SHIP-FOLLOWERS AND SEABIRD COUNTS: OBSERVER'S DISTANCE FROM STERN MAY AFFECT COUNTS

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INTRODUCTION

Numerous factors affect the numbers and species-composition of counts of birds at sea (Bailey & Bourne 1972, Tasker *et al.* in press), e.g.: the observer's height above water (Dixon 1977, Duffy 1983); the area of the count (Griffiths 1981, Powers 1982, Duffy & Schneider 1984), and differences between observers (Powers 1982). The observer's position on the ship may also influence counts. For example, counts looking aft from the stern include a disproportionate number of ship-following species. Ship-followers might affect counts other than those from the stern, even when followers were excluded from counts, if such birds can not always be distinguished from others. We examined the possibility that observers at different distances from the stern record different counts of seabirds as a result of the differing importances of ship-followers.

METHODS

While on the R.S. *Africana*, 77 m overall length, off the southern coast of South Africa, we made six five-minute counts of birds on 9 November 1983, starting at 1331 (36 03S, 21 58E, depth 247 m). One of us counted from the starboard wing of the bridge (DCD), 40 m from the stern and 11,5 m above the sea, while the other (TH) made counts from the after starboard section of the boat deck, 18 m from the stern and 6 m above the sea. We counted all birds passing through a line extending 300 m perpendicularly to the ship's course from our positions (cf Griffiths 1981). We did not attempt to exclude ship-followers because identification of ship-followers appears to be subjective, no clear explanations of existing methods appear in the literature, and we did not wish to introduce a second variable into our comparison. We therefore counted all birds which crossed our lines.

We had hoped to replicate these counts several times to test for consistent biases in our counts, but too few birds were present during the rest of the trip. To examine the possibility that one of us made consistently higher five-minute counts, we made six sequential, simultaneous counts from the port bridge-wing, using the methods described above, starting at 0630 (34 05S, 25 36E), on 15 November 1983.

RESULTS

Stern counts procured higher counts of total numbers of birds than counts from the bridge in five sample periods. Equal numbers of individuals occurred at both locations in the sixth sample period (Table 1).

Seven species occurred in the counts made from the bridge and stern: Yellownosed Albatross *Diomedea chlororhynchos*; Shy Albatross *D. cauta*, Blackbrowed Albatross *D. melanophris*, Sooty Shearwater *Puffinus griseus*, Whitechinned Petrel *Procellaria aequinoctialis*, Pintado Petrel *Daption capense*, Cape Gannet *Sula capensis*, and unidentified albatrosses *Diomedea* spp. (Table 1). Of the 33 occurrences of one of the seven taxa in a five-minute period, bridge counts were higher in 11 cases, stern counts were higher in 20 cases, and there were two ties. Since birds may follow ships for more than five minutes (Griffiths 1982, La Cock & Schneider 1982), successive stern counts are likely to have been serially correlated so that normal statistics are not valid.

Comparing the species, only Yellownosed Albatrosses and unidentified albatrosses produced higher counts at the bridge. Yellownosed Albatrosses typically followed the ship by circling on either side of its bows, rather than at the stern as did Shy Albatrosses, Sooty Shearwaters, and Cape Gannets.

The higher stern counts might have been the result of the observer at the stern (TH) having a tendency to count more birds than the other observer. Comparing total numbers of birds in the first counting period, TH saw 62 birds at the stern position, while DCD saw only 39 from the bridge. The difference was significant ($x^2 = 5.238$, $p<.05$). In the second counting period, when both observers were counting from the same position, TH counted more individual birds than did DCD in four of six five-minute counts but this is not significant (binomial, $p = .109$). In 10 of the 18 species-counts within five-minute periods, TH counted more birds than did DCD. This is also not significant ($p = .240$). However a comparison of the total numbers of birds in the 30-minute period showed that TH again saw more birds (222) than did DCD (172). The difference was also significant ($x^2 = 6.345$, $p<.02$).(Table 2).

If we reanalyze data from the first counts using the ratio of birds seen by TH and DCD in the second count (TH/DCD = 1,3) as the expected fit of the data, then there is no significant difference between counts from the two positions that cannot be explained by individual differences between the two observers (Table 3; $x^2 = 0.835$; $p>.05$, $df = 1$). The differing ratios (1,6 *vs* 1,3) between the two counts suggest that stern counts may be greater than bridge counts, although our sample size is too small to test this.

