

# Effects of disturbance by people and introduced predators on seabirds in the northwest Pacific

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## Abstract

In the first half of the 20th century, human impact on colonial seabirds was highly destructive: it involved the collecting of eggs, chicks, and adults for human consumption and as feed for fur-farming stock. Afterwards, limited protection slowed but did not completely halt the destruction of birds. The Far East fisheries at present do not seem to exert a negative influence on seabirds. The number of seabirds killed in fish nets is not large, probably because the fisheries use mostly trawl nets and not gill nets or driftnets.

There are few instances of oiled seabirds, but oil spills may present a serious threat in the southern Far East with the development of oil extraction on Sakhalin Island. Mammalian predators were introduced in the Far East early in this century. Losses to colonies were caused by arctic foxes *Alopex lagopus*, raccoon dogs *Nyctereutes procyonoides*, raccoons *Procyon lotor*, sables *Martes zibellina*, and North American *Mustela vison* and European *M. lutreola* minks. On the Kuril Islands, arctic foxes have strongly declined in numbers and persist only on Ushishir Island. The most serious threats to seabirds of the northwest Pacific are from direct human exploitation and disturbance at colonies. The conservation needs of the Far Eastern seabird colonies are discussed.

## Résumé

Pendant la première moitié du 20<sup>e</sup> siècle, les activités menées par les humains ont fortement affecté les oiseaux marins vivant en colonies : chasse au fusil, collecte des oeufs et des petits, exploitation pour l'alimentation des animaux à fourrure. À partir des années 1950, les quelques mesures de protection adoptées ont ralenti la destruction des oiseaux, sans toutefois y mettre fin. Actuellement, les pratiques de pêche en Extrême-Orient ne semblent pas affecter les oiseaux marins. Le nombre d'individus retrouvés morts dans les filets n'est pas imposant, probablement parce que les pêcheurs utilisent surtout des chaluts plutôt que des filets maillants ou dérivants.

On relève quelques cas d'oiseaux mazoutés, mais les déversements d'hydrocarbures constituent sans doute une grave menace surtout limitée à la partie sud de l'Extrême-Orient, étant donné l'extraction de pétrole dans l'île Sakhaline. En Extrême-Orient, on a introduit des prédateurs de la classe des mammifères au début du 20<sup>e</sup> siècle. Les dégâts causés aux colonies y sont attribuables au renard arctique *Alopex lagopus*, au chien viverrin *Nyctereutes procyonoides*, au raton laveur *Procyon lotor*, à la martre zibeline *Martes zibellina*, au vison d'Amérique *Mustela vison* et à la belette d'Europe *M. lutreola*.

Dans les îles Kouriles, les populations de renards arctiques ont considérablement diminué, si bien que le prédateur persiste seulement dans l'île Ushishir. Pour les oiseaux marins du nord-ouest du Pacifique, les menaces les plus sérieuses sont le fait des activités directes des humains et de la perturbation des colonies. L'auteur examine les besoins de conservation des colonies d'oiseaux marins d'Extrême-Orient.

## 1. Introduction

Data relating to the effects of human disturbance on seabirds in the northwest Pacific are anecdotal and incomplete. Little work has been carried out on colony censusing and there is almost no information on historical and modern population trends. This lack of data is due in part to the enormous extent of the coastlines of the Bering, Okhotsk, and Japan seas, and to the remoteness and inaccessibility of many breeding islands. However, the main reason for this information gap is the lack of seabird biologists. For a century after the first ornithological studies were made in the middle of the 19th century, there were no ornithologists in the Far East. Avifaunal investigations were done instead by biologists from other regions. The advent of a regional group of ornithologists had an immediate effect on the intensity of bird studies. The first stage of colony surveys was initiated in the southern parts of the Far East and has increased slowly over the years (e.g., Bergman 1935; Shulpin 1936; Dulkeit and Shulpin 1937; Gisenko 1955; Shuntov 1965, 1972, 1986; Marakov 1966; Kischinsky 1968, 1989; Labzyuk et al. 1971; Portenko 1972, 1973; Velizhanin 1972, 1978; Yakhontov 1975a, 1975b; Nechaev 1975, 1986; Litvinenko 1980; Gerasimov 1986; Kondratiev 1986; Shibaev 1987). At present, the most detailed surveys of seabird colonies have been conducted in Peter the Great Bay and have been ongoing for about 20 years.

