COASST

COASTAL OBSERVATION AND SEABIRD SURVEY TEAM

Reports 05–06

NOVEMBER 2006

Breaking News

Another record-breaking year for COASST. Is there any other kind?! Nearly 350 volunteers spent 4900 hours walking more than 9500 kilometers roundtrip; just over 1900 surveys were completed on 206 beaches! And it doesn't stop there–with the increase in survey effort, COASSTers found more than 2800 carcasses of 76 different species. We also added our first Alaska beaches this year.

A great year for COASST, translated into a bad year for Cassin's Auklets, Rhinoceros Auklets and Western Grebes. Your efforts during the winter and early-spring surveys helped document these unusual die-offs, as well as substantiate some of the usual patterns.

Oregon South

It was as if prevailing winds had completely changed direction when Anne Caples, Mary Lou Letsom, Val Knox, Cindy Burns, and Diane and Dave Bilderback found a couple of land birds–a Winter Wren and a Wilson's Warbler–on their September survey of Oregon Mile 175. Perching bird species compose quite a small percentage of the total birds found by COASST–less than 2% in any given year. Despite the low numbers, migratory songbirds are frequently blown off course over the ocean, and these exhausted individuals land on any available surface, as fishermen will testify.

Exhausted southern Oregon surveyors were looking for a place to land during the Rhinoceros Auklet die-off in March this year. On a stretch of beach about 1.6 km long (~1 mile), Bill and Jolene Poppe found 19 Rhinos in one survey of Tenmile Creek beach (same with all the folks on Mile 175)!

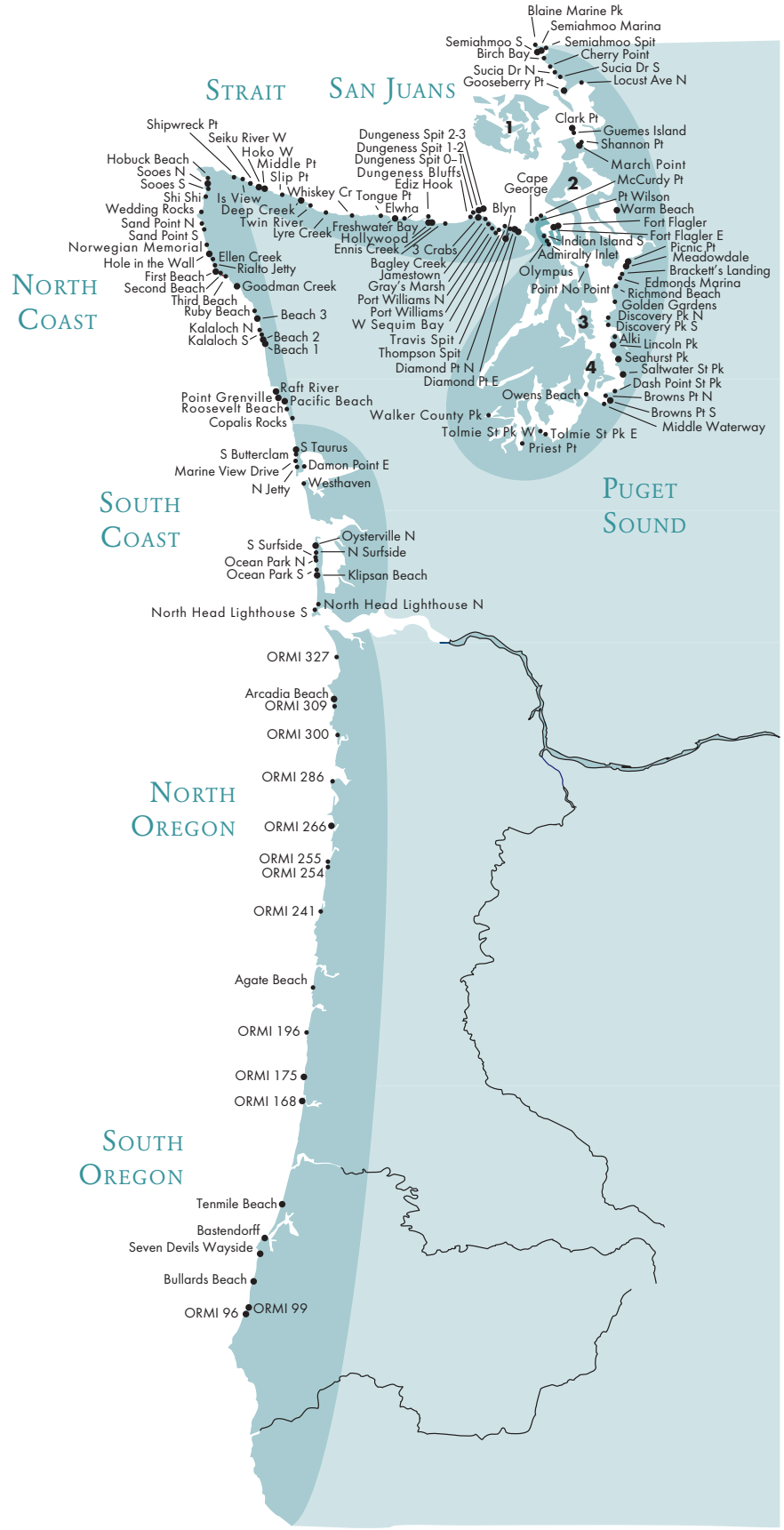
Oregon North

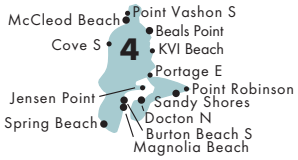
Over the years we've had a number of suggested improvements to the COASST datasheet, but Kathleen and Steve Confer from Oregon Mile 286 had the best addition thus far: "We saw three people walking three llamas on the beach–no place to count llamas on the survey :-)" Mary Holbert and John Burton might add–no place to count goats, either–like "Plum" and "Legs," their faithful Agate Beach survey partners.

Nearly as rare as a llama sighting, Jann Luesse, Lori Sinnen and Pat Reynolds found a banded Black-footed Albatross in December on Oregon Mile 327. Both this Black-foot and the one found by Sue Nattinger

P & S MacRobbie

Pat and Stu MacRobbie found these nets on Kalaloch South in February. They reported that "many would fill a full-size pick-up," and lamented that "one industry is sustainable–beach trash."





The COASST map has grown. We've moved on to page 3! This year's map includes all beaches reporting from June 2005 through May 2006. For a more detailed look at the San Juans and Puget Sound island communities, see insets 1-4.

and Coleman Byrnes on Shi Shi Beach near Neah Bay, Washington, in August were originally banded on Tern Island, as part of the Hawaiian National Wildlife Refuge's ongoing program to track the albatross populations of the North Pacific.

South Coast

Among several major storms that brought huge waves rolling into Westport last February, Craig Zora stumbled upon COASST's first Parakeet Auklets–two in one survey on Westhaven. Parakeet Auklets, like their Horned Puffin cousins that showed up for the first time last winter, disperse from breeding colonies in Alaska south into the North Pacific.

From a much warmer locale–Hawaii–a Laysan Albatross arrived, another first for COASST. Sporting the dusky-tipped pale pink bill that distinguishes the Laysan from its more prevalent cousin, the Black-footed Albatross, Mike and Barbara Patton had no problem identifying this guy on South Butterclam in August, especially given its "near perfect condition."

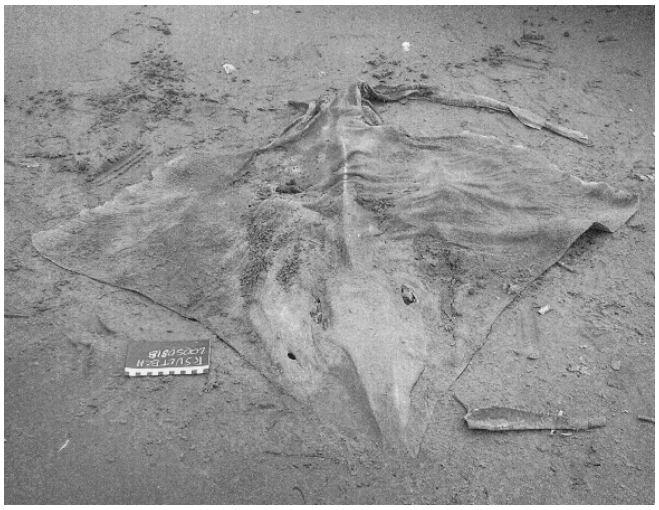
Padding her resume as the "dead bird lady" of Ocean Shores, Kathleen Wolgemuth (along with Dianna Moore and Barbara Patton) took the spotlight once again to host *Northwest Cable News* on a July survey of North Jetty. As luck would have it, they came across a real stumper, something even COASST had never seen before–a South Polar Skua.

North Coast

Great Skate! A host of non-feathered finds washed ashore on North Coast beaches this year, starting with the longnose skate Sharon Gearhart found on Roosevelt Beach last August, a black bear skin found by Sharon in April, and a raccoon found by Sasha Sicks on Sooes North in September.

An equally surprising find showed up in October on Pacific Beach–a juvenile gull that apparently didn't know its limits when it attempted to chow down a humongous rockfish. Ben and Flora Watson suspect it wasn't advised about the "never eat anything bigger than your head" rule.

There was no absence of birds on Hobuck Beach this year–Mary Sue Brancato and Barbara Blackie found 148 birds, not counting refinds. Hats off to Heidi Pedersen, Tina and Rodney Lipman and Rosie Zwanziger who helped Barb and Mary Sue find a Parakeet Auklet in February–the third one found on the outer coast that month. COASST wasn't the only one seeing Parakeet



S Gearhart

What a long nose you have! This longnose skate measured in at more than one meter wide!

J & J Pumphrey

White mantle, but it's not an eider. It's a glider, found by the Pumphreys at Whiskey Creek.

B & L Leyman

One intact, but unusually stiff carcass was spotted amongst the logs at Obstruction Pass South–a mallard decoy.

Auklets–scientists from the Point Adams Research Station conducting seabird surveys aboard the *RV McArthur II* off the coast of Washington and Oregon counted 48 (live ones…). Prior to this, there had been only about a dozen sightings on record for Washington State ever.

Strait of Juan de Fuca

Like a CSI episode, Sue Nattinger and Coleman Byrnes stumbled upon COASST's first Peregrine Falcon on Twin Rivers beach. As they were leaving the scene, they began to suspect the bird had actually been shot! After obtaining the proper permits to remove the bird, they returned to investigate further, but not a trace remained.

Luckily nobody reported any suspicious material after a 6–8 million gallon sewage spill closed beaches in the Port Angeles harbor for more than two weeks. Sewage spills, to a lesser degree than oil spills, can be damaging to marine ecosystems by decreasing oxygen levels and increasing toxins.

On Whiskey Creek, Jaci and Jeanne Pumphrey found a mysterious intact bird with no measurable bill or tarsus. And thin as a board! The unusual bird happens to be part of the "glider" family, native to toyboxes across the country.

San Juan Islands

San Juan COASSTers were a "loony" bunch this year, collecting one of each of the three loon species–a Red-throated Loon found by Jim and Jeanne Budlong on North Swifts Bay, a Common Loon found by Julia Loyd and Tristan Delahunt near Point Hammond, and a Pacific Loon found by Judy Chovan at Grandma's Cove.

One very stiff, headless, footless bird washed in at Obstruction Pass South–"best left to the experts!"–wrote Bev and Larry Leyman. And now we know–the *Beached Birds* wing table works at identifying decoys too!

The 2005–2006 year marks the first time the San Juans hasn't recorded a Bald Eagle (chick or adult) since COASST surveys ramped up in the area in 2001–2002. It's not surprising that we've found them in the past–over 12% of the total nests in Washington are found in San Juan County and the number of breeding pairs is still increasing throughout the state.

Puget Sound

Quite a large footprint was spotted by Sharon Gearhart at Tolmie State Park in December–did Big Foot lose two toes? Nope, they were Great Blue Heron prints. Found only in Puget Sound this year, the Great Blue Heron (Seattle's official bird) was the fifth most common species found in the Puget Sound region, behind Glaucous-winged Gull, Double-crested and Brandt's Cormorants, and Common Murre.

