

**Harbor Seal Monitoring at
Point Reyes National Seashore
and
Golden Gate National Recreation Area**

Annual Report 2005



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Introduction

Harbor seals (*Phoca vitulina richardii*) are the dominant and only year round resident pinniped at Point Reyes, California. The Point Reyes seal population represents the largest concentration of harbor seals in the State of California, other than the Channel Islands, accounting for 20% of the mainland breeding population (Lowry and Carretta 2003). Much of the Point Reyes coastal zone remains fairly pristine and provides excellent marine and terrestrial habitat for seals to rest, molt feed and breed where human encroachment is minimal.

Long-term monitoring studies of harbor seals have been conducted at selected colonies at Point Reyes since 1976 (Allen et al. 1989, Sydeman and Allen 1999, Allen et al. 2004). The objectives of monitoring are to 1) detect changes in population numbers, 2) detect changes in reproductive success and 3) identify anthropogenic or environmental factors that might affect population status and trends. The monitoring objectives and protocol are described in detail in Hester et al. (draft report). The information presented here is a summary of the data collected during the 2005 breeding and molting seasons, March-July. Summary data collected as part of a region-wide survey effort including adjacent areas (San Francisco Bay, San Mateo County and Sonoma County) where NPS surveys were conducted in 2005 in conjunction with other agencies and organizations are also presented.

Methods

Study Area

The Point Reyes peninsula extends from Tomales Bay (Lat. 38° 30'N) south to Bolinas Lagoon (Lat. 37° 30'N) and are referred collectively as the Point Reyes sites. Point Bonita in the Marin Headlands is the southern most seal haul out site within the study area, and along with Alcatraz collectively form the Golden Gate NRA sites. Coastal embayments include Tomales Bay, Drakes Estero and Limantour Estero, and Bolinas Lagoon. The Point Reyes National Seashore (PORE), Golden Gate National Recreation Area (GOGA), Gulf of the Farallones National Marine Sanctuary (GFNMS), and the Marin County Department of Parks and Recreation share jurisdiction over segments of this coastline.

The topographic diversity of this coastal zone provides a broad range of substrates upon which harbor seals haul out. These include tidal mud flats, offshore and onshore rocky tidal ledges, and sandy beaches. "Haul out site" is defined as a terrestrial location where seals aggregate for periods of rest, birthing, and suckling of young (Harvey 1987, Thompson 1987). Coastal locations regularly surveyed included Tomales Point, Point Reyes Headland, Duxbury Reef, Double Point and Point Bonita; estuarine locations surveyed included Tomales Bay, Drakes and Limantour Esteros complex, and Bolinas Lagoon (Figure 1).

Regional survey sites included colonies in San Francisco Bay (Alcatraz, Mowry Slough, Castro Rocks, Yerba Buena Island, and Newark's Slough), in Sonoma County (Sea Ranch, South Sonoma sites and Jenner) and in San Mateo County (Fitzgerald Marine Reserve, Pescadero, Pebble Beach, Point San Pedro, Bean Hollow, and Cowell Ranch Beach).

Surveys

Harbor seal surveys were conducted during the breeding and molting seasons which run from the March 1 to May 30 and June 1 to July 31, respectively.

National Park Service (NPS) biologists trained volunteers to conduct surveys of harbor seals during two in-class sessions and four field sessions. Many of the volunteers were trained and seasoned, having surveyed seals in previous years. Volunteers and park biologists surveyed each Point Reyes site a minimum of twice per week, weather and logistics permitting. Point Bonita was also surveyed twice per week. The Point Reyes Headland and the regional survey sites were surveyed once every two weeks on concurrent weekends. Surveys occurred primarily during low to medium tides, the time when the maximum number of seals haul out in the San Francisco Bay region (Fancher 1979, Allen et al. 1982).

Survey periods were designed to last approximately two hours, with counts occurring every half-hour to one hour, depending on location. Each sub-site was surveyed separately, and then summed to give a total for each site. All sub-sites were visible from one location with the exception of Tomales Point, Tomales Bay and Bolinas Lagoon. For each of these sites, each sub-site was counted from two to four times per survey.

For each sub-site, the observer recorded the total number of adult/immature seals, pups, dead pups, red-pelaged seals, and any fresh shark bitten animals present. Because of the difficulty in distinguishing adult from immature seals, these two age classes were lumped together. Pups were the young of the year and after weaning, were difficult to distinguish from yearling seals. Consequently, pup numbers were reliable only between March and June 1. Red pelage results from the deposition of iron oxide precipitates on the hair shaft and usually extends from the head down to the shoulder (Allen et al. 1993).

All actual and potential disturbances to harbor seals were recorded during a period from March 1 through July 20. The analysis of disturbance data was truncated and does not account for disturbance data collected during the entire molt season. The total number of disturbance survey days was 226 (Table 1). Observers recorded the time and the source of the disturbance. The seals' response to a disturbance was classified as no response, head alert, flush, flush into water or unknown. In the case of a flush or flush into water, the observer noted the number of seals that flushed, the number of pups that were left alone, and the number of seals that remained in place. After a flush into water, the time and location of where the seals rehailed were also recorded. In some cases, an unknown disturbance and unknown response was recorded if the disturbance occurred before the survey was started, and so the nature and extent of the disturbance was not directly

observed. The rate of disturbances was calculated based on the number of disturbances per survey period (survey period was usually 2 hours but may have varied by ½ hour). In future reports, disturbance rate will be calculated based on the number of disturbances per survey hour, in order to compare to other disturbance studies.

Regional surveys occurred every two weeks March – July on weekends, Friday – Sunday that had low tides during the morning or mid-day. All of the Point Reyes and Golden Gate sites, as well as the San Francisco Bay and Sonoma sites, were surveyed during these weekends. Participants in the region-wide surveys included the GFNMS and FMSA, San Francisco State University, and Stewards of Slavianka, a non-profit conservation group based in Sonoma County.

