

**Review of reported Gentoo chick mortality on South Georgia, Jan 2009**  
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Poor breeding success and the mass mortality of Gentoo penguin chicks has been reported at the following sites on South Georgia:

Godthul  
Gold Harbour  
Ocean Harbour  
Bird Island  
Prion Island  
Maiviken  
Rookery Bay  
Cooper Island  
Cooper Bay

At Bird Island and Maiviken (both monitoring sites) abandonment has been reported to be progressive and not due to a single event. Other sites are not monitored and observations have been reported from a single visit.

No similar reports have been received for other species. Adult penguins are reported to be in relatively good condition, and no significant mortality of adults has been reported. It is a common response during periods of poor food availability for adult seabirds to abandon the feeding of chicks, to best ensure their own survival in order to attempt to breed the following year.

The most likely explanation for the high mortality is considered to be a lack of food, especially of krill. Similar incidents have been recorded in 1991, 1994 and 1998, and correlate with recorded low levels of krill. Gentoo penguins are known to be highly sensitive to changes in krill availability, due to their limited foraging range (<10km from the colony) and inability to switch to other prey types.

One of the species commercially fished around South Georgia is Mackerel Icefish, which feed primarily on krill. Good catches of icefish are associated with aggregations of krill. However, the 2009 icefish season has so far been reporting poor catches of icefish, with captains noting the lack of krill marks observed. Adult icefish caught appear to have been feeding on young icefish as opposed to krill. A recently completed GSGSSI icefish research survey has reported no great aggregations of icefish and a noticeable lack of krill in the trawls. This information supports the theory that low food availability is behind the high Gentoo chick mortality.

The other possibility for the mortality is disease, though this is considered to be unlikely due to the widespread nature of the mortality and the fact that only chicks are affected. However, carcasses have been collected for post mortem and testing as a precaution.

As a direct response to the reported mortality, GSGSSI have requested that all visitors stay at least 200m away from Gentoo penguin colonies. If the cause of the mortality is found to be disease, avoidance of sites will help mitigate against the spread of the pathogen. If, as is felt to be more likely, the cause is found to be low food availability, closure of the sites will prevent the addition of additional stress generated by the close proximity of people to already struggling animals.

It is unlikely that the low food availability is a result of the commercial krill fishery around South Georgia, as the fishery is managed in order to prevent such an occurrence. At the current level of harvesting, it is extremely unlikely that the krill fishery is having any impact on the predators at South Georgia. For impacts to be affecting predators all around the island, there has to be a major shortage of krill and this is most likely to be related to environmental variability as has been seen in the past.

A review of krill management practices around South Georgia is given below.

## **Management of the South Georgia commercial krill fishery**

### **Krill abundance fluctuations**

The abundance of krill around South Georgia varies between years, and availability was much reduced in at least 4 in 20 years prior to 2000. The variation in krill abundance is thought to be linked to fluctuations in average annual temperature, and the dynamics of the ocean currents in the Scotia Sea. Warmer winters result in less sea ice development and this is linked to years with low krill abundance. Such variation reflects the open nature of the marine ecosystem around South Georgia which is influenced by, and dependent on the large scale biological and physical processes of the Scotia Sea, and more broadly, the Southern Ocean. The krill around South Georgia do not form an isolated population, as there is thought to be an input of individuals from the Southern Scotia Sea that are transported on the Antarctic Circumpolar Current. South Georgia's stock of krill is not self-sustaining; krill may be spawned much further south, possibly close to the Antarctic Peninsular or in the Bellingshausen Sea. Large inter-annual fluctuations in krill numbers around South Georgia are linked to basin-wide changes in abundance that in turn have been linked to large scale environmental processes. Periods of poor krill abundance appear to correlate with fluctuations of Sea Surface Temperature (linked to El Niño events) on an approximately 3-4 year cycle. Reduced levels of krill biomass are associated with periods of anomalously warm sea surface temperatures.

