# The rise and fall of cliff-breeding seabirds in Sør-Varanger, NE Norway, 1970-2002

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Surveys of seabirds breeding along the coast of Sør-Varanger, NE Norway were carried out in 1989, 1996, 1999 and 2002 as a continuation of a monitoring study started in 1970. Until 1983, by which time 47 colonies were occupied, there had been a rapid increase in numbers of Black-legged Kittiwakes *Rissa tridactyla* and European Shags *Phalacrocorax aristotelis* breeding in the area while the Great Cormorant *P. carbo* population had first increased and then declined. Between 1983 and 2002, the Kittiwake and Shag populations declined by ca. 60% and 85% respectively while that of Cormorants first continued to decline and then recovered to levels recorded in the 1970s. The decline in Common Guillemot *Uria aalge* and Razorbill *Alca torda* numbers recorded since 1970 culminated in 1989 when no birds were seen in the region. Since then, one individual Common Guillemot was seen in 1999. In 2002 approximately 7500 pairs of Kittiwake, 770 pairs of Cormorant and 15 pairs of Shag bred in 23 colonies. Possible causes for the main population changes are briefly discussed.

*Key words*: seabirds, Black-legged Kittiwake, Common Guillemot, European Shag, Great Cormorant, population monitoring

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## INTRODUCTION

Although known in the mid-1800s (Sommerfelt 1862) and described in some detail by Wessel (1905), the seabird colonies in Sør-Varanger, NE Norway were not systematically surveyed until June 1966 when Pethon (1966) censused 17 colonies between Bøkfjord lighthouse (69°53'N, 30°11'E) and the (then) Soviet (now Russian) border (68°47'N, 30°50'E) (Figure 1). Brun (1971) extended this survey to include the coastline westwards to Bugøynes (68°58'N, 29°40'E) in 1967 and 1970 and found six species of cliff-breeding seabirds (Great Cormorant *Phalacrocorax carbo*, European Shag *P. aristotelis*, Black-legged Kittiwake *Rissa tridactyla*, Razorbill *Alca torda*, Common Guillemot *Uria aalge* and Brünnich's Guillemot *U. lomvia*) in 48 colonies. Kittiwakes (totalling ca. 8400 pairs) dominated and were present in all but two of the colonies. Cormorants and Shags totalled 713 (in 23 colonies) and 41 (in 14 colonies) pairs respectively while 57 pairs of large auks were found in seven colonies.

Brun's 1970 survey provided a good baseline for a subsequent surveillance of the Sør-Varanger seabird populations, and nearly all the colonies were again censused in 1975, 1979 and 1983 during which time numbers of the various species fluctuated greatly. The Kittiwake population increased by 49% (8% p.a.) between 1970 and 1975, and by a further 4-5% p.a. in 1975-1983, by which time ca. 18 000 pairs bred in 47 colonies. Shag numbers also increased in both periods (by 55% and nearly 100% respectively), while those of Cormorants increased also by 55% in 1970-75 but decreased again by 30% in 1975-1983. Auk populations declined throughout both periods (Barrett & Schei 1977, Barrett 1985). This paper first presents data from four subsequent surveys (1989, 1996, 1999 and 2002) and then summarizes population changes since 1970.

Apart from ensuring the continuation of the long-term database concerning the local population of seabirds, the surveys of the Sør-Varanger colonies after 1983 were also carried out as a supplement to the Norwegian national seabird monitoring programme which started in 1979 and which focuses on few, key breeding colonies along the coast of Norway (Anker-Nilssen et al. 1996, Lorentsen 2002). One of these key colonies is on Hornøya (72°22'N, 31°10'E), an island approximately 70 km NE of Sør-Varanger (Figure 1). Documenting changes in the many small colonies in Sør-Varanger would thus help test the validity of the results from the extensive monitoring on Hornøya as being representative of the situation in the whole Varanger area (Anker-Nilssen et al. 1996).

