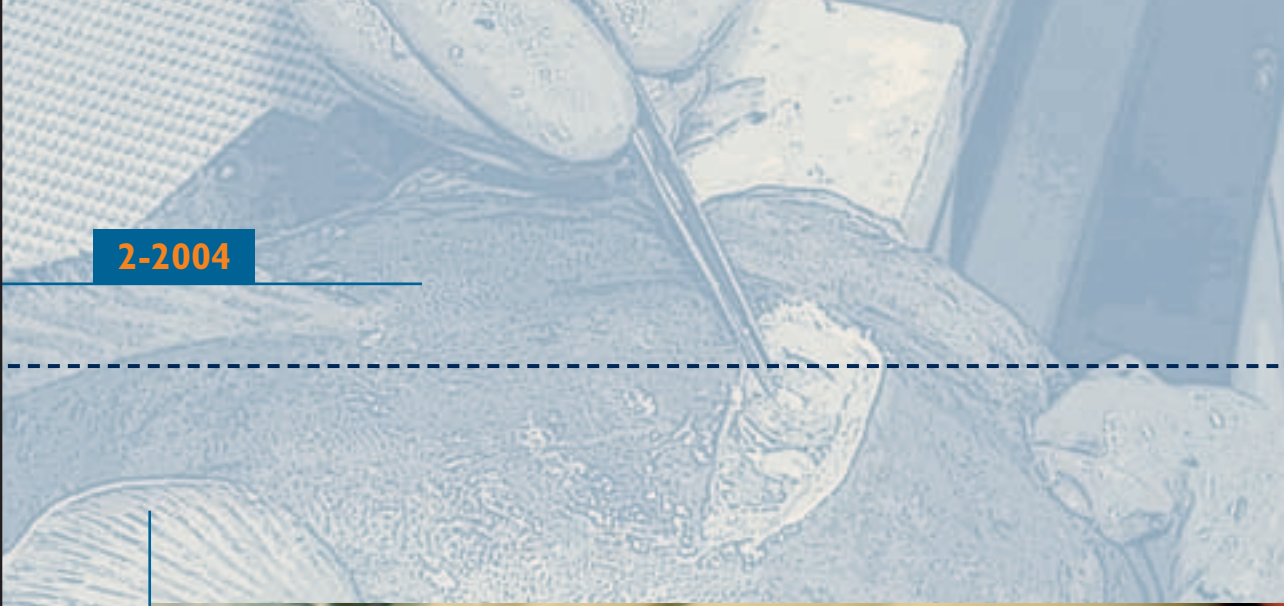


2-2004



DATA-STORAGE TAGS
– *“flight recorders” for cod*



DATA-STORAGE TAGS – “flight recorders” for cod

BACKGROUND

As long ago as the beginning of the last century, both scientists and fishermen wanted to know more about the causes of the huge fluctuations in fishing catches that could take place between one year and the next. There was a widespread belief that there was a connection between temperatures and fish distribution. Today, the belief remains that if we wish to know why and how fish distribution varies in time and space, we will need to know not only how the fish react to changes in their environment but also something about how the environment itself changes over time.

The Institute of Marine Research performs regular monitoring studies of the biomass and composition of cod and haddock stocks in the Barents Sea. The results of these surveys are based on acoustic recordings and catches made by bottom and pelagic trawls. However, variations in the availability of the fish to acoustic methods and trawls add a certain degree of uncertainty

to these time series of stock estimates. If we wish to estimate the magnitude of these sources of error we need to map out which factors influence the distribution of the fish in the water column over a period of time. When this is done we will be better able to improve the accuracy of our stock estimates.





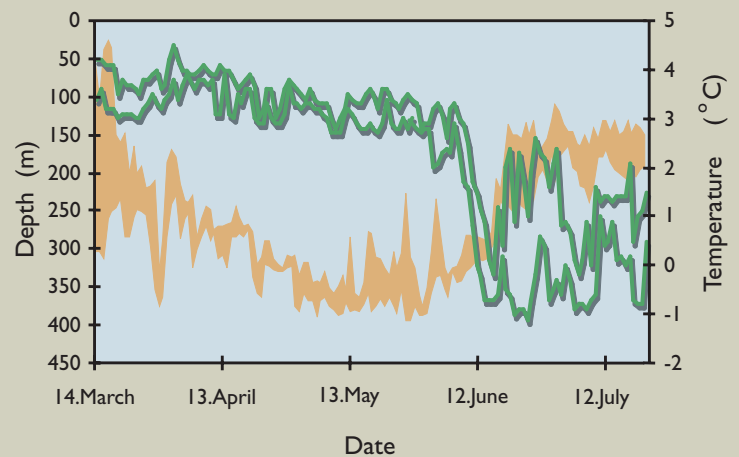
OBJECTIVES

By carrying out systematic annual tagging programmes on cod spawning grounds we can improve our knowledge of the cod and its migrations. With the aid of traditional plastic tags as well as more recently developed data-storage tags, we wish to find out whether individual fish actually migrate back to the same fjord to spawn, as well as their time of spawning, their migration routes, temperature preferences, where in the water column the cod can be found, the distance, frequency and rate of their vertical migrations, and so on.

