

reviews the official recovery plan written for this species. The American Society of Mammalogists (1984b) urges the designation of critical habitat as a measure in protection of the monk seal.

**Mirounga angustirostris.** Northern elephant seal.

**ORIGINAL DESCRIPTION:** *Macrorhinus angustirostris* Gill, Proceedings of the Chicago Academy of Sciences 1:33–34. 1866.

**TYPE LOCALITY:** Saint Bartholomew's Bay, Baja California, Mexico.

**NATIVE RANGE:** Breeds regularly on offshore islands from Baja California to central California, i.e., Cedros Island, Mexico, to Point Reyes, California. Ranges widely into the more northern waters of the eastern Pacific (Ronald, Selley, and Healey, 1982).

**RANGE IN HAWAII:** Vagrant, or perhaps a rare seasonal visitant, in the Northwestern Hawaiian Islands (three separate examples 1978–1980 at Midway Islands); and possible records for the neighboring Pearl and Hermes Atoll and Kure Atoll in the 1800s. Presence of the elephant seal in Hawai'i was first confirmed in February 1978 by George H. Balazs, who examined a living specimen at Midway (Fig. 80). The animal was a young female tagged a year earlier at San Miguel Island, off Southern California, by Burney J. Le Boeuf of the University of California at Santa Cruz. Balazs later confirmed the occurrence of an immature male and a mature male, but details of these sightings have not been published (Balazs, pers. comm.) These seals swam some 3,500 miles to have reached the Midway Islands outpost from the Mexican or California rookeries. See also Altonn (1978) and United States Department of Commerce (1978) who reported on the initial discovery.

The elephant seals are relatives of the monk seals, classified to a different subfamily of the phocid, or hair, seals (Anderson and Jones, 1967). The male is a particularly large beast, largest of all the pinnipeds, up to 15 feet (4.5 m) in length and weighing as much as 2.7 tons. Females reach a length of about 12 feet (3.6 m), but weigh only up to 0.7 ton. The male has an elongated, erectile proboscis, hence the name "elephant" seal (Ronald, Selley, and Healey, 1982). Social rituals are intense in the breeding colonies, with fierce competition between males for dominance status (Bartholomew, 1952). Foods on the Pacific coast include bony fishes, sharks and rays, and squids (Morejohn and Baltz, 1970).

Populations have recovered from nineteenth-century sealing (described by Scammon, 1968), with overcrowding now forcing establishment of new colonies. Perhaps these social pressures promote a greater than usual dispersal from traditional breeding grounds, resulting in the appearance of the several wandering animals in Hawaiian waters. The elephant seal is a hardy species,



spending its time at sea except when on the rookeries. Grinnell (1933) presents some information on the California population of that era. Both numbers and ranges were expanding. Cooper and Stewart (1983), Condit and Le Boeuf (1984), and Bodkin, Jameson, and Van Blaricom (1985) bring the record further up to date.

**Equus caballus.** Domestic horse (including feral populations and certain extinct ancestral forms).

ORIGINAL DESCRIPTION: *Equus caballus* Linnaeus, Systema Naturae, Ed. X, 1:73. 1758.

TYPE LOCALITY: Scandinavia.

NATIVE RANGE: Ancient ancestral forms evolved in Eurasia from New World stocks that spread to Asia, Europe, and Africa across the Bering Land Bridge. Residual American horses (also *Equus*) disappeared soon after the end of the Pleistocene.

RANGE IN HAWAII: Formerly present as distinctly feral populations on Hawai'i, Maui, and Kaua'i.

History of the horse in domestication is reviewed by Zeuner (1963, pp. 299–337). The late Pleistocene Eurasian equines have been regarded as geographically distinct subspecies of *Equus caballus*, or as separate species. Of these the recently extinct tarpan (*Equus caballus gmelini* Antonius) has probably been the chief contributor to modern breeds, and the living *Equus przewalskii* Poliakov may be a minor ancestor (Benirschke, Malouf, and others, 1965; Koulischer and Frechkop, 1966). Heavy draft breeds, spirited riding horses, and miniature horses have very likely been derived from the same basic stocks by selective breeding. Horses were already in domestication in the region of Turkestan or southern Russia, or in both, some 4,000 to 5,000 years ago.

Horses were first brought to Hawai'i in 1803, aboard the merchant ship *Lelia Bird*, under the command of Captain William Shaler (but often reported as captained by R. J. Cleveland). H. W. S. Cleveland (1886, p. 71) reports fully on this subject, explaining that for this voyage, after they had purchased the ship in Hamburg, Germany, his father and his partner, Shaler, decided on command of the ship "by tossing a copper." Shaler won, and Cleveland's name appeared on the ship's papers as supercargo.

