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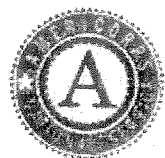
SANCTUARY EDUCATION
AWARENESS AND LONG-TERM STEWARDSHIP

ANNUAL REPORT
JULY 1998 — JUNE 1999

by
Joseph Mortenson, Maria Brown, Jan Roletto,
Leslie Grella, Leah Culp, and Jessica Kinman



San Francisco, CA
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EXECUTIVE SUMMARY

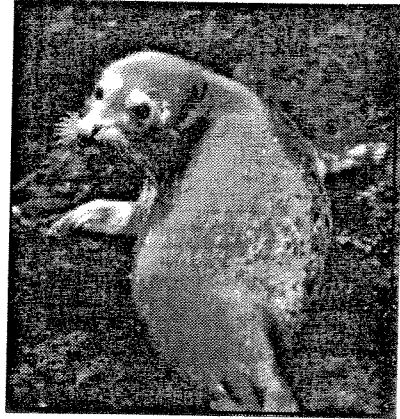
In 1996, the Farallones Marine Sanctuary Association (FMSA) in collaboration with the Gulf of the Farallones National Marine Sanctuary (GFNMS) started SEALS, a harbor seal monitoring and interpretation program along the Central California Coast. The SEALS program was developed to respond to high levels of disturbance to harbor seals and strives to achieve the following goals:

- Minimize disturbance to harbor seals and help maintain the integrity of rookery sites in the Gulf of the Farallones National Marine Sanctuary;
- Preserve the harbor seal colony size in the Gulf of the Farallones National Marine Sanctuary;
- Increase stewardship in the Gulf of the Farallones National Marine Sanctuary;
- Educate the general public about harbor seals and their habitat in the Gulf of the Farallones National Marine Sanctuary.

In order to achieve these goals, FMSA and GFNMS train local citizens to interpret and monitor harbor seals. SEALS volunteers complete an intensive 33 hour training course on harbor seal natural history, bay and lagoon ecology, interpretation and monitoring techniques, research protocols, and the history of the GFNMS.

From July 1998 to June 1999 in Marin County, California, FMSA managed two harbor seal interpretation sites, one on Clam Island and the other on Seal Island in Tomales Bay, and two harbor seal monitoring sites, one on the east shore of Bolinas Lagoon and the other on the cliffs of Tomales Point overlooking Clam and Seal Islands, in Tomales Bay. The interpretation and monitoring were conducted by volunteers with staff supervision.

In 1999, FMSA assisted the Fitzgerald Marine



A harbor seal (*Phoca vitulina*) in the Gulf of the Farallones National Marine Sanctuary

Reserve (FMR) with their harbor seal monitoring and protection program through consultation, data entry, data analysis, and reporting.

In 1999 GFNMS coordinated a Central California seal census and FMSA collated, entered, and analyzed the data. Volunteers from Point Reyes National Seashore (PRNS), GFNMS, FMSA, Seal Watch Jenner, and Seal Watch Sea Ranch simultaneously counted seals at a number of haul-outs from the southern border of San Mateo County to the northern border of Sonoma County.

TOMALES BAY, CLAM & SEAL ISLANDS HAUL-OUTS

The objective of establishing interpretation sites on Clam and Seal Islands was to reduce the number of disturbances from clammers (clam diggers). People travel to Tomales Bay to dig for clams on Clam and Seal Islands, February through June, which coincides with the harbor seal pupping season. During previous harbor seal studies in the PRNS area it was found that the seals on Clam and Seal Islands were disturbed on 81% of the observation days—almost double the percent noted a decade earlier. Clammers and fishers were associated with 51% of the disturbances (Allen and King 1992). Overall, humans were associated with 1.33 disturbances per hour in 1991, which was the highest rate of disturbance ever reported on the West Coast (Mortenson, 1996). The most significant information discovered during this study was the near abandonment of Hog Island. Since 1990, seals have rarely been seen there with less than 50 seals observed at any one time.

In order to prevent the loss of another traditional harbor seal rookery, SEALS volunteers set-up interpretive stations at Clam and Seal Islands on the low-tide weekends during pupping season to educate the public about proper distances to view seals. Volunteers 1) placed an unobtrusive flag or cone barrier approximately 300 feet around the harbor seal colonies; 2) established an interpretation site with spotting scopes and educational materials; and 3) noted the number of visitors to the islands, disturbances, and queries from the public on an observation form. Teams of



Harbor seals (*Phoca vitulina*) on the Tomales Bay mudflats

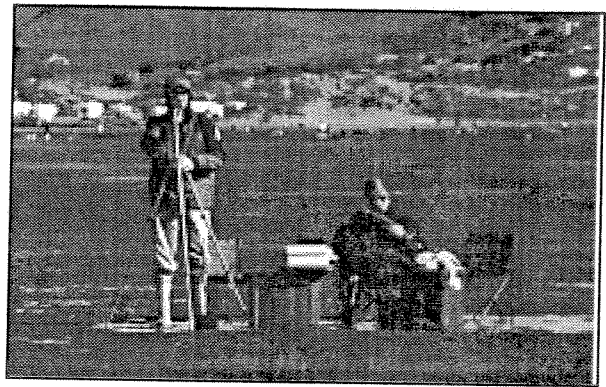
volunteers spent 103 hours on the Islands during the 1999 pupping season and observed 676 people on the Islands.

The objective of establishing a monitoring program on the Tomales Point cliffs above Clam and Seal Islands was to measure the effectiveness of docents and the visible buffer at the seals' haul-outs. The observation teams documented environmental conditions, the distribution and number of harbor seals and pups, the type and frequency of human and wildlife activities on and around Clam and Seal Islands (such as dog barking, hiking, canoeing, fishing, bird watching, flushing birds, flushes with unknown associated activity, etc.), the distance of activities from the seals, and seal behaviors.

During the 1999 monitoring season, the maximum number of seals recorded on Clam and Seal Islands was 397 in April 1999 compared to 493 seals counted in June 1998. The maximum number of pups recorded was 87 during May 1999 compared to 27 pups counted in April 1998. Although the number of seals on Clam and Seal Islands dropped slightly from 1998 to 1999, the number of pups on the islands more than tripled.

There was 78% less activity on the Islands during the 1999 monitoring season (20.33 activities per hour verses 93.48 activities per hour during 1998), because the vessel which traditionally transported clambers to and from the islands, the *CLAM CLIPPER*, did not operate. The frequency of clambers decreased by 86% to a rate of 11.65 per hour during 1999. Other human related activities, such as motorboats and kayaks, showed little change over the two years (6.79 motorboats per hour and 0.38 kayaks per hour in 1998 verses 7.36 motorboats per hour and 0.35 kayaks per hour in 1999). During 1999 there was a large increase in the number of harbor seal disturbances, e.g. flushes, which could not be attributed or associated with any known activity by humans or wildlife. These "Unknown" activities made a threefold jump in their rate of occurrence (0.40 per hour) in 1999.

Some key results regarding harbor seal flushes remained constant over the two years. Clammers were still the most frequent activity in 1999 and retained a relatively low flush rate; only 1% of clammer/visitor activities were associated



Tomales Bay SEALS volunteers

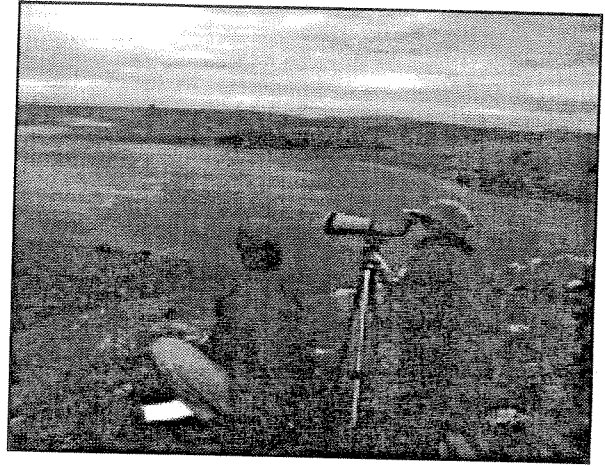
with flushes. Differences were observed in the contribution of individual activities to the overall flush rate. Motorboats, the dominant flushing source in 1998, decreased slightly in 1999 by 14% while "Unknown" activities rose 34.3% to become the most frequent cause of flushes. Among the human activities, waterborne sources were associated with the majority of flushes in both 1998 and 1999. Overall, however, flush rates associated with motorboats and kayaks decreased between 1998 and 1999 by 14% and 28%, respectively. During 1999, a PRNS enforcement boat patrolled Tomales Bay. The presence of the enforcement boat may have contributed to the decline of seal disturbances by vessels. Park rangers often approached violators of the Marine Mammal Protection Act, issued warnings or citations, and encouraged recreationists to be more cautious around the harbor seal haul-outs.

The overall flush rate increased by 29% over the two years (0.70 flushes per hour in 1998; 0.90 flushes per hour in 1999). However, most of the increase can be attributed to the rise in the rate of flushes associated with "Unknown" activities. Other activities associated with flushes decreased or remained constant over the two study years. When human related activities were analyzed separately, the flush rate for 1999 was 0.53 flushes per hour and 0.62 flushes per hour during 1998. This indicates that human caused flushes decreased by 15% between 1998 and 1999. The flush rates associated with human activities during both 1998 and 1999 were much lower than the rate (1.33 flushes per hour) reported by Allen and King in 1991.

The mean distances at which human activities were associated with flushing the seals ranged from 90 to 180 m (300 to 600 ft) from the seals. However, there were not enough flushes to recommend an appropriate distance to view seals.

BOLINAS LAGOON, CHANNEL & PICKLEWEED HAUL-OUTS

The objectives of the Bolinas Lagoon monitoring program are to determine what activities are associated with harbor seal



Tomales Point SEALS volunteers

disturbances, to determine if the rate of disturbance is increasing, and to monitor harbor seal population changes. In 1978 and 1979, Allen et al. (1984) found that harbor seals were flushed 0.09 times per hour at Kent Island and 0.05 times per hour at Pickleweed Island in Bolinas Lagoon. In 1992, Morgan and Swift observed 0.41 flushes per hour on Kent and Pickleweed Island combined.

In Bolinas Lagoon, the observation teams monitored Pickleweed and Channel haul-outs year-round. The observation teams conducted 95 baseline surveys in 1999 documenting environmental conditions, the distribution and number of harbor seals and pups, the type and frequency of human and wildlife activities on and around the haul-outs and along the east shore of the Lagoon (such as dog barking, hiking, canoeing, fishing, bird watching, birds flushing, seal flushes with unknown associated activity, etc.), the distance of activities from the seals, and seal behaviors including vigilance rate every 30 minutes. The seals were monitored during three-hour shifts from either 1000 to 1300 hours or from 1300 to 1600 hours. Observation teams also surveyed and mapped the distribution seals in the entire Lagoon once each shift.

During the monitoring year from July 1998-June 1999, the highest mean number of seals recorded in the Lagoon was 128 during July 1998 compared to 152 counted during the previous monitoring year in July 1997. The lowest mean number of seals recorded in the Lagoon was 14 during December 1998 compared to 9 in December 1997. The highest mean number of pups recorded was 23 during May 1999 compared to 18 in April 1998.

Observers recorded 20 different activities over 224 observation hours. The most numerous activities were roadside visitors to the Lagoon (2,694) followed by shoreside hikers (197). The roadside visitors were associated with one flush; the hikers, who tended to stay longer, were associated with six flushes. Kayaks and canoes were less numerous, but much more likely to be associated with flushes. Out of nine canoes recorded, three were associated with harbor seals flushing into the water. Out of 24 kayaks recorded near the haul-



Bolinas Lagoon SEALS volunteers

outs, seven were associated with seals flushing into the water. The rate of flushes per hour associated with waterborne human activities was higher than the rate for the more numerous land-based recreationists.

Harbor seals were flushed at a rate of 0.19 per hour during the July 1997-June 1998 monitoring season and 0.14 per hour during the July 1998-June 1999 monitoring season at Pickleweed and Channel haul-outs. This disturbance rate cannot be compared to the 0.41 flush rate of Morgan and Swift's 1992 study, because the current observation sites do not include the Kent Island haul-out.

The distances in which human activities were associated with flushing the seals ranged from 56 to 123 m (185 to 498 ft) from the seals. However, there were not enough flushes to recommend an appropriate distance to view harbor seals.

FITZGERALD MARINE RESERVE MONITORING & PROTECTION PROGRAM

The objective of the Fitzgerald Marine Reserve (FMR) program was to observe and reduce human disturbances to harbor seals. Nye's Rock and Flatrock were the two haul-outs monitored at FMR in 1999. The Nye's Rock area has easy access and is heavily visited by recreationists, especially tidepoolers. The seal colony at Nye's Rock has been declared a Restricted Access Zone and is demarcated with cones by ranger staff. The colony at Flatrock is more remote and is not demarcated by cones. The daily mean seal count for the 1999 monitoring season at Nye's Rock was 21.0 seals and at Flatrock was 18.9 seals. Pups were observed on only three days at Nye's Rock, with a mean number of 0.2 seals. At Flatrock a mean number of 2.0 pups was observed.

At Nye's Rock, an average of 49.6 activities were counted every 15 minutes, and these peaked in the morning. Fifteen flushes were seen at Nye's Rock (0.17 flushes per observation hour) but only three at Flatrock (0.04 flushes per observation hour). At both sites the greatest contribution to the overall flush rate were tidepoolers followed by unknown causes. The rate of flushes at Nye's Rock



Volunteers monitoring harbor seals (*Phoca vitulina*) at Fitzgerald Marine Reserve

was in the range of that seen at Bolinas Lagoon, while the rate of flushes at Flatrock was below that observed at either Tomales Bay or Bolinas Lagoon.

