

# Report from the Marbled Murrelet Technical Committee

*S. Kim Nelson, Chair and Janet G. Hardin*

## SUMMARY OF THE MARBLED MURRELET TECHNICAL COMMITTEE MEETINGS

Annual Meeting, Seattle, Washington

### *Subcommittee Reports and Protocols— February 8, 1993*

**Chair Duties** — Kim Nelson reviewed the outline previously mailed to all MMTC members, and comments were offered for some minor additions, changes and re-wording. Kim has made the changes and the final draft has been approved by the PSG Executive Council.

**Role of the MMTC** — Kim also reviewed the earlier draft describing the role of this committee. C. J. Ralph was absent from this day's meeting but had provided Kim with his comments and feedback, which she shared with the committee at large. Further suggestions were offered, and Kim has produced a final draft, which has subsequently been approved by the Executive Council.

**Membership of the MMTC** — Draft guidelines outlining the structure of this committee were discussed. Lora Leschner was not present at this day's meeting, but had previously provided valuable input regarding the structure and function of the committee. The following people volunteered to meet later and refine the ideas presented: Tracy Fleming, Kathy Kuletz, Tom Hamer, Harry Carter, Steve Speich, and Sherri Miller.

**Survey Protocol Revision** — Sherri Miller reported on the need for revision of the protocol and the progress made thus far. Meg Shaughnessy has spent a good deal of time sifting through comments and suggestions from agency personnel. This subcommittee arranged to meet again later in the week in an effort to begin finalizing the changes so the amended protocol would be available for use by all parties concerned in the upcoming survey season.

**Nest Site Sampling Protocol** — Tom Hamer gave a brief report on the latest draft of this protocol. The protocol was nearly in its final form, but Tom invited further comment and those interested met with him later.

**Nest Search Guidelines** — Nancy Naslund presented an outline of the guidelines which was reviewed by the sub-

committee. A draft manuscript was expected for the upcoming field season.

**Records of Disturbance** — Fred Sharpe had not arrived at the meeting, so Kim provided an overview of the data sheets being developed to document various types of disturbance at sites with murrelets present. She suggested that anyone interested running the data sheets through some field trials contact Fred or herself. The goal would be to develop a usable data form.

**Educational Brochure** — Kathy Kuletz reported that she and Fred had produced a mock-up of a brochure for anyone interested to examine and comment on. Fred brought the brochures and handed them out during the afternoon session. Any further comments should be sent to Fred.

**Educational Video** — Kim showed an 8-minute educational videotape she had produced on the status and biology of marbled murrelets. She has requested feedback from anyone who has suggestions for improvement in the final version. It is anticipated that this tape could be sold to interested parties to recoup the cost of its production.

**New Protocols and Guidelines** — There has been increasing interest in the development of additional guidelines for people encountering murrelets at times other than during surveys or deliberate searches. Guidelines or brochures might provide such information as: what chicks and fledglings look like; what eggshells look like; what to do with murrelets found dead or alive on the ground; who should be notified when birds or eggshells are found on the ground; where rehab centers are located; and proven methods of handling/rehabilitating murrelets. Kim has begun work on photographically documenting eggshell fragments in her collection.

It has also been suggested that a uniform set of guidelines be developed for conducting surveys of murrelets on the water, whether from shore, by boat, or from the air. Members interested in developing such guidelines were asked to sign up for working in a subgroup to meet at a later time during the week.

**Training / Certification** — Training and certification of murrelet surveyors has developed into a requirement for

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anyone hoping to collect reliable data and/or adequately survey timber sales for marbled murrelets. Sherri Miller outlined the process her group has used successfully in northern California, and all those interested in the training and certification process were asked to sign up for a subcommittee to meet later in the week.

**Central Database**— Gary Miller gave a brief statement on the status of establishing a centralized repository for data gathered on marbled murrelets. As yet no such facility is available, but it is possible that use might be made of the same framework which was set up for the northern spotted owl.

**Species Status**— Gary Miller provided a brief overview of the current status of the murrelet listing and recovery process. The following people have been named to the Recovery Team: Steve Beissinger, Harry Carter, Blair Csuti, Tom Hamer, Gary Miller and Dave Perry. The first meeting of the Recovery Team will be February 17. The team will meet four or five times in the next year, for approximately two to four days at a time. Representatives from the Bureau of Indian Affairs, Bureau of Land Management, National Forest Service, and National Park Service will serve as consultants and attend Team meetings. Gary anticipates it will take about one year to develop a draft recovery plan, with a final plan completed in about two years' time.

**State and Provincial Reports**— these will be described in detail in the next PSG Bulletin.

### Additional Subcommittee Meetings, 9-11 February 1993

**Membership of the MMTC** — After discussion of the original concepts presented earlier, Steve Speich presented an organizational flow chart of how he envisions the MMTC functioning in future. After fruitful discussion and modifications from the group, Steve agreed to write up a final draft of the organizational plan.

**Inland Survey Protocol Revision** — This group met and discussed the feedback and subsequent revisions made thus far. Meg Shaughnessy will continue work on the revisions so that the protocol will be complete and available for distribution to all concerned prior to the upcoming survey season.

**Nest Site Sampling Protocol** — Following some discussion, a few changes or additions were suggested, and Tom Hamer will produce a final draft of the sampling protocol.

**Records of Disturbance** — People interested in performing trial runs with the current version of the data form provided their names, and Kim and/or Fred will send them samples to use this summer. Those who volunteered include: Lee Foillard, Tom Hamer, Kathy Kuletz, Irene Manley, Ray Miller, Bill Ritchie, and Chuck Turley.

**Training and Certification** — After much discussion, including a debate over requiring potential surveyors to undergo hearing tests, Sherri Miller will collect methods used successfully by trainers of inland surveyors in other areas and will produce a second draft of the training protocol. Some questions remain unresolved, but at present decisions will be made state-by-state (or province) for establishing a pool of qualified evaluators and a central depository for evaluation sheets of trainees.

**At-Sea Survey Protocols** — Nineteen people attended the meeting of this new subcommittee. The purposes of doing at-sea surveys were outlined and it was decided the "protocol(s)" should be a representative compendium of methods previously used. C. J. Ralph and Sherri Miller volunteered to collate methods others have used and design a first draft of suggested guidelines. They request that everyone who has done surveys by air, boat, or from shore send them the information as to specific methods and equipment used, and the types of data collected some time in the next few weeks.

**Education Subcommittee** — Fred Sharpe offered to be the coordinator of this subcommittee and continue work on the educational brochure. Others who volunteered to help Fred include: Marilyn Sigman, Kathy Kuletz, and Bill Ritchie.

**Rehabilitation Guidelines** —x The new subcommittee began development of guidelines for the care and rehabilitation of, and data collection on, injured or orphaned murrelets. Those interested in participating should notify Nancy Naslund.

### NEST SEARCH GUIDELINES

A draft of the nest search guidelines has been completed. Persons interested in obtaining a copy or in contributing to the final version should contact Nancy Naslund.

# Marbled Murrelet Technical Committee (Continued)

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## CHAIR GUIDELINES

1. Oversee and coordinate all activities of the MMTC. Lead all MMTC meetings.
2. Act as the official spokesperson for the MMTC and act for the Executive Council in the conduct of PSG on Marbled Murrelet matters when designated or so requested by the PSG Chair. Statements made by the MMTC Chair must reflect the views of PSG and the Executive Council, not the agency or group where the MMTC Chair is employed.
3. May attend hearings, meetings and other gatherings regarding murrelets, murrelet research and murrelet habitat management. Provide information and testimony as appropriate.
4. Communicate with all murrelet researchers throughout the year to keep informed of all research activities, ideas and problems. Promote communication among researchers. Maintain a current mailing list of MMTC members.
5. Respond to public requests for murrelet information.
6. Initiate necessary resolutions concerning murrelets. Final resolutions must be approved by the Executive Council.
7. Report all activities to the Executive Council of PSG. Send copies of all correspondence to the PSG Chair and seek advice and concurrence from the PSG Chair before being involved in issues thought to be controversial. All news releases, position statements must be approved by the PSG Chair and Vice-Chair for Conservation.
8. Seek advice and review from MMTC members on all issues. In cases of emergency or timely issues, review and concurrence of the PSG Chair and/or Vice-Chair for Conservation and at least two MMTC members (designated as emergency group) would be necessary.
9. Send all copies of important issues/information to all persons on the MMTC mailing list.
10. Include a summary of the groups activities in each of the PSG Bulletins. Entire texts of resolutions should also be submitted to the Bulletin.

## ROLES OF THE TECHNICAL COMMITTEE

1. **Act as a Technical Authority about the Status, Distribution, and Life History of the Marbled Murrelet:** Serve as a source of information for the general public, agencies, industry, and the media about the Marbled Murrelet. Educate others regarding the involvement of PSG and the MMTC in Marbled Murrelet issues. Host and publish Symposia at the PSG Annual Meetings.
2. **Identify, Encourage, and Facilitate Research:** Assist development of research programs throughout the range of the Marbled Murrelet (including California, Oregon, Washington, British Columbia, Alaska, Russia and Japan). Assist and encourage the funding of research programs where possible.
3. **Work and communicate with MMTC members and Chair:** Implement a communication and cooperation network among MMTC members by (1) working together to develop research priorities and methods, (2) sharing research results, (3) responding in writing, or by fax or phone to all issues sent by the MMTC Chair for comment, (4) informing the MMTC Chair of any important issues and (5) writing reports for the PSG Bulletin twice a year (a hardcopy and disk should be mailed to the MMTC Chair). Core members should perform their assigned duties in a timely manner (see attached MMTC Guidelines).
4. **Address Conservation Problems:** When appropriate, bring scientific and technical expertise to bear on issues by assisting the PSG Chair and the Vice-Chair for Conservation in writing resolutions and letters to address specific conservation problems. Carry out the PSG Charter, by advocating for the conservation of Pacific seabirds wherever they occur (Bylaws: Article 1, Section 2).
5. **Liaison Between Research and Management:** Provide agencies and industry with research results and information on the biology of the murrelet. Work with agencies and industry in reviewing and providing technical assistance on management plans as requested. Agencies interested in Marbled Murrelet research will be placed on a mailing list (Interested Parties) to receive information on meetings or the species status.

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# Marbled Murrelet Technical Committee

## MEMBERSHIP GUIDELINES

### MEMBERSHIP OF THE MARBLED MURRELET TECHNICAL COMMITTEE:

The MMTC membership consists of the MMTC Chair and those engaged in the activities of one or more MMTC subcommittees. One must be an active member of PSG to be a member of the MMTC. One must also have the time and interest to participate in subcommittee activities to be a member of the MMTC.

### CHAIR:

The Marbled Murrelet Technical Committee (MMTC) Chair is appointed by the Chair of the Pacific Seabird Group (PSG). The MMTC Chair reports to the PSG Executive Council and PSG Chair.

### SUBCOMMITTEES:

Subcommittees of the MMTC are created or dissolved at the discretion of the MMTC Chair as needed and appropriate. Subcommittee Coordinators are appointed by the Chair. Working groups within a subcommittee are created or dissolved by the Subcommittee Coordinator and the MMTC Chair as needed and appropriate.

#### (1) Policy Subcommittee:

The Policy Subcommittee includes 3-4 individuals that are appointed by the MMTC Chair. Members of the Policy Subcommittee inform and consult with the MMTC Chair on issues and matters of policy when needed by the MMTC Chair, often on short notice. Members also alert the MMTC Chair of pertinent concerns when appropriate. Members must be knowledgeable of the biology and issues associated with the marbled murrelet. The first consideration of members of the Policy Subcommittee is the welfare of PSG.

#### (2) Research Subcommittee:

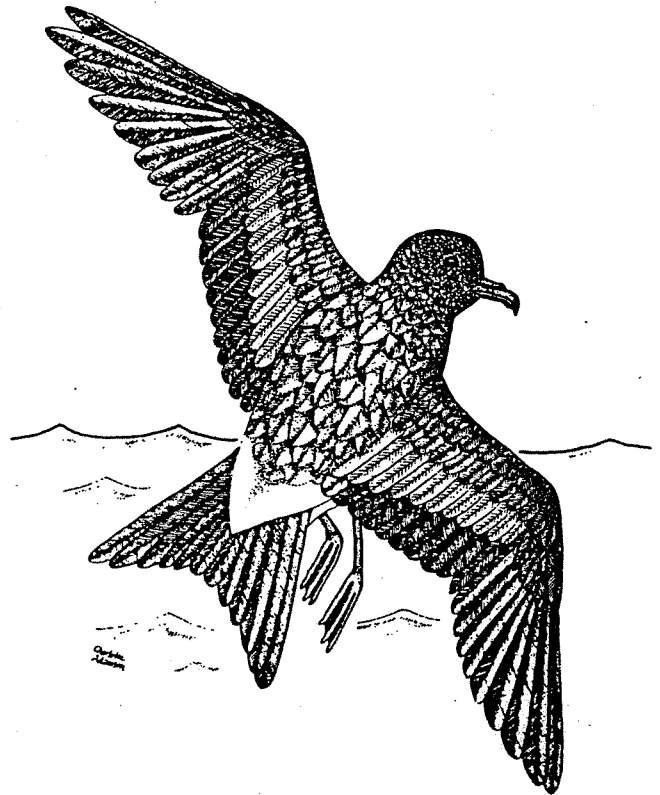
The Research Subcommittee includes three major subgroups: (a) At-Sea protocols and guidelines, (b) Inland protocols and guidelines, and (c) Research Needs and Priorities. The Inland Subgroup is currently working on the following protocols and guidelines: disturbance, dawn survey, training and evaluation, ground search technique, and nest searches. The At-sea Subgroup is developing a survey protocol. The Research Needs group is developing a protocol for collecting information from captive birds.

#### (3) Education Subcommittee:

The Education Subcommittee is currently developing an educational video and brochure to educate the public about the biology of the Marbled Murrelet.

### ADVISORS TO THE PACIFIC SEABIRD GROUP MARBLED MURRELET TECHNICAL COMMITTEE:

Agencies and other parties interested in the activities of the MMTC (including USFS, USFWS, BLM, NPS, STATES, PROVINCES, BIA, Industry, Conservation Groups, etc.) may appoint representatives to the PSG MMTC, with the approval of the MMTC Chair. Representatives inform the MMTC of the concerns, needs, policies and actions of their employers, agencies or clients regarding activities associated with marbled murrelets. Representatives are not required to be members of the MMTC; as individuals they may be members of PSG and the MMTC.



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6. **Communicate with PSG and the PSG Executive Council:** Inform the Executive Council of all activities. Provide updates on Marbled Murrelets and activities of the MMTC in the PSG Bulletin. Letters, resolutions, news releases should be approved by the PSG Chair, Vice-Chair for Conservation, and at least two members of the MMTC.

# Abstracts of the 1993 Annual Meeting

**Demography of Thick-billed Murres at Coats Island, Northern Hudson Bay.** *Tony Gaston, Canadian Wildlife Service, Ottawa, Canada K1A 0H3 and Leah de Forest and Garry Donaldson, Dept. of Biology, University of Ottawa, Ottawa, Canada K1N 5N6.*

About 18,000 chicks and adults have been banded at Coats Island since 1984. Most chicks return to the natal colony, allowing us to estimate age of first breeding (3-8, median 6), age-specific reproductive success (peaks at 8 years or older), the proportion surviving to age of first breeding (30-50%, varying with cohort), and age-specific survival (rising to 0.9 at age 8). Compared with Common Murres in Europe, the Thick-billed Murres at Coats Island have lower adult survival and lower reproductive success. However, survival to age of first breeding is higher, and overall, the population has been increasing at 3% annually, a rate similar to that seen at many European colonies studied.

**Risk and Reward: Factors Affecting Glaucous Gull Foraging Behavior in a Thick-billed Murre Colony.** *Grant Gilchrist, Dept. Zoology, Univ. of British Columbia, Vancouver, B.C., V6T 1Z4.*

In the eastern arctic, Glaucous Gulls (*Larus hyperboreus*) nest within Thick-billed Murre (*Uria lomvia*) colonies and are the primary predator of murre eggs and chicks. This study examined possible constraints on Glaucous Gull foraging within a Thick-billed Murre colony on Coats Island, N.W.T., Canada. Previous results suggested that ledge accessibility and high murre nesting density constrained gull foraging efficiency and that gull foraging activity was positively correlated to wind speed. Apparently, high wind speeds enabled Glaucous Gulls to access narrow-ledge, low-density murre nest sites. Despite these generalities, further study showed that individual gulls differed significantly in their use of attack techniques under the same environmental conditions. Further, the techniques used most frequently did not necessarily yield the greatest energetic gain as expected. I propose that gulls face a trade-off between energetic gain and risk of injury during attack.

**The Effect of Breeding-Site Characteristics on Breeding Success of Known-Age Thick-billed Murres (*Uria lomvia*) on Coats Island, N.W.T.**

*Leah de Forest, Dept. of Biology, Univ. of Ottawa, Ottawa, Ontario, Canada, K1N 6N5.*

Breeding site characteristics of known age Thick-billed Murres on Coats Island were compared in both 1990 and 1991. Older (>7-year-old) birds had higher reproductive success than young (4 and 5 year-old) birds. Having neighbours breeding nearby improved the reproductive success of older birds in both years. Site characteristics did not affect the reproductive success of young birds in 1990, as very few were successful. In 1991, young birds on sites with neighbours and walls were more successful than young birds on other sites. Sites of older birds were more likely to have  $\geq 2$  neighbours and  $\geq 1$  walls than the sites of young birds, hence a disproportionate number of young birds bred on sites that were suboptimal. Older birds were more successful than young birds occupying the same type of site. Sites which failed were more likely to be vacant in the following year. Young birds changed their site more often than older birds. The differences in site quality between young and older birds explains part but not all of the difference in reproductive success between the two groups.

