AT-SEA DISTRIBUTION AND ABUNDANCE OF SEABIRDS OFF SOUTHERN CALIFORNIA: A 20-YEAR COMPARISON

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Just like the land in Southern California, the nearshore ocean is a pretty crowded place: oil production, shipping, fishing and recreation abound. Of course, these activities are all occurring in the same waters that host more than 20 breeding species of seabirds and dozens of others that forage seasonally in the area. Numerous oil spills, colony disturbances, non-native predators, pesticides and the like have killed many seabirds in the region over the years, a situation that demands a snapshot and broad analysis of the current state of seabirds in the region. This timely publication summarizes broad-scale distribution and population estimates from aerial surveys of seabirds in southern California during 1999–2002 and compares those figures with two regional datasets from two decades earlier: the first from 1975–1978, and the second from 1980–1983 (Briggs *et al.* 1987), to derive spatial measures of continuity and change.

Four primary products are presented from the data, which extend from the shore to the southern California shelf-break:

- Densities of seabirds by species in January, May and September
- Contemporary maps of seabird density by season
- Population changes by species over the past 20 years
- A discussion of each species' ecology and how it might be related to changes in density or distribution, if any, over the past 20 years.

Overall, the authors report a decline in total numbers of seabirds in Southern California since the 1975–1983 dataset was acquired; however, an overarching root cause remains unclear. A few potential factors are discussed, including redistribution of migrating shearwaters and declines in Common Murre (*Uria aalge*) populations because of gillnets (which are now illegal), El Niño, and oil spills. Some species increased over the study period (Brown Pelicans *Pelecanus occidentalis*, for example) and plausible causal factors are discussed. Although the study did not aim to fully explain these trends, the baseline data are necessary for future steps looking more closely at driving influences, whether affecting all seabirds or individual species.

This book will be valuable to anyone managing marine areas or conducting ecological research on upper trophic level predators in Southern California. Also, because many of the species range far outside of California, and seabirds around the world face similar issues, the text should also interest researchers in other regions. Such summaries of distribution, status and trends are required to guide research questions and to make science-based decisions in the marine environment. Unfortunately, such detailed spatial data are rare, and the authors are to be commended for replicating this broad-scale study and producing a valuable dataset.

My only note of caution is that, although this dataset is exploratory, the authors perform a dizzying array of statistical comparisons (approximately 200) in time and space, and by individual species and higher taxonomic groupings. Thus, researchers using these results in the future should take care to look both at the P values and effect sizes to ensure that certain statistical tests for significance (at $P < 0.05$) were not spurious. The tests and effect sizes (mean densities) for contemporary data (1999–2002) are reported in different tables, making it somewhat difficult to see how large the differences really were during the 1999–2002 surveys. Furthermore, the densities from the 1978–1983 dataset are not reported (for space reasons, I assume). So to investigate the magnitude of most of these comparisons, and to see species-specific changes, readers will need to take a close look at the previous report on the 1975–1983 dataset (Briggs *et al.* 1987) or to contact the authors directly. Including the temporal density comparisons of any statistically different densities in the species accounts would have helped to give context to the magnitudes of reported changes and saved readers considerable time and effort. The authors performed minimal post-processing to the distributional data to avoid errors from interpolation. However, I foresee that these geographic information system datasets will inevitably be used in the future to interpolate densities and overlay species so as to calculate the biomass, diversity and density of these seabirds for the myriad management and research programs in the region.

The authors are authorities on seabird distribution and breeding patterns in California, and they present the ecology of the various species synoptically in relation to variation in ocean conditions, impacts from DDE, disturbance, oil spills, natural variation and other anthropogenic factors. Vast changes are occurring in the oceans because of the effects of fisheries, pollution, global climate change and also poorly-understood natural variation. This study is therefore a welcome addition to the current state of knowledge about southern California's seabirds; it will be even more useful if repeated again in another few decades (or sooner!).

REFERENCES

BRIGGS, K.T., TYLER, W.B., LEWIS, D.B. & CARLSON, D.R. 1987. Bird communities at sea off California, 1975–1983. *Studies in Avian Biology* 11: 1–74.

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