

Diet of Pacific sleeper shark, *Somniosus pacificus*, in the Gulf of Alaska

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The sleeper shark, *Somniosus pacificus*, ranges from Chile (Crovetto et al., 1992) through southern California (Phillips, 1953), British Columbia to the Gulf of Alaska (Bright, 1959), the Bering Sea (Wilimovsky, 1954), and Japan (Tanaka et al., 1982). It is thought to be a voracious and versatile feeder and its diet has been shown to include young marine mammals, such as harbor seal, *Phoca vitulina* (Bright, 1959), and the southern right whale dolphin, *Lissodelphis peronii*, (Crovetto et al., 1992). The purpose of this study is to describe the diet of the sleeper shark in the Gulf of Alaska area.

Methods

Sleeper sharks were collected in the Gulf of Alaska (Fig. 1) between June and August 1996 from the longline vessel *Alaska Leader*, and the bottom-trawl vessels *Vester-aalen* and *American No. 1*. After dissections onboard, each individual stomach was put in a plastic bag and frozen at sea. Tags recording date, location, and length and sex of shark were included in the sample bag. Information on the station, shark total length (TL) (measurements follow Castro, 1983), and dates samples were collected are listed in Table 1. Stomachs were thawed in the laboratory and stomach contents were analyzed. Prey were identified to the

lowest taxonomic level possible. Each prey item was weighed and standard length of prey fish was measured. Percent frequency of occurrence and the percentage of the total weight of each prey item were calculated. Octopus beak measurements were made to estimate live wet weights of octopi. According to Robinson and Hartwick (1983), pigment-upper-lateral-wall length (PULWL) has the best correlation coefficient with the live wet weight of the North Pacific giant octopus, *Octopus dofleini*; we therefore used these PULWLs to estimate the live wet weight of the octopus. Live wet weights of *Octopus dofleini* that had been consumed were calculated by using Robinson and Hartwick's (1983) equation:

$$\ln(PULWL(\text{mm})) = 0.274 \ln(\text{weight}(\text{kg})) + 2.674. \quad (1)$$

Results

A total of 13 sleeper shark stomachs were analyzed; two were empty, 11 contained food (Tables 1 and 2). The length of the sleeper sharks ranged from 218 cm to 295 cm TL (mean=264.5 cm; SD=24.9 cm). Arrowtooth flounder, *Atheresthes stomias*, was the most important prey, representing 67% of the total stomach content weight (64% of frequency of occurrence). The size of arrowtooth flounder consumed by sleeper

sharks ranged from 38 cm to 65 cm TL, (mean=44.8 cm; SD=8.0 cm). Other prey included a 48-cm wall-eye pollock, *Theragra chalcogramma* (5.2% by weight), a single 33-cm rockfish, *Sebastes* sp., a 40-cm Pacific salmon, *Oncorhynchus* sp., and a 26-cm flathead sole, *Hippoglossoides elassodon*, as well as three unidentifiable flatfish. *Octopus dofleini* were the most important invertebrate found in the diet of sleeper sharks, representing 5% of the total stomach contents weight and 73% of the frequency of occurrence. The estimated wet weight of *Octopus dofleini* (based on beak measurements) ranged from 5.65 kg to 29.07 kg (mean=18.51 kg; SD=6.58 kg). The PULWL measurements ranged from 23.3 mm to 36.5 mm (mean=31.78 mm; SD=3.64 mm). Less important invertebrate prey included squids, snails (*Fusitriton* sp.), hermit crabs, and gammarid amphipods. Fish offal (five arrowtooth flounder heads) was found in one sleeper shark stomach. It represented 12% of the total stomach contents weight and had a frequency of occurrence of 9%. No Steller sea lion parts were found in the 13 sleeper shark stomachs examined.

In our study, three specimens were collected from bottom trawls, ten from longline surveys. The weight of stomach contents of the three specimens collected from bottom trawls (sharks no. 4, 12, and 13) were more than 2000 g (4506 g; 2321 g; and 11,782 g, respectively), whereas weight of stomach contents of the specimens collected from long lines were much lower than those collected from the bottom trawls (only three weighed more than 500 g, one weighed more than 3000 g, and the rest weighed less than 50 g). Less food in the stomachs of the sleeper sharks col-

