

**Method name: Internal tagging of cod with DSTs and double tagging with a DST and a conventional tag**

**Key-words**

Cod, *Gadus morhua*, Double tagging, Data Storage Tags, DST, T-bar tags, surgical implantation

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**License for operations on fish:** license No.0304-1901, issued by the Icelandic Committee for Welfare of Experimental Animals, Chief Veterinary Office at the Ministry of Agriculture, Reykjavik Iceland.

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**Species tagged:** cod, *Gadus morhua*

**Some objectives of experiments where this tagging method has been used:** Research of the behaviour of sexually mature cod in Icelandic waters; Study of Behaviour that influences catchability such as Availability and Accessibility (Harden Jones 1974) . Migration, Vertical movements, Geographic distribution, Habitat preference, Exploitation, Mortality, Growth (Pálsson & Thorsteinsson 2003) , Spawning behaviour (Thorsteinsson & Marteinsdóttir 1998) Double tagging with a DST and conventional tag CT to observe tag retention and differential returns of tags.

**Materials and equipment:**

**Primary tag:** Conventional tag, T-bar tag 100% of release group

**Tag type, make and producer:**

T-bar Floy 89-SL Floy-Tag & Manufacturing, INC;

T-bar T3313 Hallprint Pty Ltd

**Secondary tag:** DST , 10 – 20 % of the release group

**Tag type and make:** Data Storage Tags, We use the abbreviation DST for electronic tags that go by the names of Data Storage Tags or archival tags. The types of the DST's in the MRI tagging database are DST200, DST300, used in the period from 1995 to 1999. Their max capacity is 4050 records of temperature and depth, with 8 bit microprocessors and 0.4% resolution of measurement range. From 2000-2003, DST-milli, with a capacity of 10,000 to 21,000 records of temperature and depth. Since 2003, DSTcenti-ex, with capacity up to 130,000 records of temperature and depth. The DSTmilli, and DSTcenti-ex have 12 bit microprocessors and the resolution in data collection is 0.06% of the measurement range. DST-GPS are in basic a DSTcenti ex but listens to GPS signals from sonar. The electronic

tags were all produced by Star Oddi, Iceland. For technical information on the DSTs, see the website of tag producer: Star-Oddi [star-oddi@star-oddi.com](mailto:star-oddi@star-oddi.com)

**Anesthetics:** none

**Pacifying measures:** Tonic immobility or animal hipnos caused by placing the cod dorsal side down in tagging saddle, also by cooling, keeping ample sea water running over gills and sides, and for protection of eyes blindfolding with a cloth soaked in seawater wrapped around head.

**Surgical sutures:** ETHICON, reverse cutting 40 mm, CP, 9321; DEXON II, C-12, 48mm, 9867-71.

**Antibiotics :** Engemycin (Oxytetracyclin) Interevet-Vnr 39 78 85. (0,1 ml/kg fish)

**Vitamin complex :** Becoplex vet. (1 ml / fish)

**Sterilizing media:** Superfos Biosector a/s, IDU-SCRUB

**Saddle for surgery:** made from wood and soaked in sterilizing media during the operation (figure).

**Hollow needle** to conduct the spaghetti of the DST to the exterior,

**Hose** with running seawater (ample but slow running).

**Cloth** to wrap around the head of the fish during the operation,

**Measuring board** (ICES standard)

### **Method description:**

As for all internal tags, the location of the tag capsule in the peritoneal cavity is important for the comfort and health of the fish and for the function and recapture of the tag. The location chosen for the DST tag-capsules in these experiments was on the ventral side of the peritoneal cavity, midway between the isthmus and the cloaca ([figure 1](#)).

The cod are caught with gill-nets, trawl or Danish seine. As soon as possible after capture the fish was transferred to a holding tank. Cod that looked weak or spent time near the surface in the holding tank were discarded. Only cod in good condition which were active and swam normally near the bottom of the holding tank were used.

The cod is first tagged conventional tag (CT) near the first dorsal fin. This is best done by another person tagging with the CTs and handing cod for DST tagging over to a person only doing the surgery.

Next the cod is put into a tagging saddle with the belly up ([figure 2](#)). A cloth is wrapped around the head and a hose with slow-running sea water put into the mouth so that seawater would run over the gills.

An opening is cut in the side of the belly, about 4 cm from the linea ventralis (line between the cloaca and the point of the isthmus), large enough that the tag-capsule can be slipped inside.

A surgical suture had been tied beforehand to one end of the tag capsule and the tag indicator was a priori fastened to the other end.

A hole was pierced through the abdominal-wall in front of the cloaca (in the ventral line) with a Flessa needle or a syringe needle wide enough for the tag indicator ([figure 3](#)), and the tag indicator pulled through this hole, from the inside, with the aid of the Flessa needle or syringe needle ([figure 4](#) and [figure 5](#)).

A needle with a surgical suture was pushed through the body wall in the ventral line from the inside in front of the tag indicator. The distance between these two positions of attachment must be slightly larger than the length of the tag capsule and the positions should be on the line between the cloaca and the isthmus ([figure 6](#)).

When the tag measures tilt and direction like the DST300, which has a sensor for tilt, or the new DST-compass, the tag capsule must be attached by sutures at both ends and secured in two places with its longitudinal axis parallel to the longitudinal axis of the fish. To do this the tag-capsule is pulled into the abdominal cavity by adjusting the front suture and rear tag indicator, so that the tag is between these two points of attachment.

