

### III. Marine Mammal Species Accounts

#### **Northern Fur Seal *Callorhinus ursinus* Linnaeus**

##### Description

The Northern Fur Seal, also called the Alaska Fur Seal, is actually a member of the sea lion family (Otariidae), known as the eared seals. This species displays sexual dimorphism. The males reach a length of about 2 m and weigh 180 to 270 kg (Orr and Helm 1989). The females weigh 43 to 50 kg and reach a length of 1.5 m. Although the nose of this species is pointed, the muzzle is short; this causes the area from the nose to the neck to appear convex while the head is in profile.

Until the age of 5 years both sexes look similar (Gentry 1981). At the age of 7-8 years the males experience an accelerated growth rate. At this age the neck and shoulders become quite large in comparison to the length of the body and the neck hairs appear grizzled (Orr and Helm 1989). This grizzled appearance is due to the guard hairs parting when wet, exposing the light colored underfur which is always dry. The color of the males tends to be dark brown on the dorsal side and also dark on the underside (Gentry 1981). The females are dark gray above and lighter beneath. Both sexes when mature have white vibrissae. The hair on the front flippers of both sexes ends suddenly along a contour extending directly across the base of the flipper. The hind flipper is proportionally very long in both males and females (Orr and Helm 1989).

##### Breeding

Northern Fur Seals are polygynous breeders (Reeves et al. 2002) that set up rookeries on rocky island beaches (Whitaker 1998). Adult males establish territories in late May to early June, and aggressively guard 40 or more females (Orr and Helm 1989). Adult females mate in mid-June to mid-July. Yearlings mate in August (Orr and Helm 1989). One glossy black pup weighing 4.5 to 5.4 kg is born in June or July of the following year (Whitaker 1998). Pregnant females arrive at the rookeries in June and give birth two days later. They nurse for about 10 days then go to sea to feed for four or five days. Subsequently, they feed for eight to ten days and nurse for one to two days. Pups are weaned after about four months.

##### Feeding Behavior and Diet

Northern Fur Seals forage at average depths of 70 m and feed mostly at night when fish move closer to the surface (Whitaker 1998). The majority of their diet is composed of about 50 different species of small schooling fish. Squid and other cephalopods are also common prey items. Occasionally this species will feed on other marine mammals and seabirds.

##### Habitat

These animals are at sea most of year; in the summer, they breed on rocky island beaches (Whitaker 1998).

##### World Distribution

The range of the Northern Fur Seal extends throughout the Pacific rim from Japan to the Channel Islands of California, although the main breeding colonies are in the Pribilof and Commander Islands in the Bering Sea (Orr and Helm 1989). Smaller rookeries exist on the Kuril Islands north of Japan, Robben Island in the Sea of Okhotsk, and on San Miguel Island off southern California.

##### California Distribution

The largest California breeding colony is on San Miguel Island (Le Boeuf and Bonnell 1980). A second colony was discovered in 1972 on Castle Rock, just north of San Miguel Island. It is thought

that the entire population at San Miguel Island winters in California waters. This colony was first discovered in 1968 when 40 pups, 60 females, and one male were observed (Le Boeuf and Bonnel 1980). These seals have strong attachments to their breeding areas (Gentry 1981). They do not abandon old sites or form new ones easily. The colony on San Miguel Island is therefore unusual, suggesting that the Northern Fur Seal once had a range similar to that of the Steller Sea Lion prior to its decimation by man (Orr and Helm 1989).

At the end of the breeding season the males leave in August, followed by the females and the juveniles in November (Orr and Helm 1989). Migrational dynamics of males are not well understood. Those in the northern part of this species' range tend to move south of the Aleutian Islands and along the Gulf of Alaska. The females migrate throughout the North Pacific. Adult females from the Bering Sea population migrate south as far as Baja California (Orr and Helm 1989). Immature animals do not travel as far south as the females. Little is known about their distribution until their return to the breeding islands as three-year-olds. Juvenile males under 2 years of age appear to be concentrated in areas where herring spawn from Auke Bay to Monterey Bay (York 1991).

Northern Fur Seals stay well offshore, usually 50 to 110 km, concentrated in areas of upwelling over the continental slopes and seamounts (York 1991). Young animals of less than 2 years tend to stay closer to shore. During winter migration they tend to occur solitarily, sometimes in pairs, and less frequently in small groups of three or more individuals (Gentry 1981). Throughout the winter and early spring these seals remain offshore and are the most abundant pinniped in central and northern California.

### Population Status and Dynamics

Commercial harvests began in the 1700s (Reeves et al 2002). Northern Fur Seals were first hunted for pelts in 1786 on the Pribilof Islands, home to more than 70 percent of world population (Gentry 1981). The herd at that time was thought to number roughly 2.5 million animals. Their numbers declined steadily to a low point in 1835. This decline was due to slaughter both on their breeding grounds and on the open ocean where the seals spend much of the year. This herd was allowed to recover until 1867 when the United States purchased Alaska from Russia. These islands were set aside as a reserve for the seals, but unmitigated sealing on the open ocean continued. Hunting on the islands brought the population to a second low in 1910. Under new harvest restrictions since the 1950s, the population began to increase and has continued to do so.

Although hunted extensively in the past, in 1988 the NMFS designated the Pribilof Islands herd a 'depleted stock' and made harvest illegal for anyone other than native people who rely on them for subsistence (Whitaker 1998). The California breeding population has increased exponentially since its discovery in 1965 (Le Boeuf and Bonnell 1980, Gentry 1981). The worldwide population is now thought to total approximately 1.2 million animals (Reeves 2002).

### Threats and Management Implications

About 12 percent of young fur seals die within their first month, usually from a hookworm which causes anemia and is transmitted to them via their mothers' milk (Whitaker 1998, Lyons et al., 2001).

Northern Fur Seals appear to be sensitive to the warming ocean waters of El Niño (MMC 2002). For example, a wildlife rehabilitation center (Marine Mammal Center, Marin, California) in northern California typically admits about five fur seals a year. During El Niño years, this number increased considerably to 22 in 1993 and 30 in 1997.

A substantial number of fur seals die after becoming entangled in fishing net fragments in the Bering Sea and North Pacific Ocean (Reeves 2002).

# Steller Sea Lion *Eumetopias jubatus* Schreber

## Description

The Steller (or Steller's) Sea Lion is a member of the Otariidae or eared seal family. This species exhibits dramatic sexual dimorphism. Males weigh, on average, close to 450kg and attain a length of 2.9m (Orr and Helm 1989). Females weigh 240kg and reach a length of 2.4m. Both males and females are a yellowish color, varying from a yellowish brown to a cream, or light tan. The males' necks are large and have a thick mane of coarse hair. Males lack the sagittal crest seen in the males of the California Sea Lion. Both sexes have blackish and naked front and hind flippers. Steller Sea Lions typically haul out on rocky shores during good weather and stay in the water during poor weather (Whitaker 1998).

