

Puffins

North Sea Puffins

by Mike Harris of NERC's Institute of Terrestrial Ecology at Banchory



Seabird numbers and breeding parameters are useful indicators of the state of the marine environment. In 1972, a population study of the puffin was started off the south-east coast of Scotland on the Isle of May. At that time puffin numbers there were increasing rapidly. However, in recent years, conditions have become far less favourable and numbers have stabilised.

Almost every one can identify a puffin. Most people would consider it to be a rare bird but, although the British population was doubtless larger 100 years ago, there are currently some 750,000 pairs concentrated in the north and west.

In 1969-70, a survey of all British seabirds (Operation Seafarer) found many fewer puffins than anticipated, and NERC instigated a programme of research into the factors influencing puffin numbers. Much of this research concentrated on St Kilda, Western Isles, the largest British colony where numbers had declined dramatically. The Isle of May was used as a comparison as it was one of the few places where puffins were increasing. This project ran from 1972 to 1977 and concluded that the general decline in numbers of puffins in west Britain was a result of oceanographic change.

Some aspects of the Isle of May study continued to be supported by science vote projects and by funds from NCC as it was obvious that this population could not continue to increase at this rate. A considerable amount was learnt about puffin biology on the Isle of May, not least that birds breeding there rarely left the North Sea. Puffins feed their young mainly on sandeels and the 1990 NERC Corporate Plan targeted both the interactions between sandeels and seabirds (and NERC is funding research into this at Glasgow University), and the North Sea as areas of research. A study of the puffin was almost tailor-made for this purpose.

Population changes

The 1960s and 1970s were boom times for seabirds in the North Sea. The puffin on the Isle of May was no exception. In 1960 there were just a few pairs but by 1984, the population had increased to 12,000 pairs. Birds were digging burrows all over the island and although, to our eyes, there appeared to be room for many more burrows, the population then stabilised at about 19,000 pairs. Annual counts of burrows in sample plots dispersed through the colony indicated that the number of breeding pairs had increased at 19% per annum during the 1970s but the rate then decreased quite abruptly.

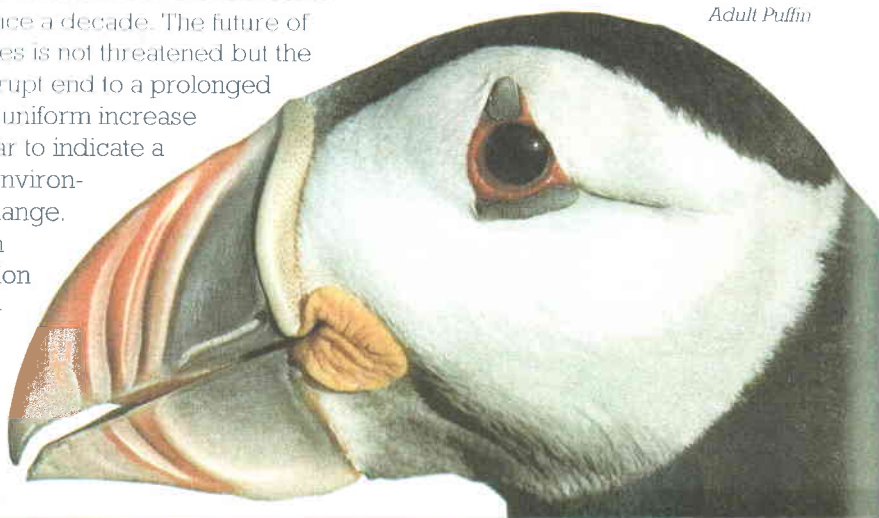
Many people seem to have a death-wish on the puffin and, to judge from the popular literature extinction looms at least once a decade. The future of this species is not threatened but the rather abrupt end to a prolonged period of uniform increase did appear to indicate a marked environmental change. Maybe an examination of the life-cycle of the puffin will give some

indication of what this might be.

Breeding

A female puffin normally lays a single egg each season so the average breeding success of 84% of pairs on the Isle of May 1973-89 successfully rearing a chick was extremely high. Success in 1990 was markedly lower, at 66%, and in 1991 some chicks died apparently of starvation. Even so production should be quite adequate as long as chicks survive when they leave the relative safety of the nesting burrow for the open sea.

Puffins feed their young on a variety of small shoaling fish which they carry back to the colony in the bill. The number of fish in a load can vary from one to sixty. Loads with many fish, which must of necessity be small, seem only to be carried when conditions are poor, weigh little and are of low calorific value. Food samples are easy to collect and so about one hundred loads are collected annually to provide an index of feeding conditions. Sandeels have always been the commonest prey on the Isle of May except for the period from 1974 to 1978 when sprats formed 50-86% of the diet. During the 1980s, the proportion of sprats declined and the importance of herring increased. This has important implications as sprats of the size eaten by puffins can be sexually mature, and so have a high calorific value, whereas similar sized herrings



Adult Puffin

Puffins

are juvenile and are not such good value. Puffins are now heavily dependent on sandeels to feed their young. Recent breeding failures of several species of seabird in Shetland have been linked to poor sandeel recruitment. There are risks in relying for food on a single species of short-lived fish.

