

# PACIFIC SEABIRDS



A Publication of the Pacific Seabird Group

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# PACIFIC SEABIRD GROUP

Dedicated to the Study and Conservation of Pacific Seabirds  
and Their Environment

The Pacific Seabird Group (PSG) was formed in 1972 due to the need for better communication among Pacific seabird researchers. PSG provides a forum for the research activities of its members, promotes the conservation of seabirds, and informs members and the public of issues relating to Pacific Ocean seabirds and their environment. PSG holds annual meetings at which scientific papers and symposia are presented. The group's publications include *Pacific Seabirds* (formerly the PSG Bulletin), *Marine Ornithology* (published jointly with the African Seabird Group and the Australasian Seabird Group), symposium volumes, and technical reports. Conservation concerns include seabird/fisheries interactions, monitoring of seabird populations, seabird restoration following oil spills, establishment of seabird sanctuaries, and endangered species. Policy statements are issued on conservation issues of critical importance. PSG members include scientists, conservation professionals, and members of the public from both sides of the Pacific Ocean. It is hoped that seabird enthusiasts in other parts of the world also will join and participate in PSG. PSG is a member of the International Union for Conservation of Nature (IUCN), the Ornithological Council, and the American Bird Conservancy. Annual dues for membership are \$25 (individual and family); \$15 (student, undergraduate and graduate); and \$750 (Life Membership, payable in five \$150 installments). Dues are payable to the Treasurer; see Membership/Order Form next to inside back cover for details and application.

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## *Pacific Seabirds*

*Pacific Seabirds* (ISSN 1089-6317) is published twice a year in the spring and fall. *Pacific Seabirds* informs PSG members about regional seabird research and conservation news. *Pacific Seabirds* seeks submissions of short peer-reviewed articles, reports, and other items that relate to the conservation of seabirds in the Pacific Ocean. Abstracts of papers presented at the annual meeting are included in the Spring issue; the Fall issue contains a summary of ongoing research. All materials should be submitted to the Editor, except that conservation-related material should be submitted to the Associate Editor for Conservation. Information for contributors to *Pacific Seabirds* is published in each Fall issue. Deadlines are March 15 for the Spring issue and September 15 for the Fall issue. Back issues of the Bulletin or *Pacific Seabirds* may be ordered from the treasurer; please remit \$2.50 each for volumes 1-8 (1974-1981) and \$5.00 each for volume 9 and later (see Membership/Order Form next to inside back cover for details).

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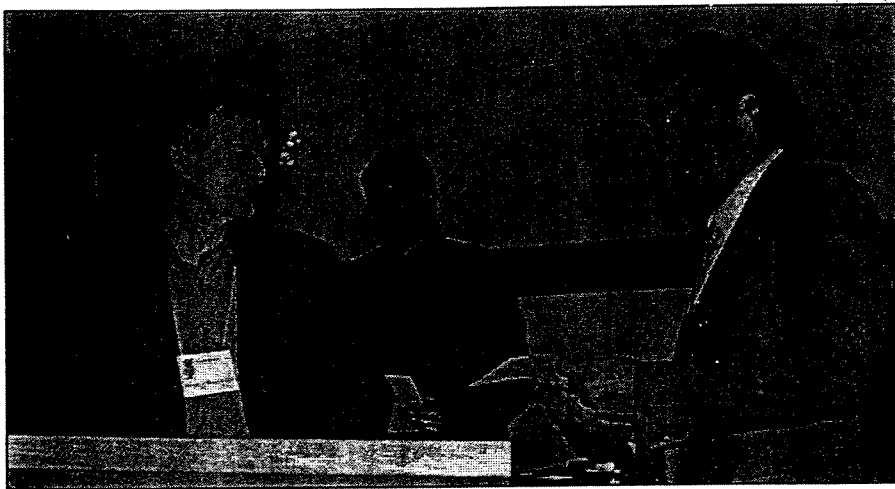
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# LIFETIME ACHIEVEMENT AWARD

The Pacific Seabird Group occasionally honors outstanding contributors to seabird science and conservation with Lifetime Achievement or Special Achievement awards. PSG presented its Lifetime Achievement Award to Robert E. Ricklefs at its annual meeting on 22 February 2003.



Bob Ricklefs receives the Lifetime Achievement Award from David Irons and Dan Roby

## ROBERT E. RICKLEFS

Daniel D. Roby

Dr. Robert E. Ricklefs received the Pacific Seabird Group's Lifetime Achievement Award in February 2003. Bob Ricklefs is an individual known to all seabird ecologists, even though most would not consider him a marine ornithologist per se.

The Pacific Seabird Group periodically presents awards to outstanding individuals who have made major contributions to the field of marine ornithology. One of these, instituted in 1993, is the Lifetime Achievement Award. This award recognizes a seabird researcher, educator, or conservationist who has made significant long-term contributions to seabird science, conservation, and education in the Pacific Ocean or the world. There is no mandate to present this award at every meeting, and in fact we have not

done so. Rather the award is presented irregularly when a nomination for an individual who has made an outstanding contribution to marine ornithology is received and approved by the Executive Council. Past recipients of this award are Philip and Myrtle Ashmole, James Bartonek, William Bourne, Richard Brown, Charles Guignet, Thomas Howell, James King, Karl Kenyon, Miklos Udvardy, and John Warham.

Bob Ricklefs' contributions are recognized and widely cited in the fields of evolutionary ecology, biogeography, phylogenetics, and community ecology. He has contributed important insights on the historical development of ecological communities and factors influencing patterns of species richness. Among his accomplishments, and most significant to our group of seabird aficionados, are his major contributions to our understanding of the ecology and evolution of life histories in birds. Bob has been publishing his scholarly works for nearly the last

40 years. Seabird biologists are fortunate that Bob has repeatedly turned his sharp perception towards the task of better understanding seabird life histories.

Bob received an AB in Biology from Stanford University in 1963 and a Ph.D. in Biology from the University of Pennsylvania in 1967. After a year as a post-doctoral fellow at the Smithsonian Tropical Research Institute in Panama, he joined the faculty of the University of Pennsylvania. He began producing a steady stream of now-classic papers the year he was awarded the Ph.D. degree, on topics that included growth rates, demography, and avian life histories. Among his most often-cited papers are those in *Ecology* on analyzing growth curves, in *Nature* on mortality rates in young birds, and a five-paper series in *Ibis* and *Auk* on patterns of growth in birds. The publication of his revolutionary and much-lauded textbook, *Ecology*, came within five years of his Ph.D. when he was only 30. That text is now in its

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fourth edition (co-authored with G. Miller); his companion text, *The Economy of Nature*, recently came out in its fifth edition. With co-editor J.M. Starck, Bob produced *Avian Growth and Development: Evolution within the Altricial-Precocial Spectrum* a major treatment of the patterns of avian development. He also co-edited (with D. Schluter) the book *Species Diversity in Ecological Communities: Historical and Geographical Perspectives*. He now has over 250 scientific publications and book chapters to his credit, in addition to these and other books.

Bob's early and abiding interest in patterns of growth and demography in birds naturally led him to field studies of seabirds. He has worked on seabirds in such far-flung locations as the Caribbean, Bay of Fundy, Newfoundland, Hawaiian Islands, Christmas Island, Galapagos Islands, South Georgia, and the Antarctic Peninsula. He has served as advisor for over a dozen Ph.D. students whose dissertations dealt mostly or entirely with seabirds. Among Bob's scientific publications are 43 specifically on seabirds. These began with papers on Sooty and Common Terns (*Sterna fuscata* and *S. hirundo*), Brown Noddies (*Anous stolidus*), and Leach's Storm-Petrels (*Oceanodroma leucorhoa*), and proceeded to cover such diverse taxa as Blue-footed Boobies (*Sula nebouxi*), Northern Gannets (*Morus bassanus*), Adelie Penguins (*Pygoscelis adeliae*), Antarctic Prions, (*Pachyptila desolata*), Phoenix Petrels (*Pterodromca alba*), Christmas Shearwaters (*Puffinus nativitatis*), Georgian Diving Petrels (*Pelecanoides georgicus*), Laughing Gulls (*Larus atricilla*), and Atlantic Puffins (*Fratercula arctica*). His paper on seabird reproductive energetics, published in *Studies in Avian Biology*, is a lucid discussion of energetic constraints in seabirds that has become a classic. Through experiments with Leach's Storm-Petrels, he has examined nestling growth rates, the factors limiting food delivery rates to nestlings, and the adaptive significance of pre-fledging fat ac-

cumulation and weight recession. This work has brought new insight to some of the more unique reproductive traits of pelagic seabirds.

In summary, Bob Ricklefs has made major contributions to the field of seabird biology and to our understanding of the ecological and energetic constraints on pelagic seabirds. He has made his contributions through his field research, laboratory studies, and modeling of seabird nutrition, growth, energetics, behavior, and life-histories. These studies have been expanded through the research of his graduate students. Moreover, his use of seabirds as models for exploring the evolution of avian life histories has conveyed a greater appreciation of these birds' unique biology to a wide scientific audience, including ecologists, physiologists, and evolutionary biologists. He richly deserves Pacific Seabird Group's Lifetime Achievement Award.

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# CONSERVATION NEWS

This section contains current news on the management and protection of seabirds. Reports on recent research are also in Abstracts, including several about seabird-salmon issues on the Columbia River.

## ANACAPA RAT ERADICATION AID XANTUS'S MURRELETS

According to the U.S. National Park Service, Xantus's Murrelets (*Synthliboramphus hypoleucus*) are responding to the eradication of some 3000 black rats (*Rattus rattus*) from Anacapa's three islets, which was completed last fall. Researchers found the first Xantus's nest since 1927 on Cat Rock (just off Anacapa), and the first nest on the uplands of Anacapa since 1929. Eggs in both nests have hatched. Radar studies are showing greatly increased nesting activity by Xantus's at Anacapa as compared to the past three years. Ashy Storm-Petrels (*Oceanodroma homochroa*) and Cassin's Auklets (*Ptychoramphus aleuticus*) have also benefited, as have Channel Island endemics such as deer mice (*Peromyscus* sp.), lizards, and salamanders, all of which were rat prey.

The National Park Service, U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game, National Oceanic and Atmospheric Administration (NOAA), and Island Conservation and Ecology Group removed the rats on Anacapa by a two-year project to drop poison-laced food pellets. The \$1.6 million in project funds came from the 1990 *American Trader* oil spill off the coast of Huntington Beach, California. Animal rights groups protested the project, and the New York-based Fund for Animals sued the National Park Service in 2001 in an attempt to halt it. PSG and other organizations provided support to the U.S. Department of Justice to defend against the suit, and the federal judge allowed the project to proceed (*Pacific*

*Seabirds* 29:97-98, 2002). The Fund for Animals still objects to the project, pointing out that 94 birds—mostly juvenile White-crowned Sparrows (*Zonotrichia leucophrys*)—were found dead on the island after the poisoning.

Researchers have found 17 Xantus's Murrelet nests on the island and in sea caves—the highest number ever recorded. Nest numbers are up 50% from the previous highest number during the most recent three years. Biologists have not found a single rat-eaten murrelet egg. Before the eradication, about 60% of the murrelet eggs that were found had been destroyed and showed signs of black rats' teeth. Ironically, researchers discovered the first documented nest on Anacapa of a Cassin's Auklet on Rat Rock, West Anacapa.

## PSG SUPPORT FOR NEW ZEALAND SHEARWATER RESTORATION PROJECT

Using a unique international approach for oil spill resource recovery, PSG has provided written support for the Rakiura Titi Restoration Project, which seeks funds from the *Command* Oil Spill Trust Fund to eradicate introduced rats from four nesting islands in the Big South Cape Group, New Zealand. The *T/V Command* oil spill took place in late September 1998 in Monterey Bay, California. Shearwaters were the second most frequent species recovered in beached bird surveys subsequent to the spill and the most numerous species identified in aerial surveys. Among the recovered dead seabirds was a Sooty Shearwater (*Puffinus griseus*) that had been banded in New Zealand. Sooty Shearwaters are

abundant in Monterey Bay during autumn as they feed and prepare to migrate south to New Zealand and Chilean breeding colonies. The rat eradication project will take place on a traditional Maori "mutton-birding" island, and, if successful, will allow for more muttonbirds to be harvested. PSG believes that it is appropriate to restore populations that have been damaged in oil spills at their colonies when this is the most efficacious means of restoration. Several years ago, PSG supported the proposal and ultimate decision of the *American Trader* Oil Spill Trustee Council in Southern California to restore a Brown Pelican (*Pelecanus occidentalis*) colony in Baja, Mexico (*Pacific Seabirds* 27:65, 2000).

## PSG COMMENTS ON BRITISH COLUMBIA FOREST PLAN

Thanks to Anne Harfenist, Louise Blight and Alan Burger, PSG commented to British Columbia's Ministry of Sustainable Resource Management on the plan, "A Working Forest for British Columbia." PSG noted concerns and uncertainty over the effects of impending legislation on prospects for maintaining old-growth habitat for nesting Marbled Murrelets (*Brachyramphus marmoratus*), which are red-listed in British Columbia and "threatened" federally. The Canadian Marbled Murrelet Recovery Team and various provincial government agencies are currently at an early stage in meeting the requirements of the Committee on the Status of Endangered Wildlife in Canada and the federal Species at Risk Act for down-listing this species. PSG pointed out that any



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restrictions on management options for old-growth forests will decrease the likelihood that the habitat needed for protection and recovery of the Marbled Murrelet will be attained. PSG recommended that Marbled Murrelet conservation issues in the forests of British Columbia be addressed by accepting the recommendations in the recent Special Report of the Forest Practices Board and in the Marbled Murrelet Recovery Team's comprehensive Conservation Assessment document.

### RENEWED DEFENSE DEPARTMENT EFFORT FOR ENVIRONMENTAL LAW EXEMPTIONS

Last year, the Defense Department sought to be exempted from compliance with six environmental laws in the Fiscal Year 2003 defense authorization bill. Congress ended up approving a proposal that exempts certain training activities from the Migratory Bird Treaty Act, and another proposal that provides for the creation of undeveloped buffer zones surrounding military bases. Proposed exemptions from five other laws, including the Endangered Species Act, were not approved. The military is exempt only from incidentally taking birds in the course of other activities; it must still obtain permits if personnel plan to kill birds intentionally, for instance at airports for safety reasons. (The Department of Defense is not completely exempt from the Migratory Bird Treaty Act, as we inadvertently stated in *Pacific Seabirds* 29:97, 2002.)

Similar proposals are now pending before Congress in the defense authorization proposal for Fiscal Year 2004. Officials of the Department of Defense and Environmental Protection Agency say that the proposed exemptions will improve the military's ability to defend the nation, while still protecting endangered species and the environment. The Endangered Species Act proposal would exempt military bases and testing facilities from protection of critical habitat or

species that have been designated under the act. Instead, military officials would continue the practice of submitting integrated natural resource management plans to the Interior Department for approval. They assert that private development and suburban sprawl has placed unfair burdens on the military. (In many developed areas, open lands owned by the Defense Department are the only available habitats for endangered species.)

Some environmental groups have voiced concerns that the Pentagon is using military readiness as an excuse to seek exemptions from environmental laws. Critics of such exemptions say environmental statutes already contain provisions that allow for exemptions in cases of national security or time of war. The Department of Defense counters that without legislative changes, lawsuits from environmental organizations can undermine military readiness (see *Pacific Seabirds* 29:10, 2002).

### U.S. SUSPENDS DESIGNATIONS OF CRITICAL HABITAT

In May 2003, USFWS temporarily stopped designating tracts of land as critical habitat under the Endangered Species Act because the program has depleted its money for this Fiscal Year. The agency is negotiating with plaintiffs and federal courts to postpone deadlines for designating critical habitats. Critical habitat is defined as a geographic area that "contain[s] habitat features essential for the conservation of a threatened or endangered species," and the agency is required under the Endangered Species Act to identify such areas, where activities that may threaten those species can be curbed.

USFWS says it is caught between federal statutes and court decisions. Federal statutes forbid agencies to spend more money than Congress has appropriated, but USFWS also must comply with court-imposed deadlines. Environ-

mental groups have brought a growing number of lawsuits seeking to force USFWS to designate critical habitat, as required under the law. While the program's \$6 million budget is the same as last year's, the number of court-imposed deadlines has grown, leaving the agency about \$2 million short of the money it needs to designate critical habitats for 33 species by 30 September 30 2003.

This issue is not new (*Pacific Seabirds* 28:11-12, 2001). Several years ago Interior Secretary Bruce Babbitt asked Congress to impose budget restrictions on the critical habitat program to prevent it from cannibalizing all funding for the Endangered Species Act, saying this was not the best use of those resources. Court-mandated critical habitat analyses were time-consuming, and they were draining resources and scientists from other protection for endangered species. The agency has been castigated for taking too long to list endangered species as well as to designate critical habitat. The logjam will not be alleviated until the agency gets adequate funding as well as orders from the courts.

The administration has taken an unfavorable view of critical habitat. USFWS has begun inserting a "disclaimer" into critical habitat designations and news releases. It opens with the statement, "Designation of critical habitat provides little additional protection to species." The previous director of the USFWS, Jamie Rappaport Clark, decried the funds being spent on designation of critical habitat at that time; however, now that she is employed by an environmental group she takes the opposite position on this issue.

### OFFSHORE WIND TURBINES AND SEABIRDS

A proposed wind turbine project in Nantucket Sound, off Cape Cod, Massachusetts, would consist of 130 towers topped with immense windmills and would produce a total of 420 mW. Cape

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Wind Associates would be the developer. This proposal has garnered a great deal of attention because it might interfere with the pleasant coastal views at summer homes of wealthy and powerful political families such as the Kennedys. More important to PSG members, some offshore projects have a potential to kill seabirds.

Many other wind farms are under consideration along the Atlantic Coast. Winergy has undertaken an ambitious plan to identify 25 potential wind farm locations along the east coast including sites off of Massachusetts, New York, New Jersey, Delaware, Maryland and Virginia that could generate 12,500 mW of electricity. Some proposed wind farms are over 1000 mW, including a 506-turbine, 1821-mW proposal for Gulf Bank off the coast of Maryland. Offshore wind farms would be a new step for wind energy in the United States. In 1981 there were only 10 mW of wind energy capacity in the nation; that capacity rose to 2554 mW in the year 2000 and nearly doubled to 4261 mW by the end of 2001.