CENTRAL CALIFORNIA HARBOR SEAL CENSUS

The objectives of the Central California Harbor Seal Census were to ascertain and detect changes in overall harbor seal numbers and to gauge reproductive success at different types of haul-outs along the coast.

Little change was seen in harbor seal numbers between 1998 and 1999. Average haul-out size (measured in the number of seals hauled out at one time) varied with Point Reyes having larger haul-outs, San Francisco Bay intermediate haul-outs, and the rocky coasts in San Mateo and Sonoma smaller haul-outs. The data suggest that rocky haul-outs have lower percentages of pups.

The information collected from the SEALS program has been used to develop educational materials. FMSA has developed responsible boating around wildlife educational materials for Tomales Bay. The Farallones Marine Sanctuary Association has also been working in cooperation with the Gulf of the Farallones National Marine Sanctuary, Marin County Open Space District, Sierra Club, California Department of Fish and Game, and Bay Area Sea Kayakers Association to educate paddlers about responsibly viewing wildlife. Data collected from the SEALS program will be used to evaluate the effectiveness of the educational materials.



Harbor seal (*Phoca vitulina*)

INTRODUCTION

THE PROBLEM: HIGH LEVELS OF DISTURBANCE

The Gulf of the Farallones National Marine Sanctuary was established to provide a secure habitat for marine species. The Sanctuary encompasses 949 square nautical miles of water off the California Coast west of San Francisco (Figure 1).

In 1995, the Gulf of the Farallones National Marine Sanctuary developed a harbor seal docent program on Clam and Seal Islands in Tomales Bay in western Marin County, CA. In the GFNMS and PRNS, there was a long history of concern that humans were disturbing resting harbor seals (Allen, Ainley, and Page, 1984). When the number of flushes per hour was compared for haul-outs on the West Coast (Mortenson, 1996), observations at Tomales Bay, Bolinas Lagoon, and the Russian River spits showed the highest rates of disturbance.

In California, the human population is projected to nearly double from 1990 to the 2040 (Heim, 1998, Figure 2), and recreational use of the coast is anticipated to steadily and substantially increase. With the growing number of Californians, how much disturbance can harbor seals tolerate along the shoreline, especially at heavily visited haul-outs? How can recreational use be managed so that people and seals can share the coast?

The conflict between increased recreational use of the coast and undisturbed resting areas for wildlife is worldwide. Already half the people in the country and the world (Weber, 1994) live along the coasts. By 2050 it is projected that more than 70% of the nearly 400 million Americans (U.S. Bureau of the Census, 1995) will live near the ocean. How will coastal species tolerate the millions of new shoreline dwellers? Perhaps successful programs to conserve seal colonies can help guide us in protecting all coastal species in the future.

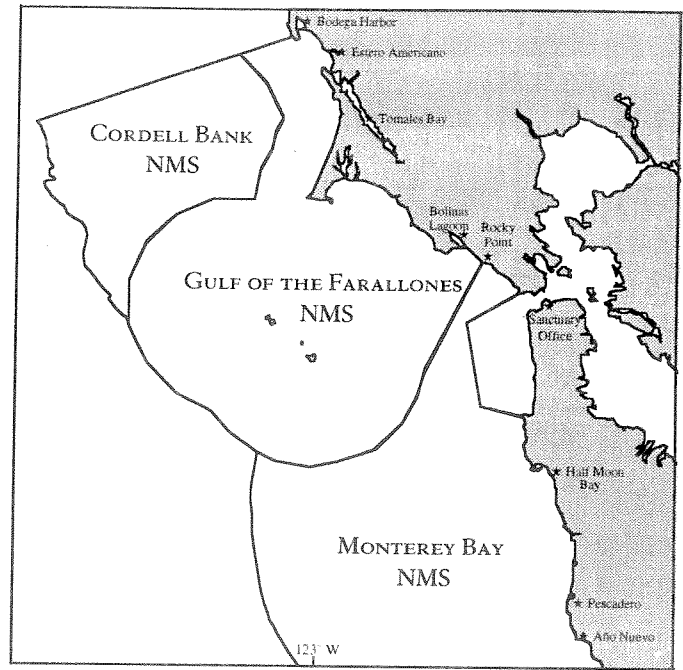


Figure 1: Map of Gulf of the Farallones National Marine Sanctuary

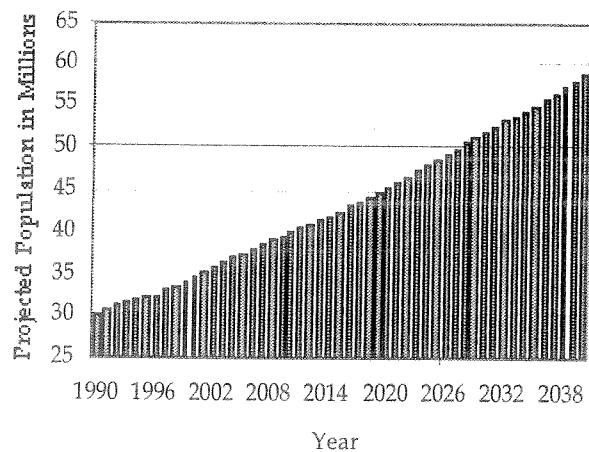


Figure 2. Projection of California population to the year 2040. Drawn from data in Heim, 1998.

THE SOLUTION: SEALS

In 1996, the Farallones Marine Sanctuary Association (FMSA) initiated a harbor seal advisory committee consisting of representatives from GFNMS, PRNS, Audubon Canyon Ranch, Marin Open Space District, and the Golden Gate National Recreation Area to determine what type of program was needed to protect harbor seals and their habitat in Bolinas Lagoon. The recommendations from the advisory committee were to develop a harbor seal monitoring program in Bolinas Lagoon and combine the Bolinas Lagoon efforts with the GFNMS' Tomales Bay harbor seal docent program.

In 1997, FMSA in collaboration with the GFNMS developed SEALS (Sanctuary Education Awareness and Long-term Stewardship), a volunteer harbor seal monitoring and interpretation program. Volunteers were recruited and trained in natural history and interpretation techniques. In the spring of 1997, SEALS fielded teams of docents on Clam and Seal Islands in Tomales Bay during the pupping season, and in the summer of 1997 SEALS commenced year-round monitoring of Channel and Pickleweed haul-outs in Bolinas Lagoon. In the spring of 1998, the SEALS program added a harbor seal monitoring site at Tomales Point to evaluate the effectiveness of the SEALS volunteers on Clam and Seal Islands. In 1999, FMSA collaborated with FMR to extend the harbor seal monitoring and protection program into San Mateo County. In 1998 and 1999, GFNMS and FMSA coordinated a harbor seal census to evaluate the harbor seal population size and distribution along the Central California Coast.

TOMALES BAY

Tomales Bay is a sunken valley that falls along the San Andreas Fault. The Bay extends fifteen miles northwestward from Olema marsh in Point Reyes National Seashore and opens to the Pacific south of Bodega Bay. Tomales Bay abounds with shellfish. The first shellfish harvesters in the Bay were native Americans, and 39 village sites have been identified along the shore, and shell middens are still visible (www.sfgate.com/getoutside/1997/oct/tb_history.html). In the past, thousands of clammers came each year to Clam and Seal Islands, two large mudflats that lie near the mouth of the Bay, aboard the *CLAM CLIPPER*, a specialized landing craft operated by Lawson's Landing in Dillon Beach. The islands are also home to a colony of harbor seals, whose numbers have rebounded since the passage of the Marine Mammal Protection Act in 1972.

Since 1982 Allen and her colleagues have studied the harbor seals of Tomales Bay as part of a region-wide inventory of pinnipeds (Allen et al., 1984, Allen, 1988). Seal numbers on the mudflats were highest in the winter (mean = 194) and lowest in the breeding season (mean = 156), unlike the pattern at other Point Reyes National Seashore haul-outs, where peaks were highest during breeding and molting periods. The winter peak seal counts coincided with herring spawning in Tomales Bay, and the low summer counts coincided with the clamming season and high summer recreational use of Clam and Seal Islands. The percentage of pups seen in Tomales Bay was less than at other sites in the Point Reyes National Seashore. Seals at Clam and Seal Islands in Tomales Bay had the highest disturbance rate of all haul-outs in the Seashore. Seals were flushed on 49% of the observation days compared with 29% at Double Point on the more remote outer coast of Point Reyes National Seashore.

Allen and Huber's analysis (1984) of the original data from 1983 and 1984 showed that 51% of the disturbances were caused by clammers and fishers, followed by boaters (30%), hikers (14%), and



Volunteers talk to visitors on Seal Island.

dogs (5%). Seals rehailed more than half the time (58%) but were much more likely to shift sand bars (28%) than at other haul-outs. The number of seals that rehailed was also lower than at less disturbed areas, such as Double Point.

In 1991, Allen and King (1992) began a observational study of Clam and Seal Islands from Tom's Point on the eastern shore of Tomales Bay. They counted seals and recorded disturbances associated with humans as part of a regional, long-term monitoring program. Human disturbances were defined as cases in which seals left the haul-out in response to people. They noted that on 81% of the observation days seals were disturbed. This was more than 1.5 times the amount of disturbances noted during the 1980's. The average number of people counted during 1991 was 350 per day; the maximum was 1,225 in one day. Overall 1.33 disturbances associated with humans were recorded every hour during 1991, which was the highest rate of disturbance ever reported on the North American West Coast (Mortenson, 1996). The most significant information discovered during this study was the near abandonment by seals of Hog Island just to the south of Clam and Seal Islands in Tomales Bay.

In 1996, GFNMS trained volunteers to serve as docents on Clam and Seal Islands in Tomales Bay. The purpose of the program was to reduce and possibly eliminate the disturbance to harbor seals by clammers during the pupping season. Docents marked the colony location and offered interpretation to visitors. In the first two years the docents reported a low incidence of disturbance by clammers suggesting that the program was effective. However, accurate seal counts and disturbance observations could not be made from the island mudflats due to the slope of the islands. Therefore, in 1998, GFNMS and FMSEA established a monitoring site at Tomales Point, which overlooks Clam and Seal Islands, to accurately assess the effectiveness of the docent program.

METHOD

CLAM AND SEAL ISLANDS DOCENTS

Docents were present on Clam and Seal Islands (Figure 3) during the harbor seal pupping season between the months of March and June, 1996-1999. During 1996-1998, the volunteers arrived at the islands on the *CLAM CLIPPER*, a specialized transport and landing vessel run by Lawson's Landing. In 1999, Lawson's Landing suspended the *CLAM CLIPPER* trips. Thus, arrangements were made to transport the volunteers to the islands initially by skiff and later by PRNS patrol boat. Early in the 1999 season volunteers went to both Clam and Seal Islands as in the past. However, the National Seashore boat could not land on Clam Island. Therefore after mid-April, only a single team on Seal Island was present. The single team counted the number of seals and human activities for both islands. The docent effort varied each year (Table 1). During the 1999 season, docents were present on 11 days, totaling 15 shifts (including simultaneous shifts on Clam and Seal Islands), 35 observation hours, and 103 volunteer hours. In addition, Tomales Bay docents traveled a total of 4,160 miles and spent 104 hours to reach the launch sites for the islands.

Once on the islands, SEALS volunteers marked a visual boundary using cones or flags at least 90 m (300 ft) around the seal haul-outs and set up an interpretive station with a spotting scope and educational materials. Since 1997, the docents have tallied all interpretations, counted all human activities they could see from their position on the mudflats, counted any dogs on the islands, and recorded observations of the seals. Human activity categories were clam digging, jet skiing, motorboating, kayaking, sailboating, and other.

TOMALES POINT MONITORING PROGRAM

During the 1998 and 1999 pupping seasons, a 2-4 person team monitored Clam and Seal Islands from Tomales Point (Figure 4) on the western side of Tomales Bay. The dates and times of observations corresponded with the days docents

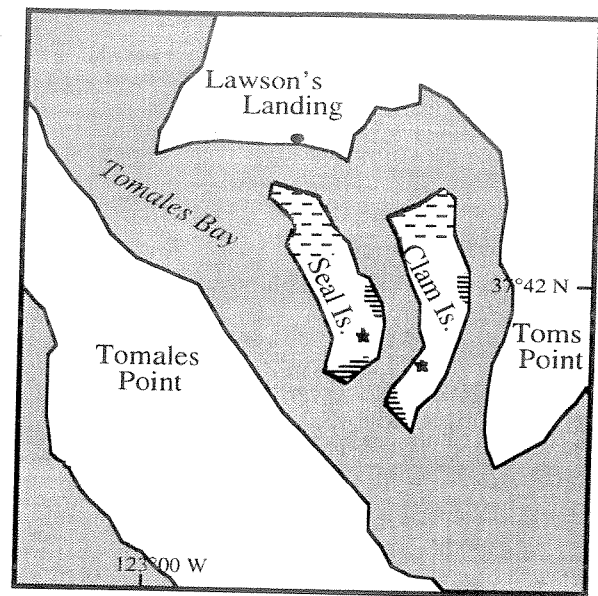


Figure 3. Map of the mouth of Tomales Bay showing Clam and Seal Islands. Stars mark docent interpretation locations, lines show frequent harbor seal haul-outs, and dashes show common clamming areas.

