BeachWatch

FARALLONES
MARINE
SANCTUARY
ASSOCIATION

ANNUAL REPORT

2005

NATIONAL MARINE SANCTUARIES
GULF OF THE FARALLONES

FMSA
FARALLONES MARINE SANCTUARY ASSOCIATION

Beaches Surveyed by Beach Watch 2004-2005

The Gulf of the Farallones National Marine Sanctuary protects an area of 948 square nautical miles (1,255 square miles) off the northern and central California coast. The Gulf of the Farallones also manages the northern 1,040 square nautical miles (1,377 square miles) of the Monterey Bay National Marine Sanctuary. These waters, located just a few miles from San Francisco, are part of an internationally significant marine ecosystem. Encompassing a diversity of highly productive marine habitats, the sanctuaries support an abundance of species.

Our Vision

We are pleased to introduce the Beach Watch 2005 Annual Report, a snapshot of the activities and data collected by our dedicated volunteers for the past year. This report also features research articles, illustrating the different ways Beach Watch data is used. Now celebrating its thirteenth year, the Beach Watch Program of volunteer citizen scientists has acted as the first line of defense against oil spills and other coastal disasters by consistently monitoring wildlife and the overall health of 42 beaches along the coasts of Sonoma, Marin, San Francisco and San Mateo Counties.

The Beach Watch program was developed in 1993 following a series of lethal oil spills in the 1980s that killed thousands of seabirds. The Gulf of the Farallones National Marine Sanctuary needed year-round shoreline assessment, violation detection and reporting, and a program to detect chronic and catastrophic oil pollution. Since its beginning, Beach Watch's citizen scientists have produced findings that establish that all-so-important baseline data set for California's coastline.

During regular beach surveys, our volunteers count, identify and document marine life and human activity on hundreds of miles of coastline. Volunteers collect data that include the number of live birds and marine mammals as well as human activity on the beach. The volunteers also document dead birds and marine mammals, knowing through their training how to identify a particular species in different stages of decomposition. This invaluable information provides a wealth of data to the Sanctuary and researchers to help "take the temperature" of the ocean environment, and it has been used by the California Department of Fish and Game, Point Reyes National Seashore and many other local, state and federal agencies. Volunteers are often the first on the scene of a marine mammal stranding, the first to find oil and tarballs on the beach, the first to collect oil samples as evidence against illegal leaks or dumping. Since its inception, volunteers have contributed nearly 130,000 hours to the Beach Watch program. Though individual beach surveys may take as long as eight hours, more than 89% of the Beach Watch volunteers stay with the program—many of them have been Beach Watch volunteers for over a decade!

Beach Watch serves as an international model for the implementation of beach monitoring programs, and we are pleased to continue sharing our knowledge with other organizations to further worldwide protection of our coastal areas.

Thank you to all those determined and dedicated people who give so much of their time and energy to protect our coastline and our marine environment.

Linda Hunter, Executive Director
Farallones Marine Sanctuary Association

Maria Brown, Superintendent
Gulf of the Farallones National Marine Sanctuary

The Farallones Marine Sanctuary Association (FMSA) is a non-profit membership organization created to increase public appreciation and guardianship of our ocean wilderness. FMSA's mission is dedicated to protecting Sanctuary wildlife and habitats through the development of a diverse community of informed and active ocean Sanctuary stewards.


BEACH WATCH STAFF

Volunteer Sarah Lenz on a practice survey during the 2005 Beach Watch training.

Highlights from the Year


BETH CATALDO
A dead Cassin's Auklet found on Beach 1-15.

2005 marked the twelfth year of Beach Watch, during which our dedicated citizen scientists donated 9,500 hours monitoring the coast and ocean. A new class of 28 surveyors was welcomed to the community, increasing our numbers to 102 volunteers. During 2005, the volunteer retention rate was 89%, and we especially congratulate the 29 Beach Watch volunteers who have now devoted 10 or more years to the program. The Beach Watch office was also busy with the full completion of our new database, an upgrade that makes for quick and easy querying of our ever-growing dataset.

Along the 241 kilometer stretch of coastline between Bodega Head in Sonoma County and Año Nuevo State Reserve in southern San Mateo County, 26 beach segments were monitored every four weeks and 16 beach segments were monitored every two weeks from October 2004 to September 2005.

For this report, data were analyzed from 39 selected beaches from October 1993 through September 2005 (Table 1). 7,701 surveys were included in the analyses, representing an incredible 16,502.34 km of shoreline surveyed for beached specimens and 16,508.89 km surveyed for live specimens. Our systematic data collection efforts provided information including live bird and marine mammal encounter rates, beached (dead) vertebrate encounter rates, tarball and oiled wildlife deposition rates, human activity and beach wrack and invertebrate relative abundance. The number of surveys and kilometers monitored varies each year; thus, to enable comparisons between the years, the numbers of dead and live are quantified as encounter rates per kilometer (i.e. number of dead vertebrates found per kilometer surveyed).

NOTABLE FINDINGS

One of the major findings this year was an unusual seabird die-off. In 2005 the Gulf of the Farallones was marked by an abnormal oceanographic season evidenced by higher than normal water temperatures and a lower abundance of krill. Many of the locally breeding seabirds depend on krill as a food source, and this decrease in an important link in the food web resulted in a challenging year for many species.

In the late winter/early spring of 2005, Beach Watch and other beached bird survey programs along the West Coast reported high numbers of dead seabirds on beaches (Nevins et al. 2005). This mortality event occurred earlier than normal; usually a post-breeding/fledging mortality peak occurs August–October (Roletto et al. 2003). Beach Watch data showed an increase in the rate of alcid and cormorant carcasses, surpassing all previous annual rates, even during El Niño years (Figure 1). Comparing cumulative year encounter rates with the 2004-2005 encounter rate, several species were seen in numbers from 1.5 to 3.5 times greater than historical rates (Table 3). These species included Common Murre, Pigeon Guillemot, Rhinoceros Auklet, Brandt's Cormorant, Double-crested Cormorant, and Pelagic Cormorant. Beach Watch vol-

Beached (dead) alcids and cormorants, 1993 - 2005

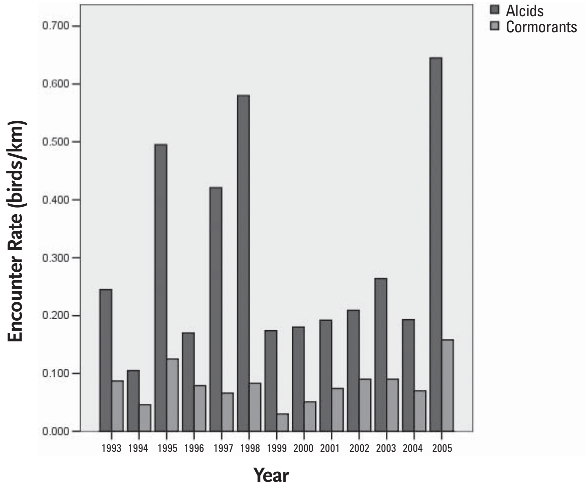


FIGURE 1. Encounter rates for beached alcids and cormorants found on 39 beaches October 1993 – September 2005, showing an increase in mortality rates in 2005 similar to those seen in the 1997-1998 El Niño.

Beached (dead) Cassin's Auklets, 1993 - 2005

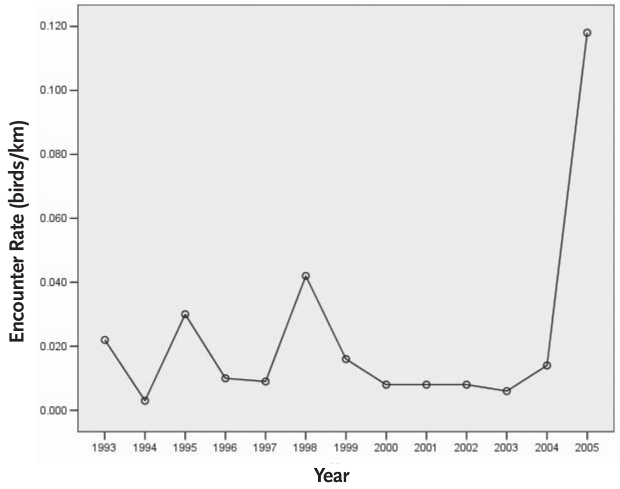


FIGURE 2. Encounter rates for beached Cassin's Auklets found on 39 beaches October 1993–September 2005, showing an unprecedented mortality rate in 2005.