**Winter Distribution of Known-Age Coats Island Thick-billed Murres in Newfoundland, Canada.**

*Garry Donaldson, Department of Biology, University of Ottawa, Ottawa, Ontario, Canada, K1N 6N5 and Tony Gaston, Canadian Wildlife Service, Ottawa, Canada, K1A 0H3.*

Hunting pressure on Thick-billed Murres is thought to reach upward of one million birds each year. This makes murres one of the most hunted birds in Canada and is therefore an excellent subject for recovery studies. Of the roughly 18,000 murres banded on Coats Island, 437 have been recovered. Most recoveries have occurred off the coast of Newfoundland in the late fall and winter during the annual "turr" hunt. Future management of the hunt will require accurate knowledge of the distribution of wintering birds. Spatial and temporal distribution distributions of recoveries of different cohorts and age classes from Coats Island will be presented.

**Foraging Ecology of Breeding Thick-billed Murres in Southeast Spitsbergen.** *Fridtjof Mehlum, Norwegian Polar Research Institute, P.O. Box 158, N-1330 Oslo Lufthavn, Norway; George L. Hunt, Jr., and Mary Beth Decker, Department of Ecology and Evolutionary Biology, University of California, Irvine, CA 92717.*

Foraging ecology of Thick-billed Murres (*Uria lomvia*) during breeding was studied in southeast Spitsbergen. At sea adjacent to two large, neighboring breeding colonies comprising a total of ca. 500,000 individuals, we mapped the flight directions and foraging areas of the birds. We also studied the spatial dispersion of foraging individuals and related their distribution along transects to measurements of the physical oceanography, hydroacoustics of prey, and plankton net tows. Specimens of murres were sampled for analysis of stomach contents.

The diet of birds foraging in waters within ca. 50 km of the colonies was predominated by pelagic crustaceans (*Thysanoessa* and *Parathemisto*), whereas individuals foraging farther south (ca. 100 km from the colonies) primarily preyed upon fish (capelin, *Mallotus villosus* and polar cod, *Boreogadus saida*). The higher spatial heterogeneity in the distribution of fish shoals compared to the pelagic crustaceans was reflected in the spatial distribution of seabirds along transects.

**Ecological and Conservation Implications of Attendance by Marbled Murrelets at Old Growth Forest Nesting Areas during the Nonbreeding Season.** *Nancy L. Naslund, Institute of Marine Sciences, University of California, Santa Cruz and U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, AK 99503.*

I studied Marbled Murrelet attendance at nesting areas in old-growth forest in central California, during 1989-91. Activity levels were quantified at five nesting areas (216 surveys). Presence/absence was determined during an additional 116 surveys. Murrelets were active year-round, though activity levels in fall and winter were about half those in spring and summer. Murrelets were absent, or activity was minimal and most variable, during August-October and March, coinciding with periods of molt. Murrelets attended nesting areas during the nonbreeding season more frequently than murrelets in other regions, and other members of the Alcidae. Circumstantial evidence suggests that wintering birds may be experienced, resident breeders. Fall and winter attendance may be important for maintenance of nest sites, nesting territories, and pair-bonds. I hypothesize that

high quality nest sites in old-growth forests are limited. Winter attendance behavior has important implications for management and conservation. Nesting areas should be protected throughout the year. In some areas, winter may be an ideal time to conduct long-term monitoring studies, as variability in attendance is low, and winter populations probably consist of high-quality breeders.

**Nesting Patterns and Competition among Breeding Terns and Black Skimmers in Coastal Southern California.** *Esther E. Burkett, Calif. Dept. of Fish and Game, 1416 Ninth St., Sacramento, CA 95814, Charles T. Collins, Dept. of Biology, Calif. State Univ., Long Beach, CA., 90840, and William A. Schew, Dept. of Biology, Univ. of Pennsylvania, Philadelphia, PA 19104.*

The breeding biology of five tern species and Black Skimmers was studied between 1987 and 1990, the period of colony establishment. The colony consists of two man-made islands created for the endangered California Least Tern, which used both islands beginning in 1979. Skimmers followed in 1985, Caspian Terns in 1986, Elegant Terns and Forster's Terns in 1987, and Royal Terns in 1988. By 1990 Least Terns numbered about 200 pairs, and were displaced from North Island to South Island. The large tern species had synchronous nesting patterns, with egg-laying occurring in May, chick hatching in June, and chick fledging by the end of July. Least terns exhibited known bimodal nesting peaks in mid-May and mid-June, and chicks fledged by August. However, skimmers had a protracted egg-laying period extending from June through August, and hatching from July through September. Color-marked skimmers have been documented on other breeding sites and continued colony growth seems likely. Management of breeding habitat for these species is challenging given limited nesting habitat in coastal California, and the endangered status of the Least Tern.

**Survival and Breeding Probability of Brandt's Cormorants on Southeast Farallon Island in Relation to Age and Environmental Conditions.** *Nadav Nur, William J. Sydeman, and David G. Ainley, Point Reyes Bird Observatory, 4990 Shoreline Highway, Stinson Beach, CA 94970.*

Brandt's Cormorants (*Phalacrocorax penicillatus*) display a very flexible breeding strategy: under poor environmental conditions, few attempt to breed. This makes assessment of survival on the basis of re-sighting individu-

als more difficult (individuals may be missed because they did not breed that year) and it presents difficulties in monitoring population size, since breeding numbers in a given year are a function of breeding probability. We present results of analyses of 15 years of observations on a marked sub-population of Brandt's Cormorants breeding on Southeast Farallon Island. We estimated annual survival probability of adults, breeding probability, and sighting probability (irrespective of breeding status), using the statistical program SURGE, with respect to age and year. Neither survival nor breeding probability varied with age, but both fluctuated strongly between years, as a function of environmental conditions. For both sexes, survival and breeding probability declined in years of poor food availability. We incorporate these two demographic parameters, and their covariation with environmental conditions, into a demographic model of Brandt's Cormorant population dynamics. We present several applications of the demographic model, including the effect of a change in prey availability on future population growth.

**Brown Pelican Roosting Behavior at Mugu Lagoon, California.** *Deborah L. Jaques, Craig S. Strong, U.S. Fish and Wildlife Service, 6924 Tremont Rd, Dixon, CA 95531; Thomas W. Keeny, U.S. Navy, Pt. Mugu Naval Air Weapons Station, Env. Div. P7320, Point Mugu, CA 93042-5000.*

We report on Brown Pelican abundance, habitat use, and responses to disturbance at Mugu Lagoon in the first year of an ongoing study initiated by the U.S. Navy. Pelicans used the lagoon year-round, with peak numbers observed in June (1,404 birds). More birds were present in daytime than after dark, and night roost locations were very specific and limited in the lagoon. Aerial and ground surveys of roost sites in southern California showed Mugu Lagoon to be the largest natural roost site on the mainland coast which is regularly used. Other large roost sites occurred on breakwaters, barges, and other man-made structures. Suitable roost locations may be a proximal limiting resource for Brown Pelicans in southern California, and disturbance can affect the quality of roosts. To evaluate the relative impact of various disturbance sources to pelicans at Mugu Lagoon, we developed a disturbance index which incorporated frequency, number, and response of birds to each disturbance type. The disturbance index may be appropriate for other species and modified for different situations. The Navy seeks to enhance the Mugu Lagoon roost by minimizing disturbance, in compliance with the Brown Pelican Recovery Plan.

**Status and Distribution of Four Storm-Petrels in California.** *Gerard J. McChesney and Harry R. Carter, U.S. Fish and Wildlife Service (NPWRC), 6924 Tremont Rd., Dixon, CA 95620.*

Breeding populations of four storm-petrel species in California were surveyed in 1989-91 as part of an update of the Catalog of California Seabird Colonies (Sowls et al. 1980). Burrow nesting birds were surveyed by burrow counts; crevice nesting birds were surveyed primarily by mist netting and capture-recapture. Leach's Storm-Petrels (12,551 birds at 13 colonies) breed primarily in northern California with smaller populations in Central (S.E. Farallon Is., SEFI) and southern (Channel Islands National Park, CINF) California. Declines at two northern California colonies due to habitat degradation led to 31% lower numbers overall. The endemic Ashy Storm-Petrel (7,209 birds at 12 colonies) breeds primarily at SEFI and CINF. The 38% higher numbers were due to higher estimates in CINF and may not reflect a true increase. Black Storm-Petrels (274 birds at 2 colonies) reach their northern limit at Santa Barbara Is. in CINF. The 83% higher numbers likely reflected differences in census methodology. No new estimates were made for Fork-tailed Storm-Petrel (410 birds at 5 colonies), which reach their southern limit in northern California. However, populations have likely declined due to habitat changes.

**Seabird Monitoring and Research Program at San Nicolas Island, California.** *Harry R. Carter, U.S. Fish and Wildlife Service (NPWRC), 6924 Tremont Road, Dixon, California 95620; Thomas W. Keeney, Env. Div., Naval Air Weapons Station, Point Mugu, California 93042; Gerard J. McChesney, Tracy A. Miner, and Leigh K. Ochikubo, U.S. Fish and Wildlife Service.*

An annual seabird monitoring and research program has been developed cooperatively by USFWS and NAWS (with DOD Legacy Resource Management Program funding) at San Nicolas Island in the Southern Channel Islands, 65 miles offshore from Los Angeles, California. As an active naval installation, NAWS must manage for the welfare of seabirds on SNI by preventing human disturbance from military operations, fishermen and recreationists. This program will provide long-term data to assess all human impacts (including pollutants and changing prey resources), given much annual variability in seabird breeding effort at this location (especially due to El Niño conditions). Breeding population size and breeding success of Brandt's Cor-

morants and Western Gulls will be examined initially, although additional studies are planned in the future. Other DOD installations with similar seabird issues will benefit from the SNI program.

**Tree and Habitat Characteristics and Behavior at Fourteen Marbled Murrelet Tree Nests in Alaska.** Nancy L. Naslund, Kathy J. Kuletz, Mary Cody, and Dennis Marks, U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, AK 99503.

In 1991-92 we located 14 tree nests of the Marbled Murrelet on Naked, Kodiak, and Afognak islands, Alaska. All nests were on moss-covered platforms in old-growth trees of western hemlock (n=2), mountain hemlock (n=7), or Sitka spruce (n=5). Nest trees were located in high stand size class (i.e., large trees) and volume class forests (the highest in the region). In addition, 18 trees were documented where murrelets landed but nests were not known to occur. The dbh of nest and landing trees ranged from 30 to 104 cm and 35 to 118 cm, respectively. Naked Island nest and landing trees were similar to each other. They were also larger, had more platforms, and had greater epiphyte cover than did the nine closest canopy trees adjacent to each. Nest trees had similar characteristics to those at more southern latitudes in that they were old-growth conifers containing large moss-covered platforms. All nests where reproductive success was known (n=7) failed because of nest abandonment, predation, or unknown causes. Preliminary analysis of murrelet behavior at dawn suggests that pairs were active, perhaps territorial, around a group of trees and that some of these localized areas of activity were consistently used in successive years.

**A Comparison of Two Confirmed and Three Probable Marbled Murrelet Nest Sites on Private Commercial Timber Lands in Northern California.** Steven J. Kerns, Wildland Resource Managers, P.O. Box 102, Round Mountain, CA 96084 Ray A. Miller, Pacific Lumber Company, P.O. Box 37, Scotia, CA 95565.

Two Marbled Murrelet (*Brachyramphus marmoratus*) nests, and three eggshell trees were found in Humboldt County, California. A juvenile bird was observed on one nest for two and one-half weeks. Information on nests, trees, and stand structure was collected and compared. All trees were coast redwood (*Sequoia sempervirens*) with 100% canopy closure at the nest site. Stand canopy closure was lower, averaging less than 50%. Three of the sites were

within 100 m of human disturbances. Findings are compared with other available data, and implications for management and future research will be discussed.

**Activity and Nesting Habitat of Marbled Murrelets on the Central Coast of British Columbia.** Rick Burns and Lynn Prestash, 12136 New McLellan Road, Surrey, B.C., V3X 2X9; Dale R. Seip, B.C. Ministry of Forests, 1011 Fourth Avenue, Prince George, B.C. V2L 3H9; Jean-Pierre L. Savard, Canadian Wildlife Service, 1141 Route de l'Eglise, St. Foy, Quebec, G1V 4H5.

Counts of Marbled Murrelets (*Brachyramphus marmoratus*) flying out of Mussel Inlet, Kynoch Inlet, and Mathieson Channel on the central British Columbia coast during April, May, and June revealed that on some days, up to 1265 of these birds flew out of these areas. Counts were conducted using a stationary count technique that recorded birds moving by a fixed point over a three-hour time period. A deep-water floating mist net system was used to catch murrelets, and of 12 birds captured, 9 had brood patches. Seven were radio-tagged and 3 were tracked to suspected nest sites on the sides of Mussel Inlet. Nest site habitat varied considerably, and included a low-elevation cedar swamp; a forested subalpine bowl; and a steep, forested slope near the shore. It appears that large numbers of Marbled Murrelets use these mainland inlets during the breeding season, and that those nesting in this area are flexible in their choice of nest sites.

**Marbled Murrelet Activity in Four Forest Types at Naked Island, Prince William Sound, Alaska.** Kathy J. Kuletz, Dennis K. Marks, Nancy L. Naslund, and Mary Cody, U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, AK 99503.

As part of the Exxon Valdez oil spill restoration effort, we studied the breeding activity of Marbled Murrelets to identify nesting habitat and guide timber acquisition within the spill zone. The study area was mixed hemlock-spruce old growth interspersed with muskeg meadows. We used U.S. Forest Service timber maps to identify four forest types, based on volume class and stand class. Sites were randomly selected in each habitat type on Naked, Storey and Peak islands in Prince William Sound. An intensive dawn survey and vegetation plots were done at 72 sites from 10 June to 11 August 1991. Only 26% of the detections (n=2246) were within 100 m of the observer and 5% of those were occupied behaviors, which occurred at 19% of the

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sites. Occupied behaviors were most frequent in high stand class forests (larger trees), and were positively correlated with on-site measurements of canopy tree dbh. The total number of detections per site was not random among forest types; moderate volume, high stand class forests had the highest mean detection rate. We conclude that in this area, murrelets tend to use moderate to high volume forests with large trees. The effects of other factors on murrelet use, such as slope, aspect, and distance from water, are examined as well.

## Results of a Ground Search Method for Location of Tree Nesting Evidence of the Marbled Murrelet.

Mark E. Freitas, S. J. Kerns, and D. A. Fortna, *Wildland Resource Managers, P.O.Box 102, Round Mountain, CA 96084.*

To augment existing data (T. E. Hamer 1991, video) regarding Marbled Murrelet (*Brachyramphus marmoratus*) nest site selection in northwest California and to facilitate management for the species, nest search methodologies were developed and tested on the commercial timber lands of Pacific Lumber Company in Humboldt Co., California. From 20 July to 11 September 1992, nine study areas were surveyed for Marbled Murrelet eggshell fragments. Five separate sets of Marbled Murrelet eggshell fragments were found in three of the nine separate study areas. Of the five eggshell finds, two yielded tree nests—one containing a nestling and the other a fecal ring. No nests were discovered in the other three trees under which eggshells were found. All trees under which the eggshell fragments were located were coast redwood (*Sequoia sempervirens*). Survey methods, factors in search area selection, and successful application of search techniques are discussed.

## Marbled Murrelet Abundance Patterns at Sea in Relation to the Marine Environment.

Suzann G. Speckman, Alan M. Springer, *Institute of Marine Science, Univ. of Alaska, Fairbanks, AK 99775,* and John F. Piatt, *U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, AK 99503.*

Marbled Murrelets were surveyed daily for 14 weeks in the summer of 1992 by boat and from the shoreline in Auke Bay and Fritz Cove, near Juneau, Alaska. Abundance patterns and movements were analyzed in relation to physical variables including tide stage, amplitude of tidal oscillations, time of day, season, weather, and water temperature. Preliminary results indicate important effects of season,

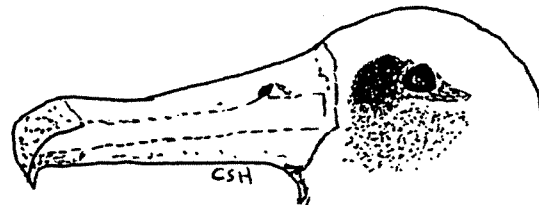
time of day, and tide cycle on Marbled Murrelet numbers at sea. Numbers were highest during the period before egg-laying, declined by half during incubation, and were highly variable after incubation. Numbers were highest on morning boat transects when water levels were highest, regardless of the direction of water movement. Numbers also peaked on days of minimum tidal oscillation, suggesting a preference for low current flow. Results from the land-based surveys at different tide stages indicated that numbers of murrelets peaked within a few hours after dawn, at a high or falling tide stage. These results have important implications for designing monitoring surveys to assess changes in Marbled Murrelet populations in Alaska and elsewhere.

