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Annotated Checklist of the Marine Mammals of the Gulf of California

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ABSTRACT.—There are reliable records from the Gulf of California (Sea of Cortez) for 30 species of marine mammals representing 8 families: the Phocoenidae (1 species), Delphinidae (12), Ziphiidae (3), Physeteridae (3), Eschrichtiidae (1), Balaenopteridae (6), Otariidae (2), and Phocidae (2). These 30 species constitute 75% of the marine mammal species known from Mexican waters and 25% of extant species. Confirming records are presented, along with statements of current status where known.

RESUMEN.—Existen registros confiables de 30 especies de mamíferos marinos en el Golfo de California (Mar de Cortés), que representan 8 familias: Phocoenidae (1 especie), Delphinidae (12), Ziphiidae (3), Physeteridae (3), Eschrichtiidae (1), Balaenopteridae (6), Otariidae (2) y Phocidae (2). Estas 30 especies constituyen el 75% de las especies de mamíferos marinos conocidas en aguas mexicanas y el 25% de las especies existentes. Se presentan registros confirmados, así como consideraciones sobre la situación actual si se conoce.

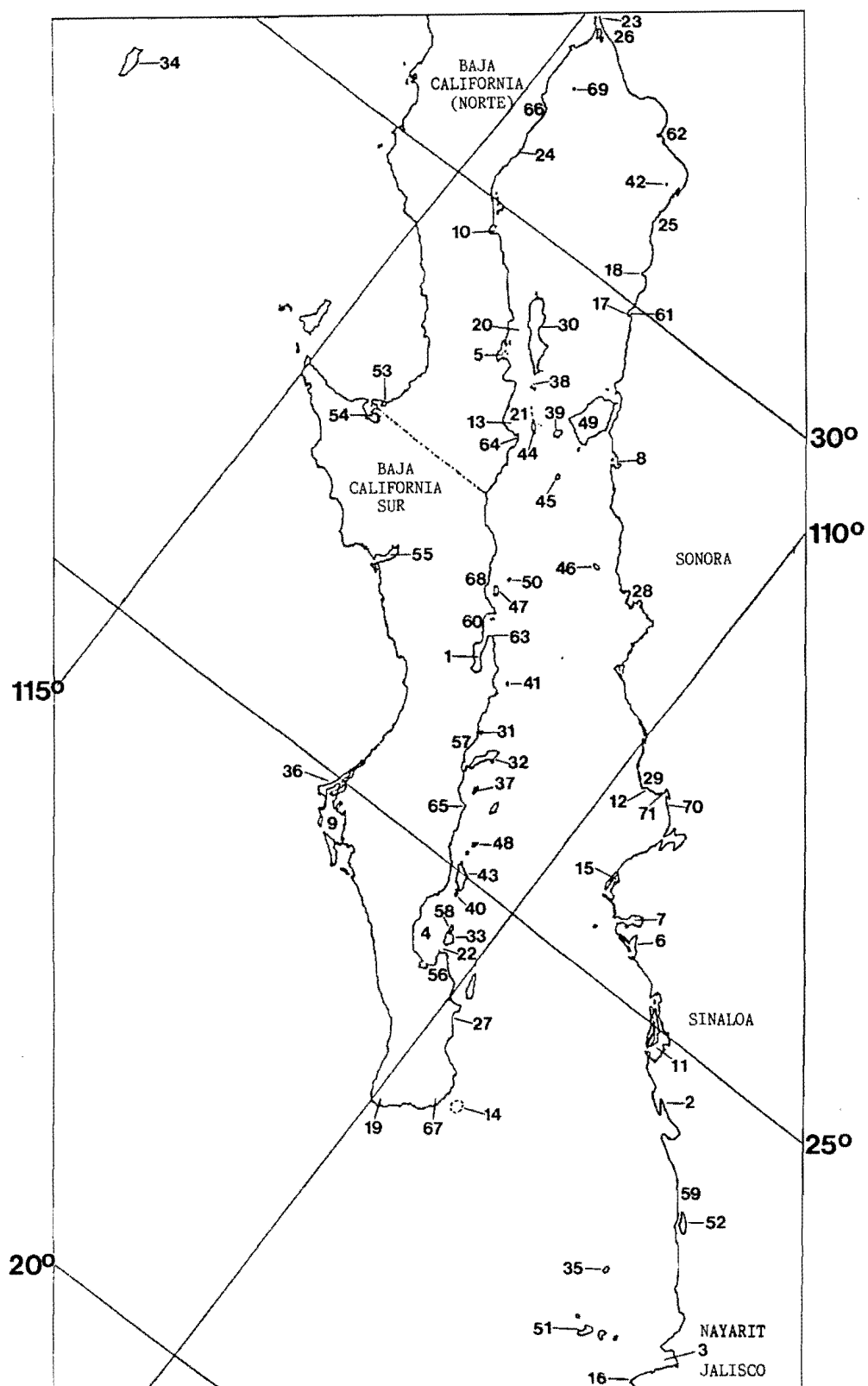
INTRODUCTION

Interest in the study of Mexican marine mammals dates from the mid-nineteenth century, mainly between 1850 and 1870, and was a direct result of their commercial exploitation. Whalers, principally American, made numerous voyages to hunt large cetaceans in the Mexican Pacific. From sailing ships and whaling dories, they sought mostly gray whales, *Eschrichtius robustus*, but also took humpback whales, *Megaptera novaeangliae* (Scammon, 1874; Henderson, 1972, 1984), and sperm whales, *Physeter catodon* (= *P. macrocephalus*) (Rice, 1974). By the early twentieth century, modern mechanized whalers had expanded the catch to include some of the faster rorquals [blue whale, *Balaenoptera musculus*, Bryde's whale, *B. edeni*, and minke whale, *B. acutorostrata* (Rice, 1974)], previously uncatchable by the "Yankee" whalers. The California sea lion, *Zalophus californianus*, Guadalupe fur seal, *Arctocephalus townsendi*, and northern elephant seal, *Mirounga angustirostris*, were also heavily exploited on islands off the Pacific coast of Baja California (Bartholomew and Hubbs, 1960; Le Boeuf *et al.*, 1983; Fleischer, 1987). Until the 1970s, scientific studies of the marine mammals of México were infrequent and limited mainly to occasional observations by American and a few Mexican scientists (e.g., Bartholomew and Hubbs, 1952; Berdegue, 1956; Norris and McFarland, 1958; Gilmore, 1960; van Gelder, 1960; Norris and

Prescott, 1961; Gilmore *et al.*, 1967; Lluch, 1969; Barham, 1970; Rice, 1974).

Although in the last 25 years increasing numbers of reports have been published on individual species or groups of species occurring in the Gulf of California (also known as the *Mar de Cortés* or Sea of Cortez), there has been no comprehensive account of this sea's diverse and rich marine mammal fauna. Furthermore, much important information remains unpublished, existing in difficult-to-obtain "gray" literature or in researchers' field notes. The purpose of this paper is to summarize relevant information on the distribution, movements, abundance, and seasonality of all marine mammals known to occur in the Gulf of California, here defined (following Alvarez-Borrego, 1983) as the marine waters from the Colorado River delta to a line connecting the tip of the Baja California peninsula (Cabo San Lucas) to Cabo Corrientes, Jalisco (Fig. 1). This summary was prepared from data representing osteological materials housed in scientific collections, strandings documented with photographs, sightings documented with photographs, and sightings presented with sufficient detail and/or by sufficiently competent/reputable observers to be judged credible.

At least 30 species of marine mammals, representing eight families, have been recorded from the Gulf of California; these constitute 75% of the species known from Mexican waters (Vidal, 1991) and 25% of extant species. The families represented are the



Phocoenidae (1 species), Delphinidae (12), Ziphiidae (3), Physeteridae (3), Eschrichtiidae (1), Balaenopteridae (6), Otariidae (2), and Phocidae (2). Three species of cetaceans not yet recorded in the Gulf of California but documented in nearby Mexican Pacific waters are Fraser's dolphin or *delfín de Fraser*, *Lagenodelphis hosei* (see Aguayo and Sánchez, 1987), the pygmy killer whale or *orca pigmea*, *Feresa attenuata* (see Holt and Sexton, 1987, 1988; van Waerebeek and Reyes, 1988), and a bottlenose whale or *zifido nariz de botella*, *Hyperoodon* sp. (see Pitman *et al.*, 1988).

The classification follows Honacki *et al.* (1982), Barnes *et al.* (1985), Heyning (1989), and Perrin (1989). English common names for the cetaceans follow Perrin (1989).