### **Comments:**

At first anaesthesia was used on the cod, but its application and the process of reviving the fish was difficult and some times unsuccessful under the working conditions which are usual at sea in winter in the North Atlantic. The use of anaesthesia was abandoned when we realised that same results could be achieved by the up side down posture in the tagging saddle. Avoiding the use of anaesthetics saved much handling time, and reduced the total time the fish spent on board the research vessel.

The method of pacifying fish by placing it on the back and keeping them dorsal side down during operations has been done successfully e.g. in shark research. Then one is taking advantage of a phenomena that is frequently called “tonic immobility” or “animal hypnosis” which is very common among vertebrates

“Tonic immobility” has been used to pacify sharks for attachment of tracking devices (Milius, 2006). In experiments with shark repellents (Michael, 2005) where efficiency of shark repellent was tested as strong enough to rouse a shark from the state of tonic immobility. Commonly used in research, husbandry or medical purposes for elasmobranchs in National Aquarium in Baltimore (Henningsen, 2005). Tonic immobility describes responses occurring in wide range of vertebrates. All have in common that a potentially dangerous situation evokes immobility. This phenomena has also been called: animal hypnosis, feigning death, Todstellreflex and to play possum because Opossums feign death when confronted with a predator (Gert van Dijk, 2003).

Through experience over a decade of tagging adult cod with DST in peritoneal cavity without anaesthetics, it seems that the most important factor in the method is the placement of the cod with belly up in the tagging saddle. In this position the adult cod very seldom moved or

showed signs of distress although no anaesthetics were applied. When turned right side up and released most of them would swim down and out of side.

The surgery-area was kept cold in the temperature range of 0 to 6 °C. The seawater temperature was between 5 and 7°C near bottom. Seawater in hose was surface seawater same temperature range. Low temperature may play a part in the lack of sensitivity of the cod to cutting and handling.

It is necessary to have an external mark that gives easy identification of an internal tag capsule. If a spaghetti tag or DST-indicator passes through the opening which was cut and closed with a suture, the DST-indicator has in some cases been seen to prevent the wound from healing properly. Holes pierced by the Flessa needle or syringe needle have not been seen to have this problem.

An example of a type of syringe needle large enough to hold the end of the DST indicator to guide the spaghetti through the body wall to the exterior, is veterinary object from KRUUSE Cat.no. 122220. The attachment part is sawn off and the sharp edges on the side filed down.

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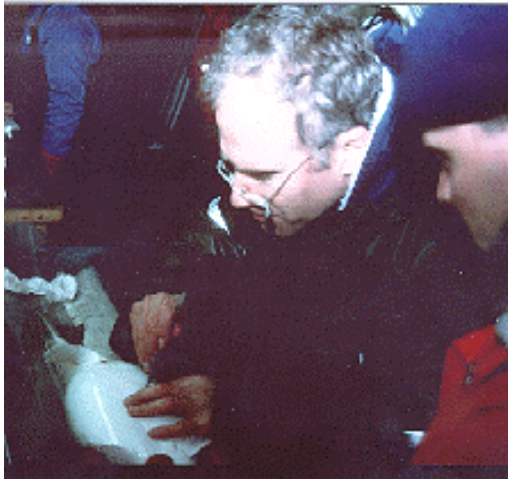
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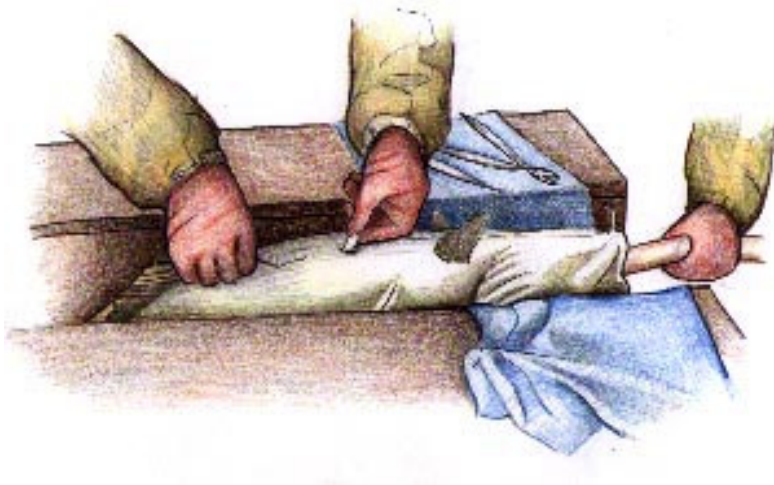
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**Figure 1**



**Figure 2**



**Figure 3**



Figure 4



Figure 5

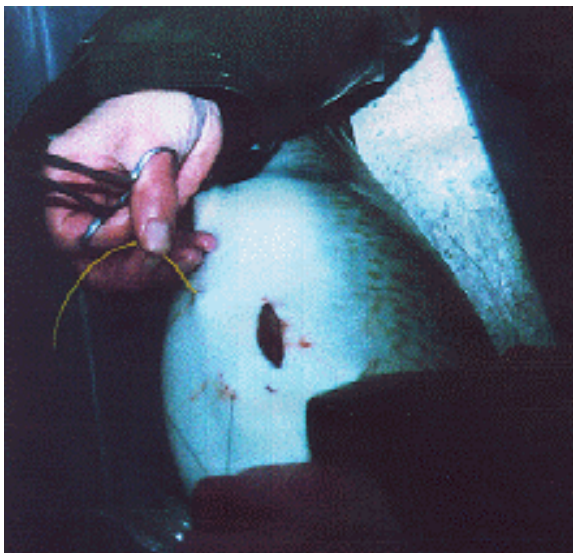


Figure 6