## Abundance and Distribution of Marbled Murrelets at Sea on the Oregon Coast.

Craig S. Strong, John R. Gilardi, Ian Gaffney, and Janice Cruz, *Crescent Coastal Research, 7700 Bailey Rd., Crescent City, CA 95531.*

Vessel and aerial surveys for Marbled Murrelets (*Brachyramphus marmoratus*) were carried out between 1 June and 10 August 1992, in the first effort to measure marine abundance and distribution of the species along the entire Oregon coast. Statewide surveys were completed once by boat and once by air, but most effort was focused from 200 m to 500 m from shore off central Oregon. Repeated transects along selected coastal sections at 500 m increments offshore, up to 3.5 km out to sea, measured distribution in relation to distance from shore. Peak densities were always recorded less than 500 m offshore.

Murrelets were most abundant between Depoe Bay and Cape Arago and at some locations between Cape Arago and the California border. Low numbers were seen north of Lincoln City. After July 22, fewer were seen in central Oregon and more were counted along the north end of the state, possibly representing a post-breeding dispersal. Murrelets were distributed unevenly, occurring in dense "patches." High-density patches varied spatially and temporally throughout the season. Minimum population numbers are presented, and estimates based on strip transects and other methods are discussed.



**Assessment of Change in Population Size for Marbled Murrelets in Clayoquot Sound, British Columbia: 1982 to 1992.** *John Kelson, Irene Manley, Conservation International, Box 67, Tofino, B.C. Canada V0R 2Z0; Harry Carter, U.S. Fish and Wildlife Service, Northern Prairie Wildlife Research Center, 6924 Tremont Road Dixon, CA 95620.*

From June 17 until June 30, 1992, we repeated an at-sea survey originally conducted in June 1982 to examine the change in population size of Marbled Murrelets over the past 10 years in Clayoquot Sound, on the west coast of Vancouver Island, B.C. This was done by repeating the protocol used by Carter in 1982 to establish the total population of Marbled Murrelets. A grid of 1-km<sup>2</sup> quadrats was surveyed by inflatable boat. The study covered the entire 335-km<sup>2</sup> area of SE Clayoquot Sound, from waters up to 3-km offshore to the heads of the inlets. The total population counted was 2704 birds in 1992, a decrease of 40% from the 1982 total of 4524. Similarly to 1982, few birds were found in fiord habitat (density 0.25/km<sup>2</sup>), 42% in channel (density 9.1/km<sup>2</sup>), and 58% in inshore waters (density 11.1/km<sup>2</sup>). Factors affecting reproductive success of murrelets, such as loss of nesting habitat from clearcut logging and adult mortality from gillnet fishing, etc., are discussed as possible causes of this decline.

**Use of Radar to Study Marbled Murrelets and Interpret Survey Results.** *Thomas E. Hamer, 615 State St., SedroWoolley, WA 98284; C. John Ralph, Redwood Sciences Laboratory, U.S. Forest Service, Arcata, CA 95521; Brian A. Cooper, Alaska Biological Research, Fairbanks, AK 99708.*

A pilot project using a marine surveillance radar system modified for ornithological research was undertaken to study Marbled Murrelets (*Brachyramphus marmoratus*) in northern California. Monitoring sessions were conducted at both inland and coastal sites. The ability of the radar to discriminate murrelets from other targets and provide estimates of abundance was assessed by comparing radar data to simultaneous ground observer detections. Radar recorded the flight speed, direction, behavior, distance, and occasionally the altitude of murrelets. Murrelets were detected by radar at distances up to 1.3 km. The average flight speed for murrelets was 77 km/hr and ranged from 56 to 105 km/hr. On average, radar recorded 2.3 times more murrelets at inland sites than did ground observers. The overall error rate in identifying murrelets by radar was 61% for coastal sites

and 2.2% for inland sites. The only inland bird species contributing to identification error was the Band-tailed Pigeon (*Columba fasciata*). Radar has advantages over observers because it can detect birds over a larger area, regardless of light conditions, fog, or background noise and does not rely on murrelets to vocalize for detection. Radar limitations with topography and vegetation are discussed.

**Quantification of Habitats in Prince William Sound from Landsat Thematic Mapper Satellite Imagery.** *Richard Podolsky, 235 West 56th Street #20N, New York, NY 10019-4330.*

The goal of this project was to identify and quantify habitats in Western Prince William Sound (PWS), Alaska from Landsat Thematic Mapper (TM) satellite imagery. Secondly, the goal was to assess the feasibility of using satellite imagery and other remotely sensed products to measure the habitat of Marbled Murrelets and other species affected by the *Exxon Valdez* oil spill (EVOS). Here I present detailed habitat data on two million acres including acreage reports of 18 surface features for the mainland and the eleven principle islands in western PWS.

Forest lands were the most abundant habitat, covering 28 %; muskegs were the second most abundant habitat covering 20.4%, and snowfields and glaciers were third, totaling 13%. Rock, cloud, and alpine and shrub thickets were each under 10% of the study area. On islands, muskegs covered 25%, whereas on the mainland they covered only 14%. Forests covered 34% of the islands, compared with 19% on the mainland. Twenty nine percent of the mainland was covered by ice fields and glaciers, compared with less than 2% for this cover type on the islands. Sixty-one thousand acres of forested slopes (17%), a habitat possibly important to Marbled Murrelets and other EVOS damaged resources, were found on the islands, compared with 24,208 acres on the mainland (9%).

An assessment of the accuracy of the thematic map produced from the Landsat data when compared with random points on aerial photographs yielded an accuracy of 91%.



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**Assessment of Seabird Mortality from the Exxon Valdez Oil Spill.** *R. Glenn Ford, Ecological Consulting Inc., 2735 N.E. Weidler St., Portland, OR 97232 and John F. Piatt, U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, AK 99503.*

Based on the recovery of about 30,000 oiled seabird carcasses, one carcass drift experiment (3% recovery) and direct observations at the time of the spill, and comparison with other studies, a preliminary conservative estimate of total seabird mortality from the Exxon Valdez oil spill was in the 100,000-300,000 range. Subsequent detailed experiments were conducted in the spill area to estimate more accurately a number of parameters that determined carcass recovery rates (loss at sea from sinking, persistence on beaches, scavenging, beach survey effort in different regions). A Monte Carlo analysis was conducted using a model that incorporated varying estimates of these parameters. The best estimate from this analysis suggests that 8% of carcasses were recovered, i.e., that about 375,000 seabirds died as a result of the Exxon Valdez oil spill. This represents the highest toll of marine birds from oil pollution ever documented. The taxa most affected were diving species: murre (74%), other alcids (7.0%), seaducks (5.3%), cormorants (3.0%), grebes (1.9%), and loons (1.5%).

**Survival of Seabirds after Oiling, Cleaning, and Release.** *Brian E. Sharp, 2234 NE 9th Ave., Portland, OR 97212.*

Banding data from oil spills on the Pacific coast were examined in an attempt to quantify post-release survival of oiled seabirds after cleaning. Of 1612 banded birds of 11 seabird species, 52 were recovered. Of 1140 banded Common Murres, 29 were recovered. Species recovered in smaller numbers included Red-necked and Western Grebes and Black, Surf, and White-winged Scoters. The mean and median number of days between release and recovery for murre were 21.1 and 8.0 days, respectively ( $n = 28$ ); for all species mean and median were 22.1 and 6.0 ( $n = 49$ ).

The probability of survival of Common Murres over five-day intervals, calculated by the maximum likelihood method, was 0.65, and their mean life span was 11.5 days. The probability of their surviving a year is  $0.65^{73}$ , where 73 is the number of five-day periods in a year. Methodological problems that may bias the estimate are discussed, including the possibility that healthy birds do not have the same recovery rate as sick birds. The implication of these data is that the considerable effort that goes into capture and

cleaning of oiled birds is for the most part ineffective and that oiled birds that are cleaned and released should be treated as dead birds for the purposes of assessing the damages of oil spills to seabirds.

**Recovery of Shoreline Ecosystems Following the Exxon Valdez Oil Spill and Subsequent Treatment.** *Alan J. Mearns, NOAA/Hazardous Materials Response and Assessments Division (HMRAD), 7600 Sand Point Way NE Seattle, WA 98115.*

In 1989, both oiling and high-energy treatment significantly altered the abundance and biodiversity of intertidal communities exposed to oil in Prince William Sound. Monitoring was conducted at least annually to document recovery and, in particular, to determine the extent to which high-pressure hot-water washing enhanced or delayed recovery of epibiota and infauna. Replicate samples were taken twice in 1990, three times in 1991 and once in 1992 at three elevations at up to 30 unoiled, oiled, and treated sites. By September 1991, the abundance and biodiversity of epibiota at oiled but untreated "set aside" sites was nearly restored to conditions at unoiled sites. On average, recovery of various species and measures of community structure at treated sites continues to lag and may take at least several more years to recover. Infauna (including clams) under both conditions are still far from recovered. Shorelines look remarkably clean, but oil in various stages of weathering remains below the surface at all previously oiled monitoring sites, regardless of treatment. This work is part of a larger HMRAD program to determine the efficacy and effects of various oil-spill clean-up methods, including bioremediation, dispersants, cleaners, and mechanical operations. These observations indicate a need for weighing in advance the net environmental benefits of oil-spill countermeasures.

**Effects of the Exxon Valdez Oil Spill on Black Oystercatchers.** *Brad A. Andres, U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, AK 99503.*

Because Black Oystercatchers (*Haematopus bachmani*) are completely dependent on marine coastal habitats for their life's requirements, they are particularly susceptible to shoreline oiling problems. Damage assessment and restoration studies of Prince William Sound Black Oystercatchers were conducted briefly in 1989 and 1990 and more intensively in 1991 and 1992. Boat survey data from Prince William Sound generally indicated that pre- to postspill population changes were more negative in oiled areas than

in unoiled areas. On Kodiak Island Christmas bird counts, postspill counts of oystercatchers were significantly lower than prespill counts. Sublethal, negative effects of the *Exxon Valdez* oil spill were also evident in the oystercatcher population. Breeding oystercatchers were influenced directly by oil disturbance and indirectly through the ingestion of oiled prey. Cleanup activities caused lower productivity on disturbed shorelines than on undisturbed shorelines of Green Island. Oystercatchers nesting on oil-affected shorelines had lower egg volumes and lower chick growth rates than those nesting on oil-unaffected shorelines; however, biomass delivered to chicks on oiled shorelines was significantly greater. Although the number of breeding oystercatcher pairs increased on Green Island between 1989 and 1992, other oil-affected areas of Prince William Sound did not experience a similar increase in breeding pairs. Mixed sand-gravel beaches that are persistently oiled provide a possible source of chronic oil exposure for Black Oystercatchers. Ongoing work will attempt to provide a link between persistently contaminated mussel prey and physiological changes in the oystercatcher consumer.

**Marine Bird Populations of Prince William Sound, Alaska, Before and After the *Exxon Valdez* Oil Spill.** *Karen K. Laing, and Steven P. Klosiewski, U.S. Fish and Wildlife Service, Anchorage, AK 99503.*

We estimated marine bird abundances using boat-based surveys in Prince William Sound following the *Exxon Valdez* oil spill, and compared population trends in oiled zones to trends in unoiled areas. We counted approximately 100 bird species. Population estimates of 11 species or species groups declined between 1972-73 and 1989-90-91, including large declines for loons (*Gavia* spp.) (>36%), scoters (*Melanitta* spp.) (>54%), arctic tern (*Sterna paradisaea*) (>78%) and murrelets (*Brachyramphus* spp.) (>65%). No population estimates increased significantly. We detected net population losses (t-tests,  $p < 0.05$ ) in the oiled zone relative to unoiled zones for Pigeon Guillemot (*Cepphus columba*) in March and Northwestern Crow (*Corvus caurinus*) in July and marginally insignificant ( $p < 0.10$ ) losses for cormorants (*Phalacrocorax* spp.), Harlequin Duck (*Histrionicus histrionicus*) and black oystercatcher (*Haematopus bachmani*). Using a 1984 shoreline survey as a baseline, oiled-zone losses were detected for loons, Harlequin Duck, scoters, Black Oystercatcher, Arctic Tern, and Mew Gull (*Larus canus*). This study demonstrated the feasibility of statistically rigorous sampling design to esti-

mate marine bird populations. However, identification of effects of perturbations such as the oil spill require repeated surveys over many years. This study should encourage scientists and managers to survey populations frequently using rigorous sampling design.

**Effects of the *Exxon Valdez* Oil Spill on Pigeon Guillemots Breeding at Naked Island, Prince William Sound, Alaska.** *Karen L. Oakley and Katherine J. Kuletz, U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, AK 99503.*

We studied the effects of the 1989 *Exxon Valdez* oil spill on the population and reproduction of the Pigeon Guillemot (*Cepphus columba*) at Naked Island, Prince William Sound, Alaska. Oil surrounded Naked Island, located 30 km southwest of the grounding site, during the prebreeding season, and oil remained on the beaches at certain colony sites during 1989. The guillemot population was significantly lower in 1989 than in the early 1980s. By 1992, the population was roughly half its former size. The Prince William Sound population as a whole declined during this period. The extent to which the decline of the Naked Island population was due to the spill is unknown. However, declines were greater in the most heavily oiled portions of the study area. Reproduction in 1989 was similar to previous good weather years. However, the cryptic nature of guillemot nests decreased our ability to detect one of the more likely effects the spill could have had: an increased incidence of unhatched eggs. Reproduction in 1990 was poor with many nests failing due to low hatching success and predation, a decreased percentage of schooling fish in chick diets and slow chick growth.

**Effects of the *Exxon Valdez* Oil Spill on Marbled Murrelets at Naked Island in Prince William Sound and Kachemak Bay.** *Katherine J. Kuletz, U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, AK 99503.*

The *Exxon Valdez* oil spill in Prince William Sound (PWS), Alaska, began on 24 March 1989 and spread 750 km in eight weeks. The Marbled Murrelet (*Brachyramphus marmoratus*) is common throughout the spill zone and is the most abundant seabird in PWS in summer. I studied the effects of the oil spill on the Marbled Murrelet at the Naked Island complex in central PWS and at Kachemak Bay on the Kenai Peninsula. The latter was only lightly oiled with weathered crude in mid-April. Prespill counts of murrelets at sea, compared with postspill counts showed that in 1989,

murrelet numbers and percentage of juveniles were significantly lower at Naked Island but not at Kachemak Bay. At both sites, there was a negative relationship between murrelet numbers and boat or plane activity. In 1989, 28 murrelets were collected in Prince William Sound and tested for internal contamination. Murrelets collected at oiled sites had petroleum hydrocarbon residues in liver tissues, whereas those collected at an un-oiled site did not. I conclude that at the Naked Island complex, murrelet numbers in 1989 were lower due to oil-induced mortality and disruption of breeding activity by human disturbance. The mean number of murrelets counted during shoreline surveys in 1990-92 at Naked Island was not significantly lower than the pre-spill mean of 1978-80.

**Effects of the Exxon Valdez Oil Spill on Black-legged Kittiwakes in Prince William Sound.** *David B. Irons, U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, AK 99516.*

The numbers of nesting Black-legged Kittiwakes did not decline at colonies in the oiled area after the *Exxon Valdez* oil spill compared to pre-spill years. Reproductive success of kittiwakes in 1989 at the oiled colonies was about one half of what was expected based on previous years and the reproductive success of birds at the un-oiled colonies ( $P = 0.04$ ). Up to 37% of birds at oiled colonies were observed during June or July of 1989 with oil on their breast feathers, and no birds at un-oiled colonies had oiled breast feathers.

Reproductive success of kittiwakes at all colonies in Prince William Sound declined in the postspill years (1990, 1991, and 1992), compared with the five previous years. The brood size of fledglings also decreased in the postspill years which suggests that there was less food available during these years.

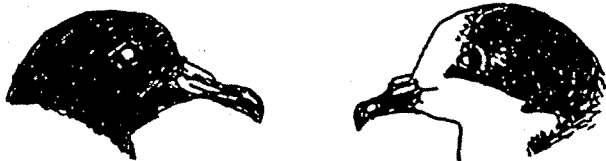
Results from contaminant analysis demonstrated that in 1989, one of ten birds from oiled colonies had livers that were contaminated by petroleum hydrocarbons. In 1990 none of the five birds collected in the oiled area was contaminated, but two of the five had contaminated stomach contents. If this contamination resulted from the oil spill, it suggests that oil may have persisted at least a year in the food chain.

**Effects of the Exxon Valdez Oil Spill on Murres: A Perspective from Observations at Breeding Colonies.** *David R. Nysewander, Washington Dept. of Wildlife, 600 N. Capital Way, Olympia, WA 98501 and G. Vernon Byrd, Alaska Maritime National Wildlife Refuge, 2355 Kachemak Bay Dr., Homer, AK 99603.*

Following the *Exxon Valdez* oil spill in March 1989, murres (*Uria* spp.) were studied at breeding colonies within and just outside the path of the floating oil. At colonies within the path of the oil (but not those just outside it), numbers of murres were reduced, nesting phenology was delayed, and reproductive rates were below normal. These characteristics persisted at some locations, but not all, through 1992. Direct mortality from oiling was the most likely cause of declines in numbers of murres. Older adult murres usually arrive at colonies first; thus, because of the timing of the arrival of the oil slick, most birds killed were probably experienced breeders. Relative inexperience of the surviving breeding population likely caused abnormal breeding schedules and reduced success. Furthermore, reduced densities due to population declines likely resulted in increased predation of eggs and chicks by gulls. Restoration strategies include monitoring to evaluate recovery rates; a feasibility study to test the effectiveness of decoys, dummy eggs, and call playbacks in stimulating normal reproductive behavior; and a public information project designed to reduce disturbance near colonies.