SPECIES ACCOUNTS

Order Cetacea Brisson, 1762—Whales, dolphins and porpoises;
ballenas, delfines y marsopas

Suborder Odontoceti Flower, 1867—Toothed whales;
cetáceos con dientes

Superfamily Delphinoidea (Gray, 1821)

Family Phocoenidae (Gray, 1825)—Porpoises: *marsopas*

Subfamily Phocoeninae (Gray, 1825)

Phocoena sinus Norris and McFarland, 1958. *Vaquita*; Gulf of California harbor porpoise: The vaquita is one of the world's rarest and most endangered cetaceans; even its external appearance was unknown to science until 1985 (Brownell *et al.*, 1987). It is the sole member of the family Phocoenidae ("true porpoises") found in Mexican waters and the only cetacean known to be endemic to México. Vidal (in press) and Vidal *et al.* (in press a) have reviewed all available information on the vaquita's distribution, population biology, and mortality incidental to fishing. The vaquita has the most limited distribution of any marine cetacean, being restricted to the uppermost Gulf of California (Brownell, 1983, 1986; Vidal, in press). Although Silber (1990a) reported two unconfirmed sightings south of Bahía de La Paz in the southern Gulf, all known osteological and anatomical specimens have been collected in the uppermost Gulf (Vidal, 1991, in press), implying that the species' range is confined to that area. Most records (osteological materials, decomposed whole carcasses, specimens captured incidentally during fishing, and sightings) are from near San Felipe, Baja California (Norte) (BCN), Rocas Consag, and El Golfo de Santa Clara, Sonora (Brownell, 1986; Silber, 1990a; Vidal, 1991, in press). Although there are no reliable estimates of abundance, the population is very small, probably numbering only a few hundred individuals (Vidal, in press).

Vaquitas are killed incidentally in gill nets, especially those with mesh sizes of 15 to 30.5 cm; 128 deaths were confirmed between

March 1985 and February 1992 (Vidal, in press). At least 65% of these were caught in gill nets set experimentally or (mainly) illegally for the endemic, endangered totoaba, *Totoaba macdonaldi*, a large corvina-like fish of the family Sciaenidae that is protected under Mexican federal law. These 128 known captures, however, certainly represent only a fraction of the total number killed in largely unmonitored gill netting for totoaba, sharks (e.g., *Carcharodon carcharias*, *Isurus oxyrinchus*, *Negaprion brevirostris*, *Rhizoprionodon longurio*, *Carcharhinus* spp., *Alopias superciliosus*, *Sphyrna lewini*, and *Mustelus* spp.), rays (e.g., *Myliobatis californica*, *Rhinoptera steindachneri*, *Dasyatis brevis*, and *Mobula* spp.), corvinas (*Cynoscion* spp., *Atractoscion nobilis*), and mackerels (*Scomberomorus sierra* and *S. concolor*), as well as in trawling for shrimps (*Penaeus* spp.). Vidal (in press) estimated at least 35 vaquitas to be killed each year by fisheries. Because this level of incidental mortality is high relative to the low population size, the vaquita is thought to be in imminent danger of extinction (Robles *et al.*, 1987; Silber, 1990a; International Whaling Commission, 1991; Klinowska, 1991; Vidal, in press).

Family Delphinidae Gray, 1821—Dolphins; *delfines*

Subfamily Steninae (Fraser and Purves, 1960)

Steno bredanensis (G. Cuvier, in Lesson, 1828). Rough-toothed dolphin; *delfín de dientes rugosos*: The rough-toothed dolphin is a pelagic species occurring in tropical and warm temperate waters around the world. In the eastern Pacific it is present, though sparse, from northern California to Perú (Leatherwood *et al.*, 1988). From the low frequency of observations during extensive casual and dedicated surveys of the eastern tropical Pacific tuna fishing grounds, rough-toothed dolphins appear to be uncommon throughout the region.

We know of only 10 records of this dolphin in the Gulf of California. Four are strandings: a decomposed carcass (length about 3.15 m) found 28 May 1984 on the beach near El Golfo de Santa Clara (Heyning, 1986), a skull collected on 4 March 1983 at El Mogote, a skull collected [?] in October 1983 at El Muelle, and a skull collected in October 1984 at San Juan de la Costa, the last three localities being in Bahía de La Paz, Baja California Sur (BCS) (Rizo, 1990; Vidal, 1991). The other six are sightings (some supported by photographs): one of seven dolphins on 30 August 1991 (J. Urbán, Univ. Autón. Baja Calif. Sur, La Paz, field notes) and one of two dolphins in early September 1991 (Vidal, Cendón, and Whitehead, field notes), both in Bahía de La Paz; one of four dolphins on 3 November 1988 at ca. 25°15' N, 109°30' W (D. Breese and B. Tershy, Section of Neurobiology and Behavior, Cornell University, Ithaca, New York, pers. comm., 12 April 1992), and one of two dolphins on 28 June 1984, one of four on 30 June 1985, and one of seven on 25 October 1983 in Bahía de Banderas (Salinas and Bourillón, 1988).

Figure 1. Gulf of California, with numbers indicating place names appearing in the text. 1, Bahía Concepción; 2, Bahía de Altata; 3, Bahía de Banderas; 4, Bahía de La Paz; 5, Bahía de los Angeles; 6, Bahía de Navachiste; 7, Bahía de Topolobampo—Ohuira; 8, Bahía Kino; 9, Bahía Magdalena; 10, Bahía San Luis Gonzaga; 11, Bahía Santa María (Reforma); 12, Bahía Santa Bárbara; 13, Bahía San Rafael; 14, Banco Gorda; 15, Boca del Río Fuerte; 16, Cabo Corrientes; 17, Cabo Lobos; 18, Cabo Tepoca (Puerto Lobos); 19, Cabo San Lucas; 20, Canal de Ballenas; 21, Canal de Salsipuedes; 22, Canal de San Lorenzo; 23, Colorado River delta; 24, Coloraditos; 25, Desemboque (del Río Concepción); 26, El Golfo de Santa Clara; 27, Ensenada de los Muertos; 28, Guaymas; 29, Huatabampito; 30, Isla Angel de la Guarda; 31, Isla Coronados; 32, Isla del Carmen; 33, Isla Espíritu Santo; 34, Isla Guadalupe; 35, Isla Isabela; 36, Isla Magdalena; 37, Isla Monserrat; 38, Isla Partida (Norte); 39, Isla San Esteban; 40, Isla San Francisco; 41, Isla San Ildefonso; 42, Isla San Jorge; 43, Isla San José; 44, Isla San Lorenzo; 45, Isla San Pedro Mártir; 46, Isla San Pedro Nolasco; 47, Isla San Marcos; 48, Isla Santa Cruz; 49, Isla Tiburón; 50, Isla Tortuga; 51, Islas Tres Marías; 52, Laguna del Caimanero; 53, Laguna Guerrero Negro; 54, Laguna Ojo de Liebre (Scammon's Lagoon); 55, Laguna San Ignacio; 56, La Paz; 57, Loreto; 58, Los Islotes; 59, Mazatlán; 60, Mulegé; 61, Puerto Libertad; 62, Puerto Peñasco; 63, Punta Concepción; 64, Punta San Francisquito; 65, Punta San Marcial; 66, San Felipe; 67, San José del Cabo; 68, Santa Rosalía; 69, Rocas Consag; 70, Tojahui; 71, Yavaros.

Subfamily Delphininae (Gray, 1821)

Lagenorhynchus obliquidens Gill, 1865. Pacific white-sided dolphin; *delfín de costados blancos del Pacífico*: In the eastern North Pacific, white-sided dolphins are common from the northern Gulf of Alaska to about 23° N, off the tip of Baja California, being among the most abundant of delphinids within that broad range. There is a specimen from farther north (Valdez, Alaska), and there are a few (sometimes disputed) sightings from farther south (near the oceanic Islas Revillagigedo, far off the west coast of México). In general, white-sided dolphin populations shift southward and inshore during winter when the water is colder, then northward from spring through autumn, when the water is warmer (Leatherwood *et al.*, 1984, 1987, 1988).

According to Aurióles *et al.* (1988, 1989), until the mid-1980s the only indications that the species occurred in the Gulf of California were fishermen's accounts (from the 1960s and early 1970s) of occasional sightings near Banco Gorda at the mouth of the Gulf. These authors reported 16 sightings (2–250 individuals) between Cabo San Lucas and Isla Coronados from 28 January to 16 August, 1980 through 1988. At least one group (seen on 15 April 1984) contained newborns. On the basis of these records, Aurióles *et al.* (1988, 1989) suggested that white-sided dolphins may be frequent visitors, at least seasonally, to the southwestern Gulf. Findley *et al.* (1988) reported a sighting of seven individuals near San José del Cabo on 7 December 1987. Urbán and Balcomb (in press) reported 13 in February 1989 at Banco Gorda, and Urbán *et al.* (1990a) and Urbán (field notes) sighted them four times in Bahía de La Paz: 18 individuals in February 1988, 20 in March 1990, 25 in April 1990, and 12 in March 1991.

Walker *et al.* (1986) studied 152 skulls from the eastern North Pacific (6 from Baja California waters north of 24°30' N, 112 from southern California waters, 32–37° N, and 34 from north of 37° N), finding modal differences between animals from the extreme northern (above 37° N) and extreme southern (below 32° N) portions of the area. Vidal (1991) documented the existence of osteological materials from eight specimens from western Baja California (Norte) and 15 from western Baja California Sur (the southernmost from Isla Magdalena, about latitude 24°35' N). These specimens have not been studied in detail. To date, no osteological materials have been collected in the Gulf.

Grampus griseus (G. Cuvier, 1812). Risso's dolphin; *delfín de Risso*: Risso's dolphins occur globally in tropical and temperate seas. In the eastern North Pacific, these wide-ranging animals have been recorded from the Gulf of Alaska [about 50° N (Shults *et al.*, 1982; Braham, 1983)] south to the equator (Leatherwood *et al.*, 1980; Kruse *et al.*, 1991). They are abundant throughout the year in warm temperate and tropical waters, with apparent zones of low density near 20° and 43° N (Leatherwood *et al.*, 1980). In cooler temperate seas (10–18° C), Risso's dolphins are most abundant during periods of warm water [15–16.9° C (Leatherwood *et al.*, 1980; Kruse, 1989)].

