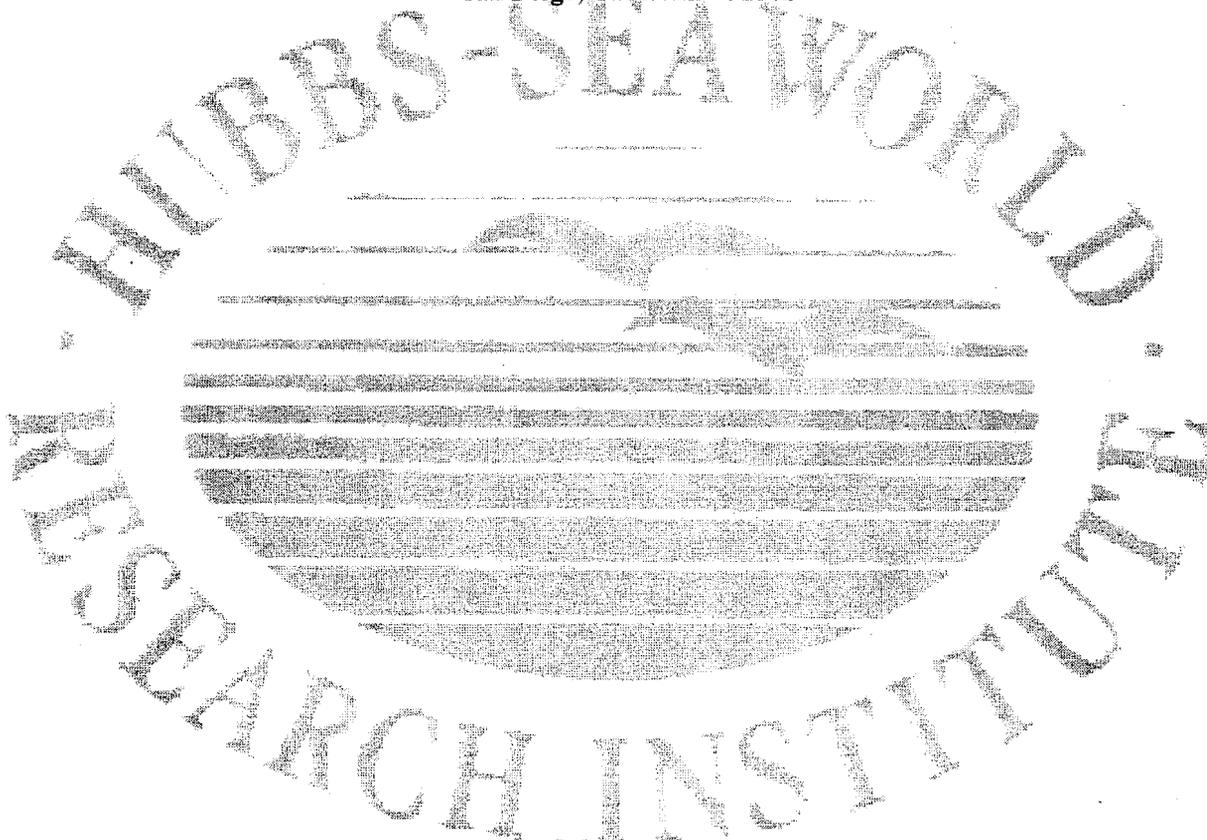


**BEHAVIORAL ECOLOGY AND DEMOGRAPHY
OF SEALS AND SEA LIONS
AT THE SEAL ROCK MARINE MAMMAL RESERVE**

Final report submitted to:
Seal Rock Marine Mammal Reserve Ad Hoc Committee
c/o Robin Stribley
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Submitted by:
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INTRODUCTION

A five-year temporary marine mammal reserve was established at Seal Rock in La Jolla by the City of San Diego in 1994. At the end of five years, the City will decide whether or not to make the Seal Rock Marine Mammal Reserve (SRMMR; Figure 1) permanent, depending in part on the results of a study on the importance of the Reserve to pinnipeds (seals and sea lions). This report summarizes the results of our two-year study (October 1995- September 1997) on the behavioral ecology and demography of pinnipeds in and around the Seal Rock Marine Mammal Reserve; preliminary results were submitted in a progress report last year (Yochem and Stewart 1996).

Specifically, this report addresses the following topics:

- Characterization of pinniped use of SRMMR (e.g., haul-out vs. rookery);
- Demography of pinnipeds at SRMMR (e.g., site fidelity, seasonal abundance);
- Diurnal and seasonal variation in haul-out patterns of pinnipeds at SRMMR;
- Impact of human activities on pinnipeds at SRMMR (e.g., effectiveness of docents).