Results and Discussion

Overall

In 2005, volunteers completed 244 surveys at sites in Marin County at PORE and GOGA between March 1 and July 30. The combined maximum pup counts for all sites during the breeding season was 1,115 pups. This is 13% lower than 2004, but comparable to previous years (Figure 2). Pup numbers, combining all sites, appear to have stabilized since approximately 2000. Drakes Estero and Double Point together produced 56% of the pups (Figure 3). Pup numbers at Double Point have continued to rebound from 2003, when the presence of a northern elephant seal (*Mirounga angustirostris*) reduced the number of seals at Double Point. Numbers were similar at most sites in the past several years, except at Drakes Estero, which has seen a decrease in pup numbers since the 2003 season, as pup numbers rebound at Double Point and when a coyote was seen preying on newborn pups in 2004 at Drakes Estero (Figure 4).

Date of first pup was observed in 2005 was March 6 compared to March 20 in 2004. There was no apparent trend in the date of first pup observed between 2000 and 2005 (Table 4).

The maximum molt count for all of the Point Reyes sites was 4,380 seals. This count is 23% lower than in 2004, but comparable to counts from 2001-2003 (Table 2; Figure 5). Seals from Drakes Estero and Double Point made up 55% of the maximum molt count (Table 1; Figure 6). The maximum molt counts recorded for Tomales Bay and Tomales Point in the 2005 season were low compared to previous years. The constant presence of fog during the peak molt period at Tomales Point reduced the number of surveys completed during this time.

Surveyors recorded 120 disturbances between March 1 and July 20. 107 of these were actual disturbances, while 13 were potential disturbances. The potential disturbances represented 11% of all disturbances. Of these, 39% (5) were motor boats, and 31% (4) were humans. The disturbance data was analyzed using only the disturbances where a reaction by the seals was recorded (107). The average rate of disturbances per survey in 2005 was 0.54. This can be compared to 0.58 disturbances per survey in 2003 and 0.48

disturbances per survey in 2004. Drakes Estero, while having the highest pup and molt numbers, also had the highest rate of disturbance, 1.03 disturbances per survey (Figure 7). Fifty-two percent of the disturbances resulted in seals flushing into the water.

Twenty-four percent of the disturbances were of unknown cause (Figure 9). The largest identifiable causes were humans on foot (22.7%), non-motor boats (16.4%), and aircraft, (14.6%). These major causes are similar to disturbance data collected from 2002-2004 (Table 3). Both motor and non-motor boat disturbances have decreased slightly. Aircraft increased from an average of 5.6% in 2003 and 2004, to 14.6% (Table 3). This increase may be linked to a rising popularity of “ultralights” which have been observed flying low, especially over Tomales Point. Also notable is the reduction in disturbance from dogs. This may be the result of current enforcement of restrictions regarding where dogs are allowed in the park.

There were no major mortality events this year. The Marine Mammal Center reported that harbor seal rescues, primarily of weaned pups, were within the range of normal variability (Marine Mammal Center, pers. comm.). In 2004, surveyors observed coyotes preying on harbor seals in Drakes Estero; however, coyote predation of pups was not directly observed in 2005. On one survey at Drakes Estero, a bobcat was reported on the tidal sandbars where seals haul out but no predation was observed.

During the 2005 season, National Oceanic and Atmospheric Administration (NOAA) reported reduced upwelling and warmer than usual water temperatures for northern California, Oregon and Washington (2005 www.noaa.gov general website). Unusual, warm water species observed at Point Reyes during 2005 included: the Humboldt squid (*Dosidicus gigas*), a Brown Booby (*Sula leucogaster*) and the California grunion (*Leuresthes tenuis*). The reduced upwelling resulted in reduced algal and krill populations, which may have impacted food availability for harbor seals. During the 1998 El Nino event, when upwelling did not occur, there was a dramatic reduction in the number of seals pupping and hauling out in the Point Reyes area (Sydeman and Allen 1999). Such a dramatic reduction was not observed during the 2005 season.

Summary by site

Bolinas Lagoon

46 surveys were completed at Bolinas Lagoon between March 1 and July 31. Bolinas Lagoon had a high pup count of 143 the week of April 18, and a peak molt count of 449 the week of July 4 (Table 1). It had the second highest rate of disturbance, 0.82 disturbances per hour (Figure 7). Humans were the main cause of disturbance, making up 47.1% of the recorded disturbances. Bolinas Lagoon was one of the top sites for disturbances in 2003 and 2004, as well (Figure 8).

Double Point

32 surveys were completed at Double Point between March 1 and July 31. Double Point had a high pup count of 291 the week of April 25, and a peak molt count of 1,126 the week of July 4. Double Point had a disturbance rate of 0.48 disturbances per survey.

78.6% of the disturbances were of unknown cause. The remoteness of this site coupled with being surrounded by high cliffs reduces the exposure to human disturbances and may prevent surveyors from identifying the natural sources for disturbance.

Drakes Estero

37 surveys were completed at Drakes Estero between March 1 and July 31 2005. Drakes Estero had a high pup count of 332 the week of May 2, and a peak molt count of 1,261 the week of July 4. Besides having the largest pup and molt numbers, Drakes Estero had the greatest rate of disturbances observed, with a disturbance rate of 1.03 disturbances per survey. Causes for disturbance at Drakes Estero were variable. Birds (22.2%) were the most frequent cause, followed by non-motor boats (19.4%), humans (16.7%), and aircraft (16.7%).

Duxbury Reef

38 surveys were completed at Duxbury Reef between March 1 and July 31. Duxbury Reef had a high pup count of 10 the week of May 9, and a high adult count of 93 the week of May 9. Disturbance was low at Duxbury Reef. The rate of disturbance was 0.03 disturbances per survey this year.