Risso's dolphin is a pelagic species, most commonly seen seaward of the continental shelf and above rugged sea-floor topography (Leatherwood *et al.*, 1980; Kruse, 1989; Kruse *et al.*, 1991, in press), although they are often sighted close to shore off southern California, where they have become abundant during the past decade (J. E. Heyning, National History Museum of Los Angeles County, pers. comm., 11 December 1992). This gregarious delphinid has been observed in groups of up to about 4000 individuals but is more commonly seen in groups of fewer than 50 (Leatherwood *et al.*, 1980; Kruse, 1989; Kruse *et al.*, 1991, in press).

Numerous records exist of Risso's dolphins from oceanic waters off western Baja California and mainland México south of the Gulf of California. However, there are relatively few records of

sightings and strandings from the Gulf. A skull collected in La Paz from a specimen stranded on 15 January 1982 represents the only osteological material from the area (Vidal, 1991). In June 1973, four females and an individual of undetermined sex were stranded together at Punta Bufeo, 160 km south of San Felipe (Leatherwood *et al.*, 1979). No materials were collected from these animals, which were estimated to be about 4 m long. This stranding, and a sighting from the Midriff Islands area, are the only records of Risso's dolphin from the northern Gulf. Six sightings, all far from shore, have been reported from between Bahía de Banderas and 25° N (Leatherwood *et al.*, 1980; Findley *et al.*, 1988). Aguayo *et al.* (1988a) and J. Urbán (pers. comm., 2 March 1992) reported four sightings: two of five individuals each and one of two individuals in August 1984 near the southeastern coast of Isla del Carmen, and one of five individuals in March 1987 off the coast of Nayarit. About 30 were observed traveling with four rough-toothed dolphins on 3 November 1988 at about 25°15' N, 109°30' W (D. Breese and B. Tershy, pers. comm., 12 April 1992).

Tursiops truncatus (Montagu, 1821). Bottlenose dolphin; *tonina*, *tursión*: Bottlenose dolphins are widely distributed in nearshore as well as offshore waters of all oceans. Differences in morphology, feeding habits, and parasite loads suggest there are at least two distinct forms (coastal and offshore) in the eastern North Pacific (Walker, 1981; Scott and Chivers, 1990). The southern California and México coastal form (*Tursiops truncatus gillii*) is continuously distributed from about Santa Barbara County, California, south to the tropics, while the eastern tropical Pacific offshore form (*T. truncatus nuuanu*) occurs farther from the mainland, including waters around islands off Baja California and California, at least as far north as Point Conception (Walker, 1981; Leatherwood *et al.*, 1988; Hansen, 1990; Scott and Chivers, 1990).

Both forms have been documented in the Gulf of California (Walker, 1981), where the species is common. Osteological materials have been collected from all parts of the Gulf (Walker, 1981; Vidal, 1991). Numerous sightings have been reported from the uppermost Gulf (Wells *et al.*, 1981; Vidal *et al.*, 1987a; Silber, 1990b), including the estuarine areas of the Colorado River delta (Pérez-Cortés *et al.*, 1989), near the Midriff Islands (Breese, 1988; Breese and Tershy, 1988a, unpublished), off the coast of Sonora and the east coast of Baja California (Ballance, 1987, 1990; Vidal *et al.*, 1987a; Findley *et al.*, 1988; Acevedo, 1989), and along the coast of Sinaloa south to Bahía de Banderas (Urbán, 1983; De la Parra and Galván, 1987; Findley *et al.*, 1988; Salinas and Bourillon, 1988). The habitat use and residence patterns of bottlenose dolphins in the Gulf have been studied in detail at only four locations. Of 155 different individuals identified by Ballance (1987, 1990, 1992) from May to July and from October to December 1984 in Bahía Kino, Sonora, at least 39% were resident in that area to some degree. Acevedo (1989) estimated that from May to September 1987, at least 60 individuals regularly used the area off La Paz. Observations from 1988 to 1992 show a group of about 30 individuals resident year round in Bahía de La Paz (J. Urbán, field notes). De la Parra and Galván (1987) identified about 30 individuals between May 1983 and February 1985 in Bahía de Topolobampo-Ohuira, Sinaloa. On 19 December 1991, four pregnant females were stranded alive at Guaymas; total lengths of two of them and total lengths and weights of three of the fetuses were: 275 cm (66.8 cm, 6 kg), 265 cm (99 cm) and ? (70.5 cm, 6 kg). The fetuses are preserved in the Marine Vertebrates Collection at ITESM-Campus Guaymas. Bottlenose dolphins are incidentally killed in gill nets in the Gulf, mainly along the coasts of Sonora and Sinaloa (Walker, 1981; Vidal *et al.*, in press b), and Mitchell (1975) estimated about 50 dolphins to be taken each year in the shark and totoaba fisheries north of San Felipe.

Stenella attenuata (Gray, 1846). Pantropical spotted dolphin; *delfín manchado pantropical*: Two subspecies or forms of the

pantropical spotted dolphin (the offshore *S. attenuata attenuata* and the coastal *S. attenuata graffmani*) have been identified in the eastern tropical Pacific, but well-supported records indicate that both can occur near shore as well as far offshore (Perrin *et al.*, 1985). Both subspecies have been captured incidentally in the offshore tuna purse-seine fishery, and several sightings have been reported in the Mexican Pacific, including the area near the mouth and just inside the Gulf of California (Perrin *et al.*, 1985). Also, two skulls of *S. a. graffmani* have been collected from Ensenada, on the northwest coast of Baja California (Norte) (J. Urbán *et al.*, unpublished).

Osteological and other anatomical materials from at least 49 individuals have been collected from the Gulf of California, but most of these were from its southeasternmost part, in or near Bahía de Banderas (Salinas and Bourillón, 1988; Perrin and Kashiwada, 1989; Vidal, 1991; Urbán *et al.*, unpublished). On the basis of skull characters, body size, and coloration (see Perrin, 1975), 30 individuals [at least nine males (1.46–2.27 m total length) and six females (1.82–2.21 m)] have been identified as *S. a. graffmani* (Esquivel, 1989; Vidal, 1991; Urbán *et al.*, unpublished). The northernmost confirmed record for the species in the Gulf is a skull of *S. a. graffmani* collected at Laguna del Caimanero, south of Mazatlán, Sinaloa (about 23°00' N, 106°05' W) on 27 May 1984 (Vidal, 1991). Salinas and Bourillón (1988) listed several sightings of this form in all seasons in Bahía de Banderas, and Findley *et al.* (1988) reported sightings in the spring off Mazatlán and near the tip of Baja California. J. Urbán (field notes) observed two tuna purse-seiner sets on *S. a. attenuata* in September 1988 near Banco Gorda.

Stenella longirostris (Gray, 1828). Spinner dolphin; *delfín girador*, *delfín tornillo*: Three subspecies of the spinner dolphin (*Stenella longirostris*) have been distinguished in the eastern Pacific: *S. longirostris longirostris*, worldwide in tropical oceans, *S. longirostris orientalis*, from tropical oceanic and coastal waters of the eastern Pacific, and *S. longirostris centroamericana*, from Pacific coastal waters of Central America (Perrin, 1990). Sightings in Mexican Pacific waters have been of *S. l. orientalis* (Perrin *et al.*, 1985; Perrin, 1990). The so-called whitebelly spinner porpoise, cited in some Mexican records, is a highly variable intergrade between *S. l. orientalis* and *S. l. longirostris* (Perrin, 1990).

Osteological materials from nine specimens have been collected in the Gulf of California (Vidal, 1991). The skull of a decomposed carcass found on 19 February 1984 at Bahía de Navachiste, Sinaloa, is the northernmost confirmed record for the species in this sea. Of six specimens from Bahía de Banderas and the Islas Tres Marías, four were collected in May (including a male and a female, both 1.68 m long, and a 1.88-m female), one in December; month of collection is unknown for the other specimen. The remaining two specimens were a 1.95-m female and a 72-cm male (the latter killed in a tuna purse-seine), collected in early April near Mazatlán. Sightings have been reported from near the mouth of the Gulf south to at least Bahía de Banderas (i.e., from about 20° N, 105° W to about 25° N, 110° W) (Perrin *et al.*, 1985; Perrin, 1990).

Stenella coeruleoalba (Meyen, 1833). Striped dolphin; *delfín listado*: In the eastern tropical Pacific striped dolphins are relatively common from the equator to about 25° N (Perrin *et al.*, 1983), although there are records as far north as British Columbia (J. E. Heyning, pers. comm., 11 December 1992).

Osteological materials from four individuals have been collected in the Gulf of California: on 12 November 1983 near San Felipe (Aguayo and Perdomo, 1985), on 18 November 1979 at Punta San Marcial, BCS (Vidal, 1991), from a 1.59-m individual on 15 January 1975 at Isla del Espíritu Santo (Mullen, 1977), and a skull collected in Bahía de Banderas and now housed at the Facultad de Ciencias of the Universidad Nacional Autónoma de México (J. Urbán, pers. comm., 2 March 1992). Rizo (1990) reported three

single strandings near San Juan de la Costa in Bahía de La Paz, October 1984, January 1985, and "winter" 1986. Several individuals (including adults) of this generally oceanic species have been incidentally killed in the tuna purse-seine fishery near the western side of the mouth of the Gulf, and sightings have been reported south to at least Bahía de Banderas (Perrin *et al.*, 1983).