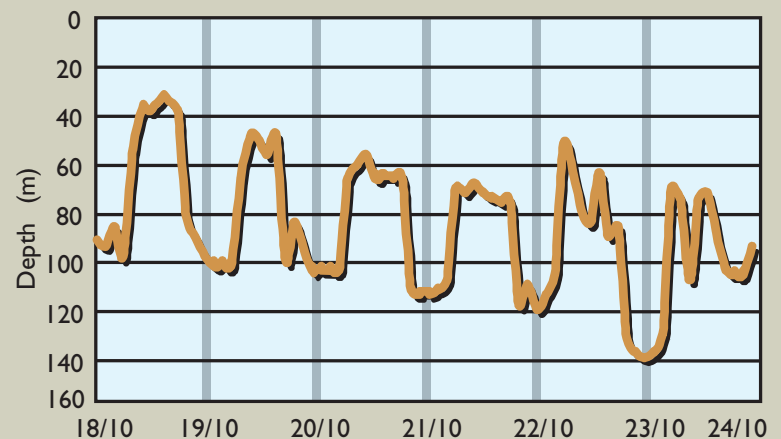
SOME OF OUR RESULTS

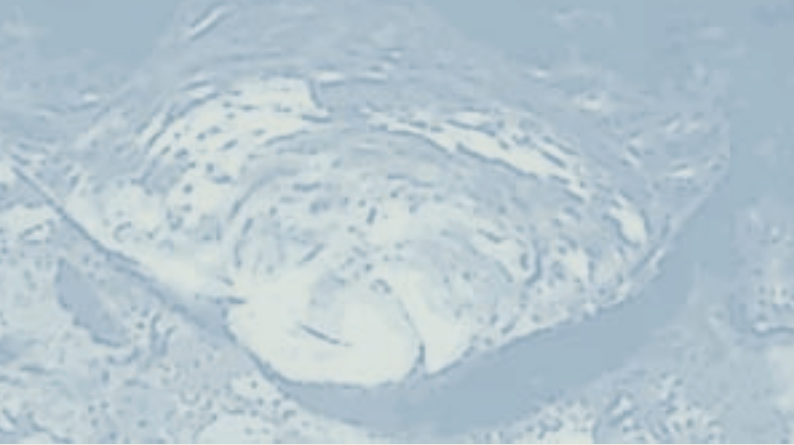
The figure on the right shows maximum and minimum temperatures (green lines) and depths (hatched area) for a single fish tagged off Lofoten. This fish has migrated northwards and into the Barents Sea under relatively stable temperature conditions (2.4–4.0 °C). In June it reached the polar front, in the far north-east of the Barents Sea. At this time the fish experienced temperatures well below –1 °C. It is also worth noting that the daily mean temperature experienced by the fish is higher in winter when the fish is in the southern and western part of its area of distribution, than in the summer when it is in the north-eastern Barents Sea.

The right-hand figure illustrates the daily rhythm of vertical migrations, which shows how the fish is swimming higher in the water column during the day than at night at this time of year.



The daily rhythm of vertical migrations





Tracking halibut by satellite.

WHY TAG HALIBUT?

When do halibut enter the fjords, how long do they stay there before they emigrate again, do they actually emigrate at all or just become unavailable to fishing gear, do all the halibut in a given fjord belong to the same population, how large are the vertical and horizontal migrations that halibut are capable of making, how often do they eat and when, do males and females behave differently? There are many questions here, and we hope that this tagging experiment will help to give us answers to some of the things we are wondering about.

WHAT SORT OF TAGS HAVE WE USED?

The tags we used are known as satellite tags or pop-up tags. They register temperature, depth and changes in light intensity every two minutes. The tags will be fastened to the fish until July 1, when a mechanism will ensure that they are released from the fish and rise to the surface, while the fish will continue swimming in the sea just as before. The tags will then send the maximum and minimum values of the data they have gathered to an Argos satellite every twelve hours. The satellite then retransmits the data to us. If we are to acquire all the data that the tag has registered, we are dependent on it being found and sent back to us. In order to ensure that we get as much information as possible about its pattern of migration, the halibut will also be fitted with a traditional fish-tag. We hope that if a halibut is caught at some time in the future, whoever

fishes it will contact us, so that we can take further samples from each individual fish.