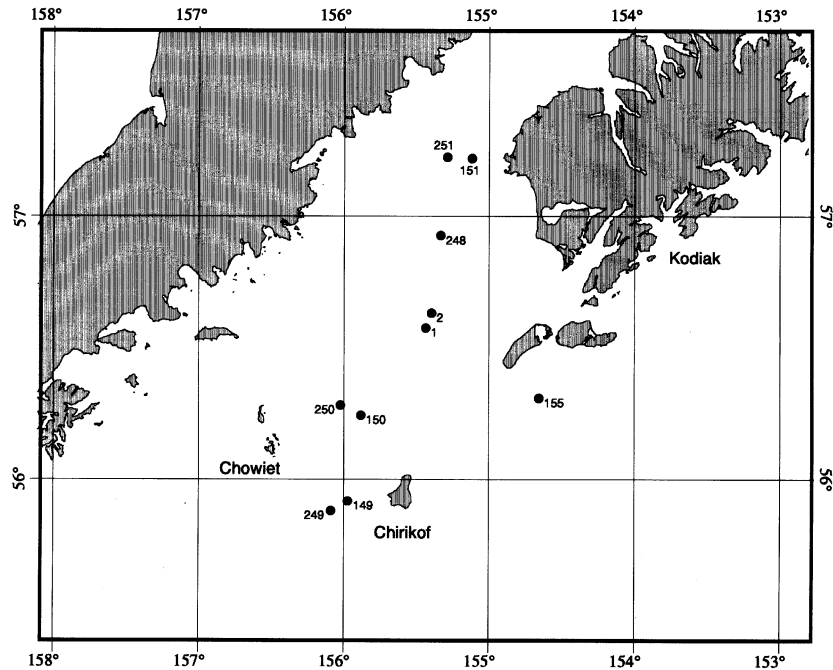


Figure 1
Locations of sleeper sharks collected in Gulf of Alaska

Table 1

Some information on the 13 sleeper shark, *Somniosus pacificus*, stomachs collected in the Gulf of Alaska in 1996. TL = Total length; Wt = stomach contents weight.

Date	Vessel	Station no.	Depth (m)	Shark no.	TL (cm)	Wt (g)
24 Jun '96	<i>Alaska Leader</i>	149	241	7	274	520
24 Jun '96	<i>Alaska Leader</i>	249	253	11	218	12
25 Jun '96	<i>Alaska Leader</i>	250	267	2	292	39
25 Jun '96	<i>Alaska Leader</i>	250	267	5	287	3094
25 Jun '96	<i>Alaska Leader</i>	250	267	6	249	0
25 Jun '96	<i>Alaska Leader</i>	150	240	8	284	821
26 Jun '96	<i>Alaska Leader</i>	151	240	1	295	0
26 Jun '96	<i>Alaska Leader</i>	151	240	3	274	11
26 Jun '96	<i>Alaska Leader</i>	251	255	9	244	11
27 Jun '96	<i>Alaska Leader</i>	248	263	10	244	900
28 Jun '96	<i>Vesteraalen</i>	155	86	4	274	4506
3 Aug '96	<i>American No. 1</i>	1	101	12	229	2321
4 Aug '96	<i>American No. 1</i>	2	113	13	274	11,782

lected by longlines is probably caused by regurgitation during the long operation (two to six hours) of longline surveys. Our data also indicate that more prey items (e.g. walleye pollock, salmon, rockfish, and snails) were found in stomachs collected by bottom trawls than collected from longlines (mainly arrowtooth flounder and octopus). Bottom depths (Table 1)

for the samples collected from bottom trawls were shallower (from 86 to 113 m) than for samples collected from longlines (from 240 to 267 m); bottom depth may also be a factor in the diet variations. Length of the sleeper sharks (Table 1) might also affect their diet; owing to the small sample size, however, no comparisons could be made from our study.

Discussion

On the basis of our sampling of stomach contents, sleeper sharks appear to feed mainly on the bottom. Even though *Octopus dofleini* represented only 5% of the total stomach content weight, they occurred in a high percentage of sleeper shark stomachs (73%). Other researchers have also found that benthic fish and invertebrates are the predominate species in the diet of sleeper sharks. Phillips (1953) found a sleeper shark in California that had fed on rockfish. Gotshall and Jow (1965) found that the diet of sleeper shark included rex sole, *Glyptocephalus zachirus*; Dover sole, *Microstomus pacificus*; Pacific halibut, *Hippoglossus stenolepis*; and cephalopods.

The diet of sleeper sharks vary with their size. Gotshall and Jow (1965) described the main food of a 114-cm female sleeper shark as *Moroteuthis robusta*. In our study lengths of sleeper sharks ranged between 200 and 300 cm. Their diets consisted mainly of arrowtooth flounder, walleye pollock, and cephalopods. Larger sleeper sharks (360–400 cm) have been reported to consume not only fishes and cephalopods, but also marine mammals, i.e. harbor seal (Bright, 1959) and southern right whale (Crovetto et al., 1992).

