

Figure 1. Breeding islands and migratory routes of northern fur seals (*Callorhinus ursinus*).

## The Role of Juvenile Walleye Pollock As Northern Fur Seal Prey in the Eastern Bering Sea

by Elizabeth Sinclair

The Pribilof Islands population of northern fur seals (*Callorhinus ursinus*) is a significant component of the Bering Sea ecosystem, with approximately 980,000 animals or 72% of the species' world breeding population. During June through October, the animals haul out on the Pribilof Islands (St. Paul and St. George) in the eastern Bering Sea to give birth and breed; from November to May, the population is pelagic throughout the central and eastern North Pacific Ocean. Adult male northern fur seals fast during the summer breeding season. Juveniles are pelagic the first few years of their lives and return to the Pribilof Islands only intermittently in the late summer or fall. Adult females give birth to their pups in June and July, then conduct cyclic feeding trips throughout the season,

which average 2.5 days onshore to nurse their pups and 5.9 days at sea to feed.

The number of northern fur seal pups born on the Pribilof Islands decreased annually from 1975 to 1981. Since 1981, the population size has remained stable on St. Paul Island but has continued to decline on St. George Island. In 1988, the Pribilof Island stock of northern fur seals was declared depleted under the Marine Mammal Protection Act. The depletion of the Pribilof Islands stock is in sharp contrast to the relative stability or growth of the species' other four breeding populations (Fig. 1).

In 1981, the National Marine Mammal Laboratory (NMML) initiated studies to determine



**An adult female northern fur seal nurses her pup. Lactating northern fur seals conduct cyclic feeding trips averaging 2.5 days on shore to feed their young and 5.9 days at sea to feed.**

the role of diet in the declining Pribilof Islands population of northern fur seals. In order to duplicate NMML studies conducted prior to the population decline, stomach contents were examined from animals collected at sea. Since 1987, NMML researchers have conducted annual studies on northern fur seals based on fecal (scat) analysis as a nonlethal means of determining diet. The data presented in this article is based on studies conducted both on stomach contents collected in 1981, 1982, and 1985, and on scats collected in 1987-90. The analysis focuses on the role of walleye pollock (*Theragra chalcogramma*) as the primary prey of northern fur seals in the Bering Sea during the 1980s and 1990 and also examines patterns in fur seal consumption of walleye pollock relative to the strength of each pollock year class.

Diet information was collected from northern fur seals in the eastern Bering Sea during August-October of the study years. Stomach and intestinal (gastrointestinal = GI) contents were examined from 73 juveniles and adult females collected at sea in the vicinity of the Pribilof Islands in 1981, 1982, and 1985. In 1987-90, 847 scats were collected from St. Paul Island rookeries, where adult female fur seals haul out.

Prey were identified from whole-body or hard-part remains (cephalopod beaks, fish otoliths) in the GI tracts and scats. We determined the importance of a prey species by examining values for percent number and percent occurrence. Percent number (PN) refers to the number of individuals representing a particular prey species as a fraction of the total number of all prey. Percent occurrence (PO) refers to the percentage of seals that consumed a particular prey species. We determined the size of pollock eaten by seals based on otolith to body length (fork length = FL) regression formulae for pollock in the Bering Sea. Ages were then assigned based on

length-age relationships for pollock from the Bering Sea.

Based on both PN and PO values, walleye pollock was the primary prey for all years in the GI tracts and scats (Figs. 2 and 3). With the exception of the 1981 samples, prey pollock were represented almost entirely by juveniles (3-20 cm FL; ages 0 and 1). The similarity between walleye pollock PN and PO values for six of the seven sampling years is a strong indication of the importance of walleye pollock in the diet of northern fur seals, as well as the comparative reliability of both collection methods.

Although juvenile pollock was the primary prey overall, there were marked differences between years in the GI tract collections. The modal size distribution of walleye pollock in GI contents of adult female and juvenile northern fur seals collected in the early 1980s reflected annual year-class strength estimates for walleye pollock. Population estimates of walleye pollock based on bottom trawl and midwater acoustic surveys in the eastern Bering Sea indicated that the 1980 year class (age 1 in 1981) was about half the average year-class size; the 1981 year class (age 0 in 1981) was the weakest observed prior to 1983, and the 1978 year class (age 3 in