Selected Beaches for Analysis, 2004 - 2005

Beach ID	Beach Name	Beach Size (km)	Total Kms Surveyed	Beached Bird Encounter Rate	Beached Mammal Encounter Rate	Oiled Birds Encounter Rate	Tar Ball Rate 1996+
1-06	Doran Beach*	3.7	925.81	1.455	0.109	0.030	0.150
1-07	Pinnacle Gulch	1.8	186.30	0.784	0.247	0.005	0.000
1-10	Dillon Beach*	2.9	642.49	1.063	0.053	0.009	0.006
1-14	Point Reyes Beach A*	5.3	1266.17	1.613	0.115	0.045	2.149
1-15	Point Reyes Beach B*	4.9	1171.79	1.335	0.107	0.057	1.710
1-16	Point Reyes Beach C	3.6	403.20	1.076	0.087	0.037	0.135
2-03	Drakes Beach West*	4.5	1009.89	0.476	0.119	0.015	2.271
2-04	Drakes Beach East	2.3	381.98	1.181	0.170	0.034	4.262
2-05	Limantour Beach West*	4.3	1174.03	0.831	0.086	0.043	71.894
2-06	Limantour Beach East	2.6	423.44	1.252	0.094	0.033	4.984
2-13	Bolinas Beach	4.5	414.45	0.328	0.135	0.010	0.007
2-19	Muir Beach*	0.6	154.77	2.274	0.194	0.194	1.220
2-23	Rodeo Beach*	0.7	192.19	3.450	0.229	0.010	0.500
2-30	Kirby Cove	0.3	40.53	1.357	0.148	0.074	5.942
3-02	Baker Beach*	1.2	272.40	0.492	0.059	0.011	0.382
3-06	Lands End	0.1	14.53	0.207	0.344	0.000	2.444
3-09	Ocean Beach Central*	3.2	613.28	1.321	0.186	0.016	8.371
3-10	Ocean Beach South	0.8	134.50	0.669	0.104	0.022	0.352
3-11	Thornton Beach North*	2.6	401.86	0.709	0.149	0.007	0.571
3-12	Thornton Beach South*	3.9	743.03	0.857	0.164	0.007	0.942
3-15	Sharp Park	1.4	269.85	0.834	0.226	0.011	2.083
3-27	South Montara Beach*	1.3	242.01	0.785	0.074	0.041	1.073
3-31	Fitzgerald Marine Reserve - Weinke Way	1.3	150.67	0.013	0.040	0.007	0.382
3-32	Fitzgerald Marine Reserve - Entrance	0.9	106.61	0.038	0.038	0.019	13.507
3-33	Fitzgerald Marine Reserve - Distillery	1.4	157.78	0.076	0.082	0.019	0.031
3-34	Fitzgerald Marine Reserve - Frenchman's Reef	1.2	143.64	0.188	0.104	0.028	5.223
3-35	Pillar Point/Maverick's	0.4	36.22	1.325	0.442	0.110	31.056
4-03	Half Moon Bay (Naples Beach)	1.1	160.60	2.528	0.249	0.037	0.043
4-05	Half Moon Bay (Frances Beach)	1.6	197.92	5.629	0.308	0.030	0.130
4-14	Pomponio Headlands	2.3	318.62	1.271	0.132	0.013	4.329
4-17	Pescadero*	1.0	261.95	1.336	0.244	0.050	0.106
4-20	Pebble Beach	2.6	340.21	0.326	0.112	0.041	2.216
5-03	Gazos Creek*	2.2	491.70	1.015	0.297	0.047	1.273
5-06	North Point	2.0	279.70	0.311	0.769	0.018	0.004
5-09	Cove Beach	0.8	82.88	1.303	0.664	0.097	0.016
5-10	Bradley Beach	1.7	201.03	0.970	0.627	0.025	0.005
6-01	Bolinas Lagoon, Dipsea Road	1.8	97.20	0.113	0.010	0.000	0.018
7-01	Brazil Beach	4.1	405.70	0.710	0.081	0.005	0.000
7-06	Tomasini Creek Beach*	4.6	801.23	0.270	0.005	0.000	0.000

TABLE 1. 39 beaches analyzed October 2004 - September 2005
Beach 2-14 (Seadrift), Beach 3-04 (China Beach), and Beach 3-08 (Ocean Beach North) were also surveyed but were not included in these analyses due to data gaps.
Encounter rate is number found per kilometer surveyed. Asterisk* denotes beaches surveyed every 2 weeks.

unteers also documented several uncommon alcid species such as 5 Marbled Murrelets, 2 Xantus's Murrelets, 4 Ancient Murrelets, 4 Horned Puffins, and 2 Tufted Puffins.

The largest increase in carcasses found by Beach Watch was Cassin's Auklets (*Ptychoramphus aleuticus*); from 1993-2004, the mean encounter rate for dead Cassin's Auklets was 0.015 birds/km, whereas for the last data season (October 2004–September 2005), the rate was 0.118 birds/km (Figure 2).

Beach Watch collaborated with BeachCOMBERS, a beached bird monitoring program in Monterey Bay, and the Marine Wildlife Veterinary Care and Research Center (MWVCRC) in Santa Cruz to identify the mortality factors affecting both Cassin's Auklets and other seabirds in the late spring/early summer. Carcasses from along the coast were collected and necropsied by MWVCRC. The majority of alcids and cormorants examined were emaciated and in poor body condition, indicating starvation (Nevins et al. 2005). This was attributed to reduced productivity and food availability in the region during January – May 2005.

A WINDOW INTO CONDITIONS AT SEA

Beach Watch surveys are an indicator for events offshore. The increased numbers of carcasses reflected conditions at breeding colonies at the Farallon Islands. PRBO Conservation Science researchers have been monitoring the Cassin's Auklet population at Southeast Farallon Island since 1971. Last year for the first time, researchers at the island documented unprecedented colony abandonment and complete breeding failure (Figure 3) (Sydeman et al. 2006). Cassin's Auklets spend their lives at sea, returning to islands such as the Farallon Islands to breed in burrows. These tiny gray and white "tennis balls" rely on krill as a food source, limited last year by a disruption in upwelling, the process in which cold, nutrient rich waters are pushed to the surface, boosting the food chain. The reduction in krill was significant; estimates of krill biomass from shipboard surveys in May 2005 showed a 52% decrease from May 2004 (Sydeman et al. 2006).

Beach Watch's long-term monitoring forms part of the overall Sanctuary Ecosystem Assessment Surveys (SEAS). SEAS incorporate data sets from a suite of surveys in the coastal, pelagic and intertidal habitats throughout the Sanctuary. As part of furthering our understanding of the Sanctuary ecosystem, an offshore monitoring program is being developed to assess occurrence patterns of vertebrates using standardized methodology for vessel-based surveys. This offshore data will enable the comparison with onshore findings collected by Beach Watch to determine how beach deposition rates compare to those found offshore. This will help us understand whether an unusual mortality event simply reflects higher abundance offshore, or if an environmental or epidemiological component is a concern.

This work highlights the importance of partnering with other organizations to increase our understanding of seabirds as sentinels of oceanographic conditions.

Breeding success and abandonment rate of Cassin's Auklets, 1971-2005 (Sydeman et al. 2006)

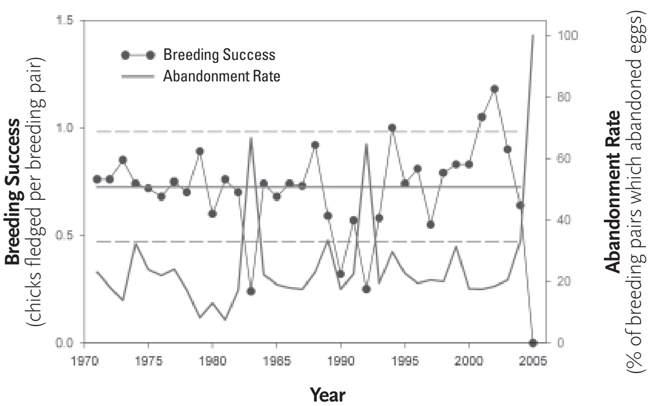


FIGURE 3. Interannual variability of Cassin's Auklet breeding success and abandonment rate at Southeast Farallon Island, California (1971 - 2005), showing the long-term mean breeding success (solid line) + 80% confidence intervals (dashed lines).

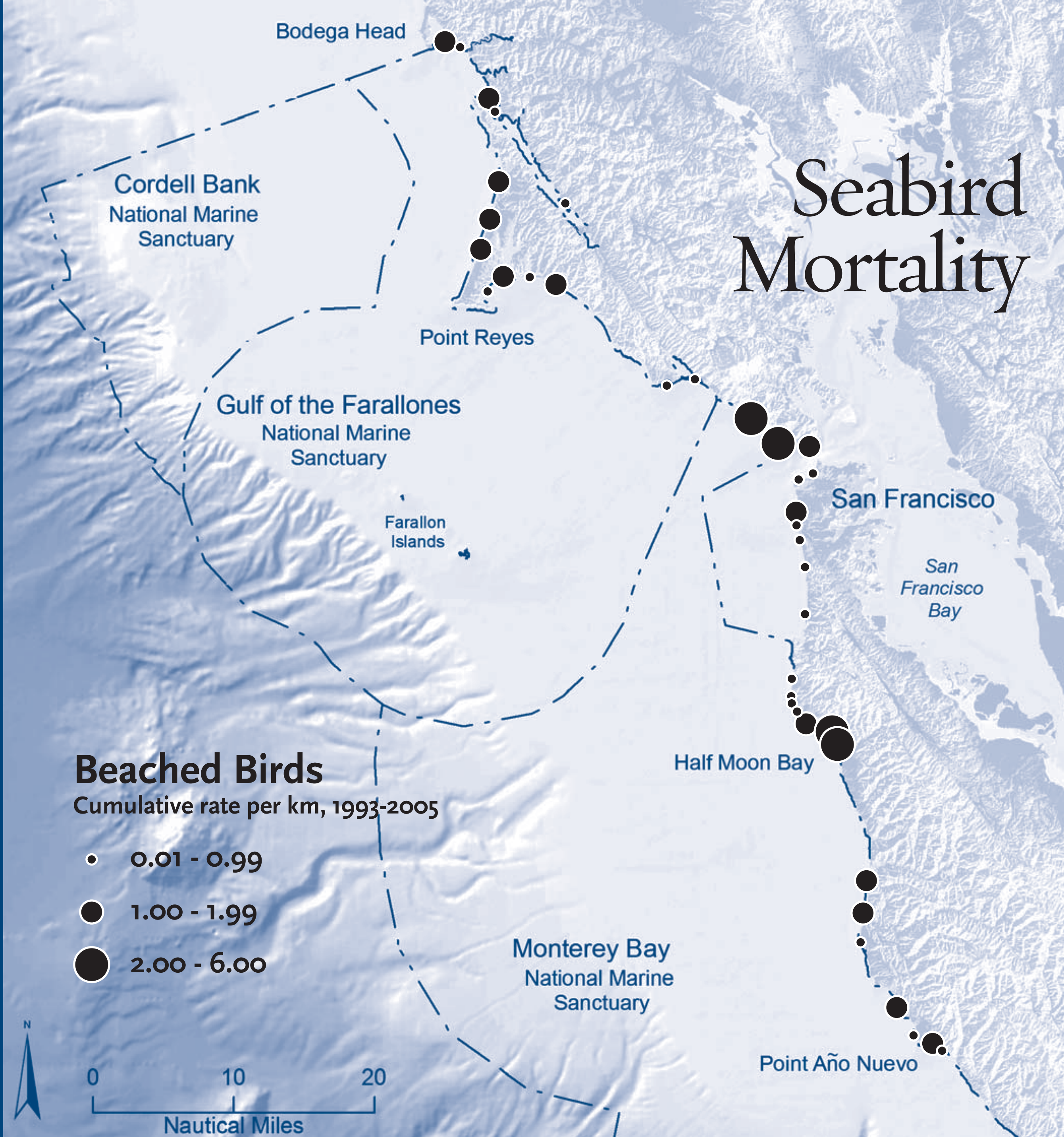
During the summer, leatherback turtles travel through the Sanctuary. Beach Watch volunteer Jacqui Bower encountered one dead on Thornton Beach N. (3-11) on August 21, 2005.

Federally Listed Species Found Dead

Species	Number Found (10/93-9/04)	Rate/km Surveyed (10/93-9/04)	Number Found (10/04-9/05)	Rate/km Surveyed (10/04-9/05)	Conservation Status
Black-footed Albatross	6	<0.001	0	0	Species of Concern
Ashy Storm-Petrel	9	<0.001	2	0.001	Species of Concern
Brown Pelican	196	0.014	13	0.008	Endangered
Peregrine Falcon	2	<0.001	2	0.001	Species of Concern
Western Snowy Plover	1	<0.001	0	0	Threatened
Black Oystercatcher	1	<0.001	2	0.001	Species of Concern
Whimbrel	4	<0.001	0	0	Species of Concern
Marbled Godwit	35	0.003	4	0.003	Species of Concern
Black Turnstone	4	<0.001	0	0	Species of Concern
Elegant Tern	6	<0.001	1	<0.001	Species of Concern
Marbled Murrelet	7	<0.001	5	0.003	Threatened
Xantus's Murrelet	2	<0.001	2	0.001	Candidate for Listing
Cassin's Auklet	194	0.014	146	0.091	Species of Concern
Guadalupe Fur Seal	1	<0.001	2	0.001	Threatened
Steller Sea Lion	31	0.002	3	0.002	Threatened
California Sea Otter	30	0.002	3	0.002	Threatened
Humpback Whale	2	<0.001	0	0	Endangered
Sperm Whale	1	<0.001	0	0	Endangered
Leatherback Turtle	1	<0.001	1	<0.001	Endangered

TABLE 2.
Conservation Status updated from USFWS 8/2006.

Seabird Mortality



Beached Birds

Cumulative rate per km, 1993-2005

- 0.01 - 0.99
- 1.00 - 1.99
- 2.00 - 6.00

MARGUERITE FINNEY

During the data season, surveyors documented five dead Marbled Murrelets, a threatened species.

> "Systematic beach surveys provide clues by which we can cure mishaps and solve mysteries at sea in the nearshore Pacific."
>
> — RICH STALLCUP, ORNITHOLOGIST

Dead Species Table 2004-2005

Common Name	Species Sum (1993-2004)	Encounter Rate (1993-2004)	Species Sum (2004-2005)	Encounter Rate (2004-2005)
Red-throated Loon	66	0.005	9	0.006
Pacific Loon	225	0.016	28	0.018
Common Loon	95	0.007	4	0.003
Yellow-billed Loon	1	<0.001	0	0
Loon (unidentified)	18	0.001	1	<0.001
Pied-billed Grebe	2	<0.001	0	0
Horned Grebe	44	0.003	2	0.001
Red-necked Grebe	10	<0.001	0	0
Eared Grebe	22	0.002	1	<0.001
Eared or Horned Grebe	24	0.002	0	0
Western Grebe	602	0.044	21	0.013
Clark's Grebe	112	0.008	5	0.003
Western or Clark's Grebe	535	0.039	16	0.01
Unidentified Grebe	52	0.004	2	0.001
Black-footed Albatross	6	<0.001	0	0
Laysan Albatross	1	<0.001	0	0
Northern Fulmar	2703	0.197	97	0.061
Pink-footed Shearwater	9	<0.001	1	<0.001
Flesh-footed Shearwater	1	<0.001	0	0
Buller's Shearwater	11	<0.001	0	0
Sooty Shearwater	236	0.017	30	0.019
Short-tailed Shearwater	51	0.004	8	0.005
Sooty or Short-tailed Shearwater	22	0.002	1	<0.001
Manx Shearwater	2	<0.001	0	0
Black-vented Shearwater	8	<0.001	0	0
Fork-tailed Storm-Petrel	23	0.002	1	<0.001
Leach's Storm-Petrel	3	<0.001	0	0
Ashy Storm-Petrel	9	<0.001	2	0.001
American White Pelican	1	<0.001	0	0
Brown Pelican	196	0.014	13	0.008
Brandt's Cormorant	725	0.053	155	0.097
Double-crested Cormorant	60	0.004	12	0.008
Pelagic Cormorant	128	0.009	39	0.024
Cormorant (unidenitfied)	63	0.005	19	0.012
Great Blue Heron	1	<0.001	0	0
Snowy Egret	1	<0.001	0	0
Black-crowned Night-Heron	5	<0.001	0	0
Turkey Vulture	5	<0.001	2	0.001
Greater White-fronted Goose	3	<0.001	0	0
Ross's Goose	2	<0.001	0	0
Canada Goose	1	<0.001	0	0
Brant	6	<0.001	0	0
Tundra Swan	2	<0.001	0	0
Gadwall	2	<0.001	0	0
American Wigeon	1	<0.001	0	0
Mallard	6	<0.001	0	0
Northern Pintail	3	<0.001	0	0
American Green-winged Teal	11	<0.001	1	<0.001
Greater Scaup	19	0.001	0	0
Lesser Scaup	2	<0.001	0	0
Surf Scoter	440	0.032	52	0.033
White-winged Scoter	55	0.004	0	0
Black Scoter	7	<0.001	0	0
Scoter (unidentified)	14	0.001	0	0
Long-tailed Duck	1	<0.001	0	0
Bufflehead	25	0.002	3	0.002
Common Merganser	0	0	1	<0.001
Red-breasted Merganser	2	<0.001	0	0
Ruddy Duck	4	<0.001	1	<0.001
Osprey	0	0	1	<0.001
Northern Harrier	1	<0.001	0	0
Sharp-shinned Hawk	1	<0.001	0	0
Red-tailed Hawk	10	<0.001	6	0.004
Peregrine Falcon	2	<0.001	2	0.001
Raptor (unidentified)	1	<0.001	2	0.001
Red Junglefowl	12	<0.001	1	<0.001
Virginia Rail	2	<0.001	0	0
American Coot	24	0.002	1	<0.001
Black-bellied Plover	5	<0.001	1	<0.001
Snowy Plover	1	<0.001	0	0
Black Oystercatcher	1	<0.001	2	0.001
Willet	44	0.003	7	0.004
Whimbrel	4	<0.001	0	0
Marbled Godwit	35	0.003	4	0.003
Black Turnstone	4	<0.001	0	0
Surfbird	1	<0.001	0	0
Sanderling	11	<0.001	1	<0.001
Western Sandpiper	1	<0.001	0	0
Least Sandpiper	0	0	1	<0.001
Dunlin	2	<0.001	0	0
Red-necked Phalarope	8	<0.001	0	0
Red Phalarope	31	0.002	1	<0.001
Unidentified Large Shorebird	17	0.001	2	0.001
Pomarine Jaeger	2	<0.001	0	0
Parasitic Jaeger	1	<0.001	0	0
Bonaparte's Gull	6	<0.001	2	0.001
Heermann's Gull	142	0.01	15	0.009
Mew Gull	33	0.002	3	0.002
Ring-billed Gull	51	0.004	14	0.009
California Gull	139	0.01	27	0.017
Herring Gull	65	0.005	27	0.017
Thayer's Gull	4	<0.001	0	0
Western Gull	1471	0.107	386	0.242
Western X Glaucous-winged Gull hybrid	71	0.005	16	0.01
Glaucous-winged Gull	603	0.044	257	0.161
Glaucous Gull	5	<0.001	0	0
Sabine's Gull	1	<0.001	0	0
Black-legged Kittiwake	55	0.004	1	<0.001
Gull (unidentified)	269	0.02	35	0.022
Caspian Tern	8	<0.001	2	0.001
Elegant Tern	6	<0.001	1	<0.001
Common Tern	1	<0.001	0	0
Arctic Tern	1	<0.001	0	0
Common Murre	3166	0.231	611	0.383

TABLE 3. Dead species encountered on 39 beaches.
Species listed in taxonomic order. Encounter rate is number found per kilometer surveyed. Beach Watch also collects data on dead terrestrial mammals, reptiles, amphibians, and fish not included in this table.

Common Name	Species Sum (1993-2004)	Encounter Rate (1993-2004)	Species Sum (2004-2005)	Encounter Rate (2004-2005)
Pigeon Guillemot	201	0.015	33	0.021
Marbled Murrelet	7	<0.001	5	0.003
Xantus's Murrelet	2	<0.001	2	0.001
Craveri's Murrelet	1	<0.001	0	0
Ancient Murrelet	8	<0.001	4	0.003
Cassin's Auklet	194	0.014	146	0.091
Parakeet Auklet	2	<0.001	0	0
Rhinoceros Auklet	90	0.007	40	0.025
Horned Puffin	4	<0.001	4	0.003
Tufted Puffin	2	<0.001	2	0.001
Alcid (unidentified)	50	0.004	1	<0.001
Rock Dove	55	0.004	3	0.002
Band-tailed Pigeon	1	<0.001	0	0
Barn Owl	10	<0.001	1	<0.001
Great Horned Owl	2	<0.001	0	0
Long-eared Owl	1	<0.001	0	0
Northern Flicker	1	<0.001	0	0
Pacific-slope Flycatcher	1	<0.001	0	0
Western Scrub-Jay	1	<0.001	0	0
Clark's Nutcracker	1	<0.001	0	0
American Crow	4	<0.001	1	<0.001
Common Raven	24	0.002	5	0.003
American Crow or Common Raven	2	<0.001	1	<0.001
Bank Swallow	1	<0.001	0	0
Song Sparrow	1	<0.001	0	0
Red-winged Blackbird	2	<0.001	0	0
Non-marine Bird (unidenitified)	2	<0.001	0	0
Marine Bird (unidentified)	40	0.003	2	0.001
Unidentified Bird (marine/non-marine)	179	0.013	7	0.004
Northern Fur Seal	4	<0.001	3	0.002
Guadalupe Fur Seal	1	<0.001	2	0.001
Steller Sea Lion	31	0.002	3	0.002
California Sea Lion	861	0.063	96	0.06
Otariid (unidentified)	93	0.007	39	0.024
Harbor Seal	273	0.02	50	0.031
Northern Elephant Seal	318	0.023	30	0.019
Phocid (unidentified)	11	<0.001	1	<0.001
Pinniped (unidentified)	75	0.005	5	0.003
Southern Sea Otter	30	0.002	3	0.002
Gray Whale	9	<0.001	0	0
Minke Whale	1	<0.001	0	0
Humpback Whale	2	<0.001	0	0
Sperm Whale	1	<0.001	0	0
Pygmy Sperm Whale	1	<0.001	0	0
Bottlenose Dolphin	2	<0.001	0	0
Striped Dolphin	1	<0.001	0	0
Common Dolphin (unidentified)	1	<0.001	0	0
Pacific White-sided Dolphin	5	<0.001	0	0
Risso's Dolphin	0	0	1	<0.001
Harbor Porpoise	35	0.003	11	0.007
Dall's Porpoise	3	<0.001	0	0
Cetacean (unidentified)	13	<0.001	4	0.003
Marine Mammal (unidentified)	18	0.001	6	0.004

Top 25 Live Species, 2004-2005

Common Name	Encounter Rate (2004-2005)
Western Gull	21.994
Sanderling	21.460
Brown Pelican	14.439
Heermann's Gull	10.700
Marbled Godwit	9.085
California Gull	9.075
Willet	6.560
Surf Scoter	6.191
Brandt's Cormorant	4.826
Harbor Seal	4.639
Dunlin	3.595
Least Sandpiper	3.193
Glaucous-winged Gull	3.180
Double-crested Cormorant	3.116
Northern Elephant Seal	2.873
Snowy Plover	2.713
Western Sandpiper	2.662
Brant	2.214
Ring-billed Gull	2.085
Common Raven	1.642
Bufflehead	1.379
Caspian Tern	1.239
Black Turnstone	1.229
Black-bellied Plover	1.218
Brewer's Blackbird	1.211

TABLE 4.
Most frequently encountered live animals identified to species on 39 beaches. Encounter rate is number found per kilometer surveyed. Full live species table available.

Unusual Sightings

Interesting Live Sightings October 2004 – September 2005

Species	Beach(es)	Date(s)
Swainson's Hawk*	Drakes West (2-03)	10/10/04
Wild Turkey*	Brazil Beach (7-01)	8/18/05
Spotted Sandpiper	Pinnacle Gulch (1-07) Drakes West (2-03) Gazos Creek (5-03)	8/19/05 8/14/05 5/4/05
Red Phalarope	Gazos Creek (5-03)	11/1/04
Parasitic Jaeger	Brazil Beach (7-01)	10/22/04
Black Skimmer*	Frances Beach (4-05) Brazil Beach (7-01)	6/17/05 8/18/05
Varied Thrush*	Gazos Creek (5-03)	4/20/05
Coyote	Drakes East (2-04) Green Oaks (5-06)	2/21/05 7/22/05
River Otter	Pinnacle Gulch (1-07)	7/22/05
Bottlenose Dolphin	Thornton North (3-11) Gazos Creek (5-03) Bradley Beach (5-10)	8/27/05 7/27/05 9/25/05

TABLE 5.
Species listed in taxonomic order
* New live species for Beach Watch

Uncommon Dead Specimens October 2004 – September 2005

Species	Beach(es)	Date
Pink-footed Shearwater	Point Reyes A (1-14)	12/19/04
Fork-tailed Storm-petrel	Point Reyes B (1-15)	7/11/05
Common Merganser*	Pescadero (4-17)	3/26/05
American Green-winged Teal	Tomasini Creek (7-06)	1/21/05
Osprey*	Limantour West (2-05)	8/28/05
Black-bellied Plover	Point Reyes B (1-15)	3/6/05
Least Sandpiper*	Tomasini Creek (7-06)	10/22/04
Elegant Tern	Drakes East (2-04)	8/6/05
Risso's Dolphin*	Point Reyes B (1-15)	6/12/05
Virginia Opossum	Drakes West (2-03) Brazil Beach (7-01)	9/25/05 2/3/05

TABLE 6.
Species listed in taxonomic order
* New beached species for Beach Watch


JAMIE HALL


LOU HELMUTH

▲ New species for Beach Watch! A dead Risso's dolphin washed up on Beach 1-15 in Point Reyes National Seashore.

◄ Spotted Sandpipers were "spotted" on a few surveys during the year.

JAMIE HALL

Entanglement in Marine Species

BY EMMA MOORE Biodiversity in the marine world is under threat driven by five causes: over-exploitation, physical alteration, pollution, invasive species and climate change (Norse et al. 2005). One of the most visible impacts of pollution is entanglements observed in marine species. Entanglement is an interaction between marine life and synthetic material whereby the loops and openings of various types of debris entangle animal appendages or entrap animals (Laist 1997).

A live elephant seal with packing strap around its neck.

Marine species become entangled in different types of materials; these fall broadly into three categories:

- Active fishing gear (by-catch)
- Discarded fishing gear ('ghost' fishing gear)
- General marine debris (includes balloons, plastic, packing strap, rubber bands, etc.)

It is difficult to detect entanglements in marine species. In the ocean animals are only visible for brief instances at or above the sea surface (Laist 1997). Moreover, animals that become entangled and die may sink, be consumed at sea, or be hidden in a mass of entangled debris (Laist 1997). In addition, death resulting from entanglement may not be visible on a decomposing carcass. Birds that drown in nets during fishing activity at sea may strand on beaches not showing evidence of their encounter with the net. Thus land-based observations of entanglements, such as those documented by Beach Watch, will represent only an unknown proportion of actual entanglements out at sea.

The impact of entanglement on the animal varies from little apparent effect (some animals are seen with the 'scars' of entanglement, suggesting the animal has become freed) to death. Sometimes a younger animal becomes entangled and as it grows the entanglement material tightens and begins to cause problems. Synthetic materials have little or no stretch and no way out for an animal with flippers or feathers.

BEACH WATCH FINDINGS

During Beach Watch surveys if the cause of death of an animal is apparent then a surveyor will record this in one of the following categories:

- Plastic
- Oil
- Shark Bite
- Fishing Line
- Gun shot
- Unknown

Entanglements in marine species are recorded by the surveyors as either fishing line or plastic. The vast majority of causes of death are recorded as unknown.

Twenty-four different species have been recorded as entangled over the last decade (1995-2005) by Beach Watch, including twenty species of seabirds and four species of pinnipeds (Table 7). Common Murres are the most frequently documented species entangled in fishing line. However, Common Murres constitute the highest numbers of carcasses recorded by Beach Watch, and thus the percentage of entanglement is comparable to other species.

Species Recorded as Entangled in Beach Watch Surveys (October 1995 – September 2005)
Brandt's Cormorant
Brown Pelican
Cassin's Auklet
Common Murre
Double-crested Cormorant
Glaucous-winged Gull
Heermann's Gull
Mew Gull
Pelagic Cormorant
Pacific Loon
Pigeon Guillemot
Red-throated Loon
Surf Scoter
Short-tailed Shearwater
Sooty Shearwater
Unidentified Grebe (Western/Clark's)
Western Gull
Western x Glaucous-winged Gull hybrid
Willet
Western Grebe
California Sea Lion
Harbor Seal
Northern Elephant Seal
Steller Sea Lion

TABLE 7.

The mean percentage of entanglement from 1995 - 2005 for Beach Watch is 0.81%. This is calculated from all dead* individual animals observed during the decade. Mean percentages of entanglements were also calculated among seabirds (0.89%) and marine mammals (0.50%); the results are shown in Figure 4 with 95% confidence limits around the mean.

In comparing similar beach survey programs, BeachCOMBERS[1] have encountered very few marine mammal carcasses entangled with only one entanglement reported in the last five years (unpublished data Nevins and Harvey 2006) and for COASST[2] the mean percentage of entanglements in seabirds is 0.42% for 2000-2005 (data provided by Litle 2006).

Each year the number of beaches and frequency surveyed by Beach Watch varies. Therefore, in order to compare the variations in numbers the data was standardized by dividing observations into the kilometers surveyed each year. Over the last decade, across all beaches, approximately 1.2 carcasses were encountered per km surveyed and 1 entangled carcass was encountered per 100 km surveyed (Figure 5).

At first glance the entanglement numbers may seem low, but observations from land-based surveys show only an unknown fraction of the entanglements that may be taking place out at sea.

The ongoing research of the Beach Watch program provides an excellent source of information to aid in monitoring locally some of the impacts of marine debris.

* All dead includes any vertebrates recorded.

1 BeachCOMBERS monitors the carcasses of mammals and birds from Santa Cruz to San Luis Obispo.

2 COASST monitors bird carcasses along the Washington and Oregon coast and San Juan Islands.

Conclusions

Live entangled animals can sometimes be disentangled if they can be reached. Rehabilitation centers such as The Marine Mammal Center and WildCare in Marin County admit entangled marine mammals and seabirds and often successfully release them after disentanglement. However, the real solution to entanglement lies in preventing potentially damaging marine debris from ever entering the ocean.

Solutions are being developed, trialed and implemented for each of the potential entanglement materials around the world.

1) **By-catch.** A wide range of practices are being investigated in this field; for example, development of "smart gear," acoustic pingers and the establishment of "no-take" areas in the ocean where no fishing is allowed at all.
2) **Discarded fishing gear.** Projects exist around the world to collect abandoned fishing gear from the ocean; the Hawaiian Islands are at the forefront in removing debris at sea. To prevent gear being discarded in the first place some recycling centers are being established such as the local monofilament recycling program run by WildCare.
3) **General marine debris.** Both manufacturers and the general public can be educated on the potential dangers of debris. Simple actions like ensuring that balloons are not released and cutting six-pack holders before disposing of them reduce the chances of entanglements occurring in marine species.

This article focuses on entanglements documented during Beach Watch surveys. However, marine debris is a global issue. Action needs to be taken at both local and global levels to deal with all potential entanglement causing materials.

Mean percentage of entanglements, 1995 - 2005

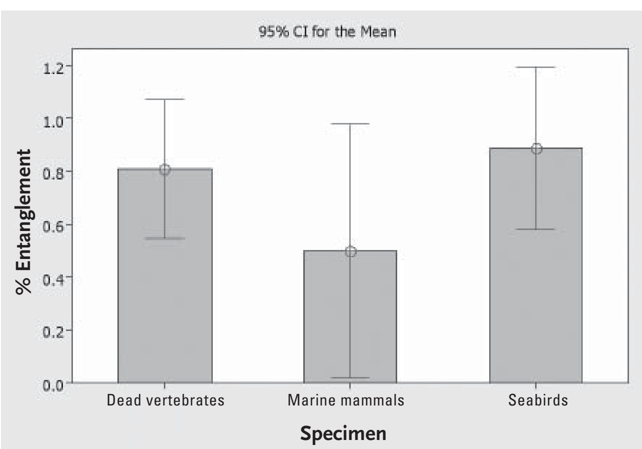


FIGURE 4. The mean percentage of beached specimens found entangled by Beach Watch, October 1995 – September 2005, showing 95% confidence limits around the mean.

Encounter rates of beached (dead) and entangled specimens, 1995 - 2005

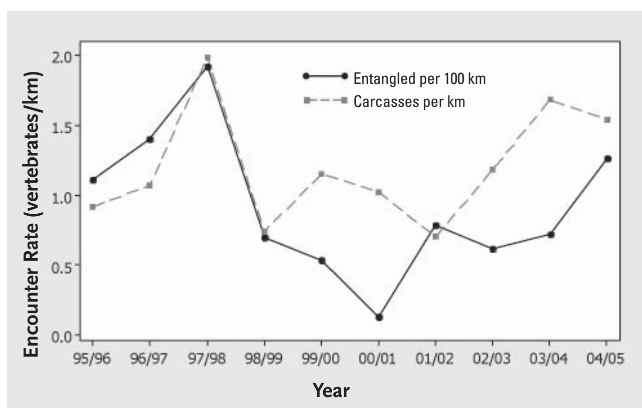


FIGURE 5. Encounter rates for beached and entangled specimens found by Beach Watch, October 1995 – September 2005.

Note: 1998 was considered an El Niño year

What can you do?

The Farallones Marine Sanctuary Association organizes local beach cleanups and participates in 'International Coastal Cleanup' day in September each year. In 2004, 51,872 California residents turned out for International Coastal Cleanup. The volunteers covered 3,110 kms of shoreline, removing 958,488 lbs of trash (Ocean Conservancy 2006).

This research is part of a report concerning a case study of entanglements in marine species in central California. Analysis of entanglements among carcasses forms one part of the picture in the area. Data has also been collected on entanglements from the following sources:

Live pinniped population censuses

- Point Reyes National Seashore surveys (1999-2005)
- PRBO Conservation Science surveys at the Farallon Islands (1995-2005)

Rescued and rehabilitated marine mammals and birds

- The Marine Mammal Center (1995-2005)
- WildCare (1997-2005)

Beach monitoring programs

- COASST (2000-2005)
- Beach Watch (1995-2005)
- BeachCOMBERS (2000-2005)

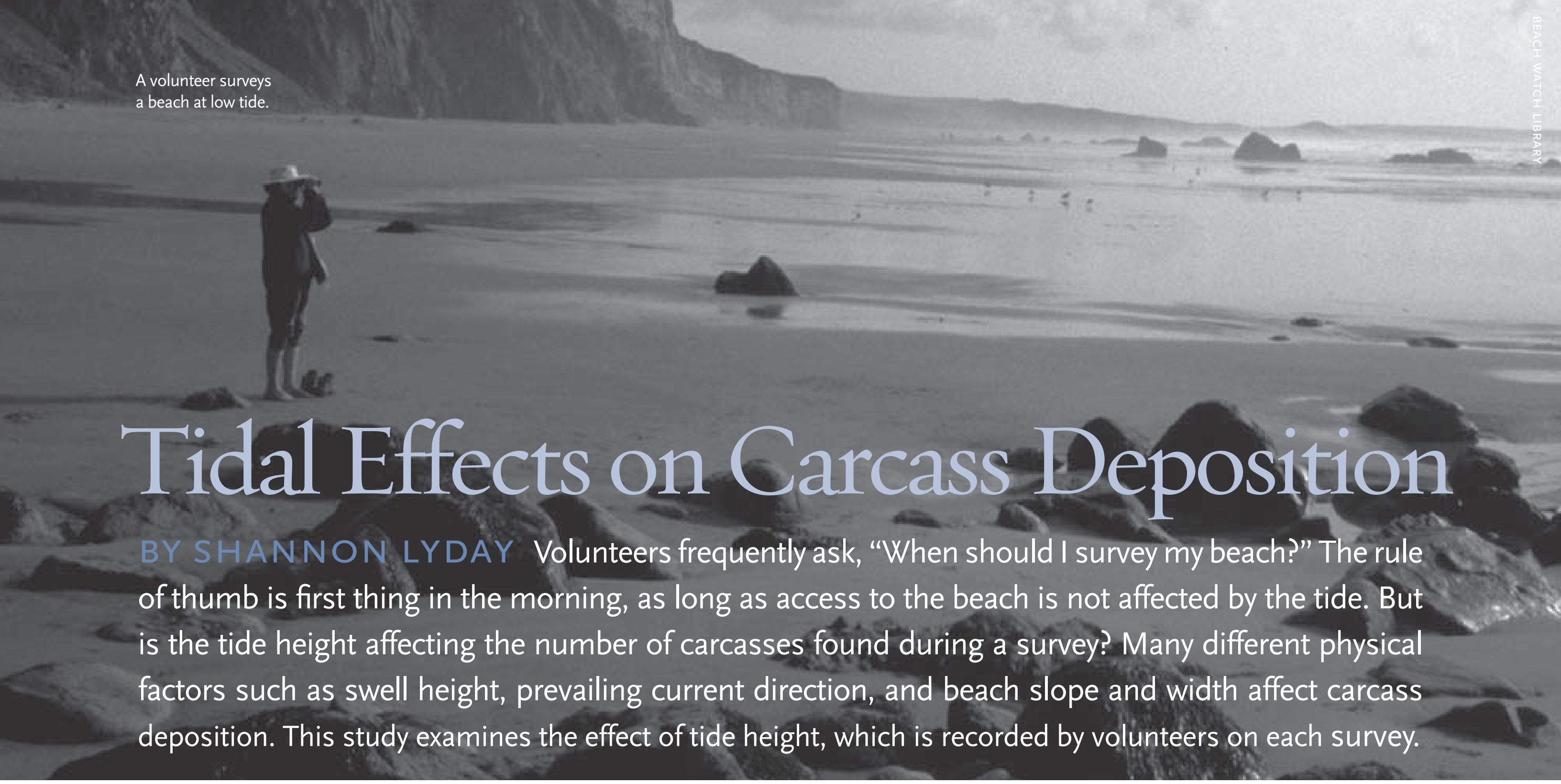
A final report on entanglement will be completed in fall 2006, please contact Emma Moore (emmajmoore@hotmail.com) for further information.

"Beach Watch has changed my life. It has made my world so much larger. Beach Watch has taught me to better appreciate what a natural part of life death is. Sometimes too young, sometimes in ways that are hard to think about, especially when caused by humans. I am grateful to have gained some new perspectives."

—Marguerite Finney, Volunteer

JAMIE HALL

Gull bill found entangled with fishing line.



A volunteer surveys a beach at low tide.

BEACH WATCH LIBRARY

Tidal Effects on Carcass Deposition

BY SHANNON LYDAY Volunteers frequently ask, "When should I survey my beach?" The rule of thumb is first thing in the morning, as long as access to the beach is not affected by the tide. But is the tide height affecting the number of carcasses found during a survey? Many different physical factors such as swell height, prevailing current direction, and beach slope and width affect carcass deposition. This study examines the effect of tide height, which is recorded by volunteers on each survey.

Two beaches in San Mateo County were selected for analysis. The beaches analyzed were:

a) **Sharp Park Beach** (Beach 3-15), a medium-high potential for carcass deposition and persistence

b) **South Montara Beach** (Beach 3-27), a medium-low potential for carcass deposition and persistence

These beaches were chosen based on the following factors: survey conducted independent of tide height, physical similarity (beach length, substrate type, direction facing), and number of surveys completed. The beaches differed primarily in deposition potential as described above (Roletto et al. 2005). Data were analyzed from October 1995–September 2005. To compare data between the two beaches, numbers of dead vertebrates were quantified as encounter rates (i.e. number of dead vertebrates found per kilometer surveyed). Tide height predictions for the start and end time of each survey were recorded in feet to the nearest tenth using the closest location, Princeton, Half Moon Bay.

ANALYSIS

To examine tidal effects on the rate of dead carcasses found, the data were analyzed using linear regression in order to answer the following three questions:

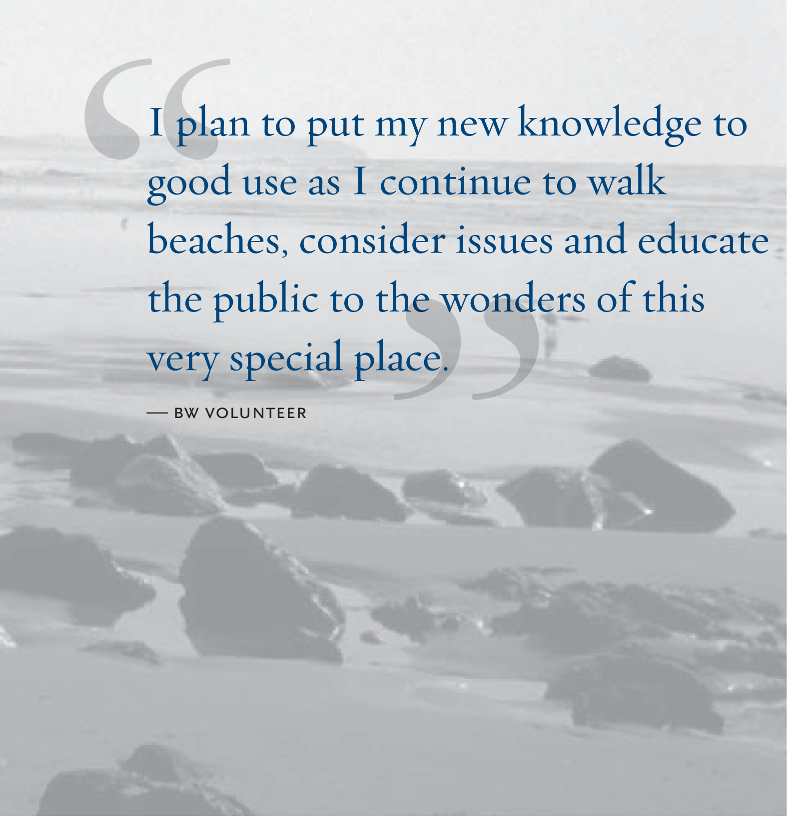
1) **Initial tide height:** Does the tide height at the start of a survey affect the rate of carcasses encountered? Results for Beach 3-15 show no relationship between initial tide height and the number of vertebrate carcasses encountered per kilometer (Figure 6). In contrast, for Beach 3-27, there was a significant relationship between initial tide height and the number of dead vertebrates encountered per kilometer (Figure 7). There is a significantly positive relationship between initial tide height and the rate of dead vertebrate deposition on Beach 3-27; as the initial tide height increases, so does the rate of dead carcasses encountered.

2) **Changing tide height:** Does the amount of change in tide height that occurs during a survey influence the rate of carcasses encountered on the beach? We looked at the amount of change (either positive or negative) in tide height during the survey. For both Beach 3-15 and Beach 3-27, the analysis shows no significant relationship between change in tide height and the number of vertebrate carcasses encountered per kilometer. This means that the amount of change in tide height during a survey does not affect the number of carcasses encountered per kilometer (i.e. a 3 foot change in tide height versus a 1 foot change in tide height during a survey is insignificant).

3) **Size of carcass:** Does the tide height affect dead vertebrates differently based on the size of the carcass? Data of birds and mammals were separated to examine small versus large carcass size. On Beach 3-15, the results show no significant relationship between initial tide height and both the number of dead birds and the number of dead mammals encountered per kilometer. The analysis for Beach 3-27 found a significant relationship between initial tide height and the number of dead birds found per kilometer, but no significant relationship for the number of dead mammals found per kilometer. The amount of dead birds per kilometer decreases as the initial tide height increases on Beach 3-27.

CONCLUSION

The number of carcasses encountered on each survey depends on a variety of physical, temporal, biological, and anthropogenic factors. Since the two beaches in this analysis gave different results, it is not possible to make a generaliza-



tion regarding the effect of tide on the rate of carcasses encountered during a Beach Watch survey. The different results between Beach 3-15 (Sharp Park Beach) and Beach 3-37 (South Montara Beach) could be due to lower deposition rates being more sensitive to factors such as tide height. Or other physical features not considered in this analysis (width of beach, beach backing, slope of beach) may explain the different results between the two beaches. To determine the significance of these other factors on the Beach Watch data, further research is required. This study highlights the subtle variation among beaches and concludes that beaches are affected differently by tidal effects. It serves to illustrate the importance of analyzing beaches separately to understand the interrelated factors that affect carcass deposition on beaches.

This summary is based on a report "Tidal and Temporal Effects on Carcass Deposition on Two Central California Beaches" by Shannon Lyday, Allegra Briggs, Nicole Antaya, & Augusto A. Uyenco III. For further information, please contact Shannon Lyday at slyday@farallones.org.

Summary of Results

Beach	Initial Tide Height	Change in Tide Height	Size of Carcass
Beach 3-15	No relationship	No relationship	No relationship
Beach 3-27	Significant relationship (F = 6.377, critical F-value =3.96)	No relationship	Significant relationship for birds (F-value = 5.281, critical F-value = 3.98)

TABLE 8.

Initial tide height vs. rate of beached (dead) vertebrates, Beach 3-15, Sharp Park Beach

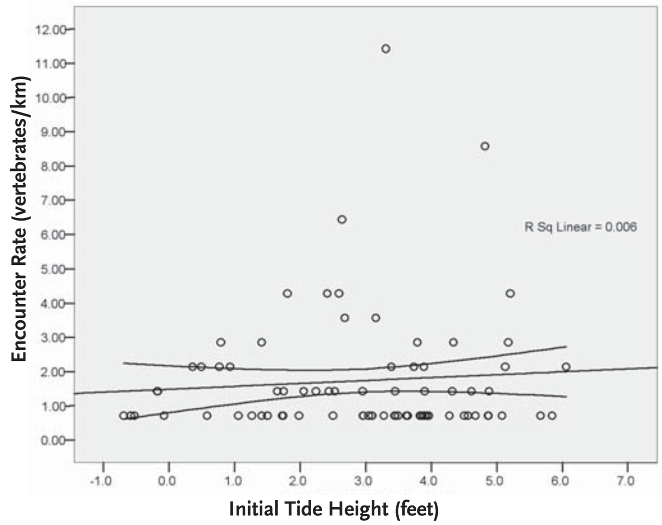


FIGURE 6. Scatterplot comparing the initial tide height and the rate of beached vertebrates found for Beach 3-15, October 1995 – September 2005. Scatterplot indicates no relationship between initial tide height and the rate of carcasses found during a survey (includes best fitting line and 95% confidence limits).

Initial tide height vs. rate of beached (dead) vertebrates, Beach 3-27, South Montara Beach

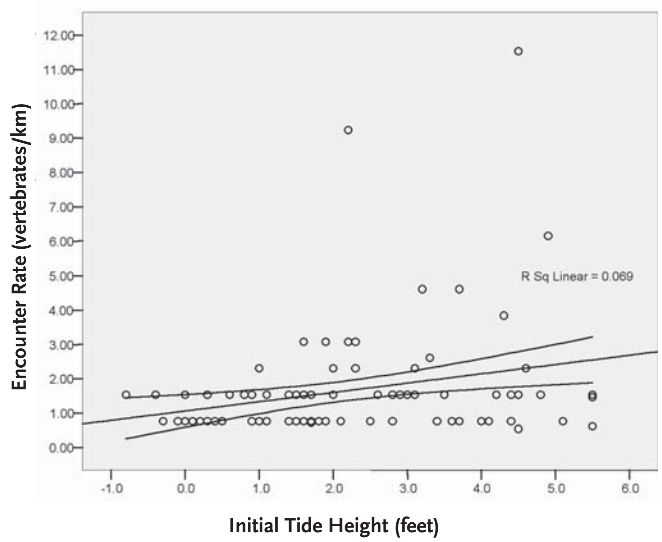


FIGURE 7. Scatterplot comparing the initial tide height and the rate of beached vertebrates found for Beach 3-27, October 1995 – September 2005. Scatterplot indicates that carcass encounter rates increase as initial tide height increases (includes best fitting line and 95% confidence limits).

BEACH WATCH LIBRARY

Front Row (left to right): Joanne Mohr, Dru Devlin, Lura Thorp, Mary Cantini, Joolie Geldner.

Middle Row (left to right): George Peterson, Sue Torres, Sara Montabon, Gary Thorp, Sharon Salisbury, Amanda Jobbins, Sarah Lenz.

Back Rows (left to right): Vladimir Hrycenko, David Stubbe, Greg Troutman, Kelly Cohen, Lee Huo, Meg DeLano, Rick Clark, Lily Lew, Shannon Lyday, Madeleine Cornu Catero, Jason Thompson, Jan Roletto, Rich Stallcup, Carla Kania, Bill Baxley.

Not Pictured but Not Forgotten: James Aliberti, Beth Cataldo, Kathleen Fortmann, Richard Fortmann, Lisa Hansen and Joan Lamphier.

Beach Watch Class of 2005

On Saturday, October 29, 2005, the 2005 Beach Watch training culminated in a celebration picnic at Muir Beach. Twenty-eight volunteers graduated from the 80-hour training that spanned a 6-week period. Volunteers traveled from all over the Bay Area to participate in Beach Watch; many had waited two years for the training opportunity. Although the diverse group of new volunteers came from all walks of life, they all shared the common goal of wanting to become involved in the protection of the marine environment.

A camaraderie quickly developed among the classmates as they delved into the intense training. Classroom and field sessions focused on learning survey protocols and the intimidating task of learning to identify the diverse wildlife of the central California coast. The volunteers took it all in stride, trying to absorb as much information as possible from the instructors, guest lecturers, and field experiences. Although the volunteers enjoyed learning about the marine environment with new friends, they were excited to get out on "their beach" and join the ranks of Sanctuary stewards.

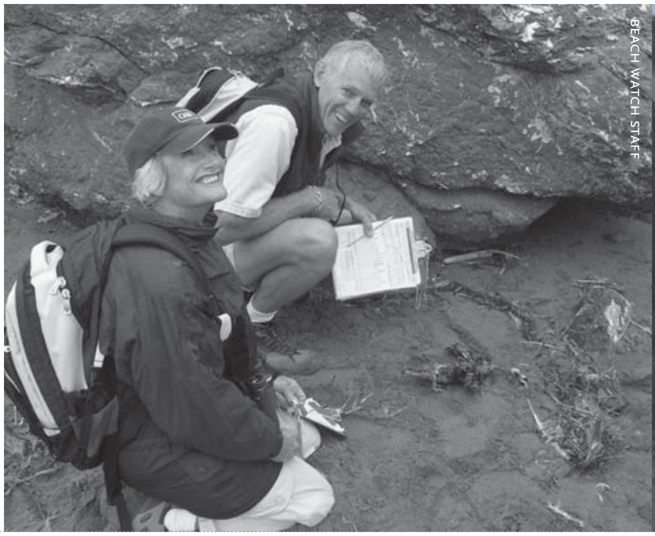
We welcome our newest class of Beach Watch volunteers!

"Beach Watch established a certain level of excellence that was impossible not to acknowledge. This training period was enjoyable, informative and not to be forgotten."

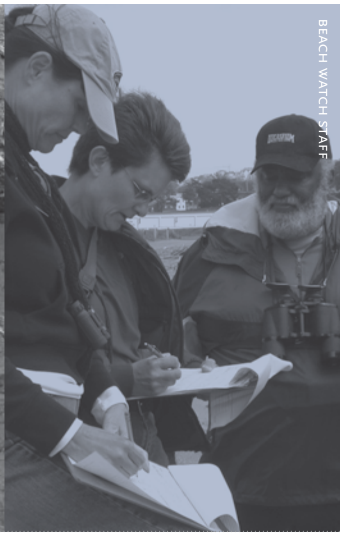
—GARY THORP

Bottom left: Husband and wife team Rich and Kathi Fortmann learn how to document a dead bird on Rodeo Beach.

Bottom right: Veteran volunteer Pam LoPinto shows Lisa Hansen and George Peterson how to record data.



BEACH WATCH STAFF



BEACH WATCH STAFF

SUSAN MCCARTHY

Volunteers

During the 2004-2005 data season, 5,949 volunteer survey hours (including drive and prep time) were donated and 65,153 miles were driven to monitor beaches. A total of 9,581 hours were donated to the program, including survey hours, office volunteers, data entry, enrichment classes and training during 2005.

Marie Kazan-Komarek has been patrolling beaches since 1994.