Delphinus delphis Linnaeus, 1758. Common dolphin; *delfín común*: The common dolphin is found in all oceans from tropical to temperate. In the eastern North Pacific it occurs from 36° N to the equator and offshore to about 142° W, with gaps between 13° and 20° N and between 27° and 32° N (Perrin *et al.*, 1985; Leatherwood *et al.*, 1988). At least two forms have been defined, by differences in morphology and color patterns (Evans, 1982; Perrin *et al.*, 1985; Leatherwood *et al.*, 1988; Heyning and Perrin, 1989): a smaller, short-beaked form (*D. delphis delphis*) distributed in three apparently separate populations (one north of 32° N off southern California, one between 28° and 30° N off Baja California, and one south of 15° N), and a larger, long-beaked form (*D. delphis bairdii*) occurring inside the 100-fathom curve north of 20° N. After analyzing morphometric and meristic data from over 270 specimens from southern California, Heyning and Perrin (1989) concluded that the two forms are "either extremely differentiated subspecies or two distinct species."

Both the short-beaked and long-beaked forms have been documented in the Gulf of California (Evans, 1982; Perrin *et al.*, 1985; Aguayo *et al.*, 1986a; Vidal *et al.*, 1987a), where the former is rare and the latter is very common (J. E. Heyning, pers. comm., 11 December 1992). Osteological materials (mainly skulls) of common dolphins have been collected along both coasts of the Gulf (Gallo and Alessio-Robles, 1989; Vidal, 1991), and undetermined numbers have been killed in the tuna purse-seine fishery in the southern part of this sea (Perrin *et al.*, 1985). This species, which is sometimes seen in groups of hundreds or thousands of individuals, is without doubt the most abundant cetacean in the Gulf of California, with sightings in all seasons and throughout the entire Gulf, from the uppermost part to Bahía de Banderas (Wells *et al.*, 1981; Urbán, 1983; Perrin *et al.*, 1985; Aguayo *et al.*, 1986a, b; Vidal *et al.*, 1987a; Findley *et al.*, 1988; Salinas and Bourillón, 1988; Silber, 1990b). On the basis of numerous sightings between 1981 and 1985, Aguayo *et al.* (1986a) concluded that the long-snouted form is resident in the Gulf, with some animals migrating to the outer coast of Baja California during winter, and that the short-snouted form occurs on the west coast of the peninsula and in the southern Gulf, penetrating farther north into this sea in winter. In the Gulf, common dolphins are incidentally killed in gill-net (Vidal *et al.*, in press b) and sardine purse-seine fisheries (Vidal, field notes). Information on total numbers of dolphins killed is lacking, but recent (1990–1991) observations suggest that this incidental mortality may be relatively high. For example, the carcasses of 19 net-caught common dolphins were found between late February and late March along 5 km of beach approximately 60 km northwest of Guaymas (Vidal *et al.*, in press b).

Subfamily Globicephalinae (Gray, 1866)

Peponocephala electra (Gray, 1846). Melon-headed whale; *delfín cabeza de melón*: These dolphins occur worldwide from tropical to warm-temperate oceanic waters (Leatherwood and Reeves, 1983). In the North Pacific, they have not been recorded from north of Hawaii and southern Baja California but have been reported widely elsewhere, including off the Pacific coast of mainland México. Perryman *et al.* (in press) have reviewed all published records of this species worldwide and added information on 12 sightings and one specimen from the eastern North Pacific from 1977 to 1983. Au and Perryman (1985) reported that these dolphins are "frequently seen . . . in the equatorial tropical Pacific," where

the distribution of sightings suggests that the species' oceanic habitat is primarily equatorial waters modified by upwelling.

The only record known for the Gulf of California is of a stranded individual collected at Isla del Espíritu Santo (Aurioles, 1987). The skeleton is housed at the Universidad Autónoma de Baja California Sur in La Paz (Vidal, 1991).

Pseudorca crassidens (Owen, 1846). False killer whale; *orca falsa*: This species has been reported from all tropical, subtropical, and temperate seas (Stacey *et al.*, in press) and has one of the largest continuous ranges of all cetaceans (Davies, 1963). In the eastern North Pacific it is known from Prince William Sound, Alaska, south to the equator (Leatherwood and Reeves, 1983; Leatherwood *et al.*, 1988). Records are sparse from California and more northerly waters but become more abundant from México southward (Leatherwood *et al.*, 1987). For example, in the files of the U.S. National Marine Fisheries Service (NMFS) in La Jolla, California, there are 240 records of sightings by observers on the eastern tropical Pacific tuna fishing grounds for the years 1972–1987 (Leatherwood *et al.*, 1989; Stacey *et al.*, in press).

There have been several sightings and some published strandings in México. Gallo and Rojas (1985) listed this species as occurring in all Pacific zones of México. The NMFS records referred to above include seven sightings from within the Gulf of California (Leatherwood *et al.*, 1989; fig. 2). Aguayo *et al.* (1986b) found that false killer whales represented only about 1% of all cetaceans seen during their surveys in the Gulf, 1981–1985. Breese (1988) and Breese and Tershy (1988a, unpublished) made 12 sightings between 1983 and 1986 in the Canal de Ballenas. Salinas and Bourillón (1988) reported four sightings in Bahía de Banderas: 3 individuals on 20 January 1983, 15 on 18 December 1984, 4 on 20 December 1984, and 20 on 22 February 1985. Strandings and collected specimens include a stranding on 29 April 1888 at Bahía de Pichilingue, near La Paz (Miller, 1920); two skulls found (Van Gelder, 1960) and later, evidently, collected on 27 June 1964 (Lindsay, 1964) on Isla San José; three skulls collected (one in August 1914 and two on 14 February 1940) on Isla del Espíritu Santo (Mitchell, 1965; Vidal, 1991); a skull collected on 28 April 1966 on Isla Partida (Norte) in the Midriff Islands; a skull collected in February 1983 in Bahía de La Paz; and a skull, partial skeleton and stomach contents from a decomposed carcass of a 4.83-m male collected on 16 April 1989 near Desemboque (del Río Concepción), Sonora (Vidal, 1991).

Orcinus orca (Linnaeus, 1758). Killer whale; *orca*: This cosmopolitan species is widely distributed in the eastern North Pacific (Dahlheim *et al.*, 1982; Heyning and Dahlheim, 1988; Leatherwood *et al.*, 1988).

As far as we know, no osteological materials of killer whales have been collected in the Gulf, although the species is observed, albeit sporadically, throughout this sea (Acevedo and Fleischer, 1987). For example, Dahlheim *et al.* (1982) reported about eight sightings from 26° N southward. The frequency of observations suggests that although the species is not abundant in these waters, it is not rare. Three reports are of killer whales attacking or harassing baleen whales. Tappy (1979) described a pod of about 30 killer whales (including several mature males) attacking and severely injuring an immature blue whale, *Balaenoptera musculus*, off the tip of Baja California. Silber *et al.* (1990) reported 15 killer whales (including two adult males and at least two calves) attacking, killing, and feeding on a Bryde's whale, *B. edeni*, near Rocas Consag, in the northern Gulf. Vidal and Pechter (1989) reported three killer whales (females or immatures) chasing two fin whales, *B. physalus*, off Tojahui, Sonora. Edward Asper, of Sea World of Florida, described an unsuccessful attack by three killer whales on a humpback whale, *Megaptera novaeangliae*, off the Islas Tres Marias in 1973 (Leatherwood, field notes). Killer whale tooth

marks have been seen on the flukes of blue whales near Loreto, BCS (Sears, 1990), and of humpback whales near Cabo San Lucas and La Paz (Urbán *et al.*, 1990b); it is not known where these attacks occurred (for recent reviews see Heyning and Dahlheim, 1988; Vidal and Pechter, 1989). Between 1983 and 1986 in the Canal de Ballenas, Breese (1988) and Breese and Tershy (1988a, unpublished) reported 21 sightings of killer whales for a total of 131 animals, with an average group size of six. Sightings were distributed throughout the year and in all months except October. One particular pod of six to eight killer whales was seen in each year of this study (Breese and Tershy, 1988a). Killer whales also have been observed in the Gulf in Bahía San Luis Gonzaga and near Isla San Lorenzo, BCS, near the sea lion rookery of Los Islotes, just north of Isla Espíritu Santo (Urbán *et al.*, 1990a), off Loreto (Findley *et al.*, 1988), at Guaymas (Findley, field notes), near Yavaros (Vidal, 1989), and in Bahía de Banderas (Salinas and Bourillón, 1988).

Globicephala macrorhynchus Gray, 1846. Short-finned pilot whale; *calderón de aletas cortas*: This species is distributed worldwide from tropical to warm temperate waters and in cold temperate waters in the eastern North Pacific, where it has been reported from the Gulf of Alaska (rare) south to Perú, being much more common from central California southward (Leatherwood and Reeves, 1983). Some individuals remain year round near some Baja California coastal islands (Leatherwood *et al.*, 1988).