**Delayed Breeding Phenology and Resultant Productivity of Common and Thick-billed Murres at Puale Bay, Alaska, Following the Exxon Valdez Oil Spill.** *Donna A. Dewhurst, U.S. Fish and Wildlife Service, Alaska Peninsula/Becharof National Wildlife Refuge Complex, P.O. Box 277, King Salmon, AK 99613 and James H. McCarthy, P.O. Box 909, Pictou, Nova Scotia B0K 1H0.*

During the summers of 1989-92, land-based productivity monitoring of common (*Uria aalge*) and Thick-billed (*U. lomvia*) Murres was conducted at Puale Bay, along the Pacific coast of the Alaska Peninsula. This four-year case study was one part of coordinated damage-assessment study on murres following the 1989 *Exxon Valdez* oil spill. Productivity steadily increased from negligible levels (5-10%) in 1989 and 1990 to 52-66% in 1992, testing significant using linear regression for both common ( $r^2=0.918, p<0.025$ ) and thick-billed ( $r^2=0.842, p<0.05$ ) murres. The mean age of fledging also increased significantly ( $p<0.025$ ), from  $16.2 \pm 3.2$  days in 1989 to  $22.6 \pm 3.8$  days in 1992,



paralleling the increases in fledging success and productivity. Murre breeding phenology at Puale Bay was approximately one month later than for comparable colonies at the Semidi Islands and Cape Peirce, with chicks fledging in late September. This late phenology was very consistent between years during 1989-91 but shifted one to two weeks earlier during 1992. A possible relationship between the late breeding phenology, gradual lengthening of brooding periods, and increase in productivity is discussed. Additionally, the percentage of breeding murre on the productivity plots decreased significantly ( $p < 0.001$ ) from 1990 because more nonbreeders were present in 1992, possibly representing pre-spill young (fledged in 1988) returning to the ledges as four-year-olds.

**Potential Restoration Options for Common Murres in the Aftermath of the Exxon Valdez Spill.** *Daniel D. Roby, Alaska Cooperative Fish and Wildlife Research Unit, University of Alaska, Fairbanks, AK 99775-0990.*

Common Murres (*Uria aalge*) suffered the greatest direct mortality from the Exxon Valdez spill of any bird species. Some spill-affected colonies have experienced low reproductive success during the four breeding seasons since the spill, presumably due to social factors. This indicates the potential need for restoration activities to encourage, enhance, and/or supplement natural recovery processes. The most feasible options for direct restoration of murres are various methods of enhancing social stimuli and nest site improvement. However, direct restoration activities may prove too costly and ineffective for appreciably enhancing recruitment at damaged colonies. The most promising potential method of indirect restoration is control of avian predators, but no control program should be initiated without prior studies to assess the severity of the problem. The best off-site restoration options appear to be eradication of introduced arctic foxes from islands in the Aleutians and acquisition/protection of seabird breeding colonies that are currently in private ownership. Enhancement of forage fish stocks and mitigation of incidental take of murres by commercial fisheries are both potentially effective restoration techniques, but current knowledge of these factors as they affect murre survival and reproduction are inadequate to judge potential efficacy. The efficacy of any and all restoration options is dependent on continued monitoring of spill-affected and control murre populations and the factors limiting those populations.

**Strategies for Restoring Seabird Colonies.** *Stephen W. Kress, Seabird Restoration Program, National Audubon Society, 159 Sapsucker Woods Road, Ithaca, NY 14850.*

Atlantic Puffins (*Fratercula arctica*), Common Murres (*Uria aalge*), Leach's Storm-Petrels (*Oceanodroma leucorhoa*), Common Terns (*Sterna hirundo*), Arctic Terns (*Sterna paradisaea*), and Roseate Terns (*Sterna dougallii*) are being restored on the Maine coast at former colony sites using active management strategies to encourage colonization. These strategies include habitat enhancements such as control of predatory gulls, artificial nesting structures, and control of vegetation using burns and landscape fabric; translocation of nestlings; and social attraction using models and sound recordings. Selection of appropriate strategies depends on life history parameters, history of extirpation and proximity of neighboring colonies. Combinations of these strategies have successfully restored puffins to two former nesting islands, terns to five islands and storm-petrels to four islands. Colonies that were restored more than ten years ago have continued to persist or grow without additional intensive management. Although protection of existing breeding colonies is usually the most cost-effective approach to seabird conservation, the active management strategies described in this paper offer additional opportunities for effective stewardship. Restoration of former colonies can benefit seabird populations by encouraging breeding at sites with lower predation rates and fewer risks from catastrophic events such as oil spills and disease.

**Status of Harlequin Ducks in North America.** *E. Frances Cassirer, Idaho Dept. of Fish and Game, 1540 Warner Ave., Lewiston, ID 83501.*

Although Harlequin Ducks (*Histrionicus histrionicus*) are locally common winter residents along northern Pacific coastlines, little is known of their numbers or population trends. Harlequin Ducks were listed as an endangered species in eastern Canada in 1990 and are a candidate for threatened or endangered status in the United States. This paper examines available data on the species' status throughout its range in North America and identifies areas of concern and information needs.

## **Breeding Ecology of the Harlequin Duck (*Histrionicus histrionicus*) in the Rocky Mountains.**

David L. Genter, Montana Natural Heritage Program, Helena, MT 59620; E. Frances Cassirer, Idaho Fish and Game, Lewiston, ID 83501; Pat Finnegan, Lewis and Clark National Forest, Choteau, MT 59422; and Rick Wallen, Grand Teton National Park, Moose, WY 83012.

Harlequin ducks have been known to migrate inland to nest on mountain streams since the first naturalists explored the northern Rocky Mountain Region. Recent studies in Montana, Idaho and Wyoming have found this species to be rare and localized in distribution and abundance. Arrival dates from the coast vary with elevation, but most mated pairs and bachelor males arrive on breeding streams in late March and April. Selected waters are typically low gradient (<2%), second- to fourth-order streams with high water quality and little human disturbance. Harlequins were closely associated with riffle and run stream habitats with a cobble or boulder substrate. Marked birds have demonstrated high site fidelity; females exhibit natal fidelity. Breeding occurs over a four-week period; females construct a nest for 2-8 eggs and incubate for 28 days. Nests have been found in hollow snags, cliff sites, in-stream woody debris (jams), and on islands behind woody vegetation. Young are flightless for 56 days, initially using waters with lower velocity and later foraging in faster water. Brood weights at fledging varied, apparently with productivity of natal streams. Pair densities ranged from one pair per km of linear stream to less than one pair per 16 km. Nesting success and survival to fledging of known juveniles varied considerably (12-68% and 16-88%, respectively). Primary factors influencing productivity were timing and magnitude of spring runoff. Population estimates for the study area during the breeding season are: Montana, 260 (110 pr); Idaho, less than 100; Wyoming, less than 100.

**A Preliminary Comparison of the Ecology of Harlequin Ducks Wintering in Eastern and Western North America.** R. Ian Goudie, Canadian Wildlife Service, Box 340, Delta, British Columbia, Canada, V4K 3Y3 and Holly A. Hogan, 2907-160th Street, Surrey, British Columbia, Canada, V4B 4Z5.

Harlequin Ducks (*Histrionicus histrionicus*) are sea ducks that are relatively uncommon. The small and distinct populations occurring in Iceland, Greenland, and eastern North America each have special protection and designation. The Pacific population of Harlequin Ducks is rela-

tively large, and the reasons for the relative "success" of this population are unknown. In a study of body size, diets, and activity budgets in Mergini, Goudie and Ankney (1986) concluded that the relatively small body size of Harlequin Ducks wintering in the northwest Atlantic incurred higher energetic costs. Greater energy requirements per unit of body mass were compensated by both increased proportions of time spent feeding and higher energy density in diets relative to larger species. This appeared to reduce options for the birds to adjust activity budgets to environmental conditions. In the southeastern Pacific, Harlequin Ducks selected diets of lower energy density than the Atlantic. Preliminary data for coastal British Columbia indicate that individuals spend less time feeding, possibly because of less harsh environmental conditions, a greater epibenthic diversity and abundance, and little hunting, which would result in reduced winter mortality compared to the Atlantic populations.

**Seabird Interactions in Puget Sound Purse-Seine Fisheries.** Jon. D. Anderson, Washington Department of Fisheries, 1111 Washington Street SE, P.O. Box 43150, Olympia, WA 98504-3150.

Observations of seabird interactions with commercial purse-seine fishing vessels were made during test fishing and commercial fisheries monitoring during the 1990-92 salmon seasons in Puget Sound. A total of 234 seine sets was observed during purse-seine test fisheries for coho salmon (*Oncorhynchus kisutch*) in the Kingston-Edmonds area in September and October, 1990-92. Four species of seabirds—Rhinceros Auklet (*Cerorhinca monocerata*), Common Murre (*Uria aalge*), Pigeon Guillemot (*Cephus columba*), and Western Grebe (*Aechmophorus occidentalis*)—were encountered in 52 sets. Of the 107 individuals encircled by seine nets, 88 escaped, 23 were entangled and released unharmed, and 6 were killed or injured. A total of 109 sets made by 82 individual commercial seine vessels was observed during coho and chum (*O. keta*) fisheries in the Seattle-Tacoma area in September and October, 1991-92. Seabirds (Rhinceros Auklets, Common Murres, and Western Grebes) were observed encircled by 22 sets. Of the 62 individuals encountered, 45 escaped, 14 were captured and released, and 3 were killed. Seabirds were not encountered during 13 sets observed during the 1991 Skagit Bay pink salmon (*O. gorbuscha*) purse-seine fishery in August-September. Seabird behavior during interactions with those fisheries was discussed.

**The Trophic Role of Dabbling Ducks in Intertidal Eelgrass Habitats of the Puget Trough.** *John R. Baldwin and James R. Lovvorn, Dept. of Zoology, University of Wyoming, Laramie, WY 82071.*

Upon arrival at the Fraser River Delta in early October, dabbling ducks (mainly American Wigeon, Northern Pintails, and Mallards) feed almost entirely in intertidal habitats. Primary foods are the seeds, leaves, and rhizomes of the exotic eelgrass *Zostera japonica* and clams and amphipods inhabiting eelgrass beds. Since the late 1950s, *Z. japonica* has extensively colonized formerly bare mudflats; it grows from seeds in the spring and is uprooted by storm waves in early winter. The early winter shift of dabbling ducks from intertidal to farmland habitats appears to be motivated by disappearance of *Z. japonica* rather than by winter flooding of uplands as previously supposed. During fall and winter 1990-91, dabbling ducks in Boundary Bay consumed an estimated 125 tonnes of eelgrass, about 24% of standing stock. Eelgrass decomposes slowly, and growth of detrital bacteria and microalgae is limited by nitrogen availability. Thus, rapid regeneration of eelgrass nutrients in duck feces, bypassing decomposition, may accelerate nutrient and energy flow to the detrital food chain leading from bacteria to harpacticoid copepods to juvenile fish to piscivorous seabirds.

**Changes in Pacific Northwest Marine Bird Breeding Populations Since the Last Ice Age—Possibilities?** *Steve Speich, Dames & Moore, 1790 E. River Road, E-300, Tucson, AZ 85718 and Terence R. Wahl, 3041 Eldridge, Bellingham, WA 98225.*

During the last Ice Age many areas now occupied by marine bird breeding sites were probably unsuitable, and breeding distributions were different from the present. During the postglacial period, the present breeding distribution of many species was established. The presence of Native Americans, who hunted and gathered marine birds and their eggs, may have limited the abundance and distribution of species, some more than others. The end of the hunting-and-gathering period likely allowed species to colonize new nesting areas and increase in abundance. Colonial, surface-nesting species likely responded. Since World War II in western Washington, several resident species as well as recent colonists, increased in numbers.

**Washington State's Simplified Approach to Natural Resource Damage Assessment.** *Laura Geselbracht and Richard Logan, Washington State Department of Ecology, P.O. Box 7600, Olympia, WA 98504-7600.*

Assessing injury to natural resources resulting from oil spills and valuing the loss has never been an easy task. Traditional field-based damage assessment requires detailed knowledge of resource distribution and abundance and timely collection of evidence. Such information is not available for the majority of marine resources and evidence collection is hampered by visual obscurity, sinking, and scavenging. The Washington State Oil Spill Compensation Schedule provides resource trustees with a simplified tool for assessing natural resource damages resulting from oil spills into aquatic environments. To calculate resource damages using the Compensation Schedule, it is not necessary to know the exact nature, extent, and value of the injuries sustained. Rather, resource damages under the Compensation Schedule are based on the type and volume of oil spilled, the sensitivity of the resources affected by the spill, and actions taken by the responsible party that minimize spill effects. Resource sensitivity is determined through use of several preconstructed relative rankings that were developed using the best available resource information and expert judgement. Perhaps the greatest advantage of the this simplified approach is relatively quick recovery of damages, allowing restoration projects and studies to be initiated in a timely manner.

**Factors Affecting Colony Attendance and Reproductive Success of Common Murres (*Uria aalge*) on Tatoosh Island, Washington.** *Julia K. Parrish, Institute for Environmental Studies, FM-12, University of Washington, Seattle, WA 98195.*

On July 26, 1991, oil leaking from a sunken Japanese fishing vessel, the *Tenyo Maru*, washed past Tatoosh Island, at the northwest tip of the Olympic Peninsula, killing at least 2172 Common Murres (*Uria aalge*) in the vicinity. At the time of the spill, ten species of seabirds were breeding on Tatoosh. It seemed likely that the spill would have a dramatic, negative impact on the Tatoosh murre population (4500 in 1991). Field population-monitoring and sets of behavioral observations were used to determine the 1992 colony attendance and reproductive success relative to prespill figures gathered in 1991. In 23 crevasse colonies attendance was approximately 30% lower in 1992, indicating an island-wide downward trend. Although the oil spill

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is the most likely culprit, there are several other potential forcing factors. During the 1992 breeding season the Pacific Northwest went through an ENSO event, an oceanographic phenomenon that can cause depression in colony attendance. Furthermore, phenology and breeding success of the murre on Tatoosh are significantly affected by colony location, and a related variable, predatory pressure. Therefore, the downturn in 1992 may be due to an interaction between two or more of these forces.

**The Conservation of Oregon Seabirds.** *Roy W. Lowe, U.S. Fish and Wildlife Service, Newport, OR 97365.*

More than 50% of the nesting seabirds on the Pacific coast of the continental United States occur in Oregon. The abundance and variety of protected breeding habitat, combined with a productive coastal upwelling ecosystem, supports an estimated 1.13 million nesting seabirds. The majority of the rocks, reefs, and islands in Oregon are included in Oregon Islands and Three Arch Rocks National Wildlife Refuges and are managed as wildlife sanctuaries by the U.S. Fish and Wildlife Service. The productive ecosystem and abundance of protected breeding habitat, combined with a lack of coastal gillnet fisheries, commercial depletion of prey resources or major oil spills, has resulted in stable or increasing seabird populations in Oregon. The greatest threat to Oregon seabirds today is harassment of nesting birds from human activities near colonies. Reproductive impacts and failure occur when shoreside users attempt to get too close to nesting birds or gain access to rocks during low tides, from boats and other watercraft approaching too close to colonies, and from low-flying aircraft. Current conservation efforts include acquisition of privately owned colony sites by fee title or conservation easement, attempts to establish buffer zones around major colonies, dissemination of information and educational materials to the public, and enforcement of federal law.

**Foraging Efficiency of Freelifving Red-necked Phalaropes at Mono Lake: A Test of the Usefulness of Laboratory Measures of Feeding Performance.** *Margaret Rubega, Department of Ecology & Evolutionary Biology, University of California, Irvine, CA 92717.*

Laboratory-based feeding experiments designed to examine the effects of changes in prey density on feeding performance have previously been conducted with Red-necked Phalaropes (*Phalaropus lobatus*). Experiments were

designed to examine the potential effects of prey density changes resulting from declining water levels at Mono Lake. To validate the results of these laboratory tests, free-living Red-necked Phalaropes were videotaped while feeding and the resulting films scored at half speed to determine field feeding rates and foraging efficiencies. The data indicate that mean foraging efficiencies of birds feeding in the lab on brine fly (*Ephydra hians*) larvae at the lowest experimental density are one-and-a-half times greater than those of birds feeding in the field. This result implies that either laboratory experiments accurately predict decreasing foraging efficiency with decreasing prey density or values for feeding performance across changing prey densities from a laboratory situation are overestimates of how "well" phalaropes can do at a given prey density and that laboratory experiments are therefore likely to underestimate the negative effects of decreasing prey density in a field situation, or both.

**Prey Choices and Foraging Efficiency of Juvenile California Gulls at Mono Lake.** *Chris Elphick, Ecology Evolution & Conservation Biology, University of Nevada, 1000 Valley Rd., Reno, NV 89512 and Margaret Rubega, Department of Ecology & Evolutionary Biology, University of California, Irvine, CA 92717.*

Mono Lake supports the second largest California Gull (*Larus californicus*) colony in the world. Consequently, concerns have been raised over the likely effects on this species of declining lake levels. To date, however, attention has been focused on increases in predator access to the islands on which the birds nest. Little attention has been paid to the effects of water diversions on the gulls' food supply. We present evidence that the more vulnerable of two potential prey species, the brine fly (*Ephydra hians*), may be a more important food source than has previously been assumed. We videotaped feeding juvenile gulls and scored films at half speed to determine prey choices and foraging efficiency. Our results show that *Ephydra* constitute a major portion of the diet of the birds filmed, and that feeding efficiency is high. We suggest that the high nutritional value of the flies and the nonmotility of floating pupae and recently emerged adults make them a valuable food source to inexperienced juvenile gulls. Such factors should be considered in the management of the gull colony at Mono Lake.