Point Bonita

28 surveys were conducted at Point Bonita. Point Bonita was added to the annual survey locations initially in 2004; however, logistics were not finalized until the 2005 season. Few pups were counted at this site (6); however, the maximum count of seals during the breeding and molt seasons was around 100-130 seals (Tables 1 and 2). Humans on foot were the major source of disturbance (Table 1).

Point Reyes Headland

Eight surveys were completed at Point Reyes Headland (PRH) between March 1 and July 30 2005. PRH had a high pup count of 44 the week of April 25 and a peak molt count of 456 the week of July 4. Disturbances are low at PRH and no disturbances were recorded in 2005. This haul out site is a primary haul out site for northern elephant seals. The peak count for northern elephant seals between March 15 and July 15 was 1,436 seals on April 29, which coincides with the molt period for elephant seals. Fog limited the number of surveys at PRH.

Tomales Bay

28 surveys were completed at Tomales Bay between March 1 and July 30. Tomales Bay had a high pup count of 188 the week of May 9, and a peak molt count of 549 the week of June 20. The disturbance rate more than doubled in the past year from 0.27 disturbances per hour in 2004 to 0.6 disturbances per hour in 2005. The largest source of disturbances was motor boats, 42.8%. The motor boats were usually clam diggers traveling from the mainland to the sandbars (Mary Ellen King, pers. comm.). Clammers, once on the sandbars and on foot, did not appear to be a source of disturbance. There were no recorded instances of clammers on foot disturbing the seals during the 2005 season.

Tomales Point

26 surveys were completed at Tomales Point between March 1 and July 30. Tomales Point had a high pup count of 101 the week of April 25, and a peak molt count of 378 the week of June 27. The disturbance rate was 0.42 disturbances per survey and the primary source of disturbances was aircraft, which made up 36.4% of the disturbances. Abalone divers are also assumed to be a primary disturbance source at Tomales Point. Often they were present upon arrival of surveyors, and so we were unable to determine the extent of their impact. Abalone collecting season begins in April and overlaps with part of the harbor seal breeding season.

Regional Sites

11 regional surveys were completed, starting on March 4, and ending July 29, at 20 locations. The seasonal peak for pups was during the week of April 30th and the peak for molting seals was during the week of July 10. The maximum number of seals during the breeding season was 3,306 and the average was 2689. The maximum number of seals during the molt was 4,691, with an average of 4,106 (Table 5). Point Reyes had the highest concentration of seals with Double Point and Drakes Estero accounting for 45% of adults during the breeding season, 49% of pups produced, and 50% of molting seals. The maximum count of pups was 1,272 and the first pups were identified at Castro Rocks and Fitzgerald Marine Reserve on March 6th. Of the 20 areas surveyed, only six produced >100 pups (Tomales Bay, Tomales Point, Drakes Estero, Double Point, Bolinas Lagoon, and Mowry Slough). Within San Francisco Bay, Mowry Slough accounted for the majority of seals, followed by Castro Rocks. Sonoma County coast haul out sites were composed of a number of small sites with larger concentrations at Sea Ranch and Jenner. San Mateo County coast sites were also composed of a number of small sites adding up to larger concentrations at Pebble Beach and Fitzgerald Marine Reserve. Only four seals were counted during one survey at Bean Hollow during the entire season. Cowell Ranch Beach and Fitzgerald Marine Reserve accounted for most of the seals counted in the county, but few pups were recorded there.

Disturbances during surveys ranged from northern elephant seal attacking harbor seals at Jenner to people on foot, tide pooling at Point Bonita. The primary sources for disturbance at San Francisco Bay were vehicles at Castro Rocks, aircraft and motor boats at Yerba Buena Island and no disturbances were noted at Mowry Slough.

Collaboration

Point Reyes National Seashore and Golden Gate National Recreation Area collaborated with multiple government agencies and non-profits on projects related to the harbor seal population. The parks collaborated with NOAA on a Tomales Bay stewardship program called SEALS. Park rangers ferried docents on boats out onto the mud flats in Tomales Bay to educate visitors and clam diggers about seals on week ends during low tides. The National Marine Fisheries Service (NMFS) conducted an aerial survey of harbor seal haul out sites along the California Coast, on the 24th and 25th of June 2005. NMFS counted 3,826 harbor seals from Point Reyes to Point Bonita, and 621 harbor seals were counted in San Francisco Bay (Lowry et al., draft report). Regional surveys were conducted in

collaboration with Stewards of Slavianka, Bodega Bay Marine Lab, GFNMS, San Francisco State University, the California Department of Transportation, Joe Mortenson and Mary Ellen King. The Marine Mammal Center released rehabilitated pinnipeds at Chimney Rock at PRNS. We also collaborated with the San Francisco State University study on sightings of satellite and radio tagged seals observed at PRNS. One satellite tagged adult female successfully raised a pup at Double Point in 2005.

Summary

Counts of pups and molting seals at the PORE and GOGA sites were lower in 2005 than the 2004 season. They are comparable to previous years and within the normal range of variation, but the maximum pup count for 2005 was the lowest recorded since 1999, and the peak molt count was the lowest since 2001. The number of disturbances recorded by surveyors remains similar to previous years and no trends are detected. Disturbances were site specific; however, hikers and boaters remain the two most frequent sources of disturbance across all sites.



Harbor seal haul out at Point Reyes Headland.

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Volunteer training at Drakes Estero.