## 2. Human exploitation and disturbance

The aboriginal peoples living on the coasts of the Far Eastern seas (Eskimos, Chukchi, Koryak), and others) and their ancestors have exploited seabird colonies for centuries. They used adult birds, chicks, and eggs for their own food consumption, as a food source for sled dogs, and for clothing. Inhabitants on Chukotka not long ago (1932-1934) traded skins of shags in the fur depots, and the bright "rosettes" of Crested Auklets *Aethia cristatella* are still used as artificial lures (Portenko 1973). The overall damage to seabirds probably was not great, because the aboriginal populations were small and settlements were dispersed.

Human impact increased during the period of Russian colonization of the Far East in the 19th century. However, the coastal Russian settlements were relatively small and dispersed like the aboriginal populations. The predominant human pressure on seabirds and their habitat in the 19th century was from fur-farming in Russia, Japan, and America, and spread throughout the Commander, Kuril, and Aleutian islands. The greatest impact, however, resulted from the introduction of furbearing mammals begun in the early 20th century.

By the 1930s, industry and commercial fisheries were intensively developed. During this period, destruction of seabird colonies increased, and by the 1950s, it assumed alarming proportions because of the commercial harvesting of eggs and adults. Pakhulsky (1951) summarized the amount of fish eaten by seabirds and pronounced them to be serious competitors of people for marine resources, and he proposed a plan of systematic eradication. As a result the annihilation of seabirds accelerated. Gisenko (1955) also advised on methods and optimum timing to collect and exterminate cormorants, gulls, and alcids of the Kuril, Moneron, and Tyulenii islands by gun, nets, or poison lures. Gisenko calculated that a single species—Common Murre *Uria aalge*—breeding on these islands would provide about 420 t of meat, 200 000 eggs, and 2100 m<sup>2</sup> of hides for commercial use. As a result of a long and uncontrolled program of exploitation of Common Murres on Tyulenii Island, the numbers decreased dramatically: from about 650 000 birds in 1947–48 (Gisenko 1955) to about 100 000 birds in 1976 (Nechaev and Timofeeva 1980).

Paradoxically, despite the obvious harm of Pakhulsky's recommendations, it stimulated the beginning of extended studies on the biology of fish-eating birds and their role in marine ecosystems. Numerous publications have subsequently discounted Pakhulsky's conclusions; and consequently, the senseless destruction of fish-eating birds has ceased and certain inshore ecosystems are now protected. Due to an uninformed populace and an absence of ecological awareness, however, nature protection policies have advanced slowly. For example, despite the existence of a 200-m exclusion zone around Moneron Island, which has a unique seabird community, it served as the base for at least 100 trawlers in 1963; ship crews hunted here without hindrance (Benkovsky 1968).

Direct eradication of seabirds lessened by the end of the 1950s due mostly to the disappearance of many coastal fish factories as well as a population movement away from coastal settlements. Mass egging is still popular, especially in places where commercial fishing is carried out (Yakhontov 1975b; Velizhanin 1978; Shuntov 1986).

Impact by tourists on seabirds and their habitat has not been very great in the Far East. It is a potential threat, however, in the Kuril Islands, where international tourist routes are planned in the near future and where there is only a single reserve. In addition, reproductive declines may result during extended visits by ornithologists and nature film crews.

### 3. Introduced mammalian predators

The introduction of mammals to the North Pacific islands was begun in the 18th century by Russian and American fur-farmers (Iljina 1950; Bailey and Kaiser, this volume). In the Far East, however, mammals were introduced only at the beginning of the 20th century; red foxes *Vulpes vulpes fulva* and brown rats *Rattus norvegicus* had been accidentally introduced much earlier. Although arctic foxes, raccoon dogs, raccoons, sables, and tundra voles *Microtus oeconomus* were

introduced on coastal and oceanic islands south of 59°N, at least two species (raccoon dogs, raccoons) disappeared soon after their introduction (Bromley 1981; Voronov 1982).

#### 3.1. Arctic foxes *Alopex lagopus*

Fifteen pairs of arctic foxes were first introduced to Ushishir Island (Kuril Islands) in 1915 by Japanese fur-farmers and later onto other islands in the chain (Matua, Simushir, Yurii, and Lissii islands). In the late 1920s, foxes were placed on islands in Peter the Great Bay: on the Shantarskii Islands between 1925 and 1928 and on Furugelm Island in 1929 (Voronov 1972, 1982; Pavlov et al. 1974).