**Significance of Stomach Oils for Reproduction in Petrels.** *Daniel D. Roby, Jan R. E. Taylor, and A. R. Place, Alaska Cooperative Fish and Wildlife Research Unit, University of Alaska, Fairbanks, AK 99775-0990 and Center of Marine Biotechnology, Maryland Biotechnology Institute, Baltimore, MD 21202.*

Stomach oils, a complex mixture of neutral dietary lipids, are typical of Procellariiform birds. We investigated the role of stomach oils in seabird reproductive energetics by comparing the Antarctic Prions (*Pachyptila desolata*), a species that feeds its young stomach oils, with the South Georgia Diving Petrels (*Pelecanoides georgicus*), a species that lacks stomach oils. We cross-fostered the two species in the field and raised the two species in the lab on low-oil and high-oil diets. Diving petrel parents deliver meals to their chicks about twice as frequently as prion parents, but diving petrel foster parents did not successfully raise prion chicks, presumably because of the absence of stomach oils in meals fed to chicks. Prion parents successfully raised diving petrel chicks to fledging, but growth rates were lower than in controls and fledging was delayed. Diving petrel chicks fed high-oil diets in the lab excreted considerable oil, and the development of these chicks was retarded. Diving petrels lack the digestive physiology and anatomy to efficiently digest and assimilate diets containing stomach oils. Prion chicks fed a high-oil diet developed at the same rate as prion chicks on a low-oil diet, but the rate of body mass increase was significantly greater. Adult prions feeding chicks had substantially lower field metabolic rates than diving petrel adults. The higher foraging efficiency of prion parents, together with the production of stomach oils in the proventriculus, allows prions to feed their young an energy-rich diet. Stomach oils appear to be an essential adaptation for enhancing the energy density of chick meals in petrel species that feed their chicks less frequently than diving petrels.

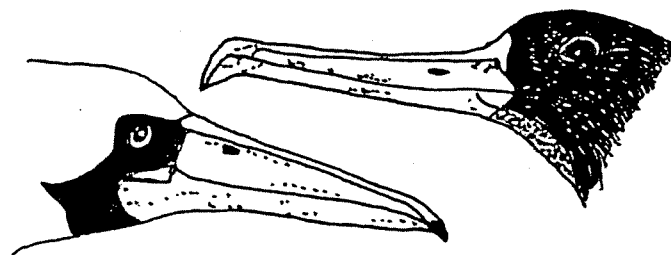
**Nest Selection in Male and Female Magellanic Penguins.** *David Stokes, Department of Zoology, NJ-15, University of Washington, Seattle, WA 98195.*

Magellanic Penguins exhibit high breeding-site fidelity. Yet although large-scale movements are rare, substantial numbers of birds change nest sites between breeding seasons. Patterns of nest selection differ between the sexes, reflecting different costs and benefits for males and females. Among males that change nests, subsequent nest choice is influenced by proximity to the old nest and nest

quality. Besides being more likely to fledge chicks, males in high-quality nests are more likely to attract females than are males in low-quality nests. Females are more likely to change nests than males and to move greater distances. Arriving at the colony later than males, females may be able to base nest selection on information not available to males.

**Air-Sea Heat Flux, Ocean Wind Fields, and Off-shore Dispersal by Gulls during Winter.** *J. Christopher Haney, Wildl. Technol. Program, School of Forest Resources, Pennsylvania State University College Place, Du Bois, PA 15801; David S. Lee and Mary J. Socci, North Carolina State Museum of Natural Science, P.O. Box 27647, Raleigh, NC 27611.*

Gulls delay dispersal to oceanic waters in the western North Atlantic until onset of winter meteorological conditions, several months after cessation of breeding. Off the southeastern U.S., gull presence in offshore habitats was inconsistently associated with seasonal variability in mean wind speed, but negatively associated with monthly and accumulated air-sea heat flux (surrogates for temperature inversions, i.e., prethermal conditions) and positively associated with windspeed variance (an energy source for flight as well as a thermal inducement). Meteorological variables explained as much as 59-81% of seasonal changes in gull abundance offshore. Our findings support Woodcock's (1940) "convective soaring" hypothesis, which attributed gull dispersal during winter to boundary-layer dynamics along eastern continental margins. We extend this model by linking gull wing morphology and flight to energy-efficient reliance on air-sea interactions and geographic patterns in seasonal wind fields. Summer meteorological conditions in much of the western North Atlantic facilitate coastal foraging by gulls, but preclude efficient foraging in offshore habitats. Coherent and synoptic processes in the aerial environment may select for (or maintain) divergent life-history strategies observed in gulls and certain other inshore feeders.



## **Auklets, Eddies, and Zooplankton in Bering Strait.**

*John F. Piatt, U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, AK 99503; Alexei Pinchuk, Lab. Mar. Res., Zoology Inst. Acad. Sci., Universitetskaya nab. 1, St. Petersburg, 199034 Russia; Alexander Kitaiskiy, Inst. Biolog. Problems North, Karl Marx St. 24, Magadan 685000 Russia.*

Millions of seabirds, mostly planktivorous Aethia auklets, breed on the Diomed Islands in the center of Bering Strait. We conducted ship-based surveys of seabirds, zooplankton (acoustic and net-tows), and oceanography (SST, SSS, and CTD profiles) in July 1991. Alaska coastal water sustained a low biomass of coastal zooplankton, few auklets, and moderate densities of fish-feeding seabirds. Least Auklets and oceanic copepods were abundant in stratified shelf water and near upwelled Anadyr water in western Bering Strait. A small (20-30 km) baroclinic eddy surrounded by upwelled Anadyr water contained the highest acoustically determined biomass of zooplankton in the study area. Crested Auklets, which feed mostly on euphausiids (*Thysanoessa* spp.), were associated with the eddy. Fish-feeding seabirds (e.g., murrelets, kittiwakes, puffins) foraged mostly in stratified Alaska and Siberian coastal waters. We conclude that physical processes (upwelling, stratification, and eddies) in Bering Strait determined zooplankton availability to planktivores. Auklets exhibited threshold responses to plankton density and appeared to forage only as far from their colonies as necessary to exploit dense, accessible plankton aggregations.

## **Stable-Isotopic Determinations of Seabird Trophic Relationships in the Northwest Pacific Ocean.**

*Keith A. Hobson, Canadian Wildlife Service, 115 Perimeter Road, Saskatoon, Saskatchewan S7N 0X4 and John F. Piatt, U.S. Fish and Wildlife Service, Anchorage, AK 99503.*

Twenty-five species of marine birds from two regions of coastal British Columbia and the western Gulf of Alaska were analyzed isotopically. Stable-nitrogen isotopic analysis of seabirds and their prey confirm that this isotope can be used to predict seabird trophic positions in each of these regions. Seabird trophic level inferences based on  $\delta^{15}\text{N}$  analyses are in general agreement with those of conventional dietary studies but suggest that lower-trophic-level organisms are more important to the diet of several seabirds than was previously recognized. Stable-carbon isotope analysis may be more generally applicable to seabird dietary analyses as an indicator of benthic vs. pelagic feeding preference.

## **Endangered Japanese Murrelets: Incidental Catch in High-Seas Driftnets and Postbreeding Dispersal.**

*Patrick J. Gould and John F. Piatt, U.S. Fish and Wildlife Service, 1011 E Tudor Rd., Anchorage, AK 99503.*

The incidental catch of seabirds in high-seas driftnets was recorded in 1990-91 by scientific observers on commercial squid and large-mesh-fishery vessels operating in the North Pacific Transitional Zone. Twenty-six *Synthliboramphus* murrelet mortalities were recorded in the months of August through December. All but one were from the Korean squid fishery in an area bounded by 38-44°N and 142-157°E. Of ten specimens identified by observers as Japanese Murrelets (*S. wumizusume*), two were collected and later confirmed as such; another three *Synthliboramphus* spp. were also later identified as Japanese Murrelets. No Ancient Murrelet (*S. antiquus*) identifications were confirmed. The estimated total mortality of Japanese Murrelets in high seas driftnet fisheries represents a significant proportion of the total world population (ca. 1000-1500 individuals) of this rare and endangered species. As fishing effort was widely distributed over a large area east of Japan, catch data suggest that postbreeding Japanese Murrelets migrate north to winter in an area southeast of Hokkaido, where persistent eddies form at the confluence of the Oyashio and Kuroshio currents. Fronts between cold Oyashio water and Kuroshio warm-core eddies promote the aggregation of zooplankton and pelagic fishes, which in turn may sustain murrelets during the nonbreeding season.

## **Seabird Colony Studies on Talan Island, Northern Sea of Okhotsk.**

*A. Ya. Kondratyev, Institute of Biological Problems of the North, Far East Branch, Russian Academy of Sciences, Karl Marx St. 24, Magadan, Russia 685000.*

Talan is a small (2.5 km<sup>2</sup>) island situated in shallow coastal water of Tauj Bay in the northern Sea of Okhotsk. This island supports one of the largest and most diverse aggregations of breeding seabirds in the Russian Far East. The most numerous species is the Crested Auklet, with close to 1 million individuals. Also abundant (>10,000 individuals) are Parakeet Auklets, Ancient Murrelets, Tufted Puffins, Horned Puffins, Thick-billed Murrelets, Common Murrelets, and Black-legged Kittiwakes. Lesser numbers of Least Auklets, Spectacled Guillemots, Pelagic Cormorants, and Slaty-backed Gulls nest on Talan. Since the spring of 1987, a field station has been occupied annually by 5-10 persons to investigate: (1) population sizes, trends, and counting methods, (2) annual productivity of selected spe-

cies, (3) seabird feeding ecology and forage, and (4) incubation rhythms and chick development. In 1992, we began collaborative work with American colleagues to assess the adult survival and population dynamics of kittiwakes for comparison with information on this species in Alaska. Continued seabird monitoring on Talan Island is especially important because nearby portions of the continental shelf are now scheduled for oil exploration and development.

**Seabird Population Changes on Middleton Island, Alaska.** *Scott A. Hatch, Brian S. Fadely, and Bay D. Roberts, Alaska Fish and Wildlife Research Center, U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, AK 99503.*

Middleton Island, north-central Gulf of Alaska, was visited in 1956 by Robert Rausch, who provided some of the earliest estimates of seabird population sizes for any Alaskan colony. Censuses of several species have been conducted almost annually since 1974. Black-legged Kittiwakes increased from an estimated 10,000-15,000 pairs in 1956 to more than 80,000 pairs in 1981 but have since declined to about half that level. Rausch found only about 400 murrelets, mostly Thick-billed, during his visit. Today the island supports a similar number of Thick-billed Murrelets but also has 6000-8000 Common Murrelets that were not present in 1956. No Glaucous-winged Gulls were breeding on Middleton in 1956. By the mid 1970s there were 500-700 pairs, and by 1990 the population had grown exponentially to more than 7000 pairs. One of four small colonies of Rhinoceros Auklets increased from fewer than 50 to more than 900 burrows between 1978 and 1992. The reasons for these and other changes can only be guessed at. Middleton Island was uplifted about 4.5 m in the Alaska earthquake of 1964, significantly altering bathymetry in the area, possibly in a manner favorable to forage fish or other seabird prey.

**Seabird Reproduction and Diets at the Pribilof Islands with Respect to Sea-Surface Temperature and the Abundance of Juvenile Pollock in the Eastern Bering Sea.** *Mary Beth Decker, George L. Hunt, Jr., Department of Ecology and Evolutionary Biology, University of California, Irvine, CA, 92717; G. Vernon Byrd, Jr., U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Refuge, Homer, AK 99603.*

Marine birds nesting on the Pribilof Islands, southeastern Bering Sea, exhibited decreases in reproductive performance (Black-legged Kittiwakes, *Rissa tridactyla*, and Red-

legged Kittiwakes, *R. brevirostris*) and changes in food habits (Black-legged Kittiwakes, and Thick-billed Murrelets, *Uria lomvia*) beginning about 1978. These changes coincided with the appearance of the unusually large 1978 year class of walleye pollock (*Theragra chalcogramma*) and the beginning of a period of above average sea-surface temperatures that lasted until 1984. Seabird reproductive performance and diets did not return to pre-1979 values after 1984, suggesting that the changes in the marine ecosystem to which the birds responded lasted longer than the cycles of warm and cool surface temperatures observed between 1975 and 1990.

**Growth-Rate Variation in Tufted Puffin Nestlings on East Amatuli Island.** *Arthur Kettle, Institute for Environmental Studies, FM-12, University of Washington, Seattle, WA 98195.*

Growth rates of Tufted Puffin nestlings on East Amatuli Island, Alaska were measured during 1976-77, 1979-82, and 1990-92. Among years, mean rates of increase of both weight and wing chord differed significantly. Growth of nestlings may be regulated in part by the abundance of prey available to foraging parents. However, an experiment of supplementary feeding of chicks did not increase growth rates. The type of prey available may also affect growth. Chick diet samples show interyear differences in the species composition of prey parents fed nestlings. Prey availability may be related to physical and biological oceanographic factors. Analysis of the relationships among growth rates, chick diet, and oceanographic conditions may make the relatively easy measurement of nestling growth a valuable gauge of more difficult measurements of Tufted Puffin reproductive success and marine productivity. Fine-scale study of within-season growth changes may provide clues about the mechanisms of interyear observations.

**Seabirds as Indicators of Marine Food Supplies: Fledging Weights Revisited.** *William J. Sydeman and David G. Ainley, Point Reyes Bird Observatory, 4990 Shoreline Highway, Stinson Beach, CA 94970.*

Seabirds are abundant predators in the marine environment, feeding primarily on small crustaceans and juvenile fish. Reproductive performance of seabirds may vary as a function of local fish and crustacean availability. In particular, chick fledging weight has been suggested to be sensitive to variation in food availability and may therefore serve as a reliable indicator of the state of marine resources. Wil-

Williams and Croxall (1990) have, however, recently challenged this idea by illustrating how the relationship between fledging weight and food supplies varies with chick age (at time of measurement) and brood size. We further evaluate Williams and Croxall's argument using a 22 year time-series of fledging weight and diet of Pigeon Guillemots at the Farallon Islands and a 10 year time-series of NMFS rockfish estimates from the Gulf of the Farallones. Fledging weights were significantly greater in years of high rockfish availability; approximately 50% of the variation in mean fledging weight could be explained by fish availability. Fledging weight was also correlated with average breeding success. However, results varied by brood size and other factors as found by Williams and Croxall. Implications of these results to oceanic monitoring programs in the north Pacific and elsewhere are discussed.

**Booby Prey-capturing Behavior in the Eastern Tropical Pacific.** Robert L. Pitman and Lisa T. Ballance, *SW Fisheries Science Center, P.O. Box 271, La Jolla, CA 92038.*

We studied methods of prey capture by Masked (*S. dactylatra*), Red-footed (*S. sula*), and Brown (*S. leucogaster*) Boobies in the pelagic eastern tropical Pacific from 1979-1990. Our observations suggest that these three species take similar sizes and species of prey (mainly flying fish) but specialize in different prey capture behaviors. Masked Boobies captured prey almost exclusively by vertical plunge diving (99% of 327 capture attempts) from a steep angle ( $> 75^\circ$ ) and a mean height of 8.9 m and remained submerged for a mean of 2.7 seconds. In contrast, Red-footed Boobies caught prey primarily in the air (83% of 328 capture attempts). They occasionally plunged but from lower heights (mean of 3.6 m), remaining submerged for shorter periods of time (mean of 1.2 seconds). Brown Boobies also caught prey using plunge dives (61% of 168 capture attempts) from low heights (mean of 4.0 m) remaining submerged for a mean of 1.4 seconds. In addition, they used a modified method that we have termed "skim plunging" (37% of attempts): plunge diving from a low angle ( $> 15^\circ$ ). We never observed skim plunging by Masked or Red-footed Boobies. Because the Red-footed Booby specializes on disturbed prey, it appears to depend more on subsurface predators for successful feeding than either of the other two boobies.

**Phenology Analysis: When Do Tropical Seabirds Breed?** Elizabeth N. Flint, *U.S. Fish and Wildlife Service, Pacific/Remote Refuges, P.O. Box 50167, Honolulu, HI 96850.*

Proximate factors related to the initiation of breeding in birds are least well understood in tropical species. I examined breeding population and phenology data collected year-round for the last 12 years at the Tern Island field station, French Frigate Shoals, Hawaii, to develop methods for quantifying variation in breeding attempts in terms of magnitude, timing, and synchrony. I also analyzed time series of breeding data for Black Noddies, Red-footed Boobies, and Red-tailed Tropicbirds using autocorrelation, spectral analysis, and cross-correlation to detect periodicities of other than 12 months and to search for relationships between initiation of breeding and oceanographic and physical fluctuations such as sea level and wind velocity. All eggs of nine species breeding at Tern Island were counted at intervals equivalent to their incubation periods. This allowed estimation of total eggs laid per year and description of their temporal distribution during the year. Measurements of egg-laying synchrony, weighted mean Julian date of laying, and total eggs laid showed striking parallels among species through the years, despite their ecological differences. Time series of these variables also showed patterns related to major oceanographic events such as the last three ENSOs (El Niño-Southern Oscillation).

