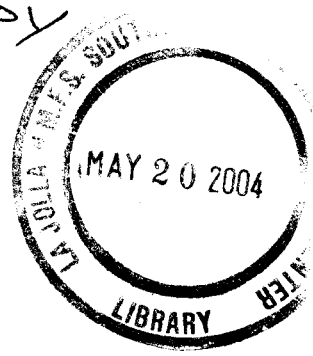


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FEBRUARY 1984

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Fredrick V. Schlexer

NOAA-TM-NMFS-SWFC-41

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
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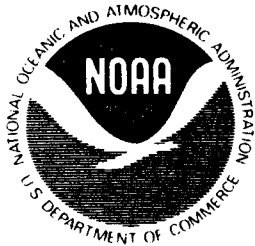
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DIVING PATTERNS OF THE HAWAIIAN MONK SEAL, LISIANSKI ISLAND, 1982

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**U.S. DEPARTMENT OF COMMERCE
Malcolm Baldrige, Secretary
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National Marine Fisheries Service
William G. Gordon, Assistant Administrator for Fisheries**

INTRODUCTION

A pilot depth-of-dive study (DeLong et al. in press), conducted on Lisianski Island, Northwestern Hawaiian Islands during the summer of 1980, indicated regular use of shallow to moderate depth waters (10-40 m) by six adult male monk seals, Monachus schauinslandi, and occasional dives to at least 121 m by some individuals. These depths correspond to the reef shallows and reef slope areas around the island, which are extensive at Lisianski (Clapp and Wirtz 1975). In addition to obtaining six records with multiple depth of dive recorders (MDR's) developed by Kooyman et al. (1983), the 1980 pilot study demonstrated the feasibility and reliability of the attachment and retrieval of the small instrument package.

Information on the hauling patterns of monk seals and the depths to which they dive is needed to extend the basic knowledge of this endangered species, so management decisions can be made relating to habitat protection and population recovery. Such information can be obtained by attaching radio transmitters and MDR's to these seals and monitoring their activities.

This report will outline the progress of a continuing study of the diving behavior of the Hawaiian monk seal to define the foraging patterns of seals by sex and various age classes.

MATERIALS AND METHODS

During this 1982 field study, which lasted from 1 July through 14 September, monk seals on Lisianski Island were instrumented with radio transmitters and MDR's. These instruments were identical to those used during the pilot study (DeLong et al. in press). Eight seals were captured, restrained, and instrumented, as described in Schlexer and Bowlby.¹ These included five adult males, one subadult female, one juvenile male, and one juvenile female. The seals were classified by age following Stone.²

¹Schlexer, F. V., and C. E. Bowlby. Restraint and instrumentation on adult Hawaiian monk seal, Monachus schauinslandi. Manuscr. in prep. Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96812.

²Stone, H. S. Hawaiian monk seal population research, Lisianski Island. Manuscr. in prep. Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96812.

RESULTS AND DISCUSSION

Of the eight MDR's deployed, one was inoperative. All other MDR's exhibited transducer calibration drift, resulting in widening of the targeted depth ranges as well as preventing complete recording coverage for the full duration of attachment. This drift occurred at a rate of about 0.5 to 2.0 psi per day, incapacitating the recorder after 5 to 20 days, when the minimum threshold reached 0 psi (MDR's were initially set to only record dives deeper than 6.8 m or 10 psi).

The MDR's remained on the seals for 12 to 46 days (mean, 24.9 days) (Table 1). All seals made dives to depths greater than 36 m (20 fathoms).

Due to the minimum threshold drift mentioned above, the majority of recorded dives, about 67%, were in the 0-10 m range. The mean depth of the dives was greater than 36 m. The mean number of dives per day was 102.5 (range 22-258). Seal J14, a subadult female, made 84 dives in 21 days to the maximum recorded depth range of 123-180 m (70-100 fathoms).