A stunningly unusual bird washed ashore on Whidbey Island this year. A Short-tailed Shearwater, common to 50 or more kilometers offshore, wound up more than 150 kilometers inland. Congratulations

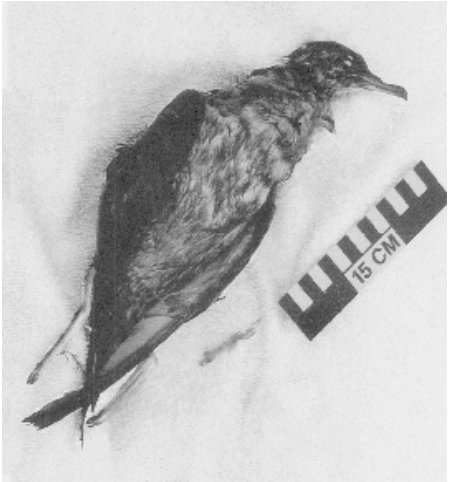
to Sandy Dubpernell, and Clarence and Jim Hein who found the Puget Sound region's second-ever tubenose!

A Red-breasted Merganser showed up on Elger Bay, but it wasn't exactly a museum quality specimen. "It didn't take us long to determine which side of the bird was downwind and we quickly moved over to the other side." Needless to say, Bill and Alice Blandin are hoping for decoys from now on.

Alaska

Last summer, we received an email from Mary Anne Bishop, a researcher at the Prince William Sound Science Center, asking about instituting COASST surveys as a part of their seasonal field work on Egg Island, in Prince William Sound. Thanks to Mary Anne, Jean François Lamarre and River Gates, COASST's first Alaska beach was established!

Since May of this year, we've added 28 more beaches to the Alaska map–some as far north as St. Paul Island! A few from Kenai Fjords National Park just snuck in under the deadline for this year. Glimpses of rare Alaskan species are starting to flood the office–keep your eyes peeled for them to make an appearance in this winter's *COASSTLine*.



S Dubpernell

WOW! This Short-tailed Shearwater (a species which breeds in Southeastern Australia) was found on Whidbey Island.

The ever-popular COASST quiz—part 1

A

P Reynolds and L Simren

vital stats

found 09/11/2005

Oregon Mile 327 (Oregon North)

Wing: 18 cm

B

S Dubpernell

vital stats

found 05/10/2006

Fort Casey (Puget Sound)

Bill: 71 mm

Wing: 26 cm

Tarsus: 69 mm

–continued on page 18

What's Washed In?

New Species

Last year, we thought we had reached the plateau in annual diversity of species with between 55 and 60 found each year. But as soon as we tell you something, it changes! This year, we hit a new record with 76. Following the Horned Puffins from last year, we have added three more northern species to the COASST list–Parakeet Auklet, Emperor Goose and Red-legged Kittiwake. Other new species included two long-distance fliers, Laysan Albatross and South Polar Skua; two additional waterfowl, Northern Shoveler and Snow Goose; two owls, Northern Saw-whet Owl and Western Screech-owl; a Peregrine Falcon; and a Winter Wren. This brings the COASST total to 94 species identified to date. We'll be on the lookout for more new species as data starts coming in from Alaska.

B & F Watson

Northern Shovelers, like the female pictured here on Pacific Beach, all sport a large spoon-like bill.

Beached Birds Identified to Species

SPECIES	YR 7 #	YR 7 %	YR 6 %	YR 5 %	YR 4 %
Common Murre	**826**	**28.9**	**47.0**	**17.8**	**24**
Northern Fulmar	**354**	**12.4**	**8.0**	**57.0**	**23.6**
Large Immature Gull	**301**	**10.5**	**13.3**	**7.7**	**10.1**
Rhinoceros Auklet	**292**	**10.2**	**1.5**	**1.0**	**1.3**
Western Grebe	**188**	**6.6**	**0.8**	**1.0**	**2.9**
Cassin's Auklet	**170**	**5.9**	**2.0**	**1.0**	**1.5**
Brandt's Cormorant	109	3.8	3.3	1.2	2.0
Glaucous-winged Gull	68	2.4	3.8	2.0	3.3
Pelagic Cormorant	49	1.7	2.7	1.3	2.6
Western Gull	48	1.7	3.3	0.9	1.8
Red Phalarope	**46**	**1.6**	**0.05**	**0.4**	**10.6**
California Gull	36	1.3	0.7	0.5	1.3
Sooty Shearwater	**33**	**1.2**	**2.0**	**0.9**	**2.1**
White-winged Scoter	32	1.1	1.0	0.5	0.9
Pigeon Guillemot	26	0.9	1.0	0.5	0.9
Surf Scoter	24	0.8	1.1	0.7	1.6
Short-tailed Shearwater	24	0.8	0.9	0.2	0.4
Common Loon	23	0.8	0.4	0.4	0.3
Double-crested Cormorant	20	0.7	0.5	0.6	0.6
Fork-tailed Storm-Petrel	15	0.5	0.2	0.3	0.1
Black-footed Albatross	14	0.5	0.7	0.2	0.4
American Crow	13	0.5	0.4	0.3	0.2
Pacific Loon	11	0.4	0.3	0.1	0.9
Caspian Tern	10	0.3	0.8	0.4	0.8
Ancient Murrelet	7	0.2	0.1	0.1	0.2
Mew Gull	7	0.2		0.04	0.2
Black-legged Kittiwake	6	0.2	0.2	0.2	0.4
Heermann's Gull	6	0.2	0.3	0.2	0.4
Marbled Murrelet	6	0.2	0.1	0.04	0.2
Red-throated Loon	6	0.2	0.1	0.04	0.2
Clark's Grebe	5	0.2			
Northern Pintail	5	0.2	0.1	0.2	0.2
Greater Scaup	4	0.1	0.05	0.1	0.2
Green-winged Teal	4	0.1	0.1	0.04	0.1
Horned Puffin	4	0.1	0.3		
Leach's Storm-Petrel	4	0.1	0.1	0.1	
Bonaparte's Gull	3	0.1		0.04	0.1
Glaucous Gull	3	0.1		0.04	
Great Blue Heron	3	0.1	0.1	0.04	0.1
Herring Gull	3	0.1	0.1	0.1	0.3
Parakeet Auklet	3	0.1			
Rock Dove	3	0.1	0.05	0.2	0.1
American Wigeon	2	0.1		0.1	
Black Scoter	2	0.1		0.04	0.1
Brant	2	0.1			0.1
Brown Pelican	2	0.1	0.4	0.2	0.4
Bufflehead	2	0.1	0.3	0.1	
Dunlin	2	0.1	0.05		0.1
Mallard	2	0.1	0.1	0.3	0.2

SPECIES	YR 7 #	YR 7 %	YR 6 %	YR 5 %	YR 4 %
Mottled Petrel	2	0.1			
Northern Shoveler	2	0.1			
Pink-footed Shearwater	2	0.1			0.1
Red-necked Grebe	2	0.1		0.2	
Varied Thrush	2	0.1	0.3	0.04	
American Coot	1	0.03		0.04	
American Robin	1	0.03		0.04	
Buller's Shearwater	1	0.03		0.1	
Canada Goose	1	0.03	0.3	0.2	0.4
Common Goldeneye	1	0.03		0.04	
Emperor Goose	1	0.03			
European Starling	1	0.03			0.1
Greater White-fronted Goose	1	0.03	0.05		
Horned Grebe	1	0.03		0.1	
Laysan Albatross	1	0.03			
Northern Saw-whet Owl	1	0.03			
Peregrine Falcon	1	0.03			
Pomarine Jaeger	1	0.03			
Red-breasted Merganser	1	0.03		0.1	
Red-legged Kittiwake	1	0.03			
Ring-necked Pheasant	1	0.03	0.05		
Sanderling	1	0.03	0.05	0.1	0.1
Snow Goose	1	0.03			
South Polar Skua	1	0.03			
Western Sandpiper	1	0.03			
Western Screech Owl	1	0.03			
Wilson's Warbler	1	0.03	0.05		
Winter Wren	1	0.03			
Tufted Puffin			0.1	0.1	
Bald Eagle			0.1	0.1	0.1
Arctic Tern			0.05		
Chicken			0.05		0.1
Common Merganser			0.05		0.1
Franklin's Gull			0.05		0.1
Great Horned Owl			0.05		
Sharp-shinned Hawk			0.05		
Surfbird			0.05		
Whimbrel			0.05		0.1
Band-tailed Pigeon				0.04	0.1
Barred Owl				0.04	0.1
Black Oystercatcher				0.04	
Red-breasted Sapsucker				0.04	
Ring-billed Gull				0.04	0.1
Black-bellied Plover					0.1
Lesser Scaup					0.1
Marbled Godwit					0.1
Parasitic Jaeger					0.1
TOTAL	**2,861**				

Species totals, excluding unknowns and refinds. Note that major species—accounting for greater than 5% in any COASST year (YR1–YR 7)—are in bold type.

Major Species

Cassin's Auklets joined the ranks of major species–defined as more than 5% of total carcasses found–this year. And Rhinoceros Auklets made it back on the list after a long hiatus since the first year of COASST surveys. At just more than 10% of all finds, Rhinos had a particularly bad year in the Pacific Northwest. Typically washing up in low numbers, both of these small Alcids experienced wrecks, or a massive die-off and beaching in a relatively short period of time: Cassin's in January and February on the outer coast of Washington and northern Oregon, followed by Rhinos in March and April in Oregon. In a single March survey, Bert Johnstone and Peggy Speer found 21 on Oregon Mile 196, Jim Maloney and Barb Holler found another 11 on Mile 168.

Following their disastrous winter of 2004–2005 in California, where auklet species suffered excessive mortality, the current winter and spring wrecks may spell trouble for these diving seabirds.

Western Grebes also made it back on the list as a major species this year. After three years at relatively low numbers, winter also brought a wreck of Western Grebes, as many of you probably remember. Eighty-three Western Grebes washed up on the outer coast of Washington in January. Mary Sue Brancato and Barbara Blackie, the North

Coast and Strait volunteer coordinators who also survey Hobuck Beach on the North Coast, found 21 of these during one survey.

Otherwise, it was the usuals–Common Murres, Northern Fulmars, and large immature gulls. Relative to earlier years, the total number of murres washing ashore was in the middle of the range (10.5–47.0% of the total). The same is true of Northern Fulmars (8.0–57.0% of the total). With the exception of the first two years, when murres had relatively low mortality, and the untoward mortality of last year, most of the annual data COASST has recorded to date puts murres in a fairly narrow percentage (~20–30% of the total). Fulmars, on the other hand, appear to have either great or terrible years.

Species of Concern

SPECIES	WA	OR
Common Murre [10]	303	523
Western Grebe [10]	154	34
Cassin's Auklet [3, 10]	105	65
Brandt's Cormorant [10]	58	51
Common Loon [8]	16	7
Fork-tailed Storm-Petrel [9]	7	8
Black-footed Albatross [11]	9	5
Marbled Murrelet [2, 6, 7, 11]	5	1
Heermann's Gull [11]	3	3
Bufflehead [9]	2	
Red-necked Grebe [9]	2	
Brant [11]	1	1
Brown Pelican [1, 4, 5]	1	1
Pink-footed Shearwater [11]	1	1
Emperor Goose [11]	1	
Horned Grebe [9]	1	
Laysan Albatross [11]	1	
Peregrine Falcon [3, 8]	1	
Red-legged Kittiwake [11]	1	
Buller's Shearwater [11]		1

[1] Federally Endangered, [2] Federally Threatened, [3] Federal Species of Special Concern, [4] WA State Endangered, [5] OR State Endangered, [6] WA State Threatened, [7] OR State Threatened, [8] WA State Sensitive, [9] OR State Sensitive, [10] WA State Candidate, [11] Audubon WatchList

T & C Herzig

Rarer than rare in Washington, this Alaska native was identified by Tom and Connie Herzig as an Emperor Goose because of its striking foot and bill coloration.

In great years (for the birds!), like this one, fulmars make up around 10% of the total. In terrible years, that percentage is pushed way up, as high as 57% in 2003–2004.