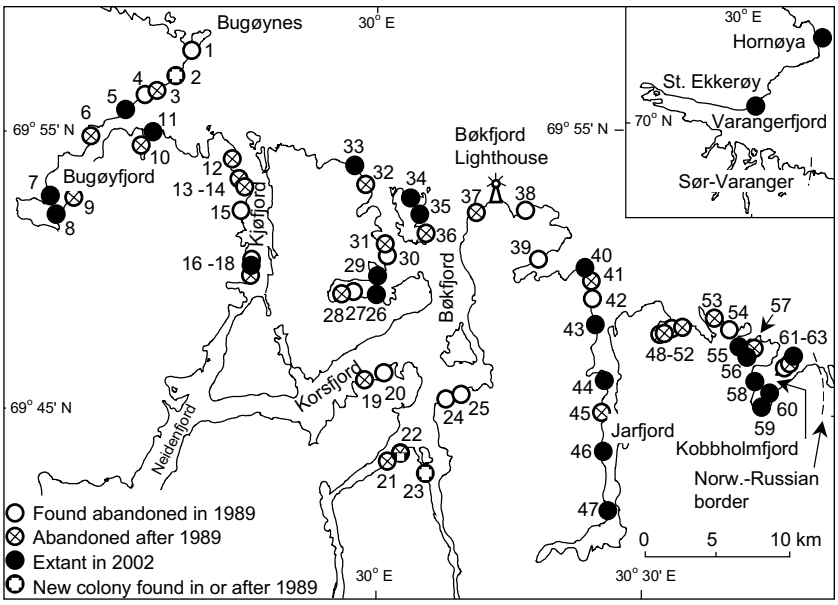


**Figure 1**
Map of Sør-Varanger showing location of the study colonies

## METHODS

The coast of Sør-Varanger, between Bugøynes and Kobbholmfjord (Figure 1) was surveyed by the author on 11-12 June 1989, 1-2 June 1996, 23-24 May 1999 and 26-28 May 2002, and censuses were made of all colonies visited. Nearly all counts were made directly from the deck of R.V. "Johan Ruud" (30.5 m, Univ. of Tromsø) using 10x50 binoculars from a distance of 50-100 m. Where a colony was too big for direct counting, counts were made from enlargements of colour photographs. A few colonies were surveyed from a 16 ft rubber boat with an outboard motor either to save travel time (e.g. cols. 21-25, 30, 31, 34-36, 61-63 in 2002) or due to shallow water preventing access by the larger vessel (cols. 55-57). Because the main activity of R.V. "Johan Ruud" was a survey of the King Crab *Paralithodes camtschatica* and my use of the vessel was opportunistic, it was not always possible to direct the boat to all colonies such that some rough estimates of minor colonies (1 in 1989 (<25 pairs), 3 in 1999 (total 170 pairs) and one in 2002 (20 pairs)) had to be made from distances of 1000-1500 m.

The populations of Kittiwakes, Cormorants and Shags were estimated from counts of apparently occupied nests. Auks were counted individually. The censuses coincided with the main incubation periods of the Kittiwakes and Shags and the early brooding period of the Cormorants. All counts made in the field were made by the author, except in 1996 when simultaneous counts were made by two-three observers (including the author). When possible, counts were repeated (or in 1996 compared) until two successive counts differed by less than 5%, and then the last count was used. In cases where conditions disfavoured accurate counting (rough seas, distance from coast or poor visibility) and estimates were noted as a range (e.g. 150-200 nests), the mid-point in the range was used in this analysis.

To arrive at overall totals for the whole coastline, colonies that were not visited in a given year were treated as follows. Where no nests of a species were recorded during the preceding and following survey, it was assumed that none bred there during the season in question. Had a species bred in the colony in the preceding and/or following survey, the population in the given year was extrapolated from the known values. This was necessary for two colonies in 1989 and four in 1999, the estimated totals of which amounted to 6% and 4% of the overall total respectively. Rates of population change were calculated as exp[(ln(LC)-ln(FC))/t], where LC and FC are the first and first count respectively, and t the number of intervening years.

## RESULTS

### 1989, 1996, 1999 and 2002 surveys

Fifty-eight of the 60 previously known colonies were surveyed in 1989 and one new colony was found. Sixty-two colonies were surveyed in 1996 (when another was found), 58 in 1999 and 61 in 2002 (by which time yet another had become established, Table 1).