## Breeding

Steller Sea Lions are polygynous breeders (Reeves et al. 2002). Dominant mature males maintain territories for one to two months and defend 10 to 30 females (Whitaker 1998). Males fast during the breeding season. Females exhibit a high degree of breeding site fidelity, usually returning to breed at the rookery in which they were born (NMFS 1992). Pups are born on offshore islands from mid-May to mid-July (MMC 2002). One dark brown to black young is born usually in late May to June, weighing 18-20kg (Whitaker 1998). Pups are a dark grizzled brownish-gray color, appearing almost black when wet (Orr and Helm 1989). Mothers stay with pups for one to two weeks before hunting at sea (Whitaker 1998). Afterwards they spend roughly equal amounts of time hunting and nursing pups on land. Pups usually nurse for a year, but some continue to nurse for up to three years. In their first few weeks, pups tend to sleep in groups on the edge of breeding areas, where they are less likely to be crushed by careless bulls. While awake, pups spend much of their time swimming in tidepools.

## Feeding Behavior and Diet

Steller Sea Lions usually feed at night in water less than 180m deep within 15-25km of shore (Whitaker 1998). Their diet consists mostly of fish including, herring, blackfish, rockfish and greenling and less frequently salmon, squid, clams and crabs. In Washington, Oregon and California this species is known to swim up rivers to feed on migrating lamprey and salmon (Laake et al. 2001, Reeves 2002). Some females routinely travel 400km from their haul-outs on six-week foraging trips (Whitaker 1998). Males occasionally kill and eat Northern Fur Seal pups, Harbor Seals, Ringed Seals and Sea Otters (Reeves 2002).

## Habitat

This species inhabits rocky shores and nearshore coastal waters (Whitaker 1998). Rookeries usually occur on remote islands beaches, often exposed to the elements, where access to humans and predators is difficult (NMFS 1992). Substrates include sand, gravel, cobble, boulders and bedrock. Rookeries may extend across low-lying reefs and islands.

## World Distribution

Steller Sea Lions are found throughout the North Pacific Rim from Japan to central California. Unlike California Sea Lions, Stellers tend to remain offshore, and to haul out in unpopulated areas (Orr and Helm 1989). Breeding occurs along the North Pacific Rim from the Kurile Islands to Año Nuevo Island in central California. The greatest concentration of rookeries is in the Gulf of Alaska and Aleutian Islands. The northernmost breeding colony is on the Pribilof Islands, while the center of greatest density is around the Aleutian Islands.

## California Distribution

Steller Sea Lions are present on rocky shores and coastal waters along the California coastline (Whitaker 1998). There are small rookeries off the California coast on Año Nuevo, Farallon, Sugar Loaf Rock/Cape Mendocino and (Point) St. George Reef (Whitaker 1998, NMFS 1992). Migration occurs in August, at the end of the breeding season; males leave first, followed by females (Schusterman 1981). Males that breed in California spend the nonbreeding months in Alaska and British Columbia, and are rarely seen in California or Oregon outside of the breeding season (NMFS 1992). This species differs from the California Sea Lion in favoring the outer coast, preferring to haul out on offshore rocks and rocky islands (Whitaker 1998). These sea lions are not often found in river mouths, bays, or estuaries like the California Sea Lion, although they will enter river mouths in to prey upon lamprey and salmon as they return from the ocean to spawn (Reeves et al. 2002, Laake et al. 2001).

Steller Sea Lions are believed to range widely throughout the non-breeding season. During the non-breeding season these animals may haul out on rocks, reefs, beaches; at rookery sites; and on jetties or other little-disturbed manmade structures such as buoys and docks (NMFS 1992). Steller Sea Lions also use traditional rafting sites where they rest on the ocean surface in tightly packed groups (Bigg 1985 in NMFS 1992).

Currently the southernmost colony is at Año Nuevo Island. This site produces more pups than any other California rookery, an average of 300 per year in the mid-1980's (Orr and Helm, 1989, D. Ainley in NMFS 1992). The southernmost breeding colony was San Miguel Island, in the Channel Islands, where adults have been seen since 1983 but no births have been recorded since 1981 (Schusterman 1981, R. Delong in NMFS 1992).

## Population Status and Dynamics

Steller Sea Lions were exhaustively hunted starting about 1860, with exploitation efforts chiefly targeting males, owing to their superior size. Hides, blubber, and reproductive organs were taken (Schusterman 1981). Intensive sealing wiped out many colonies. Colonies on the Farallon Islands and at Seal Rocks off San Francisco had been exterminated by 1889. Commercial harvests continued through 1972 (NMFS 1992). In subsequent decades commercial sealing ended, and some components of the population have increased (Schusterman 1981).

In Alaska the total number of animals increased from 250,000 to 282,000 between the mid-1950s and the mid-1970s. Since 1980 the population has decreased by over 70%, to approximately 76,000 individuals in 1992 (Trites and Larkin 1996). The current population of Steller Sea Lions is between 60,000 and 70,000 (Reeves et al. 2002).

There is presently considerable concern about this species, which has declined by 80% over the past 30 years. In 1997 two distinct populations were formally distinguished. The western stock in Alaska was listed as Endangered, while animals living in British Columbia, Washington, Oregon, and California were listed as threatened (NMFS 2002). Exact reasons for population declines are unknown. Researchers believe a decline in preferred fish stocks is a principal cause (Rosen and Trites 2000). A Biological Opinion released in 1998 by the Alaska Region's NMFS concluded that commercial fisheries in Alaska for walleye, pollock and Atka mackerel might have adverse impacts on Steller Sea Lions (NMFS 2002). The agency is currently developing alternatives to mitigate potential impacts. The synergistic effects of depleted fish stocks, entanglement in nets and plastics, take by commercial fisheries and shootings have all contributed to the Steller Sea Lion's decline (Rosen and Trites 2000, Hanni and Pyle 2000, Goldstein et al. 1999).

The number of Steller Sea Lions comprising the western stock has shown a continuous decline since the 1970s (NMFS 2002). Since 1980 Steller Sea Lion populations have dropped from 300,000 to

100,000 (NMFS 2002). The extent of this decline led the National Marine Fisheries Service (NMFS) to list the Steller Sea Lion as threatened rangewide under the Endangered Species Act (ESA) in April 1990.

Since the 1930s the Steller Sea Lion has been in decline around the Channel Islands (Schusterman 1981). This may be due to increasing water temperatures in the area (Bartholomew 1967 in Schusterman 1981).