Table 1. Total number of volunteers, observation days, shifts, observation hours, and volunteer hours at Clam and Seal Islands in Tomales Bay, 1997 through 1999.

Month	Volunteers	Observation Days	Shifts	Observation Hours	Volunteer Hours
April	25	5	10	32	78
May	20	7	9	26	61
June	15	4	6	24	60
1997 Total	60	16	25	82	199
February	3	1	1	2	6
March	9	2	4	10	22
April	7	2	3	8	19
May	22	7	12	42	76
June	10	4	4	17	43
1998 Total	51	16	24	79	166
March	10	2	4	10	25
April	11	2	3	7	24
May	17	5	6	13	35
June	7	2	2	5	19
1999 Total	45	11	15	35	103
Grand Total	156	43	64	196	468

were scheduled to visit the islands—typically, negative and zero tide weekends and holidays. The monitoring sessions began 30 minutes before the docents arrived on the islands and ended 30 minutes after they left, lasting approximately 4 hours per session. During the 1999 season, 14 days were monitored totaling 45 observation hours and 135 volunteer hours (Table 2). Tomales Point volunteers traveled a total of 4,320 miles and spent 108 hour to reach the monitoring site.

The observation area was 1,260 m by 1,260 m (4,200 ft by 4,200 ft) and encompassed most of Clam and Seal Islands and a portion of the surrounding waterways (Figure 4). To estimate distance within the monitoring area a grid was laid over a map of Tomales Bay which was accurate within an error of ± 90 m (300 ft). Spotting scopes were used to monitor seal behavior and human activities within the grid.

At half hour intervals, volunteers counted the number of seals hauled out on the islands and noted their locations. Pups were counted from the beginning of March to June 15. After June 15 it becomes hard to discriminate small, newly-molted yearlings from large, older pups. The number of red pelage seals and wounded seals were also noted. Following these counts, observers recorded the number of head alerts for a focal group of seals during a 3 minute period to measure the seals' vigilance (Terhune, 1985). A head alert was defined as a seal raising its head and clearly looking around.

In addition to the half-hour counts, volunteers collected environmental data, monitored harbor seal behavior, and enumerated human and other activities within the monitoring area. Environmental data recorded included tide height, wind speed, cloud cover, precipitation, and temperature. Seal behavioral data included head alert, approach water (seal movement towards the water but not completely in the water), and flush (seal entering the water in one continuous movement). Time, duration, and location of the seal behavior or activity type were logged. Seal behaviors were recorded regardless of human or other activities and vice-versa. Table 3 lists various types of activities documented. Any association

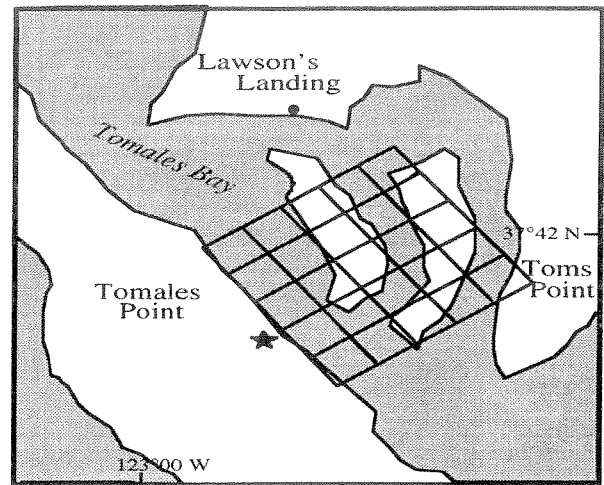


Figure 4. Map of the mouth of Tomales Bay. Grid encloses the observation area around Clam and Seal Islands. Star marks the Tomales Point monitoring location.

Table 2. Total number of volunteers, observation days, observation hours, and volunteer hours at the Tomales Point monitoring site, 1998 and 1999. Number of observation days equals number of shifts.

Month	Volunteers	Observation Days	Observation Hours	Volunteer Hours
March	7	2	8	28
April	4	1	5	19
May	17	5	25	85
June	14	4	23	81
1998 Total	42	12	61	213
March	10	3	12	40
April	6	3	10	19
May	14	5	13	39
June	11	3	10	36
1999 Total	41	14	45	135
Grand Total	83	26	106	348

Table 3. Types of human and other activities recorded within the observation area from Tomales Point.

Aircraft	Dog	Motorboat
Bird	Dog barking	Sailboat
Canoe	Harbor seal	Swimmer
CLAM CLIPPER	Kayak	Thrillcraft
Clammer	Kite flying	Unknown
Docent	Loud watercraft	Visitor

observed between an activity and a seal behavior was noted. The Unknown activity classification was special: it served as the default category when seals were observed flushing or approaching the water for reasons unknown to the observer. Thus Unknown was different from other activity types in that it was defined by the seals' behavior. All recorded seal disturbance behaviors were associated with an activity.

Conventional descriptive statistics were performed on the data. Most relationships are described as correlations (R) while the strengths of the relationships are reported as proportions of variances (R^2).

RESULTS

SEAL NUMBERS AND VISITORS

In 1999, harbor seal numbers peaked during April with a maximum of 397 seals observed. Numbers of pups peaked during May with a maximum of 87 pups observed. The first pup of the 1999 season was seen on April 18 (Figure 5). The mean counts for the 1999 pupping season were 245.9 total seals and 34.2 pups.

Figure 6 shows that in 1999 there was no obvious relation between the number of seals hauled out and the rate of human activities. A linear regression accounted for almost none of the variance ($R = -0.003$, $R^2 = 0.00$). The 1998 data were similar ($R = 0.14$, $R^2 = 0.02$).

ACTIVITIES AND FLUSHES

There was a 78% drop in the activity rate from 1998 observations (Figure 7). A total of 923 activities were observed from the Tomales Point monitoring site at a rate of 20.33 activities per hour (Table 4). Docents also reported a 67% drop in the number of interpretations given to clammers and island visitors (128 in 1998, 42 in 1999). In 1999, clammers had the highest rate of occurrence at 11.65 activities per hour followed by motorboats at 7.36 per hour. Only small percentages of clammers and motorboats were linked with flushes: 1% of clammers and 3% of motorboats. Table 4 shows that, in 1999, 78% of activity instances defined as

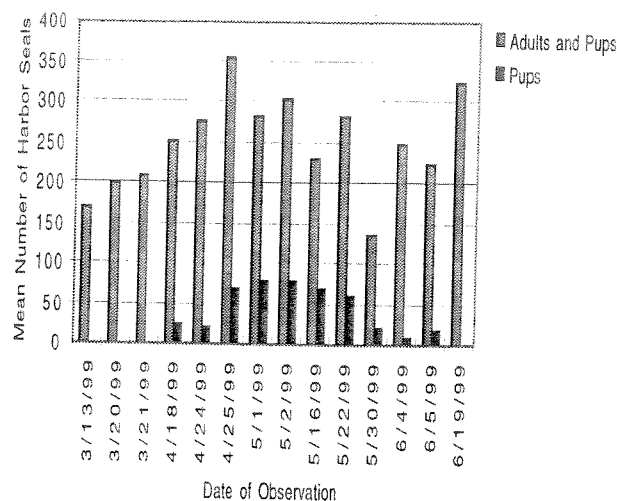


Figure 5. Mean daily seal counts on Clam and Seal Islands observed from Tomales Point during the 1999 pupping season.

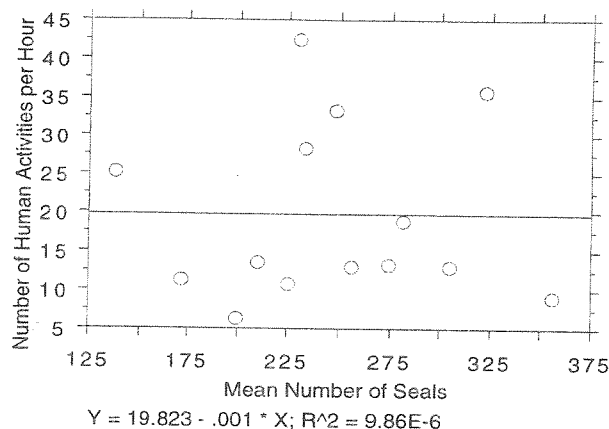


Figure 6. Mean number of seals and number of human activities per hour observed from Tomales Point during the 1999 pupping season.

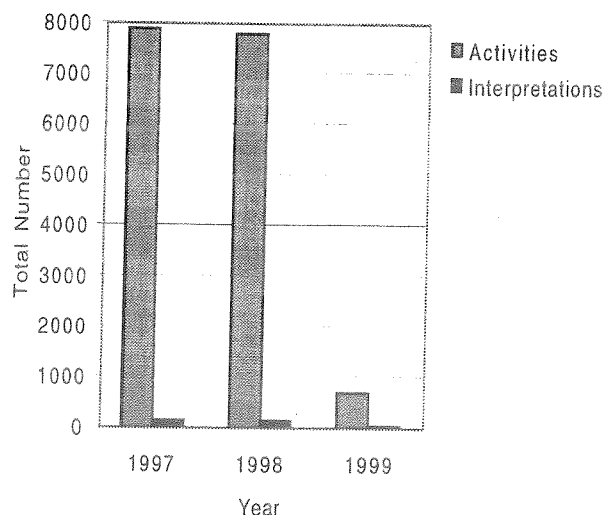


Figure 7. Total number of activities counted by docents on Clam and Seal Islands and the number of interpretations given to visitors.

Unknown were associated with a flush. The other 22% of Unknown occurrences were associated with approach waters. In addition, a large proportion of kayakers that came into the monitoring area were associated with flushes (38%).

Proportional activity use in Tomales Bay during the 1998 and 1999 pupping seasons is shown in Figures 8 and 9. In 1998 clammers represented 89% of the activities observed at Clam and Seal Islands while motorboats represented 7%. In 1999 this pattern changed radically: clammers represented 57% of the activities and motorboats 36%.

Forty-three flushes were observed during the 1999 season, a flush rate of 0.90 flushes per hour. Unknown activities were the highest contributors to the flush rate at 0.31 flushes per hour, followed by motorboats at 0.24 per hour and kayaks and clammers, both at 0.13 per hour.

The 1999 data showed a positive correlation between the rate of pedestrian activity and flushes ($R = 0.53$, $R^2 = 0.29$). The 1999 data also revealed strong positive correlation between the rate of waterborne activity and flushes ($R = 0.72$, $R^2 = 0.51$, Figure 10). Waterborne activities included canoe, *CLAM CLIPPER*, thrillcraft, kayak, and motorboat; pedestrian activities included clammer/visitor, docent, and dog. Analysis of the 1998 data showed a similar positive trend between the rate of waterborne activity and flushes ($R = 0.62$, $R^2 = 0.37$); however, no clear trend was found between the rate of pedestrian activity and flushes ($R = 0.08$, $R^2 = 0.01$).

In 1999, distances at which flushing occurred in relation to activities ranged from 90-180 m (300-600 ft) with a mean of 132 m, $\pm$ SD 135 m (438 ft, $\pm$ SD 450 ft). During 1998 the mean flushing distance was 163 m, $\pm$ SD 109 m (543 ft, $\pm$ SD 363 ft).

HEAD ALERT RATES

The mean head alert rate for the 1999 season was 0.66 head alerts per seal per minute, and in 1998 it was 0.48 head alerts per seal per minute. During 1999, there was a weak negative correlation between the number of harbor seals hauled out and

Table 4. Total number of occurrences, occurrence rate, and number of associated flushes for all activity types observed at Clam and Seal Islands in 1998 and 1999. Note that the Unknown category differs from others in that it is always associated with a seal approach water and/or flush. Data taken from Tomales Point.

Activity	Number of Occurrences		Rate of Occurrences		Associated Flushes		% Associated w/Flushes	
	1998	1999	1998	1999	1998	1999	1998	1999
Aircraft	4	5	0.07	0.11	0	0	0%	0%
Bird	3	3	0.05	0.07	0	3	0%	100%
Canoe	0	1	0.00	2	0	0	0%	0%
<i>CLAM CLIPPER</i>	132	0	2.16	0	3	0	2%	0%
Clammer	5,105	529	83.53	11.65	5	6	<1%	1%
Docent	19	13	0.31	0.29	2	1	11%	8%
Dog	1	4	0.02	0.09	0	0	0%	0%
Harbor seal	2	0	0.03	0	1	0	50%	0%
Thrillcraft	1	0	0.02	0	0	0	0%	0%
Kayak	23	16	0.38	0.35	11	6	48%	38%
Motorboat	415	334	6.79	7.36	17	11	4%	3%
Unknown	8	18	0.13	0.40	6	14	75%	78%
Total	5,713	923	93.48	20.33	43	41	<1%	4%

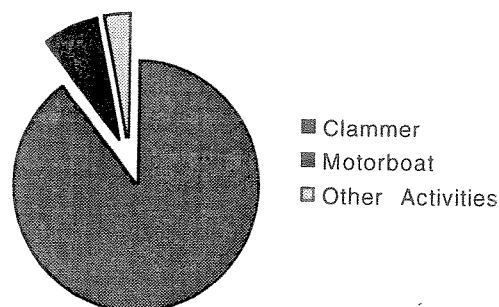


Figure 8. Percentage of total activities represented by clammer, motorboat, and all other activities at Clam and Seal Islands in 1998. Data taken from Tomales Point.