Of the initial 60 colonies, 45 (possibly 46) were occupied in 1989 with 26 colonies occupied by Kittiwakes alone, two by Cormorants and one by Shags (Table 2). The remainder were

**Table 1.** Status of seabird colonies surveyed in Sør-Varanger between 1989 and 2002.

| Year | No. of known colonies | No. surveyed | No. found abandoned | No. found recolonised | No. of new colonies found |
|---|---|---|---|---|---|
| 1989 | 60 | 58 | 14 | 0 | 1 (no. 23) |
| 1996 | 61 | 60 | 20 | 1 | 1 (no. 22) |
| 1999 | 62 | 58 | 33 | 0 | |
| 2002 | 62 | 61 | 39 | 2 | 1 (no.2) |

**Table 2.** Numbers of breeding pairs of Black-legged Kittiwakes, Great Cormorants and European Shags breeding in Sør-Varanger in 1989, 1996, 1999 and 2002. Numbers in italics are extrapolated from surveys prior and/or after the survey in question (see text). Blank means no nests were seen during any of the surveys.

| | Kittiwake | | | | Cormorant | | | | Shag | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Colony | 1989 | 1996 | 1999 | 2002 | 1989 | 1996 | 1999 | 2002 | 1989 | 1996 | 1999 | 2002 |
| 1 | *0* | 0 | *0* | 0 | | | | | | | | |
| 2 | 0 | 0 | 0 | 25 | | | | | | | | |
| 3 | 2 | 0 | 0 | 0 | | | | | | | | |
| 5 | 10000 | 9650 | 8500 | 5500 | | | | | | | | |
| 6 | 4 | 1 | 0 | 0 | | | | | | | | |
| 7 | 230 | 25 | 25 | 73 | | | | 1 | | | | |
| 8 | 95 | 66 | 15 | 8 | 25 | 52 | 12 | 26 | | | | |
| 9 | 50 | 30 | 0 | 0 | | | | | | | | |
| 10 | 22 | 30 | 25 | 0 | 67 | 60 | 150 | 0 | 5 | 2 | 0 | 0 |
| 11 | 8 | 25 | 95 | 0 | 0 | 0 | 0 | 140 | | | | |
| 12 | 500 | 55 | 65 | 0 | | | | | | | | |
| 13 | | | | | | | | | 1 | 1 | 0 | 0 |
| 14 | 3 | 25 | 0 | 0 | 60 | 1 | 0 | 0 | | | | |
| 17 | 65 | 25 | 0 | 2 | 4 | 33 | 0 | 0 | | | | |
| 18 | 8 | 2 | 0 | 0 | | | | | | | | |
| 19 | 58 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | | | | |
| 21 | *400* | 500 | *250* | 0 | | | | | | | | |
| 22 | 0 | 90 | *45* | 0 | | | | | | | | |
| 23 | 92 | 90 | *110* | 130 | | | | | | | | |
| 26 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 1 | 0 |
| 28 | 13 | 2 | 0 | 0 | | | | | | | | |
| 29 | | | | | 140 | 190 | 235 | 62 | | | | |
| 31 | 74 | 0 | 10 | 0 | 0 | 20 | 0 | 0 | | | | |
| 32 | 20 | 3 | 0 | 0 | | | | | 5 | 4 | 0 | 0 |
| 33 | 525 | 200 | 70 | 120 | 32 | 0 | 110 | 70 | | | | |
| 34 | 5 | 9 | 0 | 20 | 9 | 9 | 35 | 305 | | | | |
| 35 | *500* | 76 | 50 | 20 | | | | | | | | |
| 36 | 5 | 40 | 0 | 0 | | | | | | | | |
| 37 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | | | | |
| 40 | 450 | 350 | 130 | 100 | 25 | 45 | 42 | 34 | 0 | 3 | 0 | 0 |
| 41 | 130 | 75 | 0 | 0 | 0 | 5 | 10 | 0 | | | | |
| 43 | 20 | 55 | 250 | 20 | 10 | 2 | 0 | 2 | 1 | 2 | 5 | 0 |
| 44 | 0 | 6 | 25 | 70 | | | | | | | | |
| 45 | 5 | 0 | 0 | 0 | | | | | | | | |
| 46 | 70 | 105 | 55 | 15 | 32 | 34 | 80 | 51 | 2 | 2 | 2 | 0 |
| 47 | 385 | 625 | 700 | 620 | | | | | | | | |
| 48 | 3 | 0 | 0 | 0 | | | | | | | | |
| 49 | 50 | 15 | 30 | 0 | | | | | 3 | 0 | 0 | 0 |
| 50 | 50 | 15 | 0 | 0 | | | | | | | | |
| 52 | 4 | 0 | 0 | 0 | | | | | 1 | 1 | 0 | 0 |
| 53 | 20 | 0 | 0 | 0 | | | | | | | | |
| 55 | 3 | 3 | 10 | 7 | | | | | | | | |
| 56 | 580 | 20 | 0 | 1 | | | | | | | | |
| 57 | 60 | 0 | 0 | 0 | | | | | | | | |
| 58 | 515 | 265 | 550 | 375 | 18 | 60 | 70 | 75 | 5 | 5 | 0 | 0 |
| 59 | 170 | 240 | 360 | 255 | | | | | | | | |
| 60 | 185 | 90 | 45 | 30 | | | | | 2 | 0 | 0 | 2 |
| 62 | 100 | 5 | 4 | 0 | | | | | | | | |
| 63 | 80 | 130 | 50 | 30 | | | | | 4 | 9 | 4 | 11 |