Conservation Concerns

COASSTers found 20 species of concern this year–the most in any one year since COASST started in 1999. In fact, four of our new species this year are species of concern–the Emperor Goose, Laysan Albatross, Peregrine Falcon, and Red-legged Kittiwake. Why are the numbers up? Well, program-wide survey effort increased by approximately 20% from last year. Increased effort means increased chances of finding rare, unusual, or endangered species. It's also true that COASST keeps expanding geographically, bringing us into contact with additional species. Finally, changes in the environment bring new species to the Pacific Northwest–witness the parade of northern species into our Washington and Oregon waters.

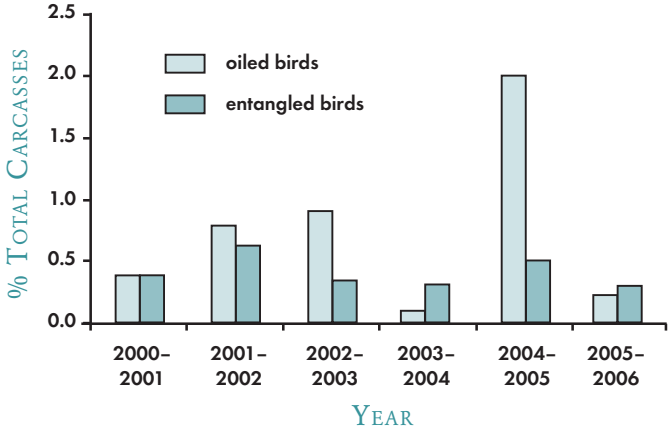
What's the concern? The COASST species of concern list includes species that are on Federal and/or State lists as endangered, threatened, sensitive, or as candidates for listing or species of concern. In addition, we include species that are on the Audubon Society's WatchList. Audubon uses information from Birdlife International and Partners in Flight, two international bird conservation organizations, to identify species whose populations are declining, that have small populations and/or limited range, and that face severe conservation threats. For example, the Emperor Goose

is on the WatchList because the population declined drastically from an estimate of nearly 140,000 in the mid-60s to fewer than 45,000 in the mid-80s. The good news is that the Emperor population has been increasing slightly in more recent years.

Altogether, species of concern accounted for almost half (48%) of all birds found by COASST this year. This may seem high, but is actually within the range of previous years (for instance, last year species of concern topped 55%). Paradoxically, one of our most consistent top ten species–Common Murres–is also a Washington State candidate species, and LOTS of murres wash up on Washington beaches. Last year, murres accounted for 85% of all species of concern; this year they were 60%, with Western Grebes and Cassin's Auklets accounting for another 10% each. Although we want to keep a sharp eye out for changes, there is good reason to believe that many of these beached murres, particularly along the south coast of Washington, are Oregon birds migrating north after the breeding season. Backing murres out of the equation, the remaining species of concern still account for almost 20% of the total count.

Oiling

After a bit of an oil scare last year, we're happy to report that things are back to normal with less than 1% of all birds found oiled. Actually, as you can see from the graph, this year was our second lowest oiling rate to date, with only 0.24% of birds oiled. That means that



Mortality Related to Human Activities

SPECIES	TOTAL	BEACH
OILED BIRDS		
Common Murre	5	Agate Beach
		Beckett Point
		North Jetty
		OR Mile 196
		Roosevelt Beach
Black-footed Albatross	1	Marine View Drive
Cassin's Auklet	1	South Surfside
ENTANGLED BIRDS		
Common Murre	4	Agate Beach [1, 2]
		OR Mile 96 [2]
		OR Mile 255 [3]
		South Butter Clam [3]
Brandt's Cormorant	2	Fort Casey [2]
		OR Mile 286 [1, 2]
Large Immature Gull	1	OR Mile 327 [1]
Surf Scoter	1	OR Mile 327 [2]
Western Grebe	1	Hobuck Beach [3]

[1] Hook, [2] Line, [3] Net

COASST found only one oiled bird for every 417 birds that weren't oiled. And none of the oiled birds that COASST found this year were coincident in space and time with any reported spill.

So far, we've been lucky. There have been no major oil spills in our area since COASST started. But every year, we seem to have at least one scare, and this year was no different. COASSTers leaped into action in November after the *F/V Bold Contender,* a 60-foot crab fishing boat, was reported to be sinking two miles off of Cape Fowlweather and Depoe Bay in Oregon. The vessel was carrying 6000 gallons of diesel fuel, 300 gallons of lube oil, and 2000 pounds of bait. Originally expected to wash ashore between Cascade Head and Cape Lookout, this vessel could have caused a large spill, but after sinking at sea, only two small sheens were reported. John and Susan Burton, John Haxton, Wade Newbegin and Paul Raffensperger all went out

following the event. Nine birds were found, but none were oiled and no oil was found on the beach. It is this short-notice extra effort that gives COASST the ability to set up-to-the-moment baselines that are so important in assessing spill impacts.

Apparently it was the year for sinking crab boats–the *F/V Northern Orion,* a retired crabber–sank at the Pier 4 Astoria dock in January. A 1.5 km slick approximately 20 kilometers upriver from the mouth of the Columbia River was the result. Tom and Connie Herzig and Jann Luesse went out to their beaches, North Head Lighthouse and Oregon Mile 327 respectively, just to make sure no oil reached the outer coast. Sure enough, no oil or oiled birds were found.

J Haxton

M Holbert and J Burton

Two entangled murres. above: net entanglement on OR Mile 241; below: bill in plastic tubing, and teenage mutant Ninja turtle to the rescue found on Agate Beach.

Entanglement

COASSTers find very few entangled birds each year. As you can see from the graph on page 9, the COASST entanglement rate has never reached 1% and is generally less than 0.5%. This year was our lowest entanglement rate yet, at only 0.31%. Common Murres were most often entangled. Mary Holbert and John Burton found a murre entangled in a fishing line with a hook on Agate Beach in August. They said it looked like a small jig line. John Haxton and Peter Witschi each found an entangled murre, on Oregon Mile 255 in July and Oregon Mile 96 in October, respectively. Although it didn't show in the photo, a phone call from Jane confirmed that Barbara Patton found a murre entangled in a net on South Butterclam in the South Coast of Washington in April. Barbara was so distressed when she found it that she rushed to disentangle it from the net before taking the COASST data and photograph.

When reporting incidents of entanglement, we are paying particular attention to entanglements in fishery gear (e.g., hooks, lines and nets). However, every year some strange entanglements show up–like the juvenile murre with its beak in a plastic hose. Although this didn't get counted in our official entanglement statistics, it definitely got our attention! If you see anything strange, be sure to document it with photos and detailed comments so that we can best determine if it is a fishery-related entanglement or otherwise.

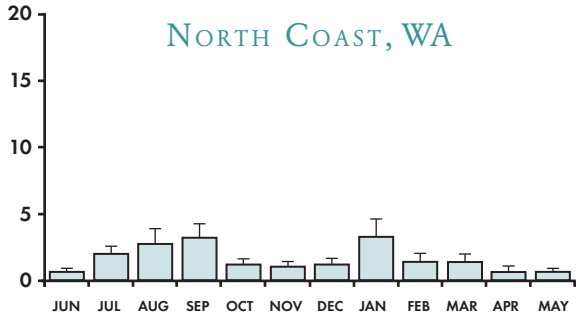
Deposition Index

It was another quiet year in the inside waters COASST regions (see graphs on page 11). Less than 5% of all COASST birds were found in the inside regions. Beaching rates along the Strait of Juan de Fuca showed the most pronounced seasonal pattern for inside waters, with a September-October post-breeding peak, and a sustained increase during the stormy winter months of December through March. The September and March signals are still apparent in the San Juan Islands. In Puget Sound proper, however, rates were fairly even across the board, with a small bump up in December. In fact, if you compare this year to previous years (still got those old *COASST Reports* lying around?), you can see that there is no consistent set of months when carcasses

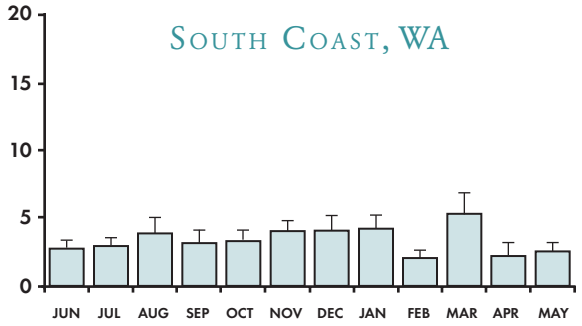
Monthly Deposition Index by Region

OUTER COAST

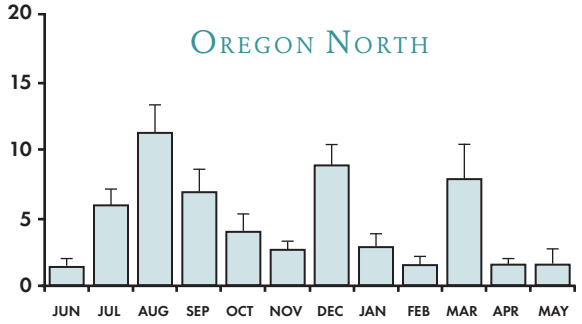
North Coast, WA



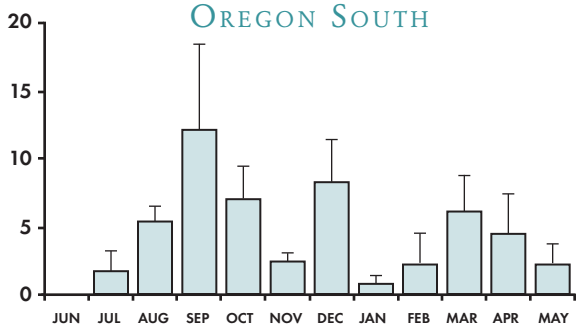
South Coast, WA



Oregon North

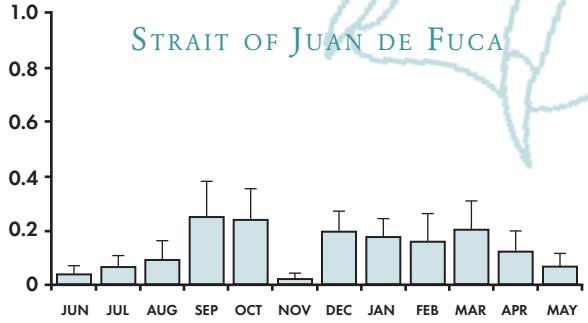


Oregon South

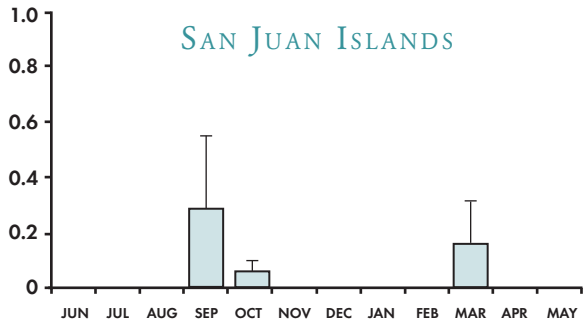


INSIDE WATERS

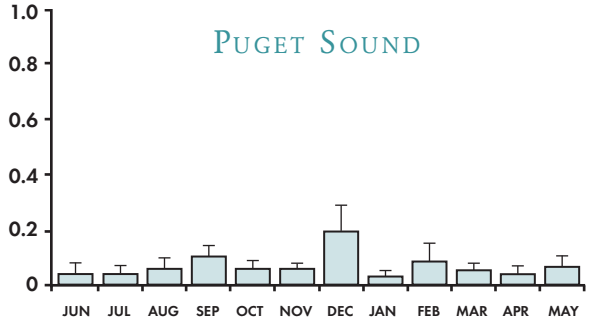
Strait of Juan de Fuca



San Juan Islands



Puget Sound



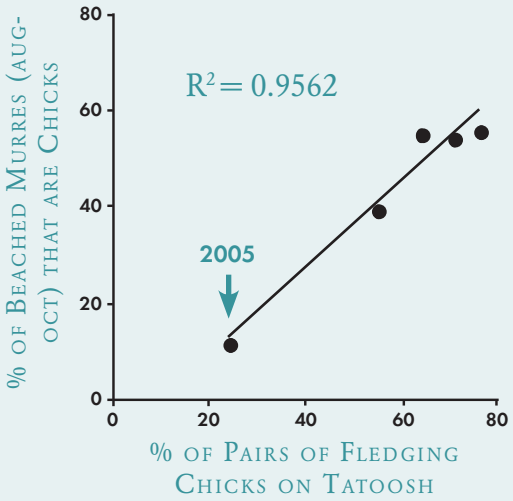
Carcasses per km

Twenty-five times more birds were deposited on outer coast beaches (left) than on inside waters beaches (right). Note the difference in the y-axes. This year, the post-breeding mortality, winterkill and Rhino die-off peaks were particularly pronounced in Oregon.

