OBSERVATIONS OF THE SEA OTTER

Enhydra lutris

POPULATION

Between Point Buchon and Rattlesnake Creek

San Luis Obispo, California

January through December 1995

By

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ABSTRACT

Sea Otter numbers, rafting sites and incidental feeding activities were recorded twice monthly in 1995. One subtidal and one intertidal survey of sea urchin and abalone densities were completed. Sea Otter behavior during unusually high activity levels within the Intake Cove were monitored both night and day.

In recent years (1992 - 1994) the study area sea otter population has remained relatively stable with an annual mean of 60. The 1995 sea otter population average was 70 increasing within the study area (Point Buchon to Rattlesnake Creek in San Luis Obispo County, California) by an average of 15%. This was also reflected in a simular state-wide increase. Study area counts ranged from a low count of 36 to a high of 113. Females and pups continue to dominate the study area representing about 95% of the resident population. Seasonal occupancy of the study area was at its highest this year in spring which corresponds to seasonal pupping and breeding events. Average pup proportions were 16%, indicative of a "healthy population". Lowest occupancy was observed in January and was a result of a series of large storms. The most commonly occupied resting sites within the study area were Lion Rock Cove (92% occupancy), Windmill & Breakwater (88%) and Barn Road with 83%.

Feeding observations indicate small molluscs continue to increase in dominance while abalone and crabs decrease. Small molluscs and other items too small to identify, now account for the vast majority (78%) of food being consumed, followed by crabs at 14% and abalone at 8%. Urchins were not observed as part of the sea otter diet this year. Subtidal surveys show a striking difference in densities of Red Sea Urchins in Diablo Cove subtidal areas when compared to last year. Diablo Cove densities now more closely resemble those of Pecho Rock. But differences in both species and size are still evident. These differences may be due to physical differences in substrate. Sea Urchin densities at Pecho Rock have increased to 7/100 m2. Diablo Cove densities of this same species at similar depths have decreased. Intertidal survey results indicate virtually the same density of Purple Urchins (27/m) as last year but a slight increase in mean size(2.8cm). Black Abalone have decreased in both density (0.23/m) and mean size (6.6cm).

Haul out behavior among Sea Otters during scheduled counts has decreased by nearly half in location, and number from last year. Nine sightings within 4 different sites were recorded with a mean of 3 animals per sighting. The frequency of sighting was the same as last year. No new haul out areas were observed. Haul out behavior was observed around low tide, at specific sites that afford physical protection from wind and swell. Sea Otters increased their frequency of use of the Intake Cove as a resting and foraging site, from last year from 78% to 88%. Haul-out behavior at this site was high in frequency and number through the course of monitoring during special activities in the cove. Daytime and nighttime Sea Otter behavior was recorded while PG&E off-loaded a 200 ft. barge. Although the animals were wary of the activities and the number of individuals using the cove temporarily decreased by 50%, those that stayed, did not appear disturbed and continued to rest, groom and forage. It is of interest that those who stayed were mostly females with pups. All individuals departed from the cove when the barge departed. Total abandonment of the cove was limited to only minutes before reentry occurred. Within 2 weeks use was back to normal Diablo Cove continues to maintain a small raft of sea otter and the observed percent occupancy has increased substantially from 56% to 83%.

INTRODUCTION

Sea otter (Enhydra lutris) activities along the Buchon Headland in San Luis Obispo County, California have been monitored since 1973 when a large group of males (~50 individuals) first began their re-establishment of resting sites along this portion of their historic range.

The 1995 sea otter report represents the twenty-third annual summary of sea otter behavior and population dynamics within the vicinity of Pacific Gas and Electric Company's (**PG&E**) Diablo Canyon Power Plant (DCPP). This year's survey represents the 10th year of sea otter observations conducted during full power operations of both generating units. These observations in conjunction with other environmental studies funded by PG&E continue to contribute to the understanding of sea otter population dynamics and the interrelationships of this species with both littoral and sublittoral community structure within the DCPP vicinity.

Objectives:

The 1995 observations of sea otter activities within the vicinity of the power plant include:

1. Recording sea otter counts
2. Recording sea otter distributions
3. Observing sea otter feeding habits
4. Surveying sea urchin and abalone densities
5. Recording tagged sea otter locations and behavior
6. Observing sea otter night and disturbance behavior

Methods:

The study area is located along 15 km of coastline off the Buchon headland in San Luis Obispo County, California (Figure 1). To provide a standardized reference, the area from Point Buchon to Rattlesnake Creek has been divided into 5 major zones based on initially established sea otter resting (raft) sites (Figure 2). In addition, these zones are further subdivided into 30 subzones as an aid in mapping and tracking sea otter activities (Figure 3).

Survey procedures for 1995 remain similar to those of past years. Observations of sea otter numbers, locations, distributions, movements and feeding behavior were conducted twice monthly. Counts and activity scans were accomplished by using 7X50 binoculars and a high resolution (80X) Questar field telescope from various points along the coastline. These points provide a relatively unobstructed and overlapping view of each zone and/or subzone. Concurrent behavior and tagged sea otter information were recorded during these counts.

Estimates of males, females and pups were also made. Pups were identified by their small size, pelage and dependent behavior. Very young pups with natal pelage (long buff colored guard hairs) were recorded as "Woolly". Adult males were positively identified by the presence of a penile ridge along the abdomen. Females were positively identified by the presence of two small nipples on their lower abdomen. When an animal's sex could not be positively identified, behavior and size was used as a "best estimate". Generally, adults were assumed to be females if they were with pups or in the immediate company of positively identified females and did not fit typical male size or behavioral

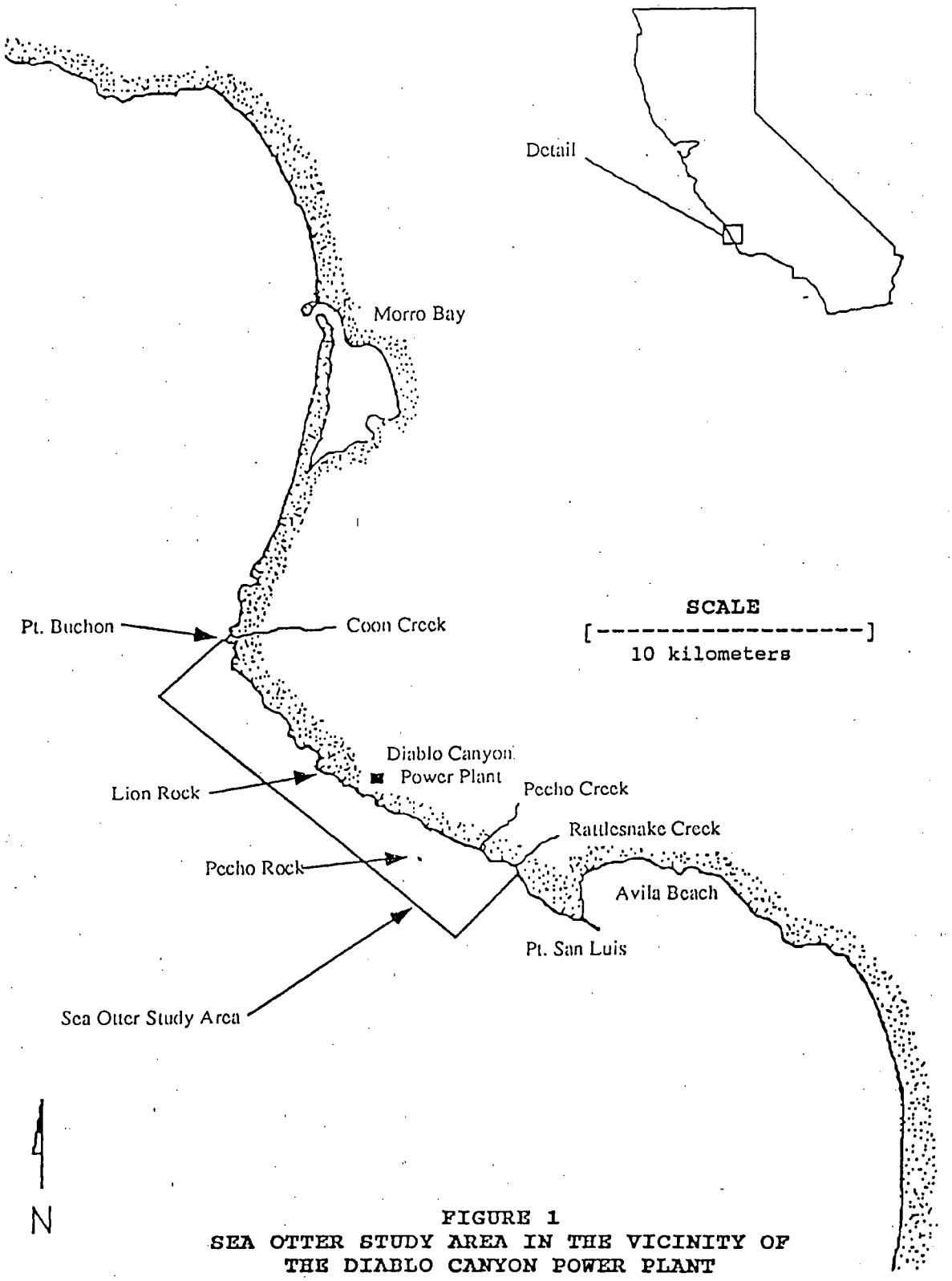


FIGURE 1
SEA OTTER STUDY AREA IN THE VICINITY OF THE DIABLO CANYON POWER PLANT

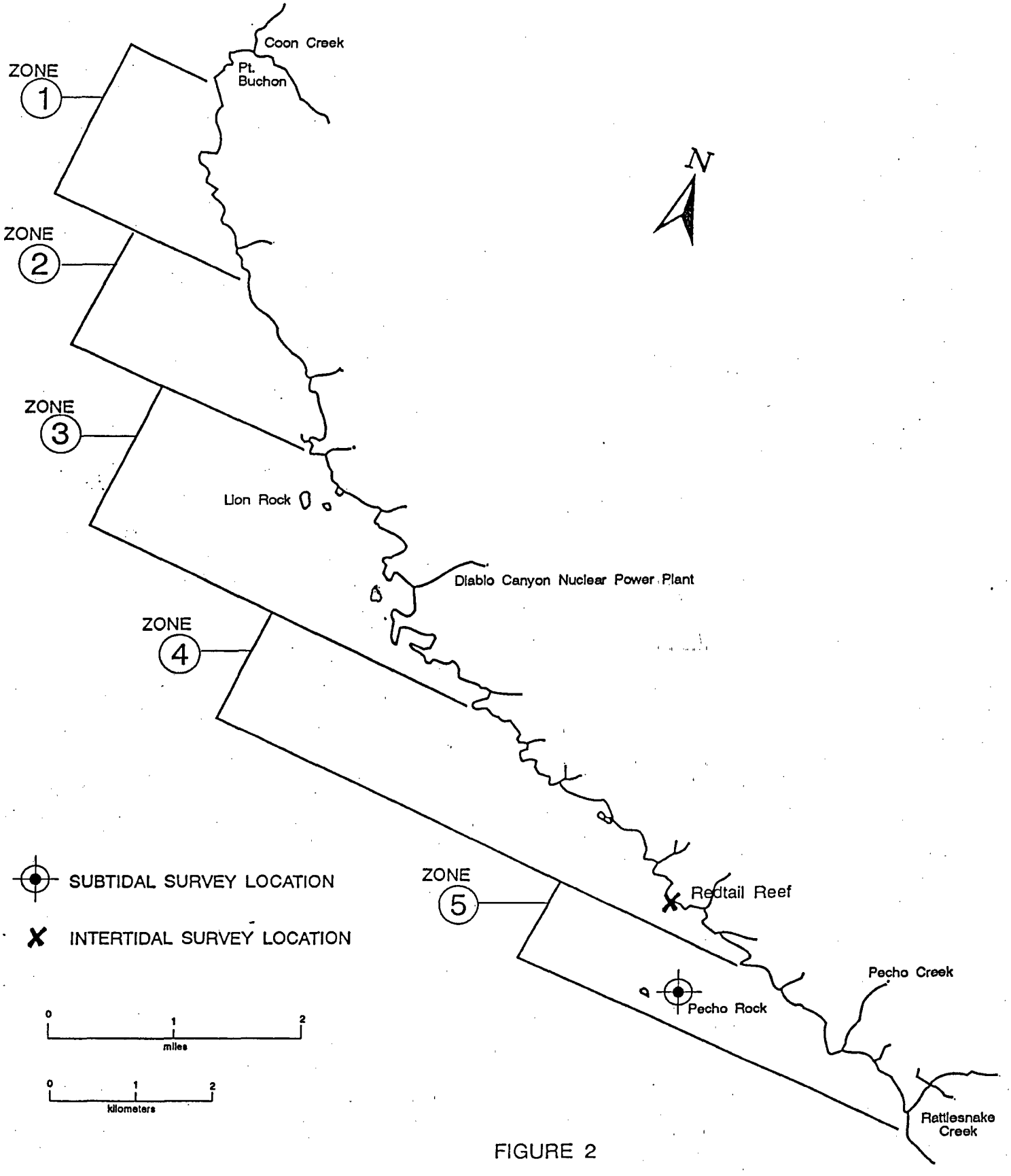


FIGURE 2

SEA OTTER STUDY AREA ZONES AND SUBTIDAL AND INTERTIDAL SURVEY LOCATIONS IN THE VICINITY OF THE DIABLO CANYON POWER PLANT

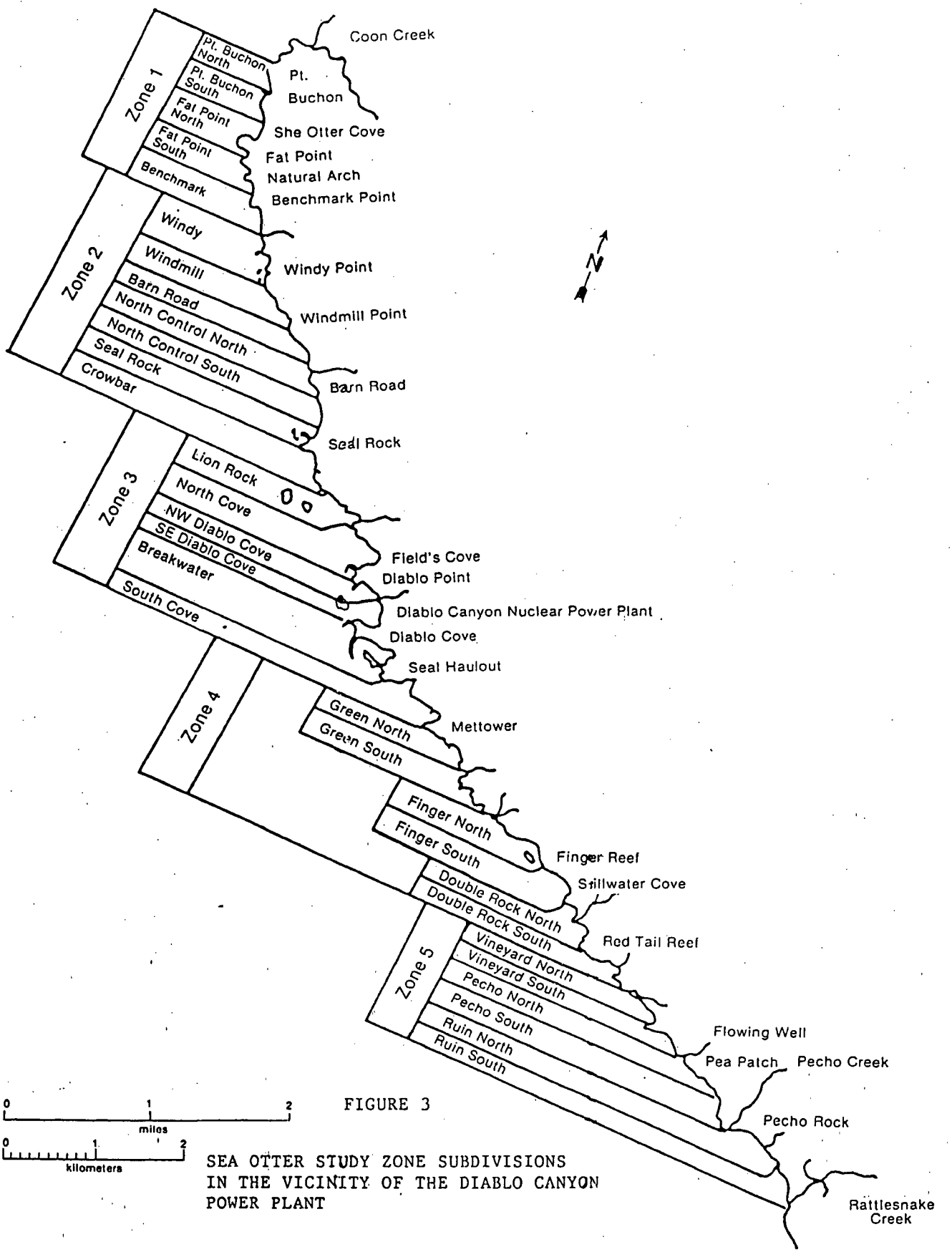


FIGURE 3

SEA OTTER STUDY ZONE SUBDIVISIONS IN THE VICINITY OF THE DIABLO CANYON POWER PLANT

characteristics.

One subtidal survey (using SCUBA) and one intertidal survey were conducted in the Pecho Rock area. This is a continuation of the sea urchin and abalone density documentation initiated in 1974 to assess the effects of sea otter foraging on two commercially important food items. In 1974, this site was chosen because there were no otters observed either resting or foraging in the area at that time. Thus, this site provides sea urchin and abalone density information both pre and post sea otter habitation. Two additional subtidal stations were surveyed in Diablo Cove using the same sampling techniques.

Sampling methods remain the same as in previous years. These include the use of a "stratified random" sampling technique. The subtidal survey at Pecho Rock included Ten circular,(30 square meter) transects placed on hard substrate within a 0.5 square kilometer area. The intertidal survey included 5 circular (30 square meter) transects located near Red Tail Reef.

Subtidal sites range from 9 to 13 meters water depth. The starting location of each site within the general vicinity of Pecho Rock was dependent on first contact with appropriate substrate and specified water depth after reaching the bottom. Appropriate substrate is defined as simply "rocky bottom". The bottom type was also described as either high or low relief. Low relief is defined as less than 1 meter in height off bottom and high relief is substrate projecting 1 meter or more off the surrounding sea floor. This substrate is suitable for sea urchin and abalone recruitment and growth. The factors used in water depth choice were related to the fact that sea otters feed at those depths,

abalone and sea urchins historically occurred in large numbers at those depths and survey diving was logistically simple and safe.

Two subtidal stations were surveyed using the same methods in Diablo Cove. These were located along the North side, in 7-9 meter depths in an area know as "North Channel". These stations were surveyed because, there has been widely different Sea Urchin and Abalone abundance estimates between Pecho Rock and Diablo Cove sites. Since data prior to 1994 were generated using different sampling techniques, depths and observers, it is important to determine if these results were different due to an artifact of sampling or real.

The yearly intertidal survey is directed toward assessing the availability of sea urchin recruitment stock in an effort to understand observed changes in the subtidal populations. Rocky intertidal habitat near Benchmark Olsen, South of Redtail Reef (figure 2), was selected for survey because of it's proximity to the subtidal survey area off Pecho Rock. Appropriate habitat was selected by tidal height (0 to+1m MLLW) and the presence of rock substrate. Population size class was estimated by measuring either all or the first 100 sea urchins and abalone encountered (whichever came first) within these stations. Sea urchin test diameter and abalone maximum shell length were measured to the nearest millimeter. Both subtidal and intertidal Sea Urchins (Strongylocentrotus franciscanus & S. Purpuratus) and Abalone (Haliotis rufescens & H. cracherodii) counts remain restricted to macroscopic animals for practical purposes. This includes abalone of greater than 1cm in shell length and urchins of greater than 1cm test diameter.

During May, 1995 PG&E made a barge delivery to the plant site via Intake Cove. Special anchoring arrangements and dock removal took place in order to secure and off-load the 200 Ft. barge. Since Intake Cove is frequently used by relatively large numbers of Sea Otters in the Spring and the associated activities with barge delivery was considered a significant increase in disturbance, Sea Otter numbers and behavior were monitored. Four night observation periods were conducted which collected hourly activity scans . One of these four hourly night scans was conducted prior to mobilization for barge delivery, two during barge operations and one after demobilization. In addition, 14 mid-morning observations were conducted during barge delivery off-loading and departure. These daily activity scans were conducted once at midmorning to best replicate the time and technique used during standard biweekly counts. Continuous observations were also made during periods of most intensive human activity, including barge arrival, and departure (Appendix I).

RESULTS

Population size:

In 1995, the mean number or core population of sea otters inhabiting the study area was 70 (±20). The highest densities of sea otters were found in the study area during May (Figure 4, Table 1). Although individual count totals varied, the mean numbers from March through August (spring/summer) equalled 81(±18). The August through April (fall/winter) average was 60(± 15). Generally, the fall/winter counts were lower and slightly less variable than the spring/summer counts. The highest single count of sea otter in 1995 occurred in May when 113 animals were observed in the study area. The lowest number was 36. This numerical low occurred in January after a series of large storms.

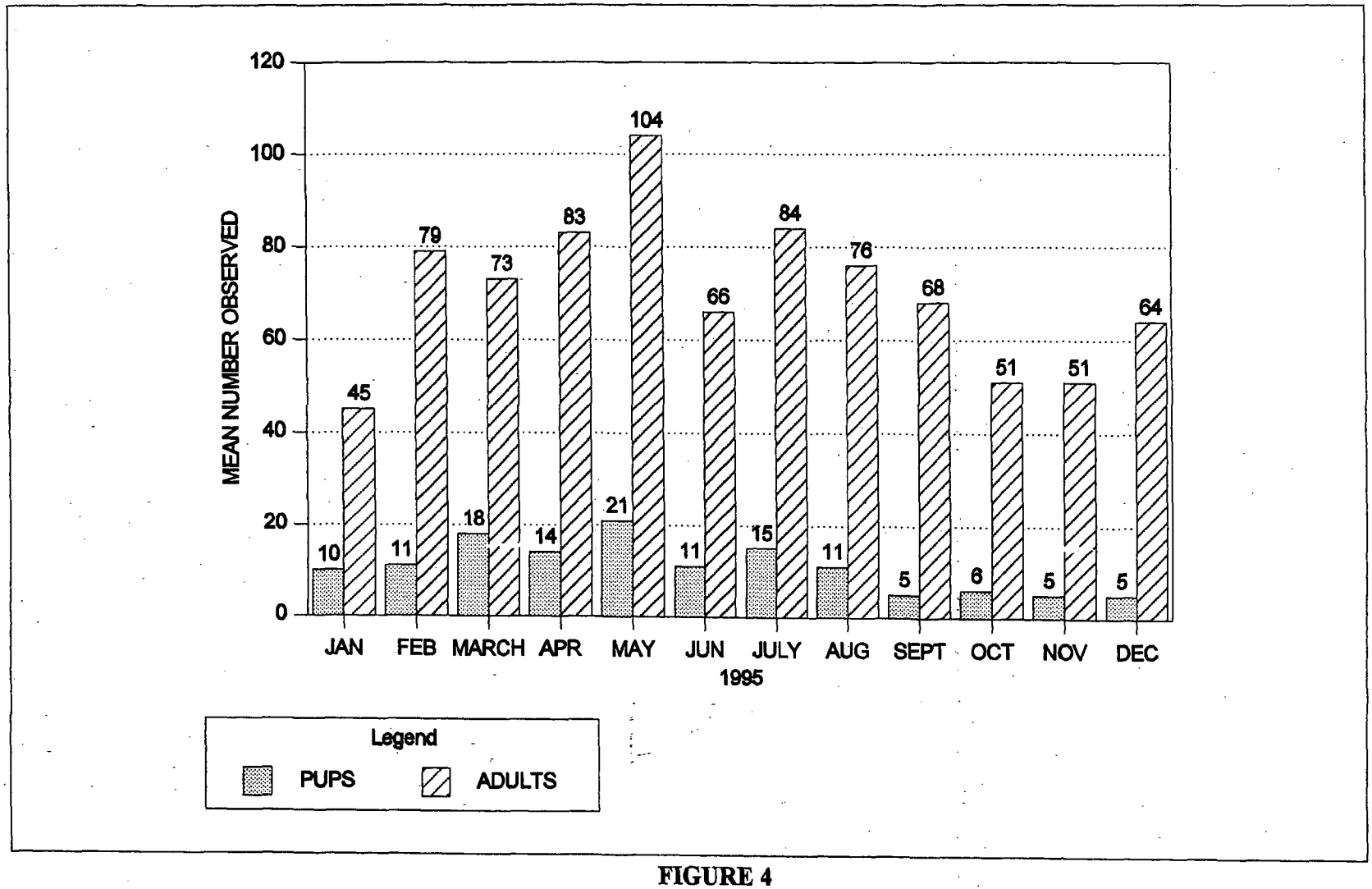


FIGURE 4
AVERAGE MONTHLY SEA OTTER COUNTS IN VICINITY OF DIABLO CANYON POWER PLANT
1995

TABLE 1
AVERAGE MONTHLY SEA OTTER COUNTS AND COMPOSITON IN VICINITY OF DIABLO CANYON POWER PLANT
1995

MONTH	COUNT	MEAN	σn-1	FEMALES		PUPS		MALES	
				#	%OF POP	#	% OF POP	#	%OF POP
JANUARY	36,53	45	±12	33	73	10	22	2	5
FEBURARY	90,67	79	±16	67	85	11	14	1	1
MARCH	67,78	73	±6	51	62	18	25	4	6
APRIL	78,87	83	±6	69	83	14	17	3	4
MAY	113,95	104	±13	80	77	21	20	2	2
JUNE	80,52	66	±20	54	82	11	17	1	2
JULY	110,58	84	±37	67	80	15	19	2	2
AUGUST	74,81	76	±5	63	83	11	15	2	3
SEPTEMBER	74,61	68	±9	61	90	5	7	2	3
OCTOBER	50,56	51	±4	44	86	6	12	1	2
NOVEMBER	60,42	51	±12	44	86	5	10	2	4
DECEMBER	57,71	64	±10	57	89	5	9	2	3

Note: Estimates of females, pups and males are only probable. These sexual determinations are based on physical and behavioral observations.

Population Distribution and Composition:

Male and female sea otters were observed throughout the study area (Table 2). The area between Point Buchon and Rattlesnake Creek however, remains dominated by females and pups which accounts for about 95% of the population. The "Southern Front", a large (50 +) consolidated raft of predominately male sea otters that once resided in the study area from 1973-1979 was not observed this year and has not been detected within these boundaries for nearly fifteen years. Currently, territorial adult males account for only about 5% of the total population. It is apparent from behavioral observations that these adult males have established territories in the study area. Although the precise boundaries are undocumented, they tend to correspond with female raft sites. Table 2 indicates the locations where positively identified males were observed resting and thus designated as territorial male sites. All Zones have at least one male site. However, there were no obvious large male groups, but rather a scattering of individuals throughout the study area. These males were observed, loosely associated with (within the vicinity of) groups of females. Female sea otter accounted for about 81% ($\pm$8) of the overall population with dependent pups representing on average, about 16% ($\pm$5). The largest proportion of males (6%) to females and pups occurred in March.

Unlike previous years, the Sea Otter population was fairly evenly scattered among all Zones except Zone 5. Typical to previous years, animals within Zone 5 were both scattered and sparsely populated. Raft (resting group) size, ranged from one to 39 animals. Zones 2 & 3 were occupied by sea otters continuously throughout the year. Zones 1 and 4 were both occupied 96% and Zone 5 was occupied during 92% of the biweekly counts.

