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Experimental tagging of Greenland halibut (Reinhardtius hippoglossoides) in Cumberland Sound, Baffin Island, during the winter fishery, May 1997

by

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ABSTRACT

Several attempts have been made to tag Greenland halibut (Reinhardtius hippoglossoides) in Cumberland Sound to determine whether adult fish move into Davis Strait. We conducted an experiment in May 1997 to test the feasibility of tagging during the winter using longlines. Sub-zero air temperatures appeared to be the main factor limiting fish survival, so we developed a method of reducing the fish's exposure to ambient air conditions. Tagged fish were held in a specifically-designed cage at depths below the cold surface water (deeper than 200m), to assess post-tagging survival. Repeated trials indicated no more than 10% mortality, even when fish were held for 56.5 hours, demonstrating that it is possible to successfully tag and release Greenland halibut during the winter using longlines set through the ice. Further modifications to our basic methods should be adequate to enable efficient and cost-effective tagging of a large number of fish without significant mortality.

INTRODUCTION

The Department of Fisheries and Oceans (DFO), Central and Arctic Region, conducted a study in May 1997 to determine the feasibility of tagging Greenland halibut (Reinhardtius hippoglossoides) in Cumberland Sound during the winter longline fishery. This experiment followed previous recommendations by DFO (Crawford 1992, Pike 1994, and AFSAC 1994) and the North Atlantic Fisheries Organization (NAFO) Science Council (1995) that a tagging study should be conducted to determine whether there is movement of Greenland halibut from Cumberland Sound into Davis Strait where they are vulnerable to the offshore fishery.

The winter longline fishery based from Pangnirtung involves upwards of 100 local fishermen in a good year, who catch "turbot" through the ice in Cumberland Sound usually between January and May. Ice conditions vary each year, affecting fishing location, effort, and success.

Earlier attempts at tagging Greenland halibut in Cumberland Sound have been either limited in scope or unsuccessful. In March 1993, a first attempt was made by DFO to tag fish during the winter fishery. However, the -20°C to -30°C air temperatures at that time proved to be lethal to the fish, even though they were exposed to air for only a few seconds during release from the hook and transfer to the tagging tank. No fish survived the tagging procedure.

A summer tagging experiment was conducted in August and September 1994, in conjunction with an exploratory fishery survey in Cumberland Sound and Davis Strait (Northlands Consulting 1994). An otter trawl was used to capture Greenland halibut for tagging; therefore, tagging was restricted to areas outside the winter fishing grounds because trawling in this area was not permitted by local fisheries interests. In Cumberland

Sound, 407 fish from seven tows were tagged and in Davis Strait 62 fish from three tows were tagged (Fig. 1). Two fish tagged at 65° 03'N 64° 59'W in Cumberland Sound were recaptured: one in November 1995 from a bottom trawl in Davis Strait; and one in Feb.-March 1996 from a longline in Cumberland Sound (Fig. 1). The fact that one of the fish tagged in Cumberland Sound was recaptured in Davis Strait suggests that Greenland halibut do pass over the shallow sill at the mouth of Cumberland Sound and emigrate into Davis Strait. However, further evidence will be necessary to confirm this.

In August 1995, DFO conducted a survey to determine summer distribution of Greenland halibut and the feasibility of using longlines to capture fish for tagging during the summer. Catches were poor; in five days of fishing only 50 Greenland halibut were captured and no tags were applied. The project was beset with a number of problems, and less than half the fishing effort was at depths greater than 900 m, where the greatest concentrations of fish had been found in the 1994 survey.

There remained a need to determine an efficient and cost effective way to tag several thousand fish. It was suggested by Mathias and Chiperzak (1996) that the most cost effective method would be to tag during the winter, so plans were made to modify the methods used in 1993 and make a second attempt in May 1997. The main questions to be answered were: a) *would Greenland halibut survive after being raised through water* temperatures of less than -0.5°C, found to depths of approximately 200 m in Cumberland Sound (Fig. 2); and b) could a method be developed to tag large numbers of fish without significant mortality?

