

Migration Studies of Northern Fur Seals

Despite the large amount of information collected on the natural history and biology of the northern fur seal, there is little information on the migratory paths and distribution of pups after they leave their islands of birth. The importance of early life history information is emphasized by the view that natural regulation of marine mammals occurs largely, if not primarily, through mechanisms related to juvenile survival.

Because very little time is spent on land during their early years, survival of fur seals during the first 2-3 years must be determined, at least proximally, by events that occur at sea. Natural factors affecting the survival of young animals at sea include their ability to capture prey, avoid predators, resist disease and parasites, and withstand the rigorous climate of the North Pacific Ocean. Factors influencing the distribution of young fur seals at sea may include the distribution of prey, water temperature, currents, bathymetry, and other climatic or oceanographic features.

There are at least two possible theories explaining the pelagic dispersal of northern fur seal pups from the Pribilof Islands after they are weaned (Fig. 1). First, the majority of pups follow the apparent path of older fur seals through Unimak Pass into the North Pacific, then eastward to the waters offshore western Canada and the United States. Thus, the distribution of pups would be similar to the assumed distribution of older animals, which is primarily confined to the continental margin of the eastern North Pacific. Second, pups may disperse over a broad pelagic area during their initial migration away from the Pribilof Islands, rather than adhere to a well-defined migratory path consistent with that of older animals. Pups may enter the North Pacific through many Aleutian Island passes, and then disperse widely into the North Pacific. This theory is consistent with the underrepresentation of young animals in the pelagic collections as well as with early records of young animals harvested commercially in the mid-Pacific.

These two theories suggest substantially different movement patterns of pups, including differential exposure to oceanic and climatic conditions, avail-

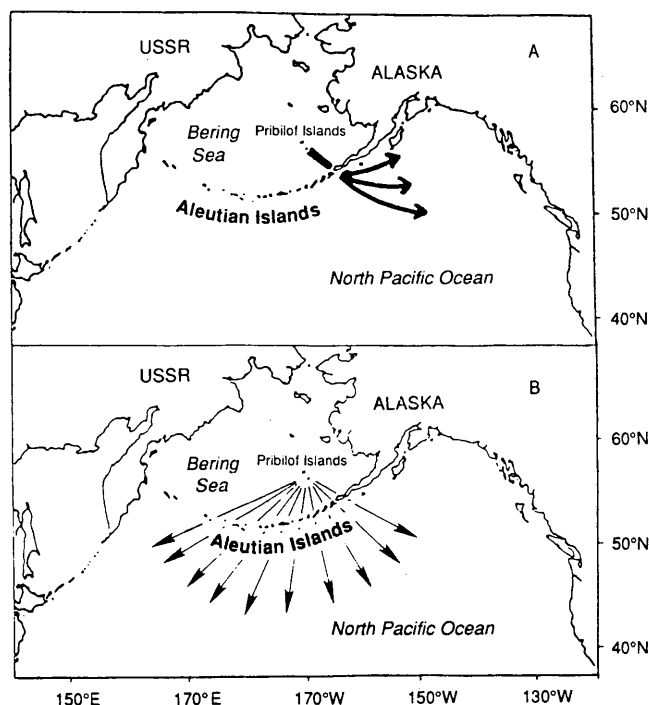


Figure 1. Two theories of northern fur seal pup migration from the Pribilof Islands in the Bering Sea into the North Pacific Ocean. The first (A) suggests that yearlings enter the North Pacific primarily through Unimak Pass, and then migrate toward the eastern margin of the North Pacific and waters off western North America. The second (B) suggests that pups disperse widely, entering the North Pacific through many Aleutian Island passes.

able food items, and interactions with human activities such as fisheries, oil and gas exploration, and drilling. In view of the need to understand the early life history of fur seals, and its relationship to the natural regulation of fur seal populations, it is critical that the pelagic distribution of young northern fur seals be determined.

During the fall of 1989, biologists from the National Marine Mammal Laboratory (NMML), Seattle, Washington, and Scripps Institute of Oceanography, San Diego, California, collaborated on a study designed to examine the initial phase of northern fur seal pup migration. The specific objectives of the study were to determine 1) the length of time for migration from St. Paul Island (of the Pribilof Islands) to the Aleutian Islands, and 2) whether Unimak Pass is the principal migratory corridor through which northern fur seal pups enter the North Pacific Ocean.