TABLE 2
SEA OTTER COUNTS IN VICINITY OF DIABLO CANYON POWER PLANT - 1995

DATE	1/9	1/31	2/9	2/27	3/18	3/29	4/14	4/28
ZONE 1 1 POINT BUCHON N.								
2 POINT BUCHON S.	6					4&4	1&1	15&4
3 FAT POINT NORTH	2	9&1	16		20&3	2	14&3	
4 FAT POINT SOUTH		4	3		1&1	3	1&1, 1	6&1
5 BENCHMARK POINT		2&1	1&1		2&2		1&1	
ZONE 2 6 WINDY POINT	1	2&1, 1				2&1		2&1
7 WINDMILL	2		2&1	10&3	2&1, 1	9&1		10&1
8 BARN ROAD	3&1	6&3	3	14&3	3&1	14&2	7	
9 NORTH CONTROL N.	2&1	1	2&1		4		3	9&1
10 NORHTCONTROL S.	1&1	4&1	1	1, 1		2&2	1	
11 SEAL ROCK			5&1		1	3&1		
12 CROWBAR								
ZONE 3 13 LION ROCK	1		3		2&1	3&1	7&1	3
14 NORTH COVE			1	1	1&1			
15 N.W. DIABLO					1&1		4	3&1
16. S.W. DIABLO						1&1		
17 BREAKWATER	1	2&2	1		1&1		13&3	5&2
18 SOUTH COVE	1				1	2&1	1	3
ZONE 4 19 GREEN PEAK N.					1	1	2	1
20 GREEN PEAK S.		1&1		3		1&1		3&1
21 FINGER NORTH	1, 1		2		1&1, 1	1	3	1
22 FINGER SOUTH			1	2&2		1&1		1
23 DOUBLE ROCK N.	8			1&1				3
24 DOUBLE ROCK S.		9	36&3	4	3		1	
ZONE 5 25 VINEYARD NORTH				5&1	2&1	7&2	2	4&1, 1
26 VINEYARD SOUTH				1				
27 PECHO NORTH		1		7	1	1	1&1	
28 PECHO SOUTH	2		1&1		2		4	3&1
29 RUIN NORTH	1		1	2&1	1			
30 RUIN SOUTH		1	3	4	1	3		
31 RATTLESNAKE								
TOTALS ADULT / PUP	33&3	43&10	82&8	56&11	53&14	60&18	67&11	73&14

&= PUPS , _ = MALES

TABLE 2 (CONTINUED)
SEA OTTER COUNTS IN VICINITY OF DIABLO CANYON POWER PLANT - 1995

DATE	5/9	5/18	6/4	6/14	7/7	8/2	8/8	8/22
ZONE 1 1 POINT BUCHON N.		2						
2 POINT BUCHON S.	1&1	2&2	1		7	1, 1		1
3 FAT POINT NORTH	8&1	16&2, 1	8&1	3&1	2		1	4
4 FAT POINT SOUTH	2&2	2			6&3	5&1		6&1
5 BENCHMARK POINT			2	2&1		5	8&3	3
ZONE 2 6 WINDY POINT		1				1&1	1	11
7 WINDMILL	20&4	1	2&1	9&3	14	9	15&2	4
8 BARN ROAD		3&2		3			1	7
9 NORTH CONTROL N.	1	2&2		4		2	1	5
10 NORHTCONTROL S.	1&1	5&1						
11 SEAL ROCK			9		2&1, 1			1
12 CROWBAR		1, 1						
ZONE 3 13 LION ROCK	16&5	7&2	27&5		23&5	5	8	12
14 NORTH COVE								1&1
15 N.W. DIABLO	4	9&2	3&1		5	3	5&2	5
16. S.W. DIABLO				2&1				
17 BREAKWATER	9&2	1	8&1	8&4	4	4	4	2
18 SOUTH COVE	1	1				2		
ZONE 4 19 GREEN PEAK N.	2	5						1
20 GREEN PEAK S.	2							
21 FINGER NORTH	1	2	4&2	1	1	2	1	1
22 FINGER SOUTH		4& 3	5	2&1	17&6	6	9	5
23 DOUBLE ROCK N.	2&1	1				8		
24 DOUBLE ROCK S.	4			1	10		8&4	8&2
ZONE 5 25 VINEYARD NORTH	3, 1	2			3	2		
26 VINEYARD SOUTH		1		1			1	
27 PECHO NORTH	7&4	1		1	1			
28 PECHO SOUTH		7&1		2				
29 RUIN NORTH	3	2		1	2			
30 RUIN SOUTH	3	1		1	2			
31 RATTLESNAKE	1							
TOTALS ADULT / PUP	92&21	78&17	69&11	41&11	95&15	56&2	63&11	77&4

&= PUPS , _ = MALES

TABLE 2 (CONTINUED)
SEA OTTER COUNTS IN VICINITY OF DIABLO CANYON POWER PLANT - 1995

DATE	9/4	9/13	10/18	10/30	11/16	11/27	12/5	12/17
ZONE 1 1 POINT BUCHON N.				1	1			
2 POINT BUCHON S.	3		1		1			
3 FAT POINT NORTH	6	10&3		1	12&1		7	4
4 FAT POINT SOUTH	17&3		2				4	7&1
5 BENCHMARK POINT	3	5	7	1		1		
ZONE 2 6 WINDY POINT	9	4	11		5	16	1	1
7 WINDMILL	5	6		15&3	12	2	14&2	12&1
8 BARN ROAD	1	2&1	6&1	4&2	1	2&2	2	5
9 NORTH CONTROL N.		1			2		1	
10 NORHTCONTROL S.		3			2&1, 1	1	3	1
11 SEAL ROCK			1, 1				1, 1	7&1
12 CROWBAR				1				
ZONE 3 13 LION ROCK	6	7	3	5&1	2	1	1&1	2
14 NORTH COVE				2				
15 N.W. DIABLO	5&1	3&1	10&1	3	4&1	3	2	3
16. S.W. DIABLO								
17 BREAKWATER	4	2	1		3	5	2	2
18 SOUTH COVE							1	2
ZONE 4 19 GREEN PEAK N.					1			3
20 GREEN PEAK S.				4		1&1		
21 FINGER NORTH					1&1	2	1	12&1, 1
22 FINGER SOUTH		6			1&1		1&1	
23 DOUBLE ROCK N.		1		1				1
24 DOUBLE ROCK S.	9			9	5	3&1	9&1	
ZONE 5 25 VINEYARD NORTH		6	2				1	1&1
26 VINEYARD SOUTH								
27 PECHO NORTH	1&1					1		
28 PECHO SOUTH					1			1
29 RUIN NORTH			2	1				1
30 RUIN SOUTH			1	2				
31 RATTLESNAKE								
TOTALS ADULT / PUP	69&5	56&5	48&2	50&6	55&5	38&4	52&5	66&5

&= PUPS ,_ = MALES

On average, the largest portion of sea otters resided in Zone 2, which represented about 28% of the total population. Zones 1 & 3 were the next largest, both with 22%. Zone 4 contained 18% of the population on average. Sea otter densities in Zone 5 were lower than all other Zones within the study area, accounting for only about 9% of the total population on average.

Only Zones 2 & 3 contained individuals during each biweekly count. No single subzone was continuously used as a resting area. The four most consistently occupied raft sites were, Lion Rock Cove (92%) and Breakwater (88%) in Zone 3 and Windmill Cove (88%) and Barn Rd. (83%) in Zone 2 (Figure 5). Double Rock S. kelp bed just North of Pecho Rock, in Zone 4, supported the largest single raft of otters. On 2/9/95, this site contained 36 adults and 3 pups, which at the time represented 43% of the population observed in the entire study area. These animals were in two large bunches within a single Nereocystis kelp bed. Each individual was very active at the time of the count. They were either grooming or swimming among the raft. This behavior is not typical of a group of resting animals but more typical of either disturbed Sea Otters or those traveling.

It is of interest to note that all primary resting sites contain kelp beds composed of a mixture of Macrocystis and Nereocystis, however the vast majority of plant cover is Macrocystis. Nereocystis plants were generally scattered amid this primary overstory.

In general, resting animals were observed scattered throughout the area both nearshore and offshore. Many of the preferred resting locations are in small coves, sheltered from northwest winds but vulnerable to large storm swells and southeasterly winds.

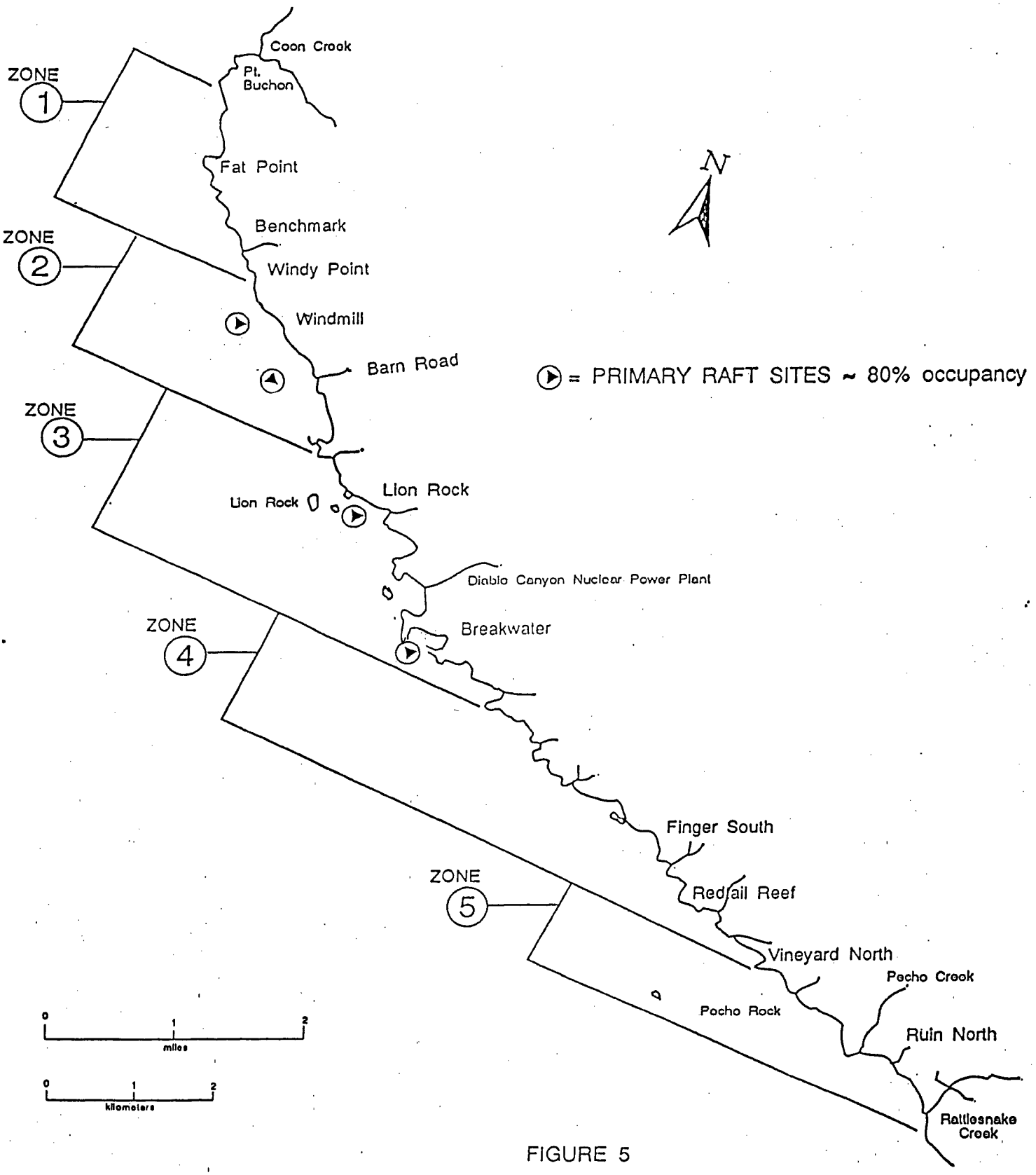


FIGURE 5

PRIMARY SEA OTTER RAFT LOCATIONS IN THE VICINITY OF THE DIABLO CANYON POWER PLANT

1995

The largest single group counted within each separate zone was as follows: 1) A maximum of 23 animals were counted in Zone 1, in a protected cove, at Fat Point North in March. 2) The maximum number of resting sea otters in Zone 2 were located at Windmill in May where 24 animals were observed. 3) Lion Rock Cove, in Zone 3, was occupied by a maximum of 32 animals in June. 4) Double Rock South contained 39 individuals in February. 5) Eleven animals comprised the largest raft observed in Zone 5 in May just North of Ruin Reef (sub zone 29).

Females with dependent pups were observed as far South as Ruin North in Zone 5. No large consolidated groups of males were detected within the study area. Males continue to be scattered and territorial in nature, however, when seen they were often observed within the general vicinity of female resting sites (Table 2).

Variations in population size seemed to be a seasonal low in the Fall/Winter and a high in the Spring/Summer. A notable increase in dependent pups was also observed in the spring. The highest ratio of percent pups to females was 1:3 which occurred during the month of March . In contrast, pup to female ratios decreased to 1:13 in September. Fluctuations in overall sex composition were observed. Changes in male to female percent ratios also ranged from 1:10 in April to 1:85 February.

The largest number of pups observed in the study area during a single count was 21 which was recorded on May 9th. Pups represented an estimated 19% of the total population in the study area at the time of the count. Monthly mean pup proportions ranged from a high of 25% in March to a low of 7% in September.

Newborn or "woolly" pups were observed in two peaks. One peak in the spring and one in the Fall. However breeding activity appeared to have only one peak, in the Winter/Spring (Figure 6).

In 1995, three primary resting locations remain in the Intake Cove area. One is the Macrocystis kelp bed along the West Breakwater, another is mid cove where there are only small traces of kelp and the third and most frequently occupied, is within a small kelp bed along the north corner of the cove near several rock pinnacles. In addition, a raft site located just at the terminus of the East Breakwater was occasionally occupied. Throughout the year, sea otters were observed in the cove 21 (88%) of the 24 biweekly daytime counts. Sea Otters were present on all the nighttime counts even during periods of unusually high human activity (Appendix I).

Sightings of sea otters in Diablo Cove were also quite frequent this year. Sea Otters were observed in Diablo Cove on 83% of scheduled biweekly daytime counts, a thirty-two percent increase over last year and an overall all-time high.

Feeding Observations

Feeding observations conducted in conjunction with study area counts indicate that the most common food item observed being consumed in the study area was not a single species, but a category designated as "small mollusc". The majority of this category includes a composite of mussels, clams, snails. However, it also includes small unidentifiable items which could include hermit crabs and small urchins etc. The "small mollusc" category represented an all-time high of 78% of all the prey species

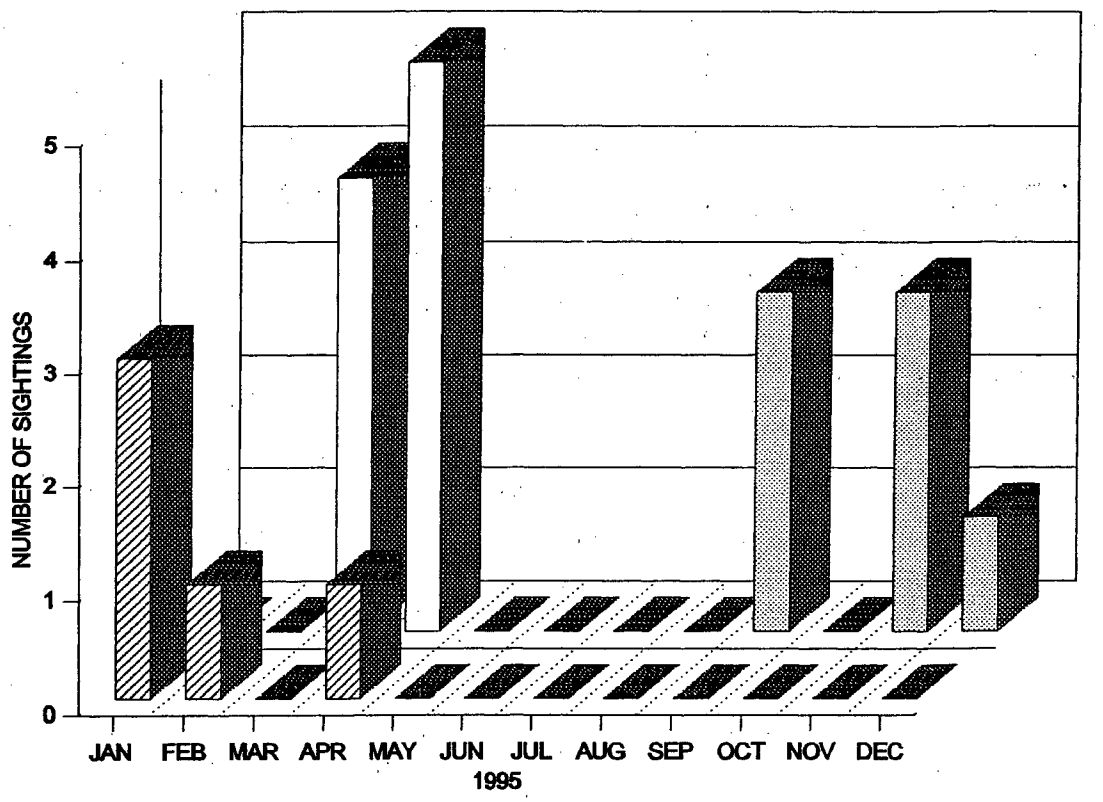


FIGURE 6
SEA OTTER NEWBORN AND MATING OBSERVATIONS IN VICINTIY OF DIABLO CANYON POWER PLANT
1995

observed being consumed by sea otters incidental to scheduled counts.

Abalones were at an all-time low as an observed food source. (Haliotis rufescens and H. cracherodii) accounted for only 8% of the total observed food items that could be specifically identified. Crabs, which generally included a variety of Cancer and Pugettia species also decreased and comprised only 14% of the observed diet. No Red Sea Urchins, (Strongylocentrotus franciscanus) or Purple Sea Urchins, (S. purpuratus) were identified being consumed during the year (Figure 7).

Zone 2 accounted for about 42% of the total feeding observations, followed by Zone 3 with 20%, Zone 1 with 14% and Zone 5 with 8% (Tables 3 & 4).

There are notable differences among forage species within the 5 major Zones of the study area (Figure 8). Each Zone is different from the other but Zones 4 and 5 displayed the greatest differences in observed food item dominance. All of the food items observed in Zone 4 were small molluscs or too small to identify; while Zone 5 was exsclusively abalones and crabs. Zone 1 displayed the greatest variety of food sources. Sea Urchins were not positively identified as being consumed in any zone. The majority of all observed feeding activity remains in the shallow subtidal and low intertidal zones (<10 meters water depth).

Subtidal and Intertidal Surveys:

Twenty-one live sea urchins were observed in nine of ten stations located near Pecho Rock in Zone 5 (Table 5). All were Purple Sea Urchins (S. purpuratus). Densities of 7/100m2 were observed for

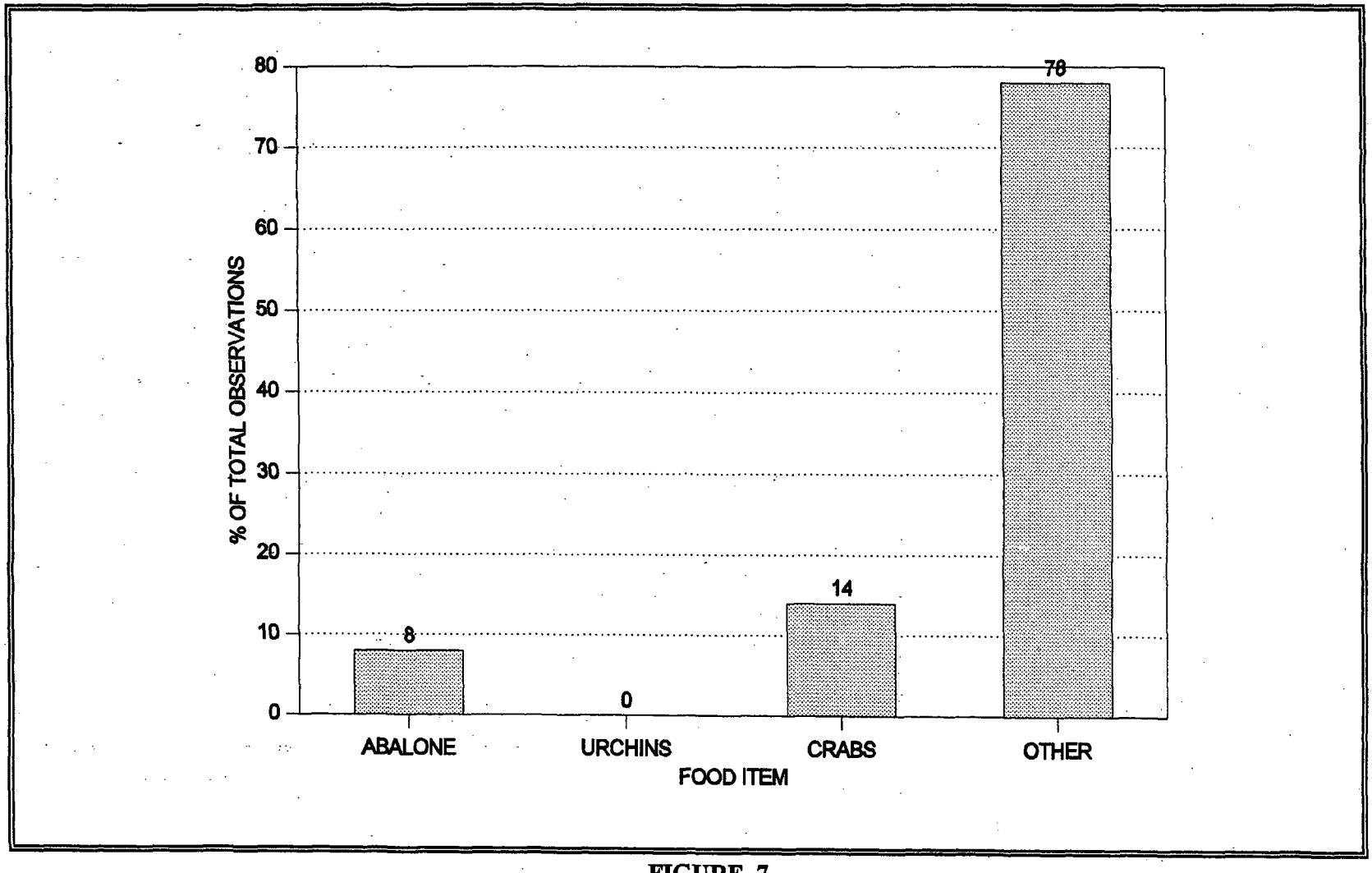


FIGURE 7
SEA OTTER FEEDING SUMMARY IN VICINITY OF DIABLO CANYON POWER PLANT
1995

TABLE 3
SUMMARY OF SEA OTTER FEEDING OBSERVATIONS WITHIN ZONES IN VICINITY OF DIABLO CANYON POWER PLANT
1995

ZONE		ABALONE	URCHINS	CRABS	MOLLUSC	TOTAL
1	# OBS	1	0	1	3	5
	% TOTAL	20	0	20	60	14
2	# OBS	1	0	0	14	15
	% TOTAL	7	0	0	93	42
3	# OBS	0	0	2	5	7
	% TOTAL	0	0	29	71	20
4	# OBS	0	0	0	6	6
	% TOTAL	0	0	0	100	16
5	# OBS	1	0	2	0	3
	% TOTAL	34	0	66	0	8
					GRAND TOTAL	**= 36**

mollusc = mostly small molluscs, but could be other small items

TABLE 4
SPECIFIC SEA OTTER FOOD ITEMS OBSERVED IN VICINITY OF DIABLO CANYON
POWER PLANT 1995

SUBZONES	UNID AB	BLSCK AB	RED AB	UNID CRAB	CANCER CRAB	KELP CRAB	MUSSLES	SMALL MOLL
ZONE 1 1 POINT BUCHON N.								
2 POINT BUCHON S.								
3 FAT POINT NORTH								2
4 FAT POINT SOUTH					1			1
5 BENCHMARK POINT	1							
ZONE 2 6 WINDY POINT								4
7 WINDMILL								
8 BARN ROAD								5
9 NORTH CONTROL N.								3
10 NORHTCONTROL S.								2
11 SEAL ROCK	1							
12 CROWBAR								
ZONE 3 13 LION ROCK								3
14 NORTH COVE								
15 N.W. DIABLO								1
16. S.W. DIABLO								1
17 BREAKWATER					2			
18 SOUTH COVE								
ZONE 4 19 GREEN PEAK N.								1
20 GREEN PEAK S.								1
21 FINGER NORTH								1
22 FINGER SOUTH								1
23 DOUBLE ROCK N.								
24 DOUBLE ROCK S.								2
ZONE 5 25 VINEYARD NORTH		1						
26 VINEYARD SOUTH								
27 PECHO NORTH				1				
28 PECHO SOUTH								
29 RUIN NORTH						1		
30 RUIN SOUTH								
31 RATTLESNAKE								
TOTALS	2	1	0	1	3	1	0	28

GRAND TOTAL = 36 OBSERVATIONS AB= ABALONE, SMALL MOLL= MOLLUSCS SUCH AS SNAILS, CLAMS AND HERMIT CRABS ETC.

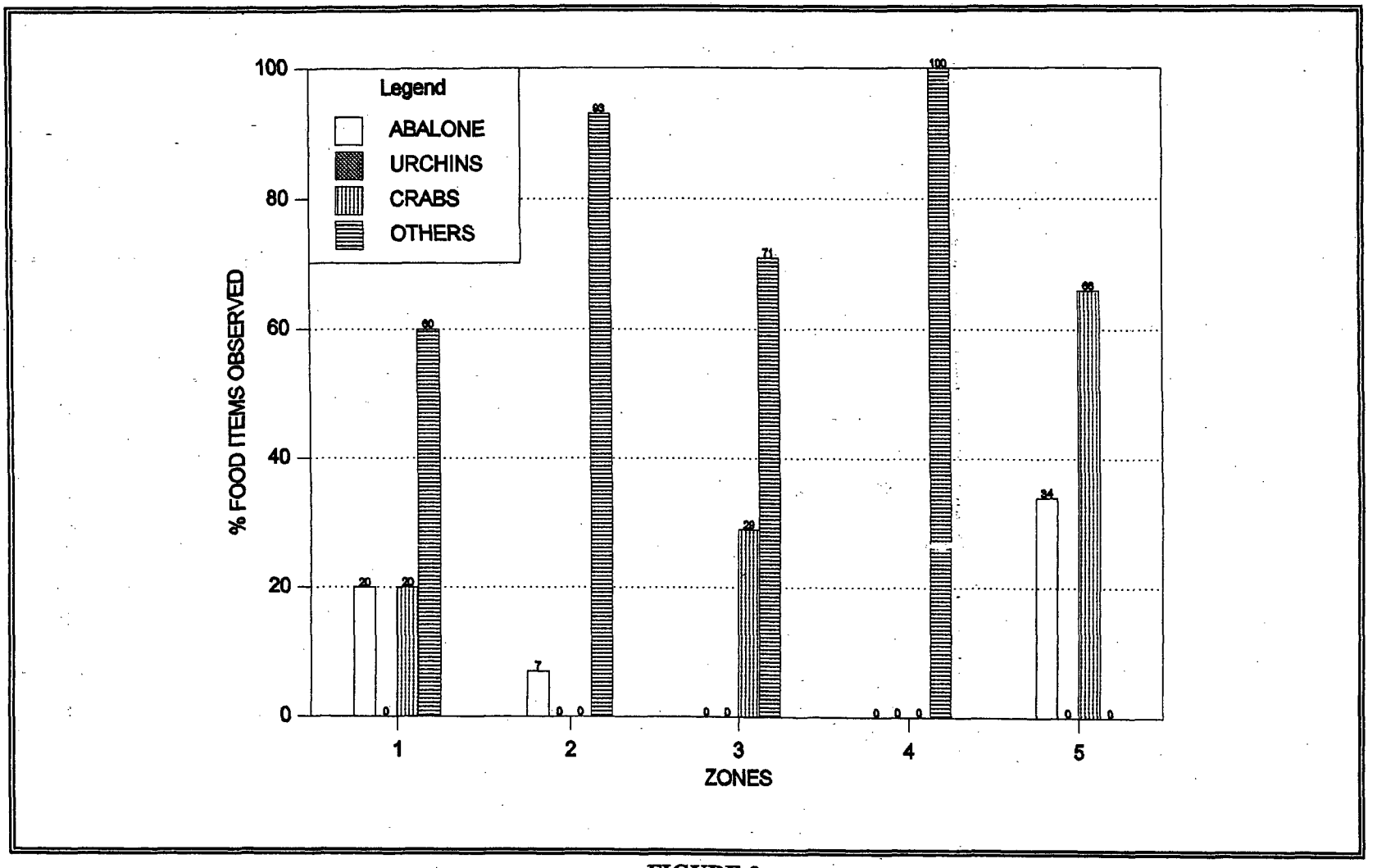


FIGURE 8
FOOD ITEMS OBSERVED IN SEA OTTER DIETS IN VICINITY OF DIABLO CANYON POWER PLANT
1995

TABLE 5
SUBTIDAL AND INTERTIDAL SURVEYS OF URCHINS AND ABALONES IN THE VICINITY OF DIABLO CANYON POWER PLANT 1995

PECHO ROCK SUBTIDAL 30M2 STATIONS					
STATION SUBTIDAL 30M2	**DEPTH (METERS)**	**RED URCHIN**	**PURPLE URCHIN**	**RED ABALONE**	**BLACK ABALONE**
1	12	0	0	1,(17cm)	0
2	12	0	1	0	0
3	7	0	5	0	0
4	9	0	7	1(4cm)	0
5	10	0	6	0	0
6	10	0	1	0	0
7	13	0	1	1(12cm)	0
8	13	0	0	0	0
9	8	0	0	0	0
10	7	0	0	0	0
RED TAIL REEF INTERTIDAL 30M2 STATIONS					
A	0±1	0	574	0	1
B	0±1	0	705	0	18
C	0±1	0	2022	0	0
D	0±1	0	594	0	9
E	0±1	0	97	0	6
DIABLO SUBTIDAL 30M2 STATIONS					
1	7	6	1(3cm)	1(25cm)	0
2	7	3	1(3cm)	0	0

SUBTIDAL: PECHO ROCK MEAN SIZE RED ABALONE = 11CM DIABLO SUBTIDAL RED ABALONE MEAN SIZE = 25CM
SUBTIDAL RED URCHIN: PECHO ROCK MEAN SIZE = NA DIABLO SUBTIDAL RED URCHIN ESTIMATED MEAN SIZE =8.6CM
SUBTIDAL PURPLE URCHIN: PECHO ROCK MEAN SIZE = 5.0CM DIABLO SUBTIDAL PURPLE URCHIN ESTIMATED MEAN SIZE = 3.0CM
INTERTIDAL RED TAIL REEF PURPLE URCHIN MEAN SIZE = 2.8CM, & BLACK ABALONE MEAN SIZE =6.6CM

this species. Red Sea Urchins (S. franciscanus) were not detected. Purple Urchins were typically small, averaging 5 cm and ranged in size from 3 to7cm in test diameter. These urchins were found in either protective holes or crevices in shale outcrops. Although the hard substrate in the study area is almost exclusively shale shelves and benches, when cobble and rock rubble was found, portions were turned and inspected for small urchins. None were found.

Three, live red abalone (H. rufesens) were found in the study area indicating a density of (1/100 m2) of appropriate habitat. They ranged in size from 4 to 17 cm in length. Mean length was 11 cm.

Nine broken Red Abalone shells were found during the subtidal survey. These were relatively large shells (9-17 cm) with some showing characteristic sea otter damage. Two Purple Sea Urchin tests (3 &4 cm in diameter) were found within the subtidal study area, there was no positive evidence of otter foraging on this species at these sites. Several small mollusc shells were also identified. The most numerous shells identified were mussels (Mytilus californianus) and snails (Tegula spp. & Astrea sp.). These shells were broken in such a way as to be possibly a result of sea otter foraging.

Intertidal surveys (near Redtail Reef) in the vicinity of the subtidal survey area indicated that within suitable Purple Sea Urchin habitat, densities averaged 27/m2. Test diameter ranged from 1.0 to 4.9 cm. The mean and mode test size were both 2.8 cm. Urchin densities were at their highest in areas covered with articulated coralline algae. Smaller urchins used this coralline algal mat for attachment and protection. Larger individuals were usually found in protective holes and rock crevices.

Black Abalone located within the same habitat were found in densities of 0.3/m2. Individuals ranged from 2.0 to 10.6 cm. Black Abalone mean size was 6.6. All abalone were located within some protected crack or undercut in the rock substrate and most abundant in the higher intertidal where sea urchins were rare.

Tagged Sea Otter Observations:

Although tagging is not a part of this study, over the years, sea otters have been physically tagged by the U.S. Fish & Wildlife Service and the California Department of Fish and Game. Some of these tagged animals have been observed in the study area. During 1995, no tagged sea otters were observed.

General Behavior:

Table 6 presents a list of selected behavioral observations. Woolly (new born) pups were observed in six of twelve months, These months included; January, March, April, May, September, November and December. The most sightings were recorded in April. Mating Activity was observed in only three months of the year, during January, February and April.