At the Farallon Islands, the number of adults and juveniles present during the breeding season declined by 50% from the late 1970s to 1990 (D. Ainley in NMFS 1992). Although Whitaker (1998) reports an estimate of about 30 pups born each year on the Farallon Islands, only 3 pups were born in 1988, 1989 and 1990 (D. Ainley in NMFS 1992). If this trend continues, the Farallon Islands may cease to be a breeding site in the near future.

Results of counts conducted on Sugar Loaf Rock/Cape Mendocino in the early 1980s and in 1989 resulted in an estimate of 900 adults present per year, producing about 120 pups (Bonnell et al. 1983 in NMFS 1992).

The breeding population on St. George Reef increased greatly between the early 1980s (~250 adults, 10-25 pups) to 1990 (674 adults, 124 pups) (Bonnell et al. 1983 in NMFS 1992). Population trends in the past few decades suggest there may be a northward shift in this species' distribution in California.

### Threats and Management Implications

Prior to the species' listing as Threatened under the Endangered Species Act in 1990, a multi-year permit was granted to commercial fisheries in 1988 allowing them to take up to 1350 individuals annually without penalty (NMFS 1992, Whitaker 1998).

These sea lions are sensitive to human disturbance; when hauled out; they will dive into the ocean upon close approach by a boat (Whitaker 1998).

Steller Sea Lions are susceptible to many of the same diseases as California Sea Lions, such as leptospirosis and San Miguel sea lion virus (NMFS 1992).

## **California Sea Lion *Zalophus californianus* Lesson**

### Description

As a member of the Otariidae family, these animals have small but distinct external ears (Orr and Helm 1989). There is a marked degree of sexual dimorphism within this species. The males are generally brown to dark brown---almost black when wet---and attain an average length of 2.25m and an average weight of 325kg. The male's neck is large and thick in comparison with the rest of the body. The top of the head of mature males has a sagittal crest that is covered with a patch of light hair. The females are tan in color, have an average length of 1.8m and an average weight of 110kg. Females are also nearly black when wet. The hind flippers of both sexes are hairless and blackish in color. When occurring in any numbers, these animals are noisy throughout much of the day and night. Under calm conditions, the calls of bull California Sea Lions may be heard at a range of a mile or more. Concentrations of these animals are commonly heard before they are seen.

### Breeding

California Sea Lions are polygynous breeders (Reeves et al. 2002). Breeding males establish territories in southern California in May, June or July (Orr and Helm 1989). Females haul out in May or June to give birth to one blue-eyed pup which weighs about 16kg (Orr and Helm 1989, Whitaker 1998). Females nurse their pup for one or two days, then leaves to forage for three to four days. This cycle continues until weaning when the pup is four to eight months of age (Orr and Helm 1989).

Mothers recognize pups within crowded rookeries through smell, sight, and vocalizations. Pups also learn to recognize the vocalizations of their mothers. Breeding takes place a few weeks after females give birth.

### Feeding Behavior and Diet

California Sea Lions are primarily nocturnal hunters, spending most of the day sleeping on islands (Whitaker 1998). This species has a diverse diet. Favorite prey includes northern anchovy, squid, sardines, pacific and jack mackerel and rockfish (Reeves et al. 2002). They feed in the cool upwelling waters near the mainland coast, along the continental shelf, and around offshore rocks; they sometimes forage at the sea floor. California Sea Lions are infamous for seizing fish from commercial fishing lines and nets. In Washington, Oregon and northern California they gather around river and stream mouths to prey upon migratory salmon and lamprey (Laake et al. 2001, Reeves et al. 2002).

### Habitat

Generally islands; sandy or rocky beaches; occasionally caves protected by cliffs (Whitaker 1998). Cooler upwelling water near the mainland coast, over the continental shelf, and offshore rocks is preferred (Reeves et al. 2002).

### World Distribution

The California Sea Lion is divided into three subspecies. *Z. c. californianus* is found along the coast from British Columbia southward to the Tres Marias Islands, Mexico (Odell 1981). *Z. c. wolfebaeki* is found on the Galapagos Islands (Ridgeway and Harrison 1981). *Z. c. japonicus* formerly resided off Japan and Korea, but is now thought to be extinct. However, Odell (1981) believes that there are some islands off the Korean coast that should be checked for remnant populations (Odell 1981).

The breeding range of *californianus* is from the Farallon Islands south to the Sea of Cortez, Mexico. (Orr and Helm 1989). They also breed on some of the islands off Baja California.

Although the breeding range is restricted, California Sea Lions are highly mobile, and they exhibit a strong degree of dispersal into waters in which they do not pup. Mature and immature males migrate northward along the coast of California, Oregon, Washington, and British Columbia after the breeding season and then travel back again in early spring (Odell 1981).

### California Distribution

California Sea Lions are present along the California coast in suitable habitat. They breed mainly on offshore islands, ranging from southern California's Channel Islands south to Mexico (Orr and Helm 1989). The most important breeding site is the Channel Islands. The largest California rookeries are on San Nicolas Island and San Miguel Island (Le Boeuf and Bonnell 1980). Annual peak abundance in southern California occurs in the summer during the breeding season (Barlow et al. 1995 in NMFS 1997).

A small number pups have been born on Año Nuevo Island and the Farallon Islands in central California (Orr and Helm 1989, Le Boeuf and Bonnell 1980). While few animals breed in Northern California, large numbers of California Sea Lions haul out on Año Nuevo Island every year. The peak is during the fall after the breeding season when the males migrate northward. Migrating males spend much time out of the water on sandy beaches, flat reefs and offshore islands (Orr and Helm 1989). They will also haul out onto inaccessible beaches on the mainland. Females tend to stay close to the rookeries all year.

The largest haul-out in central/northern California is generally on the Farallon Islands (Huber 1991 in NMFS 1997). Peak abundance usually occurs there during the spring or fall migration, but the

highest numbers have occurred during the summer breeding season in El Niño years. One notable exception occurred in the summer of 1995, when the largest concentration of sea lions in central/northern California was on Año Nuevo Island. In the San Francisco Bay area, California Sea Lions haul out at Pier 39 with peak counts occurring during winter (K. Hanni in NMFS 1997).

### Population Status and Dynamics

The California Sea Lion was once killed for oil rendered from its blubber; the meat was used for dog food. This species is now fully protected by law in both Canada and the United States (Whitaker 1998, Reynolds and Rommel 1999).

Subsequent to passage of the Marine Mammal Protection Act (MMPA) in 1972, the California Sea Lion population off the West Coast of the United States has increased at an average annual rate of more than five percent (NMFS 2002). During the 1980s this population was estimated at between 167,000 and 188,000 animals (NMFS 1997).