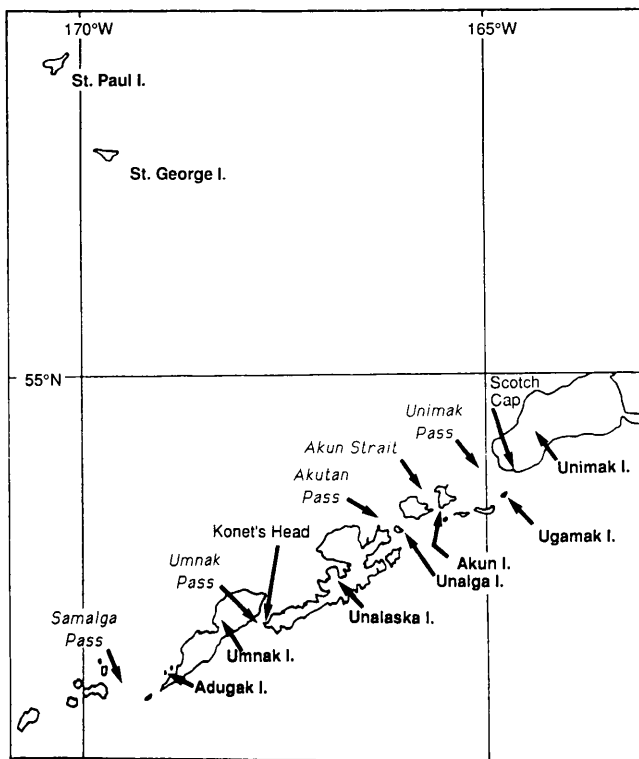


Figure 2. Locations of six automated VHF radio receiver stations at Scotch Cap (Unimak Island), Ugamak Island, Jackass Point (Akun Island), Unalga Island, Konet's Head (Unalaska Island), and Adugak Island. Also noted are the Aleutian Island passes these receiver stations were intended to cover. Distance from St. Paul Island to Unimak Pass is approximately 420 km.

In October 1989, six automated VHF radio receiver stations were erected at locations along the eastern Aleutian Islands, including Scotch Cap of Unimak Island, Ugamak Island, Jackass Point of Akun Island, Unalga Island, Konet's Head of Unalaska Island, and Adugak Island (Fig. 2). These stations were located to provide coverage of Unimak Pass, Akun Strait, Akutan Pass, Umnak Pass, and Samalga Pass (partial coverage). Receivers were programmed to scan 101 frequencies, including a reference frequency emitted by transmitters located on land near the receiver stations. Receivers scanned continuously, switching frequency every 4 seconds unless a transmitter pulse was detected, in which case the receiver continued to listen to that frequency for an additional 10 seconds. Data recorders were programmed to record frequency, date, time, and number of pulses heard whenever the receiver detected a transmitter signal.

In November 1989, prior to the onset of their pelagic migration, 90 northern fur seal pups (45 males and 45 females), 10 of which were part of mother-pup pairs, were instrumented with VHF radio transmitters. The 10 adult females of the mother-pup pairs were also fitted with radio tags. All fur seals in the study were captured at Reef rookery on St. Paul Island, with the exception of three mother-pup pairs which were captured at nearby Gorbach rookery. Relatively large pups were chosen to minimize any possible effects of the transmitter on behavior or swimming; male pups less than 16 kg and females less than 15 kg were excluded (with the single exception of a male pup weighing 15.25 kg).

Weight (± 0.25 kg) and standard length (± 1 cm) measurements were obtained for each pup but neither length nor weight was determined for adult females. During the transmitter attachment procedure each pup was physically restrained manually; adult females were restrained on a specially designed restraint board. The pelage at the transmitter attachment site on the upper back between the scapulae was cleaned with acetone and dried. Then the transmitter was attached to the pelage with quick drying, 5-minute epoxy. Transmitters emitted 85-90 pulses per minute, and each transmitter had a unique frequency for identification of individuals. Fur seals equipped with transmitters but remaining on St. Paul Island were monitored by a stationary receiver at Reef rookery which scanned individual frequencies for 30 seconds each half hour. Researchers used a hand-held receiver to scan for the frequencies of fur seals that had been away from the study site for at least 3 days. Each rookery on the island was scanned on a daily basis from 12 November until 1 December.

The Aleutian Island receiving stations were recovered in mid-April 1990, approximately 3 months after the southern migration of fur seals was expected to occur.