During 10 of 24 biweekly counts, small fishing skiffs ranging in numbers from 1 to as many as 17 were observed working in the shallow subtidal (<10 m water depths). Each skiff carried at least a dozen buoyed PVC spars containing a gang of fishing hooks on each spar. These small skiffs fish for live rockfishes. They also work within the same areas where Sea Otters rest and feed. It appears that this fishing activity causes sea otters to scatter from their resting sites when these skiffs get near.

TABLE 6
SELECTED BEHAVIORAL OBSERVATIONS RECORDED IN VICINITY OF DIABLO CANYON POWER PLANT 1995

OBS #	DATE	TIME (PST)	SUB ZONE	ACTIVITY
1	1/9	1130	28	Pair displaying courtship/ mating behavior
2	1/9	1210	21	pair displaying mating behavior
3	1/9	1300	1-7	many kelp beds torn out by previous storm Pterogophera stacked like cord wood at Windmill Beach
4	1/31	1100	17	mother with wooley pup
5	1/31	1200	6	male attempting to mate but was rejected by female
6	2/9	1020	24	36+3 pups all scattered and active in Nereocystis bed 400M N.E. of Pecho Rock, could part be large male group, ("Southern Front")?
7	2/9	1050	21	PVC hook & line fishery skiff working near shore with about 8 buoys deployed
8	2/27	1140	13	fishing boat "AtoZ' with two PVC hook & line skiffs at anchor in Lion Rock Cove
9	2/27	1150	11	male and female mating
10	3/18	1200-15	21,17,18	3 mothers with wooley pups, mom in zone 21 was also approaced by a male but he was rejected
11	3/29	1000	23-27	3 PVC hook & line skiffs working very near shore in Pecho Rock area
12	4/14	1013	18	mother with wooley pup swimming North
13	4/14	1155	17	2 mothers with wooley pups resting in Intake Cove
14	4/28	1015	25	male and female paired off to breed
15	4/28	1040	17	2 mothers with wooley pups resting in Intake Cove
16	5/18	1030	17	PG&E work teams preparing Intake Cove for 200 ft. barge arrival, no otters in the cove
17	5/18	1205	3	male approacing many females in raft, female with pup enters raft and runs off male
18	6/14	1010	13	large fishing boat anchored with 2 PVC hook & line skiffs in Lion Rock Cove
19	7/17	0930	22	17 adults & 6 pups resting in Nereocystis were disturbed and scattered by two kiyacks heading North
20	7/17	1030	4	PVC hook & line skiff working near shore with at least 10 buoys
21	8/22		1-31	6 PVC hook and line skiffs working close to shore in the study area
22	9/4	1320	4	16 females with 3 wooley pups resting in Nereocysits bed
23	9/13	0930	29	PVC hook & line skiff being launched from shore it may have had engine trouble?
24	10/18		13,22	2 PVC hook & line skiffs working the area
25	10/30		1-31	17 PVC hook & line skiffs and two "pleasure" boats fishing in the study area all but 2 close to shore
26	11/16	1310	13	large fishing boat with PVC hook & line skiff to stern in Lion Rock Cove
27	11/16		13	sea otter foraging in the exposed upper intertidal zone
28	11/16	1302	10	mother with wooley pup swimming South
29	11/27	1130	24,21	2 mothers with wooley pups at rest
30	12/5	1120	21	PVC hook & line skiff with 8 buoys deployed in water depths less than 20 feet
31	12/17	1053	29	PVC hook & line skiff working very near shore
32	12/17	1336	11	mother and wooley pup hauled out at rest

During May 1995, PG&E delivered three large electric transformers to the Diablo Canyon Power Plant site via barge. This 200 ft. barge was off-loaded within the Intake Cove. This operation represented a significant increase and change in activity within the cove. The Intake Cove has historically been and presently is used by sea otters as a place in which to rest, groom and feed. Typically, use is highest during the spring when strong winds commonly occur. Spring is also when dependent pups are highest in number. Mothers with small pups find protection from strong wind and sea conditions within the Intake Cove. Human activity is on-going at this site and the Sea Otters have become accustom to "normal" daily activity. Observations made just prior to any increase of activity within the cove indicated nighttime use reached a level of 22 and 10 pups and mid-morning use was 11 and 5 pups (Appendix I). During barge operations both daytime and nighttime use of the cove dropped by about 50%. During specific activities such as barge departure the cove was temporarily abandoned. Abandonment was could be measured in minutes however. The Sea Otters that chose to remain within the cove did not appear to be disturbed by the increase in activity. Within two weeks of resumption of "normal" activities Sea Otter numbers were once again back to normal for the season. It is of interest to note that many of the individuals that chose to stay in the cove were mothers with pups.

Sea otter haul out behavior was observed on nine separate occasions at four different sites concurrent with the 24 counts conducted in 1995 (Table 7). This represents an estimated 38% frequency of occurrence in the study area. This behavior was observed at four different sites in Zones 2&4 in January and then from April through June and then again in December. The numbers of animals at

TABLE 7
SEA OTTER HAUL-0UT OBSERVATIONS IN VICINITY OF DIABLO CANYON*
1995

OBS #	DATE	TIME (pst)	SUB ZONE	ACTIVITY
1	2/9	1200	11	1 resting on wash rocks
2	4/14	1130	19	1 resting on wash rocks with 3 harbor seals and their pups
3	5/18	0945	22	1 resting on wash rocks
4	5/18	1100	11	paired male & female with bloody nose resting on wash rocks
5	6/4	0930	22	5 at rest with harbor seals on wash rocks
6	6/4	0940	21	4 adults and 2 pups at rest on wash rocks
7	6/4	1040	11	5 at rest with harbor seals on wash rocks
8	7/17	1017	11	male, female and pup resting together on wash rocks
9	12/17	1336	11	4 females and 1 wooley pup at rest on wash rocks

*During non-standard counts, haul out behavior was observed in the Intake Cove (Sub Zone 17) both day and night (Appendix I).

each site ranged from 1-5 and included males, females and pups. The most consistently used haul out site this year was Seal Rock in Zone 2 (Sub Zone 11).

Sea otters hauled out on low relief wash rocks that were exposed at low tide. In addition, the haul out rocks are generally located in moderately to highly protected sites that are also used by harbor seals. While the sea otters were hauled out, resting and occasional grooming were the primary activities. Animals were hauled out individually or in small groups. The most popular haul out site was Seal Rock. This site is north of Diablo Canyon Power Plant, near Lion Rock Cove, and historically, is one of the most preferred intertidal resting areas within the entire study area. Seal Rock is not only a large protected wash rock, with limited human disturbance, it is also located in an area of high sea otter density which may account for its' popularity.

DISCUSSION

Population Size:

Mean population size increased by 15% to 70 in contrast to recent years where "mean" size remained a stable 60 animals. When sea otters first occupied the study area (1973-1979) there was a basic "core" (mean) population of about 62 predominantly male animals with seasonal spikes of near double the numbers in the winter and spring (Figure 9). After the departure of the male "front", in the spring of 1979, the "core" population dropped drastically to about 20 animals and then gradually increased in number. During a nine year period from 1980-1988 the study area population was predominantly

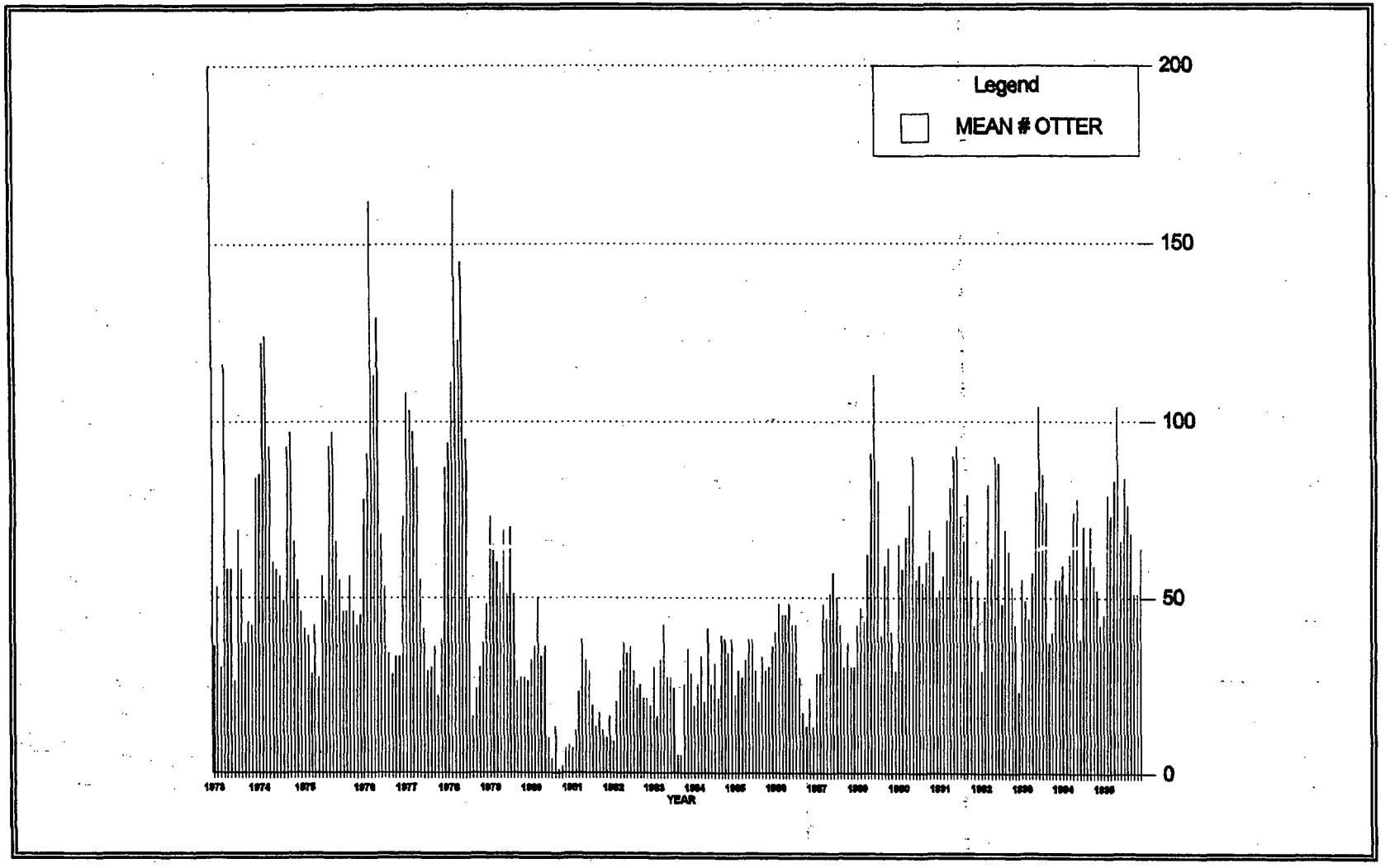


FIGURE 9
SEA OTTER MEAN MONTHLY POPULATION SIZE IN VICINITY OF DIABLO CANYON POWER PLANT
1973 - 1995

female with an average or "core" population of only 30 animals. From 1989 to present the resident or core population has basically stabilized to an average of about 60 animals the majority of which are female. This year a subtle but detectable increase in core population occurred. State-wide Sea Otter census detected a simular increase.

The 1995 data indicate the high count was later in the spring (May) than last year, as was also the seasonal fall low count. The lowest numbers of adult animals in the study area (36) occurred in January. The 1995 six month average (Spring /Summer) count of 81 was greater and more stable than last year's six month comparable count of 65. The Fall/Winter mean count of 60 was also, higher than last year's mean of 55. Both the winter lows and summer highs are becoming less divergent, supporting the suggestion that the core population within the study area is reaching some sort of stability. When compared to the last five years, 1995 monthly population averages indicate that the overall mean population has increased by about 12%. This increase in population size is also reflected in the California Sea Otter Population as a whole. A 1995 range-wide census indicated at least an 18% increase in population (Personal Communication Bryan Hatfield, U.S.Dept. Interior).

Any reduction in population size appears to be driven by low sea otter counts during the winter months when storms batter the coastline. It is possible that many animals temporally depart the exposed Buchon Headland in favor of more protected areas to the North and South of the study area.

Temporary increases in population size may be in part due to seasonal movements relative to changes in weather or human activity . It is obvious from the records of sea otters tagged at San Simeon, and

Avila Beach, that movement occurs in and out of the Diablo Canyon study area by animals from these and other sites. Sightings of tagged animals from these areas within the sea otters' present range suggest that movement of adult animals throughout the range will continue to contribute to periodic changes in sea otter population size within the study area that are not related to actual increases in the population as a whole.

Reasons for sea otter long distance movements (in and out of the study area) can be socially and individually motivated. One example of social motivation to move long distance would be territorial males running off competing males. These competing males could be those who moved into the area to challenge an established male or local young males too matue to be tolerated within the female raft. Examples of individual motivation include; an animal seeking a safer resting site, or better forage areas. Whatever the reason, sea otters continue to transit in and out of the study area.

Seasonal population "spikes" are also due to a periodic increases in pup production. Although sea otters are capable of pupping throughout the year, (Riedman et al. 1994) seasonal " pupping peaks" are the general rule in the study area. Pup to female ratios increase by an order of magnitude in the spring and fall. This year, a spring (March) pup population "spike" was apparent. A smaller, fall/winter, "spike" (Figure 4) in pup production typical of recent years was also present. The observation of newborn pups in late fall and early winter, indicates pups are also produced at this time. These pupping peaks also imply an apparent six month gestation period, It appears that If a female either looses her pup or is not successfully bred she has a second chance in the same year. This reproductive strategy may be reflected in the second smaller, fall/winter pupping peak that is normally

observed each year. An autocorrelation of sea otter population count data determined the existence of a repeating seasonal pattern (Benech , 1994). Count data were analyzed as a ratio of adults to dependant pups. The autocorrelations showed significant, repeatable annual patterns. The results indicate a spring peak in pup numbers relative to adults with a additional but more variable second peak in the late fall. This analysis also suggests a six month gestation period. This length gestation period is also indicated when one notes the presents of newborn pups relative to mating activity (Figure 6). Although like pupping, mating activity occurs throughout the year, there are peaks in the spring and fall. This also corresponds to increases in male to female ratios at these times. It is of interest to note that unlike previous years, mating behavior in 1995 was not observed during the fall.

Population Distribution and Composition:

Since 1980, females with dependent pups have been observed throughout the study area. Most of the populations occurs within zones 1-3. Historically highly occupied, resting locations (Lion Rock, Windmill, and Barn Road) contain large kelp beds of Macrocystis. The Sea Otter usually wraps itself in kelp fronds to anchor itself in place. The animal is thus safe to rest without concern of drifting into dangerous locations. This is probably more important to young, inexperienced animals than for seasoned adults. The presence of animals in any one resting or raft location this year appear more variable than in the past. This is probably the combined result of changes in food availability , atypically harsh weather conditions and human disturbance. As the Near-shore Skiff fishing industry increases along the coastline, the more frequent the disturbance of Sea Otter resting sites. During

a single fall count 17 commercial fishing skiffs were sighted in the study area. During this same time, Sea Otters were widely scattered. Lion Rock Cove once a resting site to large numbers of animals is now less densely occupied. This may be a direct result of the frequent use of this cove as an anchoring site for a "mother ship" from which nearshore fishing skiffs are deployed.

The use of the immediate Diablo Cove and Intake Cove areas by sea otters is of primary concern to PG&E when compared to the relative overall distribution of animals in the study area. Intake Cove is protected by two large breakwaters and since 1978 has traditionally provided the best calm water conditions for local Sea Otters. Intake Cove, despite continuous human activity, including boat traffic and kelp cutting, remains frequently occupied by resting otters. A reasonable explanation for this is that this area provides the best protection from the physical effects of wind and swell anywhere within the entire study area. Although people work in the vicinity, the Sea Otters are not purposely harassed and have become relatively accustom to routine power plant activities. Daytime surveys in conjunction with night surveys show that sea otters use of this area remains relatively constant during daylight hours and after dark.

The Intake Cove has traditionally been widely used by Sea Otters as a place in which to rest and feed (Figure 10). It was first occupied by a "territorial" male from 1975 - 1980. In April of 1980, a small number (2-3) of females also adopted the area as a resting site. The frequency of occupation varied widely from 1981 to 1984. This may have been a result of one or more factors including:

1) large waves partially destroying the west breakwater; (The lack of wave protection from the partial destruction of the breakwater would render it less desirable as a rest area.)

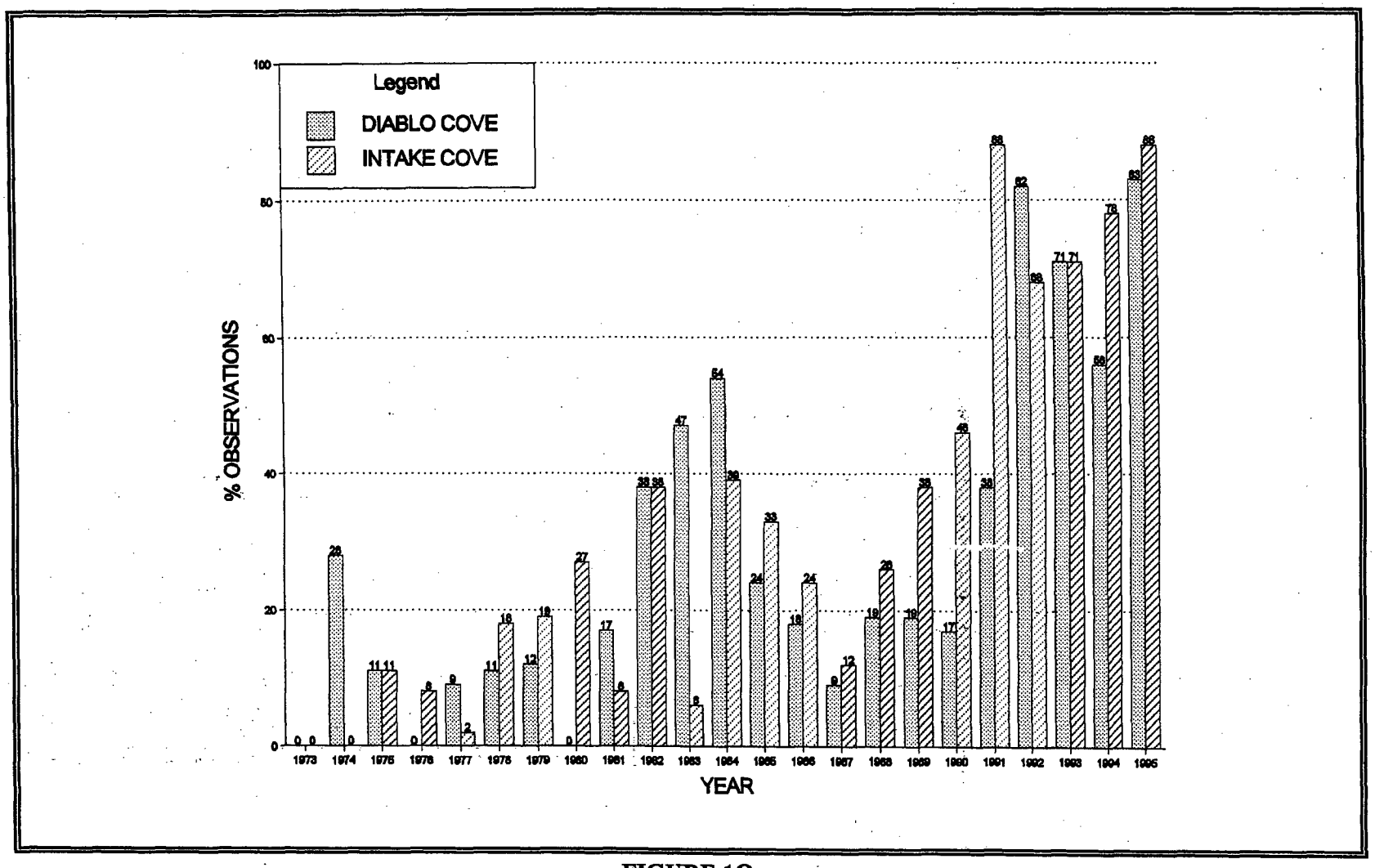


FIGURE 10
SUMMARY OF SEA OTTER % OCCUPANCY IN VICINITY OF DIABLO CANYON POWER PLANT
1973 - 1995

2) the subsequent human activity required to repair it; (The increase in large equipment and continuous daytime, in the water reconstruction activity, would be perceived as a threat by sea otters.)

3) this area was a transitional zone between large, predominantly male and female resting areas from 1977-1981; (transition zones are characteristically sparsely populated).

Although use of the Intake Cove was gradually on the increase in the early 1980's, 1984 through 1987 marked an abrupt decrease and continuous low daytime use of the cove. This may have been in large part due to the increase in human activity in and around the cove as a result of plant " start-up" of units one and two and the subsequent removal of favorite kelp beds in the cove in 1985, 86 & 87 respectively. Although human activities continued, Sea Otter use of Intake Cove steadily increased from 1987 to 1991. By 1992, the percent occupancy dropped by about 25% and the number of users dropped to nearly 1/2. Last year sea otter occupancy data indicated a slight increase. This year frequency of use equalled the 1991 all time high of 86%. The cove was used both day and night by males, females and pups. Night observations indicate that at least during the spring, the cove is always occupied (Appendix I). The maximum recorded number of animals using the cove at any one time this year during normal mid-morning counts was 16. Night-time use was greater (22 adults & 10 pups). Use of the Cove was at its' highest during the spring months. This can best be explained by the fact that in the spring months, strong winds are typical. Mothers with small dependant pups can find some of the best protection from this weather pattern within the Intake Cove.

Springtime use of the cove remained high despite two weeks of unusually high human activity during

a barge delivery in the cove. The frequency of use was only changed on a very short temporal scale (minutes to hours) and specifically related to unusual on-going activities. Numerical use of the cove was changed on a somewhat longer temporal scale (days) where the number of individuals was reduced by half the normal springtime numbers. Within two weeks of termination of this unusually intense activity , numbers of animals using the cove returned to normal (Appendix I).

It is expected that similar changes in Sea Otter frequency and numbers of use of a specific resting site would result from disturbance by the "skiff fishing fleet". Specifically, most would leave the area while the skiff was present and then return shortly after the perceived threat was gone. However it is also expected, many animals would leave for longer periods until either the perceived threat was gone (as observed in the Intake Cove in May - June 1995) or the activity was no longer seen as a threat. If the threat goes away the recovery time is of a much shorter temporal scale (days). It may take months or even years to adjust to the activity and no longer perceived it as threatening.

Diablo Cove is not quite as protected from harsh wind and sea conditions as Intake Cove. Water conditions are further disturbed in Diablo Cove as it is the discharge point for the plant's cooling water system. In 1974, during plant construction and as the southern front of male sea otter expanded their range, this cove was used as a resting area for as many as 34 Sea Otter. In recent years, Diablo Cove appears to be a site in which several otters actively forage and rest. The maximum number observed using the cove at any one time this year was 13 adults and three pups in the Spring. This high may be a direct result of increased activity within Intake Cove during this time. It appears some Sea Otter departed the Intake Cove and chose Diablo Cove as an alternate resting site because of

its' proximity and lower disturbance levels. Once disturbance levels dropped in Intake Cove, then numbers of animals found resting in Diablo Cove also dropped and numbers once again increased in Intake Cove. Despite this possible artifact of disturbance, in general, an increase in the frequency of use of Diablo Cove by Sea Otters for both foraging and resting was recorded for the year (Figure 10). The numbers of animals using Diablo Cove were both variable and small (ranging from 1 to 15). This site is frequently occupied by at least one male, two females and their pups. These Sea Otters continue to feed within and near the discharge plume on crabs and small molluscs, and usually rest in a Macrocystis kelp bed at the northern end of the cove, protected from prevailing winds. The animals display normal behavior when swimming amid the plume. Several factors could account for the continued use of Diablo Cove. Population pressure is probably the most important factor. As the numbers of animals increase throughout the range, acceptable habitat is slowly occupied. A second factor is that local sea otters appear more tolerant of human activity. Additionally, foraging opportunities may also be a factor, perhaps changes since 1988, make the cove more attractive.

Animals positively identified as adult males remain low in the study area. These low male counts may be in part, an artifact of the observation method since an individual is assumed to be female if in the company of other females and not otherwise positively identified as a male. Territorial males probably represent at somewhere around 5% of the core or base population. These "territorial" males tend to rest near and sometimes among a raft of females. Male territories appear to relate to both where there are females and general locale rather than any specific locale. For example, when females are rafting in Lion Rock Cove, Seal Rock or Intake Cove, there is at least one male near by or among them. When there are no females resting in those sites, there may or may not be a male.

Relative proportions of males to females increase during peak pup periods suggesting that males may move into the female dominated area during this time to mate (Garshells, 1983).

The mean yearly pup population ratio of 16% is at precisely the level indicated by Kenyon in 1963 for "healthy Sea Otter populations " in Alaska. This increase in pup production was reflected in the population as a whole but on average the state-wide pup population represented only about 10% (Personal Communication, Bryan Hatfield U.S. Dept. of Interior). Thus the study site appears to be an important pup producing area.

Feeding Observations:

Red Sea Urchins (20%) and abalone (66%) together represented 86% of the total sea otter diet in 1973 when sea otters first reoccupied the study area (Figures 11 & 12). 1990 marked the first year since 1980, where Sea Urchins (both Red and Purple) were once again being seen consumed by sea otters. This was a short-term event which lasted only three years. Presently, urchins are visually absent from the sea otter diet in this area. Abalone now at an all-time low represent only 8% of the total forage items. Thus, in contrast, abalones and urchins in 1995 represent only a tenth of their original importance as a food source. Constant predation on these resources by Sea Otters continue to reduced the once dominant food items in both numbers and size which in turn reduce their desirability as a forage item.

Red Sea Urchins, (S. franciscanus), although initially a major component of the sea otter diet within the study area, remain locally "ecologically extinct" within the Pecho Rock study area. Ecologically

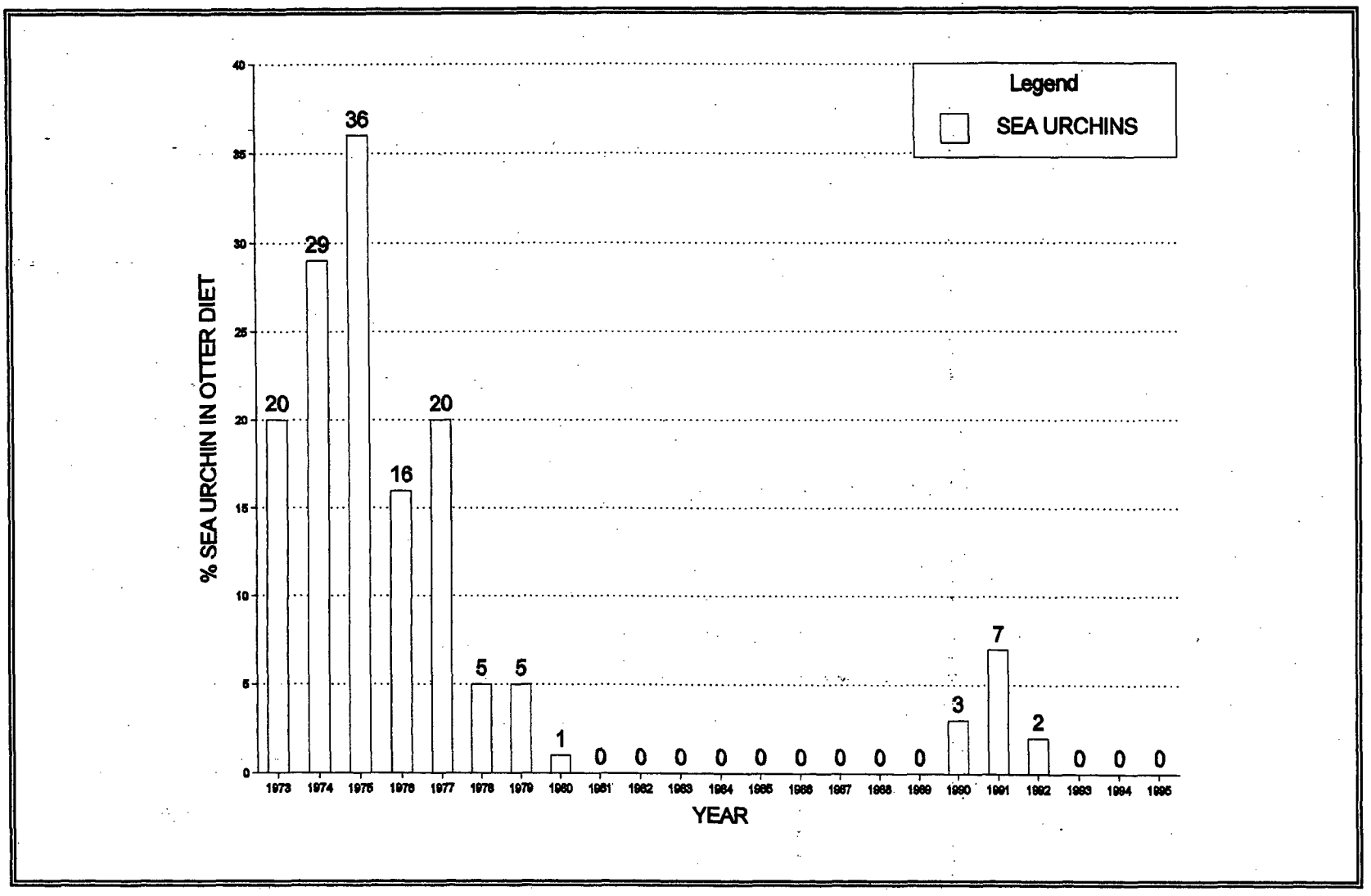


FIGURE 11
SEA OTTER DIET SUMMARY 1973-1995 IN VICINITY OF DIABLO CANYON POWER PLANT

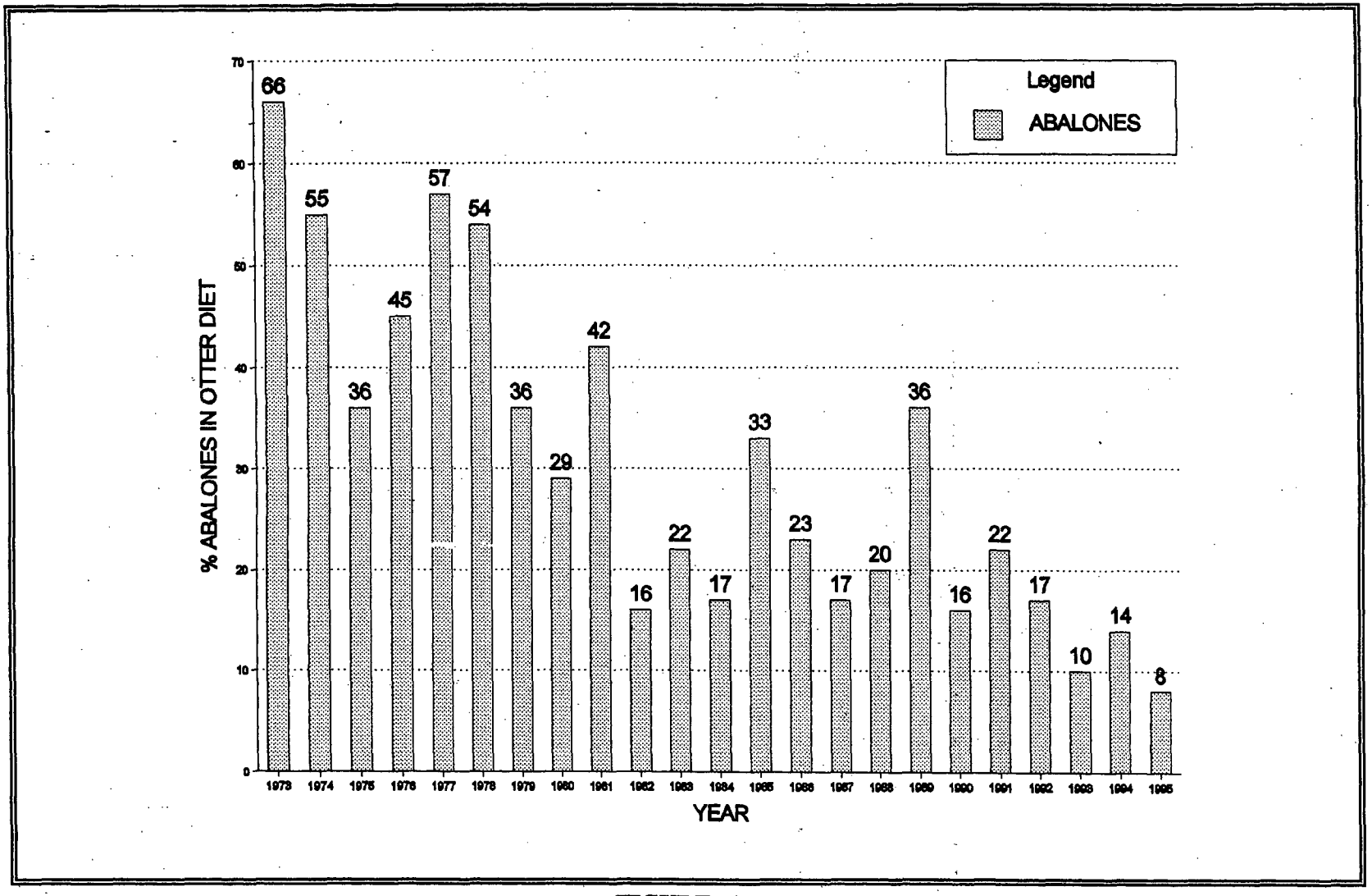


FIGURE 12
SEA OTTER DIET SUMMARY 1973 - 1995 IN VICINITY OF DIABLO CANYON POWER PLANT

extinct, by definition is " the reduction of a species to such low abundance that, although it is still present in the community, it no longer interacts significantly with other species" (Estes et al., 1989). Figure 11 indicates virtually no urchins were observed being consumed from 1980 to 1990. Then 3% of the observed food items were urchins in 1990, 7% in 1991, 2% in 1992. Once again urchins have been absent in diet observations for three years. It is important to note that the urchins that were observed being eaten were almost exclusively Purple Urchins (S. purpuratus). Only one of three separate sightings were Red Urchins in 1991. The urchin observed being eaten in 1992, was so small it could not be identified to species. The adult Purple Urchin is commonly only half the size of a full grown Red Urchin and thus, with only 1/8 the volume of edible parts, thus less desirable. Other studies indicate that sea urchins 2.5 cm or less in size are not targeted as a food source (Estes et al 1988) strengthening the above argument. It is probable that the Red Sea Urchin will continue to be rare or absent from the sea otter diet within the study area because the Purple Urchin appears to out compete it in recruitment.