Cleveland goes on to state (pp. 96–98) that the ship called at San Borgia (Baja California), where a missionary priest presented to it a stallion and a mare in foal, taken on board May 20, 1803. Another mare, also in foal, was purchased at Cabo San Lucas. Shaler arrived at Kealakekua Bay, Hawai'i, June 21, and the next day landed one of the mares at nearby "Tooagah" Bay. "This was the first



place in a very short period of time. Helicopter hunts were employed at a later stage of the program (Anon., 1980). A ten-day hunt accounted for about 900 goats killed, with an estimated 800 remaining. Hunting was to be repeated at six-month intervals. Under such a program and schedule goats will never be eliminated from Kaho'olawe, much less be kept below the required magic number of 200 reserved as perpetual breeding stock. Tenorio and Goff (1980) report that limited 1979-1980 rodent sampling at three sites on the island produced only *Mus domesticus*. Further effort is needed to determine if, indeed, the rats no longer survive. Ritte and Sawyer (1978) had occasional visits by feral cats at their camps during a 35-day stay on the island in 1976, and suspected that unseen rats depleted their vital supplies of water by gnawing plastic containers.

#### LESSER ISLANDS AND THE "LEEWARD CHAIN"

Our concern, with small exception, has been with the eight main islands of Hawai'i proper, Ni'ihau, Kaua'i, O'ahu, Moloka'i, Lāna'i, Kaho'olawe, Maui, and Hawai'i. These contain all but a minor fraction of the lands in the entire archipelago (E. H. Bryan, Jr., 1954, p. 4) and as such are of primary importance as habitat for mammals. The small to very small size of the minor islands is probably a greater factor than isolation in the determination of what mammal species, if any, occupy them on a sustained basis, and this is a proper subject for an extended investigation. Amerson (1975) and Dueser and Brown (1980) provide some guidelines.

Hawai'i Island has three adjacent islets, Keaoi (2.5 acres) at the southeast, and Mokupuku and Paoakalani near the north end. The first of these has been examined (P. H. Baldwin, 1946), but the others are possibly inaccessible, at least from the sea. Probably none is occupied by mammals.

Molokini, 3 miles off southwest Maui, is Maui's largest adjacent land mass (19 acres), and it has been mentioned in relation to *Oryctolagus*. Caum (1930) has studied its botany. 'Ālau, at the east end of Maui, and Hulu and Mōke'ehia at the northeast, are the most prominent of many islets and high rocks along its windward shore. These named, and possibly others as well, could conceivably support populations of *Mus*. All these bits of isolated terrain have ecological significance that should not be overlooked. Lāna'i and Kaho'olawe have similar lands that are biologically unknown. Mokuho'oniki, at the east end of Moloka'i, and Mōkapu and 'Ōkala off its northern peninsula, are its prominent islets.

O'ahu's windward islets are relatively well explored, especially with regard to vegetation and sea bird colonies. Mānana has been discussed in relation to *Mus* and *Oryctolagus*. Green (1942) remarks further about this islet and Mokumanu as well. Fisher (1945) was concerned about human interferences with all of O'ahu's windward islets, and his evaluations were instrumental in the





FIGURE 78.—Mānana Island, off the Southeast tip of O'ahu, as seen from the northeast. Area is 63 acres (25 ha) and elevation is 361 feet (110 m). The shallow crater at the right supports a low vegetation and several coconut palms. Populations of the house mouse (*Mus domesticus*) and feral rabbit (*Oryctolagus cuniculus*) survive Mānana's extremely dry summers. The adjacent inshore islet is named Kāohikaipu. (*Honolulu Star-Bulletin* photo by Warren R. Roll.)

declaration of nearly all of them as State Bird Reservations in 1945. The entire list of these, including some that are mere rocks, comprises Mānana (Rabbit Island), by far the largest (63 acres), and Kāohikaipu, both off the southeast end of O'ahu; Mokulua (two islets), Popoi'a, Mōkōlea Rock, and Mokumanu (two islets); Mokuolo'e (Coconut Island), Kekepa, Kapapa, Ahu O Laka, and Mokoli'i (Chinaman's Hat) in Kāne'ohē Bay; Mokuālai, Kukuiho'olua, Pulemoku, Moku'auia, and Kihewamoku off the northeast shore of the island. Popoi'a has a special significance as the type locality of *Rattus exulans hawaiiensis*, and has been referred to in the account of this rat. Colonization of Popoi'a, a raised reef of about 3 acres, suggests that *R. exulans* may be found on other similar islets among the main islands. This might depend in part on past frequency of their use by man as fishing stations or for other purposes. Thorough work of the Smithsonian Pacific Ocean Biological Survey Program has revised our knowl-



edge of mammals found on the islets of windward O'ahu (John H. Fitch, unpublished notes). These data are included in Table 1. New records are for *Mus domesticus*, first reported from Kapapa November 20, 1963, and from Kekepa on January 31, 1968, and for *Rattus rattus* seen on Kāohikaipu March 10, 1968. There is serious doubt that *Rattus exulans* still occupies Popoia. It is perhaps significant that not more than one rodent is known from any of the islets where man has not settled.