Federal agencies are involved in jurisdictional battles on these issues. Because the coastal turbines would be built in the navigable waters of the United States, the U.S. Army Corps of Engineers has jurisdiction to issue permits just as with any other project affecting wetlands or navigation. Interior Department officials want Interior to permit, regulate, and collect royalty fees for operation of offshore wind farms. Interior notes that the current regulatory framework for those projects does not force developers to make any kind of payment for use of the federal submerged lands. In what might be viewed as a naked grab for power, they argue that Interior's Minerals Management Service deserves the job of regulating offshore energy development because it has decades of experience managing oil and gas production in federally controlled offshore areas. One Minerals Management Service official told Congress that it has unparalleled experience in multiple-use land management and routinely makes decisions to balance economic activities with the need

to protect the environment. Concerns have surfaced over the potential threat to seabirds from offshore projects, just as there are concerns about terrestrial migratory birds from turbine projects on high ridges. Conservation groups are arguing that very careful consideration must be given to the potential for bird interactions at each site to prevent high avian mortality. From experience with communication towers, lighting on wind turbine towers must be limited to prevent birds becoming disoriented during poor visibility at night. The American Bird Conservancy suggests that only a few wind turbines in each project should be individually lit, and those towers should have a white strobe with a pulse rate of no more than 20 per minute.

The National Wind Coordinating Committee estimates that about 2 birds die per year at each turbine throughout the 15,000 wind turbines operating in 2001. The offshore turbines seem to be 3-4 mW each. A 1000-mW wind farm might consist of about 300 turbines, so the mortality rate of birds there could be extrapolated to somewhere around 600 birds per year. More study is needed to assess the actual impacts that might affect seabirds.

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### DELAWARE AND NEW JERSEY PROTECT HORSESHOE CRABS DURING SHOREBIRD MIGRATION

Delaware and New Jersey officials banned harvesting of the horseshoe crab (*Limulus polyphemus*) in Delaware Bay between May 1 and June 7, 2003. All spawning beaches will be closed to harvest during the critical period for spawning crabs and feeding shorebirds. Crabs are used as bait in conch and eel pots, including all taken in New Jersey and most taken in Delaware. This activity disturbs shorebirds and makes fewer crab eggs available to them for feeding.

Delaware and New Jersey also capped their harvest of crabs at one half of 2002 levels. They will require all

conch potters to use bait-saving devices such as bait bags, which can reduce crab use by half. Restrictions will also be imposed on access to state and federal beaches during the peak spawning period. Delaware and New Jersey will seek funding to stabilize and enhance horseshoe crab spawning beaches and to conduct outreach programs to educate the public about disturbing the crabs and birds.

There are concerns about declines in Red Knot (*Calidris canutus*) and other shorebird populations linked to decreased crab egg availability. About 90% of the world's nearctic Red Knot (*Calidris canutus rufa*) population migrates from Tierra del Fuego to the high Arctic each spring, making a crucial stop-over to feed on horseshoe crab eggs in Delaware Bay. Recent crab declines have meant that many of these shorebirds are not gaining sufficient weight to complete their migration and breed successfully. Dunlins (*Calidris alpina*), Semipalmated Sandpipers (*Calidris pusilla*), Ruddy Turnstones (*Arenaria interpres*), and Sanderlings (*Calidris alba*) are also highly dependent on crab eggs. Gerald Winegrad, Vice President for Government Relations, American Bird Conservancy, deserves much credit for persuading the state officials to take these actions.

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### SHIPS DUMP SLUDGE AT SEA, THEN FALSIFY RECORDS

A crackdown on ship pollution in the Northwest has uncovered evidence that tons of toxic oily sludge are dumped into the Pacific each year, then covered up with falsified records. In the past year, a captain and six chief engineers have gone to prison for installing hoses to bypass pollution control systems by pumping engine room wastes overboard. These cases involved up to 20 ships and generated millions of dollars in fines. At issue is how cargo and container ships handle leaking waste oil, solvents, and lubricants that accumulate in the engine room. Typi-

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cally, water and oil are separated and the oil is stored as sludge in a tank. Some ships burn the sludge in on-board incinerators. Others store it until the ship docks, then offload it for disposal. But getting rid of sludge properly can be expensive and time-consuming.

The shippers covered up the illegal dumping by ordering crew members to hide evidence, obtain fake waste-disposal receipts, and paint over brackets that were used to bypass pollution controls. David Uhlmann in the Justice Department's Environmental Crimes Division believes the problem is so serious that his agency has ramped up enforcement, prosecuting cases on both coasts. The Puget Sound Steamship Operators Association, which represents cargo vessel operators, disputes that many vessels cut corners on environmental issues.

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### ARMY COMPLETES JOHNSTON ATOLL CHEMICAL WARFAREWASTE CLEANUP

Johnston Atoll, a key Pacific seabird-nesting site 800 miles southwest of Hawaii, once served as storage facility for rockets, bombs, artillery shells, and mines that were filled with a nerve agent so powerful that a drop on the skin can kill a person. During nearly a decade ending in November 2000, the Army destroyed more than 400,000 chemical munitions and 2000 tons of chemical agents on Johnston. The Army recently announced that it has incinerated all secondary waste from the massive disposal of chemical weapons. This includes plastic, paper, sludge, and other materials left over from destruction of some of the most dangerous chemical weapons ever produced. The material was packed into drums and thermally treated in the metal parts furnace on Johnston Atoll.

The military facility and airport runway are expected to be closed, and by 2004 the island will be returned to its

more natural role as a refuge for seabirds and other creatures. The atoll and its remaining structures will be turned over to USFWS as part of the Johnston Atoll National Wildlife Refuge, which was established by Congress in 1926, long before the island became home to the deadly arsenal. A plutonium spill and contaminated soil will be part of the military legacy.

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### BOMBING STOPS ON VIEQUES ISLAND, PUERTO RICO

Sending fireworks shooting into the sky, Vieques islanders celebrated the U.S. Navy's withdrawal from their Caribbean island. Their protest movement helped force an end to nearly 60 years of bombing exercises on the island. President Bush announced in 2001 that the Navy would stop using Vieques this year. In the 1940s, the United States bought up 25,000 acres—about two thirds of Vieques—to create a bombing range, forcing out families and farmers. Military exercises began in 1947. The eastern third of Vieques will be administered by the USFWS forming the largest federal wildlife refuge in Puerto Rico, along with 3100 acres from a munitions warehouse on Vieques' western end. Many species of seabirds nest in the refuge.

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### VAST "NO FISHING" ZONES PROMOTED

More than 100 marine biologists issued a blueprint that seeks to reverse the decline of the planet's oceans. The group, convened by Intel co-founder Gordon Moore and Oakland marine biologist Sylvia Earle, recommended creating vast new "no fishing" zones at sea, and investing money to improve our catalog of marine species. While roughly 9% of the Earth's land is protected in reserves and parks, less than one percent of the ocean has similar protections.

The group also called on the nations of the world to draft new treaties and

agreements to manage the 60% of the world's oceans that fall in international waters—areas largely open now to uncontrolled activities. The recommendations came after a scientific conference at Los Cabos, Mexico. Recently a study published in *Nature* concluded that 90% of the world's large predatory-fish populations, including tuna, swordfish and marlin, have disappeared because of overfishing in the past 50 years.

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### RATS ON KISKA THREATEN HUGE AUKLET COLONY

In July, the *Anchorage Daily News* ran a long article featuring the efforts by PSG member Ian Jones to document the destruction of auklets by Norway rats (*Rattus norvegicus*) on Kiska Island in the Aleutians. The colony at Sirius Point on Kiska has 3 to 6 million Least and Crested Auklets (*Aethia pusilla* and *A. cristatella*), which nest in a maze of tunnels, crevices, and cracks in the lava. Jones and his co-workers found windrows of bird skulls, rat dens jammed with rotting auklet carcasses, and many empty bird-nesting crannies in the jumbled lava. Not only do rats eat adults and chicks, they cache adult birds in underground burrows, where they can rot away uneaten. Jones found one cache with 148 decomposed birds. In 2002, Least Auklets had only 10% nesting success—the lowest ever observed for this species. Jones has concluded on the basis of modeling that the Least Auklet population could be extirpated if this rate of predation continues.

Like most other Aleutian islands, Kiska had no indigenous land mammals. Fox farmers released arctic foxes (*Alopex lagopus*) there in 1835, and Norway rats arrived with the Japanese occupation in World War II. In 1986, USFWS eradicated some 700 foxes on Kiska to protect Aleutian Canada geese and seabirds. The Norway rat population exploded with the foxes gone, although biologists do not think removing foxes helped the rats.

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Alaska Maritime National Wildlife Refuge biologists Vernon Byrd and Art Sowls would like to eliminate the rats using Ramik Green, a government-approved poison. Kiska (70,000 acres) would be the largest island where that has been tried. In 2001, 200,000 rats were killed over 10 days on 27,900-acre Campbell Island, south of New Zealand. This effort cost \$1.5 million for helicopters to spread 132 tons of bait. An experiment to poison rats at Sirius Point during winter is being developed. If the effort is successful, the refuge will try to get permission to spread bait from aircraft to eradicate rats from the entire island. Kiska may be only the beginning—rats have made it to at least 21 large Alaska islands, not counting their offshore islets.

In August 2003, PSG wrote to USFWS to urge that rats be removed from Kiska. USFWS was requested to provide sufficient funding and support to begin rat control at Sirius Point in 2004 and to eradicate the rats entirely from Kiska Island within a few years. PSG also offered to encourage support for the project among bird conservationists and the public during the governmental approval process. The Environmental Protection Agency needs to approve aerial application of rodenticides, among other hurdles. Letters went to both the Assistant Director for Migratory Birds and State Programs in Washington, D.C. (Paul Schmidt) and the Director of Region 7 in Anchorage, Alaska (Rowan Gould).

### NOAA FISHERIES DEFERS MONITORING OF KODIAK BYCATCH

Monitoring of seabird and marine mammal bycatch in set-gillnets on the coast of Kodiak Island, Alaska began in 2002 (*Pacific Seabirds* 28[2]: 93-94). The project was a joint effort of two agencies, with USFWS providing expertise in bird identification and NOAA Fisher-

ies (formerly the National Marine Fisheries Service) providing logistics and most of the observers. The project was expected to last two years at Kodiak and then move to other areas with intensive set-gillnet fisheries.

The expected Kodiak bycatch monitoring did not take place in 2003, however. According to Bridget Mansfield of NOAA Fisheries in Juneau, the postponement was due to lack of funds. Mansfield said that her agency intends to resume the Kodiak project in 2004, again in cooperation with USFWS. Monitoring of seabird bycatch in Alaskan fisheries has always been an interagency effort, owing to the complexity and expense of sampling large numbers of vessels adequately over large distances.

Descriptions of federal multi-year projects usually come with the caveat, "Depending on available funds, which are not guaranteed." It is to be hoped that the agencies will give this important work a high priority in the future. It is unlikely that coastal gillnetting is affecting Alaskan colonies as severely as those in Japan (see next item); however, monitoring of bycatch is the only way to ensure this.

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### SYMPOSIUM HIGHLIGHTS JAPANESE SEABIRD CONSERVATION

The government of Japan, the Hokkaido Seabird Center, and USFWS sponsored a symposium on seabird conservation in Haboro, Hokkaido, Japan, in October 2002. The symposium was one outcome of a meeting that was held under the United States-Japan Migratory Bird Treaty in 2001. PSG members Kent Wohl and Kim Nelson were among several who attended from the United States.

One focus of the conference was the nearby island of Teuri. Although Teuri is a wildlife reserve, its seabird numbers have plummeted during the past century. This apparently has happened for two reasons. Coastal fisheries take many seabirds incidentally, without any impedi-

ment under Japanese law. And several hundred feral cats live on the island—but their removal is opposed by island's human residents.

The symposium was reported in *The Japan Times* on 31 October 2002. The paper pointed out that although murrens on Teuri have become a sort of totem for local people, having "made their way onto posters, stained glass, and even steel drain covers," the birds themselves "have quietly slipped away." Common Murres (*Uria aalge*) have declined from 40,000 in the early 20th century to 8000 in the 1960s, a few hundred in the 1980s, and only 13 in 2002. Other Hokkaido seabirds have suffered similar declines, including Red-faced Cormorant (*Phalacrocorax urile*), Tufted Puffin (*Fratercula cirrhata*), Ancient Murrelet (*Synthliboramphus antiquus*), and Spectacled Guillemot (*Cepphus carbo*). Black-tailed Gulls (*Larus crassirostris*) still number in the thousands but also are declining.

The Japan Seabird Group placed 40 decoys at the murre colony in 2003. Koji Ono reports that the numbers of murre pairs increased to 19 in 2003; however, the area with the decoys was not used by birds. Meanwhile, threats from fisheries and cats continue.

A symposium report is being prepared. For more information, contact Kent Wohl, US Coordinator for the US-Japan Migratory Bird Treaty, U.S.; Kent\_Wohl@fws.gov

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### MIDWAY ATOLL MANAGEMENT CONTINUES, BUT NOT TOURISM

Midway Atoll belonged to the U.S. Navy for most of the 20<sup>th</sup> century, but when the base was closed it became a wildlife refuge. USFWS has been managing Midway to protect the islands' seabird populations, seals, and marine turtles, and to reverse decades of environmental neglect (especially by controlling invasive plants). Starting in 1996, tourists were able to visit the refuge and

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enjoy its wildlife, historic sites, and beaches, and learn about seabirds and their environment. However, the contractor who managed the tourist services pulled out for financial reasons in early 2002. This put an end to public access; worse it threatened management of Midway's resources, since it would be impractical to maintain even a minimum permanent staff on the islands unless a contractor was maintaining the buildings, utilities, fuel farm, and airport (*Pacific Seabirds* 28:2-8, 2001, and 29:10-11, 2002).

USFWS has been able to contract for basic services in the past year and a half. However, it has not been possible to resume the provision of tourist facilities (dormitories, meals, a refuge ranger, and so on). According to Beth Flint of USFWS, public access would be feasible only if other agencies with an active interest in the islands were to contribute to funding of the maintenance contract. These agencies include NOAA (which manages the refuge's seals and marine turtles), the Federal Aviation Administration, Coast Guard, and Department of Defense (the latter three benefit from having an airport and fuel farm in the middle of the Pacific). The Department of Interior is again threatening to end all maintenance of island facilities if other agencies do not contribute. This would cripple wildlife management on Midway, even monitoring of declining albatross populations.

It is not new that federal funding is hard to come by, and this is especially true nowadays for nonmilitary projects. However, it is unfair to expect USFWS to carry the entire burden of maintaining facilities on which several agencies depend—and it is ironic that some of these facilities still contribute to the national defense.

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### PSG OPPOSES DEPREDAATION ORDER FOR DOUBLE-CRESTED CORMORANTS

PSG joined a letter by numerous scientific organizations that opposed USFWS's proposed rule to establish a

depredation order. The proposal would allow state and federal agencies in 24 states to decide when, where and how many Double-crested Cormorants they can kill if they determine the cormorants are "injurious to public resources." This proposal also would allow the U.S. Department of Agriculture to shoot unlimited numbers of cormorants at winter roost sites in twelve aquaculture states without permits or scientific review by USFWS.

Currently, a permit is needed from USFWS before cormorant control activities can occur, except at aquaculture facilities in thirteen states. Under this system, about 47,000 Double-crested Cormorants (*Phalacrocorax auritis*) are killed each year, in addition to the destruction of thousands of cormorant eggs. The permit system allows for a more orderly, science-based management approach than would the proposed rule. PSG and others noted that every study for a century has shown that cormorants do not have significant impact on the demography of desirable commercial or sport fish, except at very small scales. The major impetus for this proposal comes from perceived problems for sport fishing, but these are not supported by good science.

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### PSG COMMENTS ON SCOPING PROCESS FOR CASPIAN TERN ENVIRONMENTAL IMPACT STATEMENT

PSG commented to USFWS on the issues that should be addressed in the forthcoming environmental impact statement regarding Caspian Tern (*Sterna caspia*) management in the Columbia River estuary. PSG generally supported the three broad issues that USFWS had identified: (1) the impact of Caspian Terns on listed salmonids in the Columbia River estuary; (2) the need for active management of Caspian Terns; and (3) the need to address management actions that may be necessary to protect salmo-

nid stocks in the Columbia River Estuary.

With regard to the impact of terns on salmonid recovery, PSG urged that USFWS use peer-reviewed science to make such an assessment. PSG noted that NOAA Fisheries produces many in-house reports on this subject that are not peer-reviewed and are not based on credible science; such reports are merely non-scientific justifications of its preconceived policy goals. PSG urged that these analyses distinguish between avian consumption of two distinct but intermingled groups of salmon: hatchery salmon, and wild salmon subpopulations (Evolutionarily Significant Units) that are listed under the Endangered Species Act. The scientific justification for listing Evolutionarily Significant Units under the act is that certain demes of salmon contain unique genetic information, use unique combinations of environmental and geomorphological conditions, occur over a unique geographic range, and represent a significant ecological component of the natural ecosystem. Hatchery populations of salmonids cannot meet these criteria, and they are not endangered under the Endangered Species Act.

PSG asked that the environmental impact statement specifically evaluate the option of including East Sand Island as a National Wildlife Refuge, and discuss how this action would contribute to the goals of the National Wildlife Refuge System as expressed in the National Wildlife Refuge Management Act. The U.S. Army Corps of Engineers (COE) currently owns East Sand Island and has expressed an intention to "excess" it (give up ownership of it). East Sand Island has the largest Caspian Tern colony on earth, the largest Double-crested Cormorant colony on the Pacific coast of North America, the largest night roost of California Brown Pelican (*P. o. californicus*) in the Pacific Northwest, and one of the largest colonies of Glaucous-winged/Western Gulls (*Larus glaucescens* X *L. occidentalis*) on the west coast.

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PSG also suggested casting a broad net when discussing management options that may be necessary to protect salmonids in the Columbia River. Among these options should be the management of dams on the Columbia River, improved techniques at fish hatcheries, improvements in translocating salmonids, and modification of habitat.

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### CASPIAN TERN SITE FEASIBILITY STUDY

In February USFWS released a final version of its "Review of Caspian Tern Nesting Habitat: A Feasibility Assessment of Management Opportunities." This study was required as part of a settlement in a law suit brought by the American Bird Conservancy and other groups. USFWS evaluated 77 sites, 30 coastal and 47 interior. Twenty-three sites were determined to have management potential and were ranked according to specific criteria. Of these, six are in coastal Washington, four in Oregon, and thirteen in California. Of the six sites ranked with the highest management potential for Caspian Tern breeding, five are located in California, and one (Sand Island at Grays Harbor) is located in Washington. The state of Washington has refused to participate in any tern relocation efforts, and Oregon has agreed to review and consider sites only where Caspian Terns have historically nested. This left no new sites for active planning or development in Washington or Oregon except for three inland sites in Oregon (Malheur National Wildlife Refuge, Crump Lake, and Summer Lake). Five existing colonies in the San Francisco Bay area are being further evaluated for terns.