mixed colonies, seven of Kittiwakes and Cormorants, five of Kittiwakes and Shags and four of all three species. In addition one new Kittiwake colony was found (no. 23, Figure 1). By 2002, birds were breeding in only 10 Kittiwake, three Cormorant, eight Cormorant + Kittiwake and two Shag + Kittiwake colonies. Of the three previously censused auk species, only one individual Common Guillemot was seen in an otherwise abandoned colony (no. 13) in 1999.

The Kittiwake was by far the commonest cliff-breeding species breeding in Sør-Varanger during all the surveys (Table 2). Most (75-85%) of the Kittiwake colonies were small (<200 pairs), 15-20% were 201-1000 pairs and only one (i.e. <5% of the colonies) was larger than 1000 pairs (Table 3). Between 5-10 000 pairs (65-75% of the total population) bred in this one colony (at Ranvika, no. 5) in 1989-2002.

Between 1983 and 2002, the population of Kittiwakes dropped from ca. 18 000 breeding pairs to ca. 7 500 pairs (Table 4). This drop was at a relatively constant rate (-2 to -3% p.a.) between 1983 and 1999, but suddenly accelerated to -13% between 1999 and 2002. Much of this change was due to a decline in the large colony at Ranvika at which numbers of occupied nests dropped from ca. 10 000 pairs between 1983 and 1996 to 8500 in 1999 and 5500 in 2002 (Table 2). Excluding Ranvika, the population in the smallest (<200 pairs) of the remaining colonies declined rapidly during all four periods (between -3% and -9% p.a.), while those of the intermediate colonies (201-1000 pairs) decreased rapidly in 1983-1996 and 1999-2002 (-6 to -12% p.a.), but increased between 1996 and 1999 (+5% p.a., Table 3).

While much lower than those of Kittiwakes and breeding in fewer colonies, numbers of Cormorants and Shags also varied greatly during the survey period. The Cormorant population first dropped between 1983 and 1989 and then increased from ca. 425 pairs in 13 colonies in 1989 to ca. 770 in 11 colonies in 2002. Shag numbers decreased from 95 pairs in 13 colonies in 1983 to ca. 30 pairs in 1989 and 1996 and to 10-15 pairs in four and two colonies in 1999 and 2002 respectively (Table 4). Much of the increase in Cormorant numbers after 1989 was the result of the growth of one colony (no. 34) from 35 pairs in 1999 to ca. 300 pairs in 2002. Another large change in the same period was the abandonment of the colony in Vagnfjord (no. 10, 150 pairs in 1999) and the establishment of a new colony on Indre Kasterholmen (no. 11, 140 pairs in 2002) ca. 1500 m away.