In the early 1980s summer counts off the coast of California ranged from 4378 to 11,209; fall surveys ranged from 10,334 to 24,348 (Bonnell et al. 1983 in NMFS 1997). California statewide aerial surveys conducted in the summer of 1995 estimated 14,300 California Sea Lions, including 3000 at the Farallon Islands (Sydeman in NMFS 1997). The total fall count in 1995 was 16,900, of which 1000 were at the Farallons.

Counts at Año Nuevo Island in the early 1990s averaged 2869 California sea lions (Ono et al. 1993 in NMFS 1997). In the fall of 1995 the largest concentration of California Sea Lions in central California occurred on Año Nuevo Island, where 6745 animals were counted (Huber 1991 in NMFS 1997). Typically the greatest concentration in this area occurs on the Farallon Islands, where abundance is greatest during the spring and fall migrations.

In southern California peak abundance occurs during the summer breeding season. At the Channel Island breeding rookeries the count was 81,300 sea lions in 1994 (Barlow et al. 1995 in NMFS 1997).

### Threats and Management Implications

Human activities continue to harm these mammals. Many sea lions drown after becoming entangled in gill nets. The increasing populations of California Sea Lions and Harbor Seals has resulted in increased conflicts with commercial and sport fishing interests. Concern has increased in recent years over the impacts these animals may be having on depressed and declining salmon stocks (NMFS 2002).

During the 1970s high numbers of aborted pups were documented (Le Boeuf and Bonnell 1980). High level of pesticides and viruses were implicated as possible causes.

## **Pacific Harbor Seal *Phoca vitulina richardsi* Linnaeus**

### Description

Lacking external ears, this species belongs to the Phocidae family. Harbor Seals do not show much sexual dimorphism, although the males tend to be slightly larger (Orr and Helm 1989). The Pacific Harbor Seal may reach a length of 1.2 to 1.6m. Adult weight ranges from 60 to 80kg. The head is round, and the muzzle is shorter than is typical for other seal species. The color of the pelt is quite variable, ranging from dark brown with spots barely visible to a pale silver-gray with black or dark brown spots. The front flippers are small and hairy. The hind flipper is comparatively large and has developed so that the flipper can be expanded while swimming. These seals are clumsy on land, hopping along on their bellies for locomotion (Bigg 1981). Harbor Seals differ from other pinnipeds found in California in that they seldom vocalize (Orr and Helm 1989).

## Breeding

Harbor Seals are thought to be a serially-monogamous species (Reeves et al. 2002). A male will breed with one to a few females per season. Harbor Seals are often observed during the pre-mating and mating seasons slapping the water with their pectoral flippers as a form of communication. Males vocalize and display, mostly underwater, both to attract females and to threaten challenging males (Harvey pers, comm. 2001). Vocalizations are mostly growls and coughs, accompanied by thrusts of the head (Reeves et al. 2002).

Breeding season varies; 1 pup is born March-August, with adult fur, weighing 8-12kg (Whitaker 1998). Along the California coast pups are born between March and early May (Orr and Helm 1989). The young are usually born on a reef or sandbar. They are able to swim almost immediately. Weaning takes place at four to six weeks of age, after which there is no further contact between the mother and pup (Stein 1989 in NMFS 1997).

Females are sexually mature at 2-5 years of age and live up to 30 years (Bigg 1969 in NMFS 1997). Males are sexual mature at 3-5 years of age and generally live less than 20 years. Pregnant females often segregate into nursery aggregations away from main haul-out sites.

## Feeding Behavior and Diet

Harbor Seals are opportunistic feeders, and are known to feed on pelagic schooling fish, lamprey, smelt, flounders and salmonids; diet depends primarily on prey availability (Whitaker 1998, Reeves et al. 2002). The proportion of prey species varies with the season (Bowlby 1981). Harbor Seals can dive to depths of 90m and stay submerged for 15-28 minutes (Reynolds and Rommel 1999). Mean dive duration is directly proportional to seal size, with larger seals averaging longer dives. They generally dive by sinking slowly, closing their external ear openings.

## Habitat

Coastal waters, mouths of rivers, beaches, and rocky shores are preferred (Whitaker 1998). Harbor Seals favor nearshore coastal waters and are often seen at sandy beaches, mudflats, bays, and estuaries. They regularly swim to the upper limit of strong tidal influence in larger streams.

## World Distribution

Harbor Seals are found along coasts of the temperate Northern Hemisphere in both the Atlantic and Pacific Ocean basins (Orr and Helm 1989). They enjoy a vast distribution; in the northeast Pacific, they range from Alaska to Baja California, Mexico. Harbor Seals also inhabit the North Atlantic from Greenland to North Carolina and from Iceland south to the Netherlands, and sometimes to France. Based in part on geographic distribution, five subspecies are recognized (Reeves et al. 2002).

Harbor Seals are the most abundant pinniped in Washington and Oregon, and one of the most common pinnipeds in California (NMFS 1997). They are present year-round. They typically remain within a 25-50km area, although movements of up to 500km have been recorded. Pupping occurs in coastal waters of all three states.

Pupping season occurs sequentially along the Pacific Coast, with pups born earlier in the south and later in the north (NMFS 1997). In Washington, pups are born up to 2 months later in the inland waters of the San Juan Islands, Strait of Juan de Fuca, Eastern Bays, and Puget Sound than on the coast; in Hood Canal, the pupping season is extended from August to January.

Harbor Seals do not have extensive annual migrations (NMFS 1997).

### California Distribution

The Pacific Harbor Seal (*P. v. richardsi*), the smallest subspecies, inhabits the Pacific Coast of North America (Bigg 1981). Harbor Seals are found in appropriate habitats along the entire California coast. They are nonmigratory, generally traveling no greater than 300km for food, breeding sites, and dispersal of young. Some short movements may be associated with seasonal availability of prey and with breeding. These seals are often found in estuaries and bays. Along the coast they tend to stay fairly close to shore, hauling out on sandbars, small rocks, reefs, and islands (Whitaker 1998). It is thought that Harbor Seals are highly social as a strategy to protect them from predators. These animals are wary; as groups become larger, individual seals are able to spend more time resting and less time being vigilant (Orr and Helm 1989). Additionally, Harbor Seals are able to thermoregulate better in groups than individually (Reynolds and Rommel 1999). Despite their seeming attitude of nonchalance while hauled-out, at least some individuals among a group of Harbor Seals maintain a visual command of their surroundings. They are never far from water; whether on an island, reef, sandbar, or rock, they will flee to the water at the first sign of danger (Orr and Helm 1989).