The political and public-relations hurdles to establishing any tern colony are significant. This is largely a result of mismanagement and public relations distortions by certain salmon advocacy groups and NOAA Fisheries. Many of the salmon smolts consumed by terns

emanate from hatcheries; these smolts are not needed to restore Evolutionarily Significant Units (wild subpopulations listed under the Endangered Species Act), but rather are needed to maintain the fishery.

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### OWNERSHIP OF EAST SAND ISLAND, COLUMBIA RIVER, REMAINS UNSETTLED

As part of a settlement of a law suit with environmental organizations, USFWS and the U.S. Army Corps of Engineers (COE) agreed to issue a joint recommendation on future ownership of East Sand Island by March 1, 2003. The agencies also were supposed to make recommendations for funding to manage the island. The one-page statement that they issued failed to resolve either question and simply maintains the status quo.

The COE plans to dispose of the island and believes that transfer to USFWS is "the best end result to manage the significant wildlife resources present on East Sand Island." USFWS is shirking its responsibilities under the National Wildlife Refuge Management Act and says such a transfer decision is premature before the completion of an environmental impact statement. USFWS believes that other ownership options by state, municipal or conservation groups should be evaluated. The COE will retain ownership and management responsibilities of East Sand until the environmental impact statement is completed in February 2005, including provision of at least 6 acres of nesting habitat for Caspian Terns. If USFWS were to acquire the island, it would become part of the Oregon Islands National Wildlife Refuge.

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### WASHINGTON STATE TAKE OF CASPIAN TERNS AND OTHER SPECIES

In late February, the Wildlife Services agency of Washington State released a pre-decisional environmental assessment on Piscivorous Bird Damage Management on the Mid-Columbia River. This concerns Wildlife Services' control of Caspian Terns and other fish-eating birds at mid-Columbia River dams and hatcheries. Wildlife Services proposes to continue its avian predation control program in response to requests from public utility districts (PUDs) in Douglas, Chelan and Grant counties and at hatcheries.

From 1997 to 2001, Wildlife Services has taken 2380 Caspian Terns, 845 Great Blue Herons (*Ardea herodias*), 820 Black-crowned Night-Herons (*Nycticorax nycticorax*), 1340 Common Mergansers (*Mergus merganser*), 36,835 Ring-billed Gulls (*Larus delawarensis*), 4285 Double-Crested Cormorants, and 11,120 California Gulls (*Larus californicus*). During 2001, 938 Caspian Terns (over 4% of the estimated breeding population on the west coast) were taken. After inquiries and letters of concern, Wildlife Services has apparently stopped taking Caspian Terns pending research by Julia Parish on tern predation at dam sites (*Pacific Seabirds* 29:12, 2002). The environmental assessment states that the lethal removal of Caspian Terns at PUD facilities will not occur unless conditions exist which attract unusually high numbers of terns. Should there be extreme low water and spill, "the limited taking of this species may occur, but only intermittently." As of early July, no Caspian Terns have been seen on the Columbia River north of the culling areas.

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### JUDGE FINDS PLAN TO PROTECT COLUMBIA RIVER SALMON TO BE INADEQUATE

In May, federal district court Judge James Redden ruled that a biological

## CONSERVATION NEWS

opinion outlining salmon protection measures for the operation of Columbia River federal dams for five years is inadequate, and he remanded it to NOAA Fisheries for revision. The biological opinion was issued in December 2000 and outlines how the federal hydropower system on the Columbia and Snake rivers should be operated so as not to jeopardize 12 Evolutionarily Significant Units (subpopulations) of salmon and steelhead listed under the Endangered Species Act. Such biological opinions are required under the act when actions of federal agencies may impact a listed species. They are developed after consultations between

the listing agency and the operational agencies. Specifically, this opinion addresses the operation of dams on the Columbia and Snake Rivers by the U.S. Army Corps of Engineers, the Bureau of Reclamation, and the Bonneville Power Administration.

The judge said the five-year biological opinion relied too heavily on future, speculative actions that might be taken to protect salmon and their habitat. Many of those future actions have not been subjected to consultation with the NOAA Fisheries and may never be implemented. For example, the plan relies on future land and habitat management actions by

the Forest Service and the Bureau of Land Management that have not been subject to consultation.

Redden directed the NOAA Fisheries to consider only federal actions that have been subject to consultation and only those nonfederal actions that are "reasonably certain to occur." Environmental groups that initiated the suit had criticized the biological opinion for calling only for small changes in the operation of the hydropower system and relying instead on voluntary restoration actions by government agencies.



# PSG NEWS

## PSG ELECTS EXECUTIVE COUNCIL FOR 2003

The following members of the Executive Council were elected in fall 2001:

### Officers:

Chair-elect: Dan Roby  
Vice-chair for Conservation: Craig Harrison  
Treasurer: Ron LeValley

### Regional Representatives:

Southern California: Mark Pierson  
Canada: Louise Blight  
Oregon-Washington: Katie O'Reilly  
Non-Pacific US: Malcolm Coulter

The complete list of Executive Council members is on the inside back cover. Roby, LeValley, Pierson, Blight, and O'Reilly were newly elected (Blight returns after a term as Student Representative). PSG welcomes them to the Executive Council. All except the Chair-elect will serve for two years; the Chair-elect will become Chair next year and Past Chair the year after.

Continuing members of the Exco include chair David Irons, past chair Lisa Ballance, secretary Lora Leschner, student representative Stephani Zador, and regional representatives: Alaska and Russia Verena Gill, Northern California Meredith Elliott, Pacific Rim Beth Flint, and Old World Mark Tasker.

## EXECUTIVE COUNCIL CANDIDATES NEEDED

The following positions will be up for election in fall 2003:

Chair-elect  
Secretary  
Alaska representative  
Old World representative  
Pacific Rim representative  
Northern California representative  
Student representative

PSG needs more candidates for these positions. Pat Baird, chair (and only member) of the Election Committee, finds at least one candidate for each position each year. However, members are encouraged to nominate additional candidates, including themselves. Serving on the Executive Council is extremely interesting and keeps you up to date on conservation issues. It also is important—the Exco is what keeps PSG running.

## CANADIANS AND BRITONS CAN PAY PSG DUES IN THEIR CURRENCY

As a convenience to PSG members who live in the United Kingdom and in Canada, the regional representatives in both countries can accept PSG dues in the local currency. Residents of the UK may send dues in pounds sterling to Mark Tasker; residents of Canada may remit payments in Canadian dollars to Louise Blight. Dues in US dollars should be converted to the local currency at the exchange rate for the date you are paying.

Residents of other countries will need to continue paying dues in US dollars. If you have questions, contact your regional representative or the PSG treasurer.

## PSG'S 2004 MEETING WILL BE IN LA PAZ, BAJA CALIFORNIA SUR

The Pacific Seabird Group will hold its 31st Annual Meeting on 21–25 January 2004 in La Paz, Baja California Sur, México. Accommodation and meeting sessions will be at the Hotel Los Arcos in La Paz.

There will be a full scientific program on 22–24 January, and the meeting will feature a symposium, "The Brown

Pelican in Western North America." Plenary speakers will include George Hunt, who will discuss "Climate change, bottom-up forcing, and its potential for affecting seabird populations," and Exequiel Ezcurra. Committees will meet on 21 January. Field trips on Sunday 25 January will include Espiritu Santo island, a cactus sanctuary, birdwatching, whale watching in Magdalena Bay, snorkeling with sea lions at Espiritu Santo Island, a Todos Santos Tour, and cultural and historical city tours of La Paz. For general information, contact the local committee chair, Eduardo Palacios in La Paz, at (612) 121 2800 or epalacio@cicese.mx. The scientific program chair is Dan Roby, (541) 737-1955 or daniel.robby@orst.edu. For meeting updates, check the PSG web page.

Hotel Los Arcos consists of three floors in a courtyard configuration. All rooms and suites are fully carpeted, air conditioned, and contain private baths, satellite television, direct access telephones, and mini-bars. The hotel has a fine restaurant, a coffee shop, and a bar lounge that features the city's best view of wonderful sunsets. Los Arcos is 10 minutes from the La Paz International Manuel Marquez de León Airport. You can contact the hotel for reservations at [www.losarcos.com](http://www.losarcos.com) or (612) 122-2744; e-mail is preferred.

Transportation options to La Paz include air (from the southwestern US), ferry (from the Mexican mainland), or a rollicking bus trip from California. For flights from Los Angeles to La Paz, your choices are AeroCalifornia (800-237-6225) or AeroMexico (800-237-6639; [www.aeromexico.com](http://www.aeromexico.com)). AeroMexico also flies from Phoenix or Tucson. Another option is to fly into San Jose del Cabo and take a three-hour bus ride to La Paz. Some of the airlines that service San José del Cabo airport are American ([www.amrcorp.com](http://www.amrcorp.com)), Continental



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(www.continental.com), American West (www.americanwest.com), Alaska (www.alaskaair.com) and Aero-California. AeroCalifornia is not on the web, so to get the best fares, we suggest calling them directly or check with your local travel agent.

Ground transportation is provided from the La Paz airport to town by Servicio de Transportación Terrestre. They offer a round trip between airport and city (including hotels) for US\$25 per person. They also operate a round-trip shuttle for US\$100 per person between the Los Cabos airport and hotels in La Paz. Or you can rent a car; rentals are conveniently located at La Paz International Airport and San Jose del Cabo airport — Thrifty (www.thrifty.com.mx), Dollar (lapdollar@hotmail.com), Hertz (www.hertz.com), Avis (www.avis.com), Budget (www.budget.com.mx), Nacional (reservations@grupoantyr.com.mx), Alamo (800 GO ALAMO [from within the US]; alamoservas@prodigy.net.mx).

For those who are traveling from the Mexican mainland, there is a ferry service from Mazatlan and Topolobampo. Contact Sematur at 01 (612) 12 56588.

We look forward to seeing you at the 31st Annual Meeting in La Paz.

### BUS TRIP TO LA PAZ

Dan Anderson (www.dwanderson@ucdavis.edu) is scheduling a bus trip from San Diego to the PSG meeting in La Paz. The trip will provide 5 days of birdwatching and sightseeing. Transportation costs will be shared by all members of the "expedition." Hotel reservations will be made ahead of time by Anderson; he will arrange the rooms *en masse* through La Pinta hotel system.

To save on space and costs, it will be necessary to share rooms, with at least two persons per room (with separate beds) or four per room (with shared beds). If you must have your own room, supposing they are available when our

(hoped-for) crowd arrives, full cost will be your responsibility. There will be some opportunity for camping at some locations, but it will be cold at that time of year.

Bus transportation costs will be paid to Anderson directly. A deposit of \$100 per person is required by early December 2003. Meals, motels, and all other personal expenses will be paid directly by each participant. Of course the bus will contain several ice chests of beer and soft drinks, and there will be snack food along the way. In fact, most everything except the bus fares and snacks will be each participant's responsibility.

The return trip will be by air; these reservations are your responsibility (see preceding article for details). It will be best to get airline reservations very early.

An approximate estimate of costs follows: Bus fare and incidentals: \$200-300 per person; hotel room: \$85 per night (divided by 1 to 4 people sharing room); meals: \$20 per day per person. Add some funds for incidentals.

### FIRST-DRAFT ITINERARY FOR BUS TRIP (SUBJECT TO CHANGE!)

#### Day 1 (16 January)

Meet bus Friday morning at San Diego airport

Leave for Mexico at 1200 after lunch; travel to San Quintín, Baja California

Chaparral, coastal sage scrub, northwest Baja Pacific Coast

#### Day 2 (17 January)

Lunch at El Rosario, 1100

Drive to Cataviña for night

Baja California "Sonoran Desert"

(recent biogeographers now classify the Baja Central Desert

as a separate vegetation type from Sonoran Desert)

#### Day 3 (18 January)

Lunch at Guerrero Negro about noon

Drive to San Ignacio for night Central Desert, Vizcaino Desert, desert oasis

#### Day 3 (18 January)

Lunch at Guerrero Negro about noon

Drive to San Ignacio for night Central Desert, Vizcaino Desert, desert oasis

#### Day 4 (19 January)

Lunch at Mulege about noon

Drive to Loreto for night Magdalenan Region Desert, Sierra de la Giganta Region, Gulf of California

#### Day 5 (20 January)

Leave Loreto about 0900

Arrive La Paz about 1400

From here you are on your own—stay at accommodations you have arranged for the meeting, prepare for meeting

#### End of meeting (25 or 26 January)

One-way flight back to San Diego; resume round trip from San Diego to home. Arrange all flights on your own.

## REPORT OF THE PACIFIC SEABIRD GROUP'S 30<sup>TH</sup> ANNUAL MEETING, FEBRUARY 2003

### OVERVIEW

The 30<sup>th</sup> PSG Annual Meeting was held at the Tigh-Na-Mara Resort in Parksville, British Columbia on 19–22 February 2003. The beach was close at hand, and the weather was good for walks and birdwatching. About 230 people attended, of which more than 50 were students. One hundred and two lectures were presented and 45 posters were displayed. Authors from at least five countries came to present their work.

We were privileged to have three distinguished plenary speakers who gave excellent talks. The meeting was started

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off by Dr. Robert Ricklefs speaking on "The extreme life histories of pelagic seabirds," followed by Dr. Helen James's talk on "Prehistoric human impacts on seabirds and their ecosystems," and finished up with Dr. David Cairns talking on "Endothermy, ectothermy, and the structure of marine communities."

There was a symposium on Seabird Biogeography, which contained several exciting papers; the proceedings will be published shortly in *Marine Ornithology*. In addition there were special sessions on the Impact of Offshore Wind Farms and Other Disturbances on Seabirds, Spatial and Temporal Overlap of Seabirds and Fisheries, and Related Seabird Bycatch Issues, and Seabird Monitoring Data as a Tool to Evaluate Ecosystem Processes and Initiate Conservation Actions. Topics of papers in the general sessions included breeding biology, effects of oil pollution and other contaminants on seabirds, habitat relationships, behavioral ecology and natural selection, conservation, management, general biology, and foraging ecology.

The Pacific Seabird Group presented Dr. Robert Ricklefs with a Lifetime Achievement Award in recognition of his outstanding and original contributions to evolution and ecology of seabird life histories (see tribute to Dr. Ricklefs elsewhere in this issue).

Field trips were offered to the Mount Arrowsmith Biosphere Reserve, Baynes Sound, Winchelsea/Ballenas Archipelago, and Carmanah Walbran Provincial Park. The weather cooperated nicely.

The local committee did an outstanding job, and many people commented how well-organized the meeting was. The committee chair was Doug Bertram; he was assisted by Shelagh Bucknell, Ron Ydenberg, Mark Hipfner and many others. [Editor's note: Among the things this committee deserves credit (?) for was the biggest-ever dessert buffet at the banquet; there was even an ice cream sculpture.]

### STUDENT TRAVEL AWARDS

PSG was able to provide financial assistance to attend the meeting, thanks to generous contributions from the Canadian Wildlife Service and the U.S. Fish and Wildlife Service. Successful applicants included Sarah Davis, Adrian Gall, Who-Seung Lee, Matthew Logan, Heather Major, Rosana Paredes, M. Zachariah Peery, Samantha Richman, Brian Walker, Tammy Steeves, and Stephanie Zador

### STUDENT AWARDS FOR PAPERS AND POSTERS

PSG has long recognized that our strength is in our young and innovative members, and we encourage all students to present their work at our annual meetings. Each year PSG presents awards for the best student paper and the best student poster. This year we are happy to announce that Rosana Paredes from Memorial University of Newfoundland won the best student paper award for her presentation on "Do time depth recorders affect chick provisioning behavior in Thick-billed Murres (*Uria lomvia*)?". Heather Wilson from Anchorage, Alaska won the student poster award for her work on "Concentrations of trace elements in blood of Spectacled and King Eiders in northern Alaska."

—David Irons

### RESPONSE TO PARTICIPANT QUESTIONNAIRE

For the second year, a questionnaire was prepared for attendees of the PSG annual meeting. Here are the responses for the 30<sup>th</sup> Annual Meeting in Parksville, BC.

*Did you attend the 29<sup>th</sup> Annual Meeting in Santa Barbara?*

Yes—32

No—14

Other—0

*How many days did you attend the 30<sup>th</sup> Annual Meeting in Parksville, BC?*

1 day—0

2 days—0

3 days—7

4 days—22

5 days—12

6 days—4

*Do you plan to attend the 31<sup>st</sup> Annual Meeting in Mexico?*

Yes—38

No—2

Other—6

*Do you think you received a reasonable value for your registration fee?*

Yes—44

No—1

Other—1

*If a secure web site were available, would you use it to pay registration fees by credit card?*

Yes—37

No—6

Other—3

*Did you find the abstract submission process via the web site useable?*

Yes—25

No—0

Other—21

*Did you receive sufficient information via the web site without paper mailings?*

Yes—35

No—10

Other—1

*Did you attend a pre-conference committee meeting?*

Yes—21

No—25

Other—0

*Did you like having plenary speakers, and were there too many, too few, or just right?*

Just right—35

Too many—9

Too few—1

Other—1

*Was there sufficient space to view the posters?*

Yes—29

No—6

Other—1

*Did you like having a dedicated time to view posters?*

Yes—45

No—0

Other—1

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*Did you like having symposia, and were there too many, too few, or just right?*

Just right—29

Too many—6

Too few—1

Other—10

*Did you like having social events/mixers, and were there too many, too few, or just right?*

Just right—37

Too many—1

Too few—4

Other—4

### GENERAL COMMENTS

Many people liked the meeting and were happy with the location. The local committee was repeatedly complemented for the wonderful job they did in organizing and running the technical aspects of the meeting. High praise was given to the session chairs for keeping the speakers on time, which allowed the concurrent sessions to run smoothly. People liked having the cost of lunch paid as part of the registration fee because it allowed

people to interact more and get back to the meetings on time. Several people noted that the rooms could have been a bit larger with higher ceilings—the screens would have been easier to see. People talking outside of the meeting rooms were disruptive to some.

There were several comments made by only one or two people. These included: lower-quality talks should be presented as posters; the detailed program should be on the website prior to the meeting, so people can find out when they are speaking; cost for using the hotel's business center was high; 10 minutes is too short for an oral presentation; the style of the printed program was good; the program needed more room on pages of abstracts for notes; T-shirts should be offered for sale; the lunchtime Conservation Committee meeting did not work well; and PSG needs to spend more money on conservation issues.

