

Islands farther south. The populations of four breeding landbirds (Common Raven, Rock Wren, Starling, and House Sparrow) have been changed by human interference during the last 70 years. Based on nine complete surveys made between 1888 and 1974, the species turnover has ranged from 14 to 100%, with a mean turnover of 52% per mean survey interval of 11.6 years, or 6.12% per year. Variation in turnover rate would probably lessen if the island had a more complex habitat and thus a more diverse avifauna.

Censuses of landbirds on the Farallones provide a measure of the immigrant pool potentially available for colonization of offshore California islands. The breeding species of the Channel Islands, islands much larger and more complex than the Farallones, are reviewed in terms of their rates of occurrence on the Farallones. Species that have endemic forms on the Channel Islands either occur infrequently or never on the Farallones, or have a high propensity to subspeciate in California. Several other species that breed on the Channel Islands occur frequently and remain for long periods on the Farallones, suggesting that conditions are nearly, but not exactly, right for breeding. Others that breed on the Channel Islands occur frequently on the Farallones but do not remain. These species prefer complex habitats. A few Channel Island breeding species, namely the Scrub Jay, Bewick's Wren, Bushtit, and Rufous-crowned Sparrow, are among a group of birds that have never been present naturally on the Farallones, and are among a subgrouping of species we expect will never arrive by overwater flight because of their sedentary habits.

ACKNOWLEDGMENTS

Studies such as this would not have been possible on the South Farallones were it not for the existence of the Farallon Island Research Station of the Point Reyes Bird Observatory. This was established through the efforts and foresight of C. John Ralph and L. Richard Mewaldt, their associates and successors. The cooperation and assistance given in this venture by the US Fish and Wildlife Service, coordinated initially through the efforts of Richard D. Bauer and subsequently by personnel of the Farallon National Wildlife Refuge, Jane Gull, Elizabeth Lindeman, Cathy Osugi, Robert Personius, and Walter Stieglitz, has been and continues to be greatly appreciated. Logistic and maintenance support given by the US Coast Guard, Group San Francisco (Fifth District), and the logistic support given by the Farallon Patrol of the Oceanic Society, San Francisco Chapter (coordinated by Bob Botley, Jim Carter, and Charles Merrill), and by M. C. Whitt, W. H. Holdon, and E. Harrold has been indispensable. Equally important has been the financial support, summoned and coordinated by C. John Ralph, Fred C. Sibley, and John Smail from many sources: the members of the Point Reyes Bird Observatory, numerous individual donors to the Farallon Fund of the Observatory, the City of San Francisco, Exxon USA Foundation, Charles E. Merrill Trust, Dean Witter Foundation, Lucius M. Beebe Foundation, National Science Foundation, Lurline B. Roth Charity Foundation, Sierra Club Foundation, Standard Oil of California, The David and Lucile Packard Foundation, the Marine Mammal Commission, the Weather Service, and the US Fish and Wildlife Service.

We are indebted to numerous workers for technical help of all kinds: for operation and upkeep of the station—Peter Allen, Kathy Kuhl, John Smail, Meryl Stewart, and Helen Strong; for help in museum collections—Laurence C. Binford (California Academy of Sciences), Ned K. Johnson and Robert E. Jones (Museum of Vertebrate Zoology, Berkeley), and R. Laybourne (US National Museum); for compilation of a Farallon bibliography—G. M. Christman. Finally, many persons helped with the censusing. Those persons besides the authors who conducted this work over extended periods (usually well over two weeks) during the eight years of this study were: G. R. Ainley, R. L. Boekelheide, W. C. Clow, M. C. Coulter, K. Darling, A. W. Earle, R. Ferris, D. Gaines, R. Hansen, P. Henderson, E. Hendrickson, J. W. Higbee, H. R. Huber, K. Jewett, D. Junkin, H. Keston, R. R. LeValley, T. J. Lewis, S. Long, B. Manion, T. Manolis, D. A. Manuwal, G. McCaskie, L. R.

Mewaldt, L. Meyers, S. H. Morrell, D. O'Keefe, G. W. Page, S. R. Pierotti, C. J. Ralph, H. Robert, A. Rovetta, F. C. Sibley, J. Smail, S. Speich, R. Stallcup, M. Stewart, R. M. Stewart, D. Strong, W. Harrington-Tweit, and M. D. F. Udvady. Shorter term field assistance during the eight years of this study was provided by: E. Akers, C. Annable, J. Arnold, A. Benedict, L. C. Binford, M. Bradstreet, J. Burch, C. Coleman, P. Connors, R. Doughty, B. Engstrom, J. Evens, J. Farness, D. Greenberg, R. Greenberg, J. Guggolz, K. Hansen, E. Hunn, L. Kirkendahl, B. Lewis, R. Loveless, K. McDonald, B. Manolis, J. Nisbet, K. Opiate, W. Parsons, C. Peterson, E. Piccolo, R. W. Risebrough, R. Roadcap, T. Rogers, J. Rook, J. M. Scott, R. Shallenberger, D. Shuford, S. Smail, D. Smith, L. Stenzel, C. Strong, H. Strong, H. Walter, P. Warshall, B. Webb, D. Whitacre, M. C. Whitt, D. Winkler, J. Winter, and B. Yutzy.

Richard Stallcup contributed greatly to an earlier version of this manuscript, which was also improved by helpful comments from L. C. Binford and D. Gaines. Assistance in its preparation was given by G. Ainley, J. Bacon, J. Church, P. Daley, B. Engstrom, and H. Strong. N. Story kindly prepared Figure 1. We hope we have not forgotten anyone and we thank you all for your assistance.

This is Contribution Number 89 of the Point Reyes Bird Observatory.

LITERATURE CITED

- AINLEY, D. G. 1973. The Brown Pelican in north-central coastal California. *Calif. Birds* 3:59-64.
- AINLEY, D. G. 1976. The occurrence of seabirds in the coastal region of California. *Western Birds* 7:33-68.
- AINLEY, D. G., AND T. J. LEWIS. 1974. The history of Farallon Island marine bird populations, 1854-1972. *Condor* 76:432-446.
- AINLEY, D. G., S. MORRELL, AND T. J. LEWIS. 1974. Patterns in the life histories of storm-petrels on the Farallon Islands. *Living Bird* 13:295-312.
- AINLEY, D. G., T. J. LEWIS, AND S. MORRELL. 1976. Molt in Leach's and Ashy Storm-Petrels. *Wilson Bull.* 87:76-95.
- AINLEY, D. G., AND G. A. SANGER. 1979. Seabird trophic relations in the northeastern Pacific Ocean and Bering Sea. Pp. 95-122 in J. C. Bartonek and D. N. Nettleship (eds.), *The conservation of seabirds in northern North America*. U.S. Fish Wildl. Serv., Wildl. Res. Rept. 11.
- AINLEY, D. G., AND M. C. WHITT. 1973. Numbers of marine birds breeding in Northern California. *Western Birds* 4:65-70.
- ALBERTSON, E. A. 1960. April trip to Farallon Islands. *Gull* 42:35.
- ALLEN, A. 1922. The seasons, Aug. 15-Oct. 15: San Francisco region. *Bird-Lore* 24:356-357.
- ANDERSON, P. K. 1960. Ecology and evolution in island populations of salamanders in the San Francisco Bay region. *Ecol. Monogr.* 30:359-385.
- AMERICAN ORNITHOLOGISTS' UNION. 1957. Check-list of North American birds. Fifth ed. Baltimore.
- AMERICAN ORNITHOLOGISTS' UNION. 1973. Thirty-second supplement to the American Ornithologists' Union check-list of North American birds. *Auk* 90:411-419.
- AMERICAN ORNITHOLOGISTS' UNION. 1973. Corrections and additions to the "Thirty-second supplement to the check-list of North American birds." *Auk* 90:887.
- AMERICAN ORNITHOLOGISTS' UNION. 1976. Thirty-third supplement to the American Ornithologists' Union check-list of North American birds. *Auk* 93:875-879.
- BAIRD, J., AND I. C. T. NISBET. 1960. Northward fall migration on the Atlantic Coast and its relation to offshore drift. *Auk* 77:119-149.
- BARLOW, C. 1897. The story of the Farallones. H. R. Taylor, Alameda, Calif.
- BLANKINSHIP, J. W., AND C. G. KEELER. 1892. On the natural history of the Farallon Islands. *Zoe* 3(2):144-186.
- BOWMAN, R. I. 1961. Late spring observations on the birds of South Farallon Island, California. *Condor* 63:410-416.
- BRYANT, W. E. 1888. Birds and eggs from the Farallon Islands. *Proc. Calif. Acad. Sci., Ser. 2*, 1: 25-50.
- COGSWELL, H. L. 1955. Farallon Island trip yields unexpected species. *Gull* 37:1-2.
- COOPER, J. G. 1865. On a new cormorant from the Farallone Islands, California. *Proc. Acad. Nat. Sci. Phila.* 17:5-6.
- COOPER, J. G. 1873. Some recent additions to the fauna of California. *Proc. Calif. Acad. Sci.* 4: 3-13.