Abalone consumption has declined from a high of 66% (% of total diet) in 1973 when sea otters first reoccupied the area to an all-time low of 8% this year (Figure 12). This general decline was never steady but one typified by occasional peaks. These peaks may reflect otter movements through the study area with concurrent changes in foraging area. Subtidal surveys indicate that both the number and mean size of this food source has decreased, thus reducing its' desirability and availability.
Crab species, including primarily Cancer and Pugettia species, have been highly variable but important components of the sea otter diet. The Crab category presently represents about (14%) of the observed total (Figure 13). This food group has generally declined and stabilized at around 20%

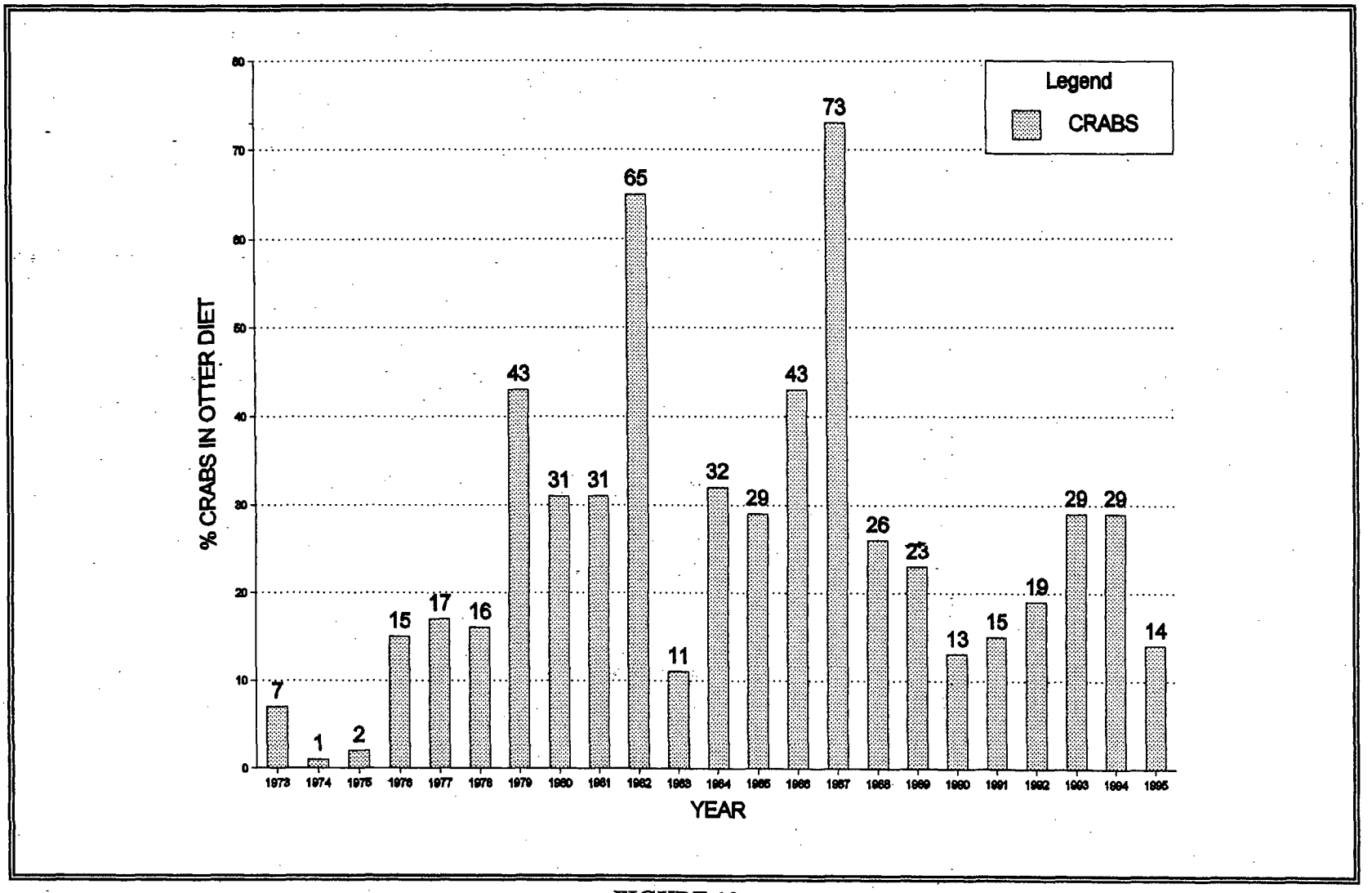


FIGURE 13
SEA OTTER DIET SUMMARY 1973 - 1995 IN VICINITY OF DIABLO CANYON POWER PLANT

since its' last and highest peak in 1987, when it represented about 75% of all feeding observations.

The category of "small mollusc & small food items" reached dominance in 1983 and continues to grow as the primary food group representing an all-time high of 78% of observed sea otter food consumption (Figure 14). This food group includes small snails, mussels, clams, octopus and other small unidentifiable food items. These unidentifiable food items could also include small sea urchins and hermit crabs. Dominance of this food category implies a significant reduction in the larger sized and/or historically preferred forage species of abalones, urchins and crabs. Presently, the proportions of each food type eaten by sea otters in the study area, is comparable to observations in more established portions of the range (Estes et al., 1986). As sea otter occupation within the study area stabilizes, it is expected that small molluscs and a variety of crustacea will continue to dominate the sea otter diet. It is also expected that abalones and urchins will continue to be reduced in both size and density.

Subtidal and Intertidal Surveys:

Zone 5 has been the site of subtidal surveys for 22 years. After 21 years of sea otter occupation, densities of both urchins and abalone remain dramatically decreased. Although one was observed in the subtidal survey area this year, Red Sea Urchins are still considered locally, ecologically extinct as a direct result of sea otter foraging. In addition, this species is not expected to return as a dominant community component in the foreseeable future for three major reasons. First, the Red Sea Urchin is being competitively excluded by the smaller, more successful colonizer, the Purple

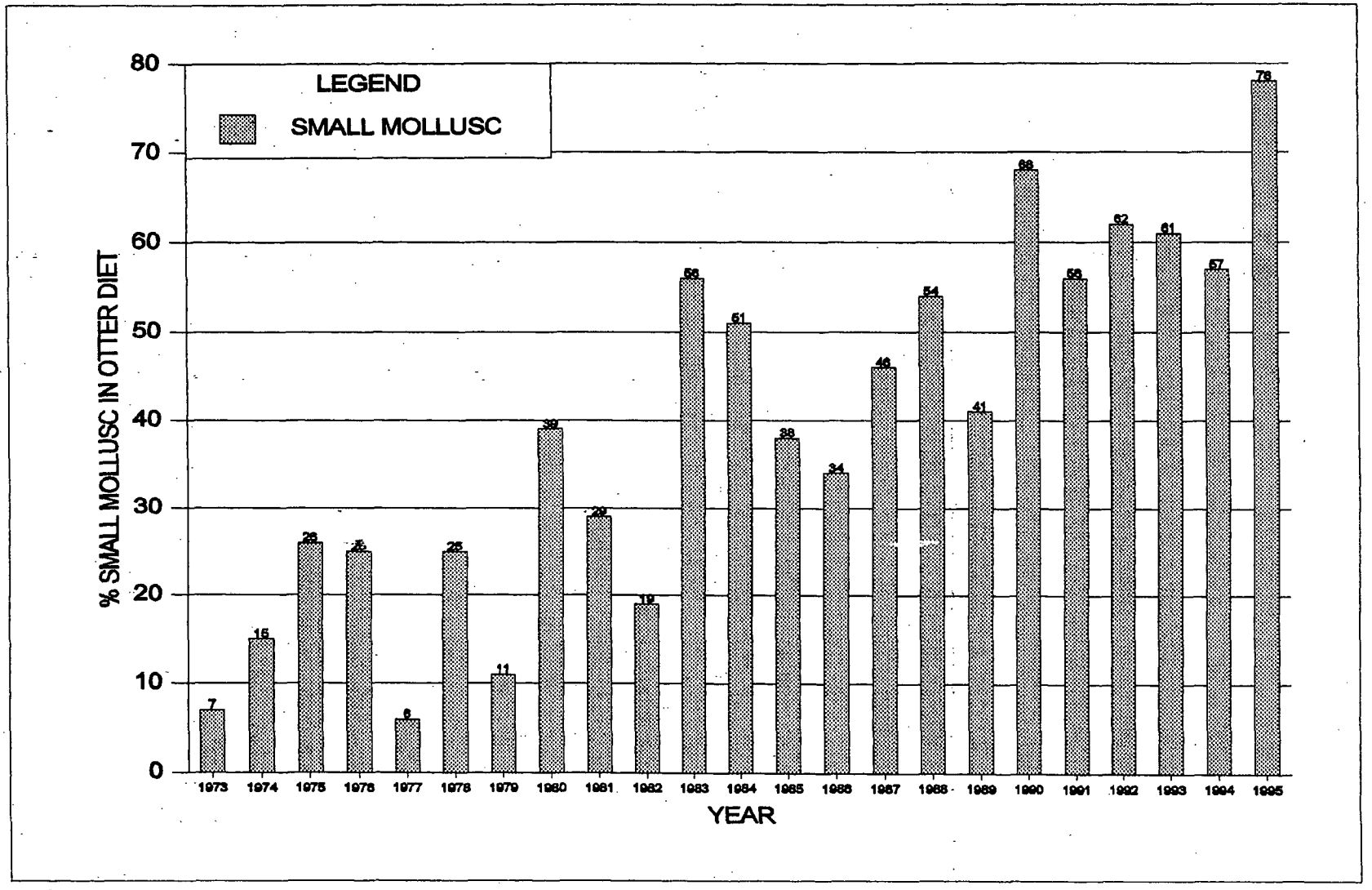


FIGURE 14

SEA OTTER DIET SUMMARY 1973 - 1995 IN VICINITY OF DIABLO CANYON POWER PLANT

Urchin (Schroeter, 1978). Second, the drastically reduced density of spawning Red Urchins in the area has lead to the reduction in recruitment (Leviten et al, 1992). Third, Red Sea Urchins, when they do manage to recruit and mature, will be targeted by foraging sea otter in preference over the smaller Purple Urchin, thus keeping densities below successful spawning levels.

In 1974, prior to sea otter occupation of Zone 5, Red Sea Urchins carpeted the rock bottom in large, closely packed aggregations with mean densities reaching 3 per square meter. In only three years, sea otter foraging reduced the population to only 1 in 60m2. After four years of otter predation, Red Urchin populations levels were reduced to near or below detection limits (<1/300m2) and remained so for twelve years. When urchins were found in subsequent years, they were almost always Purple Urchins (Figure 15). In the thirteen years from 1982 to 1994, Red Urchins were detected only five times (1 in 1982, 4 in 1991, 1 in 1992,1 in 1993 and 1 in 1994). 1994 marked the first year since 1982 that the Red Urchin found was a full adult of 12cm in size. Prior to that year, none of the Red Urchins surveyed were larger than 6cm which is about half the normal adult size and no more than two years old. Before sea otters reoccupied the area, the average test diameter was 11cm. After only two years of otter occupation, the mean test size decreased to 10cm. In 1977, mean test diameter was less than 7cm and in 1993 the Red Urchin found was only 2cm in diameter which represents about one year of age. No red urchins were detected this year.

There are two primary reasons why the Red Urchin is expected to remain "ecologically extinct" within the Pecho Rock study area. First, Red Sea Urchins, under normal conditions, out compete Purple Sea Urchins for optimum habitat because their larger adult size and relatively longer spines

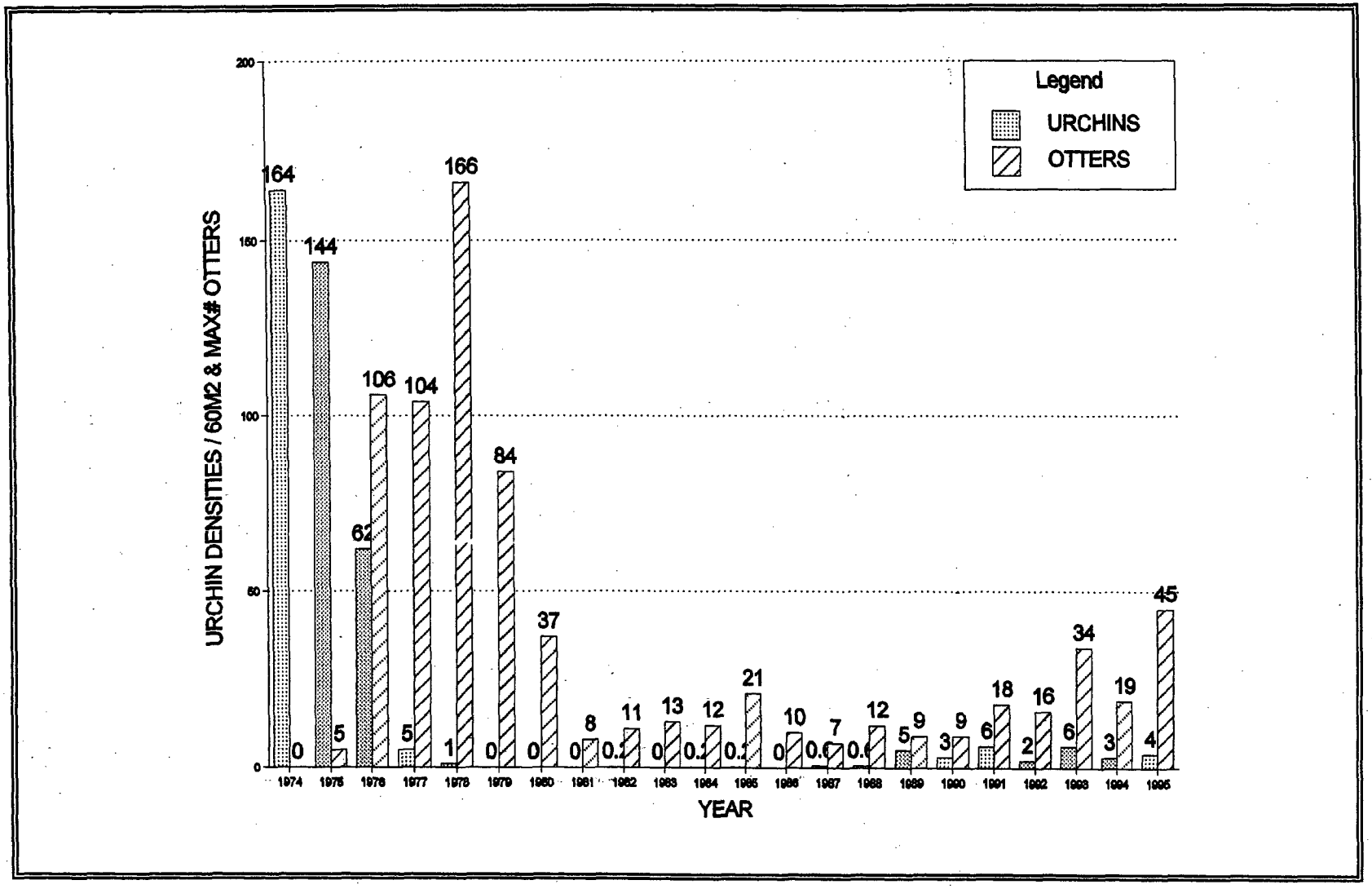


FIGURE 15
SEA OTTER AND SEA URCHIN 1974 - 1995 DENSITIES IN THE PECHO ROCK SUBTIDAL STUDY AREA

(Schroeter 1978). The Red Sea Urchin's larger size which made them the more successful competitor for optimum habitat against Purple Urchins, also made them a move preferable target for otter predation. Second, once the Sea Otters removed the large urchins which dominated the subtidal, the habitat was now available to the smaller Purple Urchin which presently are found in reproductively adequate densities in the intertidal zone.

Intertidal surveys conducted in the Pecho Rock study area in 1990, 1993, 1994 and again this year, indicate diminishing but still abundant, local "seed" populations of Purple Urchins. In 1990 a mean density of was 75/m2 was recorded, in 1993 densities dropped to 57/m2. 1994, mean densities were reduced to only 27/m2, almost a 2/3rd reduction in density was observed. This year densities were virtually identical to those of last year, thus diminished in number when compared to the past, these aggregations are still dense enough to maintain fertilization success and settlement. A population dependent on external fertilization, such as sea urchins require very high densities for sperm to successfully fertilize eggs (Levitan 1992) .

In contrast, Red Sea Urchin "seed" populations within the subtidal study area are not locally apparent within the Pecho Rock area. Studies indicate that the drastically reduced local densities like those observed in the Red Urchin Population in the study area, can lead to local extinction. Subtidal surveys in the study area suggests that the few Red Urchins occasionally observed were probably recruited from areas outside the subtidal boundaries of the study site.

Subtidal Purple Urchin densities (21/300m2) have increased from last year's 15/300m2, but lower

than the 1993 high of 28/300m2. In addition the mean diameter has varied from 5.0cm to 3.7 to 5.3 respectively. These differences are all within expected variability and appear to be relatively stable.

Subtidal Red Abalone (Haliotus rufescens) densities declined rapidly once Sea Otters established themselves in the study area. "Pre-sea otter" abalone densities recorded by California Department of Fish & Game from 1970 - 1973 in an area South of the Power Plant, in a similar habitat of the present subtidal survey area recorded mean densities of 32/300m2. After five years of sea otter occupation in that same area, densities were reduced by 85% to a mean of 5/300m2 (PG&E 1981). This was thought to be a "stabilized" density of abalone in otter occupied locales.

In 1979, when Abalone counts were begun in the present subtidal study area, Sea Otters had occupied the area for almost 5 years (Figure 16). Similar to Fish & Game data, from 1979 to 1984 densities averaged about 5/300m2 and were assumed stabilized. From 1985 to 1994 abalone densities plunged still further to less than 1/300m2, a greater than 97% decrease over "pre- sea otter" densities.

Intertidal Black Abalone densities near Pecho Rock were first measured at 4/10m2 in 1990, then 6/10m2 in 1993 by 1994 densities were reduced to 3/10m2. Densities continued to decline to 2/10m2 in 1995. Mean size has varied from 6.5cm to 7.3cm back to 6.6cm. This shift to smaller sizes once again indicates predation directed toward the largest animals, similar to what was observed with the intertidal sea urchins.

Data collected at Diablo Cove indicated Red Urchin Densities dramatically lower than last year but

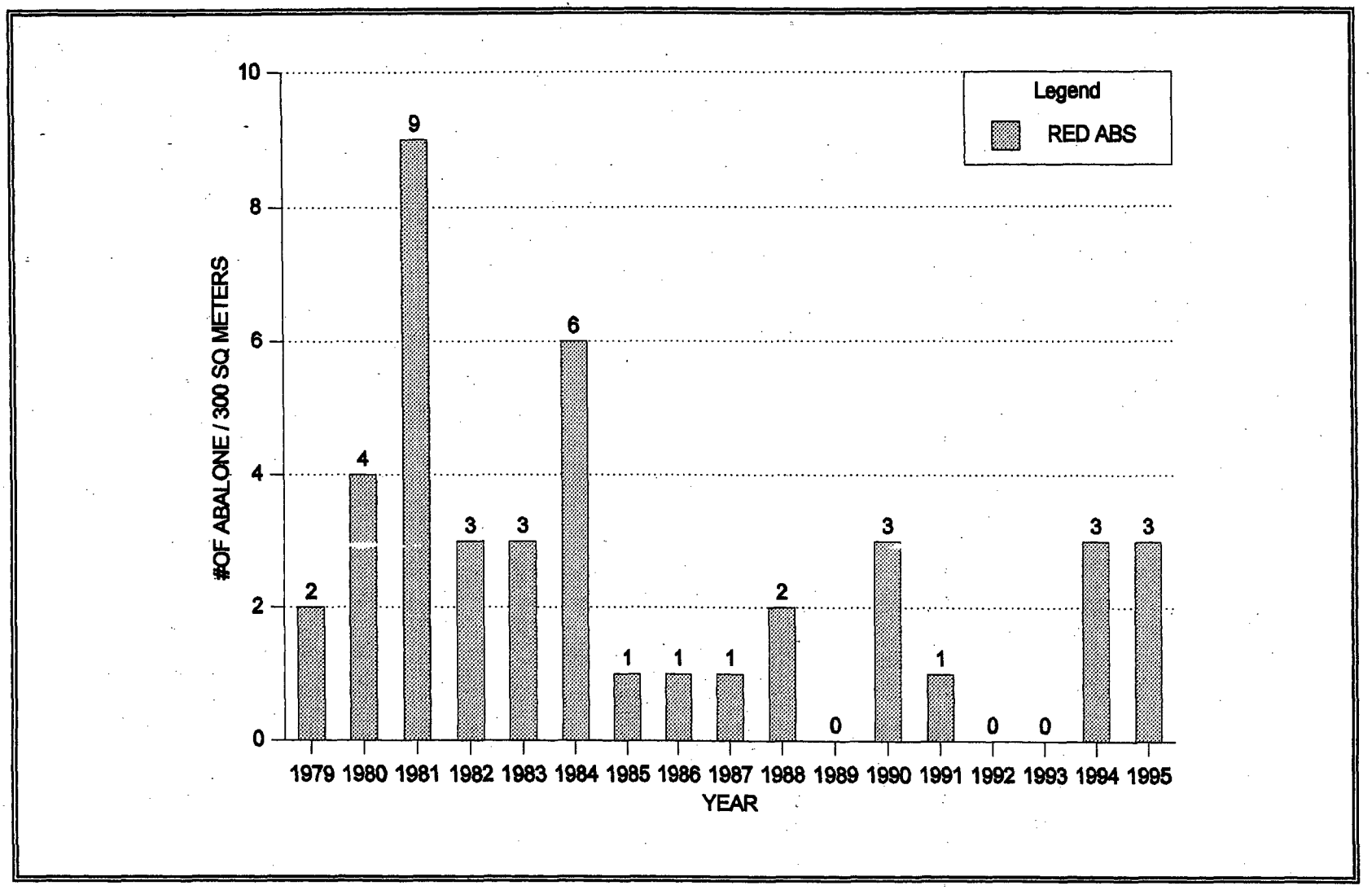


FIGURE 16
DENSITY OF RED ABALONE IN PECHO ROCK SUBTIDAL STUDY AREA 1979 - 1995

were not considered ecologically extinct like those of the Pecho Rock study area. After conducting a survey at two sites in Diablo Cove using same technique at a similar depth, and comparing the results with the two highest stations' densities for each species counted within the Pecho Rock study area, the results indicated greater similarities to Pecho Rock than the same site sampled last year (Figure 17).

Two Diablo Cove Stations (Table 5) located in "North Channel" were chosen for compatibility in depth and high relief rocky substrate to Pecho Rock stations. In addition, this area was selected because it represented the "best case" example of high red sea urchin densities in Diablo Cove. Historically, this area contained very high densities of Red Sea Urchins, typical to the historic high densities of the Pecho Rock area (Personal Observation 1974). Although the two specific 30m2 stations were randomly selected, the general area was "stratified" to represent historically optimal Red Sea Urchin habitat. This being the case, the results were then compared to the "best case examples" (two highest stations of similar depth) within the Pecho Rock study area (#s 4&5). Results of this comparison indicate, Red Abalone densities were virtually identical, Purple Urchin densities were within the same order of magnitude but, Red Urchin densities remain different. This difference may be one of substrate protection or this site has not had as much feeding pressure on this food source.

The item of interest this year is not the differences among Pecho Rock and Diablo Cove sites but the striking difference within the Diablo Cove area when compared to last year. Red Urchin densities of 42/30m2 recorded in 1994 in "North Channel" were comparable to 1976 Pecho Rock conditions after only one year of sea otter predation. The order of magnitude reduction in density to 5/30m2

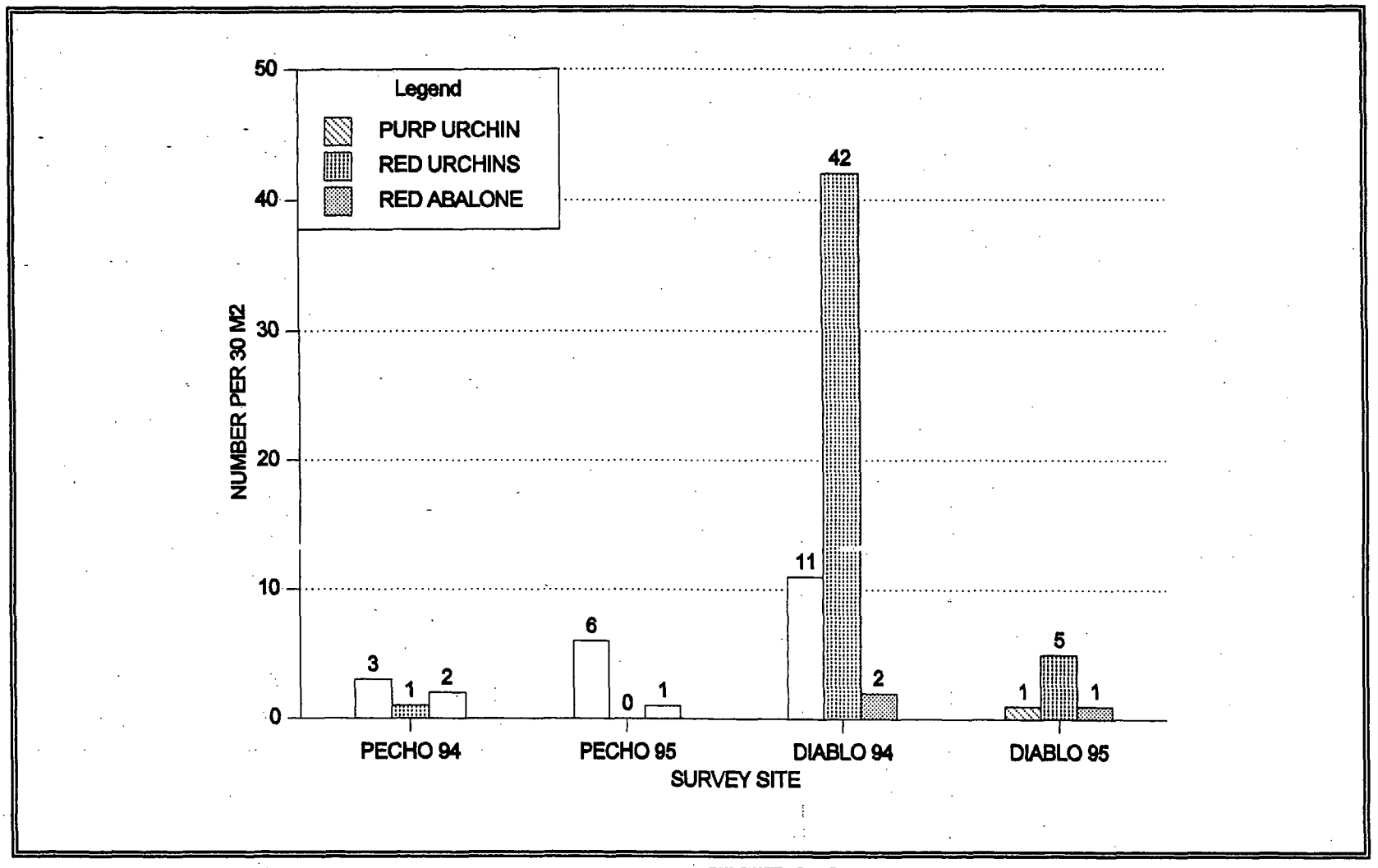


FIGURE 17
SEA URCHIN AND ABALONE DENSITY COMPARISONS BETWEEN PECHO ROCK AND DIABLO COVE 1994 & 1995

now resembles densities detected in the Pecho Rock area after two years of Sea Otter predation (Figure 15). The most plausible explanation for this extreme difference in Red Sea Urchin densities appears to be predation. The fact that Sea Otters now regularly inhabit this area strengthens this argument although no urchins have been observed being consumed here during the course of this years standard mid-day counts. But why such a wide difference between Red Urchins and only a little difference among Purple Urchin densities? This may be a result of their smaller size which makes them less attractive as a food source when compared to the larger Red Sea Urchin.

