

## Juvenile Black-legged Kittiwakes *Rissa tridactyla* with deformed bills and clubfeet in the Barents Sea

*Unga tretåiga måsar Rissa tridactyla med missbildade näbbar och klubbfötter i Barents hav*

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### Abstract

Juvenile Black-legged Kittiwakes *Rissa tridactyla* with deformed bills and feet were observed in the Barents Sea in 1996, first while passing between Franz Josef Land and Novaya Zemlya on 21–24 July (at least 10 birds) and then off the West Coast of Svalbard 20–21 September (at least 2 birds). Deformities were manifest as prolonged upper or lower mandible, hooked or crooked upper mandible, crossed bill and clubfeet. This paper reports the circumstances of the observations and discusses possible causes. Among the possible causes

are nutritional deficiencies, epizootic events, environmental pollutants (persistent organic pollutants, heavy metals or radioactivity), or combinations of these.

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### Introduction

In 1996 the Swedish Polar Research Secretariat organised an expedition “Arctic Ocean-96” to the eastern and central Arctic Ocean with the ice-breaker Oden as base. While passing the Barents Sea in July, several juvenile Black-legged Kittiwakes *Rissa tridactyla* with deformed bills and/or clubfeet were observed. Additional observations were made at Svalbard in September. This type of deformities in other species of birds has been causally linked to contamination with persistent organic pollutants (POPs) such as polychlorinated biphenyls (PCBs) (Ludwig et al. 1996). And as there are other ecotoxic effects in the Arctic where POPs are the suspected cause (de March 1996), observations like the ones presented here may provide a clue to understanding the effects of pollutants in the Arctic. In this paper, I describe my observations and discuss some possible implications.

### Methods

My usual workplace onboard was in a laboratory container equipped for chemical work on the fore deck of the ship, processing water samples for the

determination of persistent organic pollutants such as DDT and PCB. The work in the container left much time during which bird observations with a pair of binoculars were possible from the deck or bridge. Typically 20–30 minutes per hour were spent in the container and the rest on deck. After the first observation of a deformed bird, which was purely coincidental, I scanned the kittiwakes (as well as other species) around the ship more intensely to spot additional deformed birds.

### Results and discussion

The only species observed with deformities was Black-legged Kittiwake, and all birds with deformities were juveniles. While crossing the Barents Sea between Svalbard, Franz Josef Land and Novaya Zemlya during 21–24 July a total of 14 sightings of birds with deformities were made. These 14 sightings were of at least ten individuals, clearly identifiable by their specific deformities. All of these were spotted in open water or the drift ice area except one that was seen on 24 July after entering the pack ice east of Franz Josef Land. At least two additional deformed birds were seen on or off the West Coast of Svalbard on 20–21 September (Figure 1, Table 1). Deformed birds were

Table 1. Approximate positions of observations of deformed birds. Only one bird was observed that did not have any other deformity than a clubfoot. But as bill deformities are easier to see than clubfeet on a flying bird, it is possible that more birds that had only feet deformities were present but not spotted. The position is an approximation of the location at which the observation was made as the birds would follow the ship for a while.  
*Unggefärliga positioner för observationer av fåglar med missbildningar. Endast en fågel som bara hade klumpföt utan andra missbildningar sågs. Men eftersom det är lättare att se en missbildad näbb än missbildade fötter på en flygande fågel är det möjligt att en del fåglar med enbart klumpföt missades. De angivna positionerna är en approximering av den position där fåglarna sågs eftersom dessa vanligtvis följde fartyget ett tag.*

Date	Position N	E	Number of birds	Deformed upper mandible	Deformed lower mandible	Crossed bill	Club- foot	Comments
July 21	75°19'	31°08'	3	3	—	—	—	Feet not seen.
July 22	77°06'	41°34'	2	1	1	—	0	Feet seen on both birds.
July 22	77°43'	47°29'	4	3	1	—	1	One bird with clubfoot and deformed upper mandible. Feet of 2 birds with deformed upper mandible were not seen.
July 23	78°23'	55°50'	2	1	1	—	1	One bird with clubfoot and deformed lower mandible. Feet seen on both birds.
July 23	78°55'	61°07'	2	2	—	—	—	Feet not seen.
July 24	80°38'	67°03'	1	—	—	1	0	Feet seen. Bird in generally bad condition, did not fly when attacked by pomarine skua.
Sept 20	78°50'	10°00'	1	—	—	1	—	Feet not seen.
Sept 21	78°14'	15°37'	2	1	1	1	1	On the ground. Feet seen on both birds. One bird with clubfoot and crossed bill may be the same as the one seen day before.

mobbed by other individuals of the same species. If this was because of their deformities or because they were young birds that, presumably, were weakened by their deformities is impossible to say.

