Pacific Science (1993), vol. 47, no. 3: 211–214

Composition of the Hawaiian Monk Seal Population at Kure Atoll, 1990[1]

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ABSTRACT: Population recovery–related management actions have been taken to rebuild the endangered Hawaiian monk seal (*Monachus schauinslandi* Matschie) colony at Kure Atoll in the Northwestern Hawaiian Islands since 1981. In 1990, composition of the Kure population was determined by a combination of methods to identify all seals using the atoll. The resident 1990 population included 75 seals, and an increasing trend in the mean annual beach count of seals over the last decade is apparent. Two major changes have occurred in the population since 1985. A shift in the adult sex ratio (males/females), from 2.7 : 1 to 0.8 : 1, has developed and appears to be due to both adult male losses and increased recruitment of females. Also, the declining trend in births apparent between 1981 and 1986 has been reversed. These findings suggest cause for optimism for the continued growth of this population.

THE ENDANGERED Hawaiian monk seal (*Monachus schauinslandi* Matschie) uses the beaches of the Northwestern Hawaiian Islands (NWHI) to rest, molt, and give birth. Kure Atoll, the westernmost group of islands in the Hawaiian Archipelago, supports a population of monk seals that was significantly depleted during the 1960s and 1970s (Kenyon and Rice 1959, Rice 1960, Wirtz 1968, Johnson et al. 1982). The decline was attributed to harassment of seals by U.S. Coast Guard Kure loran station personnel, dogs, and vehicles driven on the beaches where the seals gave birth and nursed their pups (Kenyon 1972). By the 1970s, reduced pup survival had become apparent as low numbers of immature seals in the beach counts, a declining number of adults, and decreasing numbers of births each year (Johnson et al. 1982, Gerrodette and Gilmartin 1990).

Recently, several management actions have contributed to a recovering trend in the population. In the late 1970s and continuing through the 1980s, the U.S. Coast Guard personnel at Kure Atoll curtailed their beach activities, and some areas of beach were placed off limits (Gerrodette and Gilmartin 1990). Also, in 1981 the National Marine Fisheries Service (NMFS) initiated the Head Start Project to enhance the survival of female pups at Kure Atoll (Gilmartin et al. 1986, Gerrodette and Gilmartin 1990). Although the Head Start Project successfully increased young female suvivorship, the aged composition and low productivity of this population dictated that additional action was necessary to facilitate recovery. Beginning in 1985, the population was bolstered by an annual addition of two to three yearling females from French Frigate Shoals. These seals were collected as underweight pups and fattened in captivity for up to 10 months before introduction to the Kure population. Together, these management actions have reversed the general declining trend in Kure births and beach counts, and the prognosis for recovery now appears good (Gerrodette and Gilmartin 1990, Henderson and Finnegan 1990). The work presented in this paper is an assessment of the composition of the Kure monk seal population in 1990. Also included is a discussion of the changes that have occurred since 1985, when the last comprehensive assessment of the population, including adult composition, was conducted by Reddy and Griffith (1988).

[1] Manuscript accepted 24 September 1992.

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METHODS

Fieldwork to determine the composition of the Hawaiian monk seal population at Kure Atoll was conducted from 7 February to 20 May 1990. Beach counts of seals on all islands in the atoll were conducted three times each week using methods described in Stone (1984). Seals observed on the beaches were classified according to size and sex and individually identified by one or more of the following: (1) uniquely numbered hind flipper tags that had been applied to all weaned pups in the population since 1981 (Gilmartin et al. 1986), (2) distinctive scar patterns that had been photographed and hand drawn onto seal "scar cards" in 1990 and earlier years, and (3) unique bleach marks applied in 1990 to the pelage of seals as described by Stone (1984). The ages of all tagged seals were known from tagging records. Any animal seen for the first time (i.e., had not been previously identified on the basis of tags, scars, or earlier bleach marks) was given a bleach mark and/or its scars were photographed to document its presence at the atoll. Beach counts continued until 11 September, but no new seals were seen after 24 March. Beach counts from April through June in 1990 were compared with counts made in the same months over the last decade because data from this time bracket are available for all years.

In addition to the resident seals using Kure Atoll identified in February–May 1990, eight seals were added by NMFS to the population. On 2 May, two rehabilitated female yearling seals (born and collected at French Frigate Shoals in 1989 and held at Sea Life Park, Oahu, until they gained sufficient weight) were transported to Kure Atoll by U.S. Coast Guard aircraft, as was a third rehabilitated female on 30 May. These three yearlings were maintained in a fenced shoreline enclosure on Green Island, the largest island in the atoll, for 5–7 weeks before release. In addition, five weaned female pups collected at French Frigate Shoals in 1990 were transported by the NOAA ship *Townsend Cromwell* directly to Kure Atoll. These five seals were placed in the fenced shoreline enclosure when they arrived on 26 July. They were fed and maintained in the enclosure along with three female pups born at Kure Atoll in 1990. All eight of these pups were released from the enclosure between 21 August and 15 September 1990.

RESULTS AND DISCUSSION

The mean beach count of seals between 1 April and 30 July 1990 was 26.0, excluding pups of the year, and 29.5, including pups. The five weaned female pups from French Frigate Shoals that arrived at Kure Atoll in late July are not included in these counts. The mean beach count in 1990 was lower than in 1988 and 1989, but was still consistent with the long-term trend in increasing beach counts observed during the decade since NMFS recovery actions were initiated in 1981 (Figure 1). The mean count for 1991 was 33.1 seals (NMFS, unpublished data), which clearly supports the conclusion that the population is increasing. The reduced mean beach count (as well as births) observed at Kure Atoll in 1990 occurred at all the major monk seal breeding sites that year and was believed to be due to a food stress on the population that affected reproductive rates and hauling patterns (Gilmartin et al. 1991).