Beaching Rates Predict On-Colony Reproduction

One consequence of depressed breeding in the Pacific Northwest was a weaker post-breeding mortality signal on our beaches. Fewer adults and many fewer chicks washed up in the late summer and early fall of 2005. In fact, using information from the Tatoosh Island murre colony and COASST beaching rates of murre chicks along the North Coast of Washington, it's easy to see that these two datasets match. The data align quite closely with a straight line, a fact we can measure with a statistic called a correlation coefficient, or R^2. A high R^2 value–near 1.0–means that the points fall nearly exactly on a line and one dataset can be used to predict the other with a fair amount of accuracy. A low R^2 would indicate that the points are scattered in a random, or shotgun, way. In this case, our R^2 is 0.956, a pretty impressive correlation.

With this level of association between reproduction on the colonies and beaching rates on COASST sites, we can be fairly confident that the COASST data on murre chick beaching rates in the late summer and early fall tells us something directly about how our local breeding colonies are doing. And this is important, because state and federal agencies just don't have the resources to monitor many colonies. In the absence of direct data, beached bird information can stand in as an index of colony success.



are most likely to be found. Peaks are likely to happen anywhere in the August to March window, suggesting that the factors affecting seabirds in inside waters are probably varied in time, space, intensity, and type. Not so the outer coast.

Remember last year (2004–2005)? Instead of the usual pattern of outer coast beaching–a peak in the late summer-fall followed by another in the fall-winter–we got the "Pacific Die-off." After a year of reviewing the data, we now have a clearer picture of what happened, even if we can't quite tell why.

In the winter of 2004–2005, weather in the Pacific Northwest was mild. On the beaches, COASST picked up this signal as the absence of birds. Those fulmars that usually wash in just didn't appear, leaving our usual "double-humped" deposition curve with one less hump. To the south, in California, the winter weather was more normal, and so was the rate of fulmar beaching.

But strange things were happening in California with other birds. Rhinoceros Auklets and Cassin's Auklets were dying in extraordinary numbers. These two species breed mainly in Washington and British Columbia, but do the "snowbird" thing and migrate south for the winter. Monterey Bay is a favorite hang-out area for these small seabirds, and for many others looking for plankton and fish to fatten up on during the winter. Between December and February, 4–6 times as many auklets washed up on Monterey's beaches, giving

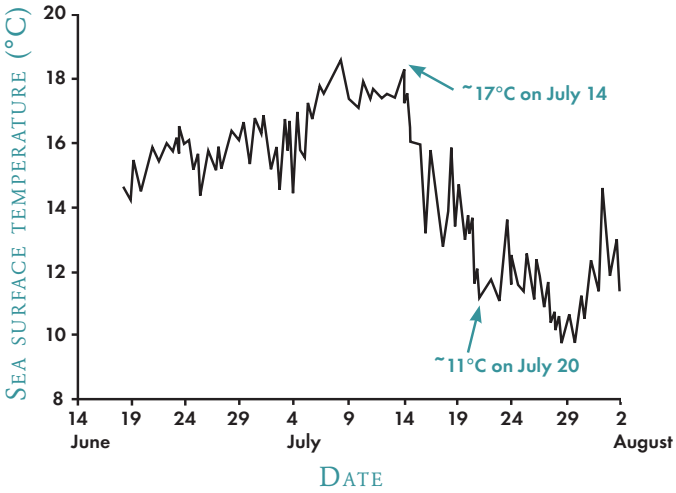
the BeachCOMBERS volunteers lots of extra work. What was the reason? Why did auklets die and fulmars survive? This mystery is still unsolved.

Unfortunately for our local breeders, the California winterkill was just the beginning. All along the West Coast the usual late-winter winds were acting oddly. In a normal year, coastal winds begin to move surface waters offshore by about mid-March. This loss of surface water creates a suction effect, bringing cold, deep, nutrient-rich waters to the surface. Like a conveyor belt, deep water upwells to the coast and is pushed offshore to be replaced by more deep water. Known as coastal upwelling, this phenomenon fuels the spring plankton bloom and turbo-charges the coastal ecosystem. No wind, no upwelling; no upwelling, no plankton; no plankton, no fish; no fish, and seabirds suffer.

And suffer they did! From Monterey to the north outer coast of Washington, Common Murres and Brandt's Cormorants washed in during the spring and early summer of 2005. Although this spring deposition signal was mild when compared to the standard post-breeding fall peak, it was still significant; in total, it is estimated that tens of thousands of "extra" birds died.

Because the COASST year ends in May, last year's report stopped in mid-story. What happened to murres and cormorants? Did they continue to die or did conditions improve? Oceanographers in Oregon recorded an amazing change in the temperature of the surface waters just off Newport in mid-July. In just six days, water temperatures went from 17.5°C to ~11°C, signaling that cold, nutrient-rich water was finally making it to the surface. Of course, by this time, locally breeding cormorants, murres, and other coastal seabirds had long since given up their efforts in Oregon.

Breeding in Washington was better, albeit still depressed relative to normal. As a consequence of the *low* number of breeders, fewer birds washed up come August and September, leading to only a mild post-breeding peak relative to earlier years. So, in fact, the spring 2005 die-off was compensated for, to some degree, by lower mortality rates later in the season. Of course, the caveat is that breeding success was very low throughout the West Coast. So although adults may have survived, they weren't able to reproduce.



The sharp and obvious drop in temperature between July 14 and 20, 2005, indicates the (late) start of spring upwelling (Sea Surface Temperature from Stonewall Banks Buoy, plot courtesy of Pete Lawson, NOAA).

The winterkill signal–usually evident between November and January–was most apparent along the Oregon coast this year. As has consistently been the case, beaching rates in Oregon exceeded those in Washington. This reflects the large difference in the number of seabirds breeding in Oregon (more) versus Washington (less).

For the first time this year we separated the Oregon coast into Oregon North and South, with the dividing line at Heceta Head, near Florence. Heceta Bank is a major oceanographic feature in Oregon associated with offshore transport of nutrient-rich coastally upwelled waters. Most of the Common Murre and Brandt's Cormorant colonies in the Pacific Northwest are found in the Oregon North region, yet the monthly pattern of beaching was very similar between the two regions, with the exception of a slightly delayed post-breeding peak in southern Oregon (September as opposed to August).

Winter–Spring Wrecks– Cassin's, Rhinos, and Grebes

After the spring die-off of 2005, we were all hoping for a normal year. But, in fact, our adage that wrecks will happen bore unfortunate fruit again this year. Murres and cormorants may have gotten a break, but the larger

auklet species and large grebes sustained the brunt of the proverbial storm. Clark's and Westerns are difficult to tell apart–you typically need a good look at the feathers around the eye (eyes of Westerns are completely within the black cap feathers, whereas eyes of Clark's are right on the black-white line). In many cases, we couldn't definitively identify wreck victims as Clark's or Westerns, so we have combined these species into "large grebes."

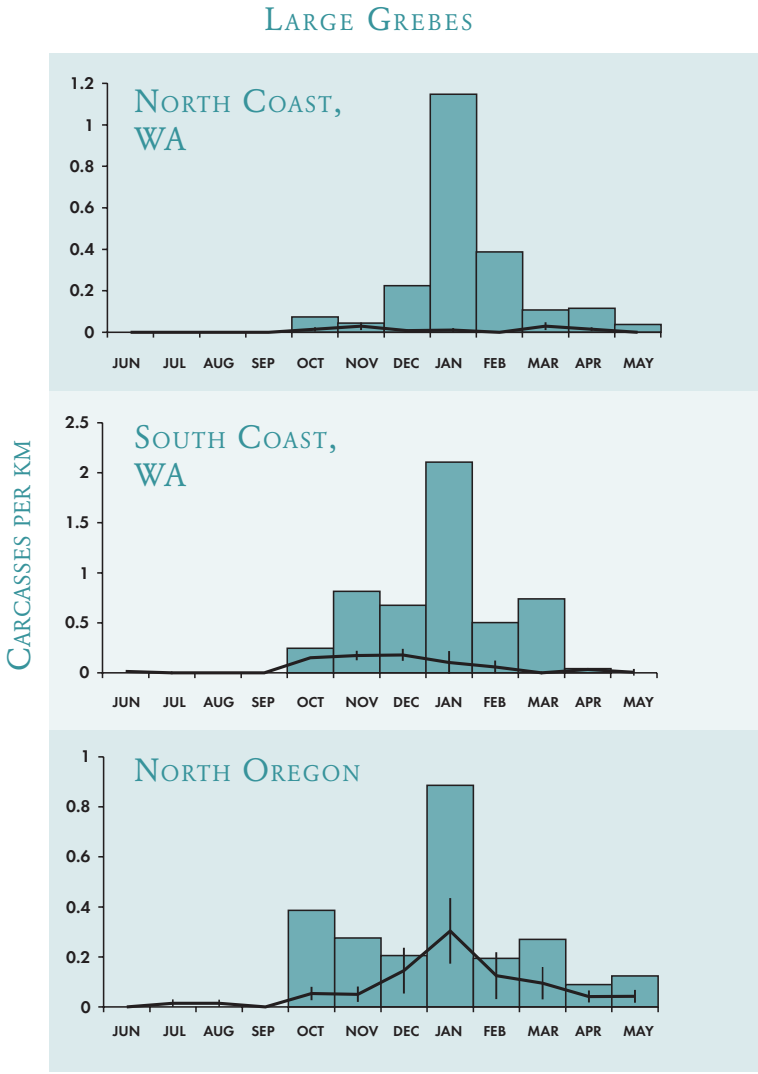
The graphs on pages 14–15 should be familiar to readers of last year's *COASST Reports*. The thick line with vertical standard error lines depicts the long-term monthly average encounter rate in each of our three northernmost Pacific Northwest regions. The histogram bars indicate the encounter rates from this year, that is June 2005 through May 2006. If a histogram bar is much higher than the top range of the standard error line (take a look at grebes in January), that's a signal that the beaching rate was anomalously high.

Grebes, and especially Western Grebes, beach most frequently during the winter (actually, November through March). This is most apparent in the North Oregon graph, where the thick line rises to a peak in January, falling off on either side over a few months time. This January, however, many, many more large grebes floated in throughout the Pacific Northwest, producing the highest values we've seen in each of these regions since the Western Grebe wreck in December and January 2001–2002. That wreck was confined to the southern coast of Washington and the northern coast of Oregon, and had peak encounter rates one-third to one-half that of this past winter's event.

Western Grebes were our 2003–2004 Species of Concern profile, because this State Candidate Species in Washington has been in decline throughout the wintering range in Washington, Oregon and California. John Bower, a Western Washington University scientist who has been documenting wintering populations of Puget Sound marine birds, estimated a more than 75% decline in grebe numbers relative to censuses last conducted in the 1970s. Winter wrecks, such as the one

B & F Watson

One of the many Western Grebes found this winter.



grebes weathered this past winter, are certainly an added stressor to the species, in addition to oiling, nesting habitat loss and changes in their forage fish foodbase.