During this study no adult male seal made dives deeper than 70 m. All of the seals instrumented in 1980 were adult males and only one seal made dives deeper than 85 m. Overall diving behavior patterns recorded in this study agree with those observed in the pilot study, which showed the majority (59%) of dives in the 10-40 m depth range (DeLong et al. in press). The only other published depth record for a monk seal is for the closely related Mediterranean monk seal, M. monachus (Sergeant et al. 1979) wherein one was caught on a tuna hook set at a depth of 75 m.

The dive profiles for the subadult female (J14) and juvenile female (J51) show a pattern different than that of the adult males. These seals made fewer dives in the shallow range (0-40 m) than most of the adult males. However, they did make many dives to depths greater than 40 m, down to the maximum recorded depth range of 150-180 m.

This may indicate a fundamental difference in the foraging patterns of adult versus immature seals but must be confirmed with more data from young seals. Causes of this difference are highly speculative. Rauzon and Kenyon (1982) have observed the inshore diving behavior of monk seals from the surface, in water 2-9 m deep. They saw adult seals threatening juveniles passing through the observation area, which contained several known prey species (spiny lobster, octopus, and conger eels). Such behavior by adults could force subadult seals to forage on deeper offshore areas. It is also possible that adult seals, being more experienced at catching prey, may deplete these species in favorable inshore reef habitat, causing immature seals to forage on the outer reef slope areas where prey would be more plentiful.

Observations on additional immature seals are recommended. New techniques, such as sonic tracking of MDR-equipped seals, will help to further delineate habitat use and requirements.

Table 1.--Dive records for Hawaiian monk seals, Lisianski Island, Northwestern Hawaiian Islands, 1982 (asterisk indicates a recorder malfunction, i.e., no data).

Seal number	Depth range (m)	Total number of dives	Number of days deployed	Mean number of dives per day
<u>Adult males</u>				
121	0-10	3,092	12	257.7
	11-20	*		--
	21-47	2		0.2
A74	0-15	2,140	46	46.5
	16-41	1,539		33.5
	42-70	170		3.7
141	0-4	3,392	36	94.2
	5-32	16		0.4
A64	0-9	337	15	22.5
	10-23	19		1.3
	24-50	3		0.2
<u>Subadult female</u>				
J14	0-8	2,793	21	133.0
	9-36	370		17.6
	37-62	42		2.0
	63-122	263		12.5
	123-152	79		3.8
	>152	5		0.2
<u>Juvenile male</u>				
J34	0-23	*	25	--
	24-51	95		3.8
<u>Juvenile female</u>				
J51	0-5	1,529	19	80.5
	6-29	454		23.9
	30-57	120		6.6
	58-85	106		5.6
	86-115	64		3.4
	116-150	151		7.9
	>150	34		1.8

LITERATURE CITED

- Clapp, R. B., and W. O. Wirtz, II.
1975. The natural history of Lisianski Island, Northwestern Hawaiian Islands. Atoll Res. Bull. 186:1-196.
- DeLong, R. L., G. L. Kooyman, W. G. Gilmartin, and T. R. Loughlin.
In press. Hawaiian monk seal diving behavior. Proceedings on Marine Mammals and Man Symposium, Third International Theriological Congress, Helsinki, 15-20 August 1982. Acta Zool. Fenn. IV.
- Kooyman, G. L., J. O. Billups, and W. D. Farwell.
1983. 5. Two recently developed recorders for monitoring diving activity of marine birds and mammals. In A. G. Macdonald and I. G. Priede (editors), Experimental biology at sea, p. 197-214. Acad. Press, N.Y.
- Rauzon, M. J., and K. W. Kenyon.
1982. Hawaiian monk seal inshore diving behavior. 'Elepaio 42(12):107-108.
- Sergeant, D., K. Ronald, J. Boulva, and F. Berkes.
1979. The recent status of Monachus monachus, the Mediterranean monk seal. In K. Ronald and R. Duguay (editors), Proceedings of the First International Conference on the Mediterranean monk seal, Rhodes, Greece, May 1978, p. 31-54. UNEP Tech. 1. Pergamon Press, N.Y.

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