Since 1911, at least 30 osteological specimens (mainly skulls) have been collected from several areas, mostly islands, in the Gulf of California (Vidal, 1991): Isla Angel de la Guarda; Baja California Sur (Santa Rosalía, Isla San Marcos, Loreto, Isla San Diego, Isla Santa Cruz, Isla San José, and La Paz); Sonora (Bahía Cholla near Puerto Peñasco, Isla Tiburón, and near Bahía Kino). Also, three mass strandings are known, of at least 14 individuals in the early 1980s in Bahía Guadalupe, north of Bahía de los Angeles (Breese and Tershy, 1988a, unpublished), of 30 individuals (26 females and 4 males ranging from 3 to 6.6 m in length) on 20 and 21 February 1988 in Bahía San Rafael, BCS (Breese and Tershy, 1988a, unpublished), and of 31 individuals (including at least eight males and six females) that were stranded and then were successfully driven offshore on 13 January 1989 near La Paz (Urbán, 1989). A carcass of this species was photographed on the beach at Coloraditos, BCS (R. Houston, pers. comm.). In addition, we know of several sightings: 5 between 1988 and 1991 in Bahía de La Paz (Urbán, 1989), 14 during 1978 between the Midriff Islands and Bahía de La Paz (Balcomb *et al.*, 1979), 6 between 1983 and 1985 on the southern coast of Baja California (Connally *et al.*, 1986), 21 between 1981 and 1987 from the southern coasts of Sinaloa and Baja California Sur to the upper Gulf of California (Aguayo *et al.*, 1988a), in the Canal de Ballenas (Breese and Tershy, 1988a, unpublished; Findley *et al.*, 1988), east of Isla San Pedro Nolasco (Gallo, 1984), near Isla del Carmen, near Isla Tortuga, and northwest of Guaymas (Findley and Vidal, field notes).

Superfamily Ziphiioidea (Gray, 1865)

Family Ziphiidae Gray, 1865—Beaked whales; *zfidos*

Berardius bairdii Stejneger, 1883. Baird's beaked whale; *zfido de Baird*: Baird's beaked whale is an oceanic species found only in the temperate North Pacific. On the eastern side, it occurs from the Pribilof Islands and Alaska south to the tip of Baja California (Leatherwood and Reeves, 1983). Along the California coast, these whales apparently spend the winter and spring far offshore, then, during early summer, move shoreward to over the continental slope, where their abundance peaks in September and October (Balcomb, 1989).

We know of only four reports of Baird's beaked whales off the

west coast of the Baja California Peninsula: (1) reporting of the species' distribution south to 32° N (Rice, 1974); (2) reporting of the species' distribution south to 28° N (Leatherwood *et al.*, 1988); (3) sightings of 10 whales on 16 August 1987 at 27°11' N, 114°49' W, and of 25 whales on 1 September 1987 at 27°18' N, 114°59' W (Aguayo *et al.*, 1988b); and (4) a sighting of a group of at least seven whales at 30°01.4' N, 117°56.5' W (Leatherwood *et al.*, 1987; fig. 15). We know of only six records from inside the Gulf of California: (1) a skull collected on 13 August 1964 at Isla San Esteban and housed in the Oklahoma Museum of Natural History, Norman (Vidal, 1991); (2) seven individuals (four males and three females, 9.03–11.35 m total length) stranded on 2 July 1986 at El Mogote, near La Paz (Aurioles, 1987) (three skulls, one each housed at the Centro de Investigaciones Biológicas, the Centro Regional de Investigación Pesquera, and the Universidad Autónoma de Baja California Sur, all in La Paz; Vidal, 1991); (3) a 10.5-m female stranded on 9 June 1990 at Costa Baja, near La Paz (Urbán and Jaramillo, in press); (4) six individuals sighted on 3 June 1990 in Canal de San Lorenzo (Urbán and Jaramillo, in press); (5) four whales photographed at the surface on 16 June 1987 near the western side of the mouth of the Gulf (23°15' N, 109°21' W) in water 730 m deep; and (6) five whales photographed at the surface on 13 October 1987 at 24°34' N, 109°59' W in water 2160 m deep (Aguayo *et al.*, 1988b). The last appears to be the southernmost confirmed record for this oceanic species, which appears to be an infrequent visitor to the Gulf.

Mesoplodon spp. Mesoplodonts; *mesoplodontes*: Confirmed records of beaked whales of the speciose genus *Mesoplodon* in Mexican waters are rare. The majority are from the Mexican Pacific. Species of this oceanic genus are difficult to identify at sea, so it is not surprising that most sightings in México remain unidentified.

Leatherwood *et al.* (1988) and Vidal (1991) reported the skull of a ginkgo-toothed beaked whale (*mesoplodonte de dientes de ginkgo*), *M. ginkgodens*, collected on 30 December 1980 at Playa Malarrimo, outside Laguna Ojo de Liebre (Scammon's Lagoon) (about 27°52' N, 114°28' W). Four publications contain references to a total of 23 sightings of unidentified mesoplodonts (only a few supported by photographs) in Mexican waters (Pitman *et al.*, 1987; Urbán and Aguayo, 1987a; Salinas and Bourillón, 1988; Aguayo *et al.*, 1988b). These include 11 sightings (38 individuals) in the Gulf of California; most of these (seven sightings for total 21 individuals) were in Bahía de Banderas, though two (four individuals) were near the mouth of the Gulf (Aguayo *et al.*, 1988b).

Mesoplodon peruvianus Reyes, Mead and Van Waerebeek, 1991. Pygmy beaked whale; *mesoplodonte pigmeo*: The pygmy beaked whale was recently described from 10 specimens stranded or incidentally captured by fishermen between 1976 and 1989 in Perú (Reyes *et al.*, 1991). This sample included only one adult (a male) of known sex (sex unknown for two other adults).

Three specimens of this species were recently found in the Gulf of California. The skull from a decomposed carcass of a male (estimated total length 3.4 m; catalog number DAG 160) and the skull and nearly complete skeleton of a female (estimated total length 3.3 m; catalog number UABCS-MM-053), both judged to be physically mature, were collected on 13 January and 19 April 1990, respectively, near La Paz (24°24' N, 110°38' W) and on Isla Espíritu Santo (24°25' N, 110°25' W) (Aurioles and Urbán, 1990; Urbán and Aurioles, 1992). These specimens are housed at the Universidad Autónoma de Baja California Sur and Centro de Investigaciones Biológicas de Baja California Sur, both at La Paz.

The third record is based on a skull and 12 connected lumbar (3) and caudal (9) vertebrae of an individual that was stranded during the summer of 1988 or 1989 at San Carlos (about 27°57' N, 110°59' W) near Guaymas (these materials were collected by a local fisherman, donated to Vidal on 7 January 1992, and are now housed at ITESM–

Campus Guaymas; catalog number ITESM 920107). The nearly completely filled mesorostral canal (mesorostral ossification) and the fusion of all vertebral epiphyses to their centra imply the animal was a physically mature male (see Moore, 1966; Heyning, 1989; Mead, 1989; Reyes *et al.*, 1991). The specimen was identified as *M. peruvianus* by the shape and small size of the cranium (condylobasal length 520 mm; zygomatic width 250 mm) and direct comparisons with the specimens collected near La Paz. Other cranial measurements (in mm, all but those with an asterisk taken on the right side by Vidal and J. Torre, following Reyes *et al.*, 1991) include tip of rostrum to posterior extension of maxillary plate, 472; tip of rostrum to anterior margin of superior nares, 357; tip of rostrum to anterior point of premaxillary crest, 388*; tip of rostrum to posterior extension of premaxillae and lateral tip of premaxillary crest, 400*; tip of rostrum to posterior extension of temporal fossa, 480; length of rostrum, 301; breadth of skull across orbital centers, 232; breadth of skull across postorbital process of frontal, 241; least breadth of skull at posterior margins of temporal fossae, 139; greatest breadth of skull across exoccipitals, 150; greatest span of occipital condyles, 97; greatest width of occipital condyle, 36; greatest length of occipital condyle (66); greatest breadth of foramen magnum, 42; greatest length of nasal on vertex, 40*; length of nasal suture, 42*; extension of premaxilla posterior to nasal on vertex, 22; greatest breadth of nasal on vertex, 27; least distance between anterior prominences of synvertex, 19; greatest transverse width of superior nares, 31; least width of premaxillae where they narrow opposite superior nares, 77; greatest width of premaxillae anterior to above, 93; width of rostrum in apices of antorbital notches, 132; width of rostrum in apices of prominent notches, 101; least distance between main maxillary foramina, 112; least distance between premaxillary foramina, 30; distance from posterior margin of maxillary foramen to most anterior point of maxillary prominence, 91*; width of rostrum at its middle, 38; width of premaxillae at middle of rostrum, 22; depth of rostrum at its middle, 47; height of skull, 200; external cranial height, 143; greatest length of temporal fossa, 37; greatest width of temporal fossa, 47; length of orbit on frontals, 75; tip of rostrum to posterior extension of maxillae between pterygoids, 313; tip of rostrum to most anterior extension of pterygoids, 279; length of vomer visible on palatal surface, 88.