Arctic foxes have persisted only on Ushishir Island; in 1938 about 600 pairs were censused (Kuznetsov 1949), but by 1971 there were only 16 pairs. Seabirds were the predominant source of food for these foxes and accounted for roughly 90% of their diet (Voronov and Voronov 1963; Voronov 1982). As a result the number of seabird colonies and their abundance decreased strongly. The progressive decline of seabird populations due to fox predation has been documented on many islands.

On Ushishir Island, from 1928 to 1959, arctic foxes ate mainly Northern Fulmars *Fulmarus glacialis*. After destruction of these colonies by 1959, the foxes switched to Crested and Whiskered *Aethia pygmaea* auklets and completely eliminated these species. Foxes reached Toporkov Island in the Commander Islands, via neighbouring Bering Island, and by 1928 had destroyed an entire colony of puffins (Marakov 1966). By 1931, only two years after their introduction to Furugelm Island, foxes also had annihilated the nesting colonies of Black-tailed Gulls *Larus crassirostris* and Temminck's Cormorants *Phalacrocorax capillatus*. At the end, only a few pairs of cormorants nesting on inaccessible ledges remained out of the original populations of thousands of nesting pairs.

Despite how unprofitable these unmanaged fox-farming programs were, and their immense damage to seabirds and other native fauna, there still are plans to continue introductions of arctic foxes to selected sites in the Kuril Islands (Voronov 1982).

#### 3.2. Red foxes *Vulpes vulpes*

Red foxes were introduced repeatedly to the Kuril Islands in the 19th and 20th centuries, even as late as the 1950s on Moneron Island, but the program failed. The cultivated stocks bred with native fox populations, which subsequently led to declines in the quantity and quality of the fur (Voronov 1974). It is known that both subspecies are important predators on nesting seabirds, but little is known about their exact effect.

#### 3.3. Sables *Martes zibellina*

Sables were first introduced to Karaginskii island in 1901 (Pavlov et al. 1973), the Shantarskii Islands in the late 1920s, and Moneron Island in the late 1960s. Without exception, soon after introduction all seabird colonies were destroyed (Voronov 1982). Moneron Island was declared a special nature reserve in 1988, and the eradication of sables is planned (V. Nechaev, pers. commun.).

#### 3.4. North American mink *Mustela vison*

North American mink escaped from Japanese fur farms in the 1940s and colonized Urup Island in the southern Kuril Islands. They are known predators on the seabird colonies on this island (Bromley 1981).

3.5. **European mink *Mustela lutreola***  
European mink, endangered in Europe, were introduced to Kunashir Island in recent years as a means to improve their numbers, and there are plans to introduce more animals on the Shantarskii Islands in the near future (Ternovsky and Ternovskaya 1988).

3.6. **Ermiones *Mustela erminea***  
Some ermines migrated naturally from Kamchatka to Verkhoturov Island and in a few years eradicated the large colony of Least Auklets *Aethia pusilla* (Viatkin 1975). As a means of reducing the numbers of brown rats, Voronov (1974) recommended introduction of this species to Iturup Island in the Kuril Islands. Although this species is found naturally on large islands in the island chain, its introduction to small islands would undoubtedly have devastating effects.

3.7. **Brown rats *Rattus norvegicus***  
Brown rats were accidentally introduced to islands in the northwest Pacific by shipwreck and trading activities (Voronov 1982). Rats are found on most of the larger islands throughout the region. On Moneron Island, rats eat both eggs and chicks of Rhinoceros Auklets *Cerorhinca monocerata* and Black-tailed Gulls and are serious predators on the small colonies of Ancient Murrelets *Synthliboramphus antiquus* and Leach's Storm-Petrels *Oceanodroma leucorhoa*.

3.8. **Tundra voles *Microtus oeconomus***  
Tundra voles were introduced to several Kuril Islands (e.g., Atlasova, Shiashkotan, Onkotan, Ushishir, Matua, Ketoy, and Simushir islands) by Japanese zoologists in 1916 to serve as food for arctic and red foxes (Bromley 1981). Their predatory effects on seabirds here are unknown, although they are known to prey upon auklet eggs and chicks on St. Lawrence Island (Sealy 1982).

3.9. **Domestic mammals**  
Feral domestic cats and dogs live on the Commandar Islands and on several islands in the Kurils (Kunashir, Iturup, Urup, Shumsku). Rabbits *Oryctolagus domesticus* were released on Anuchin Island in the Kurils in the 1950s and are responsible for some habitat degradation, but their effect on seabirds is unknown (Marakov 1966; Voronov 1982).