Kittiwakes were the most common birds around the ship while passing the Barents Sea. Due to this species being so common (typically 15–40 individuals around the ship at most times) no counting of Kittiwakes was performed, although other species were counted from the bridge (Hjort et al. 1997). Although the deformities were clearly visible when looked for, they were in most cases rather mild with prolonged upper or lower mandible, hooked or crooked upper mandible, crossed bill, and/or clubfeet. Apart from the bird seen on 24 July (Table 1), the most severely deformed bird was the first one spotted and it is possible that the other birds would have gone unnoticed if it had not been for this first observation. The clubfeet could only be seen when the birds were sitting on the railing of the ship or on the ice or ground. It is, therefore, possible that more birds with clubfeet were present, but not spotted.

Bill and foot deformities similar to the ones reported here have been reported in a large number of species (see Ludwig et al. 1996, Kuiken et al. 1999 and references therein). Unfortunately, the natural frequency of the deformities is difficult to assess as only few systematic studies exist. Hicks (1934) reported a frequency of 0.038% deformed bills in European Starlings *Sturnus vulgaris*, and this seems to be the only study of a wild population that has statistically significant data of what presumably is a background situation under natural conditions. All other studies with a statistically relevant data of bill or foot deformities in wild populations have been made on populations that are heavily affected by various contaminants, especially POPs. Although my observations will not allow calculating an exact frequency of deformations, a conservative estimation of the incidence of deformities among juvenile Kittiwakes during the days 21–24 July was 3–5%. The observations west of Svalbard are too scanty for any meaningful estimation

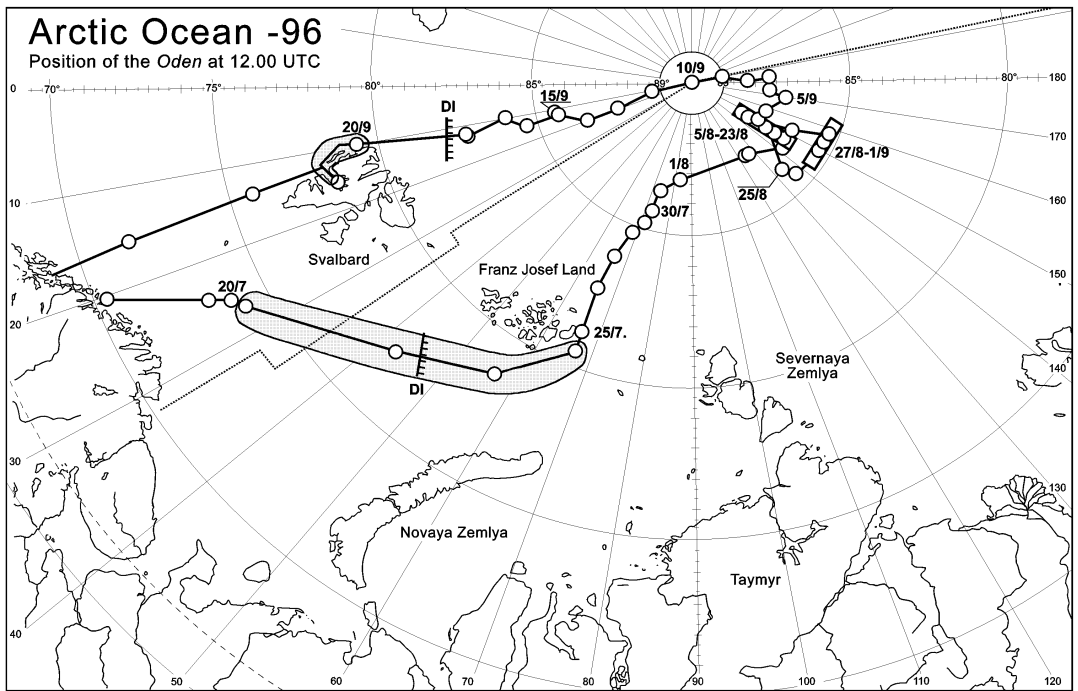


Figure 1. Cruise track of Arctic Ocean-96. Areas where the observations of deformed Kittiwakes were made are indicated by shading. DI indicates the margin of the drift ice at the dates when Oden passed the respective position. Background map courtesy of Bertil Larsson and Christian Hjort.