—David Irons

### MINUTES OF 2003 EXCO MEETING

*Pacific Seabirds* routinely publishes a summary of the minutes for each year's PSG Executive Council meeting. This year the summary will appear in the fall issue.

### PSG PLANS 2005 MEETING IN PORTLAND WITH WATERBIRD SOCIETY

The Pacific Seabird Group and the Waterbird Society will meet jointly in January 2005, in or near Portland, Oregon. Dates of the meeting are still to be determined, but will probably take place between the 2<sup>nd</sup> and 4<sup>th</sup> week of January. Katie O'Reilly will organize the local committee. More information will be available by the time of the 2004 meeting.

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## CORRECTIONS

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It was inadvertently stated in *Pacific Seabirds* 29:97 (2002) that the Department of Defense is completely exempt from the Migratory Bird Treaty Act. In fact, the military is exempt only from incidentally taking birds in the course of

other activities; it remains subject to the Act and its permit requirements when its personnel intentionally kill birds (e.g., at airports for safety reasons).

In *Pacific Seabirds* 29(2), 2002, the footer on pages 81-91 erroneously said

it was volume 28. Apologies to the authors. Other pages were correctly labeled.

If you notice an error in *Pacific Seabirds*, please let the editor know.

# SEABIRD NEWS

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## GLOBALLY THREATENED BIRD UPDATE

BirdLife International is compiling a "Globally Threatened Bird Update." This will be fed into the 2004 revision of the Red List, to be issued by the International Union for the Conservation of Nature. On-line forums were held through August 2003 on topics of the greatest concern, including Pacific birds and seabirds in general. Topics ranged from whether to adjust a species' level of listing, to whether demographic data for a threatened species can be extrapolated from a related one that is abundant. Species that were discussed included Short-tailed, Black-footed, and Laysan Albatrosses (*Phoebastria albatrus*, *P. nigripes*, and *P. immutabilis*), Ashy Storm-Petrel (*Oceanodroma homochroa*), Black-vented, Sooty, and Newell's Shearwaters (*Puffinus opisthomela*, *P. griseus*, and *P. newelli*), Ivory Gull (*Pasgophila eburnea*), Red-legged Kittiwake (*Rissa brevirostris*), Xantus's Murrelet (*Synthliboramphus hypoleucus*), and Marbled, Kittlitz's, and Long-billed Murrelets (*Brachyramphus marmoratus*, *B. brevirostris*, and *B. perditus*).

Comments and draft documents can be viewed at <http://www.birdlife.net>.

Search for "Globally threatened"; from there, you can download documents or select "Globally Threatened Bird Forms."

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## CONFERENCE EVALUATES METHODS FOR MONITORING AUKLETS

At the Alaska Seabird Working Group Meeting in March 2003, a symposium was held on the problems of monitoring auklet populations. Topics included the traditional methods of counting birds on the surface and mark-resighting; new ideas included indices based on lichen cover on rocks, infrared and remote sensing, area occupied by the colony, and sound levels at the colony. Recommendations on ancillary data to help analyze population changes included stress hormones, population genetics, and population modeling. A full report on the recommendations is planned for the next issue of *Pacific Seabirds*. For more information contact David Irons, U.S Fish and Wildlife Service, Anchorage, Alaska ([David\\_Irons@fws.gov](mailto:David_Irons@fws.gov)).

## ALBATROSS FROM TERN ISLAND FOUND ON HOKKAIDO BEACH

The carcass of a five-year-old Laysan Albatross was recovered on a beach at Erimo, Hokkaido, Japan on 19 August 2003. The U.S. Fish and Wildlife Service reported that the bird was banded on 29 May 1997 at Tern Island, French Frigate Shoals, Hawaii. Laysans are known to travel throughout the western Pacific, but biologists appreciate every opportunity to document age-specific movements.

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## WEBSITE GIVES BIRD TAXONOMY AND DISTRIBUTION DATA

A new website called Avibase contains taxonomic and distribution information for 10,000 extant species and 22,000 subspecies of birds, plus some extinct species. The creator of the site, Denis Lepage, says that it contains close to a million records, including 300,000 occurrence records and 180,000 synonyms in over a dozen languages, and represents 12 years of work. The URL for the site is <http://www.bsc-eoc.org/avibase/avibase.jsp>

# ABSTRACTS

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## ABSTRACTS OF PAPERS AND POSTERS PRESENTED AT THE 30<sup>th</sup> ANNUAL PACIFIC SEABIRD GROUP MEETING Tigh-na-Mara, Parksville, British Columbia 19-22 FEBRUARY 2003

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**Oceanographic climate, euphausiids, and auklet nesting: effects of regime shifts on phenology, diet, and growth of a planktivorous seabird**

Christine L. Abraham and William J. Sydeman. Marine Science Division, Point Reyes Bird Observatory, 4990 Shoreline Hwy, Stinson Beach, California, 94970, USA; cabraham@prbo.org

Ecosystem regime shifts transpired in the North Pacific Ocean in 1976-77, 1989-90, and most recently in 1998-99. Evidence suggests that zooplankton abundance and distribution varies significantly interannually and between regimes. In central California, Cassin's Auklets forage on the euphausiids *Thysanoessa spinifera* and *Euphausia pacifica*, and the abundance of these species is hypothesized to depend upon seasonal changes in the timing and intensity of upwelling, and the corresponding variance in sea temperature. In this paper, we investigate the ecological consequences of inter- and intradecadal variability in winter and spring oceanographic climate in the southern California Current System (CCS) by examining the timing of breeding, growth, diet composition, and parental provisioning of planktivorous Cassin's Auklets from 1973 through 2001.

Interannual quadratic trends were present in several mean monthly values of upwelling (UI; negative) and sea temperature (SST; positive) over time; significant effects of regime were also observed. The harvest of *T. spinifera* and *E. pacifica* by auklets showed significant opposite quadratic trends through time, but with no significant effects of regime. Diet sample mass decreased significantly through time, becoming lower with each regime. There was significant interannual

variability in auklet growth rates, but we found no significant effect of regime on growth. We used a backward stepwise regression procedure to determine relationships between oceanographic conditions, diet and growth. The best model was one that incorporated the proportion of *T. spinifera* in the diet and the difference between May and March SST (reflecting the strength of the spring transition).

There is some indication that euphausiids responded to changes in ocean climate as indexed by auklet diet composition and provisioning mass. Our results support the idea that both spring upwelling and sea temperature influence euphausiid availability, at least as measured by auklet diet composition and provisioning amounts. The overall decline in parental provisioning amount over time is consistent with the observation that zooplankton biomass in the CCS has declined by 80% in recent decades. Growth rate was related to spring sea temperature and this effect is likely mediated through variable euphausiid abundance. We plan further studies on the foraging effort or strategy of individual parents under variable oceanographic conditions, and how these individual contributions affect nestling growth and development.

**Inland flight patterns of nesting and non-nesting Marbled Murrelets in redwood National and State parks during the 2001 and 2002 breeding season**

Brian C. Acord, Richard T. Golightly, and Percy N. Hebert Department of Wildlife, Humboldt State Uni-

versity, Arcata, California 95521, USA; bca4@humboldt.edu

Marbled Murrelets (*Brachyramphus marmoratus*) were captured at sea and radio-tagged in April and May 2001 (n = 23) and 2002 (n = 44) near Redwood National and State Parks, California. Birds flying inland were followed from ocean to inland use sites using a combination of automated remote telemetry recording stations and mobile human-operated telemetry. In 2001, 5 murrelets initiated nests and 14 non-nesting (nesting not detected) murrelets flew inland routinely. In 2002, 21 murrelets initiated 19 nests and 16 non-nesting murrelets flew inland routinely. For murrelets that initiated nesting, data was stratified by the breeding stage (pre-nest, incubation, nestling, and post-fledging). For birds with adequate data, geographical flight paths and the timing of flights were similar for dawn flights across nesting and non-nesting murrelets. Evening flights differed between nesters and non-nesters. Inland flights of Marbled Murrelets after fledging or nest failure may have important behavioral or social considerations.

**Food habits of chick-rearing Cassin's Auklets nesting on Prince Island and foraging in the Santa Barbara Channel, California during a prolonged La Niña event**

Josh Adams<sup>1</sup>, John Y. Takekawa<sup>2</sup>, and Harry R. Carter<sup>3</sup>. <sup>1</sup>U.S. Geological Survey, Western Ecological Research Center, Western Ecological Research Center, San Francisco Bay Estuary Field Station, P.O. Box 2012, Vallejo, California 94592 USA and Moss Landing Marine Laboratories, 8272 Moss Landing Road, Moss

## ABSTRACTS

Landing, California 95093, USA; josh\_adams@usgs.gov; <sup>2</sup>U. S. Geological Survey, Western Ecological Research Center, San Francisco Bay Estuary Field Station, P. O. Box 2012, Vallejo, CA 94592, USA; <sup>3</sup>Humboldt State University, Department of Wildlife, Arcata, CA 95521, USA

We investigated the prey delivered to nestling Cassin's Auklets *Ptychoramphus aleuticus* coincident with measured foraging areas of adults during three consecutive chick-rearing seasons (1999–2001) on Prince Island, California. Radiotelemetry demonstrated prolonged spatial and temporal consistency in adult foraging dispersion, with subtle intra- and interannual differences. While rearing chicks, auklets restricted foraging to within 45 km from their colony, and aggregated over insular shelf waters near the 200 m isobath, demarcating the southern rim of the Santa Barbara Basin. During late 2000 and throughout 2001, auklets ranged over deeper basin waters. In all years, adults provisioned nestlings, primarily with euphausiids (86% and 65% by number and mass respectively), age-0 fishes (8% N and 29% M), and minor amounts of cephalopods (< 1% N and 4% M). According to the Geometric Index of Importance (GII), *Thysanoëssa spinifera* juveniles and adults were the most important items (GII = 64.5 and 55.4, respectively), followed by *Euphausia pacifica* (GII = 37.3), pleuronectid fishes (GII = 37.1), *Nyctiphanes simplex* (GII = 17.5), cephalopods (*Loligo opalescens*, and *Octopus* spp.; GII = 16.1), and rockfish (*Sebastes* spp.; GII = 14.9). Overall, diet diversity was high (51 unique taxa) including 15 species of copepods and 5 species of hyperiid amphipods. *Thysanoëssa spinifera* was most important during 1999 and 2001, whereas *E. pacifica* replaced *T. spinifera* in 2000 after an anomalous eastward inflection of the California Current occurred off Point Conception during Mar–April. During 1999 and 2000 auklets took adult *T. spinifera* during both halves of the season, but switched to juveniles presu-

ably as adults terminated spawning and became unavailable in the upper water column. During 2001, adult *T. spinifera* were poorly represented compared with juveniles indicating reduced local spawning. Auklet nesting phenology varied among years; hatching was early and protracted in 1999 compared with 2000 and 2001. Breeding success, pre-fledging mass, and nestling mass gain were similar in all years despite large variation in prey species composition. Auklets nesting on Prince Island take advantage of seasonally persistent aggregations of local euphausiids, and larval–juvenile fishes, with dietary composition determined in part by fluctuations in upwelling, regional circulation, and prey life history patterns.

### Fearing feathers: predation risk by avian predators affects behavior of Tufted Puffins

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Tufted Puffins (*Fratercula cirrhata*) forage at sea and provision nestlings diurnally so are potentially subject to predation by avian predators such as peregrine falcons (*Falco peregrinus*) and bald eagles (*Haliaeetus leucocephalus*). Puffins face the most predation risk when they approach or depart from a slope at the colony, and are safest in their burrows or on the water where they can escape predators. Predation has direct effects on populations because predators are lethal, and also indirect effects on the behavior of individuals due to fear of predation. If Tufted Puffins perceive a predation risk by avian predators then they should engage in behavior that will reduce their risk level. In 2002 on Triangle Island, British Columbia, we monitored behavior of puffins arriving and departing from the colony and scored occurrence of behaviors, and presence/absence of raptors, with an event recording program. Risky behaviors included landing and departure from the slope. We

predicted that behavior should be modified to reduce risk when raptors are present by either avoiding risky behaviors, or timing arrival/departure behavior to occur in groups to minimize risk to the individual. We found that risk of predation by raptors appears to have an impact on behavioral decisions made by Tufted Puffins; occurrence of risky behaviors was reduced when raptors were present, and individuals postponed slope departures so that they could move in a group when risk of predation was higher. Indirect effects of predation by avian predators on puffins have consequences for reproductive decisions.

### Seabird band returns from Peruvian fisheries [Poster]

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Peruvian fisheries were at one time the largest in the world. However, due to socioeconomic and cultural factors, ineffective regulations and deficiencies in law enforcement these fisheries have not been well managed. This is especially true with regard to the issue of bycatch. The bycatch of cetaceans has been documented in some fisheries. This provided information on mortality rates, distribution and occurrence of dolphins and whales off Peru. However, information on the interaction of fisheries with other protected species, such as sea turtles and seabirds, is still scarce.

During a project in 2002 to assess sea turtle mortality in fisheries we obtained bands from seabirds that occurred as bycatch in artisanal fisheries in Peru. Band returns were obtained from two locations along the Peruvian coast. First, in Mancora (04° 05' S, 81° 04' W) one band was recovered from an albatross that was caught by a local fisherman. Second, in Salaverry (08° 14' S, 78° 59' W) approximately 20 bands have been reported, mainly from the artisanal

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longline shark fishery. These bands included two return addresses: (1) U.S. Fish and Wildlife Service and (2) The British Museum. At least one band reported from Salaverry was from a Waved Albatross *Diomedea irrorata*, banded in June 1994 in the Galapagos Islands.

Commercial and artisanal fisheries in Peru represent an as yet untapped source of band returns and are therefore a potential source of information regarding levels of seabird bycatch and areas of occurrence off the Peruvian coast.

### Keep it simple—selection criteria of marine protected areas for seabirds

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Marine protected areas (MPA) comprise many forms, ranging from complete to limited restrictions on activities and scientists and resource managers are closely examining the criteria for MPA designation. In the Gulf of the Farallones, California, we identified several potential sites for marine protected area designation based on simple criteria including ecological, sociological and regulatory components. Ecological criteria included elements such as rarity and diversity of seabirds and other marine species, and source population significance. Sociological criteria took into account elements such as commercial and sport fishing effort. Regulatory criteria took into account jurisdiction, existing designations, and enforcement capabilities. We used a Geographical Information System (GIS) to analyze spatial relationships. For example, we mapped the distribution and abundance of common seabirds, the distribution of species diversity, the distribution of California Department of Fish and Game Block data and the spatial extent of jurisdictions. Applying GIS models, we identified MPAs using simple Boolean logic with the above criteria. Hot spots such as Point Reyes Headland, for example, ranked high for all criteria. Ecologically, the site is significant, exemplifying one of the few locations in

the world where major coastal upwelling occurs, and having great diversity and abundance of marine species, including nesting and roosting seabirds. Fishing effort is limited because of remoteness and hazardous conditions. Finally, Point Reyes Headland comes under the jurisdiction of several agencies. These simple GIS models, using basic criteria, allow managers to promptly identify MPAs without extensive, long-term research to justify designation.

### The diet of Arctic Tern chicks as a predictor of herring landings in the Grand Manan weir fishery [Poster]

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Information derived from seabirds is potentially useful to fisheries science. Seabird data as an estimate of prey availability are cheaper to obtain than traditional fisheries abundance indices. Seabirds interact with human fisheries by preying on the same prey species, by taking either the same or a younger age class. Consequently, correlations with commercial fisheries may be immediate or delayed depending on the age class of prey taken by seabirds. Arctic Terns (*Sterna paradisaea*) breeding on Machias Seal Island deliver age-0 herring (*Clupea harengus*) to their chicks; the youngest age class of herring taken by the commercial weir fishery of Grand Manan is age-2. If Arctic Terns can accurately predict the strength of recruitment of herring into the commercial fishery then the proportion of age-0 herring in the diet of Arctic Tern chicks in year  $x$  should be positively related to the commercial catch per unit effort (CPUE) of age-2 herring two years later. Information on diet was collected from terns in 1990–2000; herring weir CPUE (total

and age-2) for Grand Manan was obtained for 1992–2002. Linear regression revealed a nonsignificant relationship between the proportion of herring and CPUE of age-2 herring, but a significant relationship between the proportion of herring and total CPUE.

### Caspian Tern predation on juvenile salmonids in the mid-Columbia River

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We investigated Caspian Tern (*Sterna caspia*) predation on juvenile salmonids (*Oncorhynchus* spp.) in the mid-Columbia River in 2000 and 2001. We used a bioenergetics modeling approach to estimate total fish consumption by Caspian Terns nesting at Crescent Island, located near the confluence of the Snake and Columbia rivers. The predominant prey type in the diet of Crescent Island terns was juvenile salmonids, and we estimated that Caspian Terns breeding at Crescent Island consumed 465,000 juvenile salmonids (95% CI: 382,000–547,000) during the 2000 breeding season, and 679,000 juvenile salmonids (95% CI: 533,000–825,000) during the 2001 breeding season. Total salmonid predation by Crescent Island Caspian Terns was less than that reported for other predators in the Columbia River (i.e., Caspian Terns nesting in the Columbia River estuary and northern pike-minnow (*Ptychocheilus oregonensis*) in the John Day Reservoir, but more than that reported for gulls foraging at Wanapum dam. All of these predators have been, or are being, managed to reduce predation rates on juvenile salmonids. Consequently, the decision by state, federal, and tribal resource managers on whether to manage Caspian Terns nesting at Crescent Island will not be straightforward.



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### Biogeography of foraging strategies among procellariiform seabirds: how productivity in surrounding waters influences foraging

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Procellariiform seabirds exhibit high levels of parental care while they continue to forage for distant food resources and maintain their own body condition. Recent evidence suggests that many Procellariiform taxa balance the costs of parental care and maintaining their own body condition by alternating the length of foraging trips during the chick-rearing period. Several taxa alternate short (coastal, 1–5 days) and long (pelagic, 7–20 days) foraging trips thereby exhibiting a bimodal foraging strategy. However, this strategy is not universal among the Procellariiformes. The dual foraging strategy is not consistently observed among different populations of the same species and can vary from year-to-year for a population in a particular region. This presentation will address the biogeography and variability in foraging strategy among taxa that conduct unimodal versus bimodal foraging trips, or both. Variability in foraging strategy (unimodal versus bimodal trips) will be related to average productivity (chlorophyll *a*) of waters surrounding colonies, variability in productivity, and type of habitat surrounding colony. Distribution and the amount of production in the foraging environment of Procellariiform seabirds may influence strategies made by parents about how to provide for young. We will explore whether unimodal feeding in a relatively predictable environment with nearby resources can be just as profitable as an alternating foraging effort between near and distant resources.