METHODS

Ground counts

Day-long observations (daylight hours) were made at the SRMMR once or twice each month from November 1995 - September 1997. Although the primary focus of the observations was the Reserve itself, counts of seals present at nearby La Jolla haul-out sites (e.g., Children's Pool Beach) were also recorded throughout the day. The following information was noted on a data form (Figure 2): species, number, and age class of pinnipeds present; presence of tagged or marked seals; animal condition (e.g., degree of molt, presence of wounds or entangling objects like fishing gear), presence or absence of docents; type and magnitude of disturbance; time of low and high tides; general weather condition. Additional observations were made two or three times per week to check for tagged seals and to provide ground-truthing for data collected by the time-lapse cameras and automated telemetry station.

Time-lapse cameras

Ms. Julia Fleet, a resident of Building 939 (Coast Boulevard, La Jolla, California) generously allowed us to install two battery-powered time-lapse cameras on her balcony overlooking

SRMMR on 8 January 1996. One camera was directed at the Reserve and the other was directed at a nearby haul-out site outside the Reserve, the sandy beach at Children's Pool. Each camera shot one frame every 30 minutes, 24 hours per day. We checked cameras and replaced batteries and film approximately once a month. Species identifications and total number of pinnipeds present at each site could be made by examining individual frames of film, but resolution was not adequate for detailed behavioral studies.

Radio-tagged seals

We obtained permission from the National Marine Fisheries Service and Sea World of California to place flipper-tag-mounted VHF radio-tags on up to six rehabilitated harbor seals (*Phoca vitulina*) each year. Seals were tagged within 24 hours of their release in the La Jolla area. Each radio-tag transmitted on a different frequency, allowing us to document behavioral patterns of individual seals. An automated telemetry system was installed next to the time-lapse cameras on a balcony overlooking SRMMR (see above). A reference transmitter was placed at the lifeguard station at Children's Pool. Radio scans were made at SRMMR several times per week with a portable receiver and antenna to ground-truth the automated telemetry station. A uniquely-numbered, orange roto-tag (supplied by the National Marine Fisheries Service) was placed in the interdigital webbing of one rear flipper of each rehabilitated seal. Females were tagged in the right rear flipper, males in the left; the radio-tags were placed in the interdigital webbing of the opposite rear flipper.

Photo-identification study

In order to increase the number of individually-recognizable seals in the population, we began a photo-identification study to record distinctive pelage patterns of harbor seals at the SRMMR. Radio-tagged and other flipper-tagged seals were photographed as controls, and a photo catalog is being constructed of seals observed at SRMMR and nearby haul-outs.

Personnel

Research was directed and conducted by Drs. Yochem and Stewart. Two student research assistants participated in the research: Jason Blackburn (Grossmont College) assisted with ground counts and the photo-identification study; Suzanne Graham (San Diego State University) assisted with ground counts and radio-checks.

RESULTS

Dependent (i.e., nursing; Figure 3) pups were seen in the SRMMR and on the beach at Children's Pool from April - June 1996 and from March - June 1997; the largest number of nursing pups ashore in the vicinity of SRMMR was observed in May (6 pups in 1996; 5 pups in 1997). The peak pup count (nursing and weaned pups) was made in June of 1996 (10 pups) and July of 1997 (8 pups). We did not observe any harbor seal births during 1996 or 1997. An anonymous report of a harbor seal birth on the Children's Pool Beach was received on 22 April

1996 but the report could not be confirmed and the caller did not provide sufficient detail to allow us to evaluate the validity of the sighting.

Monthly peak counts of numbers of pinnipeds ashore at the SRMMR and other nearby haul-out sites are provided in Table 1 and Figure 4. The number of harbor seals hauled out at the SRMMR varied seasonally, with the highest count recorded in April (62 in 1996) or May (65 in 1997). The peak number of harbor seals counted in the La Jolla area occurred in June (166 seals in 1996) or July (172 seals in 1997).

The number of harbor seals ashore also varied with time of day and tide. Peak counts at SRMMR occurred within two hours of low tide; peak counts for the La Jolla area occurred in late afternoon or evening, regardless of tide height. There was no correlation between haul-out patterns and weather, although there were generally fewer seals ashore during the first few calm days following a major storm.

The docent program (coordinated by Ms. Monica Kelly) was only active for a few months in 1996. This was not long enough to allow us to compare harbor seal haul-out patterns before and after its implementation.