To date, these three strandings are the only confirmed records of pygmy beaked whales for the North Pacific. Also, R. L. Pitman (Southwest Fisheries Science Center, La Jolla, California) saw two individuals probably of this species on 13 July 1986 in Bahía de Banderas and three individuals (two adults and a calf) off the coast of Oaxaca, southern México (10°58' N, 98°15' W) (Urbán and Aurioles, 1992). From the available data, Urbán and Aurioles (1992) hypothesized that *M. peruvianus* is endemic to the eastern tropical Pacific (northern limit at about 25° N) and noted that the paucity of sightings and strandings in this area can be attributed to lack of search effort.

Ziphius cavirostris G. Cuvier, 1823. Cuvier's beaked whale; *zifido de Cuvier*: This species is one of the world's most widely distributed cetaceans and probably the most common beaked whale in the eastern North Pacific (Mitchell, 1968; Leatherwood *et al.*, 1972, 1988; Leatherwood and Reeves, 1983). There are numerous reports from off the west coast of Baja California (Hubbs, 1951; Mitchell, 1968; Leatherwood *et al.*, 1972, 1988; Rice, 1978; Urbán and Aguayo, 1987a; Vidal, 1991).

Osteological materials (mostly beached skulls) from the Gulf of California have been collected in Baja California (Norte) (near San Felipe; Isla Smith, in Bahía de los Angeles; Bahía San Luis Gonzaga) and Baja California Sur [Bahía Amortajada of Isla San José; Ensenada de los Muertos (24°00' N, 109°50' W) (a stranded animal found in autumn and its skull collected); at 22°55' N, 109°45' W (a stranded animal observed in summer; skull collected)] (Aurioles,

1987; Aguayo *et al.*, 1988b; Vidal, 1991). In addition, there were strandings of an adult female and a juvenile (no materials collected) in September 1980 at 24°12' N, 110°18' W (Aguayo *et al.*, 1988b) and of an animal of unknown sex photographed in September 1980 at Pichilingue near La Paz (Aurioles *et al.*, 1984). Eight sightings (20 individuals) have been reported from the Gulf. These include one near Isla San José (25°08' N, 110°29' W) on 1 April, two off Mazatlán (23°08' N, 106° 54' W and 23°01' N, 107°50' W) on 3 March, two (one on 29 June and one on 17 December) in Bahía de Banderas, and a female with a calf photographed at 25°15' N, 109°30.1' W on 3 November (Aguayo *et al.*, 1988b; Salinas and Bourillón, 1988; D. Breese and B. Tershy, pers. comm., 12 April 1992).

Superfamily Physeteroidea (Gray, 1821)

Family Physeteridae (Gray, 1821)

Subfamily Kogiinae (Gill, 1871)

Kogia breviceps (de Blainville, 1838). Pygmy sperm whale; *cachalote pigno*: Because whales of the genus *Kogia* Gray, 1846, are only rarely identified at sea, and then usually not to species, it is difficult to establish the distributional range of the two living species (see below). The pygmy sperm whale appears to be a cosmopolitan species, occurring in nearly all temperate and tropical waters (Leatherwood and Reeves, 1983; Caldwell and Caldwell, 1989). In the eastern North Pacific, it is believed to be sparsely distributed from Washington south to Baja California and into the Gulf of California (Leatherwood *et al.*, 1988).

A few records are known from the Gulf: a cranium found about 15 km north of San Felipe (Brownell, 1969); a 1.91-m moribund male stranded on 25 January 1984 at Puerto Peñasco (Maldonado *et al.*, 1984; Vidal *et al.*, 1987b); a male and female (both about 3.4 m in length) stranded together on 19 May 1985 near La Paz (Vidal *et al.*, 1987b); three sightings (one supported by photographs) for a total of five individuals on 17 June 1984 near Isla Tortuga (Vidal *et al.*, 1987b); a partial skull collected in 1868 at Mazatlán (Vidal, 1991), and a skull collected on 10 July 1991 at Isla Coronados and now in a private collection in Loreto (K. L. Connally and M. D. Daily, pers. comm., January 1992).

Kogia simus (Owen, 1866). Dwarf sperm whale; *cachalote enano*: The distribution of the dwarf sperm whale appears to be similar to that of the pygmy sperm whale, although the former apparently occurs more frequently in slightly warmer seas (Caldwell and Caldwell, 1989). In the eastern North Pacific outside the Gulf of California, dwarf sperm whales have been documented from central California and Cabo San Lucas (Leatherwood *et al.*, 1988).

Osteological materials from four dwarf sperm whales, some freshly dead, have been collected from the Gulf, all in Bahía de La Paz: a 2.27-m female on 19 October 1983 (Fleischer *et al.*, 1984) and a 2.20-m male, a female, and a third individual (sex not determined) in March 1985 (Aurioles, 1987; Vidal, 1991). Rizo (1990) reported a stranding of two animals in September 1989, also in Bahía de La Paz. The only other records we know of are a sighting of one individual on 4 November 1985 in the Canal de Ballenas (Breese and Tershy, 1988a, unpublished), three sightings of four animals plus one of a solitary individual on 6 March 1987 about 8 km east of Isla San José (J. E. Heyning, pers. comm., 11 December 1992), a sighting of three individuals on 25 February 1985 in Bahía de Banderas, and a sighting of a female with a calf there on 29 June 1985 (Salinas and Bourillón, 1988).

Subfamily Physeterinae (Gray, 1821)

Physeter catodon (= *P. macrocephalus*) Linnaeus, 1758. Sperm whale; *cachalote*: The sperm whale has one of the most extensive

distributions of any marine mammal, ranging throughout all oceans from the equator to the edges of polar ice (Rice, 1989). Mainly on the basis of commercial whaling records, it has been postulated that at least three populations of sperm whales inhabit the North Pacific, one each in the western, central, and eastern regions (Bannister and Mitchell, 1980; Veinger, 1980). The Gulf of California (within the eastern region) contains sperm whales, but their population numbers, distribution, and movements are not known.

Vidal and Findley (1984, 1986) reviewed the five known mass strandings and three single strandings of sperm whales in the Gulf: (1) 9 bulls (ranging from 10.6 to 13.6 m) on 12 April 1953 at Cabo Tepoca, Sonora (Gilmore, 1957, 1959); (2) 22 bulls (10.6–12.1 m) on 16 January 1954 at La Paz (Cockrum, 1956; Gilmore, 1957, 1959); (3) 17 whales (sex not determined for most but including at least some lactating females plus seven individuals of about 7 m and an aborted 3-m fetus) on 1 September 1973 at Huatabampo, Sonora (Balcomb, 1981); (4) 56 whales [38 males (9–13 m), 9 females (9.7–12.4 m), 9 sex undetermined, plus 3 aborted fetuses, none of which appeared to be full term] on 1 January 1979 at San Bruno, 15 km north of Mulegé, BCS (Patten, 1979; Patten *et al.*, 1979); and (5) 3 males (11.87–12.28 m), judged to be sexually mature by size and age, on 6 March 1983 at the Boca del Río Fuerte, about 40 km northwest of Bahía de Topolobampo, Sinaloa (Vidal and Findley, 1986). The single strandings were of a 13-m male on 28 December 1954 at San Felipe, a ca. 11-m individual (sex not determined) about July 1978 at Isla San José, and a 14.39-m male on 1 February 1979 at Isla Espíritu Santo (Vidal and Findley, 1986).

Vidal and Findley (1984) reviewed eight sightings of live sperm whales in the Gulf and noted that all but one were near the coast of Baja California, where the sea bottom drops precipitously and deep waters are closer to shore. They speculated that the distribution of sperm whales in the Gulf may be related to the distribution of one of their important prey items, the jumbo squid *Dosidicus gigas* (family Ommastrephidae) (see Klett, 1981). Breese and Tershy (1988a, unpublished) reported four sightings in the Canal de Ballenas, one in 1983 and three from late January to early February 1988. Aguayo *et al.* (1988a) reported seven sightings between February 1983 and July 1985 from Isla María Magdalena (Islas Tres Marias) to the Canal de Salsipuedes. Of 1849 sightings in the eastern tropical Pacific by observers aboard American tuna boats, the only ones in the Gulf were in the oceanic waters of its mouth (Reilly and Leatherwood, unpublished).

Suborder Mysticeti Flower, 1864 (= Mysticoceti)—Baleen or whalebone whales; *cetáceos o ballenas con barbas*

Family Eschrichtiidae Ellerman and Morrison-Scott, 1951

Eschrichtius robustus (Lilljeborg, 1861). Gray whale; *ballena gris*: Today, the gray whale inhabits only the North Pacific, where it is represented by two populations: the nearly extinct northwestern Pacific or "Korean" population, which migrates from the Okhotsk Sea to South Korea (Andrews, 1914), and the abundant northeastern Pacific or "California" population, which migrates from primary summer feeding grounds in the Bering, Chukchi, and Beaufort seas to principal winter breeding/calving grounds in northwest México, mainly the outer coast of the Baja California Peninsula (Scammon, 1874; Gilmore, 1960; Rice and Wolman, 1971; Jones *et al.*, 1984). The main wintering areas are in or near Laguna Guerrero Negro, Laguna Ojo de Liebre (Scammon's Lagoon), Laguna San Ignacio, and Bahía Magdalena (Jones *et al.*, 1984; Wolman, 1985).