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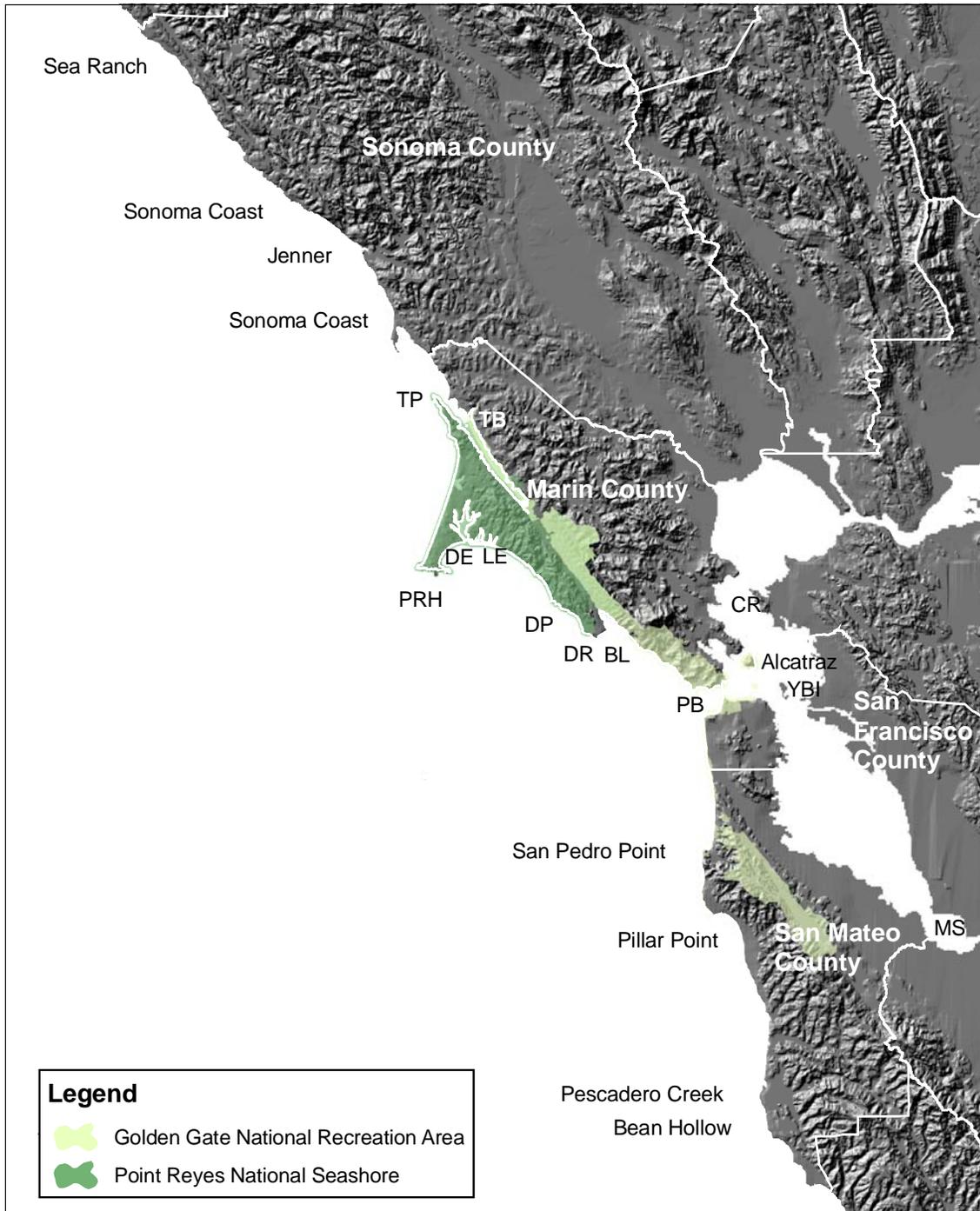


Figure 1. Harbor seal haul out sites in Marin County and San Francisco Bay, California. Map does not present all of the regional survey locations included in Sonoma and San Mateo counties. TB=Tomales Bay, TP=Tomales Point, DE=Drakes Estero, PRH=Point Reyes Headland, LE=Limantour Estero, DP=Double Point, DR=Duxbury Reef, BL=Bolinas lagoon, PB=Point Bonita, CR=Castro Rocks, YBI=Yerba Buena Island, MS=Mowry Slough.

Table 1. Summary data of harbor seal colonies for the 2005 season. All reported numbers reflect the maximum number seen during a single census over the entire season. Max # Breed = adults, immatures and pups during the breeding season, March 1 to May 31. Max # Molt =all age classes during the molting season, June 1 to July 30. The percent of red seals is a percentage of the maximum total number of seals during the molt season of each site. The number of surveys and disturbances are from March 15 to July 30.

Site	Max # Breed	Max # Pups	Max #Molt	# Surveys	# Disturbances	Reds	% Reds	Shark Bites	Dead Pups
Bolinas Lagoon	318	143	449	Weekday: 29 Weekend: 9	Weekday: 29 Weekend: 2	10	2.5%	2	1
Double Point	639	291	1126	Weekday: 20 Weekend: 9	Weekday: 13 Weekend: 1	8	1.1%	2	5
Drakes Estero	754	332	1261	Weekday: 23 Weekend: 12	Weekday: 22 Weekend: 14	15	1.4%	2	2
Duxbury Reef	93	10	64	Weekday: 29 Weekend: 8	Weekday: 1 Weekend: 0	1	1.1%	0	0
Point Reyes Headlands	84	44	456	Weekday: 8 Weekend: 0	Weekday: 0 Weekend: 0	2	1.6%	0	0
Tomales Bay	532	188	549	Weekday: 13 Weekend: 12	Weekday: 9 Weekend: 5	13	1.9%	0	0
Tomales Point	313	101	378	Weekday: 16 Weekend: 10	Weekday: 5 Weekend: 6	14	3.7%	0	1
Point Bonita	133	6	97	28	---	3	3.1%	0	1
2005 Total:	2,866	1,115	4,380	226	107				

Table 2. Summary of survey data for 1997-2005, combining all sites at Point Reyes (excluding Point Bonita for comparison between years). Maximum # of Breed and Molt, and Average # Breed include all age classes. Number of surveys and disturbances are the number completed or recorded in the entire year.

