Let's do it again: Closing the book on a pilot in situ redfish tagging experiment with Underwater Tagging Equipment

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Summary
In 2003-2008 2,777 beaked redfish (*Sebastes mentella*) were tagged *in situ* with remotely operated Underwater Tagging Equipment (UTE) developed in collaboration between Marine Research Institute in Iceland and marine-device manufacturer Star-Oddi. Tagging redfish in their own environment avoiding the hazardous trip to the surface is made possible by attaching the UTE in front of the codend of a pelagic or demersal trawl and tagging with a remotely operated robot. The main objective of the research has been studying both vertical and horizontal migration patterns of beaked redfish stocks in the Irminger Sea and adjacent waters. Of the tagged fish, 62 (2.3%) have been recaptured. The experiment included tagging 105 redfish with electronic data-storage tags (DST) of type 'micro', recording pressure and temperature but, none have been recaptured to date. The distribution of days at liberty is wide with the longest time at liberty almost 7 years and the longest distance travelled over 300 nautical miles, with few individuals migrating between defined stock units. Despite the UTE being the only known successful tool for tagging redfish at great depths only Iceland has used it. We, therefore, believe the experiment 'deserves to be repeated' with further development of UTE.

Introduction
Traditional tagging technique, which involves the bringing fish to the surface, is not possible for many fish species such as redfish. Redfish brought to the surface from high pressure deep waters are unable to release air from the swimbladder fast enough, resulting in expansion and rupture of the swim-bladder. The expansion can push the internal organs out through the oesophagus and the mouth killing the fish. Redfish brought to the surface is in most cases dead. The Marine Research Institute in Iceland in collaboration with Star-Oddi Ltd. approached the problem of tagging redfish by constructing and building an Underwater Tagging Equipment (UTE) which makes it possible to tag redfish by a robot, in the fish own environment, thus avoiding the hazardous trip to the surface (Sigurðsson *et al*. 2006). The objective was collection of precise information on vertical and horizontal migration patterns of the various stocks of redfish in the Irminger Sea and adjacent waters. Here, we describe the results obtained and suggest tagging redfish, and possibly other species, *in situ* should be developed further.

Material and Methods
The UTE mechanism, tags and tagging procedure are described in detail in Sigurdsson et al. (2006). In short, the UTE is attached to the front of the codend of a pelagic or demersal trawl. The two-way communication link is via a sonar cable, which carries control signals to the UTE cameras and hydraulic operated moving parts of the system, and in the opposite direction video signals from the four cameras to the vessel. During tagging, a fish entering the trawl is directed to the tagging chamber where it is positioned and immobilized for tagging within a holding grid. A small incision in the abdomen is then made with a knife and the tag pressed through the incision into the peritoneal cavity. A spaghetti indicator attached to the tag is left protruding to the exterior to facilitate detection at recapture. Finally, the fish is released from the UTE and liberated through an open codend.

Between 2003 and 2008, 2,777 beaked redfish were tagged at 500-800 m depth in six tagging cruises. Most of the fish were tagged with dummy tags identical in size and shape of a data-storage tag (DST). The experiment included tagging 105 redfish with DST of type 'micro' (diameter 25.4 by 8.3 mm

length), recording pressure and temperature. The tagging cruises were conducted in the Irminger Sea and on the shelves southwest and west of Iceland.

Results and Discussion

Of the 2,777 beaked redfish tagged, 62 (2.3%) have been recaptured (Figure 1). Most of the recaptures were within two years or less from tagging with 23, 13 and 13 redfish recaptured at the year of tagging, one year, and two years after tagging respectively. The longest times at liberty was 7 years, and in total 10 fishes were three years or longer in sea before being recaptured. No fish with a DST tag has been recaptured. Most of the fish were recaptured close to the tagging site, but a few fish showed long distance migration, 5 were recaptured more than 250 nautical miles from the tagging site. Two fish showed migration between defined management units of beaked redfish (Cadrin *et al.* 2010). Recaptured fish did not show any visible injuries from the tagging. The recaptures are heavily dependent on the fishing fleet which operates only in part of the year (fishing season 3-6 months) in a very concentrated are in the Irminger Sea. That is why most of the fish are caught close to where they were tagged.

Although the tagging equipment has proven to be successful of tagging redfish at great depths only Iceland has used it. The knowledge of the life cycle and migration of different beaked redfish stocks is limited, greater tagging effort with joint effort of several institutes is urgently needed in order to gain knowledge on important biological questions. We, therefore, believe the experiment 'deserves to be repeated' with the development of UTE version 1.1. UTE development might benefit in tagging other species closer to shore where the results could be compared to those from conventional tagging.

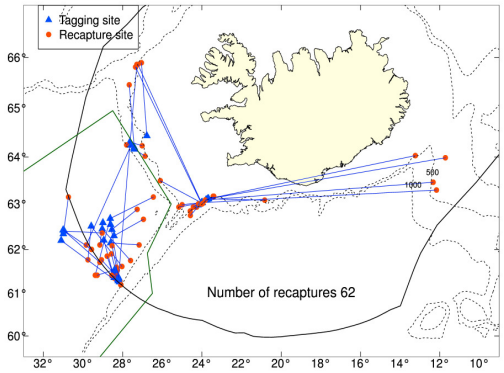

Figure 1: Tagging sites (blue triangles) and recapture sites (red circles) of 62 recaptured *Sebastes mentella*. The blue lines are drawn between tagging and recapture sites.

References

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