**Table. 3.** Size composition and rate of population change (% p.a.) of Black-legged Kittiwake colonies in Sør-Varanger in 1983, 1989, 1996, 1999 and 2002.

| | 1-200 pairs | | | 201-1000 pairs | | | >1000 pairs | | |
|---|---|---|---|---|---|---|---|---|---|
| | n | % | Pop. change % p.a.[1] | n | % | Pop. change % p.a.[1] | n | % | Pop. change % p.a.[1] |
| 1983 | 33 | 70 | | 12 | 25 | | 2 | 4 | |
| 1989 | 32 | 76 | -2.9 | 9 | 21 | -6.4 | 1 | 2 | -0.8 |
| 1996 | 29 | 83 | -5.2 | 5 | 14 | -9.4 | 1 | 3 | -0.5 |
| 1999 | 18 | 75 | -4.2 | 5 | 21 | +5.5 | 1 | 4 | -4.1 |
| 2002 | 16 | 80 | -8.9 | 3 | 15 | -11.9 | 1 | 5 | -13.5 |

[1]Based on summed populations of colonies surveyed in both years

**Table 4.** Approximate populations (breeding pairs) of Black-legged Kittiwakes, Great Cormorants and European Shags breeding in Sør-Varanger in 1983, 1989, 1996, 1999 and 2002.

| | Kittiwakes | | Cormorants | | Shags | |
|---|---|---|---|---|---|---|
| | No. of cols. | No. of pairs | No. of cols. | No. of pairs | No. of cols. | No. of pairs |
| 1983 | 47 | 18 000 | 18 | 617 | 13 | 94 |
| 1989 | 43-44 | 15 000 | 13 | 425 | 10 | 30 |
| 1996 | 37 | 13 000 | 13 | 510 | 10 | 30 |
| 1999 | 24-25 | 11 500 | 9 | 640 | 4 | 12 |
| 2002 | 20 | 7 500 | 11 | 770 | 2 | 13 |

## DISCUSSION

Despite the limitations inherent in single counts of Black-legged Kittiwake nests as a monitoring unit (discussed in Barrett 1985), the results of the four surveys show a clear reversal of the increase (at a rate of 4-7% p.a.) in the Kittiwake population documented between 1970 and 1983 (Brun 1971, Barrett & Schei 1977, Barrett 1985) with a drop in both numbers of occupied colonies and in the overall population after 1983 (Figure 2).

This pattern is very similar to that found at Hornøya where numbers of Kittiwakes increased between the early 1960s and 1983 (based on whole-colony counts in 1964, 1974 and 1983 (Brun unpubl. data, Norderhaug et al. 1977, Furness & Barrett 1985)) and then decreased again until 2002 (based on annual monitoring of fixed plots (Barrett 2001, unpubl. data)) (Figure 3). Although there was a disagreement in 1996-1999 when numbers decreased in Sør-Varanger but increased on Hornøya, there was a notable acceleration of the overall decline on both sites in 1999-2002 (Figure 3). This concordance of results suggests that similar mechanisms behind the overall population changes operate in both Sør-Varanger and at Hornøya and that the colony at Hornøya may well be representative for the whole Varanger area (see introduction).