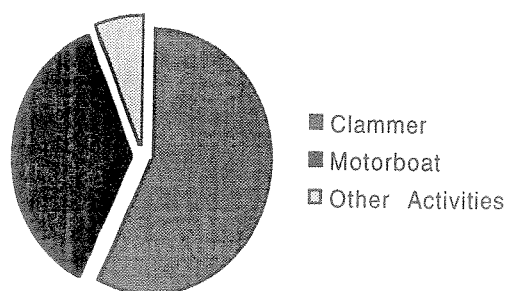


Figure 9. Percentage of total activities represented by clammer, motorboat, and all other activities at Clam and Seal Islands in 1999. Data taken from Tomales Point.

the head alert rate ($R = -0.29$, $R^2 = 0.08$). When the head alert rate was compared with the flush rate, weak positive correlations were found ($R = 0.26$, $R^2 = 0.07$). Likewise, data from 1998 showed similar weak trends for both of these comparisons.

DISCUSSION

SEAL NUMBERS AND VISITORS

The pattern observed in harbor seal numbers during the 1999 pupping season was consistent with that observed during 1998 (Mortenson et al., 1999). There was a peak at the end of April or beginning of May when pups were most abundant and another peak in mid-June at the start of the molting season. There was little difference in the mean number of seals observed over the two years (238.7 in 1998, 245.9 in 1999). However, the mean number of pups increased by over 280% (8.8 in 1998, 34.2 in 1999). This increase was significant in a paired t-test ($P = 0.01$). The 1998 season was affected by the 1997/98 El Niño-Southern Oscillation (ENSO) Event and may explain why there were low pup numbers compared to 1999. During El Niño, increased pup mortality, low pup weights, less maternal attendance, and female outmigration have been observed in California sea lions (Bonness et al., 1991, Francis and Heath, 1991, Huber, 1991). If such effects occurred in harbor seals, lower pup counts might be expected.

Beginning in 1982 and ending in 1995, the California Department of Fish and Game (CDFG) conducted an annual census of harbor seals in California (Fluharty, 1999, Figure 11). The CDFG counts were based on aerial photographs from flyovers during the last two weeks of June and were supplemented by ground counts during the census week. The most comparable data from the SEALS study were collected in late June 1998 and 1999 (320.4 harbor seals and 325.2 harbor seals, respectively). Although the methods varied and a direct comparison would be inexact, radical shifts in population trends would be evident from the two data sets. SEALS counts fall within the range of the most recent CDFG counts suggesting that the Tomales harbor seal population is neither

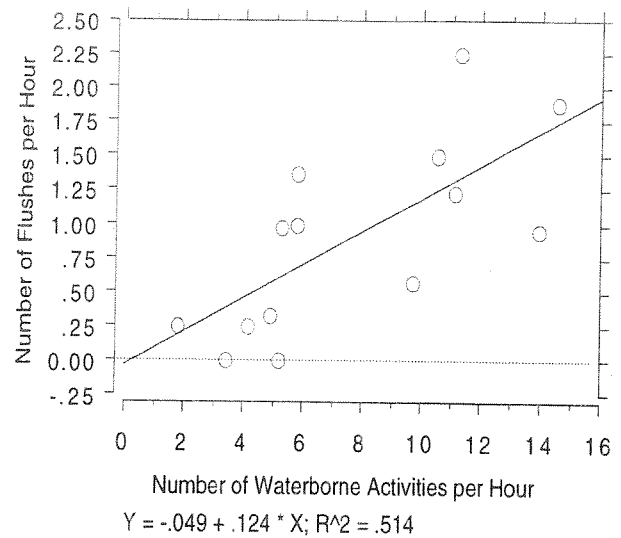


Figure 10. Flush rate and rate of waterborne activities on Clam and Seal Islands during the 1999 pupping season.

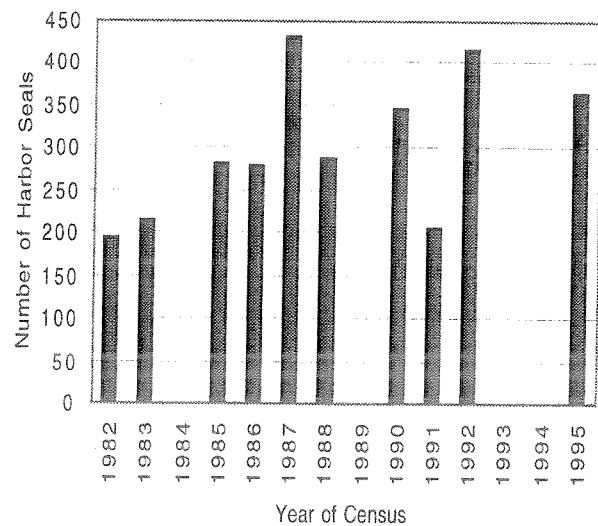


Figure 11. California Department of Fish and Game census counts for Clam and Seal Islands, 1982 through 1995 (Fluharty, 1999).

increasing nor decreasing.

The number of human visitors to Clam and Seal Islands was not strongly correlated to harbor seal abundance suggesting that most recreationists did not visit the Islands to view seals.

ACTIVITIES AND FLUSHES

In 1999, during the absence of the *CLAM CLIPPER*, the pattern of recreational use on and around Clam and Seal Islands changed radically. The islands often had tens of pedestrian visitors (mean 37.8) in 1999 instead of hundreds observed in past years (mean 425.4 in 1998). Rather than being dominated by clammers, the islands were more equally visited by motorboats and clammers. Suspension of the *CLAM CLIPPER* decreased the total frequency of activities in the monitoring area, but other human related activities, such as motorboating and kayaking, showed little change over the two years. Unknown activities associated with flushes were observed three times more in 1999 for reasons that were unclear.

Despite the drop in their numbers, clamming was still the most frequent activity in 1999. As in 1998, clammers had a relatively low flush rate in 1999 (0.13 flushes per hour): only 1% of clammer/visitor activities were associated with flushes. Clammers, once the major cause of harbor seal disturbance, now seem to have little effect on the seals. The Tomales Bay docent program appears to have been successful in this regard.

There were some differences between 1998 and 1999 in the contribution of individual activities to the overall flush rate. Motorboats, the dominant activity associated with flushes in 1998 (0.28 flushes per hour), decreased in 1999 by 14% (0.24 flushes per hour) while unknown activities rose by 343% (0.07 flushes per hour in 1998, 0.31 flushes per hour in 1999) to become the most frequent activity type associated with flushes. When human related activities were separated from all activities combined, waterborne sources (kayak and motorboat) were most likely to be associated with flushes in both 1998 and 1999. In addition, high rates of waterborne activity use tended to be correlated with high rates of seal flushes ($R = 0.60$,

$R^2 = 0.37$ in 1998, $R = 0.72$, $R^2 = 0.51$ in 1999).

Also in both years, kayaks were most likely to be associated with flushes (48% in 1998, 38% in 1999). Overall, however, flush rates for both motorboats and kayaks decreased by 14% and 28% respectively between 1998 and 1999. The presence of the PRNS patrol boat in 1999 may have been a large reason for these declines. Park rangers were often seen approaching violators of the Marine Mammal Protection Act, giving warnings or citations, and encouraging recreationists to be more cautious around the harbor seal haul-outs.

The overall flush rate for the 1999 pupping season increased by 29% (0.70 flushes per hour in 1998, 0.90 flushes per hour in 1999). However, most of this increase can be attributed to the rise in the unknown flush rate mentioned above. Other activities decreased or remained constant over the two study years. When human related activities were analysed separately, the flush rate for 1999 dropped to 0.53 flushes per hour. For 1998 it dropped to 0.62 flushes per hour. This indicates that flushes associated with human activities decreased by 15% between 1998 and 1999. Both years had much lower human related flush rates than the 1.33 human associated flush rate reported by Allen and King in 1991.

Because the data sets were small ($n = 1$ to 15) and widely varying (mean = 90 to 360 m, SD = 0 to 246.5 m), more information will be needed before recommending minimum distances of activities to harbor seal haul-outs.

HARBOR SEAL HEAD ALERTS

The mean head alert rate rose by 38% (0.48 head alerts per seal per minute in 1998, 0.66 head alerts per seal per minute in 1999). There could be several reasons for this increase including the greater number of pups in 1999, a change in weather conditions, or other unknown factors. Although there were only weak trends seen during both 1999 and 1998, higher harbor seal counts were correlated with lower head alert rates. This is expected from vigilance theory (Terhune 1985) and indicates that individual harbor seals may be less wary in large groups. Finally, SEALS data suggest

that the head alert rate may not be a good indicator of harbor seal disturbance, since the relationship was only weakly correlated between the two variables.

BOLINAS LAGOON

Bolinas Lagoon lies on the San Andreas Fault where it emerges from the sea north of San Francisco. This triangular lagoon is surrounded by roads, fields, and houses. Allen et al. (1984) studied seal disturbance at Pickleweed and Kent Islands in Bolinas Lagoon in 1978 and 1979. Time lapse movie cameras recorded activities near the islands, and the movie data were supplemented by day-long monitoring sessions each month. At the largest haul-out on Kent Island, the seals were disturbed on 71% of the days monitored. Canoes were the greatest source of known disturbance. At Kent Island most known cases of disturbances occurred within 100 meters of the seals; statistical analysis indicated the closer the people, the more probable a reaction. In all, seals were flushed 0.09 times an hour at Kent Island and 0.05 per hour at Pickleweed Island.

In 1992, seal disturbances at Bolinas Lagoon were briefly studied by Morgan and Swift of The Marine Mammal Center. Volunteers observed the seals at Kent and Pickleweed Islands on weekends during the fall. The observers were asked to note all human activities within 500 m of the haul-outs regardless of whether a flush occurred, the type of response made by the seals, the number of seals flushed, the distance at which the flush occurred, and the amount of time it took the seals to rehaul. During the 109 hours of observation 68 possible causes for disturbances were noted. Flushes were seen in 45 of the 68 potential occasions and on 21 out of 23 weekend days. Canoes and kayaks accounted for more than half the disturbances. Most flushes were caused by human activities occurring near the seals (< 100 m). Overall, Morgan and Swift observed 0.41 flushes per hour from all causes.

Residents of the Bolinas Lagoon area have been concerned about the numerous cars

stopping alongside Highway 1. Many of these motorists leave their vehicles to walk along the Lagoon shore. Are these visitors disturbing the seals? If they are, is the level of disturbance at the Lagoon severe enough to merit intervention?

To further the preservation of harbor seal rookeries and to develop methods to reduce disturbance, the SEALS program launched an investigation of activities along Highway 1 near the Lagoon and their relation to seal numbers and behaviors. The first year's study (Mortenson et al., 1999) suggested that land-based activities were associated with few flushes, while aquatic activities were associated with more flushes. It appeared that the seals were attracting the recreationists and determining a major usage pattern at the Lagoon. The SEALS program continues to study the effects of human recreation on harbor seals in Bolinas Lagoon.

METHOD

Teams of two to four observers were posted year round at a small spit of land by McKinnan Gulch (Figure 12). The monitoring area included the Channel mudflat from its eastern curve north-westward to the line perpendicular to Mile Marker 14.47 on Highway 1. If a haul-out was exposed for more than three hours, an observation took place. At half hour intervals, the observers counted the seals on Pickleweed and Channel haul-outs within the monitoring area. Pickleweed haul-out counts were conducted on the north-east side of the mudflat. Protocol was similar to that at Tomales Point. Observers recorded head alerts for a focal group of seals, collected environmental data, and enumerated and timed human activities along the east shore of Bolinas Lagoon. Hikers were a special category defined to include anyone who visited the Observation Spit or who came in close proximity to the shore between the Observation Spit and Mile Marker 14.47. Visitors were classified as people who stopped their vehicles within the monitoring area. Seal behaviors were logged and activities noted. Compass bearings and rangefinder readings were taken to determine the distance of activities to the seals. Volunteers

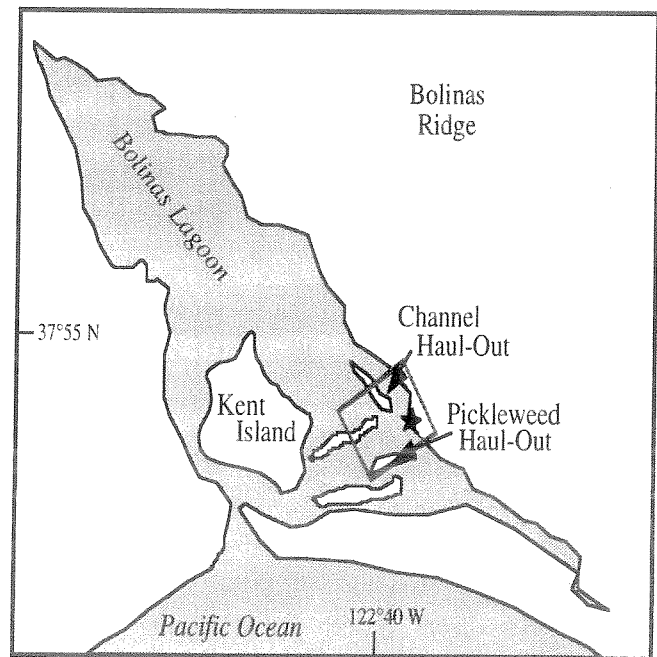


Figure 12. Map of Bolinas Lagoon. Star marks point of observation at McKinnan Gulch and box indicates area monitored for seal and human behavior.

also censused the entire Lagoon once each shift and mapped the distribution of seals. From March 15 through June 15 pups were counted for Bolinas Lagoon.