## GI Tracts

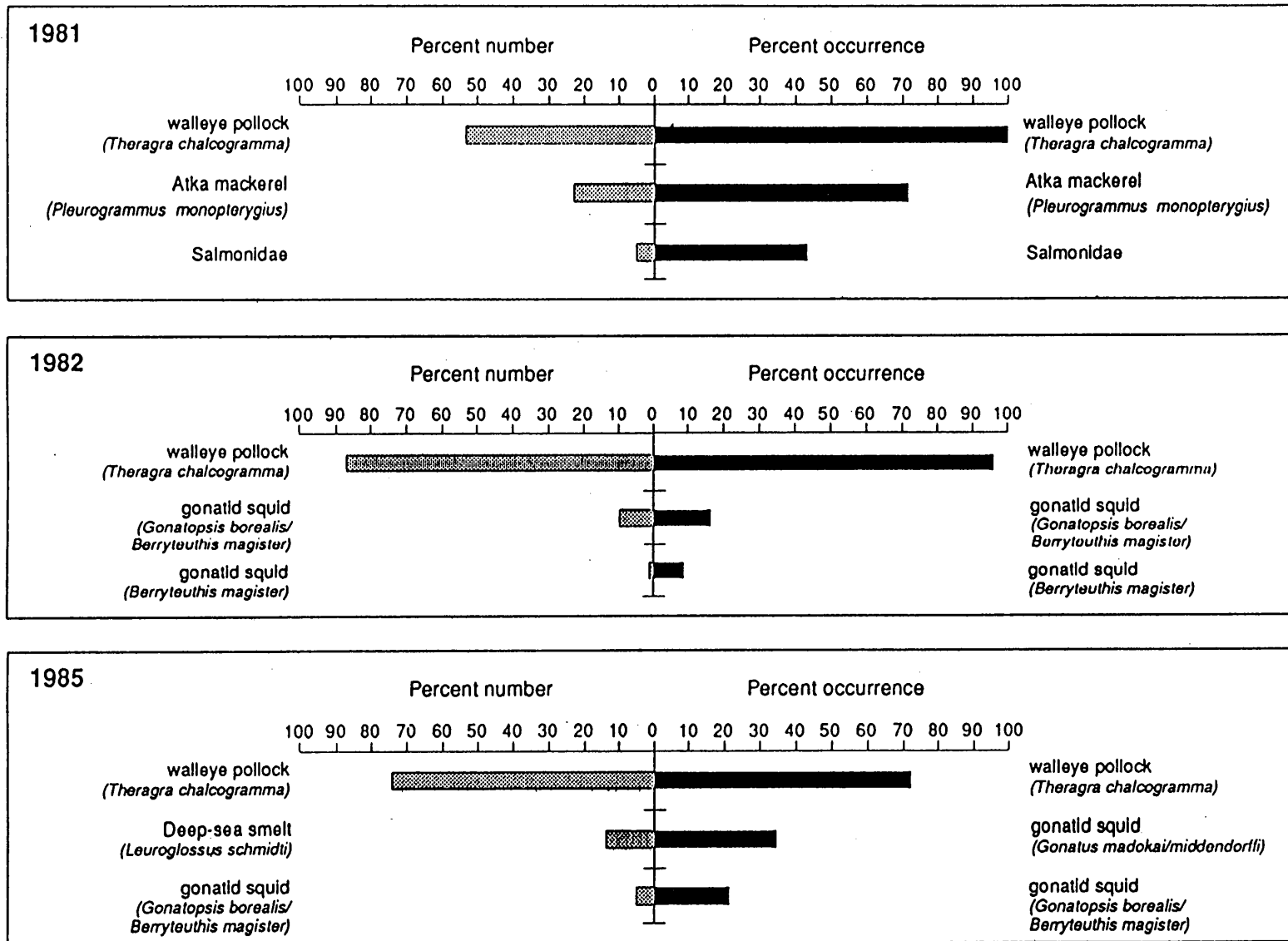


Figure 2. Percent number (PN) and Percent occurrence (PO) values for the three dominant prey species identified in northern fur seal gastrointestinal tracts collected in 1981, 1982, and 1985.