**Variation in provisioning and fledging success of Red-throated Loons (*Gavia stellata*) in western Alaska: regime shift as a potential mechanism for long-term population decline [Poster]**

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Numbers of Red-throated Loons (*Gavia stellata*) in Alaska markedly declined in the past quarter-century, due to unknown causes. The other three members of the Gaviidae family, all of which nest sympatrically with the Red-throated Loon in Alaska, have remained stable, suggesting the reason for the decline may lie in the Red-throated Loon's greater reliance on the marine environment. Rather than providing young with fish and invertebrates from the nest pond, as is the typical habit of other loons, Red-throated Loons collect fish for their young away from the nest pond primarily in the marine environment. In recent decades, large-scale changes have occurred in the physical properties of the North Pacific and Bering Sea and, subsequently, the associated marine community including some small forage fish species. The resulting impact has been a decline in a number of top predator populations resulting primarily from a reduction in productivity. These changes may have also had important consequences in terms of the quality and/or quantity of prey available to Red-throated Loons when raising young. We are investigating the relationship between provisioning variation and growth and survival of pre-fledglings to predict to what extent hypothesized changes in the fish prey community might have impacted reproductive success.

### Contaminant residues in murre eggs from colonies in the Gulf of Alaska and Bering Sea

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Analyses of Common and Thick-billed (*Uria aalge* and *U. lomvia*) Murre eggs from colonies in the Gulf of Alaska and Bering Sea suggest substantial temporal, geographic, and species differences in residue levels of persistent organic contaminants and mercury. Recent results from St. George and Bogoslof Island Common Murre colonies in the Bering Sea compared to mid-1970s data collected at these locations suggest that substantial declines have occurred in some compounds over the last 30 years, while little or no change has occurred in others. Also, eggs from Gulf of Alaska murre colonies tended to contain higher concentrations of persistent organochlorine compounds and mercury than those from the Bering Sea colonies. Principal components analyses (PCA) of these patterns detected a geographic gradient, with the largest difference occurring between the northern Bering Sea (Little Diomedé I.) and the eastern Gulf of Alaska (St. Lazaria I., near Sitka). These differences may be due to regional differences in atmospheric and oceanic transport processes and food webs. Other differences found between organochlorine residue levels in Common and Thick-billed Murre eggs might also be due to differences in prey types and wintering areas used by the two species.

### Steroid hormones in yolk and allantoic waste of Common Murres (*Uria aalge*)—patterns within a subcolony [Poster]

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We examined temporal patterns of steroid levels in egg yolk in a subcolony of Common Murres (*Uria aalge*). Most studies of steroid hormones in avian egg yolk address within-clutch variation in hormone levels in terms of its role in mitigating the effects of hatching asynchrony. Later-laid eggs usually contain more androgens (testosterone and a precursor—androstenedione), which can increase growth and aggressiveness of chicks. Although female murres lay only one egg, subcolonies are analogous to multi-chick broods—late-hatched chicks are under pressure to fledge at a younger age in order to be synchronous with their earlier-hatched neighbors. Thus, we predicted higher androgen levels in later-laid eggs within a subcolony. We assessed embryonic exposure to steroids in two ways. First, we compared hormone levels in the yolk of earlier- and later-laid eggs from a subcolony. Later-laid eggs contained significantly higher amounts of androstenedione, but there were no significant differences in testosterone levels. Second, we examined steroid hormone levels in allantoic waste of earlier- and later-hatched chicks from a subcolony. Steroid levels in allantoic waste reflect everything processed by the embryo of both maternal (yolk) and endogenous origin. We found a significant negative relationship between levels of several steroid hormones and hatch date and growth parameters, but no significant relationships with testosterone. These results suggest that murre females do not alter testosterone deposition in yolk with respect to timing of laying, but do alter its precursor, androstenedione.

**Linkages between ocean climate variability, prey species, and nestling performance on Rhinoceros Auklets on Triangle Island, British Columbia**

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Mechanistic linkages between ocean climate variability and Rhinoceros Auklet (*Cerorhinca monocerata*) nestling diet and performance are examined using a 15 year time series from 1976 and 2001 on Triangle Island, BC. In the 1970s, sea surface temperatures in April were cool but they warmed significantly through to the 1990s. Temperatures peaked in 1998, cooled abruptly in 1999 and have since remained close to the long term average. 1204 nestling diet samples were collected during this period representing 17 species of fish from 15 families. Three species accounted for 72% by mass in 11 of the 15 years: Pacific sand lance (*Ammodytes hexapterus*), Pacific saury (*Cololabis saira*), and rockfishes (*Sebastes* spp.), in decreasing order of importance. Growth rate anomalies indicated a wide range of performance across years (2.6 g/day to 9.07 g/day), with poor years of growth being particularly common in the 1990s. Annual growth rates were positively related to fledging mass and fledging success. Nestling performance was closely linked to diet composition. Favorable performance was strongly dependent upon chicks being fed meals composed of a high proportion of sand lance. All measures of nestling performance were positively related to the proportion of sand lance in the diet. Spring sea surface temperatures (SSTs) were also related to diet composition. Annual proportions of both sand lance and Pacific saury declined significantly with an increase in SST. In contrast, the proportions of both rockfish and Pacific herring (*Clupea pallasii*) in the diet increased with increasing spring SST. Our data are consistent with the hypothesis that recruitment to sand lance populations within the foraging range of Rhinoceros Auklets within Triangle Island is reduced when temperatures are

warm. Consequently, chick growth rates decline significantly as spring SST increases.

**Using radar to refine marbled Murrelet habitat use patterns in northern California**

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A key conservation objective of the Pacific Lumber Company Habitat Conservation Plan is to understand patterns of inland habitat use by Marbled Murrelets (*Brachyramphus marmoratus*). In California, Marbled Murrelet habitat relationships are primarily based on information from Pacific Seabird Group (PSG) protocol inland surveys. However, the use of PSG protocol data to evaluate the conservation importance of lands set aside for Marbled Murrelets remains controversial, particularly when the detection probability may vary among habitats and survey conditions. To understand how audiovisual detections may be related to numbers of birds, we conducted simultaneous radar and audiovisual surveys in northern California at 51 sites that were distributed across a wide range of habitats. We found a strong positive relationship between the number murrelets detected by audiovisual and radar methods. On average, the density of murrelets detections was almost five times greater near the dark unentered old growth redwood stands than in the relatively open canopy residual (partially harvested old growth) stands. In contrast to observations made by audiovisual surveyors, the number of radar detected murrelets did not increase later in the breeding season. Finally, we discuss how this information may refine our understanding of Marbled Murrelet behavior and how it may help land managers identify nesting areas most important for the Marbled Murrelet conservation.

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### Ornament magnitude in relation to mate choice and body condition in Tufted Puffins (*Fratercula cirrhata*)

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Tufted Puffins (*Fratercula cirrhata*) are rare among seabirds for their high degree of ornamentation. Our purpose in this study was to assess: (1) the role of potential secondary sexual ornaments in mate choice, and (2) whether ornaments reliably indicate adult condition. We documented ornament variation with respect to a mate choice and body condition among breeding Tufted Puffins on Triangle Island, British Columbia. For estimates of ornament magnitude, we used digital photographs to measure the color of adult legs and elaborate head features. Preliminary results suggest that, for both sexes, carotenoid-based ornaments are indicative of body condition and are used in mate choice.

### Pelagic foraging areas of Cassin's Auklets and Rhinoceros Auklets breeding on Triangle Island, 1999–2002

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We describe the at-sea distributions of Cassin's Auklets (*Ptychoramphus aleuticus*) and Rhinoceros Auklets (*Cerorhinca monocerata*) breeding on Triangle Island, British Columbia. Between 30 and 40 chick-rearing Cassin's Auklets were marked with small radio

transmitters in early June in each of 3 years: 1999, 2000 and 2001. In early July 2002, 40 Rhinoceros Auklets were marked using the same protocol. Telemetry flights were conducted over high altitude (3000 m), large-scale grids to locate the marked birds during the chick-rearing period. Between 75 and 90% of the marked Cassin's Auklets confirmed to be attending the colony were detected at sea each year. In 1999 and 2000, most of the detected Cassin's Auklets were consistently 50–75 km southwest of Triangle Island in waters 1500–2000 m deep. In 2001, however, most birds were 60–90 km northwest of Triangle Island in waters >1500 m deep. In 2002, most of the detected Rhinoceros Auklets were located 50–70 km north of Triangle Island with several birds up to 100 km distant. Reasons for these at-sea distribution patterns and shifts across years remain to be determined but are likely related to variation in distributions, abundance and/or timing of preferred prey. These telemetry results will be useful to managers in delineating a Marine Protected Area (MPA) for the Scott Island group and in assessing the potential impacts of off-shore oil and gas exploration in the area.

### Lifetime reproductive success in Western Gulls: optimization or quality effects

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Studies of lifetime reproductive success (LRS) in Pacific seabirds are extremely rare, but critical for understanding the effects of intrinsic and extrinsic factors on the population dynamics of these long-lived species. We examined the role of life history traits in predicting LRS, the total number of chicks fledged per adult, in three cohorts of Western Gulls (*Larus occidentalis*) breeding on Southeast Farallon Island, California, from 1983 to 2002. LRS of 159 individuals from the 1979, 1980, and 1983 co-

horts were analyzed; 4 of these birds are still alive and breeding. We examined the effects of age of first breeding, cohort, sex, breeding lifespan (BL), and mean annual reproductive success (MARS) on LRS. BL and MARS were significant predictors of LRS, and together explained the majority of the variance in LRS. However, contrary to previous studies of seabird LRS, and the hypothesis that less productive birds drop out of samples as they age, BL and MARS showed significant quadratic rather than linear relationships with LRS. LRS increased initially with greater BL, plateaued for a BL of ~12–13 years, then decreased slightly for the greatest BLs. The highest LRS and BL values also were associated with an optimal MARS of fledging an intermediate brood size. In other words, breeders who lived the longest and were the most fecund breeders, on average, did not show the highest LRS values. These results indicate that Farallon Western Gulls may be optimizing annual reproductive success and breeding season longevity in relation to survival tradeoffs. Alternatively, birds showing a long BL may do so because they are poor breeders and rarely incur the costs of chick-rearing.

### Brood size affects adrenal responsiveness of free-living Black-legged Kittiwake chicks [Poster]

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Birds secrete corticosterone in response to perceived stressors, which in turn functions to facilitate individual survival through modulation of behavior and physiology. Because secretion of corticosterone is linked to nutritional state and sibling aggression, and brood reduction of Black-legged Kittiwakes (*Rissa tridactyla*) is linked to low forage

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availability, we hypothesized that 1) breeding success of adult Black-legged Kittiwakes would inversely correlate with their levels of plasma corticosterone; and 2) both baseline and adrenal responsiveness of individual Black-legged Kittiwake chicks would be inversely correlated with their status in the nest (third chick > Beta > Alpha > singleton) and brood size (3 chicks > 2 chicks > 1 chick). In a field study in Chiniak Bay, Kodiak AK (2001 & 2002) we monitored breeding success and collected blood from adult Black-legged Kittiwakes during late incubation for measurement of baseline levels plasma corticosterone. In 2002, we sampled blood for analysis of baseline and stress series levels of corticosterone from 10-day old Black-legged Kittiwake chicks of 1, 2, and 3 chick broods. Productivity (chicks fledged/nest attempt) in 2001 was significantly greater than in 2002 (0.71 vs. 0.48, respectively;  $P = 0.028$ ) and baseline levels of plasma corticosterone of adult kittiwakes were, as we predicted, inversely related to productivity, averaging 1.46 ng/ml in 2001 and 2.23 ng/ml 2002 ( $P = 0.040$ ). These data suggest that Black-legged Kittiwakes in 2002 may have experienced forage limitations during incubation. Contrary to our prediction, baseline levels of plasma corticosterone of kittiwake chicks in 2002 ( $4.41 \pm 0.70$  ng/ml) did not significantly differ among chicks of different status (singleton, alpha, beta, tertiary) or among chicks occupying nests of different numbers of occupants (1, 2, 3). As predicted, adrenal responsiveness of chicks to acute stress varied according to brood size with 3-chick broods exhibiting the most rapid and profound increases in corticosterone followed in rapidity and magnitude by 2-chick and 1-chick broods, respectively. However, adrenal responsiveness to acute stress did not vary according to chick status. These data suggest that all chicks of a multi-chick brood regardless of status experience more stress than do singletons and the amount of stress perceived by multi-chick broods increases with number of nest occupants.

### Effects of the Juan de Fuca eddy and upwelling on seabirds off southwest Vancouver Island, British Columbia

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Densities of seabirds measured year-round over the continental shelf off southwest Vancouver Island, British Columbia, Canada were compared with meso-scale averages of sea surface temperature. The fixed-strip transect (110 km total length) was divided into six legs (lengths 14–30 km) to sample different shelf habitats. Three foraging guilds were recognized: divers (dominated by Common Murres *Uria aalge* and other alcids), surface-feeders (dominated by California Gulls *Larus californicus* in summer, and other gulls year-round), and shearwaters (mainly Sooty Shearwater *Puffinus griseus*). Sea temperatures showed strong seasonal trends. During winter and spring (mid-Dec through mid-Jun) all six legs had similar temperatures in each survey. During summer and autumn (mid-Jun through mid-Dec), however, temperatures differed consistently by 1–2° C among the six transect legs. Cold surface temperatures were associated with wind-induced upwelling on the inner shelf and the effects of the strong eddy over the Juan de Fuca canyon. Bird densities matched this trend. Densities in winter and spring were low and did not differ significantly among the six legs for any species or guild. Densities in summer and autumn were higher for most species and all guilds, and many species showed significant differences in density among the legs. High summer/autumn densities were consistently associated with the inner shelf edge bordering the Juan de Fuca canyon or over the canyon. Cold temperatures alone did not explain the distribution of seabirds; inner shelf areas more than 15 km from the canyon had cold summer temperatures but low seabird densities. Upwelling associated with the canyon edge appears to produce the most productive foraging for seabirds. Identifying associations of seabirds

with meso-scale bathymetric and physical ocean processes is important because these processes can be monitored using satellite imagery. In the event of a major oil spill, which is likely off southwest Vancouver Island, critical areas for seabirds can be rapidly identified and monitored using satellites.

### Application of densities derived from radar surveys in the management of Marbled Murrelet habitat

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Five studies in British Columbia have compared the numbers of Marbled Murrelets (*Brachyramphus marmoratus*) entering watersheds from the ocean with the areas of old-growth forest within these watersheds. Radar was used to count the murrelets, and GIS and forest-cover maps were used to assess areas of habitat within watersheds. These studies were on the west side of Vancouver Island (Clayoquot Sound:  $n = 17$  watersheds; Northwest Vancouver Island:  $n = 20$ ), and on the British Columbia (BC) mainland (Sunshine Coast:  $n = 19$ ; Central Coast:  $n = 17$ ; and North Coast:  $n = 22$ ). All five studies reported significant correlations between murrelet counts and measures of habitat area. Linear and power curves best fit the data, depending on study area and definition of suitable murrelet habitat used. Using the habitat most likely to be used (as defined in each study) we calculated murrelet densities (birds per ha of suitable habi-

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tat). Densities differed significantly between the two West Vancouver Island studies (mean  $0.082 \pm \text{SD } 0.034$  birds per ha;  $n = 37$  watersheds) and the three BC Mainland studies ( $0.028 \pm \text{SD } 0.019$ ;  $n = 58$ ), but the differences within each of these large regions were not significant. The overall mean for all 5 studies was  $0.049 \pm \text{SD } 0.037$  birds per ha. The application and limitations of these density data in management and conservation of murrelet nesting habitat are discussed. It is obviously essential to use the same measure of habitat to derive the density estimate as is used to determine the area of habitat needed for a specified murrelet population, but in practice this is often difficult. The reliability of the method would also be improved if common measures of habitat suitability were applied to each data set.

### Seabird monitoring data: how are they used to suggest conservation actions and to evaluate ecosystem processes?

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Most long-term seabird monitoring programs have stated objectives that relate to one or both of the following: (1) conservation of one or more species of seabirds, and (2) using the response of seabirds as a reflection of changes in the marine ecosystem. The idea implicit in goal 1 is that time-series on vital rates (e.g., population trends and productivity) will describe "normal" variability and alert us to potential problems for the species. Goal 2 is meant to evaluate responses of seabirds to fluctuations in their environment thereby helping to explain the ecosystem processes involved and ultimately suggesting causes of observed changes in birds. These goals have been accepted as justification for funding various programs in the past 30 years, and multiple-decade data sets are beginning to accumulate for a number of species and sites. Even more support seems

to be gathering for long-term monitoring, and such programs are becoming institutionalized.

Using monitoring data for the conservation of seabirds includes detecting trends that suggest populations may be threatened with extinction. For example, population data coupled with knowledge about threats were used in the process of listing Marbled Murrelet (*Brachyramphus marmoratus*) and Xantus's Murrelet (*Synthliboramphus hypoleucus*). Declines of other species are documented, but we are not aware of a standard way of deciding when population declines are serious enough to "raise the flag" of concern. Neither is it always clear who is responsible for noticing significant indications of problems. Is it the individual investigator who works with the data set, or is it the responsibility of an agency? Just as PSG and some of its individual members have played an important role in the monitoring programs and listing process for the murrelets, we might be even more proactive in helping to develop guidelines for assessing the biological significance of changes in different species for various vital rates. In any case, it seems important to make advances in monitoring data interpretation to facilitate its usefulness for conservation purposes.

Using monitoring data to help to explain ecosystem processes implies that covariates are being measured as well. Events like El Niño provide a basis for gauging short-term responses. Also, physical characteristics are being measured such as sea temperature, weather variables, and indices (e.g. the North Pacific Index) that integrate physical variables. Nevertheless, there are scale mismatches relating to some of the broad-based physical measures, and an important gap exists in time series for primary productivity and prey abundance for most areas in the North Pacific. We do not know of an easy solution to data gaps, but PSG and its members may have an important role to play in advocating for such monitoring systems.