*Karta över rutten som Arctic Ocean-96 följde. Det område inom vilket observationer av tretåiga måsar med förvridna näbbar och klumpfötter gjordes markeras med skuggning. DI indikerar gränserna för drivis vid de datum då Oden passerade respektive position. Bakgrundskarta Bertil Larsson och Christian Hjort.*

of the incidence of deformities. The distribution of observed deformities suggests that the deformed birds came from Novaya Zemlya or Franz Josef Land.

The types of bill and foot deformities observed in kittiwakes in the Barents Sea are similar to, although less severe than the deformities reported for several aquatic bird species (gulls, cormorants, terns) in the Laurentian Great Lakes of North America and other contaminated environments (e.g. Larson et al. 1996, Ludwig et al. 1996). In the Laurentian Great Lakes the deformities have been causally linked to contamination with compounds with toxicity similar to 2,3,7,8-tetrachloro-p-dibenzodioxin (TCDD-like or "dioxin"-like toxicity, Ludwig et al. 1996). The co-planar congeners of polychlorinated biphenyls (PCB) seem to be of particular importance. Other symptoms correlated to the body burdens of compounds with dioxin-like toxicity include effects on the immune system and several mortal defects. In the Laurentian Great

Lakes, some of the least severely affected juvenile birds will survive their first summer, but will not be able to acquire sufficient energy to survive the winter or to rear chicks.

It is well known today that the Arctic is contaminated with POPs such as PCB. Usually the presence of POPs in the Arctic is thought to originate from long-range atmospheric transport (de March et al. 1998). Seabirds from the Barents Sea area seems to have the higher levels of PCB compared to other parts of the Arctic, although Kittiwakes from the Norwegian part of the Barents Sea show declining levels (Barret et al. 1996, Savinova et al. 1995).

Similar defects as those described for wild Double-crested Cormorants *Phalacrocorax auritus* with high levels of organochlorine contaminants have also been described in captive birds of the same species with low levels of contaminants (Kuiken et al. 1999). Instead of high levels of POPs, the cause was vitamin D<sub>3</sub> deficiency. As of

yet, no one has clearly shown that vitamin D<sub>3</sub> deficiency causes bill and foot deformities in wild birds.

There are several other possible causes for deformed bills in birds. These include 1) genetic causes, 2) pathogens, 3) heavy metals, 4) ionizing radiation, and 5) combinations of the above (including POPs and nutritional deficiencies). A discussion of the literature on these different types of causes can be found in Kuiken et al. (1999). At present none of these causes, alone or in combination, can be ruled out as the cause of the deformities observed in 1996. However, I find an epizootic event to be especially interesting to look into. There is, to my knowledge, no evidence that any epizooty occurred among Kittiwakes in the Barents Sea area in 1996. It should be noted here though, that a high contamination level with POPs, and possibly also a deficiency in vitamin D<sub>3</sub>, might affect the immune system and make the birds more susceptible to pathogen attack. This could create a situation where some birds succumb to a pathogen that healthy birds would normally combat with ease.

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### Sammanfattning

Då expeditionen ”Arctic Ocean-96” passerade Barents hav 21–24 juli 1996 iaktogs minst 10 juvenila tretåiga måsar med missbildade näbbar och/eller fötter. Ytterligare minst två exemplar sågs väst om Svalbard 20–21 september. Missbildningarna var förlängd eller förviden övre eller nedre näbbhalva, helt korslagd näbb och/eller klumpfot. Antalet missbildade individ är högre än vad som kan förklaras med naturlig frekvens av missbildningar. Missbildningar av liknande typ hos olika sjöfåglar i de Stora Sjöarna i Nordamerika har kopplats till höga halter klororganiska miljöföreningar av typen PCB eller ”dioxiner”, men liknande missbildningar kan också framkallas av D-vitaminbrist, sjukdomar, tungmetaller eller radioaktivitet. Även kombinationer av en eller flera av dessa orsaker är tänkbara. Med nuvarande kunskapsläge går det inte att dra säkra slutsatser om orsakerna till att ovanligt många missbildningar observerades i området kring Barents Hav under expeditionen 1996.