Along the California coast pups are usually born on a reef or sandbar between March and early May. (Orr and Helm 1989). In California there are more than 860 recognized haul-out sites in addition to sites on all eight of the Channel Islands (NMFS 1997).

### Population Status and Dynamics

Populations of Harbor Seals are difficult to estimate due to the behavior of these animals. The herds tend to be small and scattered, and they are easily frightened. Aerial surveys conducted during the molting season in August provide the best estimates (NMFS 1997). The world population in 1981 was estimated to be between 760,000-950,000 (Bigg 1981). Systematic aerial photographic surveys were conducted by the California Department of Fish and Game (CDFG) from 1982-1995 and in 2001 (Fluharty 1996, Read and Reynolds 2001). Harbor Seals were counted in California during their early summer molting period, which is considered to be the time of peak abundance onshore.

The Federal Marine Mammal Protection Act has protected the Pacific Harbor Seal from hunting and harassment since 1972 (NMFS 2002). Populations of Harbor Seals on the Pacific Coast have increased at a rate of 5.6% a year since the mid 1970s and are presently at historically high levels (Hanan 1996 in NMFS 1997). The population in California is estimated at 32,699 (NMFS 1997).

### Threats and Management Implications

Harbor Seals are among the most difficult pinnipeds to approach and are easily disturbed by humans (Orr and Helm 1989). If disturbed too often, they have been known to abandon favorite haul-out sites or their pups. Human activities such sea-kayaking and seaweed collection may affect Harbor Seals on offshore haul-outs.

Each year from mid-February through the end of June, concerned citizens encounter Harbor Seal pups on beaches and pick them up, thinking they have been abandoned (MMC 2002). Usually the mothers have removed themselves from the pup in order to hunt. This problem has caused many seal pups to be unnecessarily orphaned. It puts such pups at further risk, as they are unable to get needed antibodies from their mothers' milk, thereby increasing susceptibility to disease.

Harbor Seals and California Sea Lions are known to congregate at the mouths of streams and rivers to feed on migratory lamprey and salmonids in Washington, Oregon and California (Laake et al. 2001, NMFS 1997). The National Marine and Fisheries Service (NMFS) is concerned that the co-occurrence of pinnipeds and depressed salmonid stocks may be a significant problem in the recovery of some threatened and endangered populations of anadromous fish (NMFS 1999, Laake et al. 2000).

Increasing populations of California Sea Lions and Harbor Seals have also resulted in increased conflicts with public activities, such as angler fishing (NMFS 2002).

## **Northern Elephant Seal *Mirounga angustirostris* Gill**

### Description

All elephant seals lack external ears, a characteristic they share with all members of the Phocidae family (Whitaker 1998). This species shows a high degree of sexual dimorphism. The males reach an average length of 4.5m and weigh an average of 2300kg (Orr and Helm 1989). The females reach an average length of 3m and weigh up to 900kg. Upon reaching maturity, males develop an enlarged and elongated nasal snout, hence the species' name. The ventral side of the neck of males is composed of a hard cornified skin that is mottled pink and extends down the chest. Females lack the elongated proboscis and the thickened skin of the males. Both the males and females have short stiff hairs and their color ranges from gray to brown. Adults become dark brown before they molt. Pups are born with a thick coat of dark brown hair, which they have until their first molt, after which they have a silvery-gray coat similar to the adults (Le Boeuf and Bonnel 1980).

The front flippers are small relative to the body size, but are quite mobile, especially the digits, which are used for scratching and scooping sand that is used for thermoregulation (Orr and Helm 1989). Akin to other phocids, elephant seals are unable to rotate their hind flippers under their bodies to walk (Reeves et al. 2002). On land they use their fore-flippers to pull themselves along.

### Breeding

Northern Elephant Seals are polygynous breeders and exhibit a high rate of site fidelity (Reeves 2002, Le Boeuf and Bonnel 1980). They prefer to breed on sandy beaches, probably due to their large size, but younger subordinate animals will breed on cobblestone beaches. This species is polygamous but not territorial (Reeves et al. 2002, Whitaker 1998). The bulls arrive on the breeding grounds first in early December when they establish dominance through visual and vocal displays and aggressive battles, establishing a linear dominance hierarchy (Orr and Helm 1998). By the time the females arrive, in late December, most disputes have been settled (Whitaker 1998, Orr and Helm 1989). Females give birth six days after hauling out (Whitaker 1998). Within one week of giving birth, the female breeds with the dominant bull (Orr and Helm 1989). The Northern Elephant Seal's milk is the richest in fat (54.3%) and lowest in water content (32.8%) of all mammals (Whitaker 1998). The pups' weight quadruples in four weeks to about 155kg, at which time they are weaned (Orr and Helm 1989). After weaning, females leave the rookery and return to the ocean. The pups remain near the rookery while they molt, and go to sea in April or May.

### Feeding Behavior and Diet

The Northern Elephant Seal is a deepwater feeder. The deepest dive recorded for an individual has been 1581m (Whitaker 1998). It can remain submerged for up to 80 minutes, then remain at the surface for only about four minutes before diving again (Le Boeuf and Bonnel 1980). This species feeds on deepwater marine life such as squid, octopus, ratfish, hagfish and small sharks (Whitaker 1998).

### Habitat

Temperate seas; subtropical sandy beaches for breeding and molting (Whitaker 1998).

### World Distribution

The breeding range of the Northern Elephant Seal is from the Farallon Islands off central California south to Natividad I. off Baja California, Mexico (Orr and Helm 1989).

When not breeding or molting, males migrate along the west coast of North America as far north as Vancouver Island and out to sea up to 60km. Females have a shorter transit and forage in pelagic zones off the California coast during the non-breeding season (Le Boeuf and Bonnel 1980).

### California Distribution

During the breeding season, Northern Elephant Seals live on beaches on offshore islands and at a few remote spots on the mainland (Orr and Helm 1989). The rest of the year, except for molting periods, they live as far as 8000km offshore. Elephant seals experience a ‘catastrophic’ molt each year between April and August, shedding their hair and upper layer of skin (Renyolds and Rommel 1999).

The largest breeding colonies are on San Miguel and San Nicolas Islands; smaller colonies are on Santa Barbara, Santa Rosa and San Clemente Islands in the Channel Islands (Reeves et al. 2002). In central California, colonies occur on the Farallons, at Año Nuevo Island, and on the mainland at Punta Gorda, Point Reyes, Point Año Nuevo, Cape San Martin and Point Piedras Blancas. Colonies are also established on Coronado, Guadalupe and San Benito islands in Baja California.