The study began in July 1997. The first year of data collection (Mortenson et al., 1999) took place during the strong El Niño-Southern Oscillation (ENSO) of 1997/98; the second year of monitoring was largely conducted during the La Niña year of 1998/99.

Volunteers monitored Bolinas Lagoon 95 times in 1998/99, which represented 221 observer hours and 525 volunteer hours (Table 5). In addition Bolinas Lagoon volunteers traveled 31,460 miles and spent 628 hours to reach the Observation Spit.

RESULTS

SEAL NUMBERS AND VISITORS

The annual cycle of seal numbers counted within Bolinas Lagoon is illustrated in Figure 13. These numbers were generated from censuses conducted once during each shift and represent the entire Lagoon. There was a peak in counts during July (monthly mean 128.1) and an annual low during December (monthly mean 14.3), followed by a gradual increase into May (monthly mean 94.2).

There was little difference between the average monthly number of seals observed in 1998/99 (57.2) and 1997/98 (64.2) in the Lagoon, although there were fewer pups in 1997/98 (10.1) than in 1998/99 (10.8).

Within the monitoring area, there was a striking drop in the number of seals counted from August to October, 1998 compared to the number counted during August to October, 1997 (Figure 14). This was reflected in a lower mean number of seals in the study area during 1998/99 (24.0 in 1997/98; 10.4 in 1998/99).

As Figure 15 shows, the number of visitors per hour tended to be higher when more seals were present at Channel and Pickleweed haul-outs ($R = 0.74$, $R^2 = 0.55$). A similar relationship existed between the number of active recreationists (hikers, dogs, fishers, and boaters) and the number

Table 5. Total number of volunteers, observation days, observation hours, and volunteer hours at Bolinas Lagoon, July 1998 through June 1999.

Month	Volunteers	Observation Days	Observation Hours	Volunteer Hours
July	21	9	22	54
August	28	11	28	71
September	15	6	13	33
October	12	6	12	23
November	14	7	16	32
December	18	8	12	24
January	9	5	10	16
February	19	9	19	45
March	14	6	17	41
April	25	10	23	51
May	25	10	29	74
June	24	8	20	61
Total	224	95	221	525

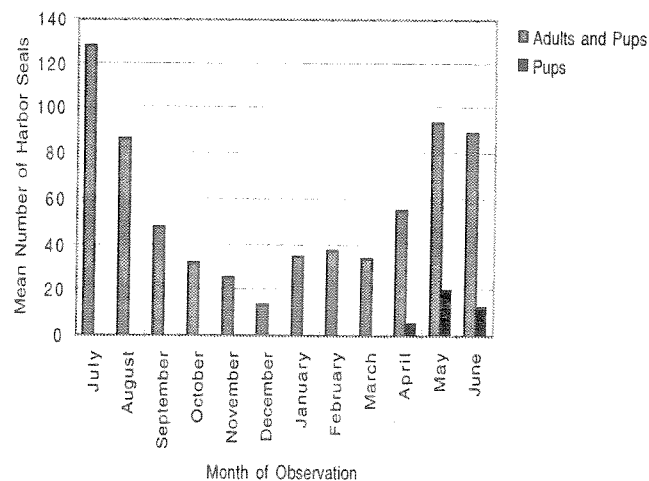


Figure 13. Mean monthly seal counts for Bolinas Lagoon, July 1998 through June 1999. Pups were counted from 15 March through 15 June.

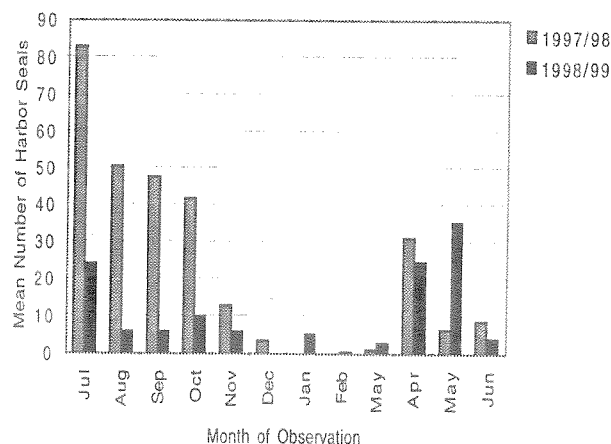


Figure 14. Mean number of harbor seals observed each month at Channel and Pickleweed haul-outs during the 1997/98 and 1998/99 monitoring seasons.

of seals ($R = 0.55$, $R^2 = 0.30$).

Both the number of seals and the hourly visitor rate were negatively related to tide ($R = -0.27$ and -0.35 , $R^2 = 0.07$ and 0.12 respectively).

ACTIVITIES AND FLUSHES

Table 6 lists all activities observed within the monitoring area and those associated (30) with seal flushes. Most activities associated with flushes were human related (21), including a dog; others were harbor seals (2), birds (2), and unknown (5). As at Tomales Bay, unknown meant that there was no observable cause when a flush or approach water occurred. Of human activities, canoes and kayaks had the highest percentages associated with flushes, 33% and 29% respectively. Hiking, the most common shoreside activity, was associated with flushes 2% of the time. Roadside visitors to the Lagoon were associated with a single flush (0.04% of all visitors in 1998/99).

The mean distances at which flushing occurred during various activities ranged from 0 to 123 m (0 to 498 ft). The two lowest values were for flushes associated with other animals: a harbor seal pup and two birds. Human associated disturbances ranged from 56 to 123 m (185 to 498 ft). The mean distance between an activity and flushing seals was 76.3 m, $\pm$ SD 55.6 m (254.3 ft, $\pm$ SD 185.2 ft).

Although few flushes were associated with individual pedestrian activity types (hikers, fishers, and dogs), there was a positive correlation between the hourly rate of all pedestrians combined and the rate of flushes ($R=0.48$, $R^2=0.23$). Data revealed a weaker positive correlation between the hourly rate of waterborne activity and flush rate ($R=0.22$, $R^2=0.05$). Waterborne activities were comprised of canoe and kayak; no motocraft were observed.

HARBOR SEAL HEAD ALERTS

Head alert rates were not obviously correlated with recreational visitation in the 1998/99 data set. Data from the 1997/98 and 1998/99 seasons were combined in order to increase the sensitivity of analysis and better detect any relationships present. The average head alert ratio

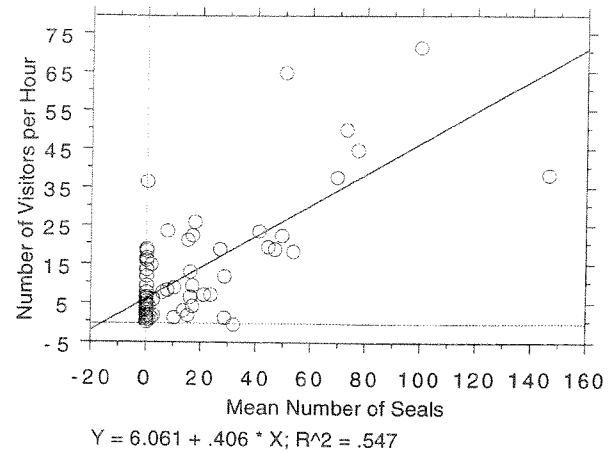


Figure 15. Number of visitors per hour and mean number of seals on Channel and Pickleweed haul-outs, July 1998 through June 1999 ($R = 0.74$).

Table 6. Total number of occurrences, occurrence rate, and number of associated flushes for all activity types observed near Channel and Pickleweed haul-outs during July 1998 through June 1999.

Activity	Number of Occurences	Number of Occurences per Hour	Associated Flushes	% Associated w/Flushes
Aircraft	3	0.01	0	0%
Automobile	35	0.16	1	3%
Bird	3	0.01	2	67%
Canoe	9	0.04	3	33%
Chain Saw	1	0.01	0	0%
Cyclist	2	0.01	0	0%
Dog	4	0.02	1	25%
Fisher	35	0.16	0	0%
Helicopter	1	0.01	0	0%
Hiker	197	0.89	6	3%
Horn	44	0.20	1	2%
Harbor Seal	3	0.01	2	67%
Kayak	24	0.12	7	29%
Loud Noise	1	0.01	0	0%
Motorboat	1	0.01	0	0%
Motorcycle	37	0.17	1	3%
Other	5	0.02	0	0%
Siren	3	0.01	0	0%
Unknown	12	0.05	5	42%
Visitor	2,694	12.47	1	<1%
Total	3,114	14.37	30	1%

relationships present. The average head alert ratio at Channel (3.10 head alerts per seal per minute) and Pickleweed (2.69 head alerts per seal per minute) were not clearly correlated to either visitor rate (Channel, $R = -0.14$, $R^2 = 0.02$, Pickleweed, $R = -0.04$, $R^2 = 0.00$) or to total activity rate (Channel, $R = -0.01$, $R^2 = 0.00$, Pickleweed, $R = -0.08$, $R^2 = 0.01$). The average head alert ratio was inversely related to the number of seals present at both sites ($R = -0.15$, $R^2 = 0.02$, Figure 16). However, the relationship between head alert rate and number of seals was not strong, and although the correlation between number of seals and head alert ratio at Pickleweed was the highest (Channel, $R = -0.18$, $R^2 = 0.03$, Pickleweed, $R = -0.28$, $R^2 = 0.08$), it did not reach statistical significance ($P = 0.11$).

DISCUSSION

SEAL NUMBERS AND VISITORS

The annual cycle in the mean total number of seals and pups counted for the Lagoon in 1998/99 followed the pattern reported for the previous research year (Figure 8, Mortenson et al., 1999). There was a peak during summer, a decline during fall, and a minimum during the winter. However, Lagoon seal counts during the 1998/99 La Niña winter did not fall as low (lowest monthly average, 26) as those recorded in the preceding 1997/98 El Niño winter (lowest monthly average, 9).

Two years of SEALS data are not enough to establish an annual population trend for Bolinas Lagoon, especially given the variability of seal numbers and the two recent weather extremes. However, a rough comparison can be made with past CDFG census counts at Bolinas Lagoon. SEALS maximum counts for June 1998 (102) and June 1999 (168) fall within the range of values obtained from CDFG censuses (Figure 17), and there is no evidence of any recent increase in harbor seal numbers in Bolinas Lagoon.

As was the case in the previous research year (Mortenson et al. 1999), the number of recreationists in the observation area was highly correlated with the number of seals. Two years of data suggest that seals attract recreationists to

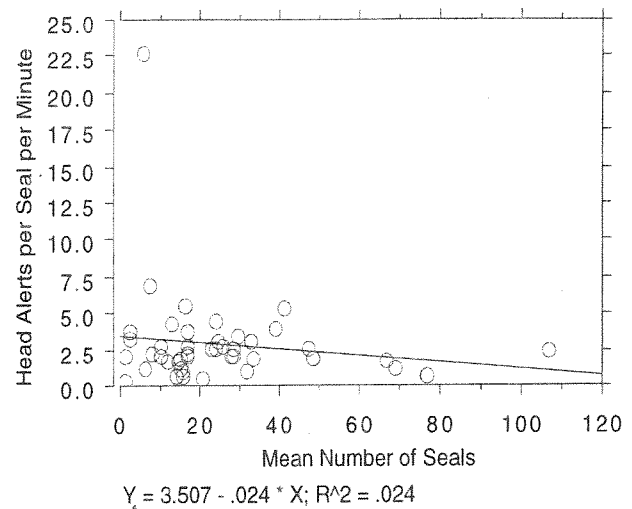


Figure 16. Mean head alert rate and mean seal counts for Pickleweed and Channel haul-outs, July 1998 through June 1999 ($R = -0.15$).

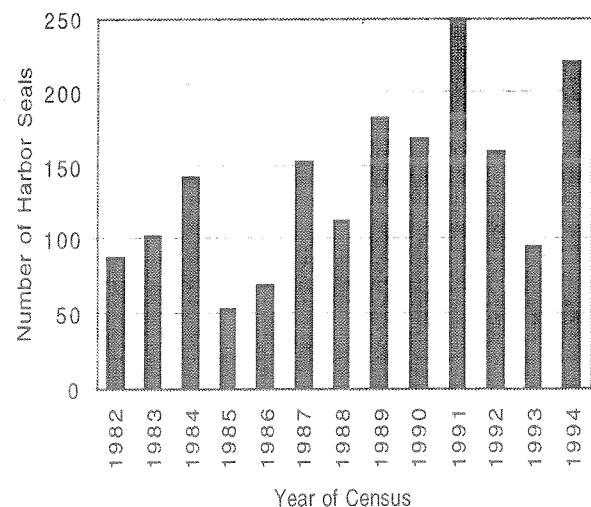


Figure 17. California Department of Fish and Game census counts for Bolinas Lagoon, 1982 through 1994 (Fluharty, 1999).

Bolinas Lagoon. This theory is further supported by an inverse correlation between the number of visitors and tide height. Seals tend to haul out when low tides make the mudflats accessible. The presence or absence of harbor seals may determine some of the major spatial and temporal patterns of recreational use in Bolinas Lagoon.

ACTIVITIES AND FLUSHING

This year's study replicates the key findings of last year's. Shoreside activities were associated with few flushes, and waterborne activities were more likely to be associated with flushes. Kayaks were again the leading activity associated with flushes, with a rate of 0.03 flushes per hour. In the previous research year, the rate was 0.06 flushes per hour. This year's lower kayak disturbance rate may reflect SEALS' recent boater education campaign.