# Scats

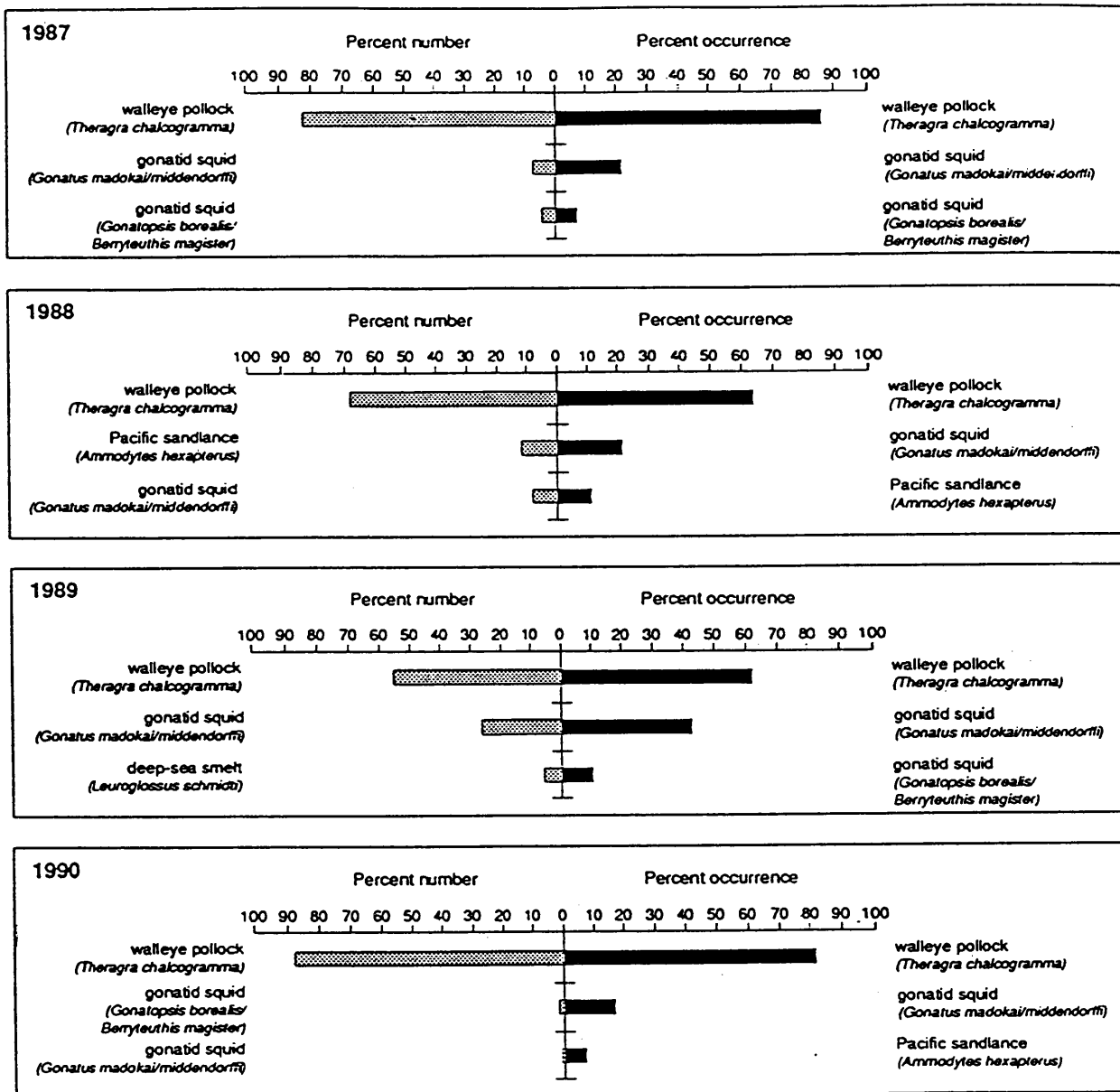


Figure 3. Percent number (PN) and percent occurrence (PO) values for the three dominant prey species identified in northern fur seal scats collected in 1987-90.

1981) was the strongest observed. The 1982 and 1984 year classes were strong and the 1985 year class was average. Similarly, there were few prey pollock in 1981 seal GI tracts with the exception of some 3- and 4-year-old fish from the 1977 and 1978 year classes. Age-1 pollock were

absent in GI tracts of seals collected in 1982, but a large number of age-0 pollock (1982 year class) was found. A large number of age-1 pollock (1984 year class) was found in seal samples collected in 1985. The synchrony of trends in walleye pollock year-class strength with the number

and size distribution of pollock observed in the GI tracts of adult female and juvenile northern fur seals indicated that the variability of juvenile pollock recruitment directly influenced the feeding habits of northern fur seals.

Contrary to results from the GI tract analysis, the age frequencies of walleye pollock from scats collected in 1987-90 were nearly identical. Year-class strength estimates for 1987-90 were average to weak; nevertheless, seals ate primarily 0-age pollock all 4 years. If the present estimates of pollock year-class strength in the late 1980s prove to be accurate, we speculate that seal consumption of age-0 walleye pollock as primary prey may be due to the absence of other alternate prey resources, strong localized abundances of age-0 fish, or the potential for a skewed concentration of remains from younger fish in the colon of northern fur seals.

The largest study of northern fur seal diet in the eastern Bering Sea was conducted by NMML researchers from 1960 to 1974. Stomach contents of 1,800 animals were collected pelagically during June-October. Walleye pollock was the principal prey species identified for all years combined in the '60s and '70s collections yet ranked less than 25% PO compared with 79% PO for all years combined in the 1980s collections. Capelin (*Mallotus villosus*) was absent in the 1980s yet ranked from first to third most important prey identified in northern fur seal stomachs from the pelagic collections. The absence of capelin in all 7 years in the 1980s samples is noteworthy since samples were collected within the same region and season as in the pelagic studies. Herring (*Clupea pallasii*) was also a principal prey species of northern fur seals in the '60s and '70s yet was present in only one GI tract and in only .02% of scats from the 1980s samples. Such changes in prey consumption by northern fur seals reflect the dynamics of the Bering Sea ecosystem over the last 20 years as the composition of potential prey changed from a system frequently dominated by herring and capelin through the early 1970s to a pollock-dominated system in more recent years. Despite any biases that may exist between NMML's recent study and historical studies, the changes in the relative proportion of primary

prey consumed by fur seals appear to reflect real-time changes in the Bering Sea ecosystem.

The 1981-90 study demonstrates the dominance of 0-age and 1-year-old pollock in fur seal diet over 7 years and the strong influence of pollock year-class strength on the age frequency of pollock in GI tract samples collected in the early 1980s. More refined estimates of pollock year-class strength and movements of juvenile and adult walleye pollock, as well as estimates of the abundance and availability of noncommercial fish and squid, are necessary to fully evaluate variable patterns in consumption of walleye pollock by northern fur seals.

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