Four harbor seals were radio-tagged in 1995 and six were radio-tagged in 1996 (Table 2). All were weaned pups that had been rescued and rehabilitated by Sea World of California. All 10 seals hauled out regularly in the vicinity of the SRMMR. Duration and frequency of haul-out varied seasonally; seals were ashore more often and for a longer time during the breeding and molting seasons than during the non-breeding season. Five additional seals with orange flipper tags were regularly observed at the SRMMR.

At least two northern elephant seal (*Mirounga angustirostris*) weaned pups were observed at the SRMMR during this study, one in 1996 (female) and one in 1997 (male). At least two California sea lions (*Zalophus californianus*; a subadult male and a juvenile female) were observed. Although only one juvenile sea lion or northern elephant seal was observed at any one time at SRMMR, their sexes could not always be determined and they had no distinguishing scars or marks. It is therefore possible that more than one individual juvenile sea lion and more than two elephant seal weaned pups used the site. The subadult male sea lion (seen in 1996 only) could be identified from scars on the muzzle and sagittal crest.

DISCUSSION

Characterization of pinniped use

Harbor seals were the most common pinniped observed at the SRMMR, although at least two northern elephant seals and two California sea lions were seen sporadically. We did not observe any harbor seal births in the SRMMR or at nearby haul-out sites, nor were we able to confirm an anonymous report of a birth in 1996. However, dependent (i.e., nursing) pups were observed in the SRMMR and on the Children's Pool beach during the 1996 and 1997 pupping seasons.

Based on our resights of tagged individuals (including radio-tagged seals), the SRMMR is a regular and frequently-used haul-out site for a group of pinnipeds rather than a temporary resting spot for pinnipeds whose primary haul-out sites are elsewhere. However, our population of known individuals is still small, consisting primarily of harbor seals rescued, rehabilitated and released as weaned pups. The photo-identification study has increased our sample size of known individuals by adding a number of animals identifiable by their pelage patterns. Preliminary analyses of resights of these individuals suggest that they also haul out regularly at the SRMMR.

Demography

The peak number of harbor seals ashore at the SRMMR and vicinity occurred during the late spring/early summer. This is consistent with observations of harbor seal haul-out behavior in other areas in the Southern California Bight (Stewart and Yochem 1994). The peak count of seals in the SRMMR increased by three animals (4.8%) from 1996 to 1997; the peak count in the La Jolla area increased by six animals (3.6%). This increase is consistent with those seen elsewhere in the Southern California Bight (Stewart and Yochem, unpubl. data).

Diurnal and seasonal variation in haul-out behavior

California sea lions and northern elephant seals were seen too infrequently to evaluate diurnal or seasonal changes in their haul-out behavior. Harbor seals hauled out most often and for longer duration in late spring and early summer. Highest counts of seals on the Children's Pool beach occurred in late afternoon and evening; highest counts for SRMMR and other La Jolla haul-out sites occurred within two hours before or after low tide and showed no correlation with time of day.

Impact of human activities

Approaches by humans and harrassment by birds (primarily gulls' pecking at seals' flippers) were the primary source of disturbance to pinnipeds at SRMMR. Other minor sources of disturbance included loud noises (traffic, barking dogs, road construction).

Our subjective evaluation is that seals were disturbed less often and approached less closely by humans when docents were present. The docent program did not last long enough to allow us to quantitatively compare disturbance before and after its implementation. Signs installed by the City, rope barriers placed by lifeguards across Children's Pool beach, and presence of lifeguards and researchers were also effective deterrents to disturbance at SRMMR and other haul-outs in the vicinity.

ACKNOWLEDGMENTS

Jason Blackburn and Suzanne Graham assisted with data collection and analysis. The Sea World of California Animal Care department assisted with tagging of rehabilitated seals. The

lifeguards at the Children's Pool station allowed us to keep a reference radio-transmitter inside their building and provided reports of unusual sightings and events. The SRMMR docents (Monica Kelly, docent coordinator) provided anecdotal observations of pinnipeds in the Reserve. Ms. Julia Fleet allowed us to establish an automated data collection station on her balcony, and graciously accommodated our regular visits to check the equipment, change batteries, and recover data. Robin Stribley expedited our research in many ways and was an excellent liaison for us with the City of San Diego. The Seal Rock Marine Mammal Reserve Ad Hoc Committee and Scientific Review Panel provided useful comments on experimental design. The Hubbs-Sea World Research Institute provided salary support for Drs. Yochem and Stewart and student stipends. The City of San Diego provided \$1500 (a grant from the County Fish and Wildlife Advisory Commission obtained by Friends of the Seals) for a 35 mm camera, film, and film development. All other equipment and supplies (e.g., time-lapse cameras, telemetry station, radio-tags, 35mm camera lenses, film, film development) were provided by Hubbs-Sea World Research Institute.