Male pups instrumented in the study had a mean weight of 18.2 kg (± 1.48 kg standard deviation (\bar{s}), range 15.25-21.0 kg) and length (tip of snout to base of tail) of 81.5 cm (± 2.43 cm \bar{s} , range 75-86 cm). Mean female weight was 17.0 kg (± 1.22 kg \bar{s} , range 15.0-19.75 kg) and length was 79.9 cm (± 2.35 cm \bar{s} , range (74-84 cm).

Radio-tagged animals remained on St. Paul Island an average of 10.3 days (± 5.8 days \pm , range 0-29 days). Daily manual scanning did not detect movement of any tagged pups to rookeries other than Gorbatch and possibly Ardiguén. These two rookeries are located on the same peninsula and are contiguous with Reef rookery. Thus, there was no indication of extensive interrookery movement of pups during November. The day of departure for the 100 animals (45 female pups, 45 male pups, and 10 adult females) is shown in Figure 3. For seven of the mother-pup pairs, the pup departed first; for two pairs the mother departed first. Departure times for the mother and pup of the tenth pair were within 26 minutes of each other, suggesting they may have departed together. The mother of this pair was located 12 days later at Akutan Pass; the pup was not located.

Thirty-one successful locations of 29 different animals were recorded in the Aleutian Islands. These locations were widely dispersed, including 3 in Unimak Pass, 16 in Akutan Pass, 4 in Umnak Pass, and 8 in Samalga Pass (Fig. 4). Departure from St. Paul Island and date of relocation in the Aleutian Islands is shown for all 29 animals in Figure 5. Successfully tracked animals included 14 female pups, 10 male pups, and 5 adult females. None of the pups from the mother-pup pairs were located after their departures from the island. On three occasions there were concurrent relocations of tagged animals in the same pass. These animals did not appear to be traveling together because their

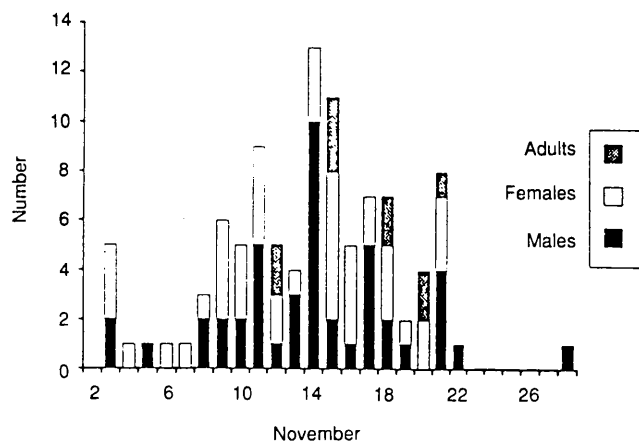


Figure 3. Histogram of departure dates for 90 northern fur seal pups and 10 adult females.

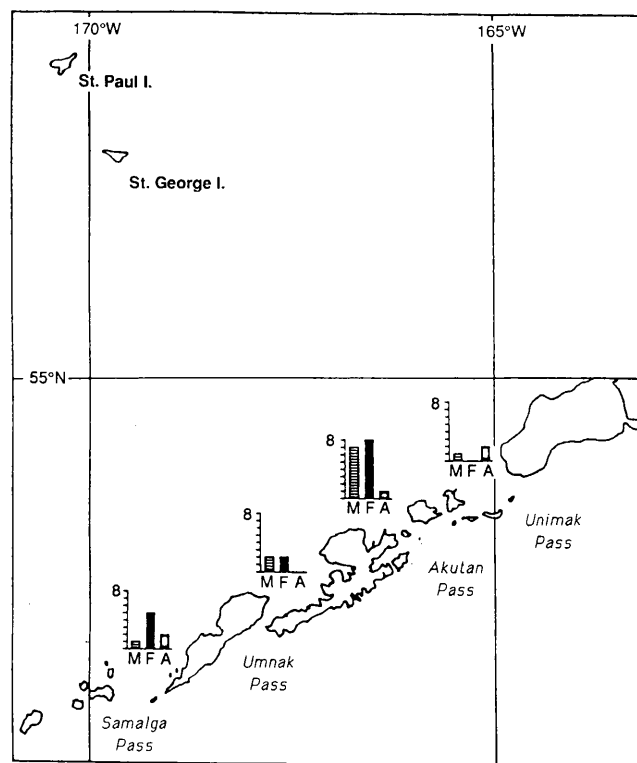


Figure 4. Distribution of male (M) and female (F) pups and adults (A) located in Unimak Pass, Akutan Pass, Umnak Pass, and Samalga Pass. Two pups were seen at 2 different passes, hence the figure is based on 31 successful locations.

departures from St. Paul Island differed by at least 1 day, or they departed from the Aleutian Island stations at different times.