Periods of low krill biomass may have deleterious impacts on various parts of the marine community, such as reducing the breeding success of whales, some fish species, penguins, other seabirds and fur seals.

## **Fishery safeguards**

South Georgia has a krill fishery which is concentrated in the winter months between May and August, outside of the breeding and chick rearing season of birdlife around the islands. GSGSSI is committed to the preservation of the islands ecosystem and its wildlife through various management objectives, including:

To conserve as far as is practicable, the indigenous flora and fauna, ecological associations and natural environment of South Georgia.

To manage sustainable fisheries in the South Georgia Maritime Zone using an ecosystem approach and to conserve the marine environment.

In addition to GSGSSI's own management objectives, the catch levels of all the island's fisheries are set by CCAMLR.

CCAMLR was established in the 1970's mainly in response to concerns that an increase in krill catches in the Southern Ocean could have a serious deleterious effect on populations of krill and other marine life; particularly on birds, seals and fish, which mainly depend on krill for food. A 'precautionary' approach has been implemented to minimise risk associated with unsustainable practices in conditions of uncertainty.

This approach is complemented by the need to take into account ecological links between species and 'natural' as opposed to 'human-induced' variability – the 'ecosystem approach'.

CCAMLR management aims to ensure that changes in populations are reversible in time scales of 20 to 30 years. Since krill is a key species in the ecosystem harvesting levels are set to maintain 75% of the unexploited population size, in

order to allow for dependent species; this is more precautionary than some other stock assessment methods. When all factors are taken into account a harvesting factor of 9.1% is applied to the estimated biomass giving a total allowable catch for FAO Area 48 of 3.47 million tonnes. Area 48 is split into 4 subareas, with Area 48.3 encompassing South Georgia and the north shelf break associated with the krill fishery. Total allowable catches for Area 48.3 are set at 1.056 million tonnes. Current levels of harvest in Area 48 are close to 120,000 tonnes, with approximately 30,000 tonnes taken at South Georgia.

Concern over the effects on dependent species of a 3.47 million tonne catch occurring in a single Subarea have led to the introduction of further safeguards. A catch trigger level has been set for Area 48 as a whole of 620,000 tonnes; if this level is reached the catch has to be further subdivided into small scale management units, each with smaller catch limits. Area 48.3 would likely be split into 3 such small-scale management units (East, West and a Pelagic area for areas over 80km distant from the island).

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Current annual catch around South Georgia (Area 48.3) is 30,000 tonnes, where the total allowable catch for area 48.3 is currently set at 1.056 million tonnes using a harvesting factor of 9.1%. This equates to 3% of the allowable catch for the area. 2008 was an exceptional year in the South Georgia krill fishery with a catch of 126,000 tonnes. This is still only 12% of the TAC for 48.3, and 20% of the trigger level.

One further safeguard to avoid damage to the ecosystem from krill fishing is the CCAMLR Ecosystem Monitoring Programme. This has been set up to monitor krill predators, to detect changes in their annual breeding performance and to determine whether these changes are due to natural causes or to the ecosystem

effects of fishing. This programme monitors a range of indicators from foraging behaviour to population size of key indicator species. One of the most important monitoring sites is Bird Island. The programme has shown that years in which penguin reproductive success was poor, such as 1991, 1994 and 1998, there were also years in which there was low krill availability at South Georgia. This was determined to be due to natural fluctuations not to fishing.

In addition to the CCAMLR CEMP site at Bird Island (which focuses mainly on the area to the West of South Georgia) GSGSSI has implemented its own higher predator monitoring programme based at Maiviken on mainland South Georgia, in order to study the interactions of predators and krill to the North and East of the island. This additional study site means that South Georgia is now one of the best monitored locations for the krill fishery. Data and information from these monitoring programmes will be incorporated into the management of the fishery and will better inform the conservation of the ecosystem.