

Cooperative Foraging by Steller Sea Lions, *Eumetopias jubatus*

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Steller Sea Lions were observed cooperatively foraging for Eulachon (*Thaleichthys pacificus*) and possibly Herring (*Clupea pallasii*) in Berners Bay, southeast Alaska in spring, 1996–1999.

Key Words: Steller Sea Lion, *Eumetopias jubatus*, Eulachon, *Thaleichthys pacificus*, Herring, cooperative foraging, southeast Alaska.

Predators may forage singly or in groups, and foragers in groups may cooperate when hunting prey. Among the marine mammals, at least five species of whales, both toothed and baleen, are known to forage cooperatively (Clapham 1993; Wursig and Clark 1993; Wells et al. 1999). However, cooperative foraging in pinnipeds has been suspected but not documented. Here we report several observations of 75 to 300 Steller Sea Lions (*Eumetopias jubatus*) foraging cooperatively.

The behavior was observed in late April or early May 1996–1999 during a study of the numerical response of vertebrate predators to the spring spawning run of Eulachon (*Thaleichthys pacificus*), a small anadromous smelt that spawns primarily in mainland glacial rivers from California to Alaska (Hart et al. 1944). Observers were present for a week before the Eulachon entered fresh water and for several weeks during and after the spawning run. Observations were made from a skiff in Berners Bay, a relatively small (4.5 km × 3 km) sheltered saltwater bay, 65 km north of Juneau, Alaska (58°45'N, 135°00'W), that is fed by one clearwater and two glacial rivers.

Around 0800 h on 6 May 1996, SMG and JNW noticed a large disturbance outside the bay approximately 4 km away. The disturbance at first appeared to be the wake of a large boat but within several minutes it became clear that it was a large group of Steller Sea Lions moving synchronously toward the bay. Approximately 20 minutes later, a line of rapidly porpoising Sea Lions was observed moving into the bay toward our skiff. The line of Sea Lions, comprised of about 200 to 300 individuals, was perpendicular to the shore and stretched nearly 0.75 km, with the nearest Sea Lion approximately 0.5 km offshore. Most individuals were no more than a few meters apart. All individuals in the line porpoised for 8 to 20 seconds before diving simultaneously for 4 to 9 minutes, after which the water became calm with no indication that any Sea Lions were in the area. Upon simultaneous reemergence in a different

section of the bay, the Sea Lions again porpoised for 6 to 15 s before diving simultaneously. During the third reemergence, the line reappeared in another part of the bay approximately 1 km away. The behavior continued for over an hour, with the foraging "line" moving into and out of different sections of the bay. The number of individuals participating gradually decreased and after 2 hours no more Sea Lions were seen foraging in this manner.

For much of the rest of the day, the Sea Lions formed large "rafts" of 10 to 80 sleeping or resting individuals in the middle of the bay (see also Orr and Poulter 1967). The "line" did not reform that afternoon and we left the area around 1700 h. When we arrived at 0900 h the following morning, the cooperative foraging was already in progress. The line, consisting of approximately 200 individuals, moved throughout the bay for over an hour before breaking apart into large rafts. The behavior was not observed again that spring.

We revisited Berners Bay in the springs of 1997, 1998, and 1999 and similar behavior of cooperative foraging, followed by the formation of large rafts, was observed. On 4 and 5 May, 1997, 100 to 300 Sea Lions participated in the foraging line, and up to 100 Sea Lions were observed cooperatively foraging during the last week of April in 1998. In all years, cooperative foraging was observed only just before, or just after, the first Eulachon entered fresh water.

As a result of the rapid movement and unpredictable location of the foraging line, it was impossible to determine with accuracy the prey species targeted by the Sea Lions while cooperatively foraging. However, in 1996 and 1997 we believe that Sea Lions were foraging on Eulachon for several reasons. First, we were able to observe the rafts at close range and some sleeping individuals had partially consumed Eulachon bodies hanging from their mouths. Second, the cooperative foraging behavior consistently occurred just as the Eulachon run was

beginning. Very little is known about the schooling behavior of Eulachon but anecdotal reports suggest that they overwinter in deep water and, following some environmental cue, rapidly migrate to freshwater spawning areas. Thus, Sea Lions may have been targeting schools of Eulachon as they moved into Berners Bay en route to the rivers where they spawn. Herring (*Clupea pallasii*) may also have been the prey pursued by the Sea Lions while cooperatively foraging. Herring spawned extensively along the eastern shore of Berners Bay in 1996 and small groups of Sea Lions (3 to 5 individuals) were seen on occasion foraging for Herring near the shore. However, Herring did not spawn in Berners Bay in 1997 and 1998, suggesting that Eulachon or some other forage fish may have been the prey species pursued during those years.

Although it is difficult to distinguish adult females and immature males while in the water, animals of both sexes and presumably all age classes were observed in the rafts following the cooperative foraging behavior. Berners Bay is located approximately 18 km from Benjamin Island, where 300 to 600 individuals "haul out" from September–May, although they are absent in the summer months (Alaska Department of Fish and Game, 802 Third St., Juneau, Alaska, unpublished data). The "haul-out" is used by adults and subadults of both sexes, including nursing females (JNW, personal observation). Many of the Benjamin Island Sea Lions probably participated in the cooperative foraging behavior, because the "haul-out" was reported to have few individuals during our observations (E. M. Anderson, personal communication), whereas hundreds of Sea Lions were present there the week prior to our observations.

To our knowledge this is the first recorded observation of Sea Lions foraging in this manner, although cooperative foraging has been suspected. Near Unimak Pass, Alaska, large groups (up to several thousand) of Sea Lions were observed simultaneously leaving rookeries or "haul-outs", swimming out to sea and, when schooling fishes were targeted, feeding in groups of up to 50 individuals before simultaneously returning to land in the late afternoon (Fiscus and Baines 1966). When large schools of fish were absent, group foraging was absent or reduced to a few individuals (Fiscus and Baines 1966). Off the coast of central California, Sea Lion rafts, consisting of up to several hundred individuals, were repeatedly observed to dive synchronously (Orr and Poulter 1967). Other observations have been made of Sea Lions foraging in groups (Loughlin and Nelson 1986; references in Hoover 1988) but no studies have indicated the cooperative foraging tactic that we observed.

Sometimes Sea Lions foraged individually for Eulachon in the rivers and probably in the ocean, and we also observed singletons foraging for Herring. However, we know very little of the specific conditions that favor solitary vs. cooperative foraging by Sea Lions. Cooperative foraging may lead to higher per capita energy intake or reduce the risk of poor foraging success (Packer and Ruttan 1988) when prey are aggregated, but such hypotheses remain to be tested in this system.

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