Table 2

Prey items (expressed in percent frequency of occurrence (%FO), and percent total weight (%W)) of sleeper shark, *Somniosus pacificus*, collected in Gulf of Alaska in 1996.

Prey name	%FO	%W
Gastropod (snail)	9.09	0.49
<i>Fusitriton</i> sp. (snail)	9.09	0.19
Cephalopod (squid and octopus)	27.27	0.17
Teuthoidea (squid)	36.36	0.62
<i>Octopus dofleini</i> (octopus)	72.73	4.63
Crangonidae (shrimp)	9.09	0.01
Pagurid (hermit crab)	9.09	0.01
Teleostei (unidentified fish)	45.45	0.33
<i>Oncorhynchus</i> sp. (salmon)	9.09	4.49
Gadidae (gadid fish)	9.09	0.49
<i>Theragra chalcogramma</i> (walleye pollock)	9.09	5.22
<i>Atheresthes stomias</i> (arrowtooth flounder)	63.64	67.21
<i>Sebastes</i> sp. (rockfish)	9.09	2.06
Pleuronectid (unknown flatfish)	18.18	0.86
<i>Hippoglossoides elassodon</i> (flathead sole)	9.09	0.98
Fishery offal	9.09	12.27
Total prey weight (g)	24,017	
Number of stomachs with food	11	
Number of empty stomachs	2	

We would like to note that stomach samples used in our study were from the area southwest of Kodiak Island, close to Steller sea lion (*Eumetopias jubatus*) rookeries at Chowiet and Chirikof Islands, as well as near numerous sea lion haulouts (Sease et al., 1993; NMFS, 1995). However, sleeper shark attacks on pups have not been reported at any time of year and we did not find evidence of predation on sea lions in our study. We did find fish offal (five arrowtooth flounder heads) in stomach samples. Bigelow and Schroeder (1948) also reported that Greenland shark, *Somniosus microcephalus* (a similar congeneric species of sleeper shark in the Atlantic Ocean), devours carrion, such as whale meat and blubber from whaling operations. It seems that sleeper shark, like Greenland shark, is sluggish and likes to stay on the bottom, feeding opportunistically on what they encounter in the environment (including carrion and fish offal).

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Literature cited

- Bigelow, H. B., and W. C. Schroeder.**
1948. Lancelets, cyclostomes and sharks. *In* Fishes of the western North Atlantic, part 1, p. 1–576. Sears Found. Mar. Res., Yale Univ., New Haven, CT.
- Bright, D. B.**
1959. The occurrence and food of the sleeper shark, *Somniosus pacificus*, in a central Alaska bay. *Copeia* 1959 (1):76–77.
- Castro, Jose I.**
1983. The sharks of North American waters. Texas A&M Univ. Press, College Station, TX, 180 p.
- Crovetto, A., J. Lamilla, and G. Pequeno.**
1992. *Lissodelphis peronii*, Lacedpede 1804 (Delphinidae, Cetacea) within the stomach contents of a sleeping shark, *Somniosus cf. pacificus*, Bigelow and Schroeder 1944, in Chilean waters. *Mar. Mamm. Sci.* 8(3):312–314.
- Gotshall, D. W., and T. Jow.**
1965. Sleeper sharks, *Somniosus pacificus*, off Trinidad, California, with life history notes. *Calif. Fish Game* 51:294–298.
- NMFS (National Marine Fisheries Service).**
1995. Status review of the United States Steller sea lion, *Eumetopias jubatus*, population. U.S. Dep. Commer., National Marine Mammal Laboratory, 7600 Sand Point Way NE. Seattle, WA 98115-0070, 45 p.
- Phillips, J. B.**
1953. Sleeper shark, *Somniosus pacificus*, caught off Fort Bragg, California. *Calif. Fish Game* 39(1):147–149.
- Robinson, S. M. C., and E. B. Hartwick.**
1983. Relationship between beak morphometrics and live

wet weight of the giant Pacific octopus, *Octopus dofleini martini* (Wulker). *Veliger* 26(1):26–29.

Sease, J. L., J. P. Lewis, D. C. McAllister, R. L. Merrick, and S. M. Mello.

1993. Aerial and ship-based surveys of Steller sea lions, *Eumetopias jubatus*, in Southeast Alaska, the Gulf of Alaska, and Aleutian Islands during June and July 1992. U. S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-17, 57 p.

Tanaka, S., K. Yano, and T. Ichihara.

1982. Notes on a Pacific sleeper shark, *Somniosus pacificus*, from Suruga Bay, Japan. *J. Fac. Mar. Sci. Technol. Tokai Univ.* 15:345–358.

Wilimovsky, N. J.

1954. List of the fishes of Alaska. *Stanford Ichthyol. Bull.* 4(5):279–294.