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- Stewart, B. S. and P.K. Yochem. 1994. Ecology of harbor seals in the Southern California Bight. Pp. 123-134 *In*: Halvorsen and Maender (eds.), The Fourth California Channel Islands Symposium: Update on the Status of Resources. Santa Barbara Museum of Natural History, Santa Barbara, CA.
- Yochem, P.K. and B. S. Stewart. 1996. Behavioral ecology and demography of seals and sea lions at the Seal Rock Marine Mammal Reserve. Progress report submitted to Seal Rock Marine Mammal Reserve Ad Hoc Committee, City of San Diego Park and Recreation Department, 16 September 1996.

Table 1. Monthly peak counts (based on ground counts) of pinnipeds in the vicinity of the Seal Rock Marine Mammal Reserve (LJT = La Jolla area total, SRMMR = Seal Rock Marine Mammal Reserve, CPB = Children's Pool Beach, OLJ = other La Jolla [e.g., rocky ledge connected to jetty]; CSL = California sea lion, NES = northern elephant seal). Months in which nursing pups were observed are marked with an asterisk (*).

Month and year	LJT	SRMMR	CPB	OLJ	Other pinnipeds observed
Nov 1995	44	25	11	8	1 CSL
Dec 1995	76	7	50	19	1 CSL
Jan 1996	113	4	107	2	1 CSL
Feb 1996	90	23	66	1	2 CSL, 1 NES
Mar 1996	134	17	106	11	1 CSL, 1 NES
Apr 1996*	150	62	85	3	1 CSL, 1 NES
May 1996*	158	57	84	17	1 CSL
June 1996*	166	21	142	3	1 CSL
July 1996	128	43	79	6	1 CSL
Aug 1996	93	32	52	9	1 CSL
Sept 1996	101	36	61	4	1 CSL
Oct 1996	81	50	20	11	1 CSL
Nov 1996	52	40	11	1	1 CSL, 1 NES
Dec 1996	65	36	23	6	1 CSL, 1 NES
Jan 1997	92	32	50	10	1 CSL, 1 NES
Feb 1997	77	20	55	2	1 CSL, 1 NES
Mar 1997*	115	23	89	3	1 CSL, 1 NES
Apr 1997*	94	19	70	5	1 CSL
May 1997*	132	65	60	7	1 CSL
June 1997*	167	33	120	14	1 CSL
July 1997	172	40	110	22	1 CSL
Aug 1997	80	27	44	9	1 CSL
Sept 1997	123	58	65	0	1 CSL, 1 NES

Table 2. Harbor seal weaned pups radio-tagged in 1995 and 1996.

