas appear to be related to the movements of smelt, salmon smolts, and Arctic cod (Fiscus et al. 1976). Major surface current patterns in Cook Inlet would suggest that the most energetically efficient route to the upper Inlet would be along the eastern coast, while the route from the upper Inlet to the lower would be on the western coast. Seasonal distribution in the Inlet suggest that localized movements, most likely related to food resources and possibly calving ground areas, are critical to sustaining this population.

Feeding grounds are determined and influenced by both biotic and abiotic factors. Concentration of food organisms is probably of major importance in determining where belukhas will feed. The biology and behavior of the food organisms play a key role in their accessibility to the belukha. Ice dynamics affect the presence of food organisms in certain areas as well as limit the movements of belukhas. Other abiotic factors, including temperature, salinity, depth, sediment characteristics, and tides and currents not only affect the distribution of the belukha but the distribution of the belukhas' food resources as well.

The belukhas' characteristic summer movement inshore to river estuaries appears to be associated with concentrations of fish in these areas (Klinkhart 1966; Sergeant 1962; Tarasevich 1960). These whales also leave the estuarine areas to feed on pelagic fishes and invertebrates in the open sea and among the broken ice (Hay and McClung 1976). Belukhas also feed along the migration routes on patchy plankton and fish concentrations (Kleinenberg et al. 1964), indicating an overlap between migration route and feeding ground categories. Large herd formation is associated with heavy concentrations of food organisms in small feeding areas (Bel'kovich 1960). Fluctuations in food organism numbers, periodicity of occurrence, and seasonal inaccessibility cause irregularity of food resources for the belukha. This variability has likely resulted in selection for the broad feeding spectrum exhibited by these whales.

There is a lack of information on the belukha's breeding biology. Breeding grounds are unknown in Cook Inlet. Due to the apparent timing of reproductive events, it is assumed here that breeding may occur along the migration route (overlap between categories) as the whales are approaching their summer feeding and calving grounds. It is also not known whether these whales feed while engaged in breeding activities.

While river estuaries are thought to be calving grounds, no births have been witnessed in these or any other areas. Recent evidence indicates that calves may be born outside the estuaries (Fraker 1977) and then move into these areas with their mothers (Hay and McClung 1976).

Therefore, these areas might be considered more appropriately as nursery grounds.

Estuarine areas are important to newborn calves due to the higher temperatures which "may lessen the shock of birth and reduce heat loss in the first few days until the young animal has acquired some subcutaneous fat" (Sergeant 1973). Fraker (1977) also emphasized water temperature as the key factor in selection of these areas. He found that at the time of their use by large numbers of whales, these river estuaries had high temperatures, high turbidities, low salinities and shallow depths. All age classes congregate in the estuaries during the calving period. Fraker (1977) hypothesized that all age classes benefit from the thermal advantages, but that newborn calves would benefit the most from this advantage due to their small surface-to-volume ratio and limited fat deposits. Food resources have not been investigated in these areas, so it is possible that juvenile and adult whales may be feeding while in the calving/nursery grounds.

There is little information available at present on the seasonal use of specific habitat categories for the Cook Inlet population. Localized migrations occur throughout the Inlet during the year and may extend outside the Inlet into Shelikof Strait or possibly as far away as Yakutat Bay in the winter. Since food resources are likely the primary influence on localized migrations, the Cook Inlet belukhas are probably feeding in most areas where they are found. There are likely to be shifts in food items correlated with season and location. If Cook Inlet belukhas are breeding in May and or June, this activity is most likely occurring in the Upper Inlet. Calving/nursery grounds would be occupied in early to mid summer. Based on information from the literature as well as aerial survey data, the large river estuaries in the northwest Inlet (from

Susitna River to Trading Bay) are probably the primary location for these activities. In summary, the Cook Inlet belukhas range widely throughout the Inlet making seasonal use of specific habitat areas and food resources.

Population Dynamics

Mating behavior has not been observed in belukhas. Sexual maturity is reached in the female at an age of five years and in the male at about eight years (Brodie 1971). Strong pair bonding between any one male and female is unlikely, since trios of two adults and a calf are not observed (Fraker 1977). This also appears to be the case for the Cook Inlet belukhas. Although Vladykov (1946) states that breeding occurs from April to June and Doan and Douglas (1953) state that breeding can occur later in the summer, the general concensus is that a breeding peak occurs in May (Brodie 1971; Doan and Douglas 1953; Vladykov 1946). Klinkhart (1966) states that all adult males taken from the Bristol Bay population from May to September were in reproductive condition. However, a short peak of calving for this population suggested that breeding was confined to a relatively short period in May or June. This timing may also be found for the Cook Inlet population.