### The Prestige oil spill in Spain [Poster]

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The oil tanker *Prestige*, carrying a cargo of 77 tons of heavy bunker oil, sank off the coast of Galicia (northwest Spain) on 19 November 2002. As a result, several hundred oiled seabirds were collected from hundreds of kilometers of oiled beaches during the first few weeks after the ship sank. Seabird distribution in the offshore waters of Galicia has not been studied well, and as a result, the impact of this spill on vulnerable populations is difficult to predict. Preliminary data on the identification of oiled carcasses suggests that the most numerous victims (in decreasing order of abundance) have been: juvenile Razorbills (*Alca torda*); winter visitors), adult Atlantic Puffins (*Fratercula arctica*; winter visitors), adult European Shags (*Phalacrocorax aristotelis*; residents), adult Northern Gannets (*Morus bassanus*; passage migrants), and juvenile Common Guillemots (*Uria aalge*; winter visitors). By 23/24 Nov 2002, it was estimated that over 80% of Yellow-legged Gulls (*Larus cachinnans michahellis*) seen in coastal Galicia were oiled, but relatively few of these were found dead or were received in rehabilitation centers. We will present seabird mortality data for birds collected and pro-

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cessed during the initial weeks of the spill. In addition, we will discuss how this event dramatically illustrates the need for (1) an effective European oil spill contingency plan and (2) subsequent impact assessments for wildlife.

### Assessing the risks to Marbled Murrelets from a proposed wind turbine generation project on Rumble Ridge, Vancouver Island

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The growing interest in wind power generation in coastal areas of the Pacific Northwest raises the problem of collisions with seabirds, and whether or not the potential for collision with towers and wires poses risks to populations, especially for rare species. We used high-frequency marine radar to count Marbled Murrelets (*Brachyramphus marmoratus*) flying across a proposed site for wind turbine electrical generators on Rumble Ridge, near Port Alice on northwest Vancouver Island. Radar counts supplemented with audiovisual surveys were done at four stations spanning the proposed wind farm, at dawn and dusk from 22 to 26 Jun 2002. Murrelets were detected at all stations but rain prevented accurate counts at two stations. Overall, we estimated that 50–100 murrelets flew along and over the ridge at dawn during the peak of the breeding season. Few of these murrelets appeared to nest within or near the areas scanned, and most were evidently headed to nesting areas elsewhere. Concurrent audiovisual surveys at the radar stations recorded no murrelet detections. The murrelets flying along the ridge represent 0.63–1.25% of the estimated northwest Vancouver Island population (~8000 murrelets). The number of

murrelets nesting in the watersheds surrounding Rumble Ridge is not known, but a small percentage of the regional population is expected to nest in those watersheds. We assessed risk of collisions with turbines and wires by considering the height at which murrelets typically fly, numbers of murrelets, flight paths and the area covered by the rotating turbine blades. Experience at other wind projects suggests that some birds might come into contact with turbines. We suspect that very small numbers of murrelets may collide with turbines, but many uncertainties exist. Even if murrelets do collide, it is impossible to assess impact to local populations without knowing the size of those populations. A post-construction monitoring program is required to reliably estimate rate of collisions, and data on the origin and numbers of birds passing by the site are needed to estimate risk to local populations. The lack of data on local populations, the difficulty in obtaining those data for a species such as Marbled Murrelet, and the uncertainties regarding the ability of murrelets to avoid collisions with turbines highlights the challenges of assessing risk pre-construction.

### The influence of food availability on life history parameters of Parasitic Jaegers in Shetland

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Several studies have shown that seabirds seem to have a certain amount of "spare" time and that this can be used to buffer against environmental perturbations. Increases in breeding effort, such as increased foraging effort could lead to the effects of food shortage on breeding success or chick growth being masked by changes in the seabirds' behavior. However, life-history theory predicts that individuals will only increase their present breeding effort if this does not decrease their probability of survival

or of breeding successfully in later seasons.

Parasitic Jaegers (*Stercorarius parasiticus*) breeding in Shetland feed predominantly by kleptoparasitism, stealing sandeels (*Ammodytes*) from Arctic Terns (*Sterna paradisaea*), Black-legged Kittiwakes (*Rissa tridactyla*), Atlantic Puffins (*Fratercula arctica*) and Common Murres (*Uria aalge*). During the 1980s the sandeel stock around Shetland declined dramatically and caused widespread breeding failure of many of these seabird species. Recruitment of sandeels increased during the 1990s, but during the 2001 and 2002 breeding seasons there seemed to be a similar shortage of sandeels in the waters around Foula, effecting most of the seabirds nesting there. Empirical data suggest a strong influence of sandeel stock size on Parasitic Jaeger breeding success.

This paper examines evidence that food shortage contributed to the poor breeding success in the Parasitic Jaeger colony on Foula by looking at the effect of a supplementary feeding experiment. Various parameters were measured for the control and experimental groups of birds including attendance on the territory, chick growth rates, breeding success, condition of the adults and return rate to breed the following season, which has been shown to be a good indicator of survival rate. The analysis of these measurements allows us to gauge the impact of food availability on the different parameters and predict the long-term effects on the Parasitic Jaeger population.

Adult body condition in terms of protein stores was measured using a pectoral muscle index. This was obtained by taking the pectoral muscle profile and various body measures and calculating the pectoral muscle volume corrected for the size of the bird. A more general measure of condition was also obtained from body mass corrected for size. Birds were caught during incubation at the beginning of both the 2001 and 2002 seasons and during chick rearing in the 2001 season.

Feather samples were taken from chicks in the control and experimental groups for stable isotope analysis. The

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stable isotope signatures for sandeels and the supplementary food (cat food) are very different, enabling us to quantify the amount of supplementary food that is incorporated into chick tissues.

Results of these studies will be presented to test the hypotheses that (a) breeding success is constrained by food supply and (b) seabirds allocate resources as a tradeoff between reproduction and survival.

### Distribution patterns of Common Murres *Uria aalge*: underlying behavioral mechanisms in the context of predator-prey theory

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Although distribution patterns of seabirds at sea have been described for decades, it remains difficult to identify the mechanisms underlying these patterns. For instance, researchers focusing on prey distribution as the primary determinant of seabird distribution have found high variability in the spatial overlap of bird and prey aggregations, partially due to the scale-dependent nature of such associations. We conducted a study to identify the behavioral mechanisms that underlie distribution patterns of Common Murres *Uria aalge* on multiple spatial and temporal scales, while murres act as central-place foragers during chick-rearing. The study was conducted on and around Funk Island, the largest colony of murres in eastern Canada (~400,000 breeding pairs), situated on the northeast coast of Newfoundland from 1998 to 2000. Due to high energetic demands during chick-rearing, we focused on elucidating search strategies used by murres to locate aggregations of prey, primarily capelin *Mallotus villosus*. To do this, we quantified (1) individual- and population-level arrival and departure behavior of murres from the colony

via colony- and vessel-based observations in combination with (2) direct measurements of the distribution, abundance and spatial and temporal persistence of capelin aggregations within foraging ranges from the colony (~100 km). Directions of return and departure flights of murres measured from the colony did not match during the same period, indicating that murres departing the colony did not use information on prey distribution provided by the flight paths of returning flocks of birds to the colony (Information Center Hypothesis). High-abundance aggregations of capelin were found to be persistent within specific 2.25 km areas ("hot spots") for up to two weeks within one year, suggesting that murres could use memory to locate hot spots on a coarse scale (1–100 km). Specific commuting routes (regular flight paths) of murres toward and away from hot spots were obvious at sea, and feeding murres consistently marked the location of capelin schools within hot spots. This provided excellent conditions for murres to locate capelin schools on both coarse- and fine- (1–1000 m) scales by cueing to activities of conspecifics (local enhancement). Further studies in this area (2000–2002) revealed that hot spots of capelin are persistent among years due to habitat selection by capelin for suitable demersal spawning sites. Therefore, throughout a lifetime in this region, marine predators could learn the locations of hot spots, resulting in the use of traditional feeding grounds through generations. These hot spots of predators and prey allow the maximization of energy transfer among trophic levels in complex marine food webs. Human predators also tend to concentrate fisheries activities within these areas and, thus, there is an eminent need to identify hot spots for protection to maintain the stability of large-scale ecosystem processes.

### Eider migration and collision potential and Northstar Island, Alaska

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We used ornithological radar and visual sampling to determine factors affecting eider migration and collision potential at British Petroleum's Northstar Island, an artificial oil production platform located offshore in the Beaufort Sea. We also evaluated the effects of an anticollision lighting system in repelling eiders from the island. Eider (*Somateria* spp.) migration rates were pulsed and were affected by date, precipitation (higher during no precipitation), and winds (higher with tailwinds than all other wind types). Velocities (highest with tailwinds) and flight directions (variable with relative wind direction) were affected only by winds. Flight behaviors were consistently directional and were affected only by moon phase and visibility (highest proportion of nondirectional flight behavior occurred around the full moon if it was not visible). Island-passing success was not affected by any factors, but passing distance was greater during poor visibility and when winds were not calm. Eiders flew farther from the island when anticollision lights were on, but the response was not pronounced. Eiders flew at a mean altitude of 8 m (i.e., at altitudes low enough for collision) and exhibited no fine-scale behavioral responses to the island. These preliminary results suggest that, although the anticollision lights caused changes in spatial distribution that increased avoidance of the island, the amount of change that they caused was small.

### A century-long decline in $\delta^{13}\text{C}$ in an Arctic seabird: monitoring the consequence or cause of climate change

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Decadal decreases of  $\delta^{13}\text{C}$  in the tissues of Bering Sea marine mammals have been interpreted as a sign of de-



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creases in primary productivity in the last half century. While variation in  $\delta^{13}\text{C}$  in marine biota can be related to changes in rates of primary productivity, it can also occur in response to changes in the isotopic composition of the source carbon in the atmosphere or ocean, or in the case of mobile upper trophic level consumers, changes in distribution. Black Guillemots (*Cepphus grylle*) are an arctic seabird that winters on the Bering-Chukchi shelf in and next to the pack ice. Feathers obtained from museum specimens and live birds from 1898 to 2002 provide a record of  $\delta^{13}\text{C}$  for the western arctic that is twice that examined in marine mammals. The feathers reveal a century-long decrease in  $\delta^{13}\text{C}$  from approximately  $-16.5\text{‰}$  at the end of the 19th century to approximately  $-18.0\text{‰}$  in contemporary birds, with the decrease accelerating in the middle of the 20th century. The magnitude and timing of this change is similar to that found in atmospheric  $\delta^{13}\text{C}$  over the same period. The latter is attributed to increases in emissions of anthropogenic  $\text{CO}_2$  which is depleted in  $\delta^{13}\text{C}$ . Arctic biota will be among the first to show the effects of climate change because warming in the region is occurring sooner and faster than at lower latitudes. Additionally the snow and ice habitats that dominate the region can respond directly to changes in air and sea temperature. However, while increasing climate variability can be expected to modify marine productivity and the distribution of marine organisms in the region, it appears that much of the decrease in  $\delta^{13}\text{C}$  on the Bering-Chukchi shelf can be attributed to changes in the composition of atmospheric carbon caused by increasing anthropogenic emissions of  $\text{CO}_2$ .

**Are you what you eat? Fatty acid analyses of seabirds and their prey** [Poster]

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Fatty acid analysis (FAA) is a relatively new procedure that is being used to examine animal diets. The main principle of FAA is that dietary fatty acids are deposited in adipose tissue with very little alteration. As a result, predator fatty acid signatures should be similar to the signatures of their prey. Adipose tissue accumulates in animals over time, thus this method can be used to infer diet composition over a longer time scale than gut content analysis alone. As part of a multi-year study, we are examining the impacts of seabirds on out-migrating salmon smolts in the mid-Columbia River using gut content and fatty acid signature analyses. From Apr to Aug 2002 we sampled adipose tissue and gut contents of Double-crested Cormorants (*Phalacrocorax auritus*), Caspian Terns (*Sterna caspia*), and Ring-billed and California Gulls (*Larus delawarensis* and *L. californicus*) collected from the Rock Island Dam tailrace and select breeding colonies within the larger region. This sample set will give us the ability to compare and contrast predators with their prey, birds collected at different distances from the river, as well as a range of life history characters (e.g. age and sex).

**The North Pacific Pelagic Seabird database (NPPSD): status, examples, and progress towards integration** [Poster]

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The need for comprehensive geographic data on the pelagic distribution of seabirds has long been recognized. Although there are a large number of datasets with detailed information on the pelagic (at-sea) distribution of seabirds in the North Pacific, integration of these datasets has been lacking. In a collaborative effort between the U.S. Geological Survey, U.S. Fish and Wildlife Ser-

vice, National Marine Fisheries Service, Canadian Wildlife Service, North Pacific Marine Research Institute, and many independent investigators, we are compiling available data on the distribution of seabirds (and marine mammals) at sea. These data are being archived in raw form, and are to be combined using a relational database. Tools for analyzing and mapping the data are under development, and we will create web-based and hard copy products for dissemination of the data to scientists, resource managers and the general public. Pelagic seabird distribution data can be used to: model, measure or predict immediate and long-term impacts of oil pollution on marine bird populations; detect and describe long-term changes in marine ecosystems; identify fine- and coarse-scaled features of marine habitats; estimate population sizes of rare or threatened species that are impossible to census using traditional methods; examine seasonal movements and winter habitat use by seabirds; assess potential conflicts between commercial fisheries and marine birds (e.g., longline fisheries and albatrosses); plan and manage marine reserves; and disseminate natural history information to the general public, educators, and the tourism industry. Examples of datasets and preliminary products are provided.

**California Least Tern diet and foraging ecology: a comparison between dropped prey and consumed prey** [Poster]

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The endangered California Least Tern (*Sterna antillarum*) is a piscivorous plunge-diving seabird, feeding on small fishes generally found within the top meter of the water column. We studied the prey choice of Least Terns by collecting two types of diet samples at two breeding colonies in south-central Cali-

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Alameda Point (located on the former Naval Air Station, Alameda in San Francisco Bay) and Purisima Point (located on Vandenberg Air Force Base). We collected dropped fish and feces from Alameda Point during the 2002 breeding season and from Purisima Point during the 2001 and 2002 breeding seasons. For each year at each colony, we stored samples collected during the courtship/egg laying, chick rearing, and fledgling periods of the breeding season separately. We compared species and size compositions between sample types (by analyzing otoliths found in feces) and found that species compositions of dropped fish samples differed considerably by sampling method and site. Prey diversity from dropped fish samples decreased from the chick stage to the fledgling stage, suggesting that as the chicks grew older, they became more experienced at handling prey and dropped only those items that were extremely difficult to handle. Additionally, prey that dominated dropped fish samples from both the chick rearing and fledgling periods were hardly represented in the fecal samples. The deep-bodied surfperch species (*Embiotocidae*) were prominent in the dropped fish collections at both sites, while slender-bodied species dominated the fecal samples. Thus, it appears that dropped fish at the Alameda Point and Purisima Point were not surplus prey items and were not necessarily representative samples of Least Tern diet.

**Status, abundance, and colony distribution of breeding Pigeon Guillemots (*Cephus columba*) throughout the inland marine waters of Washington State, as captured by PSAMP efforts 1999–2002 [Poster]**

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The Pigeon Guillemot (*Cephus columba*) is the most widely distributed of the alcids that breed within the inner marine waters of Washington State. The Washington Department of Fish and Wildlife and U.S. Fish and Wildlife Service conducted censuses of guillemot colonies in May 1999–2002 to assess their status and population trends in the region. Counts, limited to 3.25 hours after sunrise of any given day, were made from boats at the 120 colonies listed in the Catalog of Washington Seabird Colonies (Speich and Wahl, 1989), and at over 300 other colonies not previously documented; these counts covered all the known guillemot colonies within the inner marine waters of Washington. All colonies were counted regardless of colony size, with replicates on at least 2 to 3 different days. Complete counts of all colonies were made in 2000–2002, as not all colonies had been documented by May 1999. For comparing yearly trends, colonies were stratified into localized areas to limit the bias of birds shifting between colonies between years. The average total count of breeding guillemots throughout the region ranged from approximately 14,000 to 16,000 from 2000 to 2002. Habitat types at each colony were documented to assess their importance to breeding guillemots.

**A biogeographic analysis of seabird distributional data from central California**

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As part of a biogeographic assessment in support of the revision of the management plans for the Gulf of the Farallones, Cordell Bank, and Monterey Bay National Marine Sanctuaries, we compiled and integrated data from all major seabird distributional studies in Central California since 1980. These included the Minerals Management Service (MMS) Aerial Surveys, Seabird Ecology Study, Rockfish Assessment cruises, Eastern Pacific Ocean Circulation Study (EPOCS) cruises, Office of Spill Prevention and Response (OSPR) overflights, San Francisco Deep Ocean Disposal Site (SF-DODS) cruises, and the National Marine Fisheries Service's Oregon, California, and Washington Line Transect Expedition (ORCAWALE) cruises. These data were used to examine the spatial distribution of all major species in the area relative to season and to El Niño-Southern Oscillation (ENSO) status. We also determined the geographic distribution of biomass and species diversity within the area. A geographically linked principal components analysis was used to delineate habitat types based on similarities in the species assemblages throughout the study area.

**Effluent discharges from offshore oil and gas platforms: what are the regulations and the potential impacts to marine birds?**

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Alaska, Newfoundland, and countries bordering the North Sea all have offshore oil and gas production and concentrations of marine birds. Here, I focus on how the legal discharge standards for effluents generated by the offshore oil and gas industry varies among regions, and outline the potential impacts these discharges may have on marine birds. Drilling fluids and cuttings, and produced waters are the three major sources of pollutants that are discharged into the ocean in huge quantities. For example, a single platform in production



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can average 9,400 barrels/day (1.5 million l/day) of produced water for a twenty-year period. These discharges cover a wide range of pollutants that include heavy metals and petroleum hydrocarbons. The effluents that can have an immediate impact on marine birds are the permissible discharges of oil and grease. Each country has specific restrictions regarding the amount of oil and grease in discharges: Newfoundland is 60 mg/l daily maximum and 30 mg/l monthly average, regulated by the Canadian-Newfoundland Offshore Petroleum Board; the United States (federal waters) is 42 mg/l daily maximum and 29 mg/l monthly average, regulated by the Environmental Protection Agency; and the North Sea countries is 40 mg/l monthly average under the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) guidelines. To put these numbers in perspective, the International Convention for the Prevention of Pollution from Ships requires that vessels cannot exceed an *instantaneous* oil discharge of 25.5 mg/l (15 ppm); quantities greater than 25.5 mg/l result in oil sheens on the water. The U.S. has additional regulations under the National Pollutant Discharge Elimination System that prevent the discharge of free oil. OSPAR guidelines do not appear to have regulations that prevent oil sheens from occurring. The offshore waste treatment guidelines for Newfoundland (and Nova Scotia) also do not have specific regulations that prevent oil sheens from occurring. This means that a platform can create an oil slick and still be in compliance. Of most concern is the Grand Banks, which has some of the world's highest densities of seabirds and the highest permissible discharges of oil of the three regions examined. Unfortunately, the Canadian-Newfoundland Offshore Petroleum Board has a very obdurate attitude towards tightening environmental regulations and more specifically towards the necessity of quantifying the impacts on marine birds from offshore oil activities. I will provide recommendations for improving the regulations, and discuss the data required to model

marine bird populations' responses to episodic oil pollution from offshore oil activities.