In 1998/99, 33% of canoes (0.01 flushes per hour) and 29% of kayaks (0.03 flushes per hour) were associated with flushes; in 1997/98 similar percentages of canoes (29%, 0.01 flushes per hour) and kayaks (27%, 0.06 flushes per hour) were associated with flushes (Mortenson et al, 1999). In this year's study, hiking, the most common shoreside activity, was associated with flushes 2% of the time (0.02 flushes per hour), which was identical to the result from 1997/98. Also, roadside visitors to the Lagoon were associated with a single flush (0.04% of all visitors in 1998/99, 0.01 flushes per hour), just as in the preceding year. The low rate of disturbance associated with land-based recreationists along the eastern shore of Bolinas Lagoon is impressive. However, the presence of SEALS volunteers as they collect data may cause recreationists to be cautious around the seals resulting in low disturbance rates. We do not know the degree to which shoreside visitors disturb seals when volunteers are not present.

The overall flush rate in 1998/99 was 0.13 times per hour, compared to 0.19 per hour in the preceding research year. This might be expected because the mean monthly number of seals counted in the study area was less than half that of the preceding year (10.4, 1998/99; 24.0, 1997/98), and because the rate of flushing is positively correlated

with the number of seals.

The flushing rates seen in the 1997/98 and 1998/99 studies were slightly higher than Allen and her colleagues recorded separately for Pickleweed (0.05 per hour) and Kent Islands (0.09 per hour) in 1978/79 (Allen et al., 1984). The flush rates from the SEALS studies were lower than the 0.41 per hour recorded by Morgan and Swift (not dated) for Pickleweed and Kent Islands combined in 1992. Again, it is difficult to compare the flushing rates in the current studies to those determined earlier, since the sites in the Lagoon were different and the methods varied. Nonetheless, Morgan and Swift's study suggests that flushing rates may have been higher in 1992. It could be that the rate of disturbance has fallen over the years as people have become more sensitive to wildlife. It could also be that the seals have become more habituated to people in the last two decades. Finally, it could be that the presence of SEALS monitoring teams inhibited recreationists from boisterous activities and thus lowered the flush rate.

HARBOR SEAL HEAD ALERTS

Head alert ratio was inversely related to the number of seals present at both sites (Channel, -0.18, $R^2 = 0.04$, Pickleweed, -0.28, $R^2 = 0.08$) which was expected based of previous research (Terhune, 1985; Gaspari, 1994). However, this relationship accounted for only a small fraction of the variance. The tendency for lower head alert rates to be associated with higher seal numbers is to be expected based on the theoretical concept of vigilance. According to vigilance theory, larger groups spot predators more readily since more animals scan their surroundings. Individuals can scan less and conserve energy, since overall the group scans more.

FITZGERALD MARINE RESERVE

Fitzgerald Marine Reserve (FMR) lies along the San Mateo County coast in the northern portion of the Monterey Bay National Marine Sanctuary. FMR consists of a long series of reefs, which extend outward from near vertical bluffs (Figure 18). The reserve was established in 1969 by

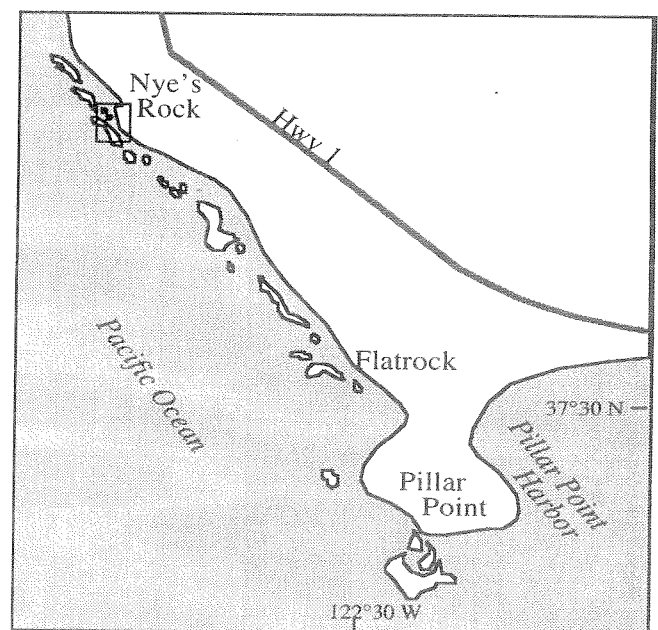


Figure 18. Map of Fitzgerald Marine Reserve showing the two harbor seal monitoring sites, Flatrock and Nye's Rock. Area in the box is shown in further detail in Figure 19.

legislative action , and is managed as a county park. As well as being a complex and fragile rocky intertidal community, FMR is also the location of several harbor seal haul-out sites. Since FMR beaches are often frequented by hikers, tidepoolers, surfers, students, and other recreationists, the FMR management has become concerned about disturbance to harbor seals. The staff has established Restricted Access Zones in areas of heavy human use to isolate seal haul-outs from the public. The restricted areas are denoted each day by orange cones placed by ranger staff around the eastern edge of the haul-outs. In an effort to establish yearly and seasonal estimates of harbor seal abundance at FMR and to determine if human activities outside the restricted areas were disturbing seals, a monitoring program similar to the SEALS program was developed for FMR. Volunteers were responsible for gathering data and participated in 54 hours of training both in the field and in the classroom to prepare them for the harbor seal monitoring.

METHOD

Monitoring took place between March and July 1999 on Wednesdays and Sundays and was usually done by two teams at two separate sites (Nye's Rock and Flatrock) simultaneously. Observation sessions covered a wide range of times and tides and lasted approximately three hours. In total, 34 different days were observed with 58 shifts, 101 observation hours, and 229 volunteer hours (Table 7).

The methods at FMR were similar to those used at Tomales Bay and Bolinas Lagoon with few differences. At each FMR site, basic data were gathered every 30 minutes, similar to Tomales Bay and Bolinas Lagoon. Seal data included total counts of seals, pups, red pelage seals, and wounded seals, and estimates of head alert rate by averaging the number of head alerts for a focal group of seals over a 3 minute period. Environmental data that were recorded included tide, wind, air temperature, and precipitation. At Nye's Rock human activities, including beachwalker, tidepooler, aircraft, and other, were recorded every 15 minutes and were not continuously logged as at Tomales Bay and Bolinas

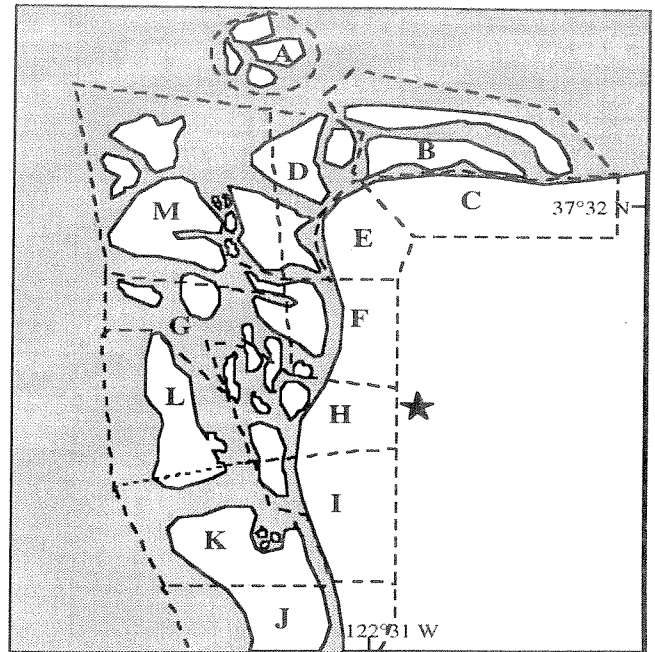


Figure 19. Map of Nye's Rock showing rocky and reef intertidal areas exposed at low tide. Star indicates observation point and quadrats are marked by dashed lines. Harbor seals haul out in zone M, designated Restricted Access Zone #1, and in zones L-K, designated Restricted Access Zone #2.

Table 7. Total number of volunteers, observation days, shifts, observation hours, and volunteer hours at the Nye's Rock and Flatrock observation sites in Fitzgerald Marine Reserve during 1999.

Month	Volunteers	Observation Days	Shifts	Observation Hours	Volunteer Hours
March	19	7	13	21	57
April	18	8	13	24	54
May	22	9	17	27	66
June	9	5	6	15	27
July	14	5	9	14	26
Total	82	34	58	101	229

Lagoon. Activity locations were also recorded at Nye's Rock based on a map divided into distinct quadrants (Figure 19). At both sites, all flushes and any associated activities were recorded.

RESULTS

SEAL NUMBERS AND VISITORS

The daily mean seal counts at Nye's Rock is shown in Figure 20. The overall mean count for the study period at Nye's Rock was 21.0 seals; the highest monthly mean was in March at 29.7 seals and the lowest in May at 15.2 seals. The daily mean seal counts at Flatrock is presented in Figure 21. The overall mean at Flatrock was 18.9 seals; the highest monthly mean was in June at 45.4 seals (only two days observed, however) while the lowest was in May at 10.3 seals. Pups were observed on only three days at Nye's Rock and on ten days at Flatrock. The mean number of pups seen at Nye's Rock (May 5 through June 9) was 0.2 with a maximum of 1 pup observed on each of the 3 days. At Flatrock the mean number of pups (April 25 through June 9) was 2.0 and a maximum of 6 pups was seen on May 12.

Figure 22 shows that seals were more likely to haul out later in the day ($R = 0.70$, $R^2 = 0.48$, Nye's Rock and Flatrock data combined). Seals were more likely to haul out at high tides as opposed to low ($R = 0.78$, $R^2 = 0.60$, Figure 23). In addition, early observation times were correlated with lower tides ($R = 0.86$, $R^2 = 0.74$).

ACTIVITIES AND FLUSHES

At Nye's Rock, an average of 49.6 activities were counted every 15 minutes (note that a rate per hour could not be generated since the activity counts were at intervals; also note that no comparable information was gathered at Flatrock). The mean daily activity rate had a significant curvilinear relation to time of observation ($P = 0.05$, $R = 0.45$, $R^2 = 0.19$, Figure 24). There was a hint of a curvilinear relation between activity rate and tide height. Fifteen flushes occurred at Nye's Rock (0.17 flushes per hour) as opposed to 3 at Flatrock (0.04 flushes per observation hour). At

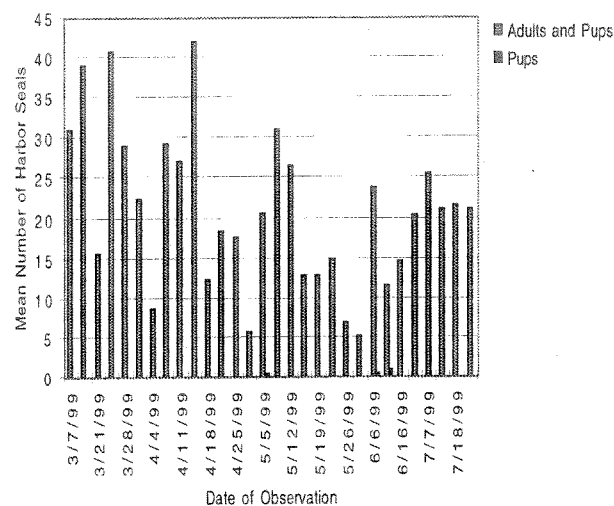


Figure 20. Mean daily seal counts observed at Nye's Rock, Fitzgerald Marine Reserve during 1999, March 7 through July 28.

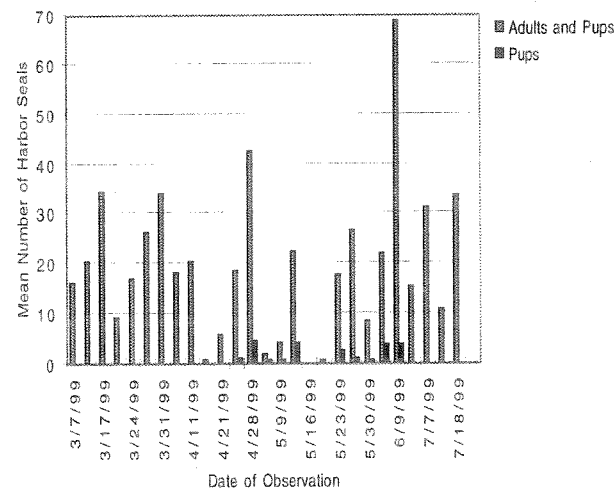


Figure 21. Mean daily seal counts observed at Flatrock, Fitzgerald Marine Reserve during 1999, March 7 through July 28.

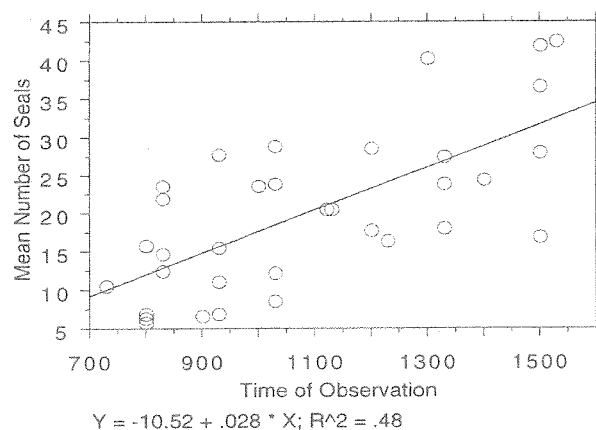


Figure 22. Mean number of harbor seals and time of observation (measured in military time) at Nye's Rock and Flatrock, Fitzgerald Marine Reserve in 1999, March 7 through July 28.

both sites tidepoolers were associated with the highest flush rate (0.08 flushes per hour at Nye's Rock, 0.02 at Flatrock) followed by unknown (0.05 flushes per hour at Nye's Rock, 0.012 at Flatrock, Figure 24).

HARBOR SEAL HEAD ALERTS

The mean head alert rate for the observation season was 0.49 at Nye's Rock and 0.61 at Flatrock. A weak negative correlation was found between head alert rate and the number of seals hauled out at Nye's ($R = -0.16$, $R^2 = 0.03$) and Flatrock ($R = -0.21$, $R^2 = 0.04$).

DISCUSSION

Overall mean seal counts were lower at both FMR sites when compared to Bolinas Lagoon and Tomales Bay. Even lower were the FMR absolute and relative pup figures. Topographical and substrate differences between FMR and the two northern sites might account for the lower seal and pup numbers. FMR has a rocky intertidal substrate that is accessible to both human pedestrian traffic and wave action. At Tomales and Bolinas, the substrates are mudflats, accessible to people only by water and sheltered from the open ocean.

Typically harbor seals haul out at lower tides, such as in Tomales Bay and Bolinas Lagoon. FMR seals, however, showed the opposite trend. Hauling out at higher tides may be a behavioral response to heavy disturbance since Nye's Rock and Flatrock may be less accessible to people at higher tides. In addition, the haul-outs may be accessible to seals only at high tides. This has been found to be the case for sites within San Francisco Bay (Allen and Markow, 1998). Time of observation also had a strong positive correlation with the number of seals hauled out. Seals may have been reacting to the time of day, preferring to haul out at later hours which was coincidentally when high tides usually occurred, or vice versa.

At Nye's Rock, where activity data were gathered, there was a bell-curve relationship between time of observation and the frequency of

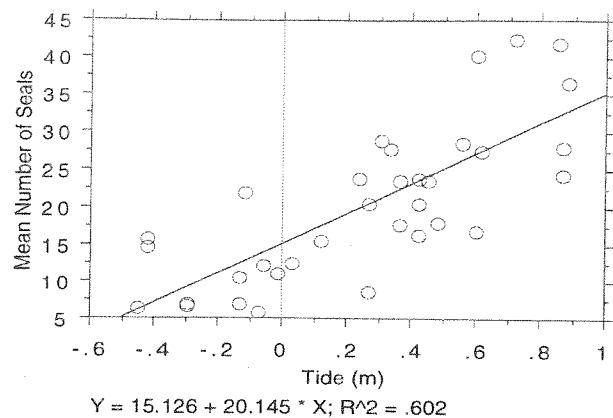


Figure 23. Mean number of harbor seals and tide height at Nye's Rock and Flatrock, Fitzgerald Marine Reserve in 1999, March 7 through July 28.

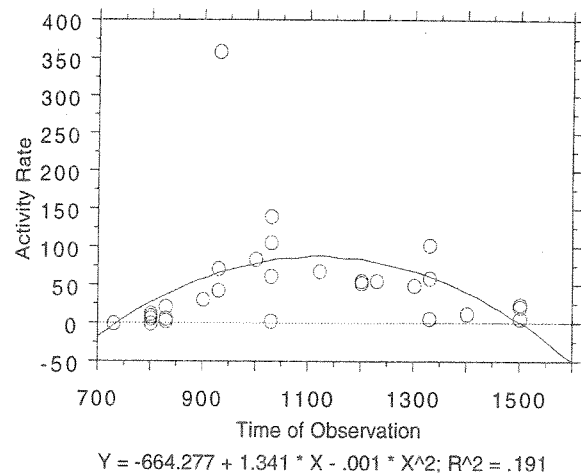


Figure 24. Mean number of activities per 15 minute interval and time of observation (measured in military time) at Nye's Rock, Fitzgerald Marine Reserve, 1999.

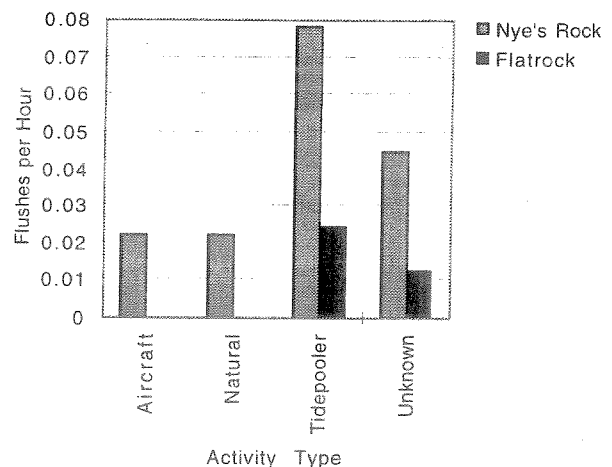


Figure 25. Flush rates for various activities at Nye's Rock and Flatrock, Fitzgerald Marine Reserve during 1999.

activities, and there was no strong relationship between tide height and the frequency of activities. These activity patterns did not match the pattern found between seal numbers and tide/time, and it cannot be assumed that seals were hauling out late in the day or at low tides in order to avoid times of high activity use.

Because information on activity frequencies was gathered only at Nye's Rock, the two monitoring sites cannot be compared to each other and related to seal abundance. It is also difficult to know whether FMR sites are more or less heavily used recreational areas than Bolinas Lagoon or Tomales Bay, because the methods used in obtaining the activity frequencies were different. Disturbance data, however, were taken in the same way at all sites. Within FMR, Nye's Rock appears to be a more heavily disturbed area with a higher flush rate than Flatrock. At both sites, tidepoolers were associated with the highest rate of flushes. Compared to Tomales Bay, FMR sites had much lower disturbance rates (81-95% less). Considering the non-typical haul out patterns, the low overall seal counts (95% less than at Tomales Bay), and low pup counts, FMR is a unique site that merits further study.

CENTRAL CALIFORNIA COOPERATIVE HARBOR SEAL CENSUS

One of the objectives of the SEALS program is to determine the health and stability of harbor seal populations within and around the GFNMS. The first census was organized by the GFNMS and was conducted during the 1998 pupping season. These counts provided estimates of the number of adult seals and pups from southern San Mateo county to northern Sonoma County. In 1999, additional sites were added and the census was extended into the summer molting period, when seal counts can be highest (Allen and Huber, 1983). The Central California breeding and molting counts provide information on trends in harbor seal populations. GFNMS, FMR, PRNS, FMSA, Seal Watch at Jenner, and Seal Watch at Sea Ranch conducted the census. PRNS and GFNMS coordinated the counts while FMSA provided data entry and analysis.

METHOD

Ground counts of harbor seals during 1998 were made from April 18 through June 14. Semi-monthly counts were made during the breeding season at prominent harbor seal haul-out areas from San Mateo to Sonoma County (Figure 26).

Counts during 1999 were made on selected days from April 18 through July 28. Count days were chosen to maximize the number of personnel available in order to allow the best coastal coverage and to include a low rising tide. More small-sized haul-outs with low seal counts were censused during 1999. Teams were asked to census at times when they would expect numbers to be highest. In general, seal numbers are highest in early afternoon during a low tide. However, this is not always the case. At some sites like the Russian River in Sonoma County, human disturbance can lower numbers during mid-day (Mortenson, 1996, 1997, and 1998). These haul-outs were censused early in the day.

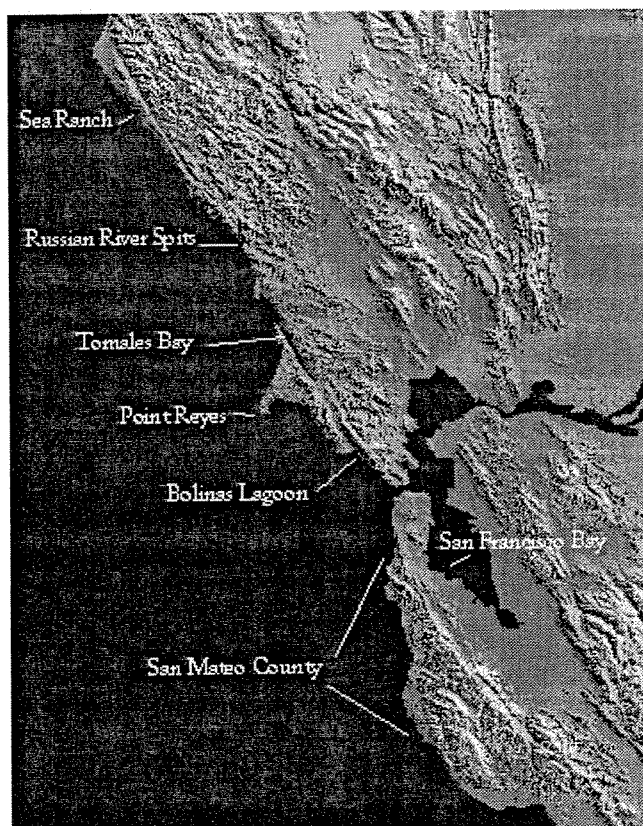


Figure 26. Central California harbor seal census locations

RESULTS

Census results are presented for both 1998 and 1999. Sites that were consistently monitored between April and May of 1998 and 1999 were compared for total seals and pups (Figure 27). These sites were separated into three regions: Point Reyes, Sea Ranch, and Southern Sonoma county. Only 11 sites were counted regularly during both years, and many new sites were added in 1999. The data showed no clear trends, although the number of pups seen on the spits of the Russian River in Sonoma County nearly doubled.

During 1999 several sites were added to the census in San Mateo and Sonoma counties and in the San Francisco Bay. Table 8 presents the seasonal mean number of seals and pups, maximum number of seals and pups, and percentage of pups seen at all regularly censused sites during 1998 and 1999.

The size of the haul-outs varied between regions. Point Reyes National Seashore haul-outs were the largest, San Francisco haul-outs were intermediate, and San Mateo and Sonoma Counties included small haul-outs, with the exception of the large haul-out at Jenner at the mouth of the Russian River. The sites in San Mateo and Sonoma Counties had fewer pups than in the other regions of the census.

The 1999 data included many small haul-outs with low seal counts. These sites had lower percentages of pups than larger haul-outs. Regression analysis found a significant positive trend between percentage of pups and haul-out size ($R = 0.29$, $R^2 = 0.85$, $P = .043$, Figure 28). To increase the number of small haul-outs represented in the analysis, both regularly and irregularly observed sites were included. These irregular census sites were not listed in Table 8, however.

DISCUSSION

A pilot analysis indicated that there was a general positive relationship between percentage of pups and haul-out size. Female harbor seals may

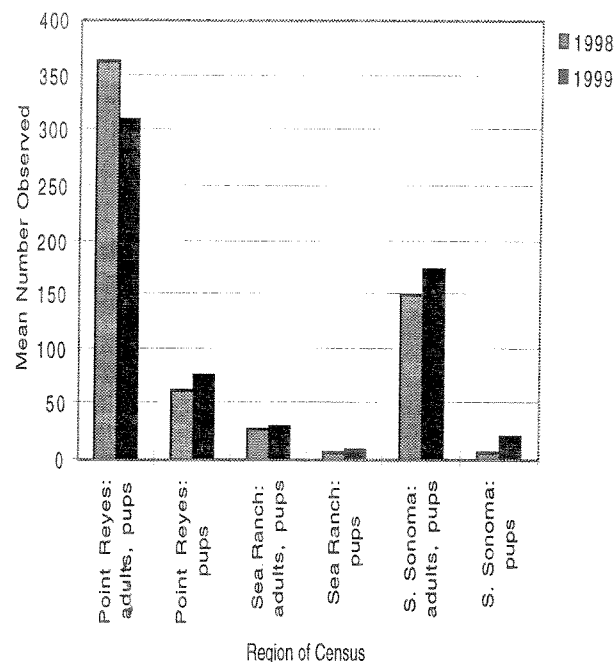


Figure 27. Mean number of harbor seals at consistently counted sites in the Point Reyes, Sea Ranch, and South Sonoma Coast Regions in May-June 1998 and 1999.

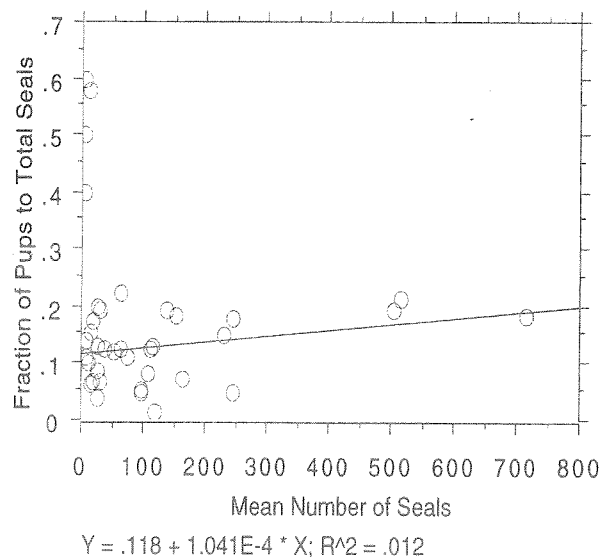


Figure 28. Mean number of seals (haul-out size) and pup proportion at census sites in May-June 1998 and 1999 ($R = 0.108$).

Table 8. Mean and maximum number of seals and pups, including pup percentage, observed at census sites in March-July 1998 and 1999.

