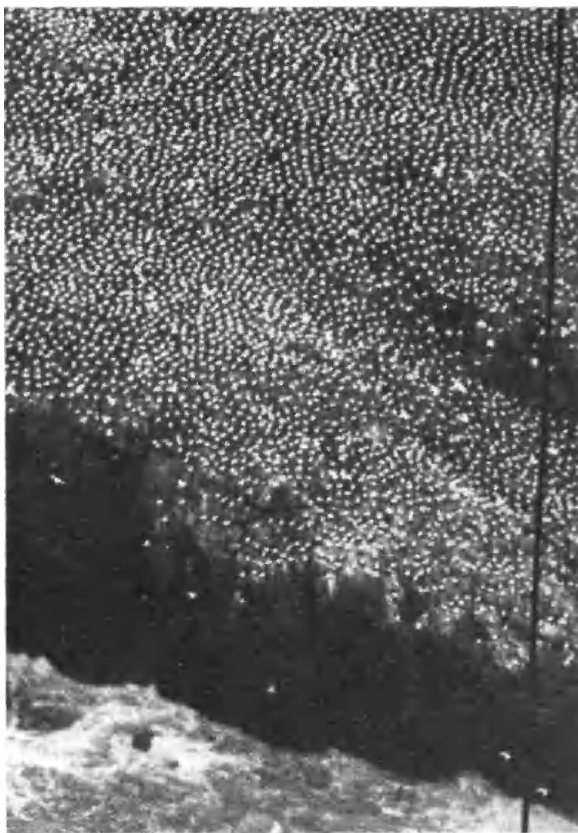


Variations in counts of seabirds from photographs

M. P. Harris and C. S. Lloyd

Logically, counts of seabird colonies from photographs ought to be more accurate than those carried out under field conditions. But are they?

There have been several generalised statements on the accuracy of counts of seabirds made from photographs, but little critical information. This paper documents observer differences in counts of Gannets *Sula bassana*, Guillemots *Uria aalge* and Kittiwakes *Rissa tridactyla* made from monochrome photographs. Harris (1976) found that his counts from photographs were much lower than field counts made at the moment the photographs were taken, and wondered whether he was too conservative



39. Part of the colony of Gannets *Sula bassana* on Grassholm, Dyfed. This aerial photograph was taken from an altitude of 600 m and used for the 1964 census of the gannetry (Barrett and Harris 1965). The artificial line defining the area counted (at the left) cuts through about 20 Gannets, which may or may not have been included by individual counters. Counts made from photos this size (Royal Navy)

in his counting of birds on photographs. The present counts were made to determine inter-observer differences; the interpretation of counts is not discussed.

Methods

Identical prints of one or more of three photographs (plates 39-41) were counted by 16 people, nine of whom had previous experience of counting seabirds from photographs. Each of the photographs was the best of a series taken under good conditions for the express purpose of making counts. Several observers voiced misgivings about counting the mass of birds in the lower left hand part of plate 41 and observers 14, 15, and 16 preferred not to count the whole of this photograph. We decided, however, to use these 'working pictures' of average standard, rather than atypically sharp ones, for testing observer differences in counting.

Helpers were asked to count individual Guillemots, pairs or nests of Gannets, and nests of Kittiwakes by the same method that they had used previously. If more than one count was made, it was from a different print and at a different time. All but one person counted the images by blocking them out by a pen mark or pin prick; most used a magnifying lens of some description, though this was not essential for the Gannet photograph. To reduce the chances of more than normal care being taken, observers were assured that specific counts would not be credited to individuals.

Results

Ten observers counted the Gannets in the photograph of part of Grassholm, Dyfed (plate 39, table 1). The mean count was 3,170 nests, with extremes of 2,823 and 3,362, a range of 17% of the mean. Observers 1 and 2 had individual ranges of 8% and 11% of their respective mean totals.

Counts of Guillemots on Moo Stack and Skerry of Eshaness, Shetland, ranged from 28 to 58 (mean 48, although there were actually 54) and from

Table 1. Counts of nests of Gannets *Sula bassana* from an aerial photograph of Grassholm, Dyfed (plate 39)

Counters with previous experience of counting seabirds from photographs are marked*.

The mean count was 3,170 nests

Counter	Number of counts	Mean count	Range	Standard error
1*	10	3,222	3,077-3,323	28
2*	8	3,051	2,852-3,192	38
3	3	2,949	2,823-3,014	63
4*	3	3,359	3,358-3,362	13
5*	3	3,301	3,274-3,315	14
6	2	3,173	3,138-3,209	
7*	1	3,092		
8	1	3,324		
9	1	3,228		
10*	1	3,000		

481 to 1,206 (mean 797) individuals respectively; even on the sharpest portion of plate 41, eight counts by four observers ranged from 387 to 475 Guillemots. Individual counts of Kittiwake nests on Moo Stack and Skerry of Eshaness varied from 110 to 141 (mean 129, although there were actually 161) and from 331 to 713 (mean 531) respectively (see tables 2 and 3).

Discussion

Aerial photography is a recognised useful technique for counting Gannets, because breeding colonies are often on inaccessible islands or cliffs and the birds contrast against the dark background. In his work on the St Kilda gannetry, Boyd (1961) counted the birds in each photograph four times; our examination of his 118 sets of replicate counts shows a range of 8.2% of his mean (standard error = 0.27, maximum 23.2%), which compares with 5.5% in the present study where any observer made two or more counts. Cullen and Pratt (1976) made individual counts of another series of photographs of Grassholm taken from an altitude of 120-185 m and found that the maximum difference between their counts from individual prints was 14%. Their counts of our plate 39 varied by over 10%, possibly because the quality was not so good (Dr M. S. Cullen *in litt*). During a photographic survey of wildebeest *Connochaetes taurinus*, 98 randomly chosen photographs initially counted by a variety of observers were recounted and the first totals were found to be 15% too low (Sinclair 1973). We conclude that counts made by different people can vary by at least 13%, but individual observers are more consistent. There are two other sources of error. The first is introduced when delimiting the parts of Gannet colonies occupied by breeding pairs, as distinct from the peripheral areas used by non-breeders; this may be 2% in the easiest cases, where it is possible to visit the colony with the photograph to be counted (Barrett and Harris 1965), but much more where colonies cannot

Table 2. Counts of individual Guillemots *Uria aalge* and nests of Kittiwakes *Rissa tridactyla* from a photograph of Moo Stack, Shetland (plate 40)

Counters with previous experience of counting seabirds from photographs are marked*.

When the photograph was taken, there were 54 Guillemots and 161 Kittiwake nests

Counter	GUILLEMOTS				KITTIWAKE NESTS		
	Number of counts	Mean count	Range	Standard error	Mean count	Range	Standard error
1*	5	35	31-38	1.5	115	110-122	2.1
2*	4	45	39-47	1.8	130	118-138	4.3
11*	3	48	47-51	1.3	132	119-141	6.8
12*	2	35	28-42		127	120-134	
13*	1	53			141		
14	1	58					
15	1	57					
16	1	53					
MEANS		48		3.2	129		4.2

Table 3. Counts of individual Guillemots *Uria aalge* and nests of Kittiwakes *Rissa tridactyla* from a photograph of Skerry of Eshaness, Shetland (plate 41)

Counters with previous experience of counting seabirds from photographs are marked*

		GUILLEMOTS		KITTIWAKE NESTS			
Counter	Number of counts	Mean count	Range	Standard error	Mean count	Range	Standard error
<i>(a) Total photograph</i>							
1*	6	649	569-722	23	521	486-601	18
2*	5	839	796-837	13	562	498-619	28
11*	3	771	745-795	15	388	331-428	29
12*	2	524	481-567		472	467-478	
13*	1	1,206			713		
MEANS		798			531		54
<i>(b) Top right part only</i>							
1*	5	434	405-475	16	221	204-250	10
14	1	387					
15	1	395			355		
16	1	389					
MEANS		401		11	288		67

40. The colony of Kittiwakes *Rissa tridactyla* and Guillemots *Uria aalge* on the main face of Moo Stack, Shetland. This photograph was taken from 100 m with a Mamiya Press camera fitted with a 150 mm lens, using FP4 film, on 17th June 1974. Counts made from photos measuring 10.9 × 15.3 cm (M. P. Harris)





41. Part of the colony of Kittiwakes *Rissa tridactyla* and Guillemots *Uria aalge* on the east face of the Skerry of Eshaness, Shetland. Photographed at 60-100 m, from the sea, with the same equipment as plate 40. Counts made from photos measuring 21.3×19.2 cm (M. P. Harris)

be visited. The second comes when building up a mosaic of pictures to cover a large colony; this has been estimated at 3.6% by Boyd (1961) and 5.2% by Dixon (1972) for the St Kilda colony. Clearly, most counts of nesting Gannets must be less accurate than is normally thought.

Guillemots are far less obvious on photographs: viewed from the front they blend with the guano-covered breeding ledges, and from behind they merge into the rock or shadows; some are often partly hidden behind their neighbours or in deep cracks. Maximum counts from our photographs

were more than double the minimum. The counts of Kittiwake nests similarly varied by over 100%. Individual Kittiwakes show up well on prints, so the differences were probably due to each observer having a different criterion for what constituted a nest. Counts of birds rather than nests might give better results for this species.

There was an obvious ranking of 'performance' among the counters of plates 40 and 41: observer number 13 always counted highest, 2 and 11 came next, followed by the less observant (or more conservative) 1 and 12. The ability of a person to replicate counts accurately over a period of years remains to be tested.

When Moo Stack was photographed, there were 54 Guillemots and 161 occupied Kittiwake nests present. The mean counts from the photographs were 48 (11% lower) and 129 (20% lower), respectively, reinforcing previous reports that counts from photographs are usually lower than field counts made at the same time (Harris 1976). We know of no attempt to correlate photographic and land counts of Gannets.

Conclusion

Photographs of seabird colonies are valuable aids for plotting changes in the extent of colonies, or the distribution of birds within a colony, and for checking unexpectedly high or low counts made under rushed or adverse conditions. In some situations (e.g. Gannets nesting on the tops of stacks or in large colonies where a human intruder would cause unacceptably high disturbance), aerial photography is the only practical way of obtaining a count. For Guillemots and Kittiwake nests, however, counts made from photographs are undoubtedly less accurate than those made in the field, and care must be taken in comparing those made by different people.

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