The age and sex composition of the population in 1990 comprised all identified seals including pups and yearlings transported to Kure Atoll in 1990 (Table 1). This is compared with the only earlier complete enumeration of the Kure Atoll population, which was performed in 1985 (Reddy and Griffith 1988). The ratio of mature to immature seals was unchanged from 1985 to 1990, but an important change occurred in the sex composition. The number of adult females doubled, and the number of adult males declined, causing a shift in the adult sex ratio (male/female) from 2.7:1 in 1985 to 0.8:1 in 1990. The loss of adult males did not appear to be due to migration to other islands; the decline was probably a result of deaths of old males that were born in the early 1960s. This change in sex ratio was a critical goal of the recovery actions at Kure Atoll because some males in the breeding populations at Laysan and Lisianski islands, which have had highly male-

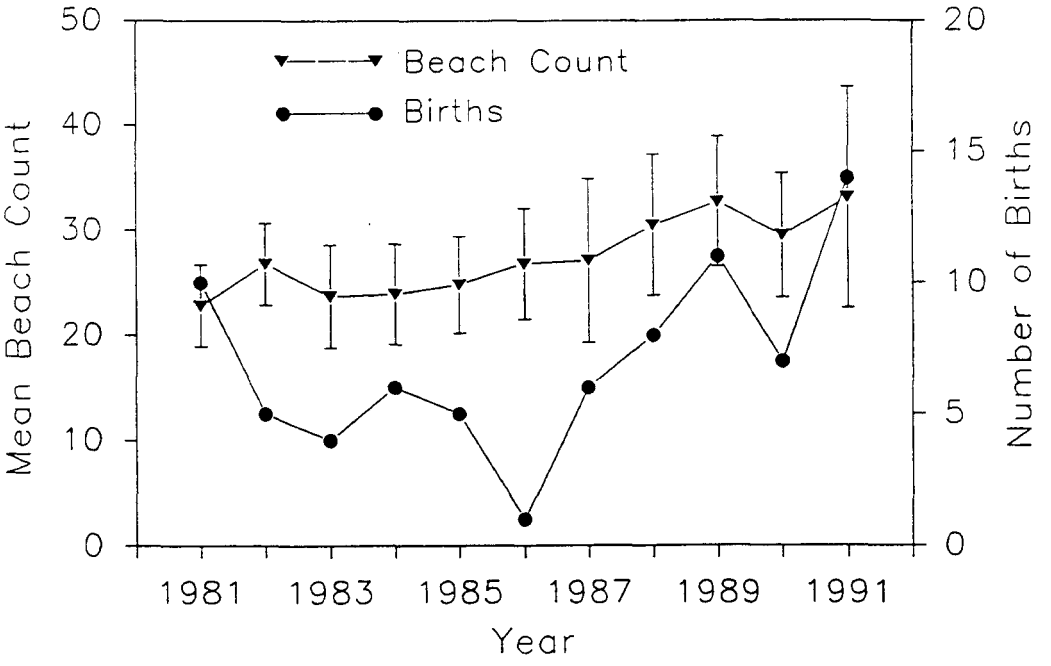

FIGURE 1. Mean beach counts (including pups) and number of births at Kure Atoll, 1981–1991. Bars indicate one standard deviation.

TABLE 1

POPULATION STRUCTURE AT KURE ATOLL FOR 2 YR IN WHICH THE POPULATION WAS ENTIRELY MARKED

SEX	SIZE	NO. OF SEALS 1985	1990
Female	Adult	10	23
	Immature	12	12
	Pup	3	3 + 5
Male	Adult	27	19
	Immature	14	10
	Pup	2	3
Total females		25	43
Total males		43	32
Grand total		68	75
Adult sex ratio (M : F)		2.7 : 1	0.8 : 1
Mature : immature ratio		1.2 : 1	1.3 : 1

biased adult sex ratios, exhibit a behavior of mass breeding attacks on adult females that commonly result in severe injuries and death (Hiruki et al. 1993).

The annual number of births also has recovered from the downward trend ending in 1986 (Figure 1). Some of the 1981 "graduates" of the Head Start Project began giving birth in 1987, and since then, births have clearly increased. As expected, an increasing proportion of the births each year were from Head Start and rehabilitated females. The drop in births in 1990 was observed at all of the major monk seal breeding sites in the NWHI and appeared to be a result of a smaller fraction of females giving birth because of a food stress on the population (Gilmartin et al. 1991). This change was transient at Kure Atoll, as the number of 1991 births illustrates.

Over the last decade, successful management has enhanced the recovery of the Kure Atoll population of Hawaiian monk seals. Survival of Kure-born female pups has been increased since 1981, and yearling females have been added to the population annually since 1985. In addition, the population has been bolstered by a one-time addition of five weaned female pups from French Frigate

Shoals, and the amount of disturbance to the population has been decreased by continuing education of resident U.S. Coast Guard personnel. These actions have not only increased the size of the population, but also have dramatically changed its composition. The aged Kure population of the 1970s and early 1980s with a high adult male to female sex ratio was transformed over the last decade into a population composed of a healthy proportion of young seals with an overall sex ratio favoring females. The outlook for the Kure Atoll population of monk seals is optimistic.

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