WHY DO WE GO TO SO MUCH TROUBLE?

As a first step, we have tagged five halibut off the coast of western Norway. These tags contain some highly advanced technology and are very expensive, but we hope that they will give us quite a new understanding of the halibut and its life in the depths of the sea. We have also made contact with fishermen who are marking undersized halibut with standard plastic tags for us.

This project will later help us to design a large-scale project in which we can optimise our sampling strategy (number of fish, optimal time for transmitting data via Argos, etc.) If money becomes available to buy more tags, we also want to tag fish off northern Norway, where the biggest stocks of halibut are found and where we will probably also find the largest individual fish of this species. However, a project of this sort will depend on financial support from several different research funds.

For the moment we can only wait in tense anticipation for time to pass and the first tags to turn up!



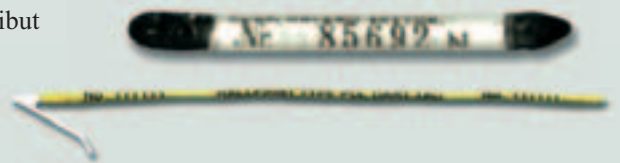
The three largest halibut that we marked were 1.71 m long, weighed around 80 kg and were probably about 30–35 years old, i.e. about the same as an adult human being of the same age (in the halibut, the females are largest).

VARIOUS TYPES OF FISH-TAG USED BY THE INSTITUTE OF MARINE RESEARCH

CONVENTIONAL TAGS

DESCRIPTION: there are a number of different tags of this sort on the market, but what they have in common is that they all carry a number and an address; i.e. they do not store any information, but act simply as a means of identification. Such tags provide information about the release and recapture sites. If the length of the fish is measured and its otoliths are removed, we can also say something about its rate of growth, age, age at sexual maturation and how many times it has already spawned.

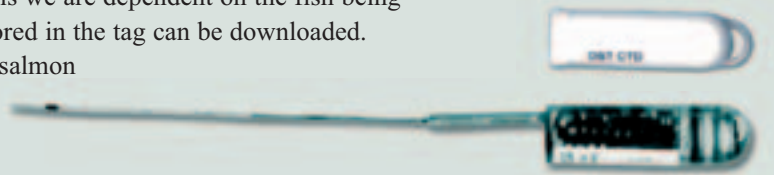
SPECIES TAGGED: cod, halibut, anglerfish, Greenland halibut



ELECTRONIC TAGS

DESCRIPTION: also known as data-storage or self-registering tags. These are white or transparent cylinders that contain sensors which register and store depth, temperature, salinity and light intensity at given intervals. Together with information about the length of the fish and its age (from the otoliths), these tags provide us with detailed knowledge about the fish and its migrations. However, for this we are dependent on the fish being recaptured and sent back to us so that the data stored in the tag can be downloaded.

SPECIES TAGGED: cod, Greenland halibut, salmon



SATELLITE TAGS

DESCRIPTION: also known as pop-up tags. These measure temperature, depth and changes in light intensity every two minutes. Such tags can remain attached to the fish for up to one year. At a given time, a mechanism releases the tag from the fish. The tag floats up to the surface, while the fish continues to swim around just as it did before. The tags then transmit maximum and minimum values to an Argos satellite, which retransmits them to us. If we want to access all the data recorded by a tag, it needs to be found and returned to us. In order to ensure that we collect as much information as possible about patterns of migration, the halibut are also fitted with a traditional tag. We thus hope that if they are caught, the fishermen will contact us so that we take more samples from each fish.