Mean number of days spent traveling from St. Paul Island to the receiver station scanning areas around the Aleutian Islands was 10.1 days for pups and 6.2 days for adult females. The distance from St. Paul Island to Akutan Pass, for example, is about 420 km. To swim this distance in 10.1 days requires a mean speed of about 41.6 km per day, or 1.7 km per hour. The mean length of time for animals remaining in the vicinity of the receiver stations was 15.1 hours (range 0.2-63.1 hours) for pups and 8.3 hours (range 1.5-21.6 hours) for adult females.

The migratory distribution of fur seal pups that were monitored successfully at the Aleutian Island passes was not consistent with the commonly assumed migratory route through Unimak Pass (Fig. 1A). Of the 31 relocations of 29 different animals, only 3 were in Unimak Pass; 2 of those

were adult females. In contrast, 28 relocations were at passes farther west (Fig. 4), 8 of those were as far west as Samalga Pass. Failure to relocate the remaining 71 animals could have resulted from animal mortality prior to arrival at the Aleutian Islands, equipment failure, or passage in areas outside the range of the most western receiver station at Samalga Pass.

Because pups were chosen by size, and because the time interval for migration from St. Paul Island to the Aleutian Islands is relatively short, it is doubtful that mortality accounts for more than a few animals. Transmitter failure is possible, but there was no indication during the study of failure while the animals remained on St. Paul Island.

Excluding the possibilities of mortality and equipment failure, the low number of fur seal relocations suggests that a large percentage of pups left the Bering Sea and entered the North Pacific Ocean west of the region covered by the receiver stations. This is consistent with the hypothesis of wide dispersal of pups into the North Pacific.

Because pups were chosen for large size, and because many pups probably had already departed when radio tagging began, departure dates from St. Paul Island are not considered representative of departure dates for all pups. If pups must reach a certain physiological state related to weight before they begin their migration, larger pups may tend to leave the island at an earlier date. Age could also be a factor influencing the timing of pup departure from the island. In addition, the stress of capture and tagging procedures may have induced pups to leave earlier than normal, although this was not apparent in the attendance record collected on St. Paul Island. Only one pup left the island on the day she was tagged. The earlier departure date for 7 of 10 pups in mother-pup pairs suggests that in most cases pups wean themselves, but a larger sample size is needed to confirm this.

There was no indication that size was related to migratory route. The radio-tagged fur seals in this study were assumed to have left St. Paul Island in a

manner representative of the 1989 cohort. The degree to which oceanographic or meteorological factors influence their migratory path is presently unknown. However, some fur seal researchers have suggested that the distribution and abundance of prey, rather than water temperature, is more significant in determining the distribution of fur seals at sea.

This study represents one step toward characterizing the migration of weaned pups away from the Pribilof Islands, and demonstrates the possibility of investigating the early part of this migration through the use of radio telemetry and land-based receiver stations.

One hundred pups and adult female fur seals were radio-tagged prior to their departures from St. Paul Island. Twenty-nine fur seals were located in the eastern Aleutian Islands between Samalga Pass and Unimak Pass an average of 10 days after their departures from St. Paul Island. A single pup was located in Unimak Pass, and 23 others were located to the west, suggesting that 1) Unimak Pass was not the primary migratory corridor for pups from the Bering Sea into the North Pacific Ocean in 1989, and 2) pups disperse more widely than assumed to be the case with older northern fur seals.

Wide dispersal of fur seal pups into the North Pacific Ocean has significant implications for their early life history, as well as the nature of their interactions with human activities. It is apparent that more information on the southern migration of pups into the North Pacific must be obtained to gain a better understanding of the oceanic regions which are commonly utilized by northern fur seals. NMML and Scripps scientists plan to examine the extent of dispersal of northern fur seal pups as they pass through the Aleutian Islands and enter the North Pacific. This work will incorporate the use of shore-based tracking stations, plus attempts to track radio-tagged fur seals at sea from vessels and fixed-wing aircraft.

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