**Conservation of Seabirds on Christmas Island.** Mark J. Rauzon, *Marine Endeavors, Box 4423, Berkeley, CA 94704* and Katino Teeb'aki, *Wildlife Conservation Unit, Kiritimati (Christmas Island), Kiribati.*

The reasons for decline in seabirds at Christmas Island, Republic of Kiribati, Central Pacific Ocean, have been confounded by the El Niño phenomenon, but the decrease in Masked Boobies, Red-tailed Tropicbirds, and Sooty Terns can be attributed in part to feral cat predation and poaching. To fulfill the Christmas Island feral animal eradication plan, biological control via feline parvovirus was successfully applied through a coordinated effort between New Zealand, Kiribati, and North American public and private conservationists. The Kiribati islanders' concerns and the ecological consequences about feral cat eradication and poaching are discussed.

**Breeding Biology of Bulwer's Petrel (*Bulweria bulwerii*) on Johnston Atoll, Pacific Ocean.** *Donna L. O'Daniel, Johnston Atoll National Wildlife Refuge, P. O. Box 317, APO AP 96558.*

During 1991 and 1992, approximately 60 pairs of Bulwer's Petrels nested along the causeway of Sand Island, Johnston Atoll. The breeding season is well defined, adults arriving in early April and departing by mid-September. They construct crude nests in natural rock crevices and arrive and depart the nest sites only between dusk and dawn. During 1991 the entire colony was monitored twice monthly, and during the nesting season of 1992, one group was monitored intensively, and a second, control group was monitored twice monthly. Adults sat tightly on their eggs during incubation and most chicks hatched synchronously, between 24 and 30 June. Most chicks fledged between 21 August and 1 September. The overall rate of success for both groups for each stage of the nesting cycle was determined: hatching success was 73%, fledging success was 97%, reproductive success was 71%. Observed feeding of chicks just before fledging suggests that adults do not abandon chicks for a period before fledging. In addition, vocalizations of Bulwer's Petrels were counted along the entire causeway at different times of the night throughout the nesting season to determine, for management purposes, when they were most vocally active.

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## Posters...

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**Management and Breeding of Captive Alcids at the Seattle Aquarium.** *Barbara K. Douma and Mary Carlson, Seattle Aquarium, Pier 59, Waterfront Park, Seattle, WA 98101.*

The Seattle Aquarium has exhibited four species of alcids since it opened in 1977: Tufted Puffins, Common Murres, Rhinoceros Auklets, and Pigeon Guillemots. Over the years, the alcid management program has evolved to include the development of a comprehensive diet and a successful breeding program. In 1991, a Tufted Puffin was hatched at the aquarium, and a breeding pair of Rhinoceros Auklets has laid an egg for two consecutive years. The staff has experimented with various artificial burrows and nest cavities, diets, and photoperiods to support captive breed-

ing. In addition, the staff has conducted a few research projects with the alcid population and is interested in entertaining research proposals from Pacific Seabird Group members. This presentation introduces the exhibit, husbandry techniques, and the breeding program.

**Radar Studies of Newell's Shearwaters on Kauai, Hawaii, During Fall 1992.** *Brian A. Cooper and Robert H. Day, Alaska Biological Research, Inc., Fairbanks, AK 99708.*

We used an ornithological radar, night-vision scope, and forward-looking infrared (FLIR) system to monitor movements of Newell's Shearwaters at eight sites on Kauai during October 1992. Concurrent sampling with the radar and the night-vision scope and information on species flying at night indicated that the error rate for identifying targets on the radar was low. The FLIR and night-vision scope (with an additional light source) could detect shearwaters up to 500-1000 m away. Movement rates were highest in northern and eastern Kauai and lowest in southern Kauai. Mean nightly movement rates ranged from 9 to 85 targets/h, and the highest hourly movement rate was 355 targets/h. We observed substantial among-night variation in movement rates and a decline in numbers over the study period. The highest movement rates occurred when shearwaters moved inland just after dark (1830-1900 h) and moved seaward just before dawn (0500-0600 h). Steady, low-level movement both inland and seaward occurred during the remainder of the night. Radar measurements indicated that most birds flew between 76 and 275 m above ground level; head winds did not seem to decrease flight altitude.

**Using Mist Nets to Capture Marbled Murrelets Over the Water.** *Rick Burns, 12136 New McLellan Road, Surrey, B.C. V3X 2X9; Gary W. Kaiser, Canadian Wildlife Service, P.O. Box 340, Delta, B.C. V4K 3Y3; Lynn Prestash, 12136 New McLellan Road, Surrey, B.C. V3X 2X9.*

Radiotelemetry and other studies of Marbled Murrelets (*Brachyramphus marmoratus*) depend on the ability to capture samples of the birds. Here we present two systems for erecting mist nets over water. One system, suitable for use in shallow, sheltered water, is light and easily portable. The other system, suitable for use in deep water, is able to withstand strong winds and large tides but requires more effort to set up or move. These systems use standard mist nets and readily available commercial fishing supplies.

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Both systems took advantage of the daily flights of Marbled Murrelets out of inlets on the British Columbia coast, and resulted in the capture of 33 murrelets.

**Potential Impact of Introduced Raccoons on Native Burrow-Nesting Seabirds of the Queen Charlotte Islands.** *Lisa Hartman and D. S. Eastman, Dept. of Biology, Univ. of Victoria, P.O. Box 1700, Victoria, B.C. V8W 2Y2.*

The introduction and spread of raccoons (*Procyon lotor*) on the Queen Charlotte Islands have raised concerns over their potential impact on native burrow-nesting seabirds. To evaluate this threat, we compared raccoon diet, home range, and habitat use in an area devoid of seabirds with those observed on an adjacent seabird colony island. Scat analysis indicated that raccoon diet consisted almost entirely of intertidal foods in the area devoid of seabirds (n=55), whereas on the colony island seabirds dominated the diet (n=12). Radio-tracking of nine animals indicated that home ranges were small (<1 km<sup>2</sup>), raccoons foraging nightly on the shoreline and denning daily within 750 m of the shore. Relatively small colony islands may therefore support raccoon populations if they contain sufficient intertidal foraging habitat. Predation was documented for one breeding season on seven transects covering 17% of the colony area. Preliminary analyses suggest that three raccoons were responsible for the loss of at least 218 adult Ancient Murrelets (7-9% of the breeding population) and 188 eggs and chicks. Documented over-water crossings of 600 m place at least 40% of the QCI seabird population at risk of colonization.

**Seabirds at Fieberling Guyot, a Midocean Seamount in the North Pacific.** *J. Christopher Haney, Wildlife Technology Program, School of Forest Research, Penn State Univ., College Place, DuBois, PA 15801; Loren R. Hauray, Marine Life Research Group, A-018, Scripps Inst. Oceanography, La Jolla, CA 92093; Lauren S. Mullineaux, Biology Dept., Woods Hole Oceanographic Inst., Woods Hole, MA 02543.*

In June and September 1991, seabirds, neuston, and plankton were investigated at Fieberling Guyot in the eastern North Pacific Ocean, 1000 km west of San Diego, California. This midocean seamount (32°25'N, 127°45'W) is a truncated submerged volcano (summit area approximately 50 km<sup>2</sup> at 600 m contour) rising from an abyssal plain at 4250 m to a summit depth of 438 m. Six seabirds

were recorded in midocean; two species were observed only at the seamount (*Pterodroma externa* and *P. ultima*). *Diomedea nigripes*, *P. cookii*, *Oceanodroma leucorhoa*, and *Phaethon aethereus* occurred both at and adjacent to the seamount. Seabirds were 1.7-2.4 times more abundant within a 30-km radius of the seamount's summit than at adjacent control sites. Seamount densities (0.68 birds km<sup>-2</sup>) were considerably lower than comparable seasonal values recorded in offshore regions of the California Current, within the range of densities in the least productive subtropical waters of the Gulf Stream, and only slightly higher than seabird abundances recorded for the oligotrophic Sargasso Sea. We discuss (1) mesoscale circulation patterns (upwelling, Taylor columns and eddies, and trapped waves) associated with these geophysical features and (2) potential trophic interactions associated with the enhanced sound-scattering layer at the seamount.

**Large-scale Driftnets and Marine Birds: Status of Data, Reports, and Research.** *Patrick J. Gould, Kent Wohl, U.S. Fish and Wildlife Service, Anchorage, AK 99504; Gary W. Shugart, Chris S. Wood, Burke Museum, University of Washington, Seattle, WA 98195; Daniel Waldeck, National Marine Fisheries Service, Sand Point Way NE, Seattle WA 98115.*

Thirty-five species of marine birds and one land bird were reported entangled in squid and large-mesh driftnets set in the North Pacific during 1989-91 scientific observer programs conducted by Canada, Japan, the Republic of Korea, Taiwan, and the United States. Seven reports on these observations have been released, and two others are imminent. Assessments of the impacts of these fisheries on incidentally caught organisms have been presented in two international workshops. A total of 1532 bird specimens was salvaged from observed operations, including at least one specimen each of 31 species. These specimens are now in the collection of the Burke Museum, University of Washington, Seattle. Scientific information being obtained from this collection includes: sex identification; age estimation, including relationship between age and condition of the bursa in banded albatross; size and condition of bursa; fat condition; gonad size and condition; analyses of stomach contents (prey items and plastic particles); stable-isotope ratios of carbon and nitrogen in breast muscle tissue; and in albatrosses, flight-feather molt and endoparasites of the upper intestinal tract. Several studies are focusing on the distribution of species as shown by the bycatch records.

**Nesting Marbled Murrelet—Fifteen Days of Behavioral Observation.** *David A. Fortna, S.J. Kerns and M. E. Freitas, Wildland Resource Managers, P.O. Box 102, Round Mountain, CA 96084.*

On 7 August 1992, an active Marbled Murrelet (*Brachyramphus marmoratus*) nest was discovered northeast of the town of Fortuna, Humboldt Co., California. For the next 15 days, observation of behavioral activities at and around the nest site were noted and videotaped. Observations included the following: (1) Two prey items presented to the nestling by a single adult; (2) both adult birds at the nest at the same time with prey items; (3) visitations by adults lasting from a few seconds to more than an hour; (4) three visitations and feedings in less than 30 minutes; (5) adult posture and interactions with the nestling during feedings. Photographs, diagrams, and multimedia video portray material gathered at the first occupied Marbled Murrelet nest found between San Francisco and the Oregon border.

**Assessing Potential Impacts on Seabirds by a Proposed Coastal Wind Generating Facility.** *Kathy Keane, P&D Technologies, P.O. Box 5367, Orange, CA 92613.*

The increasing concerns for improving air quality and to reduce dependence on fossil fuels have generated interest during recent years in wind generation. Currently, notable wind generating facilities in the United States are limited to large wind farms of thousands of turbines located in foothills and mountain passes. However, proponents of wind generation have recently begun to turn their attention toward coastal areas, given their nearly continuous and reliable wind conditions. Although coastal wind facilities are common in northern Europe, few studies on the extent of impact on seabirds are available that would be applicable to Pacific Coast avifauna. To estimate the potential impact of a 20-turbine facility proposed on the San Pedro breakwater in the Los Angeles harbor, observations were made from 45 stations on the breakwater to monitor avian activity. Two endangered species, the California Least Tern and the California Brown Pelican, forage in the vicinity of the breakwater. Species, flock size, flight height, distance from breakwater, age, and eight classes of behavior were recorded for each observation. The data were analyzed and compared with existing information on avoidance behavior of wind turbines by related species to estimate the potential for collisions and other avian impacts.

**Monitoring of Pigeon Guillemots in Puget Sound.** *Mary Mahaffy, U.S. Fish and Wildlife Service, Olympia, WA 98503 and George Divoky, University of Alaska, Fairbanks, AK 99775.*

Pigeon Guillemots have been selected as a potential monitoring species for the interagency Puget Sound Ambient Monitoring Program. Puget Sound waterbirds are monitored to allow evaluation of spatial and temporal variation in distribution and abundance, reproductive parameters, and contaminant concentrations. In 1992, wooden nest boxes were placed under piers at Port Townsend and Olympia, Washington, to recruit Pigeon Guillemots. Three boxes at Port Townsend were used by nesting guillemots, and six chicks were banded. None of the boxes at Olympia were occupied by guillemots. Nest boxes will be placed at additional locations in 1993. Further activities in 1993 will include banding chicks and adults with unique color-band combinations and determining colony size, nest productivity, and chick growth rates. Prey brought to Pigeon Guillemot chicks at locations with nest boxes will be identified to evaluate potential contaminant pathways. Assuming Pigeon Guillemots are selected as a monitoring species, every five years a limited number of eggs will be sampled from selected locations for contaminant analyses.

**Predation on a Breeding Adult Marbled Murrelet at a Nest Site.** *Dennis K. Marks, U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage AK 99503.*

This paper documents the taking of a breeding adult Marbled Murrelet from a nest site and adds the Sharp-shinned Hawk to the list of murrelet predators. Observations were made during a dawn survey on Storey Island, Prince William Sound, Alaska, on July 11, 1991. The survey site, about 180 meters inland and 120 meters in elevation, had large Sitka spruce, western and mountain hemlock, 85% canopy closure, and thick moss on the trees and ground. Large moss platforms were common on trees more than 70 cm dbh. At 0444, during twilight 27 minutes before official sunrise, an adult Marbled Murrelet was taken to the ground and killed by a Sharp-shinned Hawk; I had observed two previous visits by the murrelet(s) beforehand. The murrelet was a 200-g male with a vascularized brood patch. Although I climbed three trees, I found no nest. Predation on eggs and chicks is well documented and may account for a significant percentage of nest failures. The loss of breeding adults has an even greater potential impact on murrelet populations. This observation documents adult

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murrelet vulnerability at the nest site and may explain apparent predator-avoidance behaviors around the nest.

**Report on the First Known Markham's Storm-Petrel Breeding Area.** *Jaime Jahncke, APECO, Parque Jose de Acosta 187, Lima, Peru.*

A survey of the Parcas Peninsula was conducted to confirm previous observations of Markham's Storm-Petrel (*Oceanodroma markhami*) nesting areas. Nests were found in natural cavities or interstices under a saltpetre surface forming small colonies.

Seventy-four nesting sites were evaluated, and a total of 1144 nests was found. Fifty-four percent of the nesting sites were found at heights between 180 and 300 m above sea level.

No living birds were found at the nesting sites. Several skeletons, wings, and old eggs were present in the areas surveyed, however, strongly suggesting that the Parcas Peninsula is a Markham's Storm-Petrel breeding area—the first reported. This study was funded by the Peruvian Conservation Data Center (CDC-UNALM).

**Marbled Murrelet Surveys in Prince William Sound, Alaska: Censusing Nesting Activity by Boat.** *Dennis K. Marks, Kathy J. Kuletz, and Nancy L. Naslund, U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, AK 99503.*

To assist Exxon Valdez oil spill restoration efforts, dawn watch surveys for nesting activity of the Marbled Murrelet (*Brachyramphus marmoratus*) were conducted in western Prince William Sound, Alaska, in 1992. Intensive dawn surveys (12 June-3 August) were done from shore and anchored vessels at randomly selected sites. Upland habitat ranged from low and high volume forests to treeless areas. Numbers of detections per site ranged from 2 to 333 ( $n=85$ ,  $x=58$ ) and showed a strong seasonal trend; detections increased 3-fold after mid-July. About 30% of the boat watch detections were birds sitting on or flying over the water and may require separate analysis. This survey method is appropriate for determining general distribution and habitat association for a large geographic area primarily accessible by boat. At some sites, intensive surveys farther inland would be necessary to locate nesting areas. U.S. Forest Service Geographic Information System coverage of the area will enable us to analyze the relationship between habitat and murrelet activity within a buffer of 500 and 1000 meters of each site.

**The Olympic Coast National Marine Sanctuary.** *Linda Maxson, National Marine Sanctuary Program, NOAA, Sand Point Way NE, Seattle, WA 98115.*

The Olympic Coast National Marine Sanctuary will be designated in the waters off Washington's Olympic Peninsula. One of the last relatively undeveloped coastlines along the Pacific, the area is both spectacularly beautiful and rich in marine life. The proposed sanctuary is characterized by rocky headlands, pocket beaches of sand or cobbles, sea stacks, tidepools, offshore islands and reefs, and fishing grounds. These rocky headlands, offshore islands, and highly productive offshore and nearshore waters provide essential habitat for a wide variety of both migratory and resident marine birds. Speich et al. (1987) reported a total of 87 species of birds observed or known to occur in the area. Many species of birds are year-round residents; others may be summer or winter visitors, or migrants present only during spring and/or fall migrations. The seabird colonies in the area are among the largest of the contiguous United States.

Designation of the Olympic Coast National Marine Sanctuary will provide additional protection to the bird populations that reside within or move through the sanctuary. The National Marine Sanctuary Program provides for comprehensive management of all of the area's significant marine resources and promotes resource protection through research and education. The sanctuary will be managed to allow for compatible multiple use, balanced with measures to maintain the health and integrity of the ecosystem.