### Population Status and Dynamics

“Few, if any, living species today have been so deeply scored, so driven too the very brink of extermination” (Huey 1930 in Le Boeuf and Laws 1994). Northern Elephant Seals were hunted beginning in 1818 for their blubber---rendered into oil---until the early 1870s when they were considered extinct (Le Boeuf and Bonnell 1980). In the 1880s a few remnant populations were discovered and promptly killed in the name of science, or for oil. By the 1890s fewer than 100 seals were left, all on Guadalupe Island off Baja California. In 1922 the Mexican government granted protection to this herd, enabling these seals to multiply and spread northward (Orr and Helm 1989). Eventually populations recovered enough that a colony was established at Año Nuevo Island in 1960 and another at the Farallon Islands by the early 1970s (Orr and Helm, 1989).

In 1960 Bartholomew and Hubbs (Le Boeuf and Laws 1994) estimated the total population to be approximately 13,000. Recovered from near extinction, the population has grown logarithmically since the 1960s. The population has increased primarily due to the expansion of breeding areas. Breeding on the mainland has been a successful strategy, one that could not have worked in the past due to predation by grizzly bears, wolves and mountain lions (Le Boeuf and Bonnell 1980). In 1998 the population was estimated to be more than 175,000 animals (Renyolds and Rommel 1999).

### Threats and Management Implications

Orcas and Great White Sharks prey upon young Northern Elephant Seals, but healthy adults seem relatively immune to predation (Le Boeuf and Bonnell 1998, Whitaker 1998).

From mid-February through June, orphaned elephant seal pups are often washed away from the rookery during a storm and found stranded on public beaches or along the rocky shorelines. These pups are usually underweight. They also typically suffer from diseases such as Northern Elephant Seal skin disease, parasites, and pneumonia (MMC 2002).

## **Sea Otter *Enhydra lutris* Linnaeus**

### Description

Sea Otters show some degree of sexual dimorphism. Males of this species reach a length of 1.5 to 2m and an average weight of 27 to 38.6kg (Orr and Helm 1989). Females are smaller, reaching an average length of 1.1 to 1.4m and a weight of 16-27kg. The head of the Sea Otter is round compared to others members of the Mustelidae family. The ears are small and are slightly rolled, resembling the ear of a sea lion more than the ear of a River Otter (*Lutra canadensis*), the Sea Otter’s closest

relative (Kenyon 1981). The snout is fairly broad. The body is long with a tail that is broad and flattened horizontally. The tail is one-fourth to one-fifth of the body length and can be used as an oar.

The front paws of the Sea Otter are relatively small and are not used for swimming as much as they are used for gathering food. The hind feet are large in comparison to the front and are flipper-like, used for propulsion while swimming. The outer toe is longer than the others, allowing an individual resting on its back at the surface to reach deeply into the water to provide better thrust. The hind feet possess another notable feature: they have lost nearly the entire leathery pad---except for minute vestigial patches---near the tips of the toes (Kenyon 1981).while the otter is on its back.

As these animals do not rely upon a fat layer for warmth, their fur is very dense, about twice as dense as that of the Northern Fur Seal (Orr and Helm 1989). The coat of the Sea Otter is light brown to dark brown, but as animals (especially males) age, the head and neck become white. The young are born with a pale brown coat that turns to beige on the head and neck. This coat is replaced within a few weeks of birth by a coat of longer yellowish guard hairs. This in turn is replaced by the adult pelage within a few months (Kenyon 1981).

### Breeding

Sea Otters have a polygynous mating system (Reeves et al. 2002). Males establish aquatic territories near females and may mate with several females during the breeding season. Males often bite females' noses while mating; sexually mature females frequently have bloody noses, while older females have distinguishing scars. Females usually bear their first pup at the age of four or five years (MMC 2002). Gestation lasts from 6½ to 9 months (Whitaker 1998). Pups can be born any time of year, but in California, most are born between January and March; in Alaska, most are born during summer (Reeves et al. 2002). Pups (generally one, rarely two) are born with fur, exposed teeth and their eyes open. Birthweight ranges from 1.4 to 2.3kg.

### Feeding Behavior and Diet

Sea Otters eat while floating on their back and sculling with their tail (Whitaker 1998). While sleeping, a Sea Otter may wind a strand of kelp around its body to prevent drifting (Orr and Helm 1989). When an otter dives for food, it also brings back to the surface a small rock, against which it cracks open shellfish. This species feeds primarily on abalone, sea urchins, crabs, mussels, and fish (Whitaker 1998). Individual otters have been demonstrated to exhibit individual food preferences. There is some evidence that otters may learn foraging strategies and acquire preferences from their mothers.

### Habitat

Sea Otters occupy coastal waters within 1.5km of shore. Rocky shallows over kelp beds supporting abundant shellfish are favored (Whitaker 1998). Suggesting restricted open-ocean wandering by this species is that it had been recorded only twice at the heavily-studied Farallon Islands, 28 miles west of the Golden Gate, as of 1990 (Stallcup 1990).

### World Distribution

The Sea Otter formerly enjoyed a huge distribution, extending from the northern coast and islands of Japan along the northern rim of the Pacific down the west coast of North America to the islands off central Baja California, Mexico (Orr and Helm 1989). The current distribution is much more restricted. The northern population of Asian and Alaskan Sea Otters extends from Washington to the Kurile Islands. The southern population is centered around Monterey, California, extending from San Luis Obispo County north to San Mateo County. A small population has also been translocated from Alaska to San Nicolas Island (Channel Islands) off southern California.

Three subspecies have been identified; the Asian Sea Otter (*E. l. gracilis*) with a range from the Kurile Islands to the Kamchatka Peninsula of Russia; the Alaskan Sea Otter (*E. l. lutris*) occurring from Prince William Sound to the Aleutian and Commander Islands; and the Southern Sea Otter (*E. l. nereis*) ranging from the Washington/Canada border south to central Baja California, Mexico (Kenyon 1981).

The sea otter is nonmigratory, although individuals may travel great distances before returning to their home territories (Kenyon 1981). Most females tend to have a home range of 8 to 16km, while males may travel up to 48km before returning home (R.J. Jameson in Kenyon 1981). This species stays along the coast and adjacent offshore islands. It is partial to rocky shorelines that include kelp forests, usually in water no deeper than 20m. They are a 'keystone species' and an integral part of kelp forest ecosystems (Laur 1990).

### California Distribution

The Southern or California Sea Otter *E. l. lutris* is a distinctive subspecies (Kenyon 1981). This population is distributed along the central California coast centered around Monterey, but extends from San Luis Obispo County north to San Mateo County (Kenyon 1981). Sea Otters are rarely seen on offshore rocks along the California coast (Orr and Helm 1989).