Already in the early 1970s, Brun (1971) suggested that an increase in the abundance of capelin *Mallotus villosus* larvae and hence Kittiwake food supply in the fjords of Sør-Varanger favoured the rise of the Kittiwake population in the region, although the rise itself must have been partly caused by immigration of birds from elsewhere. At that time, there was also a general increase in Kittiwake numbers throughout Norway (Brun 1971, 1973, 1979). That the large Barents Sea capelin stocks played an important role in the increase in seabird numbers until the early 1980s at Hornøya (and elsewhere in East Finnmark) was further emphasised by Furness & Barrett (1985) and Krasnov & Barrett (1995), while Barrett & Schei (1977) again suggested that the further increases in the Sør-Varanger population may have been partly due to an immigration of birds from the larger colonies in East Finnmark (e.g. Syltefjord, Store Ekkerøy). Since 1980, however, the capelin stocks have not only fluctuated greatly (with collapses in 1985-88 and 1993-97) but have also declined overall (Gjøsæter 2002) such that Krasnov & Barrett's (1995) prediction that Kittiwake numbers would drop with those of the capelin stocks seems to be holding true. Kittiwakes in East Finnmark are not, however, totally dependent on capelin as a food source and may feed on other prey items, e.g. herring *Clupea harengus*, sandeels *Ammodytes* spp. or crustaceans (Barrett & Krasnov 1996). The possibility to exploit local populations of sandeel in Kobbholmfjord and Jarfjord (Sundet 1995, pers. obs.) may explain why three relatively large colonies (nos. 47, 58 & 59) in those fjords increased in size between 1996 and 1999 in contrast to most of the other colonies in Sør-Varanger.

A reversal of the positive trends in the Kittiwake populations in the 1960s and 1970s is also documented for the rest of Norway and to the east of Sør-Varanger, on the Kola peninsula where there have been large declines in several major colonies along the whole coast (Krasnov & Barrett 1995, Anker-Nilssen et al. 1996, Lorentsen 2002). This decline is also reflected in counts made in Shetland, Scotland and England where numbers have declined since the mid 1980s at rates of between 2% and 10% p.a. (Mavor et al. 2001).

Whereas the overall recent breeding success in the Sør-Varanger colonies is unknown, incidental notes taken of many empty but occupied nests in at least nine of the 20 Kittiwake colonies during the last survey suggest that it was very low in 2002. Among the nine colonies was the large colony at Ranvika, where several white-tailed sea eagles *Haliaeëtus albicilla* were seen patrolling

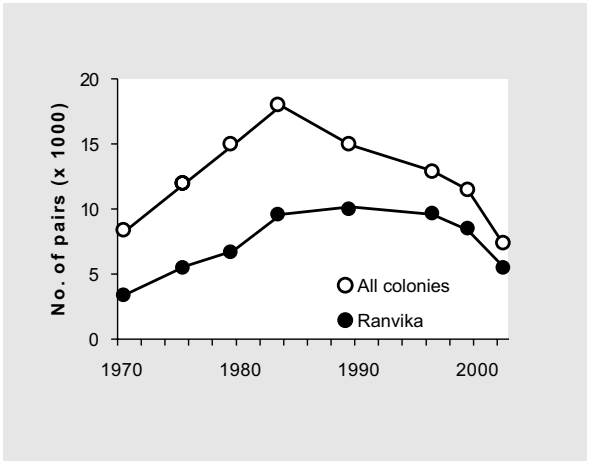


**Figure 2**
Changes in numbers of Black-legged Kittiwakes breeding in Ranvika (Colony 5, Tab. 2) and Sør-Varanger as a whole in 1970-2002.

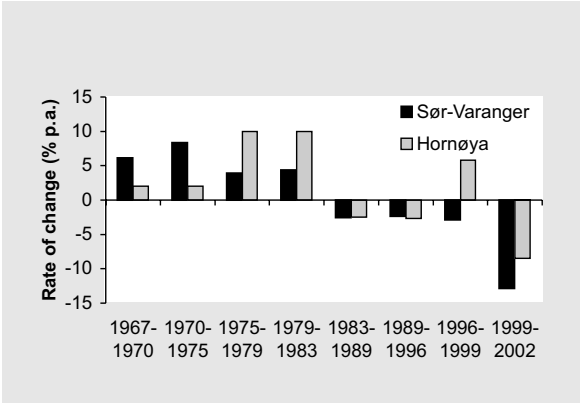


**Figure 3**
Rates of population change of Black-legged Kittiwakes breeding in Sør-Varanger and on Hornøya, 1967-2002. See text for sources of data. Note that column for Sør-Varanger 1967-1970 excludes the large colony at Ranvika.

in front of the colony and causing considerable disturbance. Such harassment by sea eagles with resulting breeding failure has been noted at several Kittiwake colonies elsewhere in North Norway (pers. obs.). A low breeding success was also observed during the 1979 survey. Both the exposure of individual nests to predators in small colonies and the poor breeding success are thus probably supplementary (to the declines in capelin stocks) factors causing the negative trend in the Kittiwake population (and also the abandonment of the area by auks) (Danchin et al. 1998, Suryan & Irons 2001).