#### 4. **Effects of industrial fishing and pollution**

4.1. **Commercial fisheries**  
Little is known about the numbers of seabirds killed in fishing nets, but apparently the scale is not large. The Far East salmon fishery is predominantly near shore and uses stationary nets. Other mass fisheries directed towards squid, herring, and sardines use trawls and do not pose as great a threat to seabirds as those using gill nets and driftnets.

The Far East fisheries have provided about 40% of the total harvest, and for the past 30 years, the Sea of Okhotsk has ranked as one of the most important fisheries resources in Russia. Its importance may increase in the future and consequently overexploitation and political changes may reduce the resource base (Shuntov 1985). How these changes will affect seabirds is unknown; at present, it does not appear that current levels of fishery efforts have had a negative impact on seabird foraging patterns.

#### 4.2. **Petroleum and industrial pollution**

The records of oiled birds in the northwest Pacific suggest that it is not a common phenomenon. Petroleum development is increasing in the Russian Far East, particularly on the east coast of Sakhalin Island and the Tartar Straits (Tronov et al. 1987). Oil pollution of marine habitats and seabirds will be a serious potential threat in the southern Far East.

Little is known about the influence of other toxic substances. There is some evidence that suggests that these are beginning to affect the marine environment. In August 1980, mass mortality of Short-tailed Shearwaters *Puffinus tenuirostris* and salmon were noted in the waters near southern Sakhalin Island (V. Nechaev, pers. commun.). The exact cause of the die-offs was not determined; however, very high concentrations of cadmium were found nearby in Aniva Bay.

#### 5. **Conclusions and recommendations**

Human exploitation and disturbance present the greatest source of damage to seabird populations in the northwest Pacific. First, and most direct, of these perturbations is the practice of mass collection of eggs by people (both fishery workers and local inhabitants), and localized destruction of colonies by hunting or intrusion. The fishing fleet of the Far East now reaches even the most remote islands and coasts, and lack of understanding by ships' crews about ecological conservation poses a serious threat to the continued existence of many seabird colonies. Although there are many prohibitions concerning exploitation of seabirds during breeding, there is no law enforcement.

There exist many potential problems relating to commercial fishing of prey species, gillnet and driftnet bycatch mortality, and oil and industrial pollution. All of these areas are international in scope and must be solved by joint efforts by the North Pacific Rim countries.

Population trends are known only for some species in the Far East; however, it is felt that the status of seabirds is satisfactory. Despite several negative factors described above, most species are not endangered. For example, the numbers of seabirds breeding in Peter the Great Bay have been stable or increased in the last decades. Due probably to favourable environmental conditions and vigorous enforcement of protective legislation, numbers of Black-tailed Gulls have doubled and Japanese Cormorants have increased 10-fold in the last 20 years on Furugelm Island. This only points out the need for more understanding about the environment and the biology of breeding seabirds, and for greater enforcement of existing laws.

Due to the gaps in our knowledge of the biology of seabirds and their environment, and our need for greater enforcement of existing laws, we make the following recommendations:

- (1) **Reduce the disturbance and destruction of seabird habitat by increasing the effectiveness and enforcement of existing laws, establishing new reserves, prohibiting eggging and hunting near seabird colonies, and restricting visits to colonies by tourists, naturalists, scientists, and others.**

- (2) **Conduct censuses of existing seabird populations by joint research with foreign scientists.** Priority should be given to seabird colonies in the Sea of Okhotsk where most of the Far Eastern seabirds are found. Special attention should be given to nocturnal and burrowing species, and to the development of uniform survey methods.
- (3) **Prohibit the introduction of mammals to breeding islands, and control and eradicate introduced species in existing areas.** The first priorities should be the eradication of arctic foxes and European mink from the Kuril Islands and sables from Moneron Island.
- (4) **Manage commercial fishery operations on forage fish, particularly in the Sea of Okhotsk.** Attention should be given to control of herring and sardine fisheries in the Sea of Japan.
- (5) **Initiate an intensive public educational program directed towards young people, local inhabitants, fishermen, but perhaps most of all towards industrial leaders and government officials.**

#### Acknowledgements

This paper benefited from repeated discussions with A.A. Nazarenko, V.A. Nechaev, Y.V. Shibaev, V.P. Shuntov, and V.G. Yudin, and the editorial efforts of D. Siegel-Causey.

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