Southern Sea Otters do not regularly haul-out as do pinnipeds (Harris pers. comm. 2002). However, there are a few known sites where, during lower low tides, small numbers of otters are frequently observed hauled out on exposed intertidal algal mats. Sea Otters use all shallow water marine habitats within their range, approximately from Gaviota northward to Halfmoon Bay. Therefore any of the surrounding marine habitats of nearshore rocks can provide foraging and/or resting areas.

### Population Status and Dynamics

This species was first hunted in the mid-eighteenth century for its fur (Orr and Helm 1989). The Russians led the way in the extermination of this species, starting with the Aleutian Islands and thence southward along the Pacific coast to California, where Fort Ross was established in 1812. The Farallon and Channel Islands were both reported to be rich in Sea Otters; subsequently, thousands were taken from waters in the general vicinity of these islands. The decimation of hundreds of thousands of Sea Otters in Alaska was considered among the chief reasons for the sale of Alaska to the United States (for \$7,200,000---"Seward's Folly") in 1867.

By the beginning of the twentieth century the Sea Otter was so close to extinction that the population was considered to be beyond recovery. In 1911 the United States, Russia, Canada, and Japan signed a treaty providing for the protection of this species. The few hundred Sea Otters then remaining in Alaskan waters received additional protection through the establishment of the Aleutian Islands National Wildlife Refuge in 1913.

To the astonishment of naturalists, a small population of Sea Otters was discovered off the coast of Big Sur, south of Monterey, in 1938 (Orr and Helm 1989). Through these small remnant populations, the Sea Otter began to recolonize their former range. Aiding and abetting natural dispersion, 708 Sea Otters were translocated to California between 1965-1972 from areas of high population concentrations in Alaska. Attempts to reestablish populations in southern California during the late 1980s were largely unsuccessful. Most translocated otters returned to their original homes in central California, died from human-related causes, or otherwise disappeared. Although translocation efforts failed, a small colony established itself at San Miguel Island in the 1990s.

As of 1996, Alaskan and Asian populations were estimated in excess of 100,000 otters, but declining. (U.S. Fish and Wildlife Service in Watson and Root 1996). Reasons for the decline are unknown, but the loss may be due to predation by Orcas (Reeves et al. 2002) The California population, as of

1996, was estimated at 2400 individuals (U.S. Fish and Wildlife Service in Watson and Root 1996). By 2000 the California population had declined to 1700 (Reeves et al. 2002). The species is listed as Threatened under the Endangered Species Act and 'depleted' under the Marine Mammal Protection Act of 1977.

### Threats and Management Implications

At present, the Sea Otter is considered endangered within much of its range, and is legally protected in the United States under the Marine Mammal Protection Act and the Endangered Species Act.

As Sea Otters do not possess an insulating layer of blubber like other marine mammals, air in their fur helps keep them warm and buoyant (Orr and Helm 1989). If the fur is damaged by an oil spill, an otter will lose the ability to thermoregulate and will die from direct exposure to seawater (Whitaker 1998).

There is an ongoing controversy regarding the Sea Otter's effect on abalone abundance in central California (Whitaker 1998). Fishermen blame Sea Otters, rather than human exploitation, for the decline in abalone populations; appearing converse to their argument are records indicating that abalone were abundant along the coast when Sea Otters were far more abundant than they are today (Orr and Helm 1989).

Gill nets were formerly a significant source of mortality for California Sea Otters (FSO 2001). On September 11, 2000, the Director of the California Department of Fish and Game made a determination of "adverse impact" on the Common Murre and the Southern Sea Otter, and issued an Emergency Order that gill or trammel nets may not be used in ocean waters of 60 fathoms depth or less from Point Reyes to Yankee Point, and from Point Sal to Point Arguello (CDFG 2002). On April 2, 2002, the Director reissued an Order closing year round the area from Point Reyes in Marin County to Point Arguello in Santa Barbara County to the use of gill and trammel nets in ocean waters of 60 fathoms or less. The recent laws prohibiting gill nets at shallow depths are thought responsible for 5-7% increases in populations that were previously stable or declining (FSO 2001). Currently, industrial pollution is believed to be a major problem for southern populations.

As Sea Otters spend 80% of their time at the ocean's surface and inhabit nearshore waters, they are especially vulnerable to human disturbance (Curland 1997). Along the central coast of California, kayakers are potentially the greatest source of disturbance within this coastal zone. Human activities seem to cause otters to spend more time traveling in and out of areas of high disturbance.

## **Literature Cited – Marine Mammals**

- Bigg, D.K. 1981. Harbor seal *Phoca vitulina* (Linnaeus, 1758) and *Phoca largha* (Pallas, 1811). Pages 1-27 in: S.H. Ridgway and R.J. Harrison, eds. Handbook of Marine Mammals. Vol. 1: The Walrus, Sea Lions, Fur Seals and Sea Otter.
- Bowlby, C.E. 1981. Feeding behavior of pinnipeds in the Klamath River, northern California. Master Thesis, Humboldt State University.
- CDFG. 2002. Emergency gill net fishery closure. Marine Region, California Department of Fish and Game. <http://www.dfg.ca.gov/mrd/gillnet/emergency.html>
- Curland, J.M. 1997. Effects of disturbances on Sea otters (*Enhydra lutris*) near Monterey, California. Master Thesis, San Jose State University.
- De Blois, Stephen. 1986. The social behavior of an emerging breeding population of *Eumetopias jubatus* on the coast of Humboldt County. M.S. Thesis, Humboldt State University.