Surveyor Effort October 2004 - September 2005

Surveyor	Hours*	Kilometers Surveyed
Willy Adam•	26.8	9.5
Tamae Agnoli•	27.5	23.5
Bill Aiken•	17.0	0.7
James Aliberti	39.3	28.8
Lewis Ames	51.8	41.6
Colette Armao•	190.5	43.5
Fradel Been•	33.8	18.4
Frank Beering•	26.5	0.9
Gordon Bennett•	27.8	19.6
Kathryn Blake	58.0	18.3
Walt Bodley	11.5	8.2
Jacqueline Bower•	32.5	19.5
Paul Buchanan	3.8	4.8
Doug Campbell	63.5	13.0
Cathleen Cannon	10.0	3.7
Kate Carolan•	62.3	21.6
Beth Cataldo	100.8	58.4
Pat Coffey•	106.8	50.7
Gene Corning	113.0	62.5
Judith Corning	143.5	80.2
Michelle Covey	31.8	20.4
Steve Covey	31.8	21.2
Arlene Davis•	38.5	7.8
Peter De Jung•	85.3	48.1
Stephanie De Moe	105.3	18.2
Dru Devlin•	49.8	31.8
James De Vry•	26.3	14.4
Connie Diernisse•	92.8	23.5
Bob Dinneen•	34.0	10.4
Molly Dinneen•	7.0	1.6
Jesse Ellinger	24.8	20.8
Don Engler	23.0	4.2
Linda Ferreira•	5.5	1.4
Richard Ferris	221.0	122.7
Dave Fichtner	89.5	32.1
Marguerite Finney	120.6	70.3
Mary Follis	71.8	37.7
Ken Frazier	105.3	18.2
Ellen Gartside•	18.2	13.0
Brenda Goeden•	56.3	43.7
Frances Gulland	2.8	0.9
Jamie Hall•	107.8	50.3
Lou Helmuth•	79.7	53.9
Jacquie Hilterman	47.5	6.8
Justin Holl	16.0	16.6
Linn Johnson	62.3	17.9
Marie Kazan-Komarek•	12.5	7.0
Sara Kimberlin	18.5	19.8
Linda King	30.3	8.0
Sandy Lelich•	33.0	17.9
Christer Lewenhaupt	79.8	46.5
Pam LoPinto	12.3	9.7
Shannon Lyday	149.5	49.3
Larry Lynch	33.8	4.8
Cindy Marconi	45.8	18.7
Anne McCamman	55.3	37.1
Judy McCarthy	63.0	57.6
Susan McCarthy•	30.75	14.0
Susan McComb•	39.5	49.6
Pat Merrill	88.8	46.2
Carrie Miller	53.5	19.6
Joanne Mohr	66.0	16.9
Andrea Mok•	53.8	18.7
Helga Mok•	62.3	21.4
Jack Mona	24.3	1.0
Jennifer Newman	16.3	8.0
Michele Nichols•	51.5	20.8
Pat O'Connell	40.3	38.4
Beth Perry•	29.3	42.5
Mary Jean Pramik	5.8	0.6
Laura Raden•	37.8	2.7
Lin Renner	77.5	48.0
Dominique Richard	91.5	67.9
Jan Roletto•	37.8	11.4
Christina Ruiz•	23.3	12.0
Brad Schleder•	40.0	13.0
Allan Schreiber	85.3	57.5
Marjorie Siegel•	93.5	50.0
Megan Smith	37.3	4.8
Branner Solano	36.0	33.8
Keary Sorenson	154.3	57.2
Sally Sorenson	155.3	57.2
Julie Starobin	39.8	35.2
Nancy Strachan-West	29.0	10.7
Jan Talbert	51.3	25.0
Craig Taylor•	33.8	18.4
Sandy Thomas•	56.8	55.0
Gwendolyn Toney	21.5	15.6
Mary Von Tolksdorf•	157.0	57.5
Andy Voropaeff•	26.0	24.0
Peter White	98.3	29.9
Bob Wilson•	70.5	21.3

TABLE 9.

* includes survey hours, prep time and drive time

• 10 or more years as a Beach Watch volunteer

FARALLONES MARINE SANCTUARY ASSOCIATION STAFF

Executive Director: Linda Hunter

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Deputy Superintendent: Brian Johnson

Program Specialist: Kelley Higgason

Resource Protection Specialist: Irina Kogan

Office Administrator: Judith Novak

Network and Web Manager: Matt Ong

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Education Specialist: Christy Walker

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Año Nuevo State Reserve

BeachCOMBERS

California Department of Fish and Game Office of Spill Prevention and Response

California State Parks and Recreation

COASST

Cordell Bank National Marine Sanctuary

Golden Gate National Recreation Area

James V. Fitzgerald Marine Reserve

Marin County

Monterey Bay National Marine Sanctuary

National Marine Fisheries Service

NOAA Damage Assessment Center

NOAA Restoration Center

Point Reyes National Seashore

PRBO Conservation Science

San Francisco County

San Mateo County

Sonoma County

The Marine Mammal Center

U.S. Fish and Wildlife-San Francisco National Wildlife Refuge Complex

U.S. Coast Guard

Enrichment classes are offered throughout the year for volunteers to improve their skills.

JAMIE HALL

"I will never look at the coast the same way again."

— JASON THOMPSON

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BOB WILSON

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Resource Legacy Foundation

Harbor seals are frequently seen during Beach Watch surveys.

We thank all of the dedicated Beach Watch volunteers, past and present, who have tirelessly walked their beaches to provide this data. We also acknowledge Rich Stallcup and his continued dedication to Beach Watch, from training volunteers to identifying every dead bird slide for the past 13 years. Last, but not least, thank you to the office volunteers and interns who have helped process surveys, catalog slides and check data. We couldn't do it without you!

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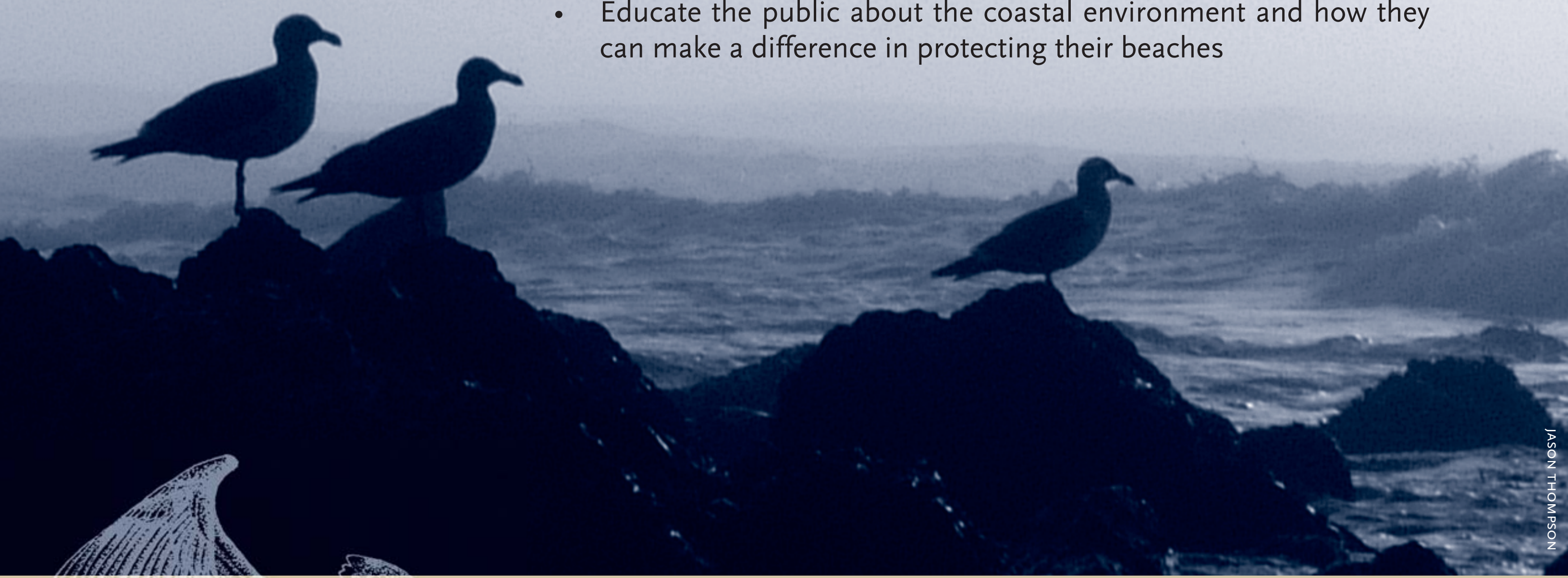
Beach Watch Program Goals:

- Provide a baseline dataset on the presence of live and beach-cast marine organisms
- Assist Sanctuary management in the early detection of natural and human-caused environmental events
- Develop a network of volunteer expert surveyors who can respond during an oil spill
- Educate the public about the coastal environment and how they can make a difference in protecting their beaches



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