### **What lies beneath: how well do surface counts of auklets track numbers of breeding pairs:**

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Breeding populations of crevice-nesting Least Auklets (*Aethia pusilla*) and Crested Auklets (*A. cristatella*) are currently monitored throughout their range by counting individuals in plots on the colony surface. This technique is favored because one observer can monitor large numbers of plots and the data are relatively simple to collect and analyze. Counts of adult auklets on the talus surface are assumed to be representative of numbers of active auklet nests beneath the surface, although this assumption has never been tested. Some previous studies have suggested, however, that among-year variation in colony attendance could reflect changes in behavior associated with food availability more than changes in numbers of breeders. We tested the assumption that densities of Least and Crested Auklets on the talus surface are correlated with nesting density below the surface at a colony on St. Lawrence Island in 2001 and 2002. Surface counts on plots that had been covered with tarps to prevent bird access throughout the laying period were compared to counts on control plots during the mid-incubation to mid chick-rearing period. The treatment, which apparently prevented all nesting in crevices beneath the tarps, did not significantly affect the average number of adults subsequently counted on the surface ( $P = 0.67$ ), although counts from treatment plots had higher variance. Colony attendance as indicated by counts

on control plots differed between years for both species. Surface counts of Least Auklets were higher in 2002 than in 2001 ( $P < 0.001$ ), whereas counts of Crested Auklets were lower in 2002 than in 2001 ( $P < 0.001$ ). Despite opposite trends in colony attendance for the two auklet species, both species had higher reproductive success in 2002. While surface counts may provide an indication of among-year differences in colony attendance, they do not accurately reflect breeding population size or productivity. Other techniques, such as mark-resighting, show more promise for detecting year-to-year changes in numbers of breeding pairs, and should be used in conjunction with surface counts on fixed plots to assess changes in auklet breeding populations over time.

### **Reproductive ecology of Glaucous-winged Gulls on Kodiak Island, Alaska [Poster]**

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Because reproductive success of seabirds is both easily monitored and has been shown to be positively correlated with available food resources, seabirds may be useful indicators of foraging conditions just prior to and during their breeding season. The use of piscivorous seabirds as indicators of forage availability in the nearshore, east side of Kodiak Island, Alaska is integral to the Gulf Apex Predator-prey project (GAP). Reproductive variables of seabirds that are sensitive to the influence of food supply include but are not limited to hatching success, egg volume, and clutch size. In 2001 we initiated a multi-year study of the reproductive ecology of the Glaucous-winged Gull (*Larus glaucescens*) to investigate its utility as an indicator of

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local marine conditions. We monitored nests on six different colonies within Chiniak Bay, Kodiak Island and followed their fates on designated plots from nest initiation through hatch. In 2002 we expanded the scope of our research to include an additional colony. Hatching success was significantly different among colonies ( $\chi^2 = 64.91$ ,  $P = <0.0001$ ), and tended to be higher in 2001 than 2002 ( $\chi^2 = 3.45$ ,  $P = 0.06$ ,  $n = 314$  in 2001 and 330 in 2002). Egg volumes differed among colonies ( $F = 2.92$ ,  $P = 0.008$ ), but not between years ( $F = 0.07$ ,  $P = 0.79$ ,  $n = 251$  in 2001 and 311 in 2002) and there was no year-colony interaction ( $F = 1.01$ ,  $P = 0.40$ ). Mean clutch sizes differed among colonies ( $F = 6.57$ ,  $P < 0.0001$ ) but not between years ( $F = 2.92$ ,  $P = 0.09$ ,  $n = 314$  in 2001 and 330 in 2002) and there was a year-colony interaction ( $F = 2.35$ ,  $P = 0.04$ ). Because there were significant differences in hatching success, egg volume, and clutch size among colonies, future GAP hypotheses concerning Glaucous-winged Gull research will address and quantify factors that may contribute to those differences, including habitat characteristics, proximity of colonies to food resources, and foraging areas of breeding adults. In addition, we are expanding research on the physiology of Glaucous-winged Gulls and developing methodologies that utilize hematological measures of body condition that may serve as a proxy for breeding success and local foraging conditions in Chiniak Bay.

### Assessment of noise disturbance on nesting Marbled Murrelets in Redwood National and State Parks: a progress report on the first two years of study

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In April–May 2001 and 2002 we captured at sea 23 and 44 Marbled Murrelets (*Brachyramphus marmoratus*), respectively, and attached radio transmitters. Subsequently we identified 5 (22% of birds) and 19 (43%) nesting attempts in 2001 and 2002 respectively, that were all within a 42 km<sup>2</sup> area (minimum convex polygon of nest locations) within the Redwood National and State Parks (RNSP). Based on radio-detected attendance patterns, 3 of these nests successfully fledged young in 2001. In 2002, 2 were known to have successfully fledged young (although 6 additional nests had uncertain outcomes and may have fledged). In 2001, we conducted a noise experiment using a chain saw at one of the successful nests during the chick-period of nesting. In 2002 we conducted 7 similar experiments (4 nests during incubation and 3 nests during chick-rearing). For each experiment at each nest we compared behavioral changes (activity, posture) in video recordings of the 30 min pre-disturbance period, a 15 min disturbance with the running chain saw, and for 30 min post-disturbance. We also monitored 3 nests with persistent video to help identify behaviors and assist with determination of nest fates. Ambient noise levels at locations beneath nests were not different than ambient noise levels at random points in the nesting area that we investigated in RNSP.

### Seabird-fisheries overlap over time and space: preliminary results from the West Coast Groundfish Observer Program

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The spatial and temporal overlap of seabirds and fishery operations has both ecological and socioeconomic ramifications. The incidental mortality of seabirds such as the Short-tailed Albatross (*Phoebastria albatrus*) can potentially significantly impact population dynamics of these long-lived species as well as severely curtail the operation of fisheries along the entire west coast of North America. Along the coasts of Washington, Oregon and California, breeding and migrating seabirds overlap in space and time with a wide variety of offshore and nearshore fisheries, potentially leading to many seabird bycatch issues. In 2001, the West Coast Groundfish Observer Program began documenting non-target fish, seabird, and mammal bycatch by training and deploying observers on trawl, long-line, and pot-gear vessels in eleven port groups along the Pacific coast from Bellingham, Washington to Santa Barbara, California. During observer trips, the observers record information on date/time of departure, date/time of gear deployment and retrieval, latitude/longitude of gear deployment and retrieval, and gear type. In addition to any seabird bycatch in sampled hauls, observations of seabirds of interest seen during gear deployment and retrieval are reported, including species, number, date/time, latitude/longitude, bird activity, and any tagged or color banded birds. During the first year of observer coverage, the extent of seabird bycatch in samples was limited to two cormorants in one trawler haul. Although bycatch was limited, several species, including those of special concern, were observed during fishing operations throughout the observer coverage area. A number of individual Short-tailed Albatross were observed during hauls in the spring, summer and fall months from areas off the Washington coast to those off Monterey, California; Black-footed Albatross (*Phoebastria nigripes*) were also observed during these months, numbering from one to 150 individuals. The spatial and temporal overlap of seabirds and fisheries and the potential seabird bycatch issues along the west coast of North America require ex-

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tensive observer coverage and methodologies. In the future, we hope to more effectively estimate this overlap by adding seabird observation protocols that will more explicitly quantify seabird distribution and abundance with respect to fishing operations covered by the West Coast Groundfish Observer Program.

### **A physiological approach to determine reproductive status of waterfowl: applications for sea duck research and conservation [Poster]**

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Conservation of North American sea ducks is inhibited by a lack of knowledge regarding basic biology, as well as effective population monitoring techniques. We describe a non-lethal method to determine reproductive status of waterfowl, based on elevated blood plasma concentrations of the two main yolk precursors vitellogenin (VTG) and very-low density lipoprotein (VLDL) during rapid follicle growth (RFG). To test the applicability of this method for waterfowl, we characterized the dynamics of VTG and VLDL concentrations in female Greater Scaup (*Aythya marila*) during the breeding cycle on the Yukon-Kuskokwim Delta, Alaska. From 19 May to 21 Jun 2002, 58 females were collected, resulting in a data set comprised of individuals representing all reproductive stages, including prebreeding, RFG, laying, and incubating. Yolk precursor concentrations were evaluated in relation to follicular development determined by dissection. Circulating concentrations of VTG and VLDL were significantly different between discrete reproductive stages. Mean concentrations were low in prebreeding birds (0.71 µg/ml and 3.96 mg/ml, respectively). VTG concentrations increased rapidly during RFG to a mean of 3.35 µg/ml for birds with a full

follicle hierarchy, while VLDL concentrations increased only slightly during RFG to a mean of 6.75 mg/ml for birds with a full follicle hierarchy. Yolk precursor concentrations remained high through the laying stage and then decreased rapidly at clutch completion with the onset of incubation. Our results for VTG are consistent with other studies in passerines, although our results for VLDL dynamics indicate that at full follicle development concentrations are almost threefold lower in scaup than has been reported for passerines. Our work indicates that the dynamics of plasma VTG are a more reliable index of egg production than VLDL in waterfowl. This technique is a potentially powerful tool that can be used to develop a more detailed knowledge of factors related to sea duck productivity.

### **Diet of the Xantus's Murrelet in southern California [Poster]**

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Little is known about the diet of Xantus's Murrelets (*Synthliboramphus hypoleucus*). Based on radio telemetry studies, they are known to forage far from the breeding colony and from shore, but prey and feeding behaviors are not well understood and difficult to observe. Prey are not visibly held in adults' bills during feeding, highly precocial chicks depart from the nest at 2-3 days old without being fed by parents, and night-captured murrelets at breeding colonies have empty stomachs (based on lavage and endoscope techniques). The most knowledge about diet is from direct examination of stomach contents of 22 murrelets collected in May 1977 by Hunt et al. (1979) near Santa Barbara Island, California. Prey consisted of primarily larval northern anchovies (*Engraulis*

*mordax*), as well as other fish. To increase knowledge of diet and help interpret at-sea distributions (using radio telemetry) of murrelets in 1995-97 and 2002-03, we collected 10 murrelets south of Anacapa and Santa Cruz Islands, California, in May 2002. Prey consisted of juvenile northern anchovies, unknown fish (family Centrolophidae or Stromateidae), Euphausiidae, and unidentified fish bones. This small sample confirmed the continued importance of northern anchovies and other fish, but also shows that they feed on invertebrate euphausiids. Xantus's Murrelets appear to exploit a variety of prey species in southern California during the breeding season.

### **Male-female differences in parental care in Little Auks (*Alle alle*) [Poster]**

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Understanding differences in male and female care among closely related species that share biparental breeding systems can provide insights into the selective pressures that shape parental strategies. Among seabirds, the Alcidae (auk family) are particularly appropriate for this approach, since they exhibit wide variation among species both in parental care at the colony and post-fledge and in chick developmental strategies. However, the roles of males and females in parental care remain incompletely understood for some alcid species. The Little Auk (*Alle alle*) is an important example, because unlike other alcid species that have semi-precocial chick development, Little Auk chicks do not fledge independently, but are instead accompanied to the sea by one parent. Despite this in-

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triguing system of parental care, the details of differences between males and females during chick rearing and fledging have never been thoroughly studied, in part due to difficulties in sexing these birds in the field. Previous studies have shown a male sex bias in captured adults carrying chick meals during late chick rearing, and adults that have been collected while accompanying their fledged chick at sea have been male. However, since there have been no observations on marked, known-sex birds, sex differences in provisioning have only been inferred, and the non-provisioning aspects of parental care remain largely unknown. Using molecular sexing, we examined Little Auk parental care at the colony during the chick rearing and fledging periods by conducting observations on marked, known-sex pairs. There were no significant differences between male and female feeding rates or their time spent at the colony during the early- and mid-chick rearing observation periods. Males delivered significantly more meals and spent significantly more time at the colony than females during late chick rearing. Very few females were present at the colony during the end of the chick rearing and over the fledging period, and all marked parents observed accompanying their chick to sea were male. Although birds in general spent more time in the nest during early chick rearing, males and females did not differ in time spent in the nest during early and middle chick rearing. Very few aggressive interactions were observed. Based on these findings, we present hypotheses on Little Auk parental care in relation to phylogeny and physiological and ecological factors.

**Results of inland Marbled Murrelet surveys in the Straits Planning Unit, north Olympic Peninsula, Washington, USA [Poster]**

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The Washington Department of Natural Resources (DNR) is conducting inland surveys for Marbled Murrelets (*Brachyramphus marmoratus*) to develop an inventory of murrelet use of state forests. Information from these surveys will be used, along with additional knowledge, to develop region-specific, long-term conservation strategies as part of a Habitat Conservation Plan under the U.S. Endangered Species Act. The Straits (of Juan de Fuca) planning unit comprises about 62,500 ha of State Forests along about 200 km of the northern and eastern perimeter of the Olympic Peninsula. DNR studied murrelet habitat relationships there from 1995–1996, which allowed a spatially explicit prediction of DNR-managed forest stands likely to contain 95% of the occupied sites on state lands in the planning unit. The study predicted that this would occur in approximately 6000 ha of generally low to mid-elevation Douglas fir/western hemlock forest. These stands were then scheduled for murrelet surveys. We delineated 289 survey sites located from Lake Crescent, east to the Hood Canal and south to Shelton in the narrow strip of nonfederal land peripheral to Olympic National Forest and/or Park. Sites averaged 20.7 ha and ranged from 0 to 15 km from saltwater. We established 1169 survey stations at these sites, one station per 5.1 ha. Surveys were conducted by a private contractor (Hamer Environmental) from 2000 to 2002. Two-year surveys ( $n = 2713$ ) for occupancy according to the Pacific Seabird Group protocol found: 60 occupied sites (1370 hectares), 110 sites with murrelet presence only (2366 hectares) and 119 sites with no detections (2251 hectares). Detections were recorded on 374 survey visits (14% of visits). Occupied sites were distributed almost exclusively ( $n = 57$ ) in the northern and western portion of the planning unit from Lake Crescent to Sequim Bay. In 2003, 19 sites will receive second-year surveys and conclude the inland survey inventory of the planning unit.

**Resolving fine-scale environmental patterns using beached bird surveys**

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Over the past three years, the Coastal Observation and Seabird Survey Team (COASST) has grown incredibly in its scope—both geographically and in terms of volunteer participation. Presently, over 150 volunteers contribute beached bird and environmental data on at least a monthly basis across 65 sites in Oregon and Washington. Because of this broad expansion, we can now examine trends in deposition, persistence, and scavenging over increasingly fine temporal and geographic scales. In this paper we will discuss some of the surprising patterns that are emerging as result of this increased coverage. For example, in 2002, our geographically comprehensive coverage of the San Juan Islands revealed how extensively oil from an isolated spill or incident might be spread. Six of sixteen COASST beaches reported tarballs during Aug–Sep and the broad extent mimicked the distribution revealed by regional driftcard studies. In another example, direct evidence of falcon/eagle predation on juvenile gulls during fall has been hard to document by conventional observation (such as bill scratches left on the breastbone). However, our data show that a disproportionately high percentage of juvenile gull carcasses are initially discovered as partial (breast missing, 24%) versus intact (complete, 6%). We think that this is due to the immediate loss of the breast meat to a predator, rather than a quicker-than-average loss to scavengers. In comparison, other top-ranking taxa (ones less vulnerable to predation) such as murres and adult gulls are found in nearly equal frequencies in partial and intact condition—suggesting that scavengers find and eat carcasses in proportion to their abundance on the beach. A similar predation signal is also conspicuous in the list of species never found intact: eleven of 15 are shorebirds and ducks, favored prey of Peregrine Falcons. COASST has been able to docu-

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ment patterns like the above because we have chosen sampling frequencies and site locations that maximize our ability to discern temporal and spatial patterns without overtaxing our volunteers.

### Geographic variation in Pacific Northern Fulmars: are there two subspecies?

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Morphological variation in Northern Fulmars (*Fulmarus glacialis*) has been well studied in the Atlantic, where two subspecies are recognized: a large-billed, monomorphic light-phase form (*F. g. auduboni*) of the boreal zone (e.g. Britain, Faroes, Iceland, Newfoundland) and a small-billed, polymorphic form (*F. g. glacialis*) found in the high Arctic. Pacific fulmars are referred to a single subspecies, *F. g. rodgersii*. The current distribution of color phases suggests a virtual absence of gene flow among the major Pacific colonies, however, and measurements reveal marked variation in body size. Pacific fulmars comprise a small-bodied, mostly dark-phase form in the Gulf of Alaska, Aleutians, and Kurile Islands, and a larger-bodied, monomorphic light-phase form in the Bering Sea and northern Sea of Okhotsk. With one notable exception (Semidi Islands, western Gulf of Alaska), Pacific colonies tend to have only one or the other of two distinct color morphs, both differing in size and plumage from their Atlantic counterparts. Light-phase fulmars at the Semidi Islands (where 85% are dark) are smaller than light-phase birds in the Bering Sea. Thus, at least two subpopulations of fulmars exist in the North Pacific that (a) differ morphologically, (b) have non-overlapping ranges, and (c) show current evidence of highly restricted gene flow. There would seem to be strong justification for recognizing

two subspecies of Pacific fulmars. We further suggest that color polymorphism in arctic regions of the North Atlantic stems from introgression of dark-phase genotypes that evolved monophyletically and originally occurred only in the North Pacific.

### At-sea movements of radio-tagged Marbled Murrelets off the coast of northern California

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In 2001 and 2002 we captured and radiotagged 23 and 44 Marbled Murrelets (*Brachyramphus marmoratus*), respectively, in coastal waters adjacent to the Redwood National and State Parks complex in Humboldt County, northern California. We used fixed-wing aircraft to track radiotagged murrelets at-sea and in old-growth forest nesting habitats. In both years, 92% of murrelets with active radios were detected per flight. Murrelets typically foraged in near-shore waters (<2 km) between the mouth of Humboldt Bay, CA, and Brookings, Oregon. Minimum convex polygons were larger for murrelets that did not initiate nesting after capture compared to murrelets that did initiate nesting after capture. Minimum convex polygon size varied between male and female murrelets. Maximum north-south distance traveled is also compared between murrelets that did not attend nest sites and murrelets that did attend nest sites after capture, and between males and females (sexed with blood samples).