Nests of European Shags are often well hidden such that it is possible that the numbers counted during the surveys are underestimates. However, as the effort put into the surveys did not vary, the overall decline is considered to be real. Shags have not been monitored regularly on Hornøya but counts made in the early 1980s, the early 1990s and the late 1990s showed little variation (50-150 pairs, pers. obs.), in contrast to those in Sør-Varanger which declined in the same time periods (Figure 4). Furthermore, a count in 2001 revealed a doubling of the population on Hornøya since 1998, while the population on Sør-Varanger remained low suggesting different factors limiting the two populations.

Whereas Shag nests are often hidden, those of Great Cormorants are generally large and conspicuous such that their numbers are more easily counted. While Kittiwakes first increased in numbers and then decreased, the opposite was the case for Cormorants that first declined in numbers between 1970 and 1989, but then recovered rapidly back to their early 1970s population (Figure 4). The recent increase is reflected in a similar positive trend in the numbers of Cormorants nesting in Kongsfjord, East Finnmark, ca. 100 km. north of Sør-Varanger (Lorentsen 2002). What is causing this increase is unknown.

## ACKNOWLEDGEMENTS

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## SAMMENDRAG

### Endringer i hekkebestanden av sjøfugl i Sør-Varanger, 1970-2002

Som en fortsettelse av et overvåkningsprosjekt startet i 1970 ble bestanden av hekkende sjøfugl (krykkje, skarver og alkefugl) i Sør-Varanger talt opp i 1989, 1996, 1999 og 2002. I 1983 var det 47 kolonier i området. Mellom 1970 og 1983 økte bestanden av krykkje *Rissa tridactyla* og toppskarv *Phalacrocorax aristotelis* hurtig. I første del av samme periode økte også bestanden av storskarv *P. carbo*, mens den gikk tilbake i siste delen av perioden. Fra 1983 til 2002, gikk bestandene av krykkje- og toppskarv kraftig tilbake med hhv. 60% og 85%. Nedgangen i bestanden av storskarv fortsatte, men snudde så slik at bestanden i 2002 var på samme nivå som i 1970-årene. For lomvi *Uria aalge* og alke *Alca torda* var det små bestander (<50 par) i 1970, mens ingen idivider ble funnet i 1989 og seinere.

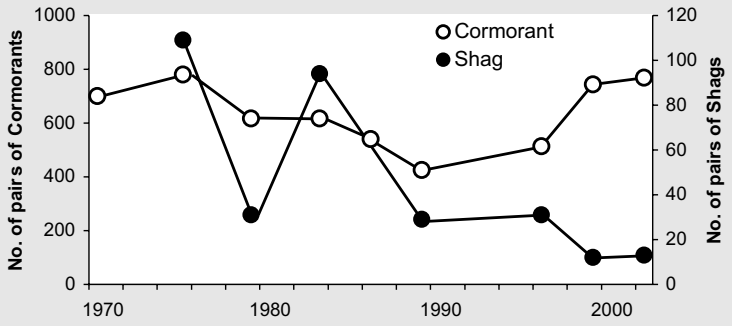


**Figure 4**
Changes in numbers of breeding pairs of Great Cormorants and European Shags breeding in Sør-Varanger in 1970-2002. The total for 1986 (Cormorant) is from a survey carried out by Nils Røv, NINA (pers. comm.).

I 2002 hekket omtrent 7500 par krykkje, 770 par storskarv og 15 par toppskarv i 23 kolonier i området. Tilbakegangen i krykkjebestanden gjenspeiler en generell tilbakegang i hele Norge og langs kysten av Kolahalvøya.

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