TAGGING METHODS

One of the primary needs is to limit the fish's exposure to sub-zero temperatures, therefore, a warm (c. 0°C) shelter from ambient air conditions is required. We used a 3 m x 4.6 m insulated tent ("Weatherall") in which we placed a fibreglass tagging tank, a kerosene heater and an iosol stove. One end of the tent was left open (covered with a removable tarp), and a fishing hole was cut in the ice just inside the open end of the tent. Our 1 m x 1.5 m hole was slightly larger than a normal fishing hole, to accommodate our holding and releasing tagged fish. The tent protected the fish (and us) from the wind, and the air inside could be warmed by the heater. We used the stove to heat water which we occasionally added to the tagging tank to ensure it was maintained at approximately 1°C.

We needed a method to assess the survival of tagged fish for a short time immediately following tagging. A holding tank at the surface had been used in 1993, but the water temperature just below the ice is approximately -1.9°C and exposure to this very cold water for extended periods may be harmful to the fish. Ambient water temperature at the depths the fish are caught (>500 m) is in the range of 0.0°C to 0.5°C. A conductivity, temperature, and depth (CTD) sound was taken in order to determine the exact conditions for our tagging site.

A cage made from 2 cm diameter PVC pipe (Fig. 3) was used to lower and hold tagged fish at depth (where ambient temperature was closer to normal) so that we might determine whether the fish could survive raising and lowering through the cold water layer, exposure to air temperatures less than 0°C, and handling during the tagging procedure.

Fishing was poor at our original location so we developed a system for taking fish from a second and third fishing hole which were located approximately 500 m from our "tagging tent". Fish from these unprotected fishing holes were removed from the hook as quickly as possible and put into a standard 70 L fish tub, containing approx. 1.0° C water, which was lashed to a snowmobile-drawn qamutik (sled). The fish tub was partially covered with a plywood sheet to limit exposure to sunlight and heat loss. When all the fish were removed from the ground line they were transported back to the tent and placed in the tagging tank where they were measured, tagged and then released through the fishing hole inside the tent.

We used yellow plastic floy tags, each individually numbered and marked with DFO's Iqaluit address. These tags were applied with a Denison tagging gun slightly posterior to the line of maximum body depth, and approximately 1-2 cm (depending on the size of the fish) below the insertion of the dorsal fin, such that the tags were anchored behind the

pterygiophores and the external portion of the tag protruded from the right (top) side of the fish, angled posteriorly.

RESULTS

Our camp was located at 65°59'N and 66°44'W (approximately 8 km east of Imigen Island) over approximately 850 m of water. The first set on May 1st produced one Greenland halibut which was tagged and put in the cage, lowered to approx. 200 m and held for 4.5 h. Unfortunately, we could not access the CTD data in the field and our estimate of the depth of the thermocline was less than it actually was (Fig. 2). Nevertheless when the cage was raised and the fish released, it appeared very strong and swam quickly down and out of sight.

Set number five produced 11 Greenland halibut; all were tagged and placed in the cage. We noted during tagging that one fish had jaw and pelvic fin damage, probably caused by a shark or entanglement in the line. The cage was lowered to approximately 200 m and held there for 5 h during which time the injured fish died (9% mortality). The other ten fish appeared strong and swam away when released.

Ten halibut were caught in set number seven. They were tagged and placed in the cage which was lowered to approximately 300 m and held for 10.5 h. No fish died (0% mortality). They were all strong and attempted to swim downward while in the cage and tagging tank. They all swam quickly down when released.

Set number 17 produced 18 halibut, ten of which were tagged and placed in the cage, while eight were tagged and released immediately. The cage was lowered to 300 m and held for 56.5 h. Nine of ten fish survived (10% mortality) and appeared healthy and normal when released. There were no visible signs of injury that could explain why the one fish had died. The results were particularly encouraging because these ten fish had been subjected to greater stress than fish we had caged previously. The longline had been fishing for 12 h, so there were more fish and it took longer to remove them all from the hooks. Therefore, the first fish were held in the fish tub on the qamutik for about half an hour in windy weather. Also, the larger number of fish led to more crowding in the transport tub and tagging tank prior to tagging. Finally, the fish were held longer in the cage (almost 2.5 days).

Weather conditions during this project were ideal for tagging. The outside air temperature varied from -12.0° C to +2.0° C during the day so we were able to keep the water temperature in the tagging tank and the air temperature in the tent at optimal levels. Windchill was a factor, particularly when removing fish from the unprotected fishing holes, but we were not able to quantify this parameter.

In total, 144 Greenland halibut were tagged and released from 25 sets over eight days of fishing. An additional 19 halibut were caught and sampled. Five sets caught Greenland sharks, resulting in tangled and/or damaged