In fact, grebes would have made up a far higher percentage of the total finds, had not Cassin's Auklets, and especially Rhinoceros Auklets, also experienced serious spikes this past year. Cassin's Auklets are usually a relatively rare visitor to Pacific Northwest beaches, as this species winters predominantly to the south, in California. Hannah Nevins, who runs our sister program BeachCOMBERS in Monterey Bay, has reported unusually high influxes of Cassin's to Monterey beaches

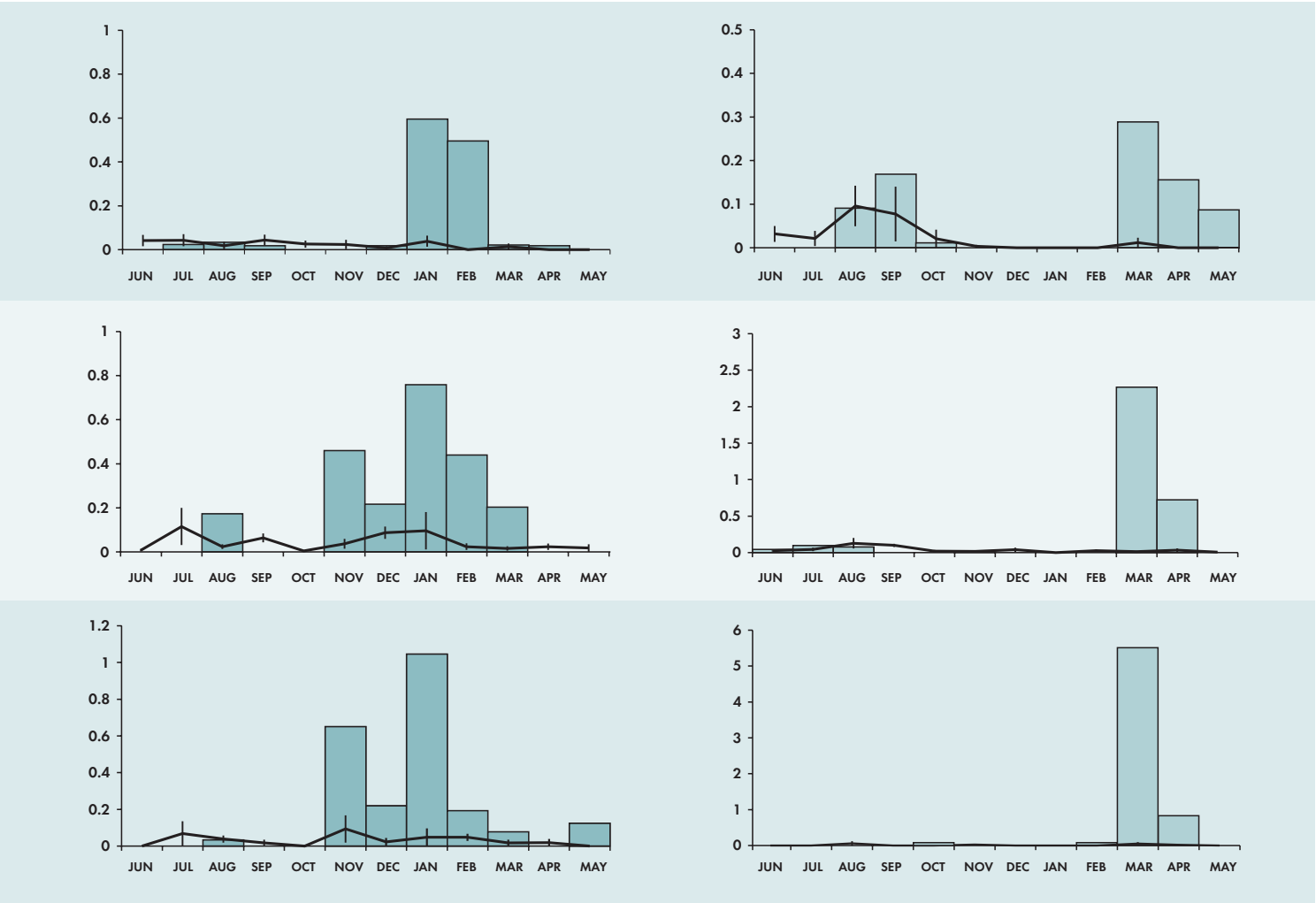
B & F Watson

One of 15 Cassin's Auklets found in a single survey of Pacific Beach in February.

Monthly Deposition Index

Cassin's Auklets

Rhinoceros Auklets



in January, and particularly in 2004. Here in the Pacific Northwest, Cassin's hit the beaches in high numbers from November through February, pushing this species into the major species category for the first time.

Unlike the grebes, Cassin's don't appear to exhibit a particularly strong seasonal signal in their beaching rate. Notice that the average lines on the graphs push up slightly in July, and then again in November through February, with no significant post-breeding or winterkill peak. Given the timing of this event and its geographic distribution, one interpretation is that a series of winter storms affected Cassin's, both on the wintering grounds and as they were moving north at the end of winter. This may be why the November signal was only apparent towards the south, while the February signal only occurred towards the north. What's interesting is that both grebes and Cassin's experienced serious wrecks throughout the Pacific Northwest in January.

You therefore might have expected our third wreck species to have also washed up in the dead of winter. But no, Rhinoceros Auklets graced our shores in March and April of 2006. Unlike Cassin's, Rhinos do exhibit a seasonal pattern of beaching in our region, appearing in higher numbers in August and surrounding months. Our graphs depict this "peak" as the mildest of bumps because we had to adjust the scale so high for this spring's huge Rhino wreck. So Rhinos, unlike grebes, washed in at the "wrong" time.

Rhinoceros Auklets, like their smaller cousins the Cassin's, also winter in California, and this species did wreck in Monterey Bay in the beginning of 2005, although the numbers hitting the beaches there were 25 times lower than our North Oregon values. By March, Rhinos are heading north for the start of the breeding season in April, so a March wreck probably caught birds massing for migration. One smoking gun many COASSTers have been wondering about is the dead zone recorded off the coast of Oregon this year. Marine scientists from PISCO reported a larger, thicker layer of extremely low oxygen water than in previous years, lasting from mid-June to October. OCNMS scientists even picked up a lower than normal oxygen signal along the North Coast of Washington. While this event happened too late in the season to have produced the Rhino wreck in March, it is a worrisome development in the oceanography of the Pacific Northwest.

Regardless of whether we can ever sleuth out the specific cause-and-effect for this year's wrecks, one thing is apparent: over the last several years a range of Pacific Northwest breeders and migrants have wrecked, at least half at the "wrong" time of year. These data are only tidbits of the full story. When taken together with the unusual oceanographic patterns–from delayed upwelling to dead zones–and concerns about changes in forage fish populations in protected waters like Puget Sound, COASST is increasingly concerned about the health of our marine environment, and what seabirds are telling us.

In March, photos of multiple Rhinoceros Auklets were commonplace.

R Suryan

Species of Concern Profile: Marbled Murrelet

In 1778, Captain Cook's naturalist collected some specimens of the Marbled Murrelet on one of the early European explorations of the West Coast of the Americas, but it took nearly two centuries for scientists to figure out where these birds were nesting. It wasn't until 1974, when a tree climber nearly stepped on a murrelet chick high up on the moss-covered limb of an ancient conifer, that the mystery was solved. With a high-pitched, gull-like series of squeals, these old-growth forest *sea*birds are also known as "fog larks." But a vocal repertoire doesn't make them easy to find; even today fewer than 900 nests have ever been discovered.

Though Marbled Murrelets are commonly seen loafing and feeding in the near-shore marine environment from Alaska to California, COASSTers have only found 19 of them on the beach since surveys began in 1999. More than half of the Marbled Murrelet finds have been on the North Coast of Washington, with nine from a single beach (Hobuck, of course!). A few have made their way inshore, with two showing up in the Strait of Juan de Fuca and two in Puget Sound. The South Coast of Washington and Oregon North have also seen a couple each.

Like all Alcids, Marbled Murrelets have three webbed toes, a football-shaped body, and stiff wings used for aerial and underwater flight. But beyond these morphological similarities, we know surprisingly little about this small relative of murres and puffins. Believed to begin breeding at 2–4 years, murrelets lay one egg per year. Parents travel to and from the nest at dawn and dusk, trading off incubation shifts, and later, dropping off a sandlance or small herring for dinner. After about 30–40 days, the almost fully grown chick leaves the nest unaccompanied by either parent, making the up to 80 kilometer flight from the tree limb to the ocean on its first attempt!

Just as we were getting to know this seabird, the Pacific Northwest population appeared to be declining concomitant with the demand for lumber and the loss of old-growth habitat in the 1970s and 80s. There was some indication that murrelets were also unwitting targets of coastal gillnet fisheries. In 1992, the US Fish and Wildlife Service listed Marbled Murrelets as threatened under the Endangered Species Act, affording the fog lark protection. Scientists began studying murrelets in earnest, developing standardized methods for counting murrelets at sea, using radio tags to study foraging and nesting patterns, and even using radar to count nightly returns along riverine corridors. Federal and state agencies, land owners and the fishing industry devised measures to protect these birds in the forest and at sea.

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N Hatch

Marbled Murrelets at sea and nesting up in a tree.

With only 20–23 thousand birds in the lower 48, compared to close to a million in Alaska and British Columbia, the Pacific Northwest "south of the border" harbors only 2–3% of the total population, making even small changes in our region locally significant. Is the murrelet on the road to recovery, or ruin? Opinion is divided, as is often the case in contentious natural resource cases. There have been recent proposals to delist the species, and remove some forest from critical habitat designation. Region-wide studies–from Alaska to California–are now underway. We hope that both beach walkers and forest hikers will have a chance to see–and hear–the Marbled Murrelet for decades to come.

The COASST quiz—part 2

C

B & F Watson

vital stats
found 10/31/2005
Pacific Beach
(South Coast, WA)
Bill: 38 mm

D

T & C Herzig

vital stats
found 05/17/2006
North Head
Lighthouse South
(South Coast, WA)
Bill: 98 mm

Answers to the Quiz

A. Oh, if only the annual report were in color! A light, dark, light speculum points us to the waterfowl family. Mallard, Stellar's Eider (female), Northern Pintail and Green-winged Teal are all good choices, but only one has a wing chord that short—the Green-winged Teal.

B. Long, slender hooked bill, fairly dark plumage and webbed feet put this one in the cormorant family. Dark bill and light chin mean this must be a Brandt's Cormorant—a juvenile with pale breast plumage.

C. There's no mistaking it—that's a tubenose! With a light, stocky bill, it's a Northern Fulmar—a light morph (note head plumage).

D. Whoa! That's a giant-sized bill! This tubenose has a much less obvious tube than the Northern Fulmar, and based on its dark head plumage, bill plates and bill color, it's an adult Black-footed Albatross.

COASST People

Volunteers

As COASST stretched geographically, our volunteer base also expanded. One hundred and twenty enrolled as COASST "freshmen" this year, and after a few surveys, our total combined enrollment reached 345. Of course, with such a large program, we also lost some volunteers. Just under 50 COASSTers moved on to other pursuits or locations. But, some COASSTers are so dedicated that even after they move, they still want to do surveys. Ever wonder why COASST has a single site–Kehena Beach–on the Big Island in Hawaii? Because Darlene Nichols just couldn't stop…

Altogether, COASSTers surveyed for 4900 hours, and put in another 2700 hours in traveling to and from their beaches–one person would have had to work full-time for more than three and a half years to match this effort! In all that time, COASSTers walked nearly 10,000 kilometers round-trip–now that is quite a feat!

If COASST surveying ever became a competitive sport we'd be quick to nominate a few key volunteers. Among them, Ben and Flora Watson, just starting in August, surveyed more than 56 hours this year, continuing even when, "We recorded over 100 kilometers per hour on our wind gauge the nights of Feb 4 and 5. The storm just ground everything to feathers and shards!"

Bert Johnstone and Jann Luesse took the lead on two of Oregon's

busiest (dead bird) beaches–Oregon Mile 196 and Oregon Mile 327, respectively. Cumulatively, they logged more than 100 hours of survey effort, sometimes each going solo to process more than 30 birds per survey. All the beach time paid off with some pretty incredible finds–a Buller's Shearwater in November for Jann and four Fork-tailed Storm-Petrels between March and April for Bert.

As part of his work with the Quinault Nation, Kenny McCoy logged in 50 hours of survey time at two of our more remote beaches in Washington–Point Grenville and Raft River. Careful to survey quickly through those "numerous mud slides from bluff to beach" areas, Kenny found Washington's only Leach's Storm-Petrel this year.

But it is hard to beat Wolter van Doorninck, who came in at the top of the list for survey hours for the fourth year in a row, with 104 hours. Sue Nattinger was not far behind this year with 98. Others at the top of the list, with more than 40 survey hours, include Coleman Byrnes, Vic Nelson, Julia Loyd and Ann Elliot.