YEAR	Max # Breed	Average # Breed	Max # Pups	Max # Molt	# Surveys	# Disturbances	Disturbances Per Survey
1997	3,268	1,830.50	983	NA	Weekday: 44	Weekday: 9	0.2
		SE = 379			Weekend: 29	Weekend: 37	1.3
		N = 4			Total: 73	Total: 46	
1998	2,481	1,744.60	528	3,070	Weekday: 79	Weekday: 24	0.3
		SE = 122.5			Weekend: 64	Weekend: 46	0.7
		N = 8			Total: 143	Total: 70	
1999	3,325	1,779.90	1,068	2,863	Weekday: 139	Weekday: 71	0.5
		SE = 173.5			Weekend: 69	Weekend: 54	0.8
		N = 10			Total: 208	Total: 125	
2000	3,506	2,511.10	1,342	3,108	Weekday: 106	Weekday: 78	0.7
		SE = 224.4			Weekend: 91	Weekend: 116	1.3
		N = 7			Total: 197	Total: 194	
2001	3,485	2,218.80	1,247	3,769	Weekday: 112	Weekday: 57	0.5
		SE = 244.8			Weekend: 119	Weekend: 107	0.9
		N = 4			Total: 231	Total: 164	
2002	4,180	2651.3	1193	4297	Weekday: 123	Weekday: 67	0.5
		SE = 119.7			Weekend: 144	Weekend: 102	0.7
		N = 8			Total: 267	Total: 169	
2003	3820	2280	1117	4534	Weekday: 172	Weekday: 86	0.5
		SE = 303.9			Weekend: 115	Weekend: 83	0.7
		N = 9			Total: 287	Total: 169	
2004	4534	2518.3	1267	5633	Weekday: 161	Weekday: 52	0.3
		SE = 348.6			Weekend: 97	Weekend: 53	0.5
		N = 10			Total: 258	Total: 105	
2005	2,733	2182.3	1,109	4,283	Weekday: 166	Weekday: 80	0.5
		SE = 195.1			Weekend: 78	Weekend: 29	0.4
		N = 11			Total: 244	Total: 109	

Table 3. Causes for disturbance during 2002-2005 for Point Reyes sites; percent is of total disturbances for a given year.

Year	Type of Disturbance								
	Motor boat	Non-motor boat	Vehicle	Dog	Aircrafts	Human pedestrian	Bird	Unknown	Other
2002	13%	16%	6%	0.5%	11%	24%	6%	21%	2%
2003	13%	20%	2%	0%	9%	21%	7%	23%	6%
2004	5%	10%	8%	2%	3%	39%	7%	25%	2%
2005	8%	13%	1%	0%	15%	25%	9%	23%	6%

Table 4. Date of first pup by year at Point Reyes, including all sites.

Year	Date
2000	14 March
2001	16 March
2002	03 March
2003	27 March
2004	20 March
2005	06 March

Table 5. Regional surveys of harbor seals in central California, March through July 2005. Eleven surveys were conducted, 7 during the breeding season and 4 during the molt.

Location	Breeding Season				Molt Season		
	Average	SE	Total* Max	Pup* Max	Average	SE	Total Max
Sonoma County							
Sonoma Coast	160.9	62.2	230	56	194.5	37.4	237
Jenner	78.4	73.3	152	7	268.5	--	285
Marin County							
Tomales Bay	331.0	24.3	532	188	358.5	53.9	549
Tomales Point	161.8	18.1	313	101	255.5	40.9	378
Point Reyes Headland	63.4	8.2	84	44	367	45.6	456
Drakes Estero/Limantour	516.8	26.9	754	332	796.8	81.3	1261
Double Point	370.1	27.2	639	291	663.1	80.2	1126
Duxbury Reef	42.4	4.6	93	10	26.5	4.7	64
Bolinas Lagoon	170.7	14.0	318	143	287.5	27.7	449
Point Bonita	60.7	50.4	133	6	76.8	13.2	89
San Francisco Bay							
Castro Rocks	212.8	68.4	339	43	191.25	16.1	213
YBI	91.9	33.0	151	9	158.3	47.6	194
Newark Slough	7.1	4.6	13	5	2.0	2.0	4
Mowry Slough	86.3	34.6	139	108	123.3	60.3	210
San Mateo County							
San Pedro Point	7.6	13.1	37	0	43.5	--	75
Bean Hollow	--	--	0	0	--	--	4
Cowell Ranch Beach	70.7	23.8	114	22	130.5	--	135
Pescadero	18.3	9.3	26	5	34.0	--	48
Pebble Beach	77.0	36.9	149	20	162.5	--	170
Fitzgerald Marine Reserve	152.3	17.6	188	19	147.3	17.2	163
GRAND TOTALS	2,668.7	507.7	3,102	1,272	4,105.8	726.9	4,778

*Based on the total for a single day.

Figure 2. Maximum pup counts at PRNS from 1997-2005. See text for methods.