Survival of adults

Puffins like most seabirds have a high annual survival rate and hence a long life expectancy. A 25-year old puffin is not that exceptional. Up to 1981, on average, only 4% of adult puffins died overwinter but since then the figure has been 9%. Doubling of the annual mortality will have serious consequences for puffin numbers unless immature survival increases.

Reasons for change

Many changes have occurred in the North Sea during the last few decades but it is extremely difficult to show causal effects between marine conditions and seabird survival. However, a comparison of puffin data and the stocks of small fish by Roger Bailey (Scottish Office Agriculture and Fisheries Department) and myself found a strong temporal association between the rather abrupt change in adult survival rate around 1981 and a sharp decrease in the population and distribution of sprats in the North Sea in 1979-80. Sprats are a common food of auks in the winter when many sandeels are buried in the sand, and have a much higher calorific value than other small fish. This throws up the problem of why these changes in fish stocks occurred but this is, perhaps, a rather different research question.

Colony fidelity

Once a puffin has bred it never moves to another colony. However, during the years between fledging and first breeding, many immatures visit several colonies and some settle away from where they were reared. The initial increase on the Isle of May during the 1960s was so rapid it must have been due to such immigration. Estimating survival rates of immatures is essential to understanding bird populations but this is one of the most intractable problems facing seabird

biologists. Obtaining an accurate measure of immature survival is both time consuming (as the young do not breed until 5 years old) and labour intensive and hence is not undertaken lightly. Many puffins colour-ringed as chicks on the Isle of May in 1973-79 have been seen subsequently at distant colonies when old enough to breed. I calculated that half the surviving young moved elsewhere.

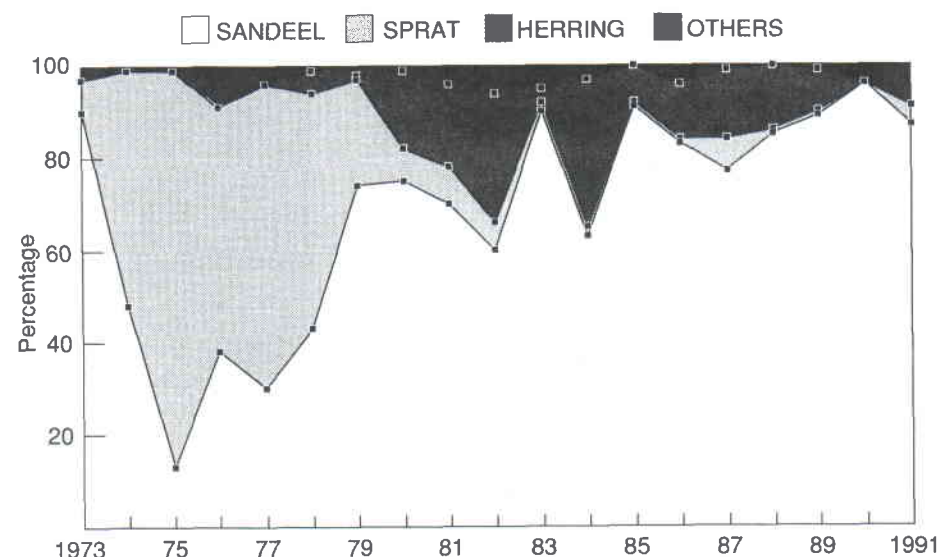
The future

Incorporating estimates of population parameters into a simple model suggests that the population on the Isle of May should remain stable at about the present numbers even with the present increased adult mortality. However, this calculation depends heavily on immature survival still being at the level estimated during the 1970s. This may well not be a valid assumption. Immature puffins

are easily identifiable by bill characteristics and rather fewer immatures were seen on the Isle of May in the late 1980s than had been recorded in the 1970s. If the mortality of immatures has increased as much as that of adults then the population must decline.

Only long-term studies like this will enable us to understand the processes influencing seabird numbers. The Nature Conservancy Council acknowledged the importance of the present long-term studies on the Isle of May and purchased the island, already a National Nature Reserve, in 1989. BP Exploration have awarded ITE's Banchory Research Station a £45,000 grant towards revitalising this NERC funded work for a further three years. The future of this study is assured, at least in the short-term.

The graph below shows the percentage of diet (by weight) of young puffins on the Isle of May between 1973 and 1991 indicates the importance of sandeel to the young.



The population of puffins on the Isle of May increased very rapidly up until 1981. The rate of increase then slowed down. Numbers are now stable.