**A Long-term Monitoring Program for Puget Sound Seabird Populations.** *David Nysewander, Matt Nixon, and Janet Stein, Washington Department of Wildlife, Olympia, WA 98501-1091.*

The Washington Department of Wildlife has initiated a long-term monitoring program of the seabird and waterfowl populations that use Puget Sound. This work is being conducted as part of the Puget Sound Ambient Monitoring Program, which identified marine bird populations as one of the key environmental indicators for monitoring the health of Puget Sound. Aerial and boat surveys for marine birds are conducted during summer and winter covering the entire coastline and some open-water areas of the sound, the San Juan Islands, and the eastern Strait of Juan de Fuca. An onboard computer linked to a global positioning unit (GPS) records position and time every 5-10 seconds, providing a very precise description of the actual trackline of the aircraft or boat. Bird observations are initially recorded on audio

tape, later transcribed into a sightings database, and then merged with the GPS output by using a common time field. Several computer programs have been written for use in analyzing historical Washington seabird data and future observations. These programs are designed to assist in allocating survey effort and making statistically reliable population estimates. Survey results may be graphically displayed in various formats, such as density maps of species represented by latitude-longitude blocks or as contour surfaces, using CAMRIS.

**Shore-based Surveys of Marbled Murrelets Along the Oregon Coast, 1988-1992.** *S. Kim Nelson and Janet G. Hardin, Oregon Cooperative Wildlife Research Unit, Oregon State University, Nash 104, Corvallis, OR 97331-3803.*

Beginning in 1988, Marbled Murrelets (*Brachyramphus marmoratus*) were systematically counted from shore during the breeding season at 31 locations along the Oregon coast. Using spotting scopes and following a prescribed method, we counted murrelets out to approximately 500 m offshore. Bird behavior, plumage condition, age, and group configuration were recorded. The distribution and relative abundance of murrelets along the Oregon coast were mapped and compared with the distribution of suitable nesting habitat inland. Three sites on the central coast were chosen for intensive study. We monitored variation in numbers of murrelets on a daily and yearly basis among these sites. Murrelet abundance was highly variable, and their distribution along the coast was patchy.

**Puffin Food Webs in the Northwestern Gulf of Alaska.** *John F. Piatt and Scott A. Hatch, U.S. Fish and Wildlife Service, 1011 E. Tudor Road, Anchorage, AK 99503.*

We analyzed data collected over 15 years on the distribution and diets of Tufted Puffins and Horned Puffins in the northwestern Gulf of Alaska (18,163 prey at 20 colonies over 1300 km). On the continental shelf around Kodiak, Semidi, and Shumagin islands, the food web consists largely of resident bank species like capelin and sandlance. From the Shumagin Islands to the eastern Aleutians, advected juvenile walleye pollock form the basis of Tufted Puffins food webs. At oceanic islands in the eastern Aleutians (e.g., Bogoslof), pelagic prey like squid and lanternfish dominate the food web. Horned Puffins have a narrower diet than Tufted Puffins and feed largely on sandlance and capelin. Puffin colony and pelagic distribution maps reveal that

Horned Puffins concentrate in the central Semidi-Shumagin bank area, whereas Tufted Puffins are most abundant to the northeast (Kodiak) and to the southwest (Aleutians) of the core area for Horned Puffins. Interpretation of variability in puffin diets and breeding success must account for the markedly different nature of each food web (resident vs. advected prey, local vs. distant oceanographic influences, differential recruitment and availability of age classes, etc.).

**Estimating Seabird Populations in Alaska from Colony and Pelagic Databases.** *John F. Piatt, Patrick J. Gould, U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, AK 99503; Arthur L. SOWLS, Alaska Maritime NWR, U.S. Fish and Wildlife Service, Homer, AK 99603.*

The abundance of seabirds at sea and on colonies in Alaska has been well documented during the last two decades. At-sea censusing was usually conducted from large ships using 10-min line transects (300 m width). We used pelagic data collected in May-August (ca. 21,500 km of transects in a 2 million km<sup>2</sup> area) to extrapolate seabird populations (east of 180° W) during the breeding season. Seabird colonies in Alaska were censused by counting or estimating the total numbers of all species present during visits to colonies in summer. We compiled census data on 25 species, comprising 23,149,000 seabirds from 1254 colonies located east of 180° W. Population estimates derived from both data sets for 13 well-studied, diurnal seabird species were strongly correlated ( $r^2=0.94$ ). Pelagic population estimates were higher than colony estimates, except for Leach's Storm-Petrel and Horned Puffin. Large discrepancies (>3%) between pelagic and colony estimates were found for ship followers (fulmar, Larus gulls), and nocturnal species (Fork-tailed Storm-petrel, Ancient Murrelet, Rhinoceros Auklet, and Whiskered Auklet). Overall, concordance of these two data sets suggests that both censusing techniques provide reasonable order-of-magnitude estimates for most colonial seabird populations in Alaska.

**Measuring Productivity of Murres by the Mayfield Method.** *Brian E. Sharp, 2234 NE 9th Ave., Portland, OR 97212.*

Seabird productivity is usually measured by either the Type I or Type II methods. The former entails monitoring a sample of nests throughout the breeding season; the latter is a one-time check of the number of chicks near fledging age. At Cape Thompson, ice delays access until after the

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start of incubation. The bias caused by failure to detect early nest failures results in an overestimate of productivity. The Mayfield method of estimating songbird nest success uses the intervals between observations of eggs and chicks and provides an estimate of mean survival rate over the interval. A daily survival rate is calculated that can then be used to calculate the mean survival of eggs or chicks over the incubation or nestling period, or the combined survival rate over the nesting period, i.e., productivity. The Mayfield method assumes survival is constant over the defined period. At Cape Thompson in 1990, there was an even pattern of egg and chick losses for murre. Losses of kittiwakes were unevenly distributed, mostly occurring at or near the time of hatching. Mayfield and Type I methods gave estimates of productivity for Thick-billed Murres that were 0.59 and 0.76; for Common Murres, 0.76 and 0.86; and for Black-legged Kittiwakes 0.33 and 1.0, respectively.

**Surveying the Marbled Murrelet: Techno-Assistants.** *Jonathon R. H. Storm and Phyllis Reed, USDA Forest Service, 1405 Emmens St., Darrington, WA 98241.*

Audio recording equipment was used in the Marbled Murrelet (*Brachyramphus marmoratus*) survey program on the Darrington Ranger District, Mount Baker-Snoqualmie National Forest. The objectives were to extend the survey effort, examine recording equipment suitability for murrelet surveying, and determine appropriate equipment systems and techniques for murrelet surveying. Sixty-three surveys were done on 37 mornings, using surveyors, surveyors with audio recording equipment, and recording equipment only. The results suggest recording equipment is suitable for recording murrelet presence and activity level and, in limited situations, location. Review of tapes provides additional data and accuracy by definition of call numbers, spacing of calls, and call patterns. Tapes may be used for verification of surveyor's accuracy and for documenting murrelet's presence.

**Changes in Blood Parameters, Muscle Myoglobin, and Muscle Lactate Dehydrogenase of the Common Murre (*Uria aalge*) during Maturation.** *Wendy A. Williams, 127 Ridgeway Dr. #2, Lolo, MT 59847.*

Blood oxygen-carrying capacity, myoglobin levels, and lactate dehydrogenase (LDH) isozyme compositions in the heart and gastrocnemius and pectoralis muscles were determined in adult Common Murres and maturing chicks at sea. Blood hemoglobin and hematocrit and muscle myo-

globin in chicks increased significantly with growth. In the heart, adult levels of the aerobic isozyme, LDH 1, were found throughout chick maturation. When more anaerobic isozymes were present in the heart, they occurred more frequently in younger chicks and in newly fledged, independent chicks. In the gastrocnemius muscle, all five LDH isozymes were present at or near adult levels throughout chick maturation. The pectoralis muscle showed high levels, and hence high anaerobic capacity, of LDH 5 at all stages of maturation; LDH 1, LDH 2, LDH 3, and LDH 4 were lower in younger chicks and increased with maturation. When chicks leave the nesting colony, their aerobic and anaerobic capacities in the heart and gastrocnemius muscles are similar to those of adults, reflecting muscle metabolic requirements for maturation at sea. The chick pectoralis muscle has anaerobic capacities similar to those of adults; however, aerobic capacities in the chick pectoralis increase with maturation, concomitant with the needed proficiency for aerial and aquatic flight upon fledging.

**Distribution and Abundance of Marbled Murrelets in Alaska.** *John F. Piatt, U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, AK 99503; R. Glenn Ford, Ecological Consulting Inc., 2735 N. E. Weidler St., Portland, OR 97232.*

Seabirds usually breed in colonies on offshore islands, but most Marbled Murrelets fly inland to nest on trees in ancient coniferous rain forests. Thus, while most seabirds may be counted conveniently at breeding colonies, murrelet population estimates must be extrapolated from densities at sea—an uncertain exercise at best. In Alaska, an enormous effort to census seabirds at sea and at colonies was undertaken in the 1970s and 1980s under the supervision of the Outer Continental Shelf Environmental Assessment Program (OCSEAP). Comparing these data, colony and pelagic population estimates for 13 colonial seabird species were strongly correlated ( $r^2=0.94$ ). For non-colonial murrelets, we estimated conservatively from pelagic data that about 160,000 birds breed in Alaska. Actual numbers are probably higher because OCSEAP surveys were limited in the sheltered fiords and bays favored by murrelets. Most (97%) murrelets were concentrated during the breeding season in marine waters adjacent to large tracts of old-growth forest, i. e., in the Alexander Archipelago, Prince William Sound, and the Kodiak Archipelago. Murrelets appeared to disperse in winter from northern regions to offshore (>50 km) areas of the Gulf of Alaska and to the Aleutian Islands.

# Other Seabird News

## COMMON MURRE DIE-OFF IN ALASKA

Unusually large numbers of Common Murres feeding nearshore, and small numbers dying from apparent starvation, were reported from Sitka (SE Alaska) and Valdez (Prince William Sound) in early February. In early March, numerous reports of dead or dying murres were received from fishermen and biologists working along the Kenai Peninsula and Kodiak Island. The largest numbers of dying murres were observed around Resurrection Bay. Thousands of murres moved into the Seward Boat harbor at the same time as some large schools of juvenile herring. However, the herring left after less than two weeks while the murres, many of which were obviously moribund, remained. About a thousand dead murres were counted on beaches there and in adjacent bays throughout March and April. At the same time, reports of murres flying inland and landing on streets and parking lots were received from many populated areas, including Anchorage in upper Cook Inlet. To date (5-16-93) about 3100 dead murres have been tallied by U.S. Fish and Wildlife and National Park service biologists, and there were unconfirmed observations of "hundreds to thousands" dead at sea. Given a very limited beach survey effort (if only we'd had an oil spill!) and the wide geographic range of mortality (SE Alaska to the Alaska Peninsula), it seems likely that total mortality was in the 10-100 thousand range. The only species apparently affected was the Common Murre.

Necropsies revealed that most murres were extremely emaciated (about half their normal winter weight). Some had pulmonary edema, and unusual focal hemorrhaging in the intestines. All birds were still in winter plumage, and a large proportion appeared to be sub-adults. A battery of detailed examinations for possible sources of mortality including bacteria, viruses, parasites, heavy metals, lead, organochlorines, and biotoxins, have largely been negative so far. Trace amounts of saxitoxin were found in gut contents of two murres, and in some euphausiids that had washed up on a Seward beach, but this could represent normal background levels. A working hypothesis is that the event simply represents a "murre wreck" resulting from wide-spread starvation. In turn, this might be related to recent oceanographic conditions. Sea surface temperatures in coastal areas of the Gulf of Alaska have been warmer (0.2-1.4 C) than average since November 1992. On the other hand, a few birds recovered early were of normal weight, and some of the pathological results remain unexplained. A variety of tests are still underway, and beach surveys continue in some areas. A few freshly-dead, emaciated murres continue to appear on beaches at Seward, and about 50

freshly-dead murres were observed last week on Middleton Island beaches. To date, Black-legged Kittiwakes have failed to begin nesting activities at Middleton Island— not unprecedented, but unusual at this late date.

Other oddities have occurred this winter and spring in the northeast Pacific. A projected bumper crop of herring for Prince William Sound failed to materialize in April, and about a third of herring caught had subdermal lesions diagnosed as being due to Viral Hemorrhagic Septicemia. Trace amounts (perhaps background levels) of domoic acid were also found in some herring. Further south, Common Murres and Rhinoceros Auklets were found in numbers 3-4 times higher than usual for winter beach surveys on Vancouver Island. In California, effects of a continuing ENSO appear to be strongly felt by seabirds at the Farallon Islands as breeding activities have been delayed markedly. An unusual large die-off of Cassin's Auklets was observed in central California in late December and January, and small numbers of moribund murres and cormorants have been coming in to rehabilitation centers throughout the spring. Some or all of these phenomena might be related to anomalous warm sea temperatures that have persisted off the west coast throughout winter. Given all these unusual observations, it will be interesting to see how seabirds fare at colonies from California to Alaska in summer, 1994.

*Compiled by John F. Piatt and Thomas van Pelt, Alaska Fish and Wildlife Research Center (AFWRC). Information provided by David Ainley (PRBO), Jack Ames (Cal F&G), Ron Britton (USFWS), Alan Burger (U. Victoria), Vern Byrd (USFWS), Lynn Creekmore (USFWS-Madison Wildlife Health Lab), Scott Hatch (AFWRC), Bill Hughes (USFWS), Rich MacIntosh (NMFS), Vivian Mendenhall (USFWS), Mike Tetreau (NPS), John Wilcox (ADF&G), Chris Wood (NMFS), and Dennis Zwifflhoffer (USFWS).*

**The Alaska Maritime National  
Wildlife Refuge office has moved.**

*Please note the new address:*

**Alaska Maritime National Wildlife Refuge  
2355 Kachemak Bay Dr., Suite 101  
Homer, AK 99603**

## Other Seabird News

### Critical Wildlife Resources at Risk in Oil Slick

Laysan Island, the crown jewel of the Hawaiian Island National Wildlife Refuge, has been hit with a mystery oil slick. The 913-acre island is located 700 miles northwest of Honolulu. Basketball-sized blobs of weathered oil began washing ashore on Friday, March 26, 1993 and continued to contaminate the shore until March 28. About two-thirds of the island's shoreline is flecked with oil and about 350 feet of the southeast corner is heavily oiled. Storm waves pushed the oil up the beach and into the vegetation, threatening the unique and abundant wildlife of Laysan Island. At the advent of the pupping season, at least 15 endangered Hawaiian monk seals are already oiled. Although few birds are yet oiled, most species have just returned from the ocean to begin breeding. Black-footed Albatrosses that nest on the upper beaches may be particularly vulnerable.

Laysan Island supports a colony of 2 million seabirds of 17 species, including albatrosses, frigatebirds, tropicbirds, boobies, shearwaters, petrels, terns, and noddies. In addition to monk seals and threatened green turtles, Laysan Island is critical habitat to endangered Laysan Ducks and Laysan Finches. Three land birds went extinct on Laysan Island early in the twentieth century when the vegetation was decimated by introduced rabbits.

The sensitive ecology of Laysan Island requires special considerations. The clean-up efforts used after the *Exxon Valdez* oil spill are not appropriate for this tiny island. Large teams of workers could damage the wildlife and possibly introduce rats, seeds of alien plants, or insects that might do long-term damage to the simple island ecology. Federal agencies are attempting to respond in a way that minimizes the cumulative impacts of the oil spill and the clean-up efforts. It is unclear whether additional slicks may wash ashore.

*For more information contact Mark Rauzon: Phone 510-531-3887 FAX 451-3208.*

### New Address?

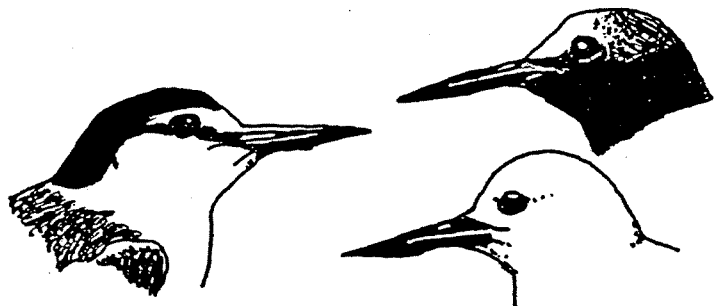
Please send all address changes to Ken Warheit, 8205-E Martin Way NE, Suite 238, Olympia, WA 98516-238.

### INFORMATION NEEDED ON CAPTIVE MARBLED MURRELETS

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The MMTC subcommittee on captive murrelets requests information for guidelines on documentation, care, and release of grounded Marbled Murrelets. We would appreciate information on weights, measurements (unflattened, flattened, or maximum flattened wing chord; tarsus; culmen or exposed culmen; please specify which), fat, status (i.e. general health if live, body condition if dead), situation of captivity (if relevant), date, and location of nestling, fledgling, or juvenile Marbled Murrelets. We are also interested in the same information for adult murrelets that have been found at inland sites or have been in captivity. Please send any information you have to us at the address below. Be sure to include the appropriate citation as we would like to include a table of this information in the guidelines to be used as release criteria for captive murrelets. We would also appreciate any records of Marbled Murrelets in captivity and a contact person for obtaining details of each record (if possible), and names and addresses of any others who are interested (or who you think might be interested) in contributing to the guidelines. Thank you for your help.