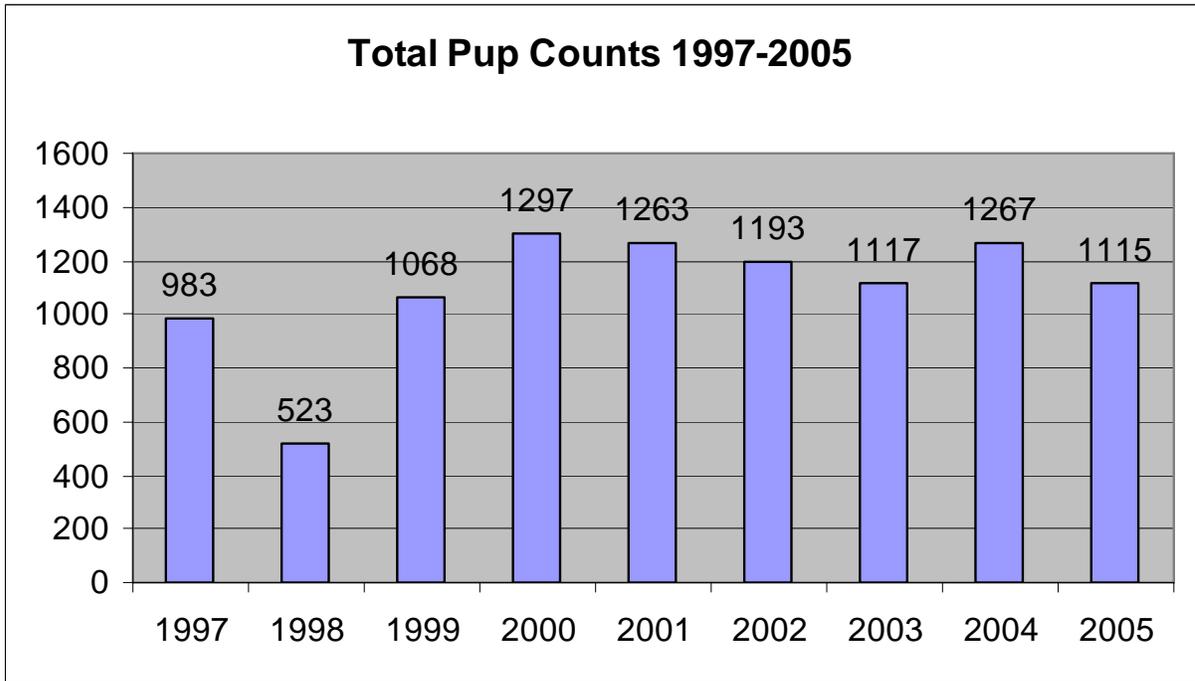


Figure 3. Maximum pup counts by site at PRNS during the 2005 season. See text for methods.

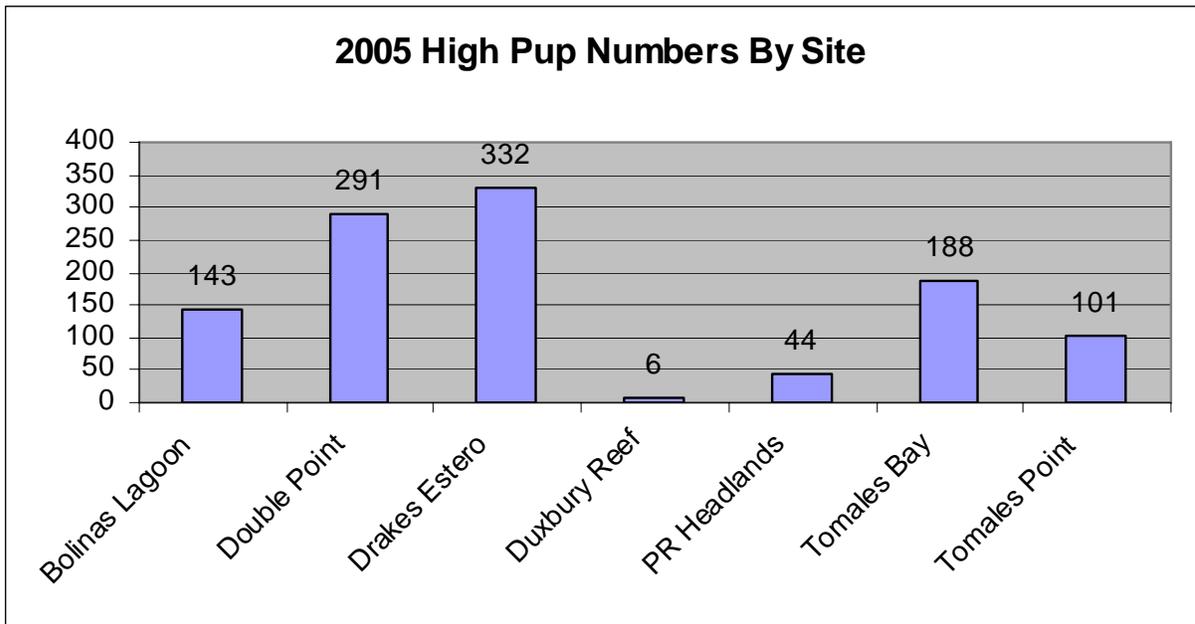


Figure 4. Maximum pup counts by site at Point Reyes, 2002-2005. See text for methods.

