



# Is the abundance of sandeels in the North Sea declining due to a change in survival of early stage larvae?

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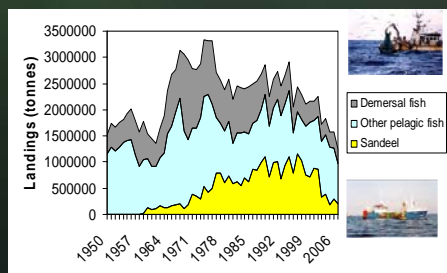
Jens Rasmussen, John Fraser, Michelle Inglis, Simon Greenstreet & Steve Hay: Marine Scotland

## Headlines

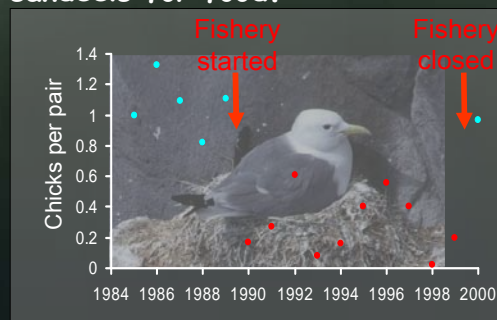
- Sandeel stocks in the northwestern North Sea are declining despite restrictions on fishing for sandeels.
- Declining sandeel availability is causing breeding failures at seabird colonies.
- The survival of sandeel larvae has increased, not decreased, as the stocks have declined.
- Warming winter temperature is the most likely cause of the stock decline - by compromising the survival of hibernating sandeels.

## The sandeel fishery and its effect on seabirds

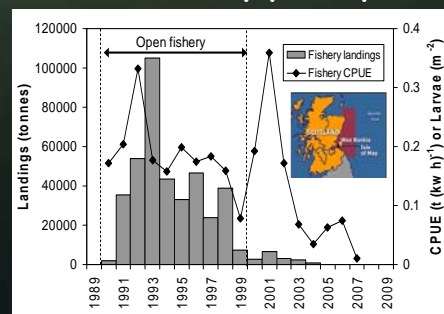
Landings of sandeels for reduction to fishmeal have been a significant component of the North Sea fishery, but since 2002 the stocks and landings have declined



Sandeel fishing off the east coast of Scotland was closed in 2000 to protect kittiwake breeding colonies on the Isle of May which rely on sandeels for food.



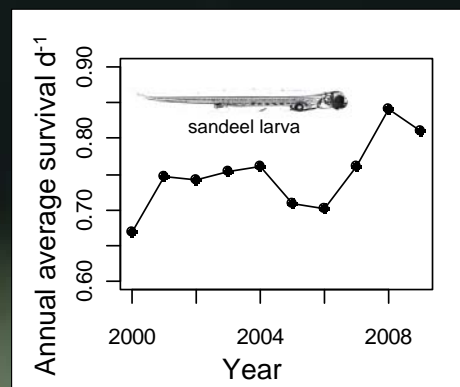
Following the closure of the fishery, the sandeel stock in the area initially recovered, but then declined steeply. Why?



## Sandeel larvae

The Lesser Sandeel (*Ammodytes marinus*) spawns in January. The eggs rest on the seabed until they hatch in March. Newly hatched larvae are only 4mm long and vulnerable to predators in the plankton as they drift with the current. After ~8 weeks, when they are 40-50mm long, the few survivors find patches of sand on which to settle and grow into adults.

We derived the survival rate of sandeel larvae over their first 20d after hatching. Weekly sampling was carried out off Stonehaven, in the area closed to fishing, during 2000-2009. Larvae were counted, measured, and the daily growth rings in their otoliths counted to estimate their age. Contrary to expectations, the survival rate increased as the stock declined!



## Conclusion

Stock decline was not due to poor survival of larvae. After examining other factors, a likely cause seems to be reduced survival during the winter. Sandeels bury in the sand and hibernate during the winter. Rising sea temperatures are thought to reduce the length of time they can survive in this way without feeding.

### Amazing!

Otoliths are calcium carbonate structures in the ears of fish. A new layer is deposited onto the otolith each day. By counting the layers, or rings when seen in cross-section, we can tell the age of a fish. But, the otoliths of larvae are very small - this one from a 7d old sandeel is only 25 microns diameter.

