

# Ontogeny of Diving Behaviors of California California Sea Lions (*Zalophus californianus*)

Anthony J. Orr, Robert L. DeLong  
The National Marine Mammal Laboratory  
Alaska Fisheries Science Center, NOAA Fisheries  
7600 Sand Point Way NE, Seattle, WA 98115  
email: torr5@u.washington.edu

Glenn R. VanBlaricom  
Washington Cooperative Fish & Wildlife Research Unit  
School of Aquatic & Fishery Sciences, University of Washington  
Seattle, WA 98195

Miles L. Logsdon  
College of Ocean & Fishery Sciences  
University of Washington  
Seattle, WA 98195

## ABSTRACT

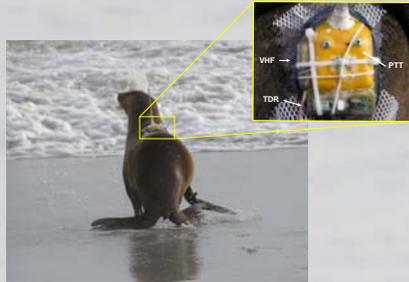
Otariid pinnipeds are marine mammals that lead an amphibious existence. During their ontogeny they undergo a prolonged, purely terrestrial phase after birth relying on their mother's milk and with age they gradually forage independently in the aquatic environment. During this transition, an individual otariid is able to store more oxygen in its lungs, blood, and muscles as it grows, which allows it to dive to greater depths, travel longer distances, and forage on a greater variety of prey. As part of a multidisciplinary study to examine the development of diving and foraging behaviors, we summarized dive (n = 7) and movement (n = 11) data of young-of-the-year California sea lions (*Zalophus californianus*) at San Miguel Island, California (34.03°N, 120.44°W). Satellite transmitters (SirTrack KiwiSat Platform Transmitter Terminal, Havelock North, New Zealand) and time-depth recorders (MK9, Wildlife Computers, Redmond, WA, USA) were deployed on animals aged 8 (n=2), 9 (n = 6), and 10 (n = 3) months old during February through April 2005. Data from recovered instruments indicated that of 29,238 dives, mean depth = 14.9 m (SD = 17.0), mean maximum depth = 103 m (SD = 41.4; maximum = 167 m), mean duration = 0.9 min (SD = 0.8), mean maximum duration = 3.97 min (SD = 0.98, maximum = 4.75 min), and mean distance from haulout = 20.2 km (SD = 13.7, maximum = 49.6 km). These results were similar to those reported in the literature of immature Steller sea lions (*Eumetopias jubatus*), a similar species. Additionally, dive characteristics and movement patterns indicated that immature California sea lions developed to an extent that they were capable of performing dives and movements similar to adults.



Figure 1. Distribution locations of 11 California sea lion pups instrumented on San Miguel Island, California during February - April 2005.

Table 1. Diving behavior of seven young-of-the-year California sea lions instrumented in February, March, and April 2005.

Pup ID	Age (months)	Sex	Mass (kg)	Duration of Deployment (days)	# of dives	Dive Depth (m)		Dive Duration (min)		Overall % time diving
						Mean ± SD	Max	Mean ± SD	Max	
1	8	Male	31.8	40	9701	14.3 ± 14.2	107	0.90 ± 0.80	4.17	16
2	9	Female	35.5	4	596	25.8 ± 21.2	83	1.44 ± 1.05	4.57	15
3	9	Female	20.4	7	1033	6.6 ± 4.36	41	0.42 ± 0.36	1.92	4
4	10	Female	31.8	17	3687	18.6 ± 22.3	143	1.01 ± 0.94	4.75	15
5	9	Female	30.0	17	5525	8.3 ± 9.6	89	0.57 ± 0.60	3.77	14
6	9	Female	31.0	25	6948	18.5 ± 20.6	167	1.01 ± 0.87	4.72	19
7	10	Female	27.0	8	1748	17.7 ± 14.3	92	1.03 ± 0.72	3.85	15



California sea lion instrumented with a platform terminal transmitter (PTT), a VHF transmitter (VHF), and a time-depth recorder (TDR).

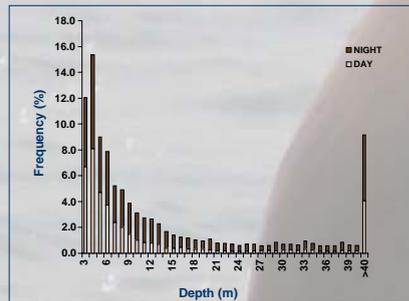


Figure 2. Distribution of dive depth during day (0600 - 1800h) and night (1801 - 0559h) as a proportion of all dives from seven young-of-the-year California sea lions.

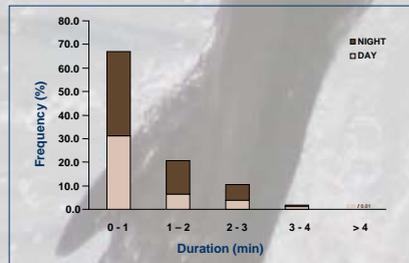


Figure 3. Distribution of dive duration during day (0600 - 1800h) and night (1801 - 0559h) as a proportion of all dives from seven young-of-the-year California sea lions.

## SUMMARY

Though there was individual variability, young-of-the-year California sea lions primarily performed shallow dives (< 10 m) for short durations (< 2 min). A majority of their dives were performed during night. Night-time dives were on average deeper and longer compared to day-time dives. At-sea locations indicated that the animals primarily remained south of Point Conception, California. They were distributed on and off the continental shelf. From visual observations of individuals suckling we know that some of these animals had not weaned during the study period. The diving behaviors of younger and older age classes of California sea lions are being examined to better understand their development of foraging behaviors.

## ACKNOWLEDGEMENTS

We thank Ryan Jenkinson, Andrea Pecharich, and Tracey Goldstein for their help in the field. A special thanks to Ian Williams of the National Park Service for his support. Much appreciation is extended to Sharon Melin, Marty Haulena, Michelle Caudle, Wendy Carlson, and Karna McKinney for their contribution on various aspects of this project and presentation. Background photo was provided by Josh London.

Figure 4. An example of a dive profile of a young-of-the-year California sea lion.

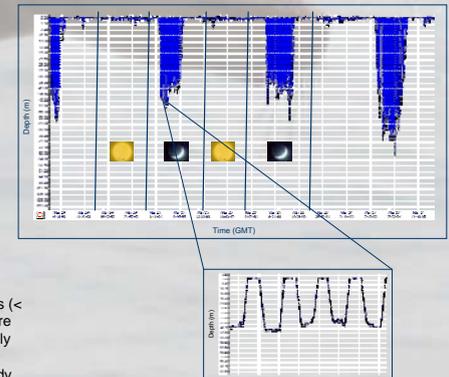


Photo by Philip Colla Photography/Oceanright.com