Belukhas have a three year reproductive cycle (Brodie 1971). The gestation period is about 14 months (Sergeant 1962 and 1973). The breeding period occurs approximately 2 months prior to the calving period. Assuming that breeding occurs in May, Brodie (1971) found that females gave birth approximately 14 months later, in late July and early August. Lactation

lasted for the next 21 months, indicating an almost 2 year period of nursing. Reproductive rates have not been calculated for any population. However, assuming an average life span of 32 years (Kleinenberg et al. 1964) with the onset of maturity in the female at 5 years and a 3 year period between calving, a female would have an average of nine calves over her life span.

The sex and age structure has not been determined for the Cook Inlet population. Males cannot be easily differentiated from females. However, color differentiation can be made between juveniles and adults, since attainment of white coloration corresponds to sexual maturity. In the large concentration observed in August 1978, approximately one of seven whales was a juvenile.

Mortality factors include predation, parasites, diseases, and hunting. The only natural predator of the belukha known to occur in Cook Inlet is the killer whale, *Orcinus orca*. Killer whales are seen only in the lower Inlet in summer. Since the belukhas are generally in the central and upper Inlet areas during this time, there is probably little loss of belukhas to killer whale predation.

Endoparasites found in the belukha include acanthocephalans, trematodes, cestodes and nematodes (Kleinenberg et al. 1964; Klinkhart 1966). Their effects on the belukha are unknown. The occurrence of these parasites in Cook Inlet belukhas has not been studied. Other diseases are unknown in belukha populations.

Only limited hunting of the Cook Inlet belukhas has taken place since the 1950's. Belukhas found near fishing nets and vessels are occasionally shot and killed. There are no concrete data on the frequency of occurrence of whales killed in this manner, but it is unlikely more than two per year.

Food Habits

The belukha has a broad feeding spectrum. Their food resources include a variety of fishes and various kinds of octopus, squid, crab, shrimp, clams, snails, and sand worms (Fay 1971). The maximum size of food organisms is limited by the capacity of the esophagus, since food items are swallowed whole (Fay 1971; Fraker 1977). Kleinenberg et al. (1964) state that belukhas do not feed on deep water organisms.

Important food organisms of the belukha in Cook Inlet in the summer appear to be the osmerids and salmonids. Belukhas caught in Bristol Bay and Cook Inlet during the summer were found to contain salmon, smelt, flounder, sole, sculpin, shrimp and mussels. Data for the upper Inlet are not available. Possible foods for the belukha in the Kachemak Bay area are shrimp, crab, halibut, sole, herring and octopus.

The food of the belukha can be expected to vary seasonally and with location. During the spring and summer, the Cook Inlet belukhas probably feed on salmon smolts migrating from river estuaries as well as heavy concentrations of adult salmon schooling off the river mouths. Throughout the summer, belukhas may switch from one salmon species to the next.

King salmon run earliest in the Inlet with reds, pinks, chum and silvers following in that order. In the fall-winter season belukhas may eat smelt, bottom fishes and invertebrates. In the spring belukhas are found near concentrations of smelt.

Sergeant and Brodie (1969) suggest that productivity of the winter environment is critical in determining the adult size of belukhas in different regions. They suggest that "Selection has reduced the biomass of an individual white whale to that enabling it to maintain its metabolic activity on the available food." Further, "there appears to be no gross difference in numbers of white whales between trophically suboptimal and more suitable environments; the difference is expressed in individual biomass."

The food of the belukha also varies with age and sex. Lactation lasts about 2 years in belukha (Brodie 1971; Sergeant 1973). Young of the year feed only on milk, while yearlings supplement the milk by feeding on capelin, sandlance, shrimp, and small bottom dwelling crustacea (Brodie 1971; Kleinenberg et al. 1964; Sergeant 1962). The food of subadults is similar to the diet of adult animals. Adult males feed primarily on large fish while females prefer food items such as sandlance, octopus and particularly *Nereis* (Kleinenberg et al 1964). Fluctuations in food organism numbers, periodicity of occurrence, and seasonal inaccessibility cause irregularity of food resources for the belukha. This may have caused the belukha not only to widen its feeding spectrum but to differentiate food habits by age and sex. This differentiation enables the belukha to successfully utilize the available food (Kleinenberg et al. 1964).

Behavior

Possible feeding behavior of belukhas has only been observed on two occasions during aerial surveys in Cook Inlet. Near shore feeding groups appear to consist of small aggregations of belukhas randomly aligned with respect to one another. Whales were seen lying at the surface facing the shore; individuals pitched forward in the water such that only the flukes were visible at the surface and then pitched back to the original position. The whales appeared to be operating individually in their efforts to catch food.

Groups of migrating belukhas vary in number and composition. Most groups contain a predominance of adults with a few juveniles. Generally the animals are closely spaced, although a widely scattered group in which all individuals had the same directional heading was observed in March 1979. In groups of 10 to 30 animals, all whales do not surface simultaneously. Instead, there is usually a wave of three groups: the first group surfaces; as it is beginning to submerge, the second group surfaces; as this group is beginning to submerge, the third group surfaces; this is closely followed by the first group surfacing while the third is still at the surface. Calves closely follow their mother's movements and on all occasions were seen to the left rear side of the adult.

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