- Eliason, Julie J. 1986. Mother-pup behavior in the harbor sea, *Phoca vitulina richardsi*. M.S. Thesis, Humboldt State University.
- Fluharty, M.J. 1999. Summary of Pacific harbor seal, *Phoca vitulina richardsi*, surveys in California, 1982 to 1995. CDFG – MR Administrative Report 99 – 1.
- FSO 2001. Comments presented on behalf of Friends of the Sea Otter by science director Mathew Rutishauser. Friends of the Sea Otter, Monterey, CA. Internet URL: <http://www.seaotters.org/CurrentIssues/index.cfm?DocID=85>
- Gentry, R.L. 1981. Northern Fur Seal *Callorhinus ursinus* (Linnaeus, 1758). Pages 143-160 in: S.H. Ridgway and R.J. Harrison, eds. Handbook of Marine Mammals. Vol. 1: The Walrus, Sea Lions, Fur Seals and Sea Otter.
- Griswold, M.D. 1985. Distribution and Movements of pinnipeds in Humboldt and Del Norte Counties, California. M.S. Thesis, Humboldt State University.
- Harris M. 2002. Personal Communication. Sea Otter Biologist, Environmental Scientist California Department of Fish and Game. Morro Bay, CA.
- Harvey, J.T. .2001. Personal Communication. Moss Landing Marine Laboratories. Moss Landing, CA 95039-9647
- Huber, H.R. 1991. Changes in the Distribution of California Sea Lions North of the Breeding Rookeries During the 1982-83 El Nino. Pages 129-137 in: F. Trillmich and K.A. Ono eds. Pinnipeds and El Nino.
- Kenyon, K.W. 1981. Sea Otter *Enhydra lutris* (Linnaeus, 1758). Pages 209-223 in: S.H. Ridgway and R.J. Harrison, eds. Handbook of Marine Mammals. Vol. 1: The Walrus, Sea Lions, Fur Seals and Sea Otter.
- Laake, J., R. DeLong and H. Huber. 2001. Pinniped consumption of salmonids in the Columbia River. National Marine Mammal Laboratory. Alaska Fisheries Science Center, NMFS. Seattle WA 98115.
- Laur, D.R. 1990. The differential effects of macroinvertebrates and fish on “turf” communities (kelp beds). PH.D. Dissertation. University of California, Santa Barbara.
- Le Boeuf, B.J. 1991. The Natural History of the Northern Elephant Seal. Page 205 in: F. Trillmich and K.A. Ono eds. Pinnipeds and El Nino.
- Le Boeuf, B.J. and M.L. Bonnel. 1980. Pinnipeds of the California islands: Abundance and distribution. Pages 475-493 in: Power, D.M., ed. The California islands: Proceedings of a multidisciplinary symposium. Santa Barbara Museum of Natural History. Santa Barbara, California.
- Le Boeuf, B.J. and J. Reiter. 1991. Biological Effects Associated with El Nino Southern Oscillation, 1982-83, on Northern Elephant Seals Breeding at Ano Nuevo, California. Pages 206-218 in: F. Trillmich and K.A. Ono eds. Pinnipeds and El Nino.
- Le Boeuf, B.J., S. Kaza.. Editors. 1981. The Natural History of Ano Nuevo. Boxwood Press. Pacific Grove, CA.
- Le Boeuf, B. J. and R.M. Laws; editors. 1994. Elephant seals: Population ecology, behavior, and physiology. University California Press.
- Lyons, E.T., S.R. Melin, S.R., R.L. DeLong, A.J. Orr, F.M. 2001. Gulland and S.C. Tolliver. 2001. Current prevalence of adult *Uncinaria* spp. in northern fur seal (*Callorhinus ursinus*) and California sea lion (*Zalophus californianus*) pups on San Miguel Island, California, with notes on the biology of these hookworms. *Veterinary Parasitology*, 97(4): 309-318.
- MMC 2002. The Marine Mammal Center. Education, Pinnipedia,. <http://www.marinemammalcenter.org/learning/education/pinnipeds/pinnipeds.asp> The Marine Mammal Center, Sausalito, CA.

- NMFS 1992. Recovery plan for the Steller sea lion (*Eumetopias jubatus*). Prepared by the Steller Sea Lion Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. 92 pp.
- NMFS 1997. NOAA-NWFSC Tech Memo-28: Impacts of California Sea Lions and Pacific Harbor Seals on Salmonids and on the Coastal Ecosystems of Washington, Oregon, and California. U.S. Dept Commerce/NOAA/NMFS/NWFSC/Publications March 1997
- NMFS 2002. National Marine Fisheries Service, NW region studies on pinniped impacts on salmon. Internet URL: <http://www.nwr.noaa.gov/1seals/factsheet2.htm>
- Odell, D.K. 1981. California Sea Lion, *Zalophus californianus* (Lesson, 1828). Pages 67-97 in: S.H. Ridgway and R.J. Harrison, eds. Handbook of Marine Mammals. Vol. 1: The Walrus, Sea Lions, Fur Seals and Sea Otter.
- Orr, R.T. and R.C. Helm. 1989. Marine Mammals of California. University of California Press. Berkeley, California.
- Pierotti, R. 1988. Interactions Between Gulls and Otariid Pinnipeds: Competition, Commensalism, and Cooperation. Pages 213-239 in: J. Burger, ed. Seabirds and Other Marine Vertebrates.
- Read, R.B. and K. Reynolds. 2001. Final Report: Survey of Harbor seals in California 2001. CDFG Administrative Report.
- Reeves, R.R., B.S. Stewart, P.J. Clampham and J.A. Powell. 2002. National Audubon Society guide to marine mammals of the world. Alfred A. Knopf, Inc. New York.
- Report to Congress. 1999. Impacts of California sea lions and pacific harbor seals on salmonids and west coast ecosystems. U.S. Department of Commerce National Oceanic and Atmospheric Administration and the National Marine Fisheries Services.
- Reynolds J.E. III and S.A. Rommel. 1999. Biology of Marine Mammals. Smithsonian Institution Press. Washington.
- Riedman, M. 1990. The Pinnipeds: Seals, Sea Lions, and Walruses. University California Press. Berkeley, CA.
- Schusterman, R.J. 1981. Steller Sea Lion *Eumetopias jubatus* (Schreber, 1776). Pages 119-141, in: S.H. Ridgway and R.J. Harrison, eds. Handbook of Marine Mammals. Vol. 1: The Walrus, Sea Lions, Fur Seals and Sea Otter.
- Shaffer, Kevin. 1989. Seasonal and site variations in diets of harbor seals, *Phoca vitulina richardsi*, in northern California. M.S. Thesis, Humboldt State University.
- Stack, J.D. 1981. Diurnal activity patterns of nonbreeding *Zalophus californianus* and *Eumetopias jubatus* at Klamath Cove, California. M.S. Thesis, Humboldt State University.
- Stallcup, Richard. 1990. Ocean birds of the nearshore Pacific. Point Reyes Bird Observatory, Stinson Beach, California.
- Stone, G., J. Goebel, S. Webster. 1997. Pinniped Populations, Eastern North Pacific: Status, Trends, and Issues.
- Trillmich, F., K.A. Ono, D.P. Costa, R.L. Delong, S.D. Feldkamp, J.M. Francis, R.L. Gentry, C.B. Heath, B.J. Le Boeuf, P. Majluf, and A.E. York. 1991. The Effects of El Nino on Pinniped Populations in the Eastern Pacific. Pages 247-270 in: F. Trillmich and K.A. Ono eds. Pinnipeds and El Nino.
- York, A.E. 1991. Sea Surface Temperatures and Their Relationship to the Survival of Juvenile Male Northern Fur Seals From the Pribilof Islands. Pages 94-106 in: F. Trillmich and K.A. Ono eds. Pinnipeds and El Nino.
- Whitaker W.O. Jr. editor. 1998. National Audubon society field guide to north American mammals. Alfred A. Knopf, New York.