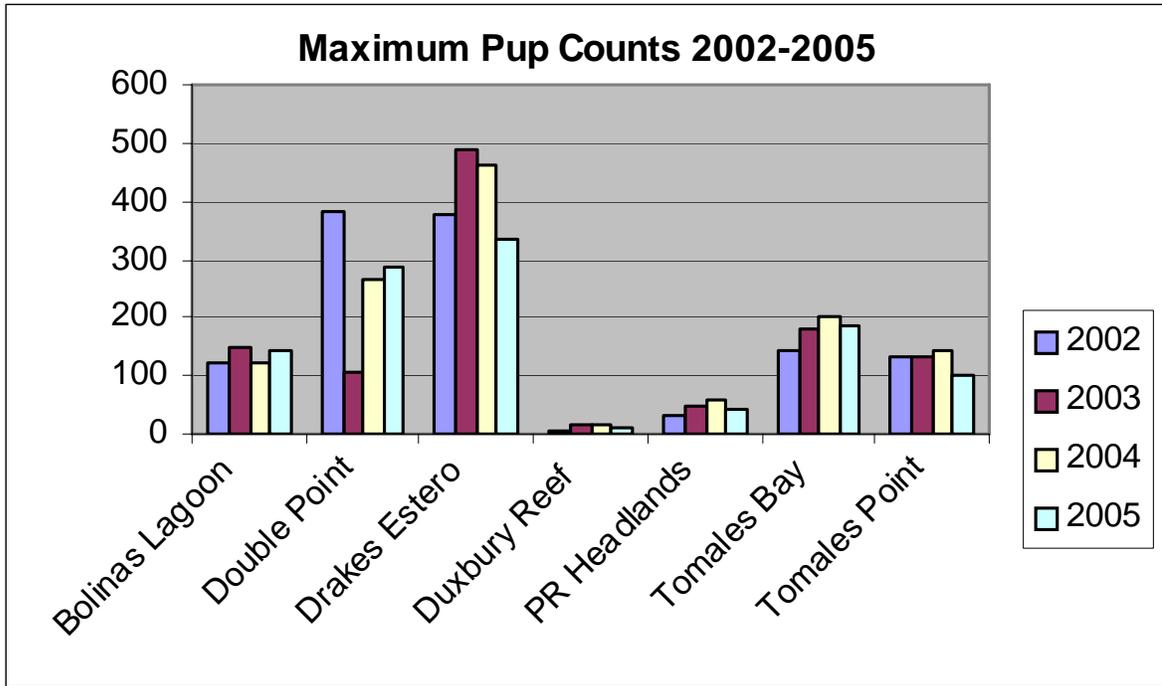


Figure 5. Maximum molt counts for Point Reyes, 1998-2005. See text for methods.

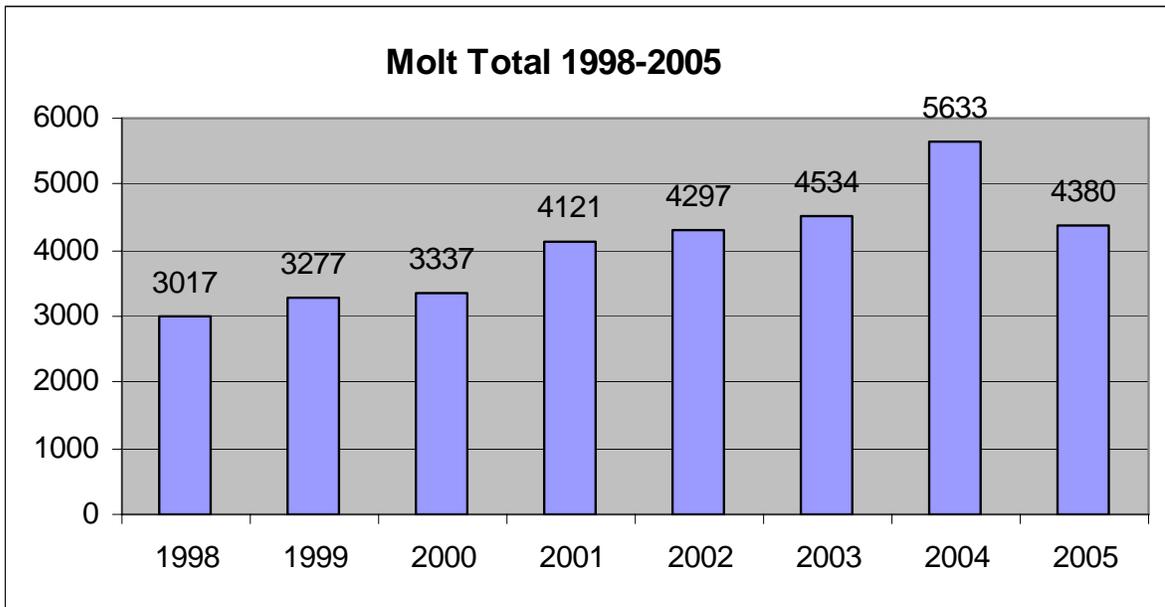


Figure 6. Maximum molt counts for the sites at Point Reyes during the 2005 season. See text for methods.