Region	Site	Mean Number Seals		Mean Number Pups		Mean Pup Percentage		Maximum Number Seals		Maximum Number Pups		Maximum Pup Percentage	
		1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
San Mateo	S. Bean Hollow	66.3	—	8.0	—	12.4%	—	68	—	10	—	14.7%	—
	Bean Hollow	—	0	—	0	—	0%	—	0	—	0	—	0%
	Cowell Ranch	—	95.0	—	4.7	—	4.9%	—	178	—	10	—	50.0%
	Devil's Slide	—	27.0	—	1.0	—	3.7%	—	27	—	1	—	3.7%
	MM 11.62	—	36.8	—	4.7	—	12.7%	—	71	—	11	—	37.5%
	MM 11.79	—	9.0	—	1.0	—	11.1%	—	27	—	2	—	16.7%
	Pebble Beach	—	13.7	—	0.8	—	6.1%	—	51	—	3	—	25.0%
	N. Pebble Beach	—	2.9	—	0	—	0%	—	13	—	0	—	0%
	Pescadero	—	31.0	—	6.0	—	19.4%	—	31	—	6	—	19.4%
	N. Pescadero	—	25.0	—	2.2	—	8.7%	—	39	—	3	—	27.2%
	S. Pescadero	—	0	—	0	—	0%	—	0	—	0	—	0%
	San Pedro	—	28.8	—	2.0	—	6.9%	—	50	—	3	—	17.7%
	S. Pillar Point	—	110.0	—	14.0	—	12.7%	—	110	—	14	—	12.7%
San Francisco Bay	Castro Rocks	—	107.7	—	9.1	—	8.5%	—	139	—	21	—	22.7%
	Mowry Slough	—	136.8	—	26.4	—	19.3%	—	243	—	78	—	57.8%
	Yerba Buena Island	—	119.9	—	1.9	—	1.6%	—	198	—	7	—	7.4%
Point Reyes	Bolinas Lagoon	116.0	177.4	28.3	27.9	24.4%	15.7%	149	288	47	50	32.9%	32.9%
	Duxbury Reef	—	97.0	—	5.0	—	5.2%	—	98	—	10	—	10.2%
	Double Point	675.3	458.9	121.0	106.1	17.9%	23.1%	847	890	160	283	22.9%	31.8%
	Drakes Limantour	715.0	505.2	133.7	99.2	18.7%	19.6%	853	922	192	237	24.1%	33.8%
	Point Reyes Head	63.7	131.8	15.7	14.3	24.6%	10.8%	77	431	23	38	37.1%	48.7%
	Tomaes Bay	244.2	—	12.1	—	5.0%	—	485	—	68	—	22.2%	—
	Clam Island	—	74.3	—	8.4	—	11.4%	—	284	—	53	—	30.8%
	Seal Island	—	229.7	—	35.0	—	15.2%	—	356	—	89	—	25.0%
	Tomaes Point	345.3	211.6	56.0	38.9	16.2%	18.4%	485	478	68	110	22.2%	32.3%
S. Sonoma	Chalanchawi	3.0	3.7	0	0	0%	0%	6	9	0	0	0%	0%
	Jenner	144.6	179.3	7.4	18.5	5.2%	10.3%	249	298	13	35	8.9%	15.0%
	Odin Cove	1.5	7.4	0	0	0%	0%	3	26	0	0	0%	0%
Sea Ranch	Cormorant Reach	22.7	27.6	5.3	5.1	23.5%	18.6%	43	44	7	19	40.0%	43.2%
	Del Mar	12.0	4.9	0	0	0%	0%	13	11	0	0	0%	0%
	Dune Drift	16.3	21.2	2.0	1.1	12.2%	5.3%	28	47	4	6	14.3%	40.0%
	Green Cove	27.3	25.8	4.3	3.1	15.9%	12.1%	46	46	6	10	20.0%	40.0%
	Shell Beach	2.5	—	1.5	—	60.0%	—	5	—	3	—	60.0%	—
	Tidepool Rookery	56.7	63.9	17.0	12.8	30.0%	20.0%	65	146	18	44	36.0%	36.9%
	Lodge	—	13.8	—	2.1	—	15.5%	—	34	—	6	—	50.0%

migrate from scattered, smaller populations to the larger haul-out sites to pup. Haul-out substrate may play a role in determining haul-out size. Pregnant females may migrate from rocky coasts to sheltered mudflats or beaches to give birth. If this is the case, efforts should concentrate on protecting larger haul-out sites.

At the Russian River spits, average pup numbers and the average percentage of pups increased from 1998 to 1999. The low number of pups in 1998 may be related to the ENSO event of that year. The higher number of pups in 1999 are consistent with the gradual increase in the percentage of pups on the Russian River spits (Mortenson, unpublished data). This long-term trend of increased percentages of pups may reflect the efforts of Seal Watch docents to minimize harbor seal disturbances at the Russian River spits during pupping season.

There was no obvious trend in overall seal numbers from 1998 to 1999 at the consistently counted sites, despite the successive ENSO and La Niña years represented in the census. Harbor seals may not be as severely affected as other pinnipeds during ENSO events. The harbor seal population appears to be stable in Central California (comparison of the current values with long-term data from Fuharty, 1999; Mortenson and Twohy, unpublished data; Sarah Allen, personal communication).

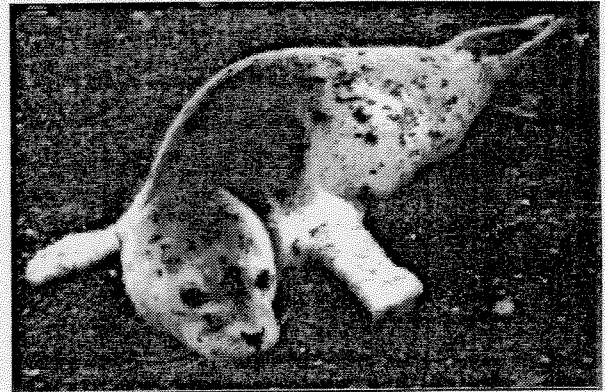
SUMMARY

The SEALS program continues to achieve its goals of 1) minimizing disturbance to harbor seals; 2) maintaining the integrity of rookery sites; 3) preserving the harbor seal colony size; 4) increasing stewardship; and 5) educating the general public about harbor seals and their habitat in the Gulf of the Farallones National Marine Sanctuary.

During the 1999 monitoring season, volunteers donated a total of 763 hours to the SEALS program in Tomales Bay and Bolinas Lagoon and 229 hours to the Fitzgerald Marine Reserve harbor seal monitoring program. In Tomales Bay the disturbance rate associated with human activities dropped from 0.62 flushes per hour in 1998 to 0.53 per hour in 1999. In Bolinas Lagoon the overall disturbance rate dropped from 0.19 flushes per hour during the 1997/1998 monitoring year to 0.13 flushes per hour in 1998/1999 monitoring year.

Prior to the SEALS program 51% of the flushes at Clam and Seal Islands in Tomales Bay were associated with clammers and fishers. Clamming remained the most frequent activity on and around the Islands; however, only 1% of the clammers were associated with flushes in 1999 (0.13 flushes per hour in 1999 compared to 0.25 flushes per hour in 1998). There were six incidences in which clammers were associated with flushes—two incidences occurred while docents were present on the Islands.

For the second year in a row, boating was the dominant human activity associated with harbor seal disturbance in Tomales Bay and Bolinas Lagoon. Although only 3% of the motorboats in Tomales Bay were associated with flushes, motorboats were associated with the most disturbances (0.24 flushes per hour). In contrast kayaks were associated with almost half the number of flushes (0.13 flushes per hour) as motorboats, but were more likely to be associated with a flush (38% of the kayaks were associated with



Harbor seal (*Phoca vitulina*) pup.

flushes). Because there were far more motorboats than kayaks, motorboats were the largest single activity associated with flushes. In Tomales Bay there was a strong positive relationship between the rate of human aquatic activities and flushes.

In Bolinas Lagoon 33% of the canoes and 29% of the kayaks were associated with flushes. However, the rate of disturbance in Bolinas Lagoon was far less than at Tomales Bay. Canoes were associated with 0.01 flushes per hour and kayaks were associated with 0.03 flushes per hour. Although visitors stopping along highway one (2,694) was the most frequent human activity near Pickleweed and Channel haul-outs in Bolinas Lagoon, they were associated with only one flush during the 1998/1999 monitoring year. The number of visitors and seals on Pickleweed and Channel haul-out were positively correlated indicating that seals attract visitors to the Lagoon.

During the 1999/2000 monitoring year, the SEALS program will expand monitoring to Kent Island in Bolinas Lagoon. By adding Kent Island the SEALS program will be able to make a more direct comparison between current disturbance rates and disturbance rates from past studies. It will also provide a broader overview of human activities in the Lagoon as a whole.

The Farallones Marine Sanctuary Association (FMSA) assisted the Fitzgerald Marine Reserve with developing a harbor seal monitoring program. FMSA staff provided background materials, protocols, and data analysis for the Reserve. Two sites were monitored in the Reserve, Nye's Rock and Flatrock. The disturbance rate at Nye's Rock (0.17 flushes per hour) was similar to Bolinas Lagoon. Out of all the study sites, Flatrock had the lowest disturbance rate (0.04 flushes per hour). Nye's Rock had the lowest percentage of pups recorded in all the study sites indicating that female seals are staying away from the area.

The Central California Cooperative Harbor Seal Census was initiated during the 1998 pupping season. Comparison with past long-term population counts suggests the harbor seal population is stable. The data reveal that rocky haul-outs have a lower percentage of pups (approximately 1.6%-8.5%) indicating the need to protect sandy beach and mudflat haul-outs. The

SEALS program would like to add more rocky haul-outs to the census to obtain additional information about substrate preferences and pup survival rates.

The SEALS program has already begun to use the data collected to develop education programs. FMSA developed and posted a flyer on boating and seals for Tomales Bay. After presenting the data at the Bolinas Lagoon Technical Advisory Committee, the Marin County Open Space District initiated a wildlife disturbance subcommittee. The Farallones Marine Sanctuary Association has played a key role in the subcommittee and have involved the Bay Area Sea Kayakers (BASK) Association in developing materials for paddlers. The subcommittee has worked with the Marin County Open Space District to design responsible wildlife viewing and responsible kayaking signs for Bolinas Lagoon. The Marin County Open Space District has implemented a voluntary group kayaking permit program for the Lagoon. Kayaking outfitters are requested to mark their kayaks with identification decals, so SEALS volunteers can track if individuals or kayaking groups are causing wildlife disturbances. The subcommittee has developed a "PADDLERS Etiquette" to educate paddlers how to responsibly view wildlife (Figure 29). The etiquette has been incorporated into the Marin County Open Space District's Bolinas Lagoon brochure, Marin Open Space District's web site, FMSA's newsletter, and the BASK newsletter. The etiquette will be incorporated into FMSA's web site this summer. The etiquette has also been designed as a flyer to post at outdoor retail stores and a placard to attach to kayaks. The subcommittee is working on distribution of the flyer and placard. The data collected from the SEALS program will be used to evaluate the effectiveness of the educational materials.

The 1997/1998 ENSO and the 1998/1999 La Niña weather events have provided interesting weather conditions for SEALS observations. The coming years will reveal if these unique weather events effected the data collected. In the meantime, the SEALS program will continue to provide a secure habitat for harbor seals to give birth, molt, and rest.



PADDLER'S ETIQUETTE

Help Us Protect Seals, Birds, Whales, and Otters!

PASS FAR

Maintain a sufficient distance so that animals do not feel threatened. When an animal's behavior changes because of your presence, you are creating a disturbance. Some wildlife can be disturbed at distances over 650 feet. Responsible visitors watch for changes in animal behavior to avoid disturbing them. Stay at least 300 feet away (approximately the length of a football field) from wildlife or places where they could be resting out of view.

APPROACH PARALLEL

Avoid a direct approach. Do not slow down, speed up, or splash your paddle. Do not walk or paddle toward, through, or near wildlife or flocks of birds. Do not allow your dog to disturb wildlife. Keep dogs leashed and away from wildlife. Know your local area and paddle only when you can least disturb wildlife.

DISCREET VIEWING

Restrain your impulse to get closer. Your best viewing is usually from further away and from a position of stillness. Use binoculars. As you pass, do not engage in any stalking activity, or attempt to approach animals undetected. You cannot get a good picture unless you have a 500 mm or more lens. If you get too close, wildlife will leave. If an animal reacts in any way to your presence, you are too close!

DEFER IMMEDIATELY

Certain animal behaviors indicate they are being disturbed; for example, seals lifting their heads or birds moving away or flapping their wings. When you observe these signs of stress, you should retreat from the area immediately to avoid prolonged stress on the animals. It is less disturbing to backpaddle away from wildlife than turning your boat around.

LEAVE ALONE

Do not handle or rescue young or adult wildlife that you believe may be abandoned or injured. When parents forage, they may naturally leave their young unattended. Your rescue may cause the youngster's death. Wild animals, even small ones, that are injured can bite or peck unexpectedly and cause injury. If you are concerned about any animal, call your local wildlife agency or animal control agency.

EXPLAIN EFFECTS

Tell other paddlers and small boaters about how they can help protect wildlife. Marine mammals and migratory birds are protected from harm, flushing, and harassment by the Marine Sanctuary Act, the Marine Mammal Protection Act, the Migratory Bird Treaty Act, and often local laws. Continuing disturbances can result in areas being closed to boating. Protect your paddling and boating privileges by helping educate less aware paddlers.

Figure 29: PADDLER'S Etiquette

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