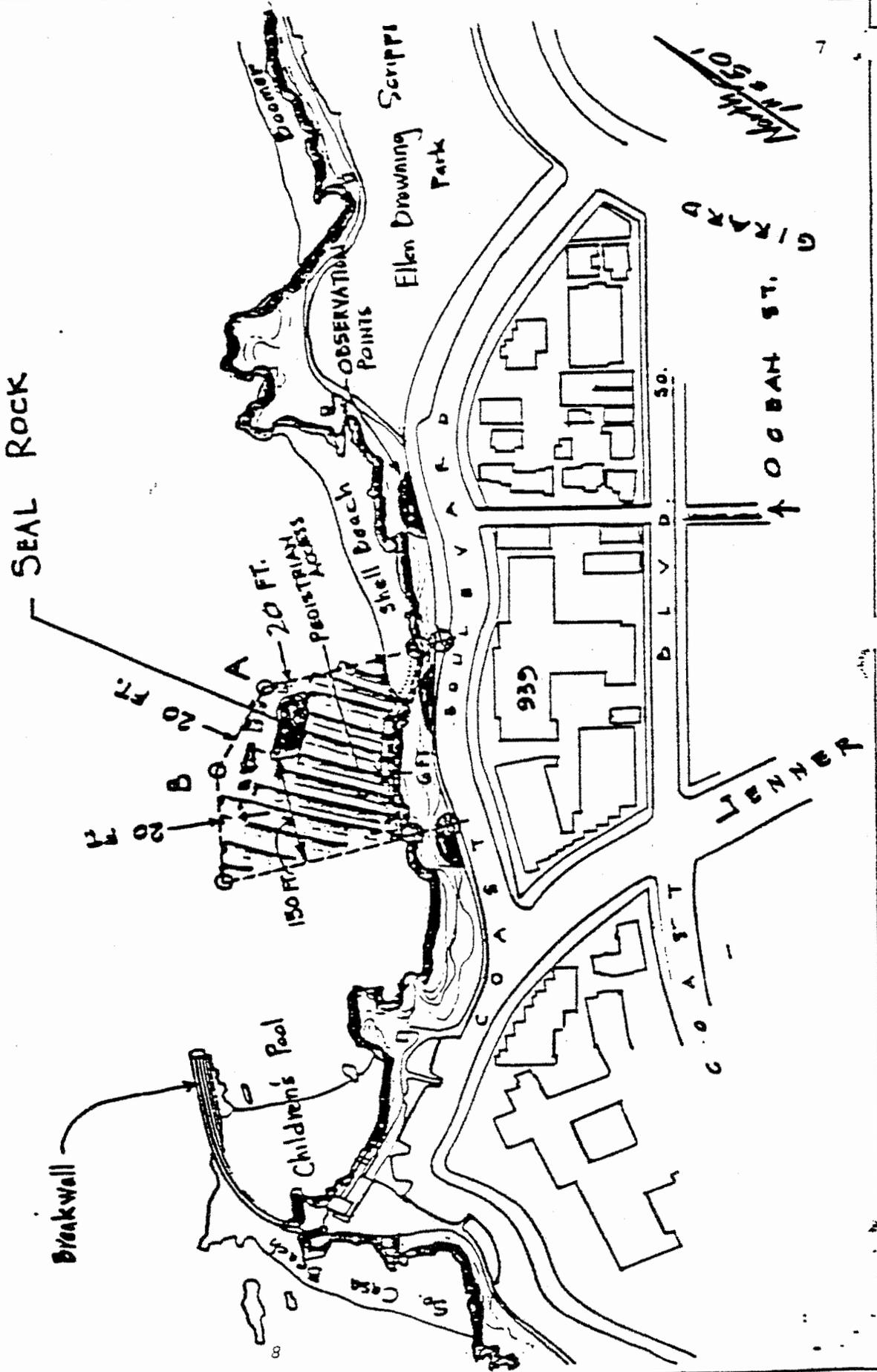
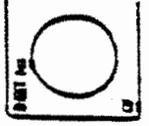
Tagging Date	NMFS Tag No. (Orange roto-tag)	Radio-tag Frequency (MHZ)	Sex	Length (cm)	Girth (cm)	Weight (kg)
14 Sept 1995	11011 left	164.065	M	101	84	31
"	11012 right	164.154	F	99	81	30
"	11013 right	164.185	F	91	76	23
"	11014 left	164.284	M	86	66	22
19 July 1996	11040 left	164.084	M	99	69	24
"	11041 right	164.134	F	101	61	20
2 Sept 1996	11045 left	164.144	M	94	63	22
"	11046 left	164.164	M	97	65	20
"	11047 left	164.174	M	97	68	22
"	11048 right	164.194	F	87	66	21

SEAL ROCK MARINE MAMMAL RESERVE

Design Associates
 ARCHITECTS
 1500 CALIFORNIA ST. SUITE 100
 SAN FRANCISCO, CALIF. 94109

SEAL ROCK MARINE MAMMAL RESERVE
 1500 CALIFORNIA ST. SUITE 100
 SAN FRANCISCO, CALIF. 94109

Project No. 9217
 (FIELD NO.)
 Date 9-10-72
 Drawn by
 Checked by



**Hubbs-Sea World Research Institute
Seal Rock Pinniped Survey Form**

Observer: _____ Date/Day of Week _____
 Location (rocks or beach): _____ Page _____ of _____
 Record Weather and Tides on Reverse

TIME			Harbor Seals	Harbor Seals	Harbor Seals	Harbor Seals	Entangled or Scarred Animals Total	Comments (e.g., Tag Numbers, Presence of Other Pinniped Species or Docents)
			Total	Adults	Imm.	Pups		
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Specify age classes only if you are certain, otherwise just report total number. Don't count seals in the water.

marks:

Figure 2. Data form used during twice-monthly observations at Seal Rock Marine Mammal Reserve.

Figure 3. Harbor seal female and nursing pup photographed on Children's Pool Beach, 13 May 1997.



Figure 4. Seasonal abundance of harbor seals at the Seal Rock Marine Mammal Reserve and nearby haul-out sites (based on monthly peak ground counts).

OLJ = Other La Jolla haulouts

CPB = Childrens Pool Beach

SRMMR = Seal Rock Marine Mammal Reserve

LJT = La Jolla area total