SPECIES TAGGED: halibut



ACOUSTIC TAGS

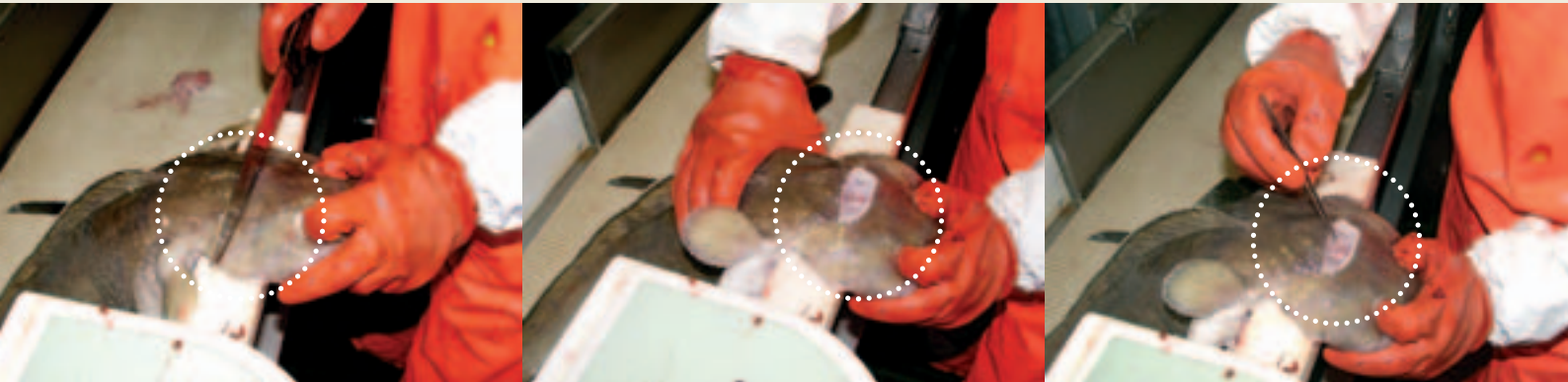
DESCRIPTION: these tags transmit sound signals (every one-and-a-half seconds, with a signal strength of 158 decibels) which are picked up by three positioning buoys on the surface. All the buoys must receive the signals from the tag for the position of the fish to be defined accurately. In order to allow individual fish to be identified, the tags transmit signals at different frequencies. Tags of this sort allow the movements of the fish to be mapped in detail (from position and depth information received at intervals of a few seconds). This sort of experiment can be carried out within a limited area and for a relatively short period of time. It does not depend on the fish being caught, and the tags can be reused several times. These tags were used last year to study whether spawning-ready cod try to avoid fish-farms.

SPECIES TAGGED: cod, ling



WHAT TO DO WHEN YOU CATCH A TAGGED FISH

1. Note the date, position and depth of the catch
2. Remove the tag from the fish and note any injuries
3. Measure its length, identify its sex and remove its otoliths (see pictures below)



4. Send the tag, otoliths and information about the fish to:

Institute of Marine Research
Attn: Kathrine Michalsen
P.O. Box 1870 Nordnes
N-5817 Bergen
Norway

If you include your name, address and a Norwegian bank account number, you will receive a finder's fee and information about your fish and the project.

FINDER'S FEES ARE AS FOLLOWS:

Conventional tag:
t-shirt or lottery scratch-card

Electronic tag and fish:
NOK 200,-



ARE YOU INTERESTED IN TAGGING FISH YOURSELF?

Do you sometimes catch halibut that are smaller than the minimum permitted size of 60 cm, and are you interested in knowing more about the halibut and its migrations? We can tell you how to tag these fish. We will send you detailed instructions, a tagging needle and tags. Unfortunately, we cannot pay you, but we promise to keep you informed of all the information we gather during this project.



Contact Kathrine Michalsen, tel.: +47 55 23 86 84, e-mail: kathrine@imr.no

**HAVFORSKNINGSINSTITUTTET*****INSTITUTE OF MARINE RESEARCH***

Nordnesgaten 50
P.O. Box 1870 Nordnes
N-5817 Bergen – Norway
Tel.: +47 55 23 85 00
Faks/Fax: +47 55 23 85 31

www.imr.no

HAVFORSKNINGSINSTITUTTET, TROMSØ

Sykehusveien 23
P.O. Box 6404
N-9294 Tromsø – Norway
Tel.: +47 55 23 85 00
Faks/Fax: +47 77 60 97 01

HAVFORSKNINGSINSTITUTTET, FLØDEVIGEN

N-4817 His – Norway
Tel.: +47 37 05 90 00
Faks/Fax: +47 37 05 90 01

HAVFORSKNINGSINSTITUTTET, AUSTEVOLL

N-5392 Storebø – Norway
Tel.: +47 55 23 85 00
Faks/Fax: +47 56 18 22 22

HAVFORSKNINGSINSTITUTTET, MATRE

N-5984 Matredal – Norway
Tel.: +47 55 23 85 00
Faks/Fax: +47 56 36 75 85

REDERIAVDELINGEN***RESEARCH VESSELS DEPARTMENT***

Tel.: +47 55 23 68 49
Faks/Fax: +47 55 23 85 32

INFORMASJONEN***INFORMATION***

Tel.: +47 55 23 85 21
Faks/Fax: +47 55 23 85 55
E-mail: informasjonen@imr.no

CONTACT PERSON

Kathrine Michalsen,
Tel.: +47 55 23 86 84,
E-mail: kathrine@imr.no

