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Counting Seabirds at Sea from Ships: Comments on Interstudy Comparisons and Methodological Standardization

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In a recent paper Tasker et al. (1984) addressed the difficulties of counting seabirds at sea. They reviewed quantitative seabird surveys and discussed the various methodologies these surveys used. Their treatments of the biases inherent in detecting seabirds and the implications of these biases to survey methods are comprehensive and significant to anyone concerned with improving seabird research design. These authors concluded by advocating the use of a standardized sampling method (300-m band transect) that would allow comparisons between studies and distinguish between sitting and flying bird densities to reduce bias of flying birds when estimating density. The authors' criticism of various other methods was that they "cannot provide data for the calculation of absolute abundances." They maintained that this precludes comparisons, apparently based on abundance, between different studies.

I have surveyed seabirds in the South Atlantic Bight off the southeastern United States for two and one-half years using a band-transect method very similar to that used by Tasker and colleagues. My experiences have led me to question whether calculations of absolute abundances are possible without considerable additional qualifications. I discuss these qualifications, elaborate on the problems of counting flying birds during seabird censusing, and question the present implementation of standardized seabird survey methods. I should relate that my study of a subtropical and tropical seabird fauna, primarily from an oceanographic perspective, interjects a certain regional and disciplinary "bias." Ecological patterns of seabird faunas and species in tropical marine environments may be quite different from the high-latitude, temperate-boreal communities (e.g. alcids, penguins, etc.) that Tasker et al. cite in their treatment.

One of the major recommendations by Tasker et al. was to correct for the movement of flying birds in the band transect by using separate instantaneous counts within each counting block. Instantaneous counts of flying birds in the whole block are "impossible" due to observer inability to detect all birds at distances exceeding much more than 200-300 m. They correctly noted that counts of all seabirds seen to pass through the zone covered by the band transect would overestimate bird density and actually would be a measure of "flux" (see also Wiens et al. 1978).

Tasker et al. (1984: 572) suggested that a distinction (for comparative purposes) be made between sitting and flying bird densities as a means to compensate for overestimation of bird density caused by flux. Such a distinction is difficult for some species (e.g. feeding storm-petrels), and in some studies it may create as many problems as it attempts to solve. Seabirds sitting on the ocean surface are not necessarily more interactive with their environment. Seabird faunas in some regions may be totally or nearly lacking in species that spend any appreciable time on the ocean surface. For example, after two years of seabird counts in Gulf Stream waters on the Blake Plateau off the southeastern United States, I found that Black-capped Petrels (*Pterodroma hasitata*) and Sooty Terns (*Sterna fuscata*) were numerically dominant. Both species forage and feed on the wing. The former species was rarely and latter species never observed on the water surface. This type of ecological variation between regions would seriously complicate between-study comparisons based on absolute abundances separated into flying and sitting bird densities.

Because seabirds are not sessile marine organisms and do not permanently occupy any unit of ocean surface area at the time and space scales sampling usually is undertaken, absolute abundances are difficult, if not impossible, to obtain. The residence times of sitting birds that are feeding or resting on a given patch of ocean might be longer than that of flying birds. Eventually, however, sitting birds will move into another, adjacent patch of ocean in the same manner that flying birds do. Theoretically, the residence times of sitting and flying birds generally increase with increasing patch size until some upper

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limit is reached that includes the total ambit characteristic of an individual's life history. Because the total ambit is never sampled, any measure or estimate of seabird abundance ultimately is influenced by bird movement (flux).

The scale-dependent heterogeneity of marine environments (Haury et al. 1978) also makes absolute abundances of seabirds difficult to calculate. Patterns of seabird distribution and abundance are highly sensitive to scale. Significant differences in seabird abundance due to small-scale (1-5 km) spatial heterogeneity in the ocean may occur (Haney and McGillivary 1985a). Furthermore, the detection of temporal and spatial changes in abundance, correlated with physical oceanographic features or other factors influencing prey, is in part dependent upon the scale at which the investigator analyzes the data (Haney and McGillivary 1985b). Detection of any change ultimately is affected by the scale at which the sampling was executed. Inattention to scale-dependent variability makes the calculation of absolute abundances subject to extreme inaccuracy.

Seabird "density" cannot be thought of as density in the strictest and absolute sense. Rather, it seems desirable to recognize that large-scale changes in relative abundances, however they may be expressed, are comparable only when the small- and intermediate-scale phenomena responsible for variation are identified and integrated into the study. A stratified sampling design based on known environmental heterogeneity is one step toward achieving that goal. This will give better models of the roles seabirds play in energy/nutrient budgets within marine ecosystems (Schlitz and Cohen 1984), and will give more precise information on the temporal and spatial distribution of seabirds necessary for assessing potential effects of offshore commercial development (Tasker et al. 1984: 573).

The majority, if not all, of the studies cited by Tasker et al. (1984) were undertaken to assess the variation of seabird abundance and distribution within their respective study areas. They were never designed for the between-study comparisons that Tasker and colleagues suggest are important. It does not seem appropriate to me to use the inability to compare these studies as the principal reason for methodological standardization. Standardization is appropriate when the main objective of a particular investigation is to compare biomass or populations in two regions. This is, however, but one of many questions marine ornithologists currently are addressing.

Is universal standardization of seabird survey methods presently justified? I think not. Terrestrial avian ecologists have hardly reached agreement on techniques of counting birds (Ralph and Scott 1981), and it may be premature to call for standardization in an even younger discipline (Brown 1980). Methods should continue to be designed to suit the particular needs of the study rather than to meet the singular requirements of some hypothetical future comparison. Until we know more about how seabirds interact with their environment away from the breeding colonies in different regions and during different seasons, such standardization could limit advances in the field of seabird biology.

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