Nancy L. Naslund  
Migratory Bird Management  
U.S. Fish and Wildlife Service  
1011 E. Tudor Rd.  
Anchorage, AK 99503  
(907) 786-3597  
(907) 786-3641 FAX



### Volunteer Directory Available

The American Birding Association devoted its December 1992 newsletter, *Winging It*, to 1993 volunteer opportunities for birders with the U. S. Forest Service, the Bureau of Land Management, the National Park Service, and the U. S. and Canadian Wildlife Services. The special issue lists approximately 285 projects, including raptor, waterfowl, neotropical migrant, and single-species surveys; checklist and interpretive display development; photographic file creation; and nest box building, repair, and replacement.

Given the diversity of the projects, anyone interested in applying their birding, photographic, or construction skills to worthwhile conservation efforts while gaining valuable field experience should be able to find a project that meets their interest, skill level, and availability. Not every project requires a super birder!

At a time of heightened awareness of the need to preserve our avifauna and of limited government funding for such projects, birders have an opportunity to contribute to very worthwhile and critical projects. Some projects do have some funds available to reimburse the volunteer for various out-of-pocket expenses, and perhaps, pay a small per diem.

This volunteer directory is part of a partnership between the American Birding Association and various government agencies. To obtain a copy of this directory, send \$2.00 to cover printing and mailing costs to Volunteer Directory, American Birding Association, P. O. Box 6599, Colorado Springs, CO 80934. If you have any questions, call Virginia Maynard at 800-835-2473,

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### 1992 Activities Report from the ICBP/SSC Seabird Specialist Group

With the publication of two technical volumes on the status of the world's seabirds (Croxall et al 1984; Croxall 1991) and the scheduled 1993 publication of a third volume on the management of seabird islands (Nettleship et al 1993), the ICBP/SSC Seabird Specialist Group has documented the major problems presently confronting approximately 288 species of seabirds throughout the world and has recommended actions needed to ameliorate such problems. These problems vary from region to region and range from pollution to habitat destruction to human predation and competition for fishery resources.

The past year has been one of transition and planning, and has left the Seabird Specialist Group with two goals

clearly in mind: to implement programs designed to address seabird problems and to develop a means of identifying and dealing with future problems. However, it is not yet clear how the group will achieve these goals.

Implementing programs will require staff and financial resources, raised either by the Seabird Specialist Group itself, by ICBP and SSC, or by outside parties such as UNEP and the EEC, by other conservation organizations, or by individual nations. ICBP, while changing its overall structure, has focused most of its attention toward its new national affiliates, placing less emphasis on its network of specialist groups. A December meeting dealt frankly with the need for further support for the groups, but ICBP policies toward specialist groups remain in transition.

To identify future problems of seabirds and vulnerable species, two opposite scenarios exist. In the first, the Seabird Specialist Group would continue to be a loose-knit committee of correspondents that would meet perhaps once a decade to update the existing volumes on seabird status and that would conduct occasional letter-writing campaigns concerning threats to seabirds. In the second scenario, different committees within the group might seek to identify new threats and problems, serve as sources of technical expertise, and implement programs ranging from education to the eradication of feral pests to the development of international laws concerning seabirds.

1993 will be a year of transition for the Seabird Specialist Group. It can grow, divest some of its program responsibilities to other institutions, or remain primarily an information-gathering body with no institutional capabilities. Whatever its fate, the need remains for an international group to monitor seabirds and their problems and to ensure that necessary conservation actions are carried out.

*David Cameron Duffy, Box 109 Shelter Island Heights, NY 19965*

Croxall, J. P. (ed.). 1991. *Seabird Status and Conservation: A Supplement*. International Council for Bird Preservation Technical Report. Cambridge UK.

Croxall, J. P., G. H. Evans, and R. W. Schreiber (eds.). 1984. *Status and Conservation of the World's Seabirds*. International Council for Bird Preservation Technical Report. Cambridge UK.

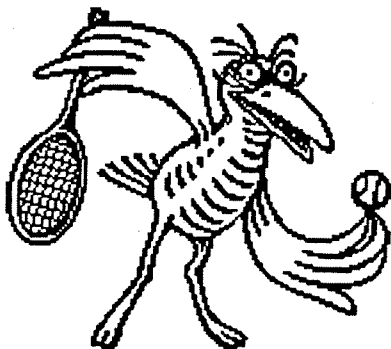
Nettleship, D. N., J. Burger, and M. Gochfeld (eds.). 1993. *Seabirds on Islands; Threats, Case Studies and Action Plans*. International Council for Bird Preservation Technical Volume. Cambridge UK.

SILLY SEABIRD TRIVIA

Plumb the depths of your trivial knowledge by answering the following questions: (answers below).

Questions

- 1) T or F: The Marbled Murrelet is a Robin-sized seabird.
2) What seabird's scientific name means "a very small seabird" when literally translated?
3) What species of seabird is the spiritual symbol for a clan of Tlingit Indians from Southeast Alaska?
4) What is the most commonly eaten seabird?
5) T or F: Murrelets were named after the famed naturalist John Muir.
6) What seabird genus name aptly translates as "winged-runner?"
7) T or F: The Marbled Murrelet is the only seabird in the North Pacific Ocean.
8) How many seabird biologists does it take to change a lightbulb?
9) T or F: Tree-nesting by the Marbled Murrelet is aberrant behavior for an alcid.
10) T or F: The "Exxon Valdez" oil spill caused significant damage to seabird populations in Alaska.
11) What North American shorebird predated the eggs of tropical seabirds during winter?



- 1) False! Marbled Murrelets (ca. 220-240 g) are big brutes compared to American Robins, which weigh in at only 70-90 g.
2) The Least Auklet Aethia (Greek, a seabird), pusilla (Latin, very small).
3) What else... the Marbled Murrelet is immortalized in song and hat by the Tlingit "Murrelet Clan".
4) Very likely the Thick-billed Murre. About a million murrets are hunted annually in Newfoundland alone, and they are also taken in Russia, Alaska, Iceland, and Greenland. Short-tailed Shearwater (Muttonbird) may run second. Recommend stir-fry murre with curry.
5) False! Murrelet is the diminutive of murre, a little murre.
6) Pterodroma. From the Greek. Just try to catch a good look at one.
7) Probably false, but suggestions to change the name of the Pacific Seabird Group to the Pacific Murrelet Group has confused some people.
8) If you have government biologists on one side and industry biologists on the other, it is doubtful whether there would even be agreement on whether the bulb needed to be changed. Government biologists would tell you that the light was damaged irreparably, or in the best case scenario, would come back on by itself in 50 years. The industry biologists might admit that the bulb had flickered for a few seconds, but claim that it was now burning brightly—if you just looked at it the right way. Several symposia and a billion dollars worth of research would be required to reach a consensus on how to best restore the bulb to its original working order. In the meantime, we remain in the dark.
9) Probably False. Recent studies suggest that Brachyramphus may be the oldest alcid, and it probably evolved at a time when huge Metasequoia ranged from California to northern Alaska. Ground-nesting may be a "recent" aberration.
10) See 8 above. Recommend you form your own opinion.
11) This is a trick question. Because predation means to precede, almost all living birds predate any eggs they may encounter. Eggs that fail to hatch and remain unharmed for some time could actually predate many of the birds that would consider eating the eggs. This leads to a bizarre but true fact about seabirds—all parent birds predate their young. Try bringing this up in your comprehensives if you're looking to buy time and want to confuse your committee. By the way, the Bristle-thighed Curlew (Numenius tahitiensis)—which migrates from breeding grounds in Alaska to winter on seabird islands in the Central Pacific—eats the eggs of seabirds.

ANSWERS

RECENT PUBLICATIONS  
and REPORTS

*If you would like to announce a report or publication in the next PSG Bulletin that would be of general interest to members, please drop a note to the editor, with appropriate details.*

- Vermeer, K., K.T. Briggs, K.H. Morgan, and D. Siegel-Causey [Eds.]. 1993. The Status, Ecology, and Conservation of Marine Birds of the North Pacific. Special Publication, Canadian Wildlife Service. [available from (AF): Publications, CWS, Environment Canada, Ottawa, Ontario K1A 0H3]
- Croxall, J.P. [Ed.]. 1991. Seabird Status and Conservation: A supplement. ICBP Tech. Publ. No. 11. [AF: ICBP, 32 Cambridge Road, Girton, Cambridge, CB3 0PJ, U.K.]
- Kawasaki, T., S. Tanaka, Y. Toba, and A. Taniguchi. [Eds.]. 1991. Long-term Variability of Pelagic Fish Populations and their Environment. Pergamon Press. [AF: Pergamon Press, Inc., Maxwell House, Fairview Park, Elmsford, New York 10523, USA.]
- Gaston, A.J. 1992. The Ancient Murrelet, A Natural History in the Queen Charlotte Islands. T & A D Poyser Ltd. [AF: in U.S., c/o Academic Press, San Diego CA 92101]
- Carter, H.A. and M.L. Morrison [Eds.]. 1992. Status and Conservation of the Marbled Murrelet in North America. Proc. Western Foundation of Vertebrate Zoology 5(1). [AF: West. Fndn. Vert. Zool., 439 Calle San Pablo, Camarillo, CA 93010]
- Nagel, P.A. [Ed.]. 1992. Results of the Third Joint US-USSR Bering and Chukchi Seas Expedition (BERPAC), Summer 1988. US Fish and Wildlife Service, Washington DC. [AF: Publications Unit, US Fish and Wildl. Serv., 1849 C Street, NW, Mail Stop 130-ARLSQ, Washington DC 20240]
- Gaston, A.J. and R.D. Elliot [Eds.]. 1991. Studies of high-latitude seabirds. 2. Conservation biology of Thick-billed Murres in the Northwest Atlantic. Can. Wildl. Serv. Occ. Paper 69. [AF: Publications, CWS, Environment Canada, Ottawa, Ontario K1A 0H3]

Vermeer, K., R.W. Butler, and K.H. Morgan [Eds.]. 1992. The ecology, status, and conservation of marine and shoreline birds on the west coast of Vancouver Island. Can. Wildl. Serv. Occ. Paper 75. [AF: Publications, CWS, Environment Canada, Ottawa, Ontario K1A 0H3]

Piatt, J.F., S.A. Kitaiskiy, A. Pinchuk, and A. Springer. 1992. Foraging Distribution and Feeding Ecology of Seabirds at the Diomed Islands, Bering Strait. Final Report to Minerals Management Service. OCS Study MMS 92-0041. [AF: MMS, Alaska OCS Region, Library/Public Infor. Room, 949 East 36th Ave, Rm. 603, Anchorage, Alaska 99508-4302]

Mendenhall, V., L. Haggblom, E. Murphy, and B. Sharp. 1993. Monitoring of Populations and Productivity of Seabirds at Cape Pierce, Bluff, and Cape Thompson, Alaska. Final Report to Minerals Management Service. OCS Study MMS 92-0041. [AF: MMS, Alaska OCS Region, Library/Public Infor. Room, 949 East 36th Ave, Rm. 603, Anchorage, Alaska 99508-4302]



Beringian Seabird Bulletin (BSB)

The BSB is an outgrowth of the successful Russian bulletin "Information on Seabird Studies in the USSR" that was published between 1990 and 1992 by the Laboratory of Coastal Ecology and Resources, Institute of Biological Problems of the North (IBPN), Magadan. The BSB is a joint effort between the Laboratory and the Marine and Coastal Bird Project, U.S. Fish and Wildlife Service, Anchorage. This project is conducted under the auspices of the U.S.-U.S.S.R. Agreement on Cooperation in the Field of Environment Protection. The BSB was initiated to improve coordination, communication and the exchange of seabird information between Russian, American, and other scientists interested in northern seabirds. The objectives of the BSB are to summarize annually seabird investigations that occur primarily in Beringia and, secondarily, in other Arctic regions and the North Pacific. In addition, short articles about Beringian seabird management issues and conservation activities will also be included periodically.

The editors of the BSB are Alexander Kondratyev, IBPN, Magadan, and Kent Wohl, U.S. Fish and Wildlife Service, Anchorage.

The first edition of the BSB will be distributed in May 1993. If you would like to receive a copy please contact Kent Wohl at the U.S. Fish and Wildlife Service, 1011 East Tudor Road, Anchorage, Alaska, 99503.

## Other Seabird News

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*The following is an abstract that was left out of the original meeting program.*

**An Introduction to the Seabird Aviary at the Oregon Coast Aquarium.** *Allen Monroe and Patty Shreve, Animal Husbandry Department, Oregon Coast Aquarium, 2820 S. E. Ferry Slip Road, Newport, Oregon 97365.*

The largest seabird aviary in North America has been built at the Oregon Coast Aquarium in Newport, Oregon. Opening in May 1992, this outdoor mesh-enclosed exhibit measures over 7000 square feet, with 30,000 gallons of sea water pools and 25-foot high naturalistic cliff faces. Currently on display are over 100 alcids, including *Cephus columba*, *Lunda cirrhata*, *Uria aalge*, and *Cerorhinca monocerata*. Although most of the birds are not yet mature, this past breeding season saw successful courtship, nest burrow construction, copulation, and egg laying. The long-term goal for the exhibit is to establish a self-sustaining breeding population. A seabird rehabilitation program is underway with emphasis on returning viable birds to the wild and studying factors affecting strandings, such as malnutrition and Aspergillosis. Other research projects underway for 1993 include the use of biotelemetry to measure incubation parameter for Tufted Puffins and the development of nutritional supplements specific for Pigeon Guillemots. Public education is the primary goal of the Oregon Coast Aquarium, achieved not only through exhibit interpretation for visitors, but also through an active outreach and onsite education program reaching over 20,000 school children annually.

### Parakeet Auklet Information Needed

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Spencer G. Sealy is preparing a species account of the Parakeet Auklet for the Birds of North American project and is looking for papers, reports, and/or unpublished manuscripts or other material. If you have any relevant information, please send copies to

Spencer Sealy  
Department of Zoology  
University of Manitoba  
Winnipeg, MB, R3T 2N2

## WANTED

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**Photos of foxes or rats eating seabirds**

**Contact:**

Craig Harrison  
4001 North Ninth Street #1801  
Arlington, Virginia 22203

## ALSO WANTED

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**Information on the occurrence of Dovekies in Alaska**

**Contact:**

George Divoky  
10535 Interlake Ave. N.  
Seattle, Washington

## Mark Your Calendar!

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Deadlines for submittals to the PSG Bulletin are **15 April** for the spring issue and **15 October** for the fall issue. Please make a note of these dates and plan your regional reports and other articles accordingly.

Also, please submit all material to be published on 3.5-inch disks. No 5.25-inch floppies!

## SEABIRD GROUP SUBSCRIPTION

Subscription for Ordinary members is £10.00, due on 1st February each year. If you pay by Standing Order to the Bank of Scotland the cost is £9.00. Students and pensioners may pay a reduced rate of £5.00. We strongly encourage you to pay by Standing Order. Subscription may be paid by VISA or MasterCard.

Return this to Sheila Russell, Clober Farm, Milngavie, Glasgow. G62 7HW, Scotland.

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# THE SEABIRD GROUP



The Seabird Group was founded in 1966 to promote and better co-ordinate the study of seabirds. It is a registered charity run by an elected committee and maintains close links with national and international ornithological bodies.

Everybody with an interest in seabirds and their welfare can join the Seabird Group and receive 3 newsletters each year containing a variety of news items, including reports on seabird conservation issues and research projects, as well as the Group's annual journal *SEABIRD*, which contains papers on current research at home and abroad.

The Seabird Group initiates and encourages fieldwork and grant-aids specific research projects. The two national censuses of breeding seabirds in Britain and Ireland in 1969-70 and 1985-87 were to a considerable extent organised and carried out by our members. The results of these surveys were published in two books, *The Seabirds of Britain and Ireland* (1974) and *The Status of Seabirds in Britain and Ireland* (1991). The Seabird Group helped establish the Seabird Colony Register, begun in 1985, which collates all information on the numbers of seabirds breeding in Britain and Ireland.



# PACIFIC SEABIRD GROUP EXECUTIVE COUNCIL 1993

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Chair	George Divoky, 10535 Interlake Ave. N., Seattle, WA 98133 Phone and FAX (206) 525-2131
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## REGIONAL REPRESENTATIVES

Alaska	Kent Wohl, USFWS, 1011 E. Tudor Road, Anchorage, AK 99503 (907) 261-4670 FAX (907) 561-4860
British Columbia and Washington	David Nyeswander, Washington Dept. of Wildlife, Olympia, WA 98501-1091 (206) 664-9348
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Central California	Jean Takekawa, San Francisco Bay NWR, Box 524, Newark, CA 94560 (415) 792-0222 FAX (415) 792-5828
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Pacific Region	Ken McDermond, P.O. Box 50167, Honolulu, HI 96850 (808) 541-1201 FAX (808) 541-1216 FTS 551-1201
Inland	James Lovvorn, Dept. of Zoology and Physiology, University of Wyoming, Laramie, WY 82071 (307) 766-6100 FAX (307) 766-5625
Great Lakes	James Ludwig, 2395 Huron Parkway, Ann Arbor, MI 48104 (313) 677-0050 FAX (313) 677-0055
Northeast	Mark Tasker, Nature Conservancy Council, 17 Rubislaw Terrace, Aberdeen AB1 1XE, United Kingdom (UK) 0224-642863 FAX (UK) 0224-643347
Southeast	Roger Clapp, National Fish and Wildlife Laboratory, National Museum of Natural History, Washington, D. C. 20560 (202) 357-1972 FAX (202) 357-4770 FTS 357-1972

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Craig S. Harrison, address above