Kauai has only one islet, Moku'ae'ae, off its north shore, known principally for its colony of the red-footed booby (*Sula sula*). Lehua is a 291-acre island at the north end of Ni'ihau, and this is cited in the accounts of *Oryctolagus* and *Rattus rattus*. Ni'ihau has only one other prominent islet, Kūakamoku, on its west shore.

Ka'ula (136 acres), an isolated island about 20 miles southwest of Ni'ihau, is not a part of the Hawaiian Islands Bird Reservation; rather it is under the jurisdiction of the United States Navy. Caum (1936) and E. H. Bryan, Jr. (1938a) present biological data on this island. A specimen of *Mus domesticus*, Acc. #2449 in the Bishop Museum collections, dated August 14, 1937, confirms the presence of this species, at least formerly, on Ka'ula. Byrd and Telfer (1980) confirm the presence of *R. exulans* on this island.

Ka'ula, like Kaho'olawe (and Mānana in World War II), is subjected to military target practice; it is also a lighthouse station. The island has been a nesting base for several species of noddies and terns. These birds have been functionally important to the fishermen of Kauai in helping them to locate schools of fish. Anon. (1965g, 1965h) report on attempts to halt transfer of Ka'ula to the Navy from the Coast Guard, which had control of it for about 50 years. Naval units had already been bombing the island "for some years," and with assent of a local group (Anon., 1965i) may continue this activity for some time to come. It is necessary to "put the heavy stuff on Kaula due to Kahoolawe's close proximity to Maui." Evans (1976) and Balazs (1979a) provide important background and bibliographic information related to military uses of Ka'ula.

The remaining northwestern lands of Hawai'i make up the Northwestern Hawaiian Islands. Nihoa, Necker Island, French Frigate Shoals (with its residual La Pérouse Pinnacle), and Gardner Pinnacles are the last of the high islands; those beyond have been reduced and re-formed, usually as atolls, with a maximum elevation of 35 feet (Laysan Island). The high islands have significance for mammals as present or former habitat of *Monachus*. This is true also for the rest of the chain—Laysan, Lisianski Island, Pearl and Hermes Atoll, Midway Islands, Kure Atoll, and isolated or associated reefs. E. H. Bryan, Jr. (1942) has admirably described, mapped, and given historical accounts of all of the northwestern islands. Laysan and Lisianski are referred to in their many





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FIGURE 79.—Laysan Island viewed from the south in June 1962. White coral sand, dark vegetation, and the central lagoon, are readily distinguished. Size is about 1,000 acres (400 ha). The Hawaiian monk seal (*Monachus schauinslandi*) is the only mammal found here. (David B. Marshall photo.)

aspects in my discussion of *Oryctolagus*. Laysan was once occupied also by the guinea pig, pig, and donkey, but see also Schauinsland, 1899. Midway Islands, consisting of Sand and Eastern islands, later received the Laysan donkeys, as well as domestic dogs and *Rattus rattus* and *Mus*, as described in the section on these species, and by Fisher and Baldwin (1946), M. S. Johnson (1945), and Fisher (1949). Wray (1939) provides an historical reminder of the danger of wartime pursuits to this and others of the Northwestern Hawaiian Islands. Green Island at Kure marks an extreme in the range *R. exulans*, which is its only land mammal.

The Northwestern Hawaiian Islands have still a great potential as natural areas in spite of the catastrophes that have at times overtaken their flora and fauna. Lamoureux (1964) emphasizes this point and reviews the possibilities for botanical studies. Constant vigilance and action will be necessary to prevent short-sighted interferences, by well-meaning expeditions to these islands, from causing further loss to all their biological reserves. D. B. Marshall (1964) and



FIGURE 80.—Young female of the northern elephant seal (*Mirounga angustirostris*), the first of this species identified with photographic record in Hawai'i: Midway Islands, February 1978. The animal had been tagged at a California rookery. (George H. Balazs photo.)

American Society of Mammalogists (1965) indicate a need for real concern in this matter. The Pacific Ocean Biological Survey Program generated a series of fine inventory and survey reports, including intensive searches of the literature. Records of mammals, terrestrial and marine, may be found as follows: Nihoa (Clapp, Kridler, and Fleet, 1977); Necker (Clapp and Kridler, 1977); French Frigate Shoals (Amerson, 1971); Gardner Pinnacles (Clapp, 1972); Laysan (Ely and Clapp, 1973); Lisianski (Clapp and Wirtz, 1975); Pearl and Hermes Atoll (Amerson, Clapp, and Wirtz, 1974); and Kure Atoll (Woodward, 1972). United States Department of the Navy (1977) reviews all islands, islets, atolls, and shoals of Hawai'i and gives a table (pp. 29C–29F) of 132 entities, including sizes of each in acres. A beginning of biological surveys for islets supporting sea birds, or having potential for harboring such birds, is indicated by Kepler, Kepler, and Simons (1984).

Gagné and Conant (1983) summarize information on the biota of Nihoa accumulated during periodic visits to the island—a total of more than six months spent there—in the years 1980–1983. The northern elephant seal is a new addition to the faunal list of Midway Islands (Fig. 80).



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