We applaud the efforts of our inside waters residents who get out on the beach consistently, even when bird finds are few and far between. Vic and Sharon Nelson, Jim Todd, Peter Linton, Mike Kaill, Larry Leyman and Carolyn Watts all made it out for more than 30 surveys this year. Among our Puget Sound volunteers, we want to give a special thanks to Peter Linton,

—continued on page 23

Office Help Feature: Jaci Pumphrey

Helping out no matter what the task may be, Jaci offers COASST essential office support.

Courtesy of J Pumphrey

In June 2004, Jaci Pumphrey wandered into the Olympic Coast National Marine Sanctuary office, and suddenly COASST–and OCNMS–had a volunteer extraordinaire. "Wandered" is a bit inaccurate, as Jaci credits her COASST conversion to daughter Jeanne who surveys Whiskey Creek and encouraged Jaci to volunteer after a brain aneurism ended her career in retail. Jaci originally joined Jeanne on Whiskey Creek, but eventually switched beaches and recruited her 89-year-old mom, Louise Bollman, to survey Hollywood Beach. Three generations of Pumphreys now volunteer for COASST!

Surveys are just the tip of the iceberg. Jaci does everything from copying and filing to data entry and quality control. Her favorite task is reviewing data sheets because she can participate vicariously in the surveys. "I know what the numbers mean and can imagine what the day was like. It's almost like going out myself." And even though she grimaces, Jaci willingly refurbishes the sand-filled and bird goop-decorated COASST packs at the OCNMS office. With a smile and a story, Jaci is ready to conquer any task we have, and we know she'll do an excellent job.

A native of Pismo Beach, California, Jaci recalls watching the demise of the Pismo clam over her 25-year residence. "The larger-sized clams flat disappeared over about four or five years. Abalone were also going down. At the time I was living in Pismo, I was thinking these were private things, shown just to me, but then I realized they had other connections." Later, the discovery of global warming made Jaci realize the importance of collecting long-term data sets that document ecosystem response to change. "The marine environment has always fascinated me. I decided that if I could contribute to data recording for the greater good, I would. COASST and OCNMS allow me to play an important role in environmental monitoring and stewardship." And we are thrilled she chose to work with us.

VOLUNTEER*	SURVEY HRS	TRAVEL HRS	KM
Kelly Ames	0.8	8.5	2.0
Rob Ames	0.8	8.5	2.0
Liam Antrim	3.9	4.0	1.9
Ken Arzarian	12.3		30.6
Arthur Ayres	1.2	0.3	2.2
Bill Baccus	8.0	15.0	6.2
Kathie Balcom	11.0		16.6
Celia Bartram	5.5	6.0	12.0
Jim Bartram	5.5	6.0	12.0
Tracy Beals	8.1	20.0	9.8
Bryan Bell	4.9	12.0	5.9
Carol Bernthal	4.5	1.0	16.4
Ruth Betz	11.0	8.0	6.0
Linda Bierma	19.7	3.3	15.9
David Bilderback	30.5	18.2	18.2
Diane Bilderback	27.5	18.2	16.6
Perry Black	12.0	0.8	8.0
Barbara Blackie	46.4	36.5	19.5
Wendy Blair	1.8	1.5	4.5
Paul Blake	27.7	0.0	38.4
Alice Blandin	22.8	1.8	10.1
Alynda Blandin	0.8		2.0
Bill Blandin	19.5	1.8	9.1
Bent Blichfeldt	23.1	6.0	6.0
Louise Bollman	1.6	0.2	1.0
Sherry Bottoms	7.2	3.3	5.0
Lee Bowen	15.0	2.8	24.1
Ed Bowlby	15.5	15.5	6.1
Jane Boyden	24.9	6.7	16.1
Mary Sue Brancato	65.3	56.7	29.9
Mel Breitsprecher	4.0	3.0	4.5
Barbara Brock	2.0	0.5	1.6
Stephen Brown	16.0	3.7	11.0
Jeanne Budlong	15.1		20.0
Jim Budlong	15.1		20.0
Cindy Burns	26.0	4.5	14.9
John Burton	30.2	1.7	16.1
Susan Burton	2.0	0.3	1.6
Kathy Bush	38.5	3.7	16.5
Rick Bush	38.5	3.7	16.5
Coleman Byrnes	74.3	75.0	69.5
Barbara Campbell	29.2	6.3	27.6
Anne Caples	26.0	4.5	14.9
Betsy Carlson	2.5		4.5
Ricki Carlson	9.5	0.4	10.0
Christine Cassidy	0.8	0.7	0.5
Kathleen Chase	4.3	0.4	4.0
Scott Chase	4.3	0.4	4.0
Anne Chiller	23.8	3.3	22.0
Judy Chovan	13.9	12.3	6.8
Daniel Clark	5.0	2.0	3.2
Joan Clark	5.0	2.0	3.2
Joyce Clark	6.9	8.0	6.4
Susan Clark	39.0	8.3	36.9
Debra Clausen	15.9	1.8	35.2
Scott Clausen	0.8		1.8
Li Clinton	28.6	40.4	18.0
Margie Cochrane	10.9	1.7	8.0
Jane Comerford	11.4	1.0	9.7
Kathleen Confer	38.6	15.2	20.9
Steve Confer	38.6	15.2	20.9
Roger Contor	22.0	18.5	21.5
Susan Contor	22.0	18.5	21.5

VOLUNTEER*	SURVEY HRS	TRAVEL HRS	KM
Carol Cory	16.6	3.5	8.5
Amber Cox	2.5	4.5	1.4
Deb Cox	24.1	45.5	15.6
Tom Cox	13.3	23.0	8.6
Barbara Craig	1.5	0.3	3.6
Elaine Cramer	6.0	0.3	3.2
Cass Dahlstrom	10.0	6.7	7.3
Judy D'Amore	8.0	0.2	9.0
Joseph Deegan	13.3	15.2	24.7
Tristan Delahunt	2.3	0.3	2.0
Lucinda Diann	2.6	4.0	3.0
Pam Dick	35.1	4.0	28.4
Paul Dinnel	16.9	8.7	28.6
Jane Dolliver	3.2	0.8	5.5
Robin Donnelly	3.8	2.0	2.4
Sandy Dubpernell	21.1	18.0	41.0
Carole Elder	1.0	2.5	1.6
Ann Elliott	40.9	52.2	43.5
Nick Elliott	3.8	6.0	5.3
Martha Ellul	25.7	0.0	38.0
John Epler	14.0		62.6
Aleta Erickson	11.9	39.0	10.4
Field Trip	16.3		21.8
Melissa Fielding	10.5	0.7	4.8
Mike Fielding	2.5	0.3	1.2
Sheila Fiepke	7.8	2.0	10.0
Kathleen Foley	6.0	2.3	4.5
Burton Foote	5.1	5.3	4.7
Rose Forbes	24.3	7.0	27.6
Mark Freed	10.8	9.0	13.5
Ellie Friars	10.0	1.0	20.0
John Friars	10.8	1.1	22.0
Ron Frisch	23.3		30.1
Dick Fritsch	22.7	18.0	5.9
Joanne Fuller	22.6	16.5	17.6
Leroy Fuller	9.3	3.8	8.0
Sue Gabriel	19.1	1.3	12.9
Varian Gacek	12.3	5.5	13.6
River Gates	5.0	2.0	8.0
Elizabeth Gates	5.0	1.0	3.4
Sharon Gearhart	36.3	38.0	24.8
George Gerdts	1.4		1.8
Frank Geyer	10.0	0.7	7.0
Sue Gilleland	15.0	2.8	24.1
Tom Golding	21.8	5.4	22.7
Matt Gray	2.3		4.2
Rhoda Green	11.1	9.0	9.4
Phil Green	0.8	0.1	0.8
Amy Groesbeck	1.1		1.6
Dick Groesbeck	21.1	19.0	30.0
Nona Groesbeck	7.8	7.6	12.0
Jan Gross	1.5	0.2	2.0
Pete Gross	1.5	0.2	2.0
Jan Grove	2.5	0.3	4.0
Ron Groves	14.1		2.4
Andy Gruse	8.0		6.0
Guest	131.0		125.1
Troy Guy	1.9	2.0	0.8
Mary Ann Hanson	14.7	25.0	50.0
Wayne Hanson	14.7	25.0	50.0
Patti Happe	2.5	6.0	2.1
Caroline Harding	2.5		3.0
Sandy Harold	1.0	0.7	0.8

VOLUNTEER*	SURVEY HRS	TRAVEL HRS	KM
John Haxton	20.5		20.9
Jill Hein	27.0	21.5	43.8
Clarence Hein	5.8	2.0	6.4
Kristin Hemmelgarn	2.5	1.3	5.0
Connie Herzig	37.5	66.0	23.1
Tom Herzig	37.5	66.0	23.1
Olivea Higley	0.5	0.2	3.0
Tonja Higley	0.5	0.2	3.0
Linda Hillman	8.7	3.5	5.6
Chelsea Hime	7.4	26.0	6.8
Clem Hoerner	14.0		62.6
Mary Holbert	30.0	1.7	16.1
Barb Holler	21.4	7.0	11.6
Rayna Holtz	23.1	1.3	12.0
Beth Horton	4.7		2.0
Molly Hukari	4.1		2.4
Gay Hunter	4.3	6.0	4.0
Pattie Hutchins	4.0	1.0	2.0
Jeanne Iverson	27.5	19.2	23.2
JoAnn Jackson	13.3	6.0	14.9
Ellen Jenkins	22.0	3.0	19.8
Kyle Jenkins	2.3	6.0	2.1
Ruth Jenkins	21.4	50.0	20.6
Dick Johnson	14.8	1.8	22.0
Mary Johnson	3.8	0.6	8.0
Bert Johnstone	57.2	8.0	38.6
Mike Kaill	23.2	24.0	19.8
Marilyn Kastien	5.1	0.5	3.6
Christina Kessel	4.5		4.0
Phyllis Kind	6.8	1.3	8.0
Barb King	22.3	5.3	12.8
John King	14.3	3.3	8.0
Dave Kirner	1.5	1.5	2.4
Norma Klein	7.5	9.0	9.8
Valerie Knox	21.8	4.0	13.3
Emily Kolkemo	12.5	5.0	8.3
Gary Korb	16.4	3.3	5.2
Brad Krall	14.2	14.0	9.4
Tamara Krall	9.3	8.0	5.8
Jean-François Lamarre	2.7	2.0	4.0
Linda LaMay	2.3	0.2	4.4
Mac LaMay	2.3	0.2	4.4
Ryan Langley	2.5		3.6
Don Leak	1.5	0.7	1.0
Joyce Leak	1.5	0.7	1.0
Edi Leonard	2.3		1.5
Mary Lou Letsom	26.8	4.5	14.9
Bev Leyman	3.9	17.0	2.5
Larry Leyman	7.2	29.5	5.4
Dennis Linden	1.1	2.2	1.5
Iris Linton	1.0	0.8	1.0
Peter Linton	35.1	36.7	33.0
Tina Lipman	14.7	12.3	7.9
Kate Litle	2.4		4.0
Camilla Loyd	1.8	0.3	2.0
David Loyd	20.8	4.0	24.0
Julia Loyd	42.6	7.7	46.0
Jann Luesse	50.9		30.6
Megan MacClellan	6.4		15.0
Pat MacRobbie	27.1	36.5	17.1
Stuart MacRobbie	29.6	40.5	19.5
Charlotte Maloney	17.7	18.0	10.0
Dave Manson	11.7	16.0	6.0