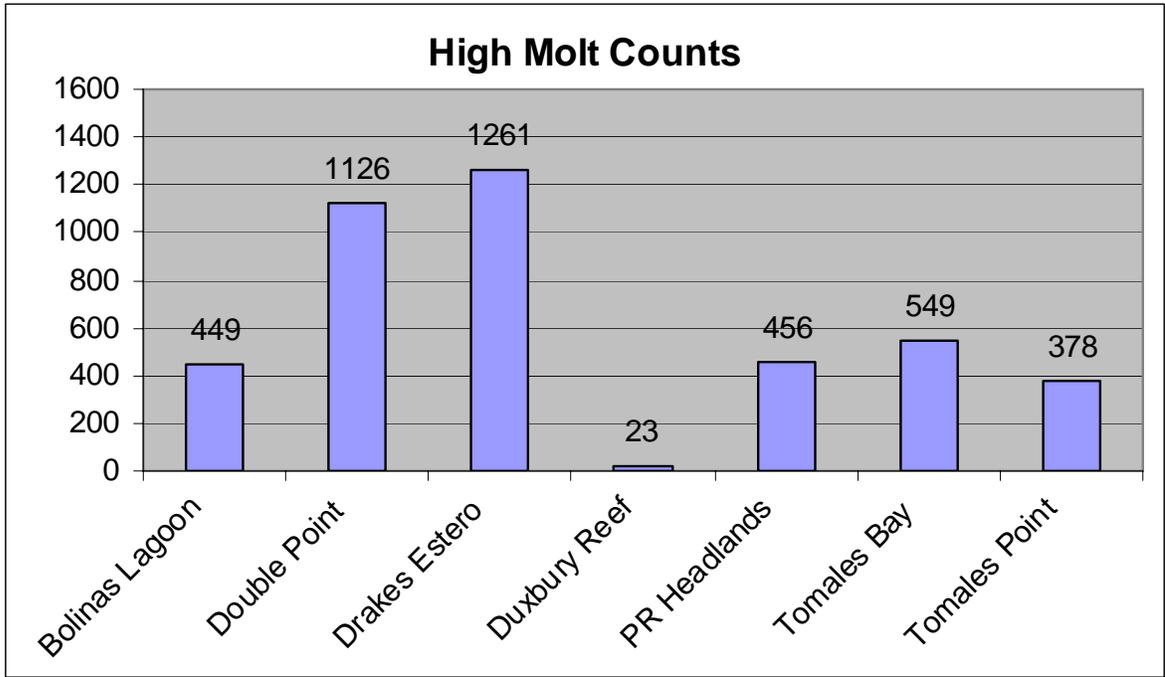


Figure 7. Average number of disturbances per survey, by site at Point Reyes, 2005. See text for methods.

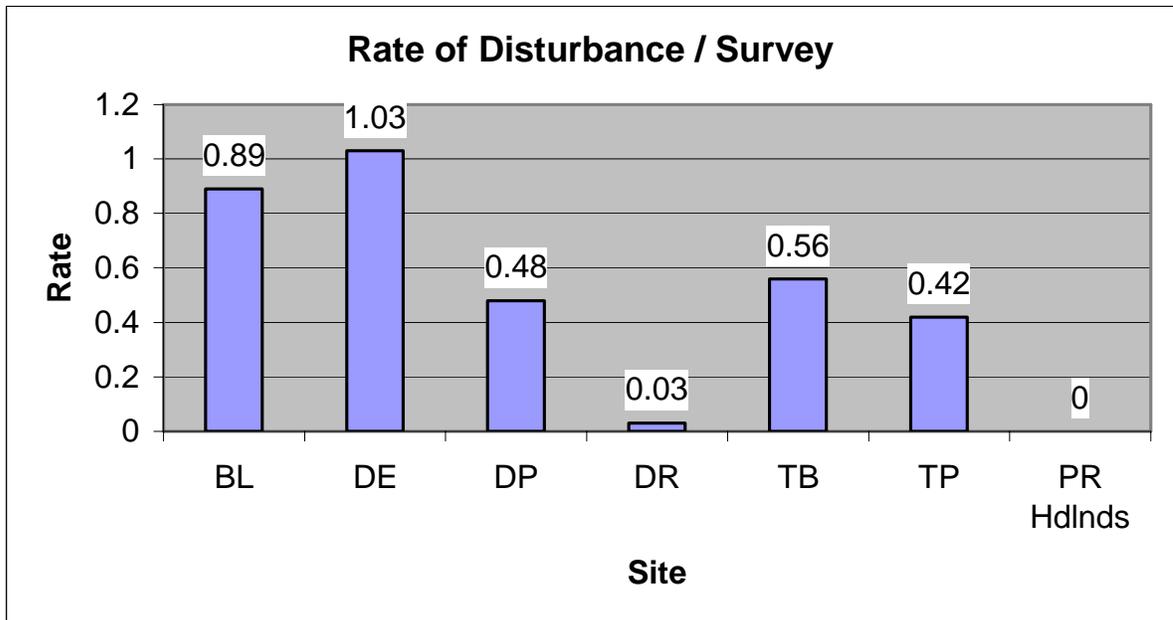


Figure 8. Average number of disturbances per survey, by site at Point Reyes for 2003-2005. See text for methods.

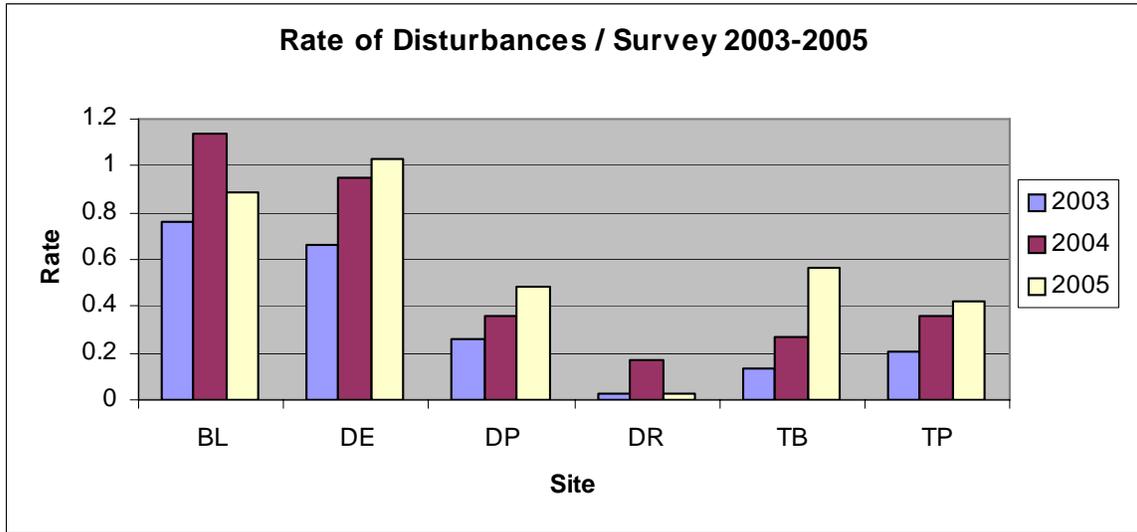


Figure 9. Causes for disturbance by percent for all of Point Reyes sites in 2005.

