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THEME SECTION

Technological innovation in marine ornithology

Editors: George L. Hunt Jr., Rory P. Wilson

CONTENTS

INTRODUCTION

The coming of age of marine ornithology

George L. Hunt Jr.[1,*], Rory P. Wilson[2]

[1]School of Aquatic and Fishery Sciences, Box 355020, University of Washington, Seattle, Washington 98195, USA
[2]Swansea Moving Animal Research Team, Biosciences, College of Science, Swansea University, Swansea SA2 8PP, UK

ABSTRACT: The founders of the at-sea study of marine birds were scientists who had the opportunity to go to sea on cruises designed for other purposes. Likewise, the first studies of seabirds in colonies were parts of larger expeditions or programs. Data were obtained by direct observation and manual recording in the field. With the advent of the miniaturization of electronics, data acquisition has become largely automated, the types of questions addressed are more sophisticated, and the analysis of large data sets has greatly advanced. As the field has matured, at-sea observations have become collaborative efforts between ornithologists and traditional oceanographers, and colony studies have begun to address fundamental questions of evolution and ecology. The continued development of devices that reveal the behavior and physiology of free ranging birds provides exciting opportunities for the expansion of marine ornithology.

KEY WORDS: First World Seabird Conference · Remote sensing · Technological advances · Seabirds

Marine ornithology is a relatively young science, but it has come a long way from the early days of colony studies based on expeditions to collect eggs, and at-sea observations made from whaling ships (Murphy 1914, 1936). Indeed, the early days of marine ornithology were defined by resourcefulness with, for example, Wynne-Edwards (1935) making observations from a passenger ship crossing the Atlantic Ocean. Although Jesperson (1930) was perhaps the first to quantify the distributions of seabirds

*Email: glhunt@uci.edu

at sea with respect to an oceanographic variable (zooplankton biomass), the at-sea study of seabirds did not become an active branch of marine science until the 1950s and 1960s with the pioneering work of Kuroda (1955), Bourne (1963), Brown (1968), Jehl (1973), and Pocklington (1979), among others. Likewise, the study of the breeding biology and reproductive ecology of seabirds gained momentum in the early 1960s and 1970s with seminal work by Ashmole & Ashmole (1967, 1968), Ashmole (1971), Bédard (1969), and others. It may be hard to realize in today's world of electronic devices, but almost all data gathered at sea before the mid-1980s were recorded on sheets of paper, and most colony data were gathered either by handling the birds or by sitting in blinds for hours waiting to record salient bits of behavior.

In 2010, the Pacific Seabird Group hosted the First World Seabird Conference in Victoria, British Columbia, and we decided that it would be a good time to examine how marine ornithology had advanced since its beginnings, and the role that technological innovations had played in various aspects of the study of marine birds. We solicited 9 contributions for a theme session entitled 'Technological and Analytical Innovation in Seabird Research', with topics ranging from progress in at-sea studies of seabirds (Ainley et al. 2012, this Theme Section), through smart tags attached to birds to elucidate at-sea behavior (Wilson & Vandenabeele 2012, this Theme Section) to food consumption studies (Karnovsky et al. 2012, this Theme Section), stress hormones, genetics (Taylor & Friesen 2012, this Theme Section), as well as conservation issues.

The changes in methodology over the past decades have been profound. New, automated systems are permitting more data to be gathered, more quickly and with less effort. The assessment of accuracy has been improved, along with the precision of measurements. New chemically-based approaches to genetics, physiology and diet studies have emerged. Behind almost all of these advances is the development of computing power and the miniaturization of all things electronic. Without the increased capacity of everyday electronics incorporated in, for example, mobile phones, many of the gadgets used in seabird studies that we now take for granted would not be possible. Perhaps as important, improved computing power and increased sophistication in the manipulation and analyses of data have resulted in the ability to work with data sets the size of which was unimaginable 3 decades ago. These advances are revealing much that we have wanted to know about the evolution, behavior and ecology of marine birds. In many cases, these same devices are also telling us much about the oceans in general, and the parts of the oceans used by birds in particular. The contributions to this Theme Section provide a taste of the wide range of topics covered at the First World Seabird Conference, and insight into the growing interconnections between marine ornithology and other branches of marine science.

Contemplation of the future in a field as vibrant and fast-moving as marine ornithology is always exciting. The ability to assess the position of a bird to within a fraction of a meter will allow assessment of the use of territory space in a way heretofore impossible, and if several birds are so 'marked' it will become possible to ascertain interactions with neighboring birds, chicks and potential predators. We might be able to understand what makes a good parent, what makes a good territory, and how the dynamics of interactions among territory holders define the milieu of the colony. More refined genetic studies will allow identification of relationships among birds on a colony as well as between colonies. Perhaps we will be able to answer some of the questions about kin selection and natural selection in the evolution of coloniality. Studies of how individual birds use the ocean are likely to accelerate. High-resolution multi-frequency echo-sounding equipment is now readily available and affords the opportunity to quantify the movements of birds underwater with respect to their prey field (Benoit-Bird et al. 2011). In the near future we should be able to ask about the prey fields in places where birds choose to feed and where they inspect the water column but do not tarry to forage. We can also expect strong advances in devices designed to track where a bird has gone, in or out of the water, and how the vagaries of movement relate to the structure of the aquatic environment. Coupled with simultaneous measures of physiology, the energetic costs and benefits of foraging habitat selection will be elucidated. Indeed, advances in technology promise to tell us exactly where and when birds have swallowed every prey item, and the energy expended to acquire it. That said, it seems doubtful that instruments will replace bird observers on sea-going vessels. Not only are the challenges of form recognition formidable, limiting the use of electronic scanners, but there is the added benefit of building collegial relationships with fellow scientists on multi-disciplinary cruises. Personal contacts on shipboard are important for the establishment of inter-disciplinary research, and besides that, no amount of electronic gadgetry is going to replace the value of good friends.

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LITERATURE CITED

Ainley DG, Ribic CA, Woehler EJ (2012) Adding the ocean to the study of seabirds: a brief history of at-sea seabird research. Mar Ecol Prog Ser 451:231–243

Ashmole NP (1971) Sea bird ecology and the marine environment. In: Farner DS, King JP (eds) Avian biology, Vol 1. Academic Press, New York, p 223–286

Ashmole NP, Ashmole MJ (1967) Comparative feeding ecology of seabirds of a tropical oceanic island. Bull Peabody Mus Nat Hist 24:1–131

Ashmole MJ, Ashmole NP (1968) The use of food samples from seabirds in the study of seasonal variation in the surface fauna of tropical oceanic areas. Pac Sci 22:1–10

Bédard J (1969) Feeding of the least crested and parakeet auklets around St. Lawrence Island. Can J Zool 47: 1025–1050

Benoit-Bird KJ, Kuletz K, Heppell S, Jones N, Hoover B (2011) Active acoustic examination of the diving behavior of murres foraging on patchy prey. Mar Ecol Prog Ser 443:217–235

Bourne WRP (1963) A review of oceanic studies of the biology of seabirds. In: Sibley CG (ed) Proc 13th Int Ornithol Congr 1962, American Ornithologists' Union & Museum of Zoology, Louisiana State University, Baton Rouge, LA, p 831–854

Brown RGB (1968) Seabirds in Newfoundland and Greenland waters, April–May 1966. Can Field Nat 82:88–102

Jehl JR Jr (1973) The distribution of marine birds in Chilean waters in winter. Auk 90:114–135

Jesperson P (1930) Ornithological observations in the North Atlantic Ocean. Oceanogr Rep Dana Exped 7:1–36

Karnovsky NJ, Hobson KA, Iverson SJ (2012) From lavage to lipids: estimating diets of seabirds. Mar Ecol Prog Ser 451:263–284

Kuroda N (1955) Observations on pelagic birds of the northwest Pacific. Condor 57:290–300

Murphy RC (1914) Observations on birds of the South American Atlantic. Auk 31:439–455

Murphy RC (1936) Oceanic birds of South America. Am Mus Nat Hist, New York

Pocklington R (1979) An oceanographic interpretation of seabird distributions in the Indian Ocean. Mar Biol 51:9–21

Taylor SA, Friesen VL (2012) Use of molecular genetics for understanding seabird evolution, ecology and conservation. Mar Ecol Prog Ser 451:285–304

Wilson RP, Vandenabeele SP (2012) Technological innovation in archival tags used in seabird research. Mar Ecol Prog Ser 451:245–262

Wynne-Edwards VC (1935) On the habits and distribution of birds on the North Atlantic. Proc Boston Soc Nat Hist 40:233–346