VOLUNTEER*	SURVEY HRS	TRAVEL HRS	KM
John Maré	19.0	2.7	12.9
John Markham	8.8	0.3	14.5
Jane Marks	13.3	0.3	6.0
Jerry Marsh	12.0	4.0	12.0
Mary Marsh	17.3	4.5	14.5
Robert Mauri	7.4	7.0	18.0
Linda May	1.8	1.0	2.5
Laurel Mayall	4.8	2.7	6.2
Ivert Mayhugh	1.5	4.0	0.9
Kenny McCoy	49.9	7.5	32.9
Judith McDougall	8.0	0.5	3.6
Gary McDowell	17.0	2.0	27.9
Mary McDowell	17.0	2.0	27.9
Anita McMillan	12.9		14.9
Vicki McNeil	14.0	7.3	24.2
Jean Mendel	10.7	1.5	19.4
Sharon Metcalf	5.7	2.0	8.8
Bob Middleton	4.3	8.0	4.0
Lauren Middleton	4.3	8.0	4.0
Ian Miller	6.1	12.0	9.6
Marilyn Miller	2.4	4.5	1.2
Lindsey Milonas	3.4	4.0	1.9
Gary Montesano	8.6	2.0	6.0
Dianna Moore	31.1	3.2	27.4
Harry Moore	10.2	10.5	7.0
Rica Motoyoshi	7.3	1.0	12.0
Carolyn Murphy	7.6	3.0	9.0
Frank Murphy	3.5	2.0	6.0
Susan Murphy	7.2	1.3	5.6
Lorre Myers	5.2	12.0	4.0
Sue Nattinger	98.6	97.5	93.7
Sharon Nelson	32.2		48.0
Vic Nelson	53.0		79.5
Wade Newbegin	23.3	20.3	19.3
Nancy Newman	23.5	21.0	19.2
Darlene Nichols	4.8	14.0	3.2
Kern Nuttall	11.4	17.0	18.0
Carolyn Ollikainen	23.3	1.7	16.1
Robert Ollikainen	31.1	2.2	20.9
Eli Owens	5.4	5.0	6.3
Margaret Owens	5.4	5.0	6.3
Connie Owston	16.8		9.7
Pete Owston	21.5		16.1
Andy Palmer	6.8	0.5	12.3
Autumn Palumbo	22.9	49.5	28.6
Ric Palumbo	14.4	31.5	18.2
Barbara Patton	19.8		14.4
Mike Patton	16.2		12.0
Heidi Pedersen	25.3	3.4	25.5
Sheila Pera	7.2	1.3	5.6
Mollie Peters	6.8	0.7	6.4
Truda Peters	1.0		1.8
Mackenzie Pickert	3.5	7.0	4.9
Ellen Plews	5.5	8.0	4.8
Larry Plews	5.5	8.0	4.8
Bill Poppe	14.2	6.0	9.6
Jolene Poppe	6.5	3.0	4.8
Mary Porter-Solberg	4.7	5.0	8.2
Bob Poulin	3.5	3.0	8.4
Jean Poulin	3.5	3.0	8.4
Jaci Pumphrey	7.6	3.2	8.2
Jeanne Pumphrey	18.4	9.0	21.6
Sally Pytel	14.3	16.3	26.6

VOLUNTEER*	SURVEY HRS	TRAVEL HRS	KM
Drew Raffensperger	1.8	1.7	1.6
Paul Raffensperger	17.3	15.0	14.5
Michelle Ramsden	7.2	3.3	5.0
Brent Ramsey	12.0	0.8	8.0
Barbara Reisman	2.0	1.0	4.0
Patrick Reynolds	24.0		12.9
Ginger Ridgway	1.0	1.0	0.3
Holly Robinson	5.5	0.4	16.0
Moria Robinson	5.5	0.4	16.0
Emma Ruggiero	2.9	2.0	2.8
Micki Ryan	2.6	2.0	1.7
Wilma Sale	0.7		0.5
Tim Saskowsky	4.5		3.9
Krissy Sawyer	5.0	0.8	6.6
Cheri Scalf	13.8	9.0	6.3
Dave Schmalz	1.8	2.0	1.9
Dennis Schroeder	1.0	0.3	1.0
Joan Schwindt	2.8	0.3	2.2
Pete Seidel	2.5		3.0
Brenda Sestrap	5.5		8.3
Sasha Sicks	17.4	17.5	15.6
Nan Simpson	0.8	0.7	0.5
Lori Sinnen	32.2		17.7
Max Smith	2.7		1.6
Randy Smith	6.6	2.3	9.9
Richard Smith	23.0	6.0	27.9
Trina Smith	3.9	2.0	3.3
Jim Somers	1.3	1.3	2.0
Linda Songer	11.4	11.0	11.0
Rick Spaulding	9.2	5.5	13.8
Peggy Speer	25.6	7.3	16.1
Ann Spiers	0.9	1.0	1.1
Gayla Spratt-Nuffer	16.6	28.0	15.3
Ron Spring	22.0	6.0	9.7
Cindy Stafford	10.3	16.0	16.4
Al Standish	15.9	12.0	22.6
Ann Stark	0.9	0.2	1.2
Doug Stark	12.4	2.2	15.6
Arlene Stebbins	21.8	10.5	22.4
Wendy Steffensen	8.0	8.2	6.8
Jesse Stewart	12.7	1.7	20.0
Iris Stober	10.7	2.7	14.4
Shaylon Stolk	1.8	1.5	4.5
Linda Streitfeld	8.3	10.0	8.0
Eftin Strong	13.7	24.0	11.7
Ingrid Strong	13.7	24.0	11.7
Kim Sundberg	6.3	0.7	12.8
Kim Suryan	20.7	0.7	11.3
Rob Suryan	21.9	0.8	12.9
Ed Swan	4.3	1.0	5.0
Sarah Swanson	2.7		1.6
Rowann Tallmon	0.8	0.7	0.8
Cheryl Tinaves	0.3	0.8	1.5
Bob Toby	5.8	0.8	4.8
Marcia Toby	5.8	0.8	4.8
Jim Todd	27.7	38.8	93.0
Judy Trieber	8.2	3.0	4.8
Al Vail	1.8	1.0	2.0
Anneka van Doorninck	29.8		40.8
Wolter van Doorninck	104.8		139.2
Barbara VanderWerf	24.3	6.0	19.3
Bill VanderWerf	24.0	6.0	19.3

VOLUNTEER*	SURVEY HRS	TRAVEL HRS	KM
Tina Vogel	10.0	4.0	5.5
Carol Volk	16.4	3.3	5.2
Darlene Wahl	12.3		30.6
Hank Warren	24.0	19.5	23.4
Raedell Warren	24.0	19.5	23.4
John Warrick	17.6	72.0	16.5
Greg Waters	4.0	3.5	2.7
Ben Watson	56.3	34.8	26.6
Flora Watson	56.3	34.8	26.6
Carolyn Watts	35.1	5.7	70.7
Anne Weisbrod	2.3	1.5	2.1
Dick Weisbrod	4.0	12.8	4.9
Jon Wendt	2.0	2.5	1.6
Don Wester	6.3	8.0	6.4
Linda Wester	6.3	8.0	6.4
Don Wilkin	13.7	10.5	14.9
Jodi Wilmoth	2.6	2.0	5.0
Beth Winslow	15.0	11.0	13.0
Pam Winstanley	3.8	0.6	8.0
Peter Witschi	20.2	18.0	14.4
Beth Wolgemuth	8.7	1.3	5.7
Kathleen Wolgemuth	37.6	4.8	22.7
Bruce Wood	22.0		14.1
Patty Wood	26.9	1.0	17.3
Carrie Wooten	23.5	21.0	19.2
Ami Wright	2.3		4.2
Randy York	12.5	1.8	22.0
Pat Young	24.8	21.0	6.9
Robert Zimmerman	1.6	0.3	1.5
Craig Zora	29.7	7.3	22.0
Rosie Zwanziger	0.6	0.6	2.2
TOTAL	**4900**		**4776**

*Volunteer effort June 2005–May 2006

Courtesy of D Bilderback

Dave Bilderback and Iris and Manfred Welsch pause while processing a Common Murre chick.

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faithful surveyor of Eby's Landing and Perego's Lagoon, and past emissary at the annual Sound Waters event. Unable to continue surveying due to health issues–everyone's knees give out sooner or later–we hope Peter will continue to work with COASST in other ways.

With the price of gas skyrocketing this year, COASST has become a significant investment for some of our volunteers. Each year, many COASSTers travel hours one way to reach their survey site(s). We especially want to recognize the efforts of Sue Nattinger and Coleman Byrnes (Shi Shi Beach), John Warrick and Ruth Jenkins (Sand Point North and South), Tom and Connie Herzig (North Head Lighthouse North and South) and Ann Elliott, who's just been all over!

Finally, this year we recognize our octogenarians, who–unlike their younger counterparts–don't jump beach logs like hurdles or own "microfleece" outerwear. Louise Bollman, Tom Golding, Wayne Hanson, Stu MacRobbie, Harry Moore and Peter Linton all remind us that learning doesn't end when you leave the classroom–it's never too late to start something new!

Staff

Of course the biggest news is that after working for COASST since its inception, Todd Hass has moved on to a full-time teaching career. Many of you know how good Todd is at teaching, having experienced his wit, style and expertise firsthand during a COASST training or refresher session. And of course everyone has used *Beached Birds,* the COASST field guide Todd was instrumental in inventing. We all wish Todd the very best of luck, and know our loss is his new students' gain.

Jane Dolliver, who has worked for COASST since she was an undergraduate intern, has stepped up to full-time COASST employment, filling some of the gaps left by Todd's departure. Jane has handled your phone calls and emails for years, and has recently been our über-Mom in the COASST office, scheduling and training our bevy of undergraduate interns. This year Jane has also taken on training sessions and data verification, and her subtle humor can be felt throughout *COASST Reports* and *COASSTLine*.

Kate Litle has been another Seattle office stalwart,

Courtesy of OCNMS

Mary Sue Brancato (left) and Barbara Blackie, North Coast and Strait of Juan de Fuca volunteer coordinators, are happy to help anyone start surveying on the Olympic Peninsula.

keeping the office humming, doing the books, handling the logistics of special projects (who else could make sure the Atlantic version of *Beached Birds* actually became a published reality?), and keeping all of the rest of us on track. This year Kate started graduate school as a student in the School of Marine Affairs at the University of Washington. No worries, she still works for us part-time, and is using COASST data to develop her thesis.

Out in Port Angeles at the Olympic Coast National Marine Sanctuary COASST office, Mary Sue Brancato had an exciting year of scientific discovery on top of her full schedule of training and refresher sessions for North Coast and Strait of Juan de Fuca volunteers. Mary Sue was co-leader of a scientific team aboard the *RV McArthur II* cruise that discovered many new areas of deep sea coral within the Sanctuary waters. After that, she had a chance to get up close and personal with the Common Murres nesting on Tatoosh Island.

Barbara Blackie's big news, other than once again scoring major cool carcass points with Mary Sue on Hobuck Beach, was that she got married!! A one month honeymoon in Ireland was, we hear, devoid of a single beached bird walk, although she did admit to engaging in some live bird watching. After her return, Barbara leaped back into her OCNMS and COASST duties, working with Mary Sue on trainings and surveys.

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—continued from page 23

Our executive director Julia Parrish spent the year in expansion mode–working to secure COASST funding and extend COASST's reach and science. We're happy to report that her efforts paid off: COASST now has beachheads in both Alaska and northern California, and a series of new funding and training partners. Back at home, Julia worked with WDFW Wildlife Division Manager John Pierce to include COASST in a special avian flu monitoring network. Finally, Julia spent the spring finishing the first scientific paper using COASST data; COASSTers can rest assured that their efforts will soon be published!

Interns and Office Help

With more beaches and volunteers than ever before, COASST UW student interns stepped up to keep the COASST office swimmingly efficient. Cumulatively, they logged in more than 600 hours to file and track the more than 3000 data sheets that made their way to the COASST office this year.

Amy Groesbeck helped keep things rolling summer, fall and spring quarters, and even did a little clandestine volunteer recruiting to get her father Dick roped in to surveying on Semiahmoo Spit near Bellingham, Washington. While not officially listed in the phone book, "Groesbeck towing and damage control" proved invaluable when Amy and Jane faced two flat tires on their way to the Bellingham training in February.

Facing wet fall conditions (but no car trouble) Truda Peters made her way around the state, spending more than 80 hours collecting data on marine debris as part of her UW School of Aquatic and Fishery Sciences undergraduate senior capstone project. What Truda found will be highlighted in an upcoming *COASSTLine*.

Thanks also to Katie Fulkerson, Natalee Nussock, Tegan Pennell, Tiffany Stevens and Leda Chahim who provided essential help in entering data, answering volunteer questions, and organizing trainings, the COASST bird specimen teaching collection and our wealth of digital photos.

Volunteer Spotlight

Kathy and Rick Bush–Strait of Juan de Fuca

After 26 years, 7 ships and 3 round-the-world circuits as a Senior Chief Petty Officer in the Navy, Rick and his wife Kathy Bush were more than ready to stay home. Lucky for us, they live along east Sequim Bay, a skip and a jump from Travis Spit–their COASST beach since spring of 2001. Neither weather nor the promise of a beautiful summer day inland have deterred Rick and Kathy from their monthly routine. "Every month is so different on our beach. Survey periodicity must remain constant," observes Rick. Kathy agrees, "Too much changes all the time to do it less frequently." With 58 surveys under their belts, only extreme tides this past December chased them off their appointed rounds. And not only that, Rick dutifully enters their data on the website immediately after each survey. Hard copies and photos arrive at the OCNMS COASST office within the week.

"Our first COASST find was a Rhinoceros Auklet in 2001. That remains a favorite because it was so easy to identify…and what a name!" Although they only encountered three beached birds this year, one, a Common Loon, was actually found hanging from a large snag over their beach segment. Avid birders–Kathy is the Olympic Peninsula Audubon Society's treasurer–the Bushes record their live bird sightings in the comments section of their data sheet. There are many more live than dead, we are happy to

Courtesy of R & K Bush

Rick and Kathy Bush share a passion for COASST and spending time in the great outdoors.

report. They have also come across beached harbor seals and river otters, and the decomposed skin of a mystery ungulate–possibly an elk. In May of last year, they even had a live gray whale sighting just 5 meters off the beach.

Both Kathy and Rick worry about changes in their local marine environment. "I am concerned about pollution, over-fishing, global warming, and their effects on food supplies," notes Rick. "Will birds begin starving because of global warming and changes in upwelling?" In June 2001, Kathy and Rick had the chance to act locally on the conservation front. Only a meter or so above the high-tide line, they came across an open five-gallon container of an unknown petroleum product. Calls to the property owner eventually resulted in its removal and thus averted a local chemical spill.

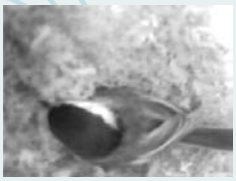
COASST surveys give the Bushes a chance to contribute to a broader scientific context, and to be part of a conservation community. "We feel a part of the whole. We GET it." And we are thrilled to "get" Rick and Kathy as part of our COASST team for the duration!

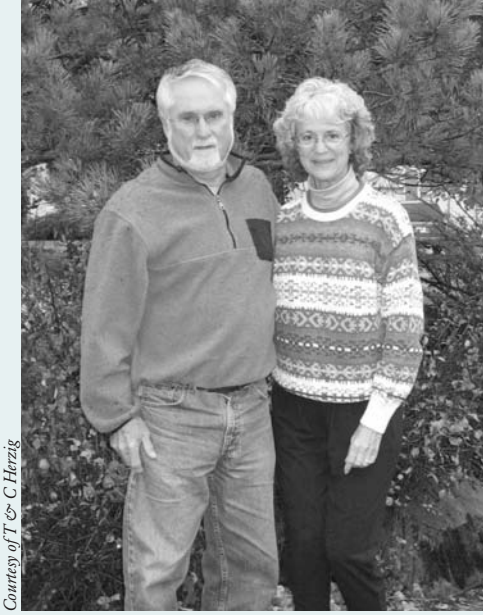
Tom and Connie Herzig–South Coast

Google the words "bird" and "monitoring" and you might just find a link to Tom and Connie Herzig. Besides regular COASST surveys on their North Head Lighthouse beaches at the mouth of the Columbia River, Tom and Connie are out and about doing monthly raptor surveys in Oregon, monitoring eagles' nests on the Columbia River, and on the look-out for visitations to the Black-capped Chickadee box in their backyard (Tom even set up a remote camera–see small photo above). After all that, they still manage to get in a fair bit of traveling–a trip back east to visit their new grandson (and check out some birds on the Delaware coast) and a trip to Arizona (to see the birds there, too).

Tom first heard about COASST from longtime volunteer Linda Bierma. Though other (live) birding enthusiasts might remark, "yeah that's kinda cool, but it's dead" Tom remembers the first time he got to look through *Beached Birds* as part of an Olympic Peninsula Audubon BirdFest trip to the north outer coast, "our trip leader said, if you follow me another mile down the beach, I'm sure we'll find something else. After putting the field guide to work on a loon, I was hooked."

Tom and Connie Herzig in their yard and (below) a chickadee they "captured" with their remote camera.





Courtesy of T & C Herzig

Since then, Tom and Connie have found a multitude of species, a number of them not even in the COASST guide, "I'd definitely have to say the Emperor Goose is the coolest, though." With only a few miscellaneous parts left–feet, head and tail–Tom and Connie's bird sleuthing skills were really put to the test. "I like the challenge of COASST: figuring out a bird with only a limited amount remaining. On our last survey, we started with a pretty nondescript wing, moved through the COASST guide, pegged it to species and plumage morph–a dark morph Northern Fulmar," recounts Tom, "that's pretty impressive!"

Of course, Tom first came to our attention when he called into the Seattle office to suggest an improvement in the chalkboard slates. A man of his word, Tom now manufacturers all of the COASST slates himself, and scours the stores for old-fashioned chalk–dustless chalk is just not as good.

On live bird surveys, Connie is Tom's "eyes and ears" but on dead bird surveys you don't have to listen for distant calls or spend hours carefully hunting for cryptic creepers; if it's on the beach, you're pretty much guaranteed to find it. "I like that about COASST–it's simple. Julia told us that in order to be a COASST volunteer we only had to know three things: it's a bird, it's dead and the alphabet. And really, what else in our lives is that simple?"

Partner Profile: Washington Department of Fish and Wildlife

COASST started with 12 brave proto-volunteers on just a handful of beaches on the south coast of Washington in 1999. Over the last six years, we've grown to more than 200 beaches in four states. However, Washington State remains central, with more than 85% of all COASST beaches.

Since its inception, COASST has worked hand-in-hand with the Washington Department of Fish and Wildlife (WDFW), the State agency tasked with promoting "sound stewardship of fish and wildlife" in the evergreen state. Among the many WDFW scientists who work with COASST, Scott Pearson, a member of our advisory board, has been a special ally.

Scott joined WDFW in 2005 as a research scientist in the Wildlife Research Division, the arm of WDFW specifically interested in seabirds. As part of his job, Scott manages an extensive set of research and monitoring projects, from Streaked Horned Larks (not a seabird) to Snowy Plovers to Marbled Murrelets, and from habitat selection to diet. Scott and Julia Parrish have been collaborating on colony studies of Washington's seabirds, focusing on factors affecting breeding populations of Common Murres, Tufted Puffins and Rhinoceros Auklets.

Courtesy of S Pearson

Scott Pearson, of WDFW, one of COASST's long-time supporters.

But even the Herculean amount of research Scott manages doesn't begin to provide the comprehensive geographic coverage of COASST. "Changes in seabird mortality detected by COASST volunteers alerts my agency, Washington's wildlife managers, to potential threats to seabird populations." Scott values the "many eyes on the beach" COASSTers provide.

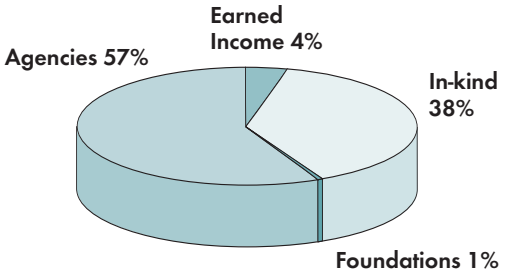
And large-scale, long-term monitoring is exactly what agencies like WDFW need to begin to piece together the changes happening around us. "I am very concerned about climate forcing," Pearson says. "Some changes in the nearshore marine environment are already occurring, with very significant effects on plankton, fish, seabirds and marine mammals. For example, last season's die-off of Common Murres and Brandt's Cormorants, which was detected by COASST volunteers, apparently resulted from changes in the typical pattern of winter downwelling and the transition to spring upwelling." Pearson worries that "this type of event may become more common." COASST data "will play a vital role in tracking changes in seabird mortality, whether they are caused by upwelling anomalies or other types of oceanographic events, or even human activity."

In Scott's mind, participation in "extremely well-run citizen science programs like COASST" is important because "volunteers who spend time learning about seabirds, who regularly walk our beaches, and who see changes in seabird mortality, are likely to care more about the marine and coastal environment and are likely to take an active role in seeking solutions to the threats facing those environments."

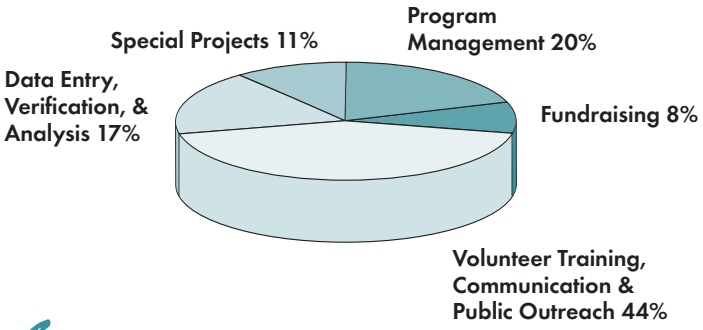
We thank Scott, and WDFW, for the active role they have taken in promoting COASST, and in helping to sustain our efforts financially. Without agency partners who provide funding, and use our data, COASST would not be the success story Scott is so fond of touting.

COASST, July 2005–June 2006

Funding Sources



Expenses



COASST Funding

We're excited to report that every year COASST keeps getting bigger–more beaches, more volunteers, more surveys and greater geographic coverage. Program growth translates into a larger annual budget.

Our agency partners rose to the occasion, providing nearly 60% of our funding this year. We are grateful for additional contributions from local Audubon chapters and individual donors as well. COASST receives a substantial contribution of in-kind support from the University of Washington and Olympic Coast National Marine Sanctuary in the form of staff salaries, space and equipment. In addition, we are fortunate to receive corporate donations in the form of cable ties (so essential for marking those carcasses!) and photo printing (which makes it possible for Jane to verify your data!).

Of course COASST could not exist without all of you–our volunteers! According to the Independent Sector valuation of volunteer time, COASST volunteers contributed more than $135,000 in survey and travel time in 2005–2006. This contribution nearly matched the COASST annual budget for the year!

If you have creative ideas for COASST funding in the future, please let us know. We gratefully accept gifts of any amount. Checks should be made payable to the University of Washington (with COASST on the memo line) and mailed to: COASST, UW School of Aquatic and Fishery Sciences, Box 355020, Seattle, WA 98195-5020.

Sponsors

COASST would like to thank the following sponsors, who provided operating funds, support for special projects and in-kind donations during 2005–2006.

Operational Support

East Lake Washington Audubon Society
Grays Harbor Audubon Society
NOAA Fisheries
Oregon Department of Land Conservation & Development
UW Program on the Environment
UW Earth Initiative
UW School of Aquatic & Fishery Sciences
Washington State Department of Fish & Wildlife

Special Projects

Bird Studies Canada
North Pacific Research Board

In-Kind Support

Cable Markers Co. Inc.
Olympic Coast National Marine Sanctuary
Photoworks.com
UW School of Aquatic & Fishery Sciences

We thank the following organizations for supporting volunteer training and events: Camano Island BeachWatchers; Clallam County BeachWatchers; CoastWatch, Oregon Shores Conservation Coalition; Dungeness National Wildlife Refuge; Makah Natural Resources; Ocean Shores Interpretive Center; Olympic National Park; Olympic Peninsula Audubon Society; Port Townsend Marine Science Center; Quileute Natural Resources; Quinault Natural Resources; ReSources; San Juan County BeachWatchers; Skagit Valley Community College; and Whidbey Island BeachWatchers.

COASST Mission

The Coastal Observation and Seabird Survey Team (COASST) is a citizen science project focused on the coastal areas of the North Pacific. COASST believes citizens of coastal communities are essential scientific partners in monitoring marine ecosystem health. By collaborating with citizens, natural resource management agencies and environmental organizations, COASST works to translate long-term monitoring into effective marine conservation solutions.

Printed on recycled paper using biodegradable inks by University of Washington Publication Services

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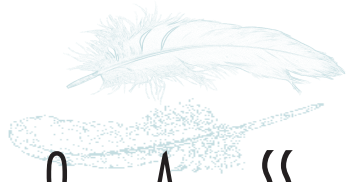

COASST *Reports* 05–06

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