Similarly the comparable numbers of Red Abalone at both sites can be explained by crevasse size. Crevasse size at both sites may be too small to be helpful to the large Red Urchin with its' long spines and high profile, but large enough for successful abalone attachment which has a long low profile.

Tagged Sea Otter Observations:

A total of 33 different tagged sea otters have been observed since 1988. Several months after U.S. Fish & Wildlife Service began their translocation program to San Nicolas Island located 256 km southeast of the study area, returning sea otters were observed. All animals taken to San Nicolas Island were tagged with color coded hind flipper tags. Thirteen individuals returning from San Nicolas Island have been positively identified in the study area since 1988. An additional 15 animals were also spotted with tags, and although not positively confirmed, are probably animals returning from San Nicolas Island. The remaining five were from mainland sites North and South of the Study area. Tag observations in the study area generally confirm that at least some males and females move relatively large distances within their present range. However, most individuals prefer to remain in familiar area of a radius of 15 to 20km.

No tagged animals were detected within the study area this year. This is more likely a result of tag loss over time than due to lack of Sea Otter movement.

General Behavior:

Haulout behavior, remains common in the study area, but had decreased in the numbers of animals and in the location where it was observed. Sea otters continue to haul out individually and in groups. This behavior is demonstrated by males, females and pups of all sizes. It is directly related to physical events such as tidal height and swell condition and may also be related to water temperature and wind velocity. This behavior appeared to be more seasonally dependent than in years previous with increased sighting in the spring. Since this resting activity tends to save energy, it may be important and most useful during peak pupping periods and in areas of higher energy demand (e.g. colder water or sever weather) or lower forage density.

Most of the haul out sites remain on nearshore wash rocks covered with the alga Endocladia. There are exceptions. Sites also include bare rock, and sandy shoreline. No new sites were observed this year (Figure 18). There is a total of 20 documented sites in the study area. The abundance of protected wash rocks, remote beaches and little or no human harassment, give the sea otters the combined conditions necessary for a safe haul out.

In order to be consistent, only data collected during normal counts are included on Figure 18. It is

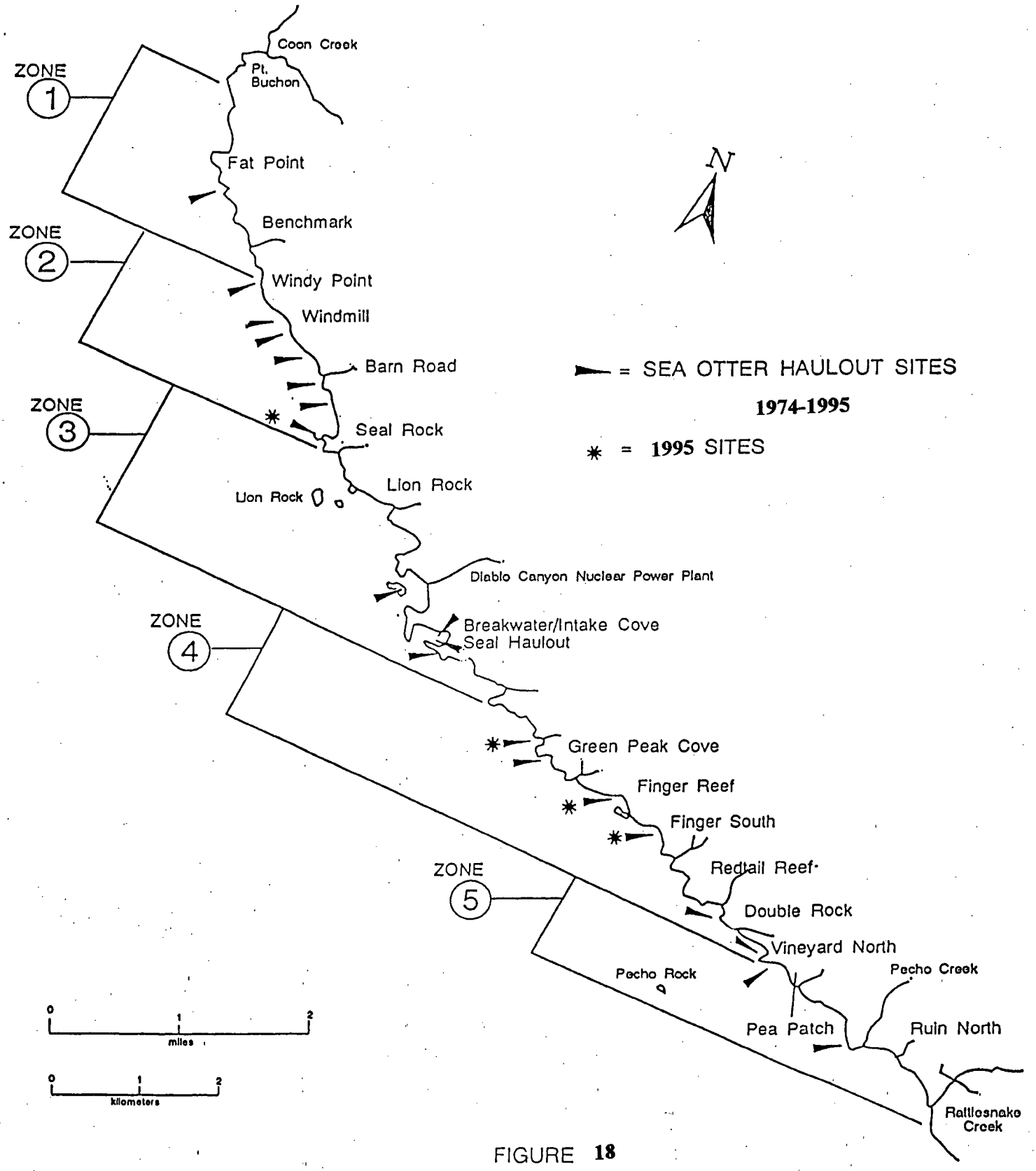


FIGURE **18**

A SUMMARY OF THE DOCUMENTED SEA OTTER HAULOUT SITES IN THE VICINITY OF THE DIABLO CANYON POWER PLANT

important to mention that additional haul out behavior was observed within the Intake Cove during night-time and early morning observations. Haul out behavior appears to be numerically higher at night (Appendix I).

Daytime use of the Intake Cove by resting sea otter has increased in both frequency and number. Most animals are unalarmed, yet aware of typical boat and kelp cutting activities. Routine human activities around and within the cove are easily tolerated. However, unusual or direct confrontations with the sea otters still illicit an avoidance response where some animals will exit the cove if they feel threatened by unusual human activity. This avoidance behavior is short-term and individuals have been observed returning to rest within minutes of cessation of unusual activities within the cove. This avoidance response does not appear to effect long-term use of this area.

The increasingly popular near-shore skiff fishery activities appears to have scattered resting groups of Sea Otter. This is indicated by their dispersal and activity when these skiffs are present.

SUMMARY

1995 Sea Otter Survey

--The mean population has increased from a three year annual mean of 60 to an annual mean of 70.

--Fluctuation in population size displayed a seasonal "storm" dip in the winter and a "pup spike" in the spring.

--The majority of the population is composed of females and pups which account for 95% of the total. On average, pups accounted 16% of the overall population. This number is said to be indicative of a healthy population.

--The use of Diablo Cove and Intake Cove has increased in frequency of occupation since last year.

--The category of "small mollusc" which also includes very small food items remains the dominant food source and has reached an all-time high. Abalone has reached an all-time low.

--Red Sea Urchins are still considered "ecologically extinct" within the Pecho Rock subtidal survey area. Purple Urchins remain dominant, and have increased in both density and size.

--Density differences in subtidal Red Sea Urchins between Diablo Cove and Pecho Rock is probably due to predation levels by Sea Otters.

--No tagged sea otters were observed in the study area. This is probably due to loss of ageing tags rather than lack of sea otter movements.

--Sea otter haul out behavior decreased in number of sites and animals within sites. Observation frequency remains relatively stable. There are 20 known haul out sites within the study area but only four were observed being used this year. Night observations indicated that haul out activity increases.

-- Sea otter disturbance by atypical human activity scatters and displaces individuals but appears to short term in duration.

REFERENCES

Benech, S.V., 1979. Sea otter Activities Within the Vicinity of the Diablo Canyon Power Plant 1973 to 1978, Cal-Neva. Wildlife, 1979: 33-44.

Benech, S.V., 1993. observations of the Sea Otter Enhydra lutris Population between Point Buchon and Rattlesnake Creek, San Luis Obispo, California January through December 1993. Unpublished Report. 67pp.

Estes, James et al. 1986. Activity-Time Budgets of Sea Otters in California. J. Wildl. Manage. 50(4):1986 p626-636.

Estes, James et al. 1989. Extinctions in Kelp Forest Communities, Conservation Biology, Vol.3,#3 Sept. 1989, p252-264.

Garshells, David L., 1983. Ecology of Sea Otters in Prince William Sound, AK PhD Thesis.

Hatfield, Brian, 1995. Personal Communication, U.S.Dept. of Interior, National Biological Service, Piedras Blancas Research Stn. San Simeon, CA.

Kenyon, K.W., 1969. The Sea Otter of the Eastern Pacific Ocean, U.S. Bur. Sportfish. & Wildl. No. Amer. Fauna (68).

Levitan, Don R., Mary A. Sewell,& Fu-Shiang Chia, 1992. How Distribution and Abundance Influence Fertilization Success in the Sea Urchin Strongylocentrotus franciscanus. Ecology, 71(1), 1992, pp 248-254.

PG&E, 1981. Environmental Investigations at Diablo Canyon 1979-1980 Unpublished Report, Chapter XII p.35.

Ralls, Katherine, B.B. Hatfield, & D.B. Siniff, 1995. Foraging patterns of California Sea Otter as indicated by telemetry, Can. J. Zool. 73: 523 - 531 (1995).

Riedman, M.L. et al. 1994. Breeding Patterns in California Sea Otters. J.Wildl.Manage. 58(3), 1994. p391-398.

Schroeter, Stephen C., 1978. Experimental Studies of Competition as a Factor Affecting the Distribution and Abundance of Purple Sea Urchins, Strongylocentrotus purpuratus (Stimpson), PhD. Dissertation, Univ. Ca. Santa Barbara 1978, p85-92.

Vanblaricom, G. R., and J.A. Estes; Editors 1988. Ecological Studies, Vol. 6. The Community Ecology of Sea Otters. Springer-Verlag, N.Y. 247pp.

APPENDIX I

NIGHT OBSERVATIONS

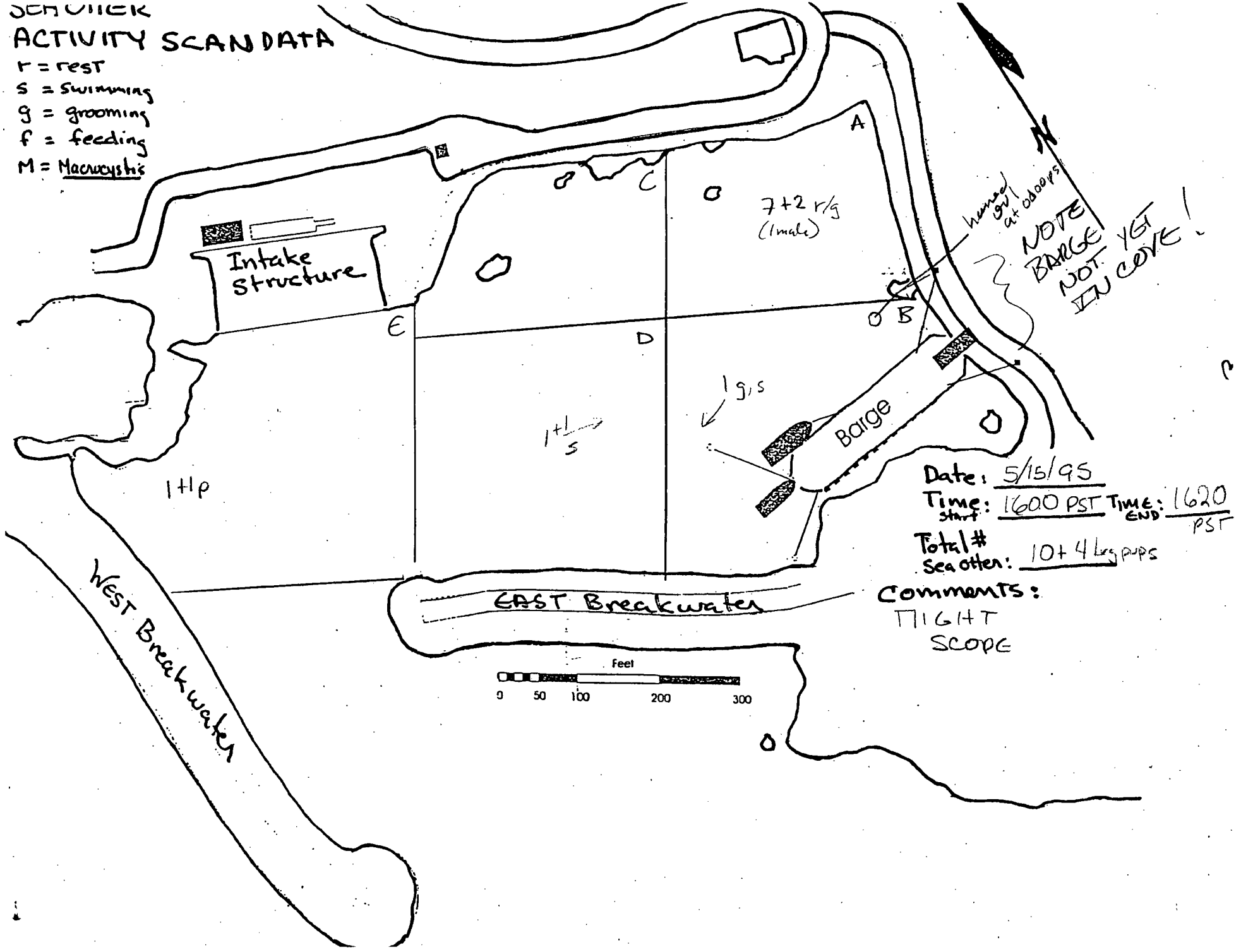
ACTIVITY SCANS DURING BARGE DELIVERY OPERATIONS

SEA OTTER ACTIVITY SCANS

DATE: 5/16/95
GENERAL LOCATION: INTAKE cove
OBSERVER: SVB/AJF

Pre-Activity

TIME (pst)	LOCATION (Zone)	NO.	ACTIVITY	TOTAL Intake Cove
0200	A	6+1p	5+1pup rest & 1 swim across Cove	
	B	3+1p	hauled out near boat dock	9+2
0230	A	5	1 hauled out 4 rest kelp	
	B	3	3 hauled out near boat dock	
	C	1+1p	1+1p grooming	
	E	1+1p	1+1p grooming	10+2
0300	B	5+1p	2+1 hauled out near dock 2 hauled out mid cove	
	A	4+2p	1 ♂ swimming 3+2 pups rest in kelp	
	C	3+2p	1 hauled 2♀+2pups rest in kelp	12+5
0400	A	4+2p	rest macro kelp	
	B	2+1p	hauled out near dock	
	C	3+2p	resting & grooming	
	D	4+2p	Grooming, Swimming & pupcaring	13+7
0500	A	9+3p	scattered in kelp Raft (1 hauled out)	DAYLIGHT
	B	2+1p	no kelp but at rest	
	C	10+4p	6+2 hauled out on Rks 4+2 rest in kelp	
	E	1	swimming out of Cove	22+9
0515			64 otters depart cove (may have missed some hauled out before)	
0530	still more		animals leaving cove (Photos)	roll #2
0600	A	14+2p	1+1 hauled out, others rest kelp	
	D	7+7p	2+2 hauled out	
	E	1+1p	rest in Macro at breakwater	22+10
0715	A			
	C			
	D			
	E	3+2		19+7


SEA OTTER
ACTIVITY SCAN DATA
r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis
A
B
C
D
E
7+2 r/g (1 male)
Intake Structure
1 g, s
1+1 s
1+1 p
Barge
NOTE BARGE NOT YET IN COVE!
Date: 5/15/95
Time start: 1600 PST
Time END: 1620 PST
Total # Sea otter: 10+4 kelp pups
Comments:
TIGHT SCOPE
EAST Breakwater
WEST Breakwater
Feet
0 50 100 200 300

SEA OTTER ACTIVITY SCANS page 1 of 3

DATE: 5/15/95 Clear / high clouds / rain / calm
GENERAL LOCATION: INTAKE COVE
OBSERVER: SVB / AGF

Pre-Activity

TIME (pst)	LOCATION (zone)	NO.	ACTIVITY	TOTAL in Intake Cove
1600	A	7+2p	rest in macro (male checking females	
"	B	1	grooming & swimming	
"	D	1+1p	swimming toward "A" group	10+4p
"	C	1+1p	grooming	
1700	A	11+5p	rest in kelp	12+6p
"	C	1+1p	rest in kelp	
1800	A	12+6p	rest in kelp	13+7p
"	C	1+1p	grooming then in 10 minutes moved into group pup tried to feed off 3 others in mothers ignored it	mothers ignored it
1900	A	11+5p	rest in kelp	
"	B	1+1p	rest near docks	13+7p
"	D	1+1p	grooming	
1945	~~DARK~~		rain prevented set up of Night Scans	
2000	A	8+3p	rest in kelp	
"	B	2+1p	near boat dock	10+4p
2100	A	7+5p	1+1 grooming others at rest in kelp	
"	B	1+1p	grooming & swim at dock (Full moon moon rise)	8+6p
2200	A	8+4p	1♂ checking ♀'s & harassing pups, Animals scattered	
"	B	2+1p	at rest near dock	10+5
2300	A	11+5p	6 grooming 5+5 pups rest least 1 pup feeding most scattered at	
"	B	1+1p	rest in macro near boat dock	12+6p
0000	A	9+5p	rest & grooming most in Macro	
"	B	3+1p	grooming & foraging	
"	C	1+1p	rest in kelp (macro)	13+7p
0100	A	8+4p	rest in Macro widely scattered	
"	B	1+1p	hauled out on wash rock w/pup	
"	C	2+1p	♂ chasing female, pup crying	11+6p

* SEA OTTER ACTIVITY SCANS

During BARGE ACTIVITY

DATE: 5/21/95 – 5/22/95
GENERAL LOCATION: INTAKE COVE
OBSERVER: SVB / AJF / JER

High overcast
Calm seas
Light winds

TIME (pst)	LOCATION (ZONE)	NO.	ACTIVITY	TOTAL
1830	A	3+2p	grooms & resting	
"	F	1+1p	foraging SM crab entering cove?	4+3p
1900	A	3+2p	resting in Macro	
	C	1+1	Grooming	
	D	2+2	swimming toward A	
	F	1+1	Swiming toward A	7+6
DARK 2000	A	5+4?	rest/groom Macro (hard to see pups in macro)	
	C	2+2	1+1 hauled out / 1+1 r macro	7+6
2100	A	7+5	rest macro	
	C	2+2	1+1 s, 1+1 R(M)	9+7
2200	A	6+4	r	
	C	3+3	2+2 hauled out; 1+1 s toward F	
				9+7
2300	A	5+3	r (pups particularly noisy)	
	C	2+2	1+1 s toward D; 1+1 g.	7+5
2400	A	5+3	R	
	C	2+2	Haul out	
5/22 0100	A	4+3	R macro	
	C	3+2	2+2 rest macro 1 S	7+5
0200	A	4+3	3 rest & 1 g	
	C	5+3	4+2 hauled out 1+1 S to A	9+6
shot some video 0300	A	6+4	1 Groomig ♂, others R in (M)	
	C	3+3	1+1 g 1+1 R (M) 1+1 hauled out	9+7
0400	A	7+5	5+4 pups R(M) 1 naked, 1+1 R(M)	
	C	2+2	1+1 R (M) 1+1 R(M) Pup drifted from mom & came back again (mom came to check)	9+7

swells 3.5 ft < 4 ft ok for barge entry

* obs after cove prep for barge & then barge entry

SEA OTTER ACTIVITY SCANS

DURING BARGE ACTIVITY

DATE: 5/22/95
GENERAL LOCATION: Intake cove
OBSERVER: SVB

TIME (pst)	LOCATION	NO.	ACTIVITY	TOTAL
0450			tug entering cove	3+2
			one pair depart now →	2+1
0520			kelp cutter & DIVE BOAT moved	
0540	F	1+1	1+1 reenter cove S to C	
	C	2+1	1+1 R(M), 1	3+2
0600	C	1	rest in	
	E	2+2	moved from C to pit	
	F	1	1 foraging at mouth of cove	4+2
0620	———		tug departed cove	
			standby – need <12k	

SEA OTTER ACTIVITY SCANS page 3 of 4
DURING BARGE ACTIVITY

DATE: 5/22/95
GENERAL LOCATION: INTAKE COVE
OBSERVER: SVB / AJF / JER

TIME (pst)	LOCATION ZONE	NO.	ACTIVITY	TOTAL
0500	A	0	MOST otters departed cove A10s to Activity	≈ 0430 pst
	C	3+2	when 1st tug arrived	3+2
			hauled out animals returned to water	
			all watched tug 2 more concerned than on 4/1/94	
0600	C	1	Project put on stand by	3+2
	E	2+2	meeting at 0700 to decide	
	F	1	what to do	4+2
0700	C	1	R (M)	
	E	1+1	R (M) in "pit"	2+1
0800	C	2+1	rest macro near underwater	
	E	1+1	rest macro in Pit	3+2
0900	C	1	rest	
	E	4+2	1 grooming 2+2 rest 1 foraging kelp crabs	5+2
1000	———	———	Project restart - barge enroute	
1100	———	———	Barge in site Coast Guard Clean Seas	———
1100	E	4+2	rest	4+2
1115			Tug enters cove other	
			cross path heads for C	

SEA OTTER ACTIVITY SCANS page 4 of 4
DURING BARGE ACTIVITY

DATE: 5/22/95
GENERAL LOCATION: INTA
OBSERVER: SKB

TIME (pst)	LOCATION	NO.	ACTIVITY	TOTAL
1131	—		TUG Departs Cove	
1131	C	1	Foraging Crabs and swimming W	
1131	F	1	swimming across W at mouth	2
1143	E	1+1	enter cove go to pit look around	1+1
			and then head out of cove W	
			way and then turns around	
1145	—	—	male & female 1 1 depart Cove	~~0~~
1200			BARGE on its way	0
1235			BARG in Cove No Otter	
1300	—	—	—	~~0~~
1340	A	1	MADE a loop at ♂	
1350			Cancer Crab moved to	
1354			mouth of cove from	
1400			Fire/Hasmat safety	
			Asked to Put up boom	0
			SAID YES.	
1415	—	—	No otter in cove	
1500	—	—	—	0
1530			Oil containment boom deployed	
1600	—	—	no otter in cove	0

SEA OTTER ACTIVITY SCANS

During Activity

DATE: MAY 25, 1995
GENERAL LOCATION: INTAKE COVE - Barge in place / all off loaded NO ACTIVITY
OBSERVER: SNB / AJF Spill boom runs from E to F (east line of E to F.

TIME (pst)	LOCATION	NO.	ACTIVITY	TOTAL
1830	E	1+1	1+1p R (M) in kelp corner	
	A	2+1	1+1p R (M) 1g / large pup	
	B	1	♂ foraging (small wt. semi-soft)	4+2p ≈ 5cm Diam
1900	E	2+2	rest in macro kelp bed	
	A	2+1	rest in macro " "	
*	BDF	1	♂ foraging / then SWAM out of cove	5+3p
2000	A	2+1	R in macro	
	C	1+1	R in macro	
	E	2+2	R in macro	5+4p
2100	A	3+1	R - -	
	C	1+1	R - -	
	E	2+2	R - -	6+4
2200	A	3+1	R - -	
	C	1+1	R - -	
	E	2+2	R - -	6+4p
2300	A	3+1	R - -	
	C	1+1	R - -	
	E	2+2	R -	6+4p
2400	A	3+1	1S 2R w/p	
	C	2+2	1S 1R w/p	
	E	1+1p	1R	6+4p
5/26 0100	A	1+1p	1S	
	C	3+1	2 haulout 1 swim	
	E	2+2	R	6+4p
			SEE NEXT PAGE	

* otter swam to about 2m off boom at southern edge near E. Breakwater and dove under, came up about 3m on other side then swam on surface

SEA OTTER ACTIVITY SCANS

Diving Activity

DATE: MAY 26, 1995
GENERAL LOCATION: INTAKE COVE
OBSERVER: SVB / AJF

BARGE IN PLACE
Spill boom runs
EAST SIDE % (E&F)

	TIME (pst)	LOCATION	NO.	ACTIVITY	TOTAL
*	0200	A	3+2	rest kelp	
		C	5+4	3+2 R, 1+1 foraging pupcaying, 1+1 hauled out	
		E	2+1	R, macro	10+7
→	0300	A	3+2	Rest macro / Also saw Harbor Seal	
		C	3+2	Rest macro	
		D	1+1	Swimming toward entry Cove	
		E	2+1	R macro	9+6
→	0400	A	5+2	R, (M)	
		C	2+1	2R, (M), 1+1 swimming N.E.	
		E	3+2	R, (M)	10+5
	0430	———	———	Human Activity Increases CRANE/MOVE STUFF	DAYLIGHT DEMOB BEGINS
	0500	C	4+2	1R, 1+ swimming & hauled out, 1+1 hauled out	
		E	5+3	Rest macro	9+4
	0515	went to video		hauled out arms & bat went dead	
				2+2 departed haulout	
				& exited boom on S. side	
	0545	—> JIM et al removed spill BOOM			
	0600	C	1+1	1+1 head mom+1 enter cove & wrap in kelp	1+1
				behind rocks near Intake	
	0645			Begin removal of mooring Lines	

* Low tide/notably 2 otters & no harbor seals hauled out

hauled out

9

1 of 1

SEA OTTER ACTIVITY SCANS page 3 of 4

Diving Activity

DATE: 5/26/95
GENERAL LOCATION: INTAKE COVE
OBSERVER: SVB

TIME (pst)	LOCATION	NO.	ACTIVITY	TOTAL
0650	C	2+1	1 foraging, 1+1p R M	2+1
0700	C	2+1	1 f, 1 R 1+1p, Macro in rocks	
0725			Begin to remove last mooring	at N side
0740		3+1	2 s, 1+1 R (m)	3+1
			BARGE out of Cove	
0800	C	1+1	Rest Macro	
	E	2	Rest macro	3+1
0800			N. Diablo Cove Rst macro	7+4pups

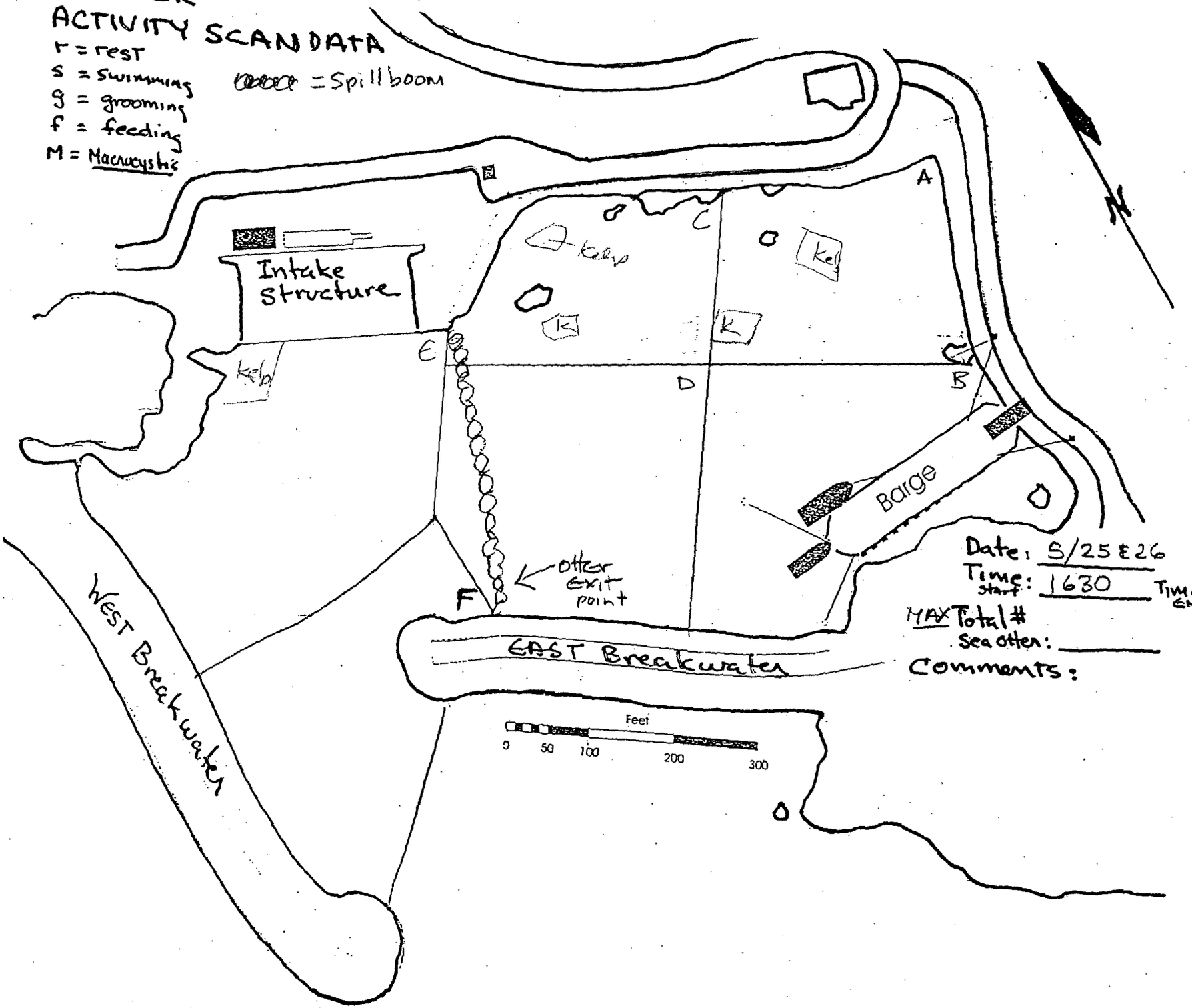
USING DIABLO

SEA OTTER

ACTIVITY SCAN DATA

r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis

= Spillboom



Date: 5/25 & 26

Time start: 1630 TIME END: _____

MAX Total # Sea otter: _____

Comments:

OBSERVER: SVB

7/7/7

SEA OTTER ACTIVITY SCANS page 1 of 2

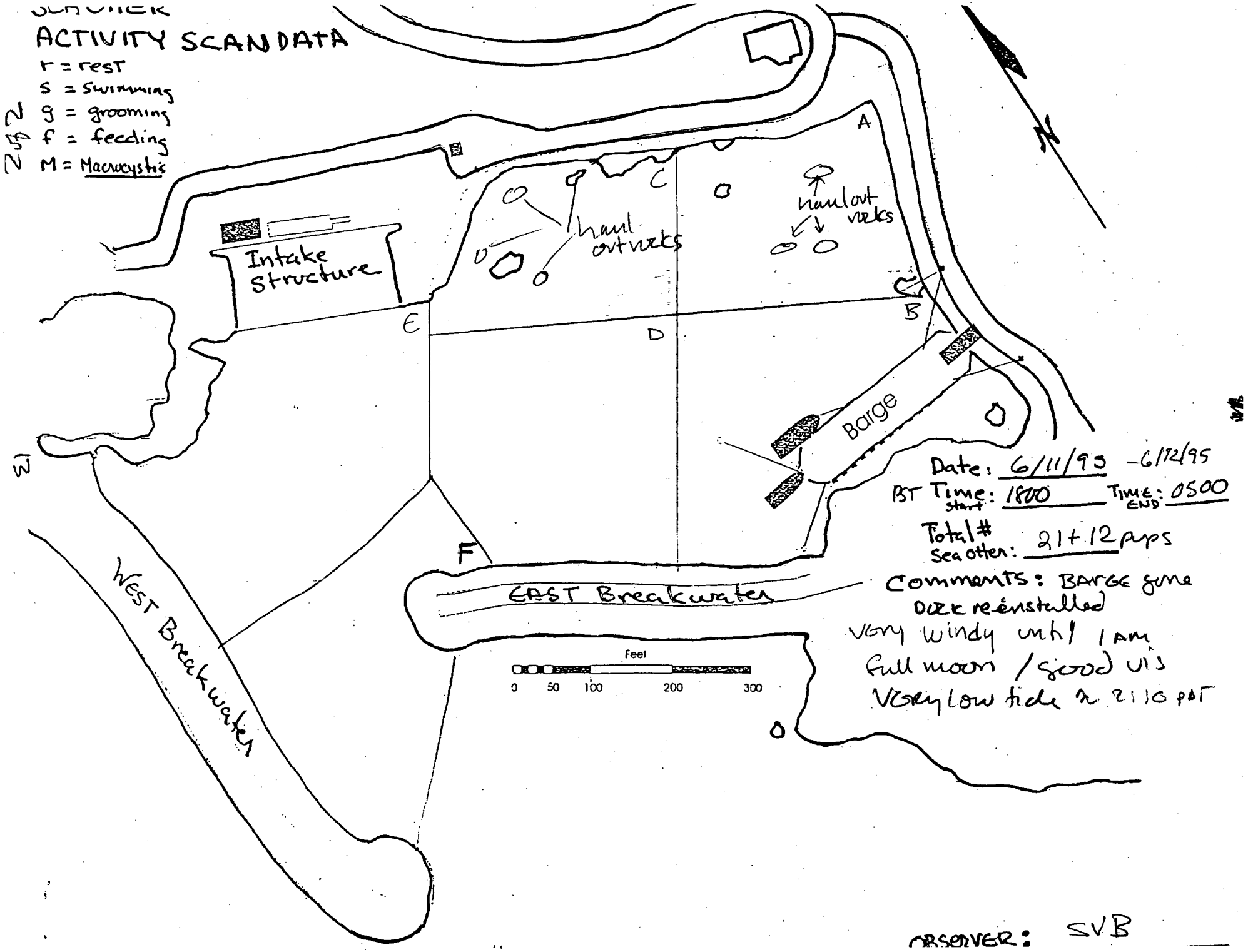
(Post Activity)

DATE: 6/11/95
GENERAL LOCATION: INTAKE COVE
OBSERVER: SVB / AJF

rough & windy seas

TIME (pst)	LOCATION	NO.	ACTIVITY	TOTAL
			← BOTH WOOLIE PUPS	
1800	C	2+2	1+1 swiming to D 1+1 foraging	2+2
1900	C	1+1	Grooming (herself & pup)	1+1
DARK→ 2000	A	5+3	3+2 REST N. MOST 1s & 1+1 r S. kelp	
	C	1+1	rest kelp & rocks	6+4
2100	A	6+4	5+3 rest 1+1 foraging on Crab	
	C	3+2	2+1 swimming 1+1 rest kelp	9+6
2200	A	6-4	2 swimming 1 rest	
	C	4-3	1 groom 2 rest 1 swim	10+7
2300	A	6-4	rest.	
	C	4-3	3+2 Haul out. 1+1 swim	10+7
2400	A	15:7	Resting	
6/12/95	C	4-3	2+2 Haul out 1+1 Rest	19+10
0100	A	16-7	Resting	
	C	5-3	3 haul out.	20+10
0200	A	8+3	1+1 hauled out 7+2 scattered active	
Woolie Pups	C	8+4	all hauled out on scattered rocks	16+8
0300	A	13+6	1+1 haued out others Rest in kelp	
	C	8+6	6+4 hauled out others swim & rest in kelp	21+12
First Glow 0400	A	12+6	2+1 hauled out others Scatter in kelp	
	C	8+6	6+5 hauled out 2+1 R in kelp	20+12
LIGHT→ 0500	A	12+6	4+2 hauled out others Resting Swimming	
	C	7+6	all but (2+1) hauled out on wash rocks	
	F	1	Swimming out of Cove	20+12
0515	~		more activity animals moving out	~

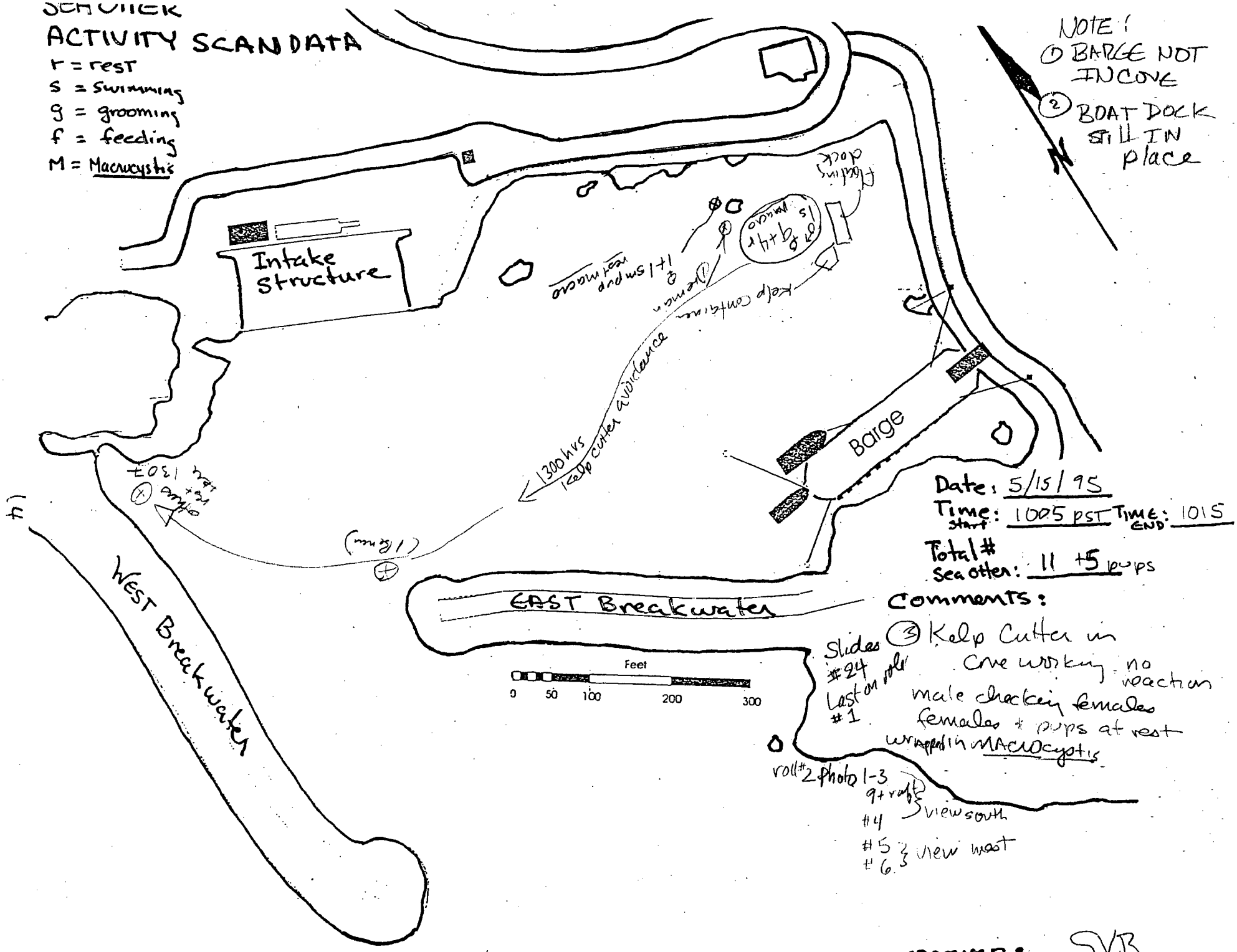
pups crying


ACTIVITY SCANDATA
r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis
Intake Structure
haul outrocks
haul out rocks
A
B
C
D
E
F
Barge
EAST Breakwater
WEST Breakwater
Feet
0 50 100 200 300
Date: 6/11/95 - 6/12/95
PST Time: start 1800 END 0500
Total # Sea otter: 21 + 12 pups
Comments: BARGE gone
DOCK reinstalled
VERY windy until 1 AM
Full moon / good VIS
VERY low tide @ 2110 PST
OBSERVER: SVB

SCHOOL

ACTIVITY SCANDATA

r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis



NOTE:
① BARGE NOT IN COVE
② BOAT DOCK STILL IN place

Date: 5/15/95
Time: start 1005 PST TIME: END 1015
Total # Sea otter: 11 +5 pups

Comments:
Slides #24 Last on roll #1
③ Kelp Cutter in Cove working, no reaction
male chasing females
females + pups at rest wrapped in Macrocystis

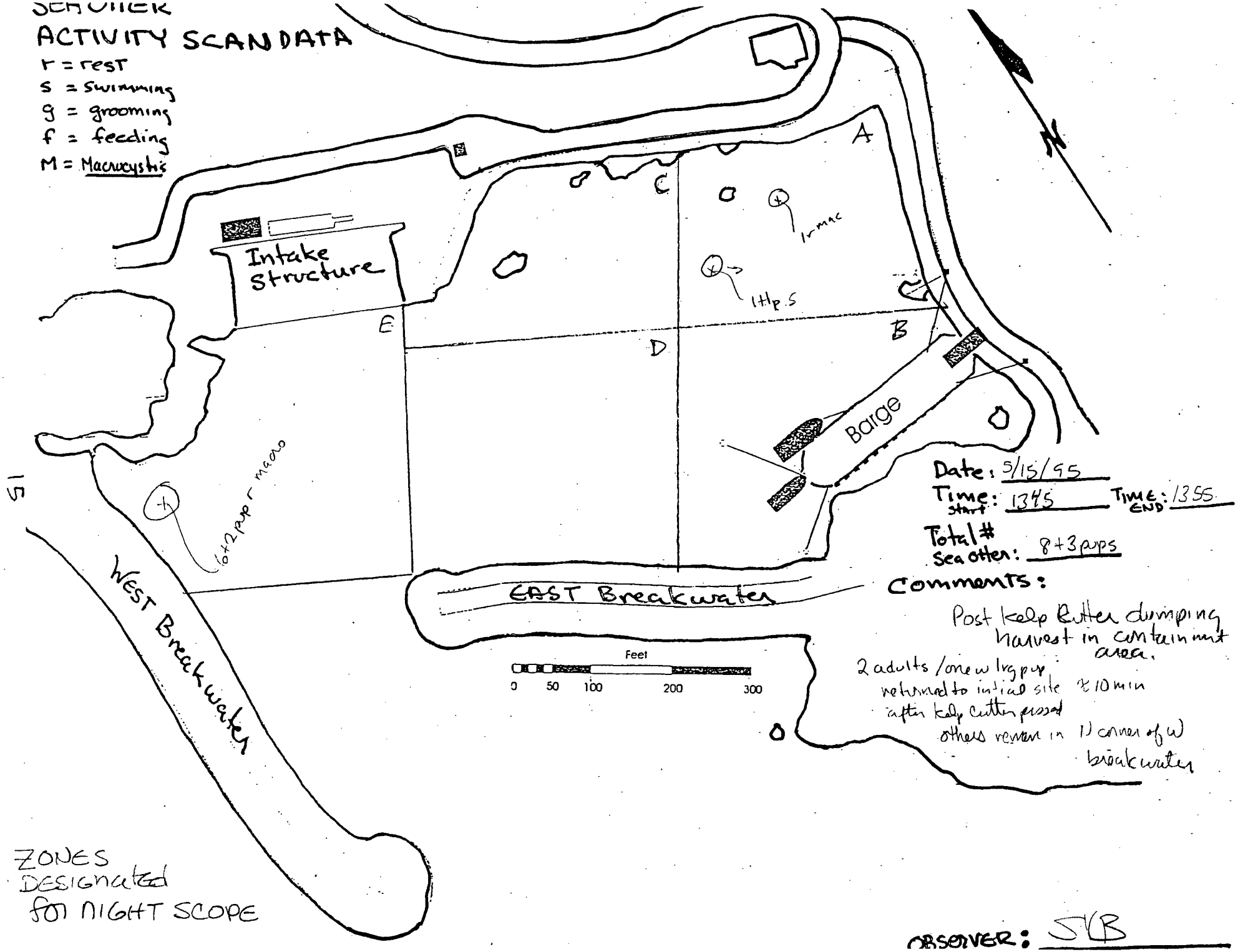
roll #2 Photo 1-3 q+ raft
#4 } view south
#5 } view west
#6

OBSERVER: SVB

SCHUMER

ACTIVITY SCAN DATA

r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis



Date: 5/15/95
Time start: 1345 Time END: 1355
Total # sea otter: 8+3pups

Comments:

Post kelp cutter dumping harvest in containment area.

2 adults / one w lrg pup returned to initial site ~10 min after kelp cutter passed others remain in N corner of W breakwater

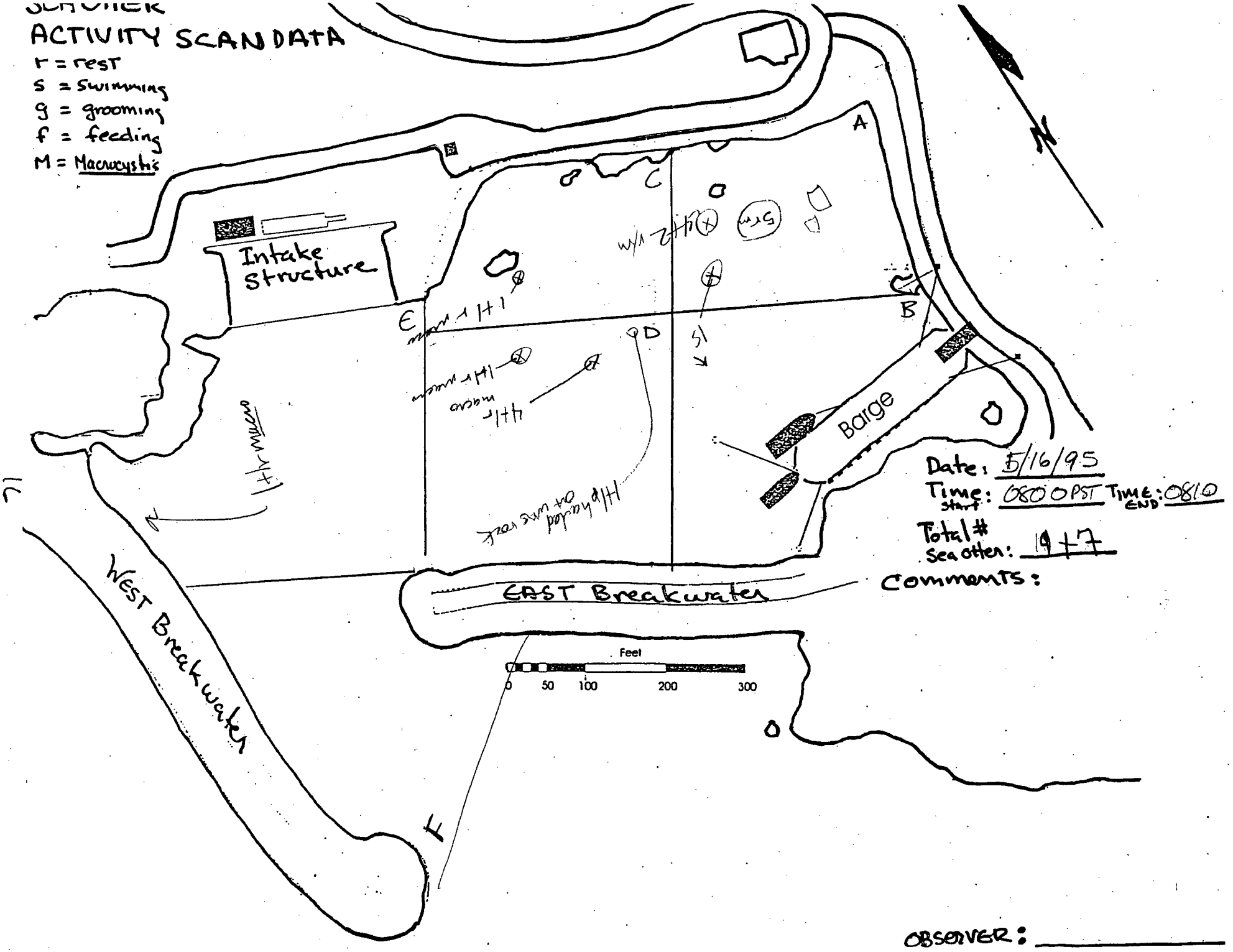
ZONES DESIGNATED FOR NIGHT SCOPE

OBSERVER: SKB

SEA OTTER

ACTIVITY SCAN DATA

r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis



Date: 5/16/95

Time: start 0800 PST TIME: END 0810

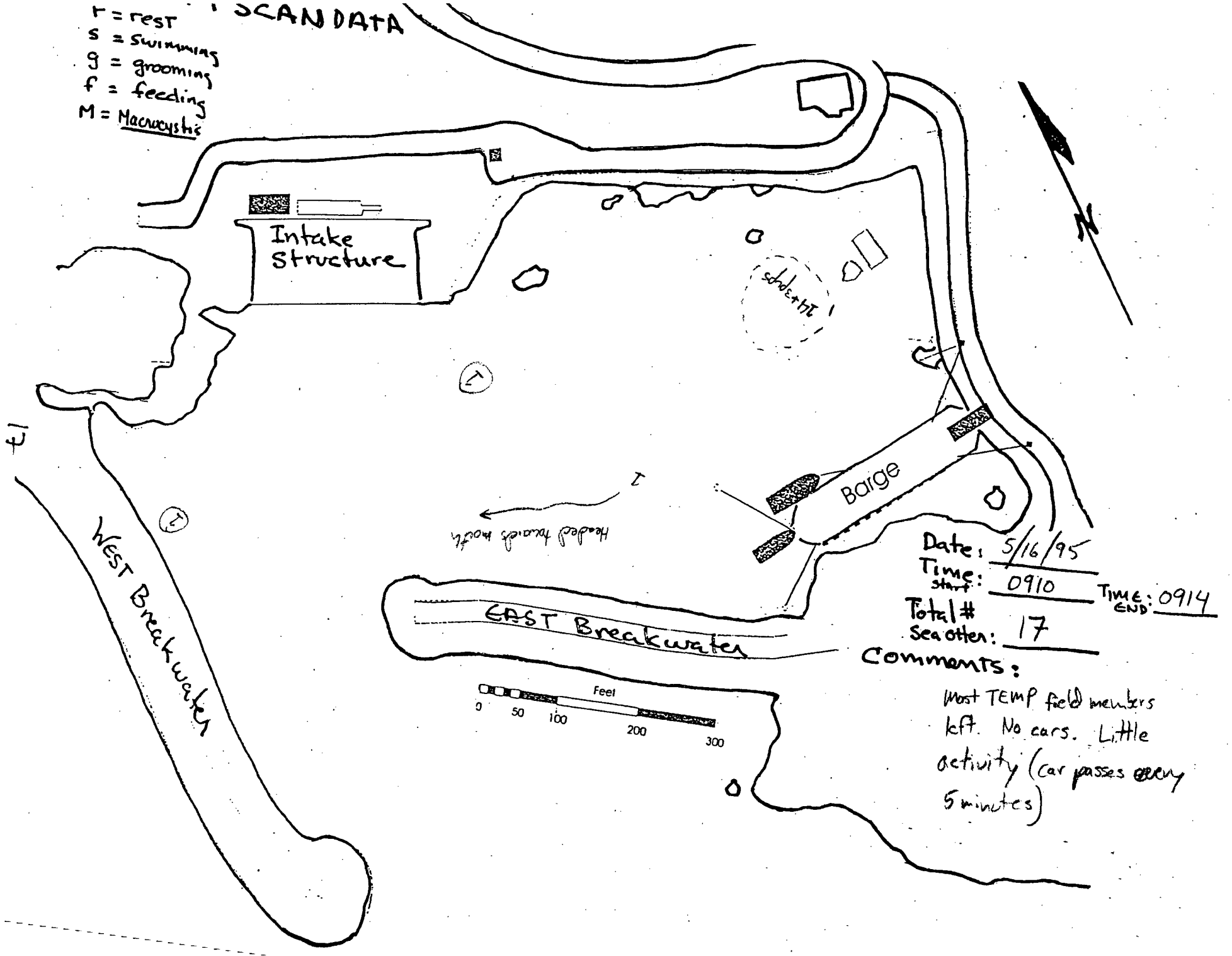
Total # Sea otter: 19+7

Comments:

OBSERVER: _____

r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis

SCANDATA

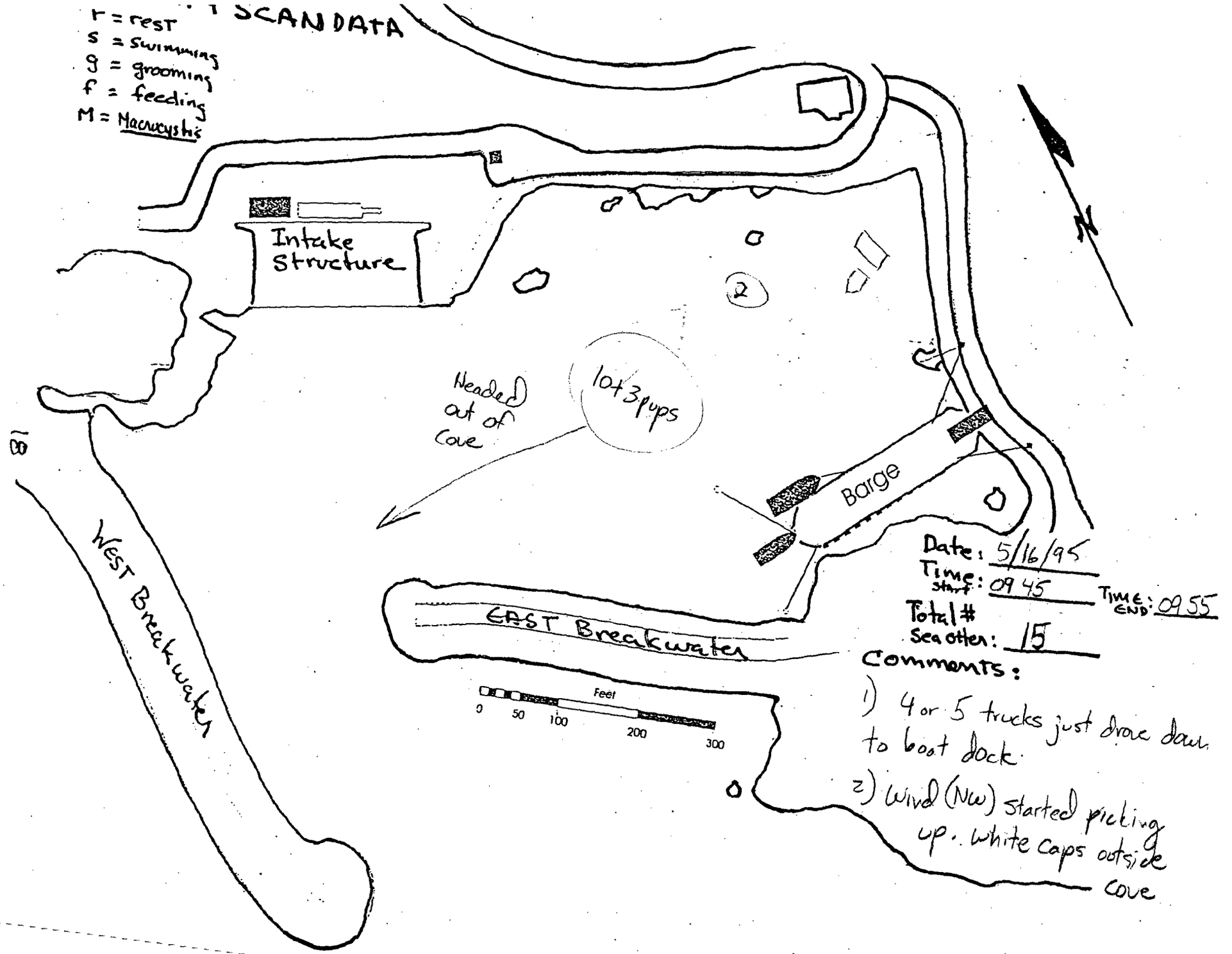


Date: 5/16/95
Time start: 0910
Time end: 0914
Total # Sea otters: 17

Comments:
Most TEMP field members left. No cars. Little activity (car passes every 5 minutes)