DISCUSSION

Whereas our results again show the importance of inter-observer differences (Powers 1982), they also show differences in species' composition between the two counting positions as well as some indication of different numbers. Circumstances on the cruise did not permit us to replicate our results, with observers switching positions. We also made our two counts in two different areas, the first was offshore whereas the second was close inshore. It would have been preferable to conduct all the counts in a single area. The limited number of tests we were able to undertake did not permit statistically powerful tests of the data. We hope that others will have the opportunity to undertake a longer series of counts. We feel,

TABLE 1

COUNTS OF BIRDS FROM THE BRIDGE (DCD) AND AFTER SECTION OF THE BOAT DECK (TH: IN PARENTHESES) BETWEEN 1331 AND 1401 ON 9 NOVEMBER 1983

Species	Five-minute counts beginning at: 1331	1336	1341	1346	1351	1356
Yellownosed Albatross	-	-	1 (0)	2 (0)	2 (0)	1 (0
Shy Albatross	0 (1)	0 (1)	1 (2)	1 (8)	4 (10)	1 (0
Blackbrowed Albatross	-	-	-	1 (0)	-	0 (1
Albatross sp.	1 (0)	-	2 (0)	-	-	-
Sooty Shearwater	0 (2)	0 (2)	0 (1)	1 (3)	0 (8)	1 (2
Whitechinned Petrel	-	1 (0)	-	1 (1)	2 (2)	3 (1
Pintado Petrel	-	-	-	0 (2)	-	-
Cape Gannet	2 (2)	2 (3)	0 (1)	3 (4)	4 (0)	2 (1
Total numbers	3 (5)	3 (6)	4 (4)	9(18)	12 (20)	8 (5

TABLE 2

SIMULTANEOUS COUNTS OF SEABIRDS BY DCD AND TH (IN PARENTHESES) DURING 0630-0700 ON 15 NOVEMBER 1983

Species	Five-minute counts beginning at: 0630	0635	0640	0645	0650	0655
Jackass Penguin *Spheniscus demersus*	-	-	-	-	3 (0)	-
Cape Gannet *Sula capensis*	3 (3)	7 (13)	11 (23)	19 (18)	14 (10)	5 (4
Kelp Gull *Larus dominicanus*	-	3 (6)	-	-	-	1 (2
Terns *Sterna* spp.	3 (8)	32 (37)	10 (17)	38 (33)	20 (42)	2 (1
Skuas *Stercorarius* spp.	-	-	0 (1)	1 (0)	0 (1)	-
Total numbers	6(11)	42 (56)	21 (41)	58 (51)	37 (53)	8 (7

TABLE 3

COMPARISON OF TOTAL BIRD NUMBERS AND RATIOS OF NUMBERS OF BIRDS OBSERVED BY THE TWO OBSERVERS ($X^2 = 0.835$, $P > .05$)

OBSERVER	DCD	TH	PROPORTION
Observed (first counting period)	39	62	1,6
Expected (second counting period)	172	222	1,3
Total number of birds	211	284	

however, that even our limited data allow us to urge caution in comparing the results of the FIBEX and SIBEX (First and Second International BIOMASS Experiments: multinational biological surveys of the Southern Ocean) bird counts. South African FIBEX counts were made from the helicopter deck at the stern of the M.V. *S.A. Agulhas*, using a method similar to ours (Griffiths 1982). SIBEX counts have been made from the bridge, using a zone extending from 300 m ahead of the ship to 300 m abeam (BIOMASS Working Party on Bird Ecology 1983). The switch from bar counts to zone counts will change the species' composition (Duffy & Schneider 1984) as will the change of counting location from the stern to the bridge, whatever the area counted. Ship-followers, unless rigorous, replicable methods are used to exclude them, will probably swell FIBEX counts relative to those of SIBEX.

Finally, comparisons of methods (Powers 1982, Duffy & Schneider 1983, Tasker *et al.* in press, this study) suggest that different counting schemes are not easily comparable. Different research questions or sea and weather conditions may require different methods of counting birds. Whereas standardization would be useful to allow comparisons of counts in different areas (e.g. Tasker *et al.* in press), marine ornithologists may have to agree on the questions they want to answer, before they attempt to agree on the methods.

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CORRECTION

In the paper: Duffy, D.C. 1983. The effect of wave heigh bird counts at sea. *Cormorant* 11: 21-23, several er occurred during editing. The equation for calculating visual horizon should be $v = 3\ 838\ h^{.5}$ and the equation effective visual horizon should be $vs = 3\ 838\ (h^{.5}-s^{.5})$ wher is the observer's eye height and s is the swell height (bot metres).