### Environmental predictability, foraging range, and timing of breeding in seabirds: Lack and Ashmole revisited

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Reproduction in birds is often timed to take advantage of peaks in resource abundance in order to maximize reproductive success. Seabirds have evolved two mechanisms to match breeding with peak resource (usually food) abundance: 1) they respond to fine-scale environmental cues that predict future resource availability, or 2) they time their breeding to a rigid annual cycle. Why should birds adopt one strategy over the other? Using a simple computer model of food availability for seabirds with large and small foraging ranges, we demonstrate that species with small foraging ranges have a more unpredictable food supply. The model assumes that for both types of foragers, prey varies on the same spatial and temporal scale, and there are no other differences in foraging ecology. Following the logic of this model, there is stronger selection for small-range foragers to time their breeding in response to the environmental cues that are more immediate predictors of increased resource availability (e.g., sea surface temperature). Because these predictors are often variable in time, we predict that small-range foragers will have a more variable phenology. In contrast, large-range foragers can more effectively buffer against temporary food shortages, which leads to weaker selection for responding to these environmental cues. We predict that large-range foragers will often have a less variable breeding phenology, and are more likely to time their breeding to coarse predictors of peak resource availability (e.g. day length). A comparison between foraging ranges and variability in timing of breeding in the Hawaiian seabirds lends support to this hypothesis.

### Associations of seabirds with subsurface predators in Hawaiian waters [Poster]

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Tropical seabirds are known to feed in strong association with subsurface predators such as tunas and dolphins. In waters around Oahu, Hawaii, during summer and fall of 2000 and 2001, 74% of these associations were with skipjack tuna (*Katsuwonus pelamis*). Seabirds were also observed feeding with yellowfin tuna (*Thunnus albacares*), mahi mahi (*Coryphaena hippurus*) and spotted dolphins (*Stenella attenuata*). Wedge-tailed Shearwaters (*Puffinus pacificus*) were the most abundant birds in the feeding associations, followed by Red-footed and Brown Boobies (*Sula sula* and *S. leucogaster*), Brown and Black noddies (*Anous stolidus* and *A. tenuirostris*), Sooty Terns (*Sterna fuscata*), Newell's Shearwaters (*Puffinus newelli*), White Terns (*Gygis alba*), and migrating Sooty and Short-tailed Shearwaters (*Puffinus griseus* and *P. tenuirostris*). Sooty Terns and the four species of shearwaters showed seasonal absence from the associations as they migrated out of Hawaiian waters.

### Diet and at-sea distribution of Leach's Storm-Petrel *Oceanodroma leucorhoa*: avian planktivores in northwest Atlantic food webs

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Leach's Storm-Petrel (*Oceanodroma leucorhoa*; LESP) is a small (ca. 50g), wide-ranging, highly pelagic planktivorous seabird. The world's largest colony breeds on Baccalieu Island on the east coast of Newfoundland. Despite its being the most abundant breeding seabird in eastern North America, little is known about the species' foraging ecology. This is cause for concern as both fishing activities and oceanographic

variations have caused major shifts in pelagic food webs over the Newfoundland Shelf during the 1990s. These changes have had demonstrated effects on reproductive performance and feeding ecology of piscivorous seabirds, but little is known of potential effects on planktivores. This study combines colony and vessel-based research to investigate the foraging ecology and trophic relationships of LESP.

Comparisons are made of parental food samples ( $n = 795$ ) collected at colonies lying within two different oceanographic regions; Green Island off Newfoundland's south coast (1987-88) and Gull Island off the east coast (1988). These samples augment current collections and importantly, allow comparisons before and after the regime shift of the early 1990s. These food samples provide information on (1) occurrence of prey types and species, (2) apportionment by numbers and mass, and (3) the size and mass of prey consumed. Fish and crustaceans formed the bulk of the diet in the late 1980s; fish occurred in 96% of the samples and crustaceans were present in 71%. Fish contributed little by number, but due to their large size they were the major component of the diet. The fish portion of the diet was dominated by myctophids, with capelin *Mallotus villosus* and cod (*Gadidae* spp.) and also making significant contributions. Hyperiid amphipods and *Hyperia galba* in particular dominated the crustacean portion of the diet. Site, seasonal, and annual variations in prey consumption will be discussed. Ongoing research, using both traditional dietary techniques and fatty acid profiling (see Logan and Montevecchi this meeting), will provide important information on LESP diets in the northwest Atlantic. Such food sampling could also provide potentially useful information on 0-group age classes of some fish species.

Using standard strip transect surveys, the density and distribution of LESP over the Newfoundland Shelf was quantified annually in both May (1999 to 2001) and Aug (1998 and 1999) aboard fisheries research vessels conducting

acoustic surveys of capelin. LESP were typically first encountered 30 km offshore, but densest concentrations were found in the vicinity of the shelf edge and slope waters. Distributions of birds will be analyzed across a variety of spatial and temporal scales, and where possible linked with distributions and densities of prey and oceanographic features. Being widely distributed and functioning at a low trophic level, LESP will provide insight into factors driving changes in both forage fishes and ecosystem-level processes through integration with a larger multi-species complex involving piscivorous seabirds.

### Predictability of seabird distributions within the Gulf of the Farallones at various temporal and spatial scales

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Seabird survey design and analysis is often dependent on assumptions about the scale of seabird movement and distributional change. Data that support these assumptions, however, are often not available. This analysis was designed to examine the variability and predictability of seabird distribution at various temporal and spatial scales. During the oil removal operation from the wreck of the *S.S. Jacob Luckenbach*, weekly or near weekly aerial seabird surveys were conducted over a nine-month period by California Department of Fish and Game's Office of Spill Prevention and Response (OSPR) contractors. The survey coverage area included a majority of Gulf of



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the Farallones National Marine Sanctuary and the northern portion of Monterey Bay National Marine Sanctuary. From the data collected for these surveys, bird densities were calculated within 1 nm blocks and a subsequent pair-wise comparison of densities was done for all blocks. The coefficient of correlation was then calculated for all pairs of blocks falling within 1 nm of each other at a given time step. This was repeated for multiple time steps between 24 hours and 6 months, and for multiple spatial bins between 1 nm<sup>2</sup> and 1000 nm<sup>2</sup>. The densities of Western Grebes (*Aechmophorus occidentalis*), Sooty Shearwaters (*Puffinus griseus*), Brown Pelicans (*Pelicanus occidentalis*), Surf Scoters (*Melanitta perspicillata*), Western Gulls (*Larus occidentalis*), Common Murres (*Uria aalge*), Marbled Murrelets (*Brachyramphus marmoratus*), and Cassin's Auklets (*Ptychoramphus aleuticus*) were each analyzed separately. In general, the predictability of distribution decreased with time for all species, but varied widely among species at a given spatial scale.

### Ecology of relaying in Cassin's and Rhinoceros Auklets at Triangle Island, British Columbia

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The relaying ecology of Cassin's Auklet (*Ptychoramphus aleuticus*) and Rhinoceros Auklet (*Cerorhinca monocerata*) was studied at Triangle Island in 2002 by collecting first eggs from early-laying females. Most birds relaid (90% of Cassin's Auklets, and 81% of Rhinoceros Auklets). Among control Cassin's Auklet pairs: (1) breeding success was moderately high (60%) and only very weakly declined with laying date; (2) chick mass at fledging declined with later hatching; and (3) *Neocalanus cope-*

pod dominated nestling diets throughout the season. Among experimental (i.e., relaying) Cassin's Auklets: (1) breeding success was high (68%), and (2) chick mass at fledging did not follow the population-wide seasonal decline. Among control Rhinoceros Auklets pairs: (1) breeding success was low (46%) and declined with later laying, due to a decline in hatching success; (2) fledging mass was unaffected by hatching date; and (3) sandlance dominated nestling diets early in the season, but there was a marked switch to Pacific saury beginning late in July. Among experimental (relaying) Rhinoceros Auklet pairs: (1) breeding success was low (30%), following the population-wide seasonal decline in hatching success; and (2) the few pairs that succeeded had their chicks fledge at normal masses. We conclude that both Cassin's and Rhinoceros Auklets have a high capacity to relay. However, whereas there was little immediate consequence associated with relaying in Cassin's Auklets, consequences were considerable for Rhinoceros Auklets. Possible reasons for the difference will be discussed.

### Trends in Marbled Murrelet inland activity in old-growth forests: Olympic Experimental State Forest, Washington, USA

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The Washington Department of Natural Resources (DNR) manages 110,000 ha of state forests on the western Olympic Peninsula, where widespread inland activity of the threatened, forest-nesting Marbled Murrelet (*Brachyramphus marmoratus*) occurs. DNR conducted 4856 murrelet surveys between 1994 and 2001, recording 7683 detections at 642 sites that comprised 17,200 ha of old-growth forest. I explored annual trends in murrelet

activity apparent in these data, to help develop hypotheses useful for developing and monitoring a murrelet conservation strategy. Given a discrete study area and consistent forest stand condition, I hypothesized that inland activity was influenced by oceanographic phenomena and the passage of time. I developed several murrelet activity indices, and obtained monthly average sea-surface temperature (SST) and upwelling data from federal agency internet sources. I reduced the numbers of dependent and independent variables by examining correlations between and among murrelet and oceanographic metrics, and comparing within-sample variability. I selected dependent (average annual total and sub-canopy detections per survey, annual proportion of surveys with detections, and average annual total detections from just those surveys), and independent variables (winter and summer average SST, and year). Multiple regression analyses (all  $n = 8$ , i.e. 8 years) suggested that annual murrelet activity was associated with SST and year: both total and subcanopy detections per survey were negatively correlated with year and winter SST; adjusted  $r^2 = 0.58$ ,  $P = 0.05$  and adjusted  $r^2 = 0.56$ ,  $P = 0.05$ , respectively. However, average annual detections per survey are mathematically and, I believe, ecologically a function of the annual proportion of surveys that record any murrelet activity and the average numbers of detections from just those surveys. The annual proportion of surveys that recorded detections was negatively associated with year—adjusted  $r^2 = 0.39$ ,  $P = 0.06$ ; while average detection rate on those surveys was negatively correlated with winter and summer SST—adjusted  $r^2 = 0.71$ ,  $P = 0.02$ . No DNR-managed old-growth forests were harvested during this study, and results of nearby inland radar and marine counts (both of shorter duration) do not suggest a

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population decline. However, the association of detection rates with the passage of time and winter SST suggests a nearly 10% annual decline in activity over the study area, given average winter SSTs. Assuming that murrelets' activity is an index of their attraction to particular forest stands, I hypothesize that inference regarding attractiveness of sites be modified based on the years of survey—i.e., sites studied later were relatively less likely to receive high activity levels, merely because murrelet activity declined with time. Similarly, I hypothesize that estimates of murrelet inland activity for either conservation planning or monitoring purposes should consider influences of oceanographic phenomena.

### **A digital habitat “fly-through” model-scenario for nesting Marbled Murrelets in desolation Sound, British Columbia [Poster]**

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The flight path Marbled Murrelets (*Brachyramphus marmoratus*) take from the ocean to their nesting site is not exactly known. However, it is widely believed that most birds fly inland along rivers and bottom valleys, but rarely cross mountain ridges to reach their nests. Here, foraging and resting locations on the ocean are linked to nest sites using least-cost path analysis. The Marbled Murrelet nest data set for Desolation Sound, British Columbia, for the years 1998–2000 from the Centre for Wildlife Ecology consist of 84 georeferenced capture locations and corresponding nest locations determined by helicopter telemetry. Together with a Digital Elevation Model (DEM TRIM1), a least-cost path analysis was calculated in ArcView 3.1 and ArcGIS. For the first time, a digital Habitat Fly-Through Animation is presented for flight paths, as well as for landscape types overflowed by birds. Visualized results allow for general flight path characterizations, e.g. length, shared

flyways, and how a Marbled Murrelet could perceive the landscape while flying to and from nests. Findings show that specific and commonly used flyways follow rivers and streams. The relevance of the assumptions that birds follow low elevation features and avoid crossing mountain ridges are discussed. In addition, decision rules are hypothesized how murrelets on the water reach their nests. This approach allows to identify relevant nesting areas within 70 km inland when the basic landscape and habitat characteristics are known.

### **A predictive Marbled Murrelet model using combined marine and terrestrial habitat components for the Canadian coast during the breeding season**

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Marbled Murrelets (*Brachyramphus marmoratus*) spend a substantial amount of time in coastal habitats, particularly during the breeding season. This complex habitat is characterized by a terrestrial as well as a marine component and is therefore difficult to describe efficiently. Here we describe Marbled Murrelets' Canadian coastal habitat with the terrestrial and marine component using a quantitative GIS modeling approach across three scales (“bins” of 5, 25 and 50km). For each bin scale, we compiled data on marine bird abundance, nesting evidence, and (occupied) detection surveys. These data sets are linked with over 30 “coastal habitat” predictors to construct the “best” model that characterizes Marbled Murrelets' habitat association during the breeding season. We used an advanced set of habitat descriptors derived from field surveys and GIS data layers. Our results allow for efficient modeling and predicting the linkages between Marbled Murrelets and their coastal habitat. An approach for model

and inference assessment is shown. We also present a large-scale eco-classification approach for the coastal Marbled Murrelet habitat in Canada. Our methods and findings are important in deriving valid population estimates and for understanding how coastal habitat affects distribution and abundance of birds during the nesting season. This is for instance relevant for predictive modeling of Marbled Murrelet radar surveys.

### **Investigations of Marbled Murrelet nesting habitats using a geographic information system (GIS) and radiotelemetry in Desolation Sound and Clayoquot Sound, British Columbia, Canada**

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Marbled Murrelets (*Brachyramphus marmoratus*) are Pacific seabirds of conservation concern that nest mainly in coastal old-growth forest trees. However, their habitat features required for breeding are incompletely known. We report on 121 nest sites found in a fragmented forest landscape of Desolation Sound in 1998–2001, and on 36 nest sites from Clayoquot Sound for 2000–2002. We captured and radio-tagged murrelets on the water, and subsequently located nests during systematic aerial searches during the birds' incubation periods. We determined nesting success from aerial survey data, climbed all trees that could be accessed from the ground, and confirmed



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the presence of nests and nesting success in all such cases. For Desolation Sound, most nests occurred in Old Forest (>140 years) polygons, as classified on 1:20,000 forest cover maps. However, many nests were found in non-contiguous "Old Forest scrub," small (e.g. 5–20 ha) Old Forest patches, and other classes. We investigated the influence of topographic features on nest site habitat selectivity and nesting success. For Desolation Sound, nests typically occurred on steeply sloped sites (mean 33°, minimum 0°, maximum 70°) at a mean elevation of 748 m  $\pm$  350 SD (median 748 m), and ranging from 38 to 1530 m. These topographic characteristics of nest sites were compared to randomly selected locations in a 50-km radius circle centered at the aquatic capture site, using 1000 random samples generated using a GIS for each analysis. For Desolation Sound, Marbled Murrelets selected nest sites on steeper slopes, even when the topographic distribution of Old Forest habitat was taken into account. Nesting success was higher on steeper slopes and at high elevations. For evaluation, we repeated the same study approach for Clayoquot Sound. Although sample sizes are relatively small, our results are in agreement with findings from Desolation Sound. Nest locations in Clayoquot Sound were found at mean elevations of 569 m  $\pm$  326 SD (median 614 m) ranging from 29 to 1191 m; the mean slope was 30°, ranging from 4 to 49°. Our results differ from traditional studies that used ground-based approaches to locate nests, which generally imply that murrelets would prefer shallow slopes at lower elevations. We provide several possible explanations for these differences, and suggest that biases in data collection may partially explain them. Our findings should help guide land management decisions designed to protect suitable nesting habitat for this species.

### Plumage-based aging criteria for the Black-footed Albatross [Poster]

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The accurate assessment of the status of albatross and petrel populations has become a conservation priority, in light of pervasive mortality in longline fisheries. In addition to colony-based counts, at-sea surveys can improve our ability to monitor these populations in a variety of ways. For instance, an improved understanding of the distribution of different age classes can help assess potential population-level impacts of fisheries bycatch. Moreover, changes in population composition can be used to test the predictions of modeling studies, which frequently invoke shifts in the population age structure. However, these valuable insights can only be gained if reliable field aging techniques are developed.

In this paper I describe and assess the utility of plumage-based aging criteria for the Black-footed Albatross (*Phoebastria nigripes*), a vulnerable species according to International Union for the Conservation of Nature (IUCN) criteria. First, I quantified the repeatability of plumage assessments using 67 known-age museum specimens. Overall, 95%, 95%, and 100% of the inspected birds were reliably scored into one of three plumage classes. Next, I evaluated the correspondence between these plumage classes and age groups defined on the basis of bursa characteristics: juvenile (birds of the year, 0.5 years), immature (pre-breeders, 1.5–4.5 years), and mature (breeding-age, >4.5 years). There was a generally good correspondence between the age groups and the plumage classes, with 82% and 100% of the juvenile and mature birds belonging to the first and third plumage classes respectively. Immature birds were more difficult to characterize, with 14%, 68%, and 18% of the specimens belonging to plumage classes 1, 2, and 3 respectively. Finally, to illustrate the applicability of the aging criteria described here, I quantified the age

composition of the Black-footed Albatross population off southern California (29° to 35° N, 117° to 124° W) from February through December.

I surveyed albatrosses during 19 cruises between Aug 1996 and Apr 2000. Overall, 97% of the 294 birds sighted during surveys were aged using these plumage-based criteria. I combined all birds sighted during a given month and used hierarchical clustering to identify time periods with similar age-class population composition. This analysis revealed four stages: (1) incubation (Nov–December), characterized by the absence of white-rumped (mature) individuals; (2) early chick-rearing (Feb–Mar), characterized by the numerical dominance of juvenile birds and the presence of all age classes; (3) late chick-rearing (Apr–Jun) and post-breeding (Aug–Oct), characterized by the presence of all three age classes and the numerical dominance of mature birds; and (4) dispersal from breeding colonies (Jul), characterized by the absence of juvenile birds.

These observations are in agreement with previous studies of Black-footed Albatross distributions off the West Coast of North America. Banding and telemetry studies have revealed that breeding age birds occur off California between Spring and Fall, and that juveniles are most numerous during Winter. Despite substantial individual variability in molting and bursa involution patterns, this study suggests that plumage characteristics can be effectively used to characterize Black-footed Albatross age classes at sea.

### Marine bird response to internal oceanographic variability in a dynamic transition zone: southern California (1997–99)

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