Though less widely published, smaller numbers of gray whales also occur throughout the Gulf of California (Findley and Vidal, unpublished). Most recent records for the Gulf come from its southern half, as in the nineteenth century, when the species began to be commercially exploited (Scammon, 1874; Henderson, 1972,

1984). Until about 1984, gray whales still visited the two winter calving sites most distant from the summer range, the area of Yavaros-Tojahui, Sonora, and Bahía Santa María (Reforma), Sinaloa (Gilmore and Ewing, 1954; Gilmore, 1960; Gilmore and Mills, 1962; Gilmore *et al.*, 1967; Vidal, 1989; Findley and Vidal, unpublished). A few cow/calf pairs and occasional solitary subadults could be seen at these two sites during the winter, principally from mid-January to late March. However, with the accelerated economic development of these areas, especially with increased fishing and shipping, it appears that gray whales no longer visit these sites or do so only sporadically (Findley and Vidal, 1983, unpublished; Vidal, 1989).

In other areas of the Gulf, gray whales have been seen along both coasts in small groups, as cow/calf pairs or, most commonly, as solitary individuals. There have been isolated sightings or strandings from as far south as Bahía de Banderas (Salinas and Bourillón, 1988) to the northernmost parts of the Gulf, such as Puerto Peñasco and near El Golfo de Santa Clara (Brownell, 1971; Patten and Samaras, 1977; Findley and Vidal, 1983, unpublished; Tershy and Breese, 1991). In general, gray whales are seen in Gulf waters most frequently during the species' wintering residence on the outer coast of Baja California, and most of the few cow/calf pairs have been reported from the southern Gulf. Sightings and strandings in the northern Gulf have usually involved solitary subadults (Tershy and Breese, 1991; Findley and Vidal, unpublished). Some of these have been during late spring, autumn, or even summer, indicating that not all individuals participate in the normal migration to summer feeding grounds in the North Pacific (Findley and Vidal, 1983) and must therefore find food in Gulf waters (Tershy and Breese, 1991). Movements of gray whales within the Gulf remain unknown.

Family Balaenopteridae Gray, 1864—Rorquals; *rorcuales*

Subfamily Megapterinae Gray, 1864

Megaptera novaeangliae (Borowski, 1781). Humpback whale; *ballena jorobada*: Humpback whales are widely distributed in all oceans, from tropical wintering grounds around islands and continental coasts where they breed and calve, to high-latitude summering grounds (even to the edges of polar ice) where they feed (Leatherwood and Reeves, 1983). Three stocks are recognized in the North Pacific: the Asian, Hawaiian, and Mexican (Leatherwood *et al.*, 1988).

After reviewing records of humpback whales on winter breeding grounds in the Mexican Pacific, Aguayo *et al.* (1984) and Urbán and Aguayo (1987b) recognized four regions of concentrations: (1) the southernmost coasts of Baja California, (2) the mainland coast of México, including Isla Isabel and the Islas Tres Marias, (3) the oceanic Islas Revillagigedo, and (4) the central Gulf of California, where a few individuals are hypothesized to remain year round, not participating in the seasonal migration of the other groups. Urbán *et al.* (1987, 1989) and Urbán and Balcomb (in press) reported partial segregation and different migratory (feeding) destinations of the groups in the Mexican Pacific, with central California being the destination for whales of the southern Baja California and mainland coast and an unknown area (Gulf of Alaska?) being the destination for those of the Islas Revillagigedo. Urbán *et al.* (1990b) estimated that approximately 1500 humpback whales visit the Mexican Pacific each winter. We know of only one report of a stranded humpback whale in the Gulf, of a ca. 11-m male near La Paz on 19 March 1983 (Fleischer *et al.*, 1984).

Subfamily Balaenopterinae (Gray, 1864)

Balaenoptera acutorostrata Lacépède, 1804. Minke whale; *ballena minke*: The cosmopolitan minke whale occurs from the

Bering and Chukchi seas south to at least the equator in the eastern North Pacific but is not abundant anywhere within this range (Leatherwood *et al.*, 1988).

Apparently, this species is not common in the Gulf of California. Only a few confirmed records exist, including three of whales found dead (Vidal, 1991, field notes): one at Bahía San Luis Gonzaga (an 8-m female on 15 June 1986), two near El Golfo de Santa Clara (a 7.4-m male on 12 April 1990 and an 8.23-m female on 1 February 1992). Vidal (1991) reported a partial skull found at Bahía San Luis Gonzaga, and Findley saw a complete skull being used as a house ornament at Coloraditos, south of San Felipe. During extensive observations in the Canal de Ballenas, Tershy *et al.* (1990) saw only 17 minke whales, six of which were individually identified. These authors concluded that minke whales were less transient than either the fin or blue whales observed there and that this smallest of the rorquals seemed equally abundant throughout the year. Only a few other sightings have been reported, e.g., near San Felipe and Isla San Pedro Mártir (two individuals, Wells *et al.*, 1981), and in the central Gulf (Balcomb *et al.*, 1979; Le Boeuf, 1984).

Balaenoptera borealis Lesson, 1828. Sei whale; *ballena sei*: The sei whale is a cosmopolitan oceanic species inhabiting mainly polar and cold temperate waters. In winter in the northeastern Pacific, sei whales occur from California (35°30' N) to the Islas Revillagigedo (18°30' N) (Leatherwood *et al.*, 1988).

The only confirmed records for the Gulf of California are two sightings, one in January off the north end of Isla del Carmen and one in March off Los Islotes (Connally *et al.*, 1986). However, because sei whales are difficult to distinguish from Bryde's whales in the water, it is possible that some individuals reported as Bryde's whales, from both observations at sea and whaling, could actually have been sei whales. Nonetheless, sei whales appear to be infrequent visitors to the Gulf.

Balaenoptera edeni Anderson, 1878. Bryde's whale; *ballena de Bryde*: Bryde's whales occur in tropical and warm temperate waters around the world. In the eastern North Pacific, they are apparently limited to warmer waters south of 30°N. In Mexican waters, Bryde's whales have been reported from 26°N, off western Baja California Sur, south to Cabo San Lucas, and from several localities in the Gulf of California, south along the mainland coast to at least the Islas Tres Marias (Leatherwood *et al.*, 1988).

In the Gulf, skulls have been collected near La Paz and on Isla Angel de la Guarda (Vidal, 1991). Sightings of Bryde's whales are relatively common, mainly in summer and autumn, around the Midriff Islands, especially in the Canal de Ballenas (Vidal *et al.*, 1987a; Breese, 1988; Breese and Tershy, 1988a; Tershy *et al.*, 1990), near Loreto (Cummings *et al.*, 1986; Flóres, 1989), and in and near Bahía de La Paz (Urbán *et al.*, 1991). Apparently, Bryde's whales worldwide migrate relatively short distances, in contrast to the other balaenopterid whales, which typically migrate great distances. However, seasonal and local movements of Bryde's whales in the Gulf are poorly known. As a result of concentrated efforts in the Canal de Ballenas between 1983 and 1986, Tershy *et al.* (1990) photo-identified 160 individuals of 307 seen and concluded that the species was the most abundant baleen whale in that area. Although present in all months of the year, Bryde's whales were more abundant in summer and fall, their numbers being positively correlated with water temperature (Tershy *et al.*, 1990). Calves were observed in every month of the year, and of all individuals seen, cow/calf pairs constituted from 11% (in 1983) to 22% (1985–1986) (Breese and Tershy, 1987, 1988b; Tershy, 1992). Overall, 10.6% of all individual identified adults were females with calves, and these pairs were more sedentary in the study area than were Bryde's whales of undetermined sex (Tershy *et al.*, 1990). Urbán *et al.* (1991) photo-identified more than 60 individuals (of 307 seen between May 1989 and June 1991) in Bahía de La Paz, 82% of all

baleen whales they sighted (mainly during summer and fall) were Bryde's whales.

Balaenoptera musculus (Linnaeus, 1758). Blue whale; *ballena azul*: Blue whales occur in all oceans. Reilly and Thayer (1990) reviewed the distribution of blue whales in the eastern tropical Pacific. Over 90% of the 211 sightings (355 individuals; since 1974) they presented were made in just two areas: along the Baja California Peninsula, and in the vicinity of the oceanographically defined Costa Rica Dome (about 9° N, 89° W). Because the whales were sighted in relatively cool upwelling-modified waters (the most productive parts of the eastern tropical Pacific), these authors suggested that blue whales at low latitudes select habitats that permit foraging for euphausiid crustaceans (krill). The waters off western Baja California were occupied seasonally, with a peak in sightings coinciding with the spring peak in upwelling and biological production.

A similar pattern of blue whale distribution has been found in the Gulf of California (Gendron and Sears, 1989; Gendron, 1990; Vidal *et al.*, unpublished). Blue whales have been seen in the Gulf from January through August but are more concentrated in March and April along the southwestern side of the Gulf (Sears *et al.*, 1987; Gendron, 1990; Sears, 1990; Vidal *et al.*, unpublished). Gendron (1990) reported blue whales feeding on daytime surface swarms of their predominant prey, the euphausiid *Nyctiphanes simplex*, in the southwestern Gulf in spring from 1984 to 1989 and discussed the year-to-year variability of blue whales in this area in relation to *El Niño*. Vidal *et al.*, (unpublished) have identified four areas of blue whale concentration: (1) islas San José, Santa Cruz, and San Francisco; (2) islas Monserrat, Carmen, and Coronados; (3) from Punta Concepción, BCS, to Isla San Ildefonso; and (4) Canal de Salsipuedes and Canal de Ballenas. In the latter area, Tershy *et al.* (1990) reported sighting only nine blue whales from May 1983 to April 1986, but frequency was highest in April and May. They noted a cow/calf pair on 20 October 1984, and Vidal *et al.* (unpublished) saw a subadult on 11 November 1985. Tershy *et al.* (1990) concluded that blue whales were more transient there than were Bryde's and minke whales. Isolated sightings have been reported from near San Felipe, Guaymas, and Yavaros (Vidal *et al.*, unpublished).

On the basis of photo-identification matches, Sears *et al.* (1987), Sears (1990), and Calambokidis *et al.* (1990) suggested that blue whales seen in the Gulf (a total of 117 different individuals since 1983) migrate out of the Gulf and north along the Pacific coast in late spring to central and northern California, thence southward toward the Gulf in late autumn. Although certain stereotyped sounds produced by blue whales in the Gulf of California (Thompson *et al.*, 1987) differ somewhat from those recorded off California, the similarity in general characteristics and inter-sound intervals tends to support this migration hypothesis (Thompson, Findley, and Vidal, unpublished). The Gulf is probably an important calving and/or nursery area for this species. Between December and March, 1984–1990, at least 22 different cow/calf pairs were reported in the Gulf, representing between 8 and 9% of the blue whale calves catalogued to date in the northeastern Pacific (Sears, 1990).

Balaenoptera physalus (Linnaeus, 1758). Fin whale; *ballena de aleta, rorcual común*: The fin whale is a cosmopolitan species. In summer, fin whales of the eastern North Pacific are distributed from at least the Southern California Bight north to the Bering Sea and occasionally to the edge of the pack ice. In winter, the southern limit of distribution shifts south to at least 20°N, perhaps farther (Leatherwood and Reeves, 1983; Leatherwood *et al.*, 1987, 1988). Leatherwood *et al.* (1987) suggested that fin whales may remain off the west coast of Baja California and southern California year round, not vacating those latitudes in winter as was once thought, but simply shifting farther offshore.

Although the fin whale's abundance in the Gulf of California peaks in winter and spring, sightings in all seasons and most months

led to the speculation that fin whales in the Gulf are residents (Gilmore, 1957; Leatherwood *et al.*, 1972). A review of the seasonality of observations along the west coast of Baja California and in the Gulf by Aguayo *et al.* (1983) and comparison of some vocalizations of fin whales in the Gulf with those in other areas by Thompson *et al.* (1992) support this hypothesis. Also, Aguayo *et al.* (1983) reported that a few calves have been sighted in all seasons. In the Canal de Ballenas, 2.7% of individually photo-identified adults (148) were females with calves (Tershy *et al.*, 1990). Urbán *et al.* (1988) reported 31 sightings and five strandings between July 1978 and August 1987 in the southern Gulf, and on the basis of lack of records between Cabo San Lucas and Cabo Corrientes agreed with the hypothesis of a resident population in the Gulf of California. This hypothesis, however, needs further testing.

Within the Gulf, the fin whale is the most widely distributed and abundant mysticete (Wells *et al.*, 1981; Aguayo *et al.*, 1983; Rojas, 1984; Maldonado *et al.*, 1984; Tershy and Strong, 1984; Connally *et al.*, 1986; Cummings *et al.*, 1986; Vidal *et al.*, 1987a; Findley *et al.*, 1988; Tershy *et al.*, 1990; Thompson *et al.*, 1992). Areas of major concentration are the Canal de Ballenas and Canal de Salsipuedes, off Puerto Peñasco, Puerto Libertad, Isla San Pedro Mártir, and Isla Tiburón, between Bahía de La Paz and Isla del Carmen, between Isla San Pedro Nolasco and Guaymas, and Bahía Santa Bárbara. One hundred forty-eight different individuals (of 291 seen) in the Canal de Ballenas (Tershy *et al.*, 1990; Tershy, 1992) and several others near Guaymas, Puerto Libertad, and Bahía Santa Bárbara (Findley and Vidal, unpublished) have been photo-identified. In the Canal de Ballenas, Tershy *et al.* (1990) sighted fin whales in all months of the year, most frequently in winter and spring; numbers were negatively correlated with water temperature. Data presented by these authors suggest that, like blue whales, fin whales are more transient in the Canal de Ballenas than are Bryde's and minke whales. The distribution of the fin whale in the Gulf, like that of other mysticetes, is undoubtedly correlated with upwelling or tide-driven vertical mixing (for the Midriff Islands) supporting high biological productivity (Findley *et al.*, 1982; Tershy *et al.*, 1990).

Order Carnivora Bowdich, 1821

Family Otariidae Gill, 1866

Subfamily Otariinae (Gill, 1866)

Zalophus californianus californianus (Lesson, 1828). California sea lion; *lobo* or *león marino de California*: Three subspecies of *Zalophus californianus* inhabit the Pacific: *Z. c. californianus*, found on the west coast of North America from British Columbia south to at least Mazatlán and the Islas Tres Marias, México, including the entire Gulf of California, *Z. c. wolfebaeki*, found at the Galápagos Islands, and *Z. c. japonicus* (possibly extinct), found in Japanese waters (Odell, 1981). A comparison of skulls of *Z. c. californianus* from California with those from the Gulf of California showed no significant morphological differences between the two areas (Orr *et al.*, 1970).

California sea lions are widely distributed on many islands and islets off the west coast of the Baja California Peninsula and in the Gulf. At least 29 colonies have been identified in the Gulf, but only four of these lie on mainland coasts [Cabo Lobos and Guaymas (Cabo Haro), Sonora; Punta San Francisquito, BCN; and Cabo San Lucas] (Aurioles, 1988). Fourteen of the 29 colonies are located in the northern Gulf (83.5% of the Gulf's sea lion population), 11 colonies (15.8%) are in the central Gulf, and four colonies (0.7%) are in the southern Gulf (Aurioles, 1988). This distribution is apparently related to concentrations of stable food (fish) resources. About 83% of the annual pup production occurs in the northern part

(Aurioles, 1988). The total Gulf population has been estimated at about 20,000 individuals, representing nearly 24% of the entire Mexican population (Le Boeuf *et al.*, 1983; Aurioles, 1988). The population biology of sea lions in the Midriff Islands has been studied by Morales and Aguayo (1992).

Arctocephalus townsendi Merriam, 1897. Guadalupe fur seal; *lobo fino de Guadalupe*: This is the only species of *Arctocephalus* found north of the equator. After coming dangerously close to extinction as a result of overhunting during the late eighteenth and early nineteenth centuries (by the early 1950s the species was believed to be extinct), the Guadalupe fur seal is slowly recovering. Today, the species is confined to Isla Guadalupe (its only known breeding rookery) far off the west coast of Baja California at 28°N, with isolated strays on the Channel Islands of southern California (Bonner, 1981). The population on Isla Guadalupe was estimated at 1073 individuals in 1977 (Fleischer, 1978, 1987) and at 3531 individuals in 1988 (Tórres, 1991).

We know of only three records of stray Guadalupe fur seals seen in the Gulf of California: one on 27 October 1981 at Guaymas, and two on 20 July 1985 and 26 June 1986 at Los Islotes near La Paz (Aurioles *et al.*, 1985, in press).

Family Phocidae

Mirounga angustirostris Gill, 1866. Northern elephant seal; *elefante marino del norte*: Northern elephant seals are regularly found from Isla Cedros and Islas San Benito (ca. 28°15' N) off the Pacific coast of central Baja California north to the Farallon Islands, California, although nonbreeding individuals are frequently seen farther north along the west coast of North America to Vancouver Island, Canada (McGinnis and Schusterman, 1981). Males typically go to the Aleutian Islands to feed. The southernmost records are of four juveniles from the west coast of Baja California: a male (1.3 m in length) on 20 January 1982 at 26°20' N, 113°12' W and an individual of unknown sex, a female (ca. 1.4 m), and a male (1.98 m) in February, on 6 June 1983, and on 29 November 1984, respectively, at 24°20' N, 111°43' W (Aurioles *et al.*, in press).

We know of only six records (total of seven animals) of stray northern elephant seals, all immature, in the Gulf of California (Aurioles *et al.*, in press): one at Isla Angel de la Guarda on 4 July 1979; two at Isla Granito in Puerto Refugio, northernmost Isla Angel de la Guarda, one on 29 June 1984 (Condit and Le Boeuf, 1984; Aurioles *et al.*, 1985) and the other (a female 3 or 4 years old) on 4 May 1987 (Petruszyn and Mesnick, unpublished); a "yearling" in Bahía de los Angeles in August 1982; another "yearling" in the canal de Ballenas in March 1986; and two (a "yearling" and a 6- or 7-year-old male) at Isla San Pedro Mártir in May 1992 (Tershy and Breese, unpublished).

Phoca vitulina richardsi Linnaeus, 1758. Harbor seal; *foca común*: Harbor seals are regularly found from the central-west coast (Isla Asunción) of Baja California north to the Aleutian and Pribilof islands (Bigg, 1981). A few individuals, all of which were likely strays, have been reported south to Cabo San Lucas (Gallo and Aurioles, 1984).

We know of only two records of stray harbor seals in the Gulf of California: on 8 April 1981 at Los Frailes (ca. 23°30' N) and on 23 April 1983 at Los Islotes, southernmost Baja California (Gallo and Aurioles, 1984; Aurioles *et al.*, in press).

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