r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis

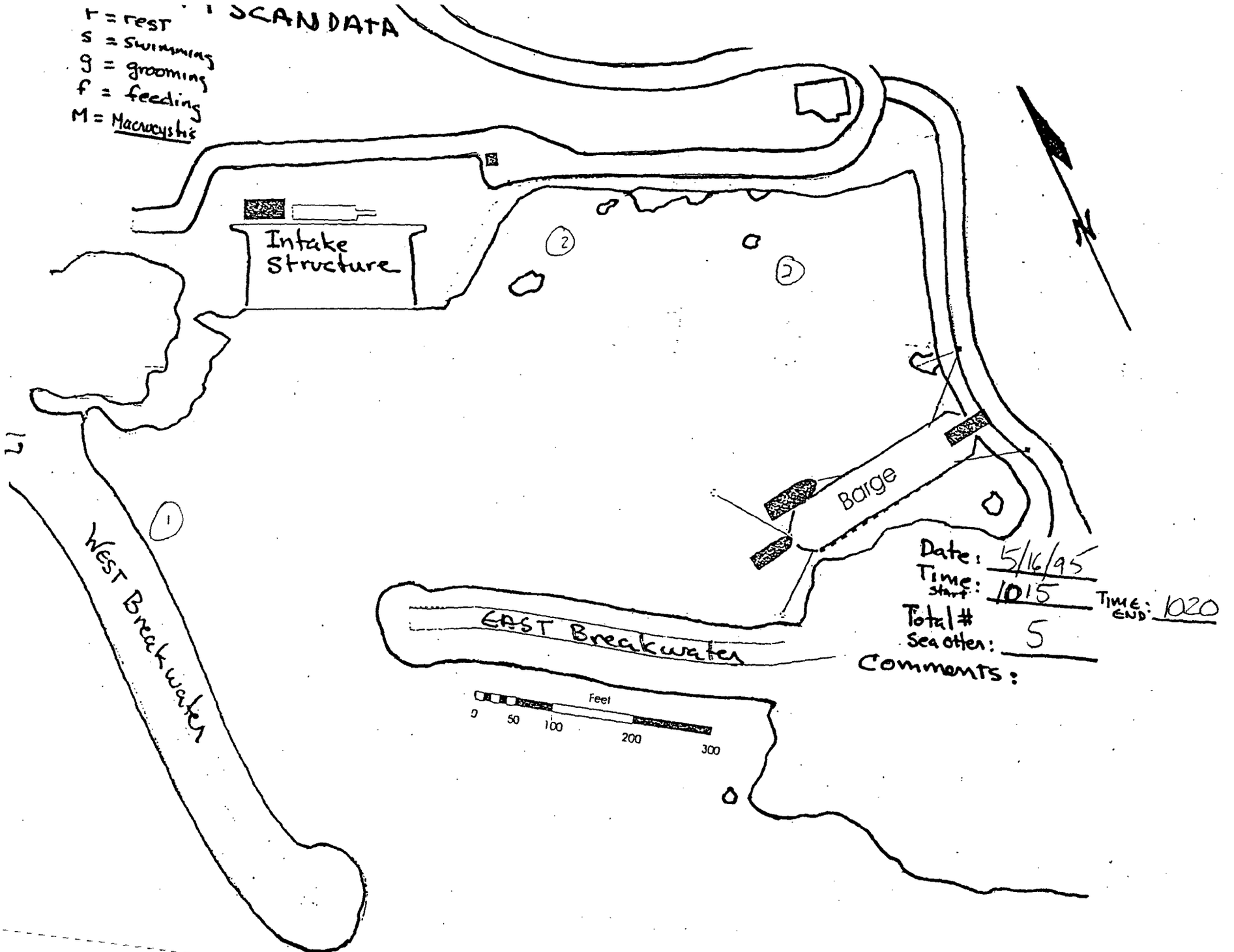
SCANDATA



Date: 5/16/95
Time start: 09 45
Time end: 09 55
Total # Sea otter: 15

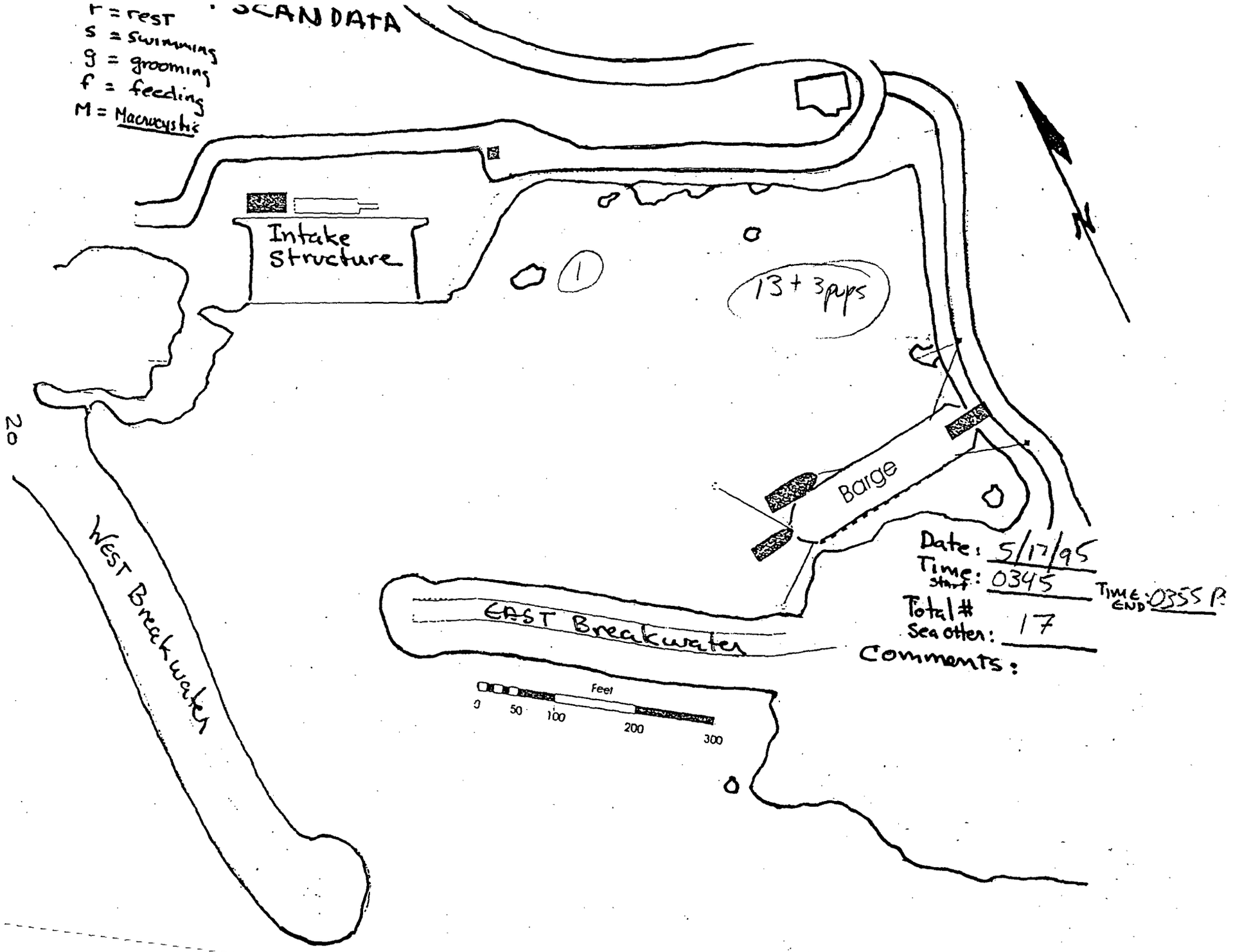
Comments:

1) 4 or 5 trucks just drove down to boat dock.
2) Wind (NW) started picking up. White caps outside Cove


r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis
SCANDATA
Intake Structure
Barge
WEST Breakwater
EAST Breakwater
Feet
0
50
100
200
300
Date: 5/16/95
Time start: 1015
Time end: 1020
Total # Sea otters: 5
Comments:

r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis

SCANDATA

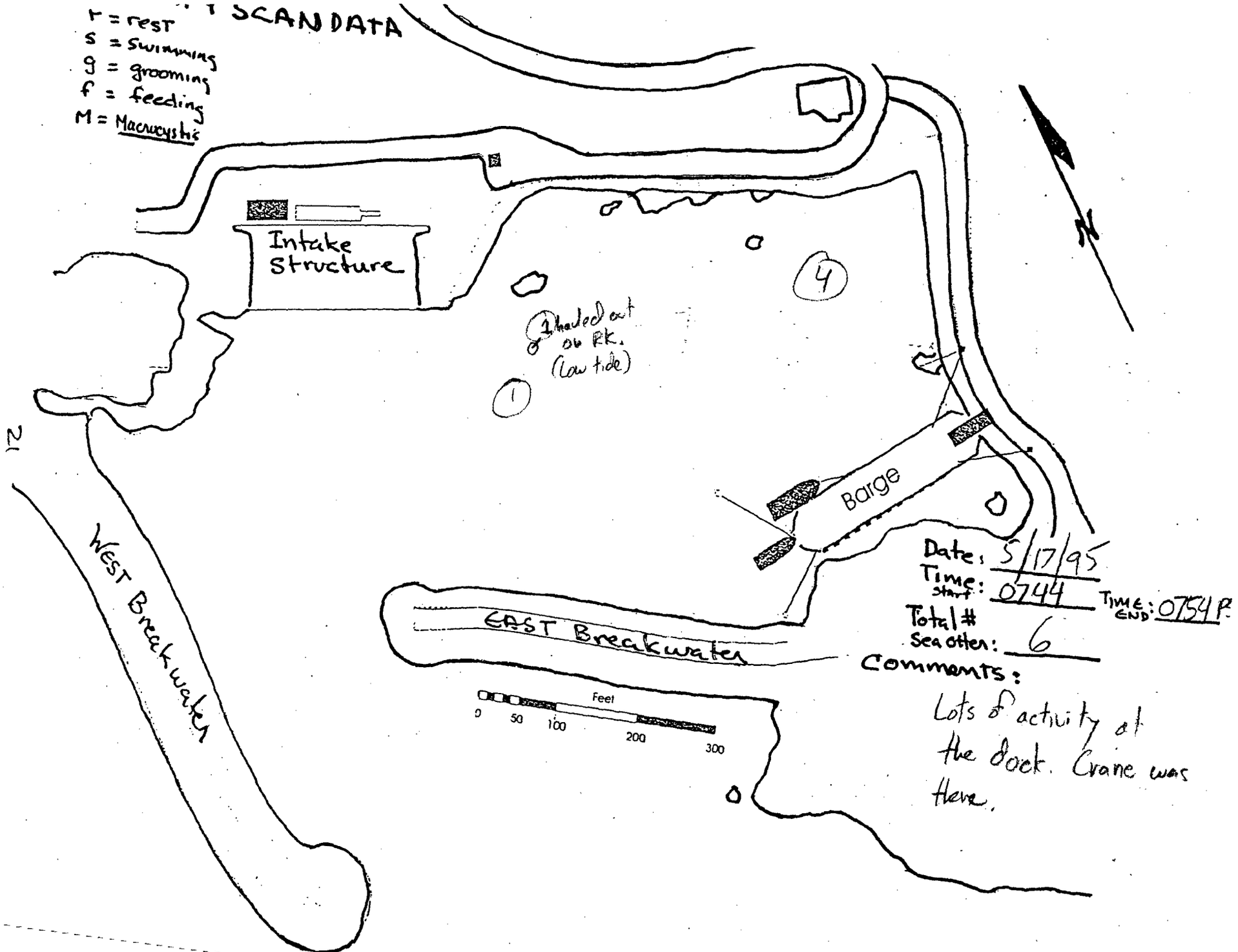


Date: 5/17/95
Time start: 0345
Time end: 0355 P
Total # Sea otter: 17
Comments:

20

r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis

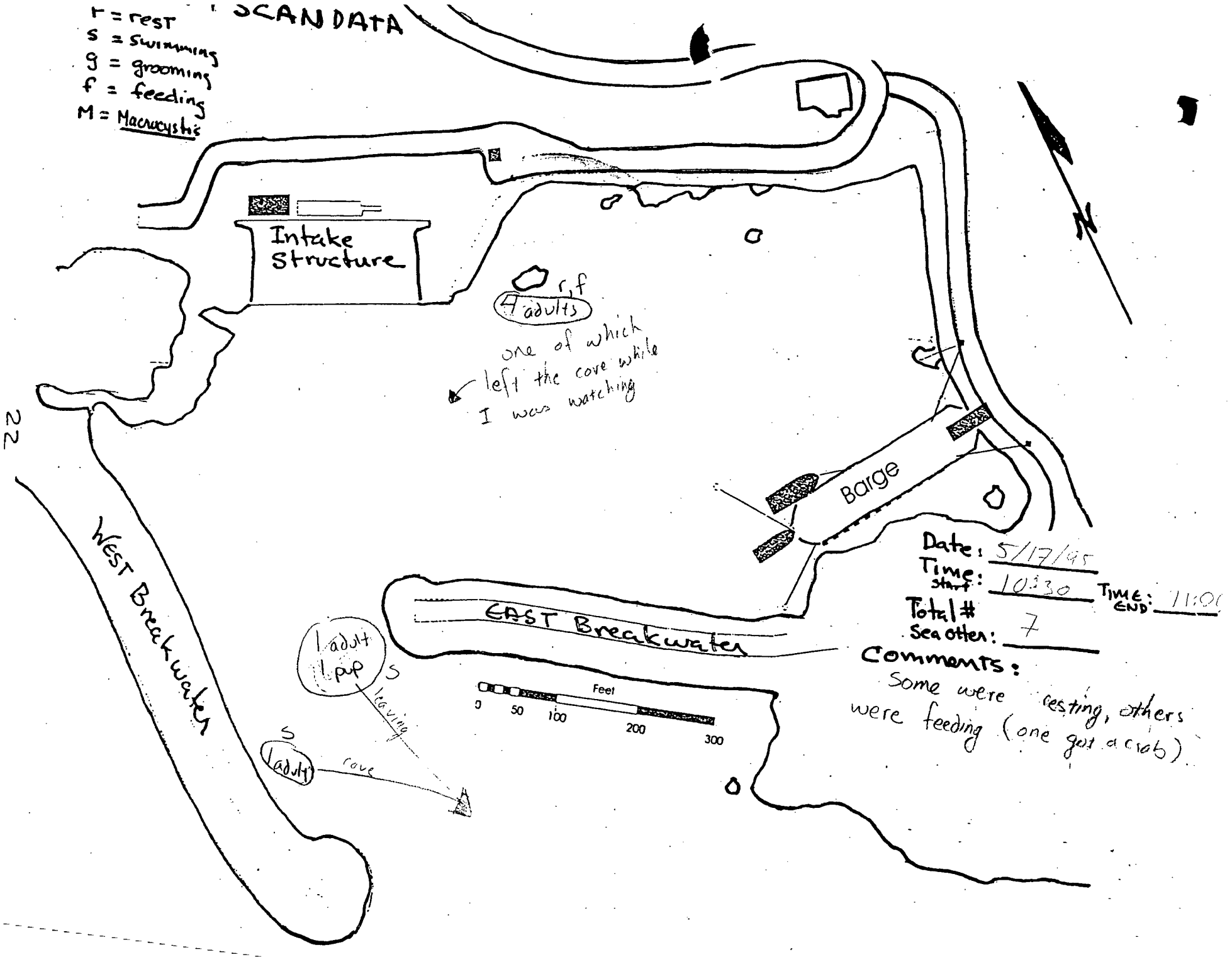
SCANDATA



Date: 5/17/95
Time start: 0744 TIME END: 0754 P
Total # Sea otter: 6
Comments:
Lots of activity at the dock. Crane was there.

r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis

SCANDATA

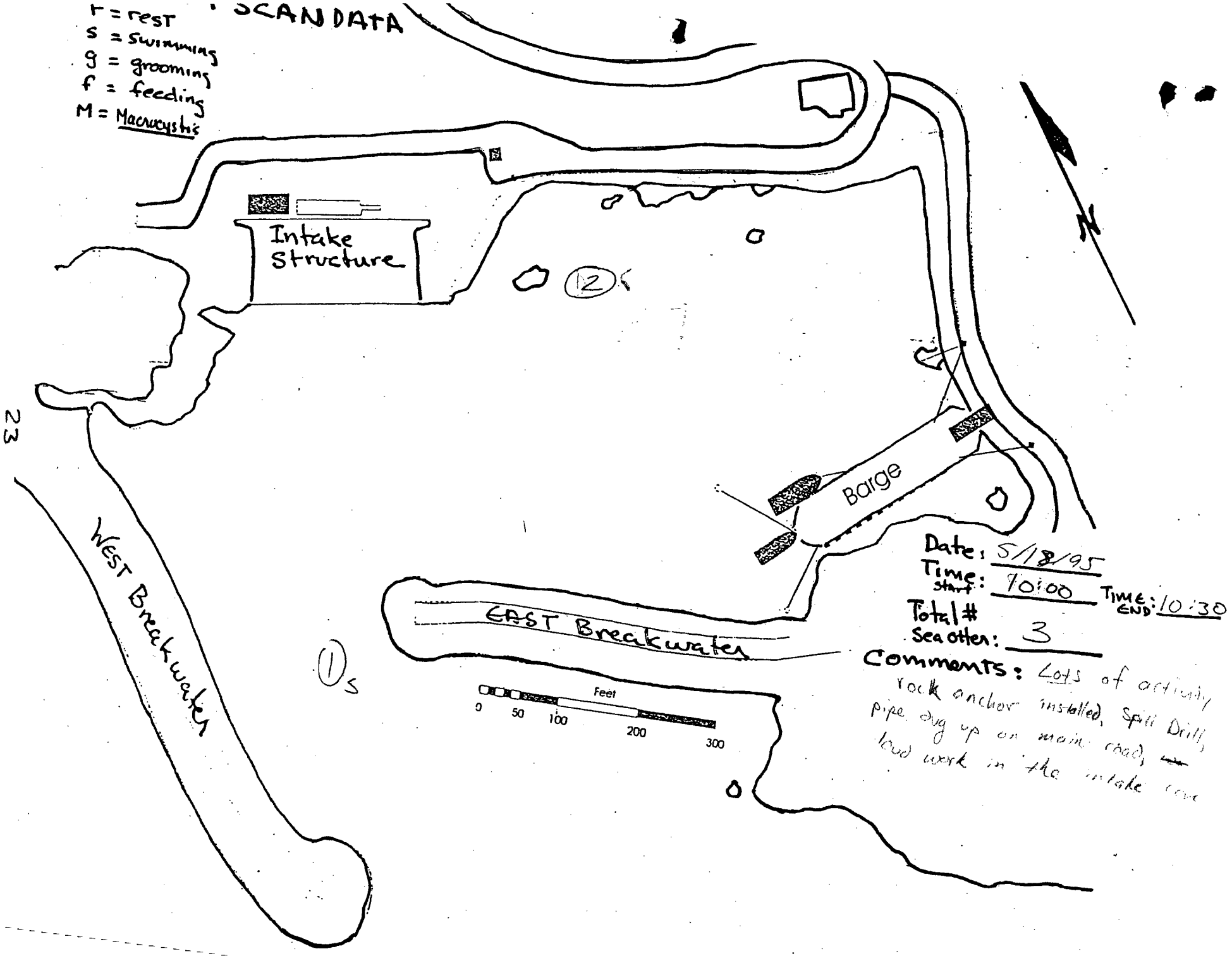


Date: 5/17/95
Time start: 10:30
Time end: 11:00
Total # Sea otter: 7

Comments:
Some were resting, others were feeding (one got a crab)

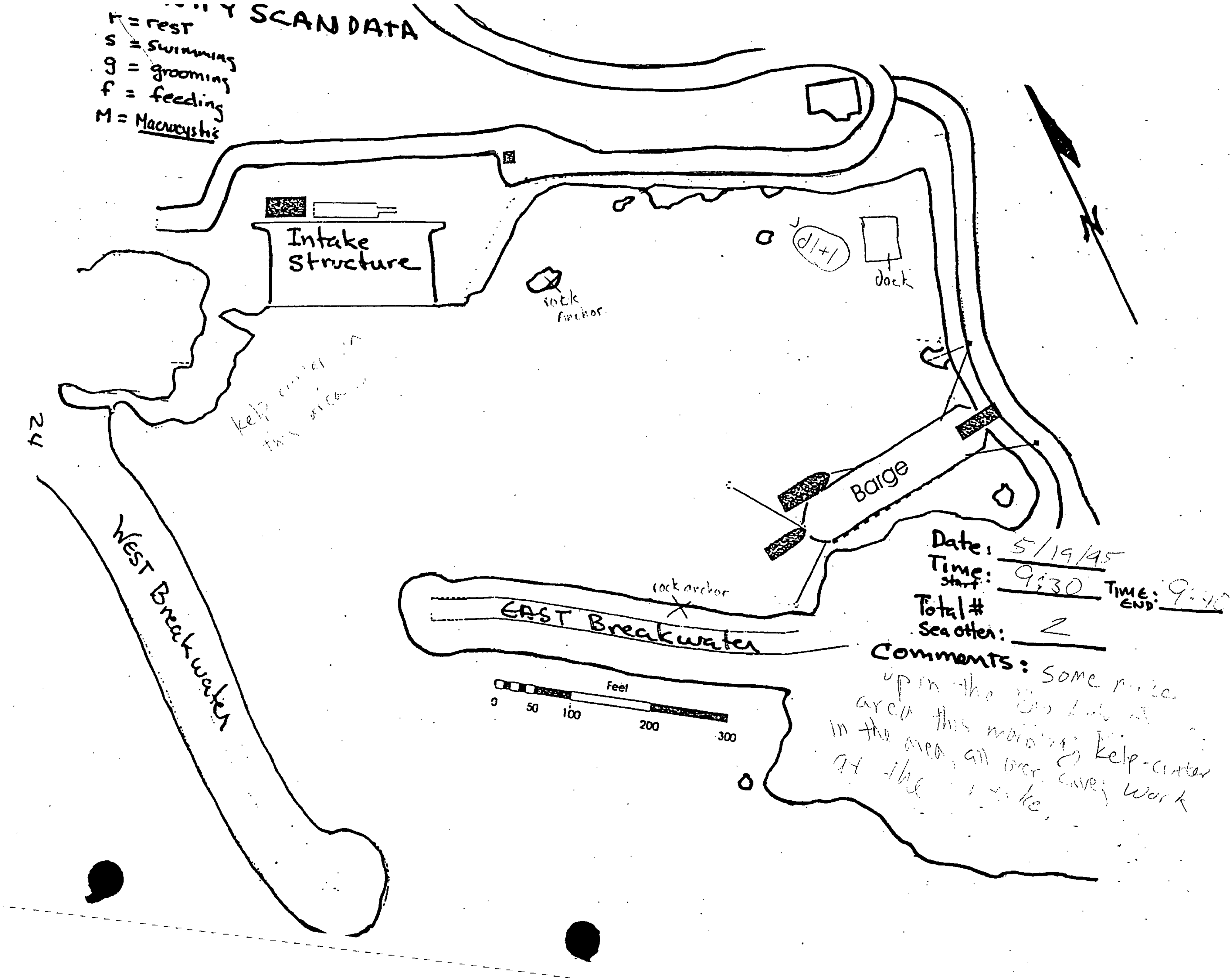
r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis

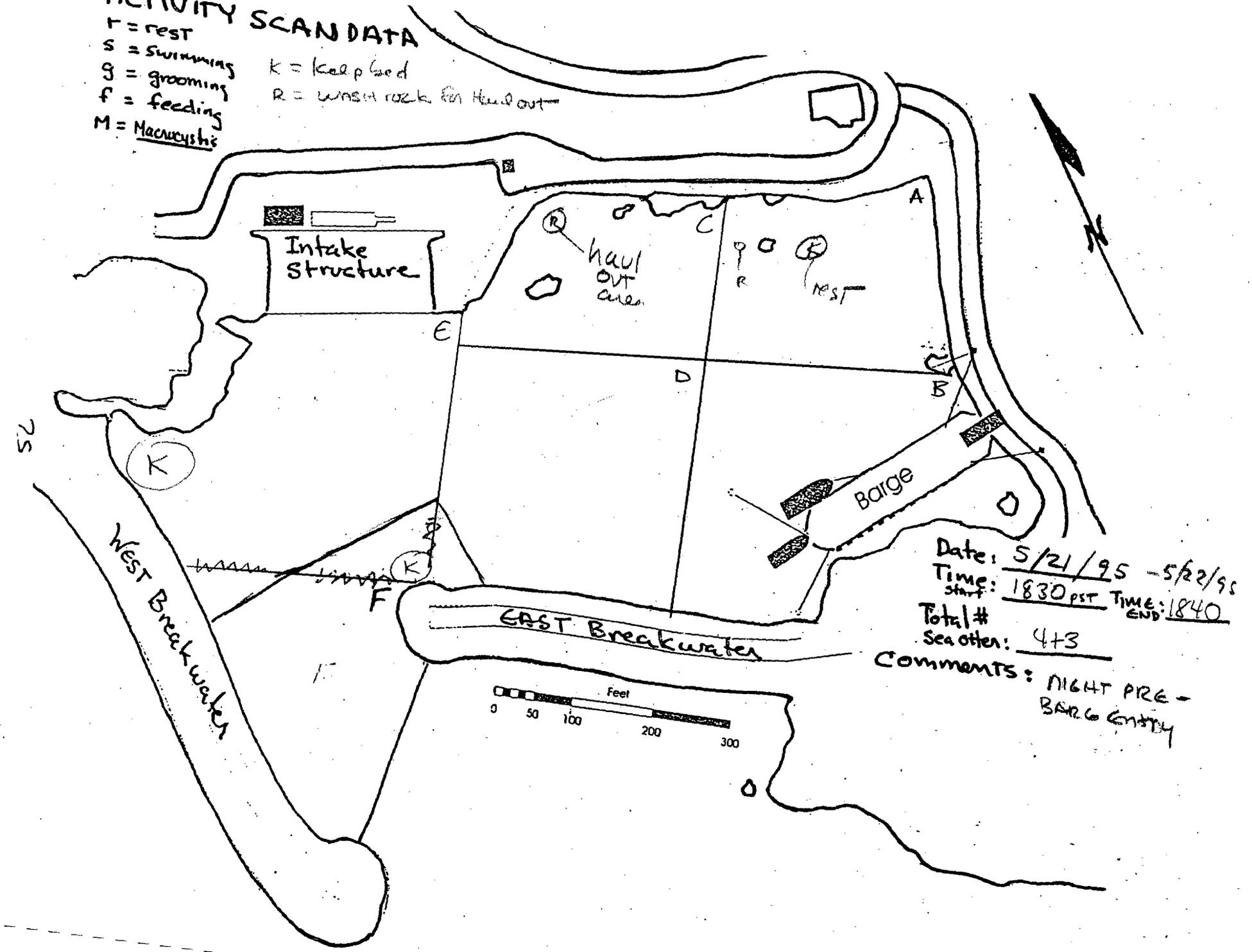
SCANDATA



23

Date: 5/18/95
Time start: 10:00 Time end: 10:30
Total # Sea otter: 3
Comments: Lots of activity rock anchor installed, Spill Drill, pipe dug up on main road, — load work in the intake cove

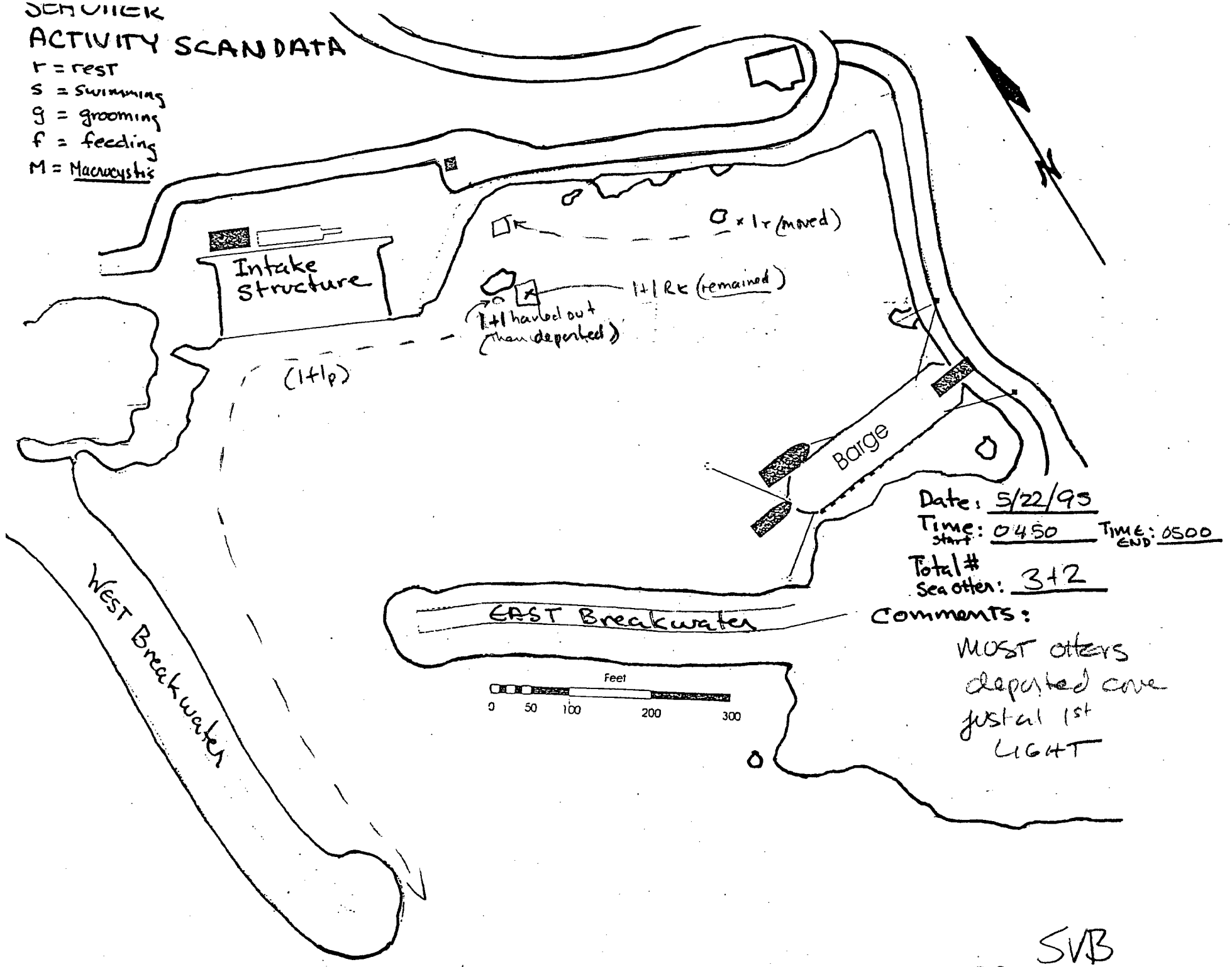

SCAN DATA
r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis
Intake Structure
rock anchor
d1+1
dock
N
24
West Breakwater
Barge
EAST Breakwater
rock anchor
Feet
0 50 100 200 300
Date: 5/19/95
Time start: 9:30
Time end: 9:40
Total # Sea otter: 2
Comments: Some
up in the
area this
in the area, all
kelp-cutter
work


ACTIVITY SCAN DATA
r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis
k = kelp bed
R = wash rock for Haul out
Intake Structure
haul out area
A
B
C
D
E
F
K
R
Barge
EAST Breakwater
WEST Breakwater
Feet
0
50
100
200
300
Date: 5/21/95 - 5/22/95
Time start: 1830 PST
Time end: 1840
Total # Sea otter: 473
Comments: NIGHT PRE-BARGE ENTRY

SCHOOL

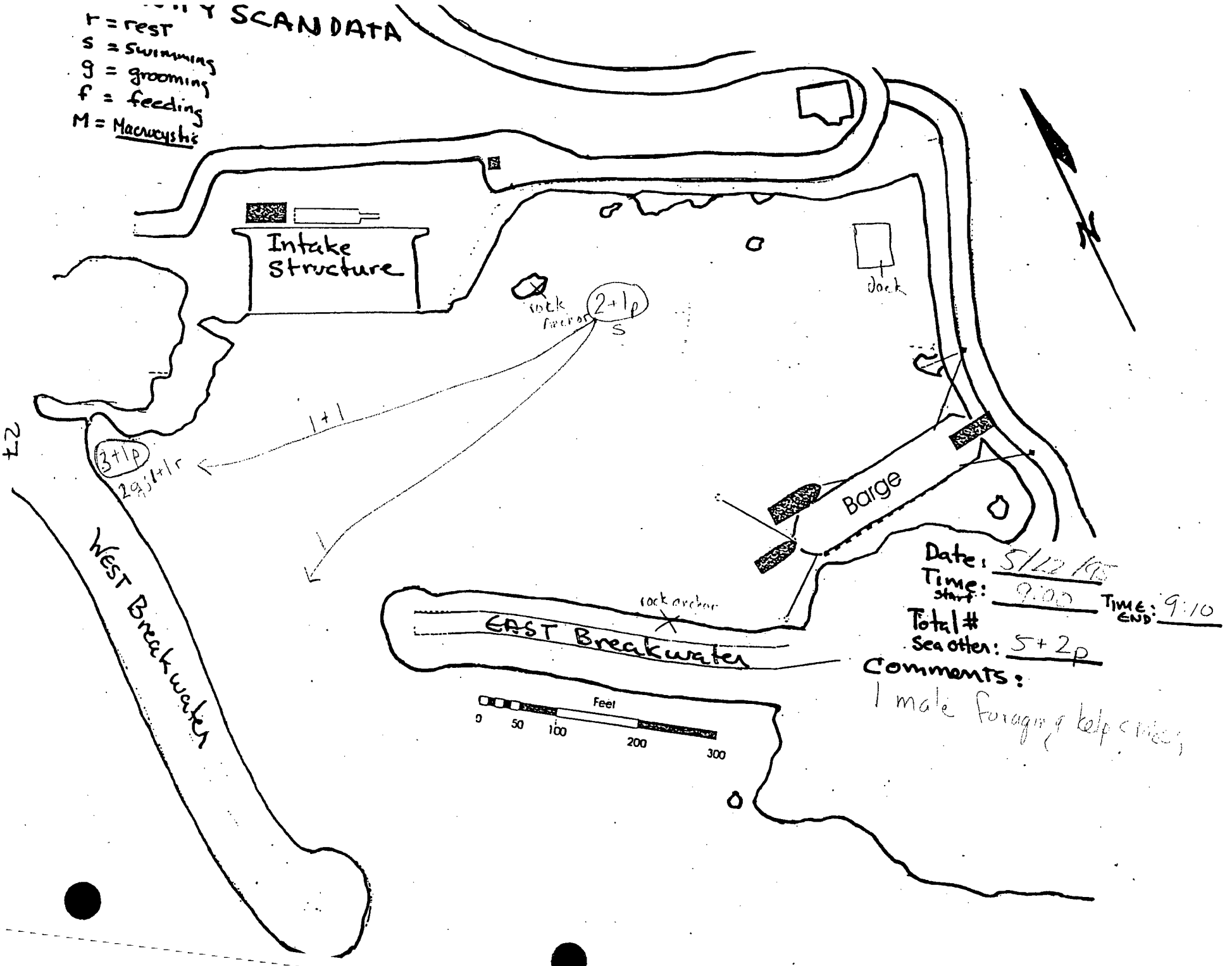
ACTIVITY SCANDATA

r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis



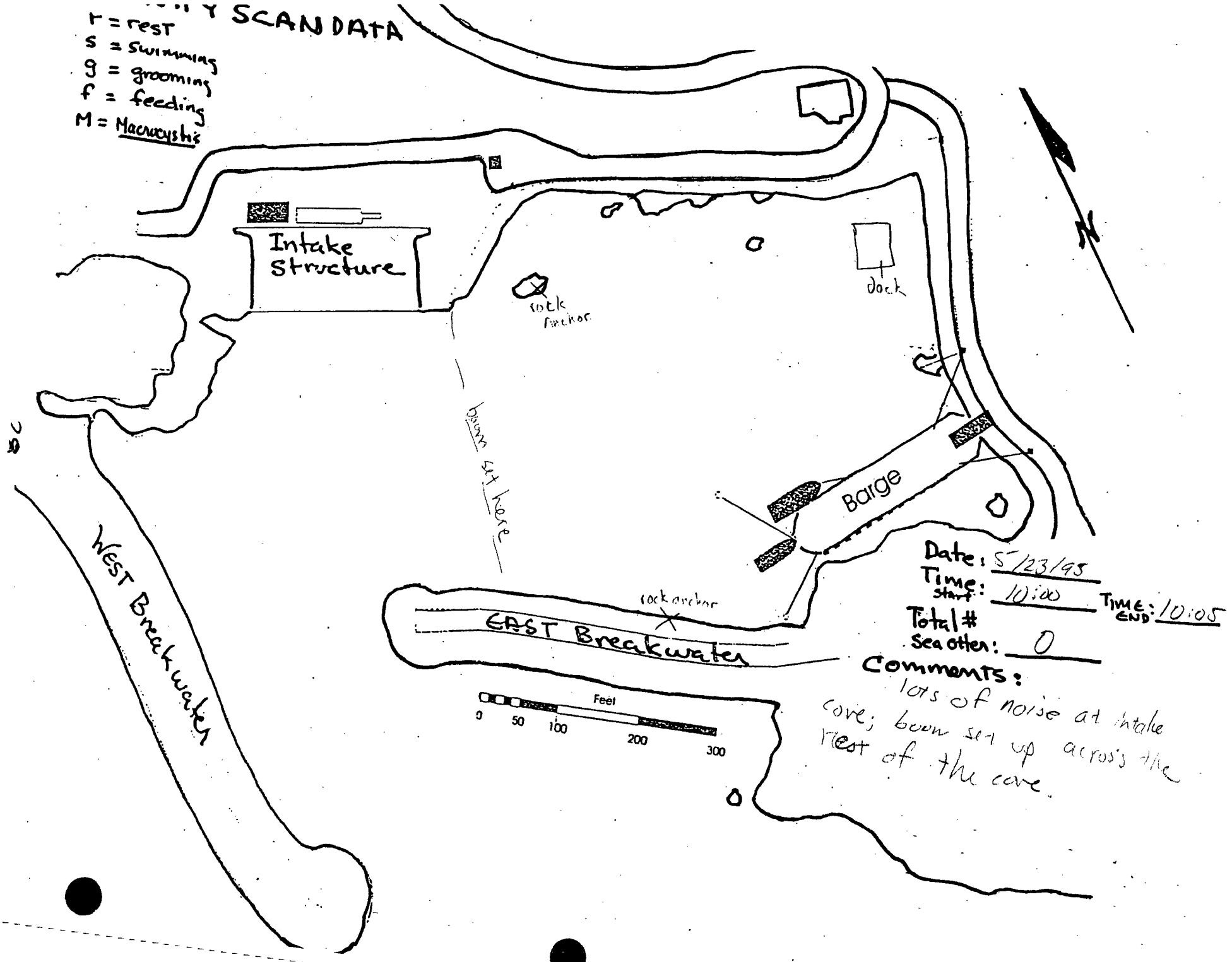
Date: 5/22/95
Time start: 0450 Time END: 0500
Total # Sea otter: 3+2
Comments:
MOST otters departed cove just at 1st LIGHT

OBSERVER: SVB


r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis
SCANDATA
Intake Structure
dock
rock
2+1p
s
1+1
3+1p
2g,1+1r
Barge
rock anchor
EAST Breakwater
WEST Breakwater
Feet
0
50
100
200
300
Date: 5/22/15
Time start: 9:00
TIME END: 9:10
Total # Sea otter: 5+2p
Comments:
1 male foraging & kelp eating

SCAN DATA

r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis

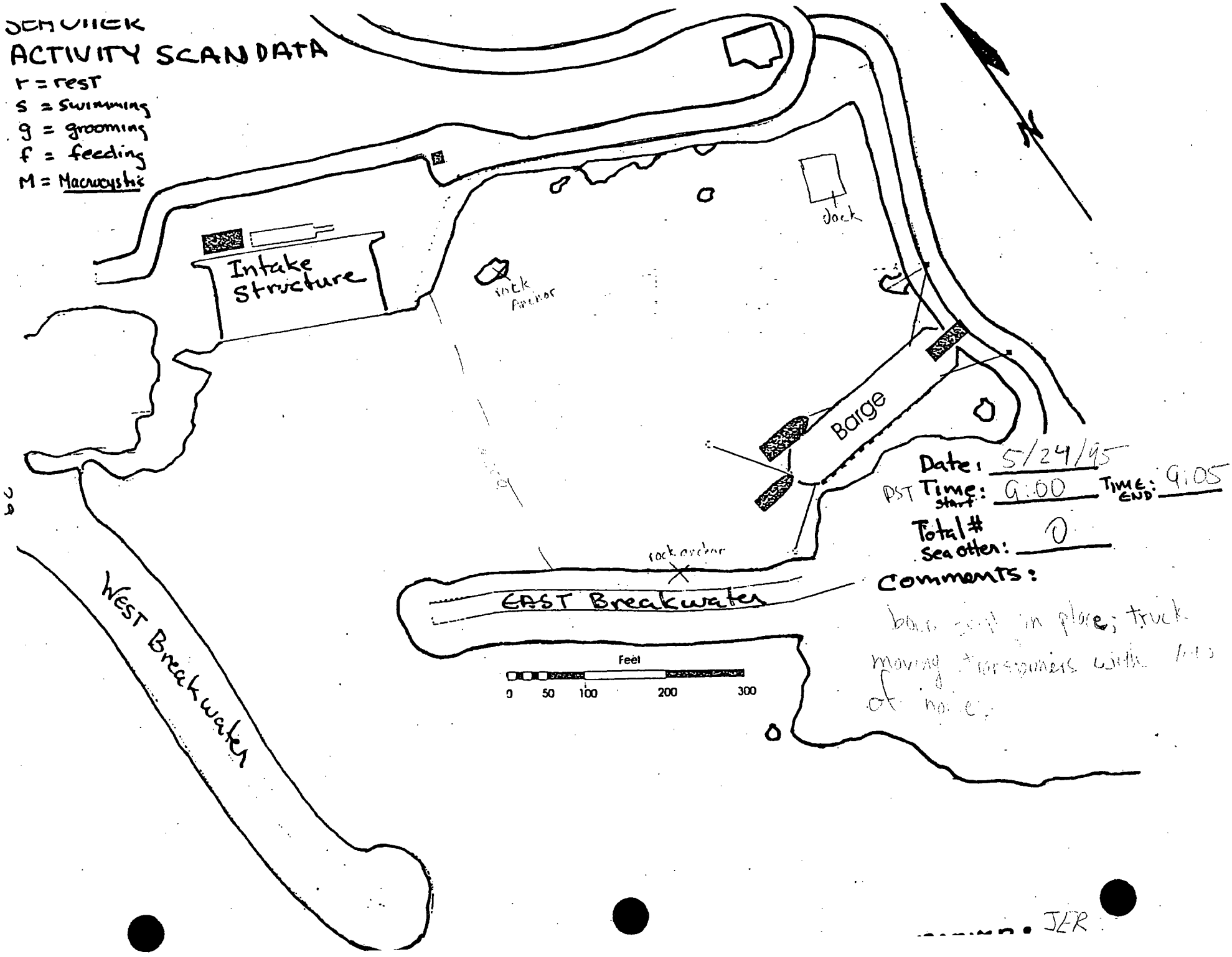


Date: 5/23/95
Time start: 10:00 Time end: 10:05
Total # Sea otter: 0
Comments: lots of noise at intake cove; boom set up across the rest of the cove.

JERVICK

ACTIVITY SCAN DATA

r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis

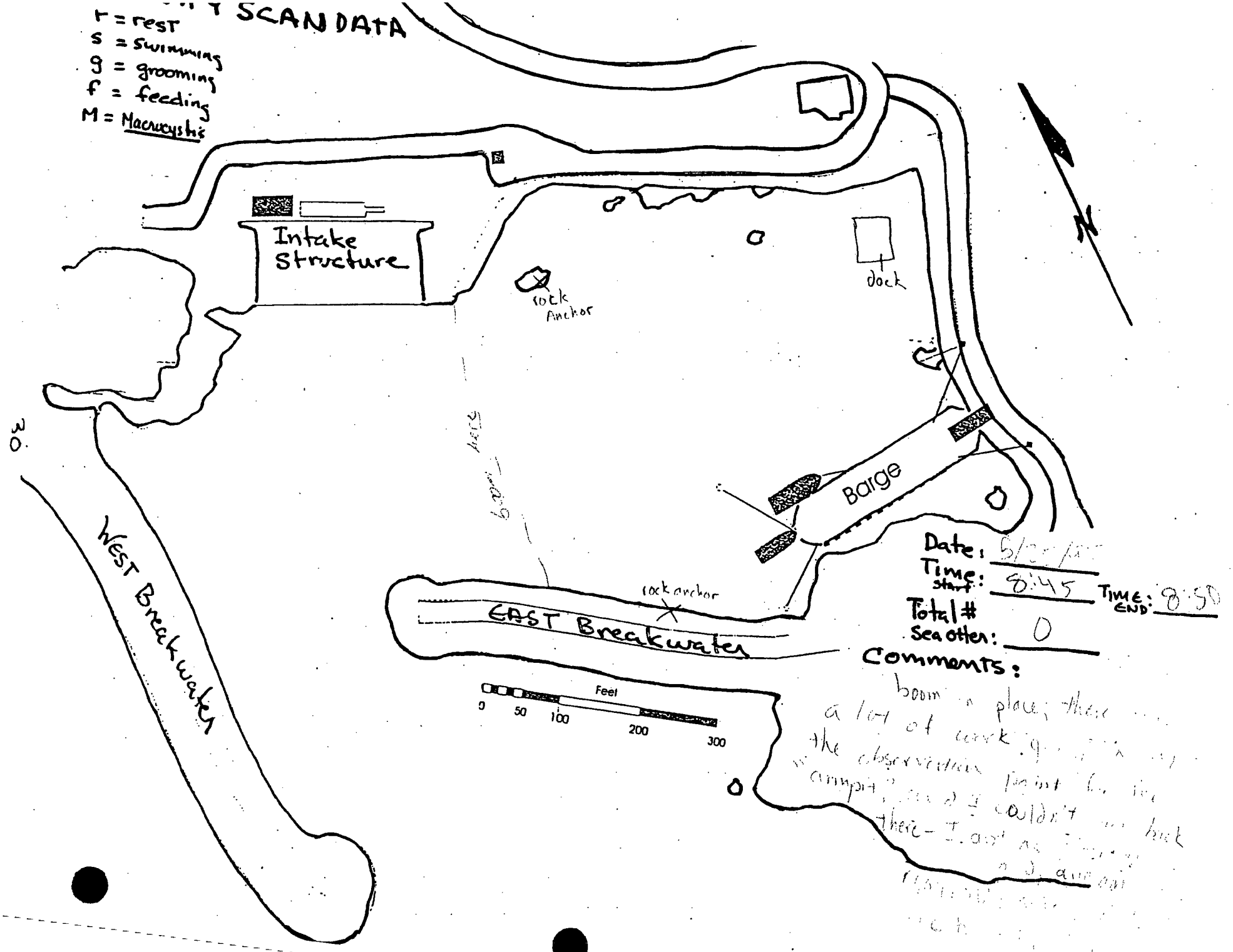


Date: 5/24/95
PST Time: start 9:00 END: 9:05
Total # sea otters: 0
Comments:
barge set in place; truck moving transformers with lots of noise

JER

r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis

SCAN DATA

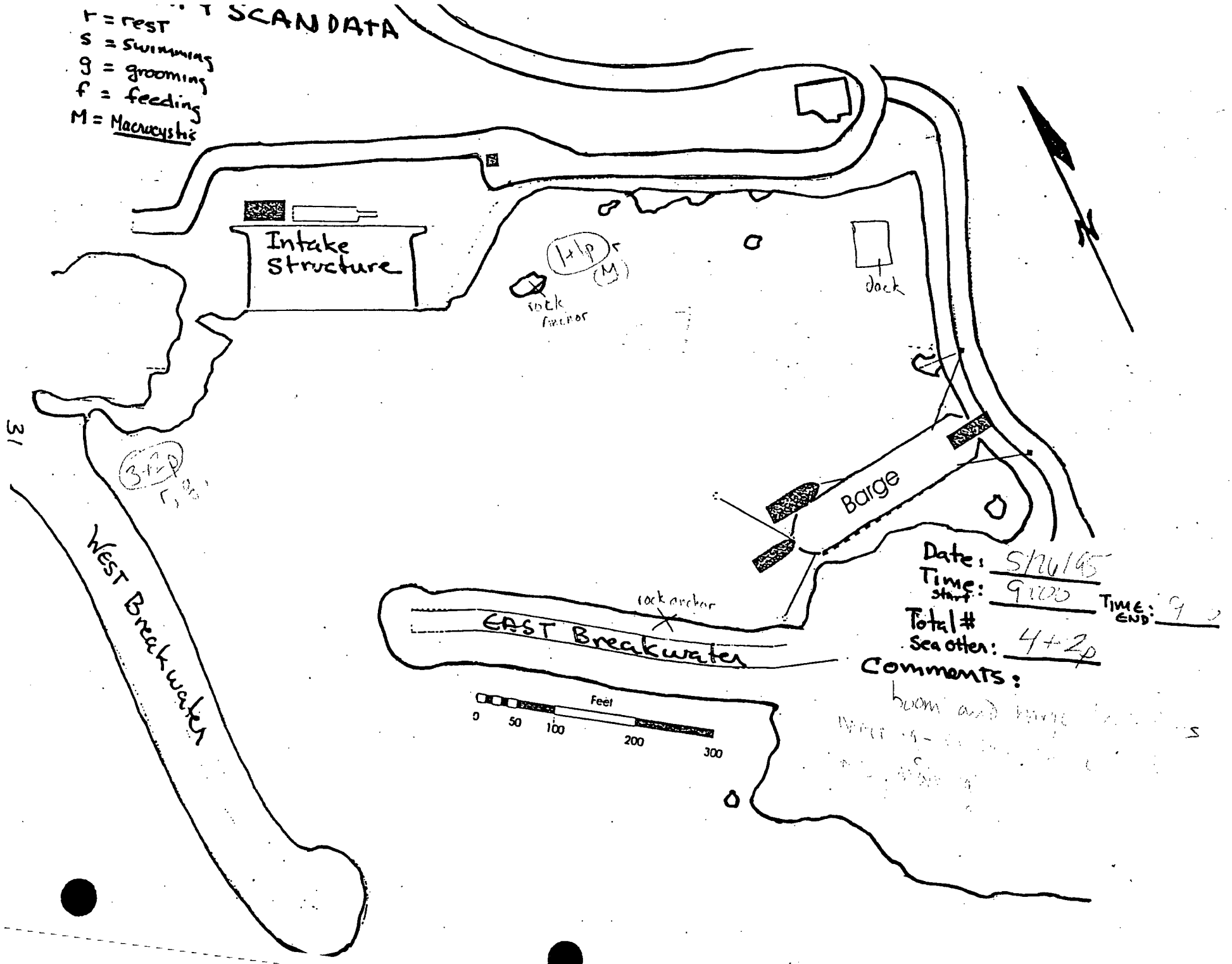


Date: 5/2[illegible]
Time start: 8:45 TIME END: 8:50
Total # Sea otter: 0

Comments:
boom [illegible] place; there [illegible]
a lot of work [illegible]
the observation point [illegible]
camp[illegible] and I couldn't [illegible] back
there - I [illegible]
[illegible]

r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis

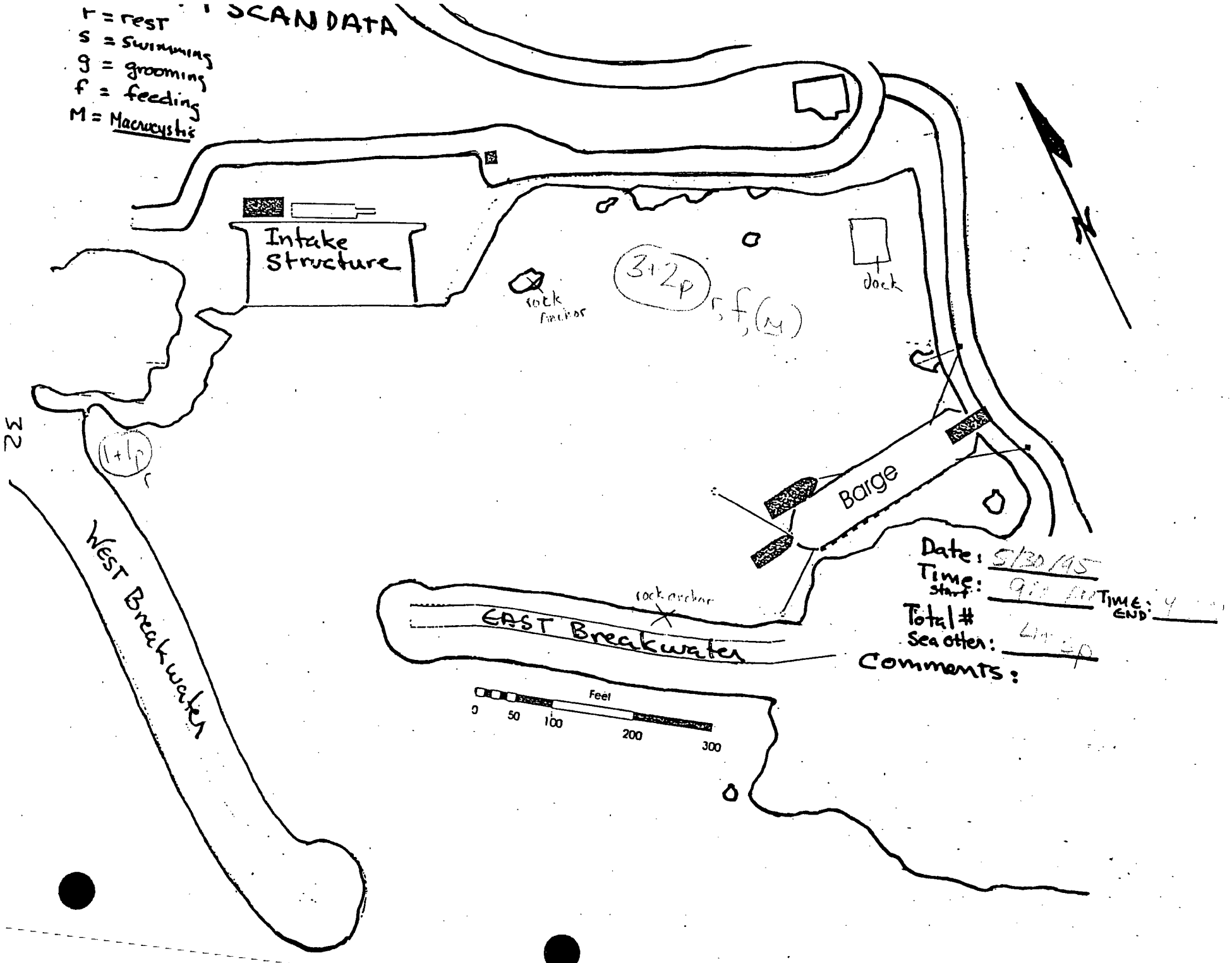
SCANDATA



Date: 5/26/95
Time start: 9:00 Time end: 9:2
Total # Sea otter: 4+2p
Comments:
boom and barge

r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis

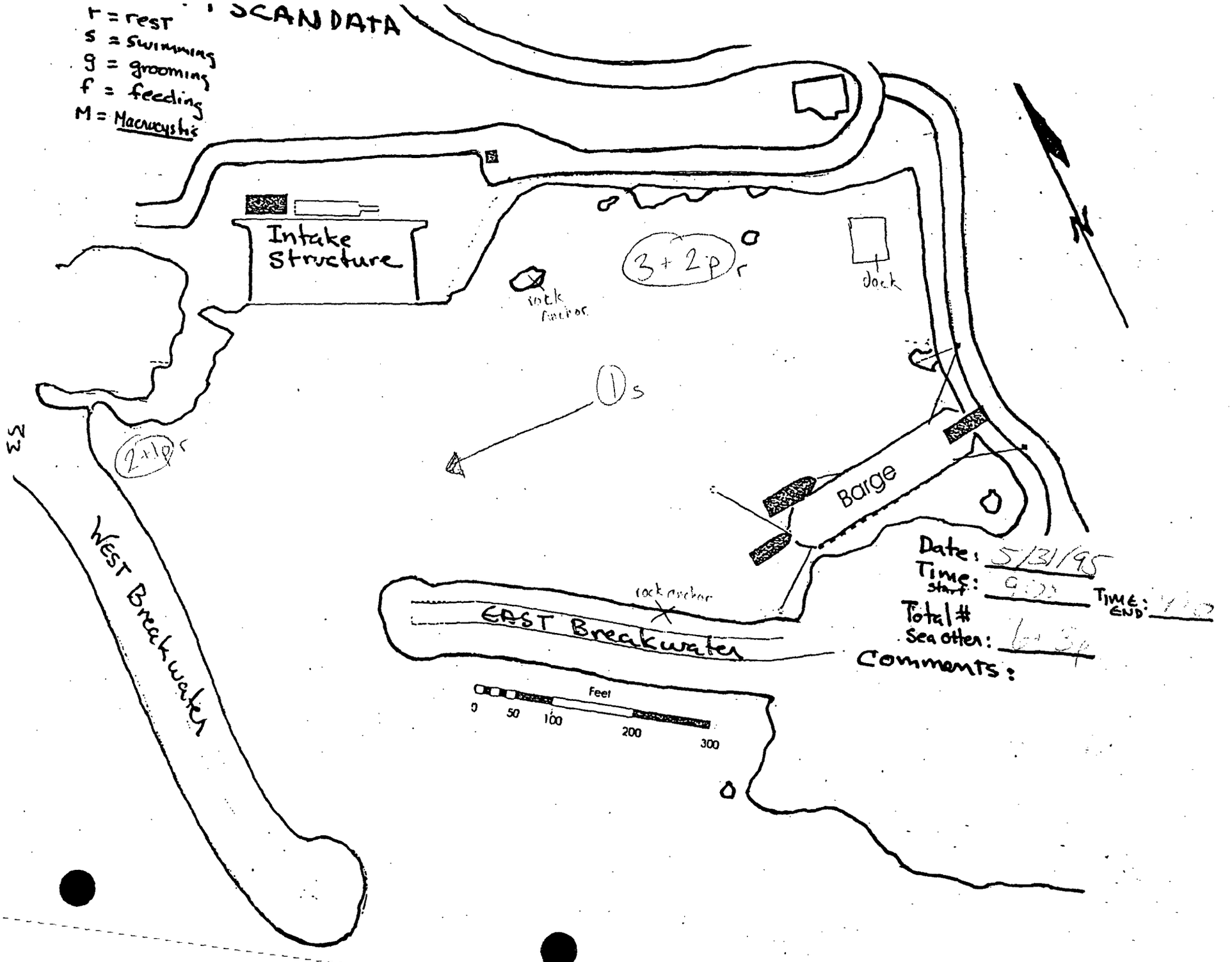
SCANDATA



Date: 5/30/15
Time: start: 9:[illegible] TIME: END: 4:[illegible]
Total # Sea otter: 4m 2p
Comments:

r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis

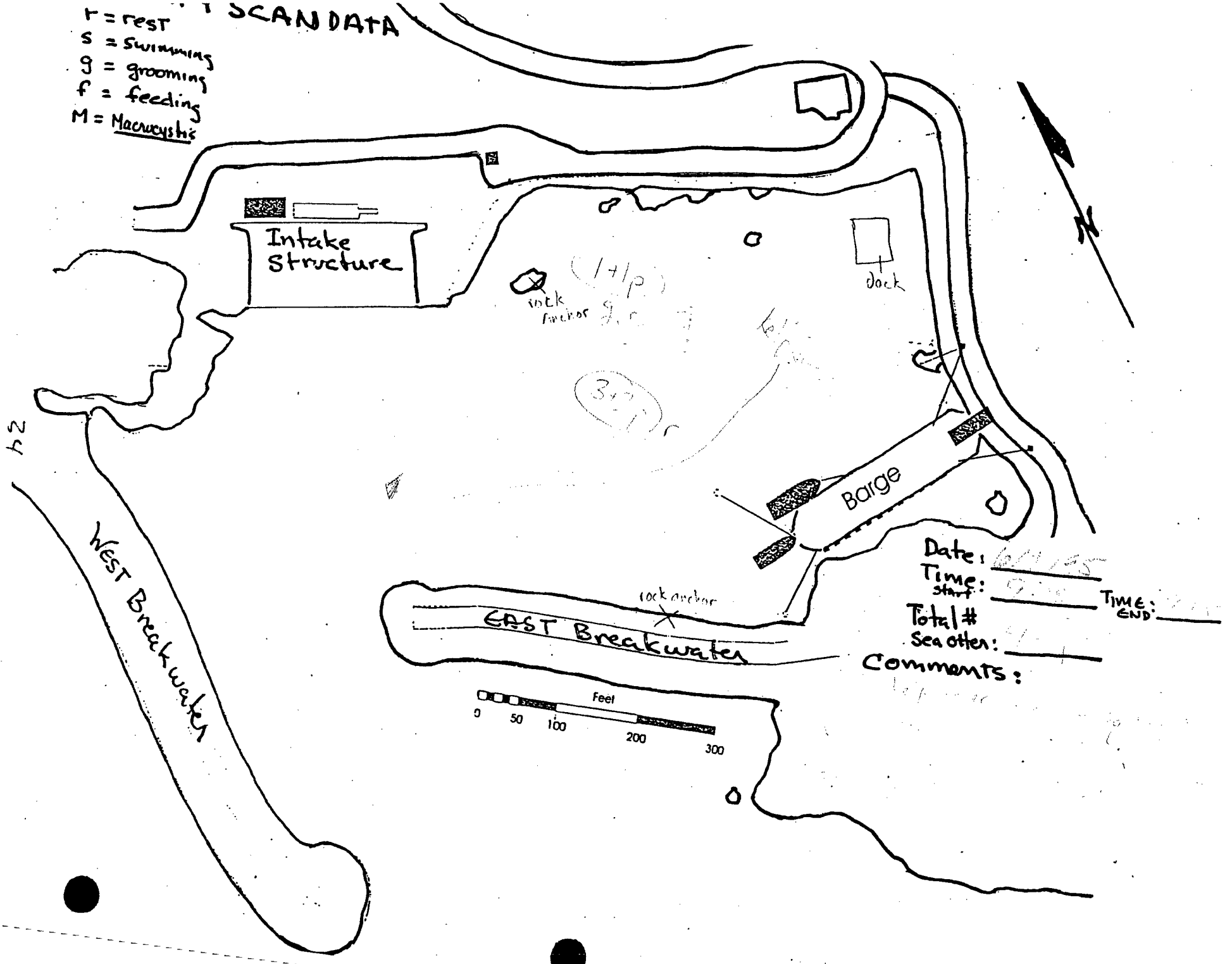
SCANDATA



Date: 5/31/95
Time: start: 9:22 TIME END: 1:10
Total # Sea otter: 4+3p
Comments:

r = rest
s = swimming
g = grooming
f = feeding
M = Macrocystis

SCANDATA



Date:
Time: start
TIME: END
Total # Sea otters:
Comments: