EFFECTS OF HUMAN DISTURBANCE ON A RED-FACED CORMORANT COLONY 1/

John L. Trapp

U.S. FISH AND WILDLIFE SERVICE
1011 EAST TUDOR ROAD
ANCHORAGE, ALASKA 99503

Abstract.--The effects of human disturbance on nesting Red-faced Cormorants (Phalacrocorax urile) was investigated in the western Aleutian Islands, Alaska, 1974-76. Nesting success at a repeatedly disturbed colony was significantly lower ($p < .005$) than at a nearby undisturbed colony (6% vs 81%). Frequency distribution of brood size differed significantly ($p < 0.10$), and the number of young per successful nest (1.5 vs 2.1) was also lower ($p < 0.001$). Human disturbance frightened adult cormorants from nests and ultimately led to increased predation of eggs and nestlings by Glaucous-winged Gulls (Larus glaucescens).

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Despite the dramatic increase in the volume of seabird research within the past few years, there has been little investigation into the effects that research workers may unwittingly have on the species being studied. While it is generally recognized that human disturbance has a disrupting influence on breeding activities of seabirds, few studies have experimentally investigated the effects of disturbance on breeding success.

A cursory review of the literature yielded only 13 references, many of which are anecdotal, to the effects of human disturbance on the reproductive performance of seabirds. There are undoubtedly others, but this sampling is probably representative of our state of knowledge. Five of the published reports dealt with controlled studies of Western Gulls Larus occidentalis (Robert and Ralph 1974), Herring Gulls L. argentatus (Hunt 1972, Kadlec and Drury 1968), Glaucous-winged Gulls L. glaucescens (Gillett el al. 1974), and Double-crested Cormorants Phalacrocorax auritus (Ellison and Cleary 1978); all five showed a close negative correlation between nesting success and degree of disturbance (i.e. as disturbance increased, nesting success declined). While engaged in field work in the western Aleutian Islands, Alaska during the summers of 1974-76 I had an opportunity to gather information on the effects of human disturbance on nesting Red-faced Cormorants (Phalacrocorax urile). These observations were made incidental to other studies.

METHODS

Investigations associated with the Aleutian Canada goose (Branta canadensis leucopareia) recovery project on Agattu Island necessitated

walking along the tops of sea cliffs in close proximity to cormorant colonies. Because of Agattu's arduous terrain, we routinely followed a network of fox trails ringing the perimeter of the island. This tactic resulted in frequent close contact with cliff-nesting seabirds. A 1.6 km stretch of coastline extending north from Aga Cove, Agattu Island, containing approximately 8 thousand nesting seabirds, including about 1,500 Red-faced Cormorants, was traversed approximately once every 2-3 days from early May to mid-August 1974; in addition, blinds were erected at two subcolonies to make detailed observations on nesting behavior. The locations of all nests were mapped and nest contents were recorded at approximately two-week intervals. All observations were made from vantage points atop the nesting cliffs. No attempt was made to climb to nests, examine eggs, or handle young.

Nest contents were recorded at previously undisturbed colonies at Cape Sabak, Agattu on 4 August 1974 and at Alaid-Nizki Island on 14 July 1976. These constitute the "control" (and this term is used in a very loose sense). The Aga Cove and Cape Sabak nesting colonies are separated by a linear distance of only 8 km; Alaid-Nizki is situated 48 km north of Agattu.

Nesting success is defined as the percentage of active nests that fledge at least one young. For purposes of this study, a nest is considered to have been successful if it contained 2-week-old young in July or early August.

RESULTS

The disturbed Aga Cove colony suffered virtually complete nesting failure in 1974. Only 17 (6%) of 270 nests active in May and June contained young in late July. By contrast, 72 (81%) of 89 previously undisturbed cormorant nests examined at Cape Sabak contained young. Similarly, 18 (90%) of 20 nests examined at Alaid-Nizki on 12 July 1976 contained young. Compared with nesting success at Cape Sabak in 1974 and at Alaid-Nizki in 1976, nesting success was significantly ($p < 0.05$) reduced at Aga Cove in 1974 (Table 1). Nesting success at the undisturbed colonies at Cape Sabak and Alaid-Nizki did not differ significantly ($p > 0.90$).

Also, compared with the undisturbed colonies at Cape Sabak and Alaid-Nizki, the frequency distribution of brood size at Aga Cove differed significantly ($p < 0.10$) (Table 2). Broods of 1 were disproportionately represented at Aga Cove, while broods of more than 2 were uncommon. Frequency distribution of brood size at the undisturbed colonies at Cape Sabak and Alaid-Nizki did not differ significantly ($p \geq 0.50$). Successful nests at Aga Cove fledged an average of 1.5 young, compared with 2.1 and 2.4 young at Cape Sabak and Alaid-Nizki, respectively; this difference is highly significant ($p < 0.001$). The number of young fledged per successful nest at the undisturbed colonies at Cape Sabak and Alaid-Nizki did not differ significantly ($p > 0.10$).

DISCUSSION

Recent studies of Red-faced Cormorants in the Probilof Islands (Hunt 1976, 1977) suggest an average nest success of between 50 and 70%.

The figures for my undisturbed colonies are somewhat higher than this, and suggest that I failed to detect and record some unoccupied nests that had been active earlier in the year. Even assuming a nesting success of only 50% in the undisturbed colonies, which appears to reasonable, then the Aga Cove colony still suffered an 88% reduction in nesting success.

Widespread food shortage and severe storms have been implicated as causes of reproductive failure in seabirds. Both of these factors were considered as possible causes for the low nest success at Aga Cove, but were rejected because of lack of evidence.

The sample sizes represented here are admittedly small, and the comparisons suffer somewhat from lack of a suitable sampling design; never-the-less, the decrease in reproductive performance of the disturbed Aga Cove colony is dramatic. It seems quite clear that the proximate factor responsible for the nest failure was repeated disturbance of adult birds from nests by human intruders. Red-faced Cormorants are easily alarmed and the close approach of humans often cause all birds in a colony to fly from their nests. This type of repeated disturbance alone, especially during the nest building, egg-laying, and early incubation stages, may have been sufficient to cause Red-faced Cormorants to desert their nests.

The ultimate factor leading to nest failure was predation of eggs and young by Glaucous-winged Gulls, which were quick to swoop down on vacated nests. During 1974 and 1975 I recorded 15 instances of gull

predation on eggs and young of Red-faced Cormorants after adults had been flushed from nests. Gulls continually soared back and forth along the cormorant colony, constantly on the alert for unattended eggs or young. On one occasion I observed 2 or 3 adult gulls repeatedly attack an apparently healthy 2-week-old chick that had been left unattended. During a period of 142 minutes the chick was attacked 9 times. At the culmination of the attacks the chick was bleeding profusely from a large wound at the base of the wing; it was obviously weak and was no longer able to defend itself. Murie (1959) noted the persistence of Glaucous-winged Gulls in seeking the eggs and young of cormorants, especially in conjunction with human disturbance, as early as 1936.

Red-faced Cormorant nest failure associated with human disturbance has also been documented elsewhere in Alaska. Dick et al. (1976) observed 100% nest mortality in two colonies located on islands popular as picnic spots and close to boat channels. Nyeswander and Hoberg (1978) noted total breeding failure at one colony which they attributed to human disturbance and predation by Northwestern Crows (Corvus caurinus). Interestingly, Nyeswander and Hoberg (1978) found that most other cormorant colonies in their study area were not bothered by avian predators, even when disturbed by humans.

CONCLUSIONS

These observations suggest that the tolerance of breeding cormorants to disturbance at nesting colonies will vary from colony to colony and from one geographic area to another depending upon a number of variables.

These include: (1) age and prior breeding experience of the birds, (2) frequency and timing of disturbance in relation to the nesting cycle, (3) presence and abundance of avian predators, and (4) the availability of alternate prey for those predators. The effects of human disturbance on seabird nesting success, especially in carefully designed research projects, are rarely as dramatic as the Red-faced Cormorant nest failure at Aga Cove. However, it is probably safe to say that even when extreme precautions are taken to minimize adverse impacts on breeding birds some disturbance occurs, although the overall effect may not be evident and may even be insignificant at the population level. The fact that different species may exhibit varying degrees of tolerance to disturbance under different environmental conditions complicates comparisons of geographic, yearly, and age-related variation in breeding success. Certainly there is a need to gather additional information concerning the effects of investigator disturbance on seabird productivity. Cliff-nesters such as cormorants, kittiwakes, and murres have been particularly ignored in this regard, and these are the species which may be most adversely affected by disruptions during the critical periods of egg-laying and incubation.

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TABLE 1

Comparison of nesting success between disturbed and undisturbed colonies on Agattu Island, July and August 1974, and Alaid-Nizki Island, July 1975.

	Agattu Island		Alaid-Nizki Island
	[a]	[b]	
	Disturbed	Undisturbed	Undisturbed
Number of active Nests	270	89	20
Number of Successful Nests	17	72	18
Percent Successful Nests	6	81	90

[a] Aga Cove

[b] Cape Sabak

TABLE 2

Comparison of brood size distribution between disturbed and undisturbed colonies on Agattu Island, July and August 1974, and Alaid-Nizki Island, July 1975.

	Percentage of broods		
	Agattu Island		Alaid-Nizki Island
Number of young in Nest	Disturbed[a]	Undisturbed[b]	Undisturbed
1	53	19	16
2	41	47	28
3	6	28	44
4	0	6	12
Number of nests	17	72	25
Mean brood size	1.5	2.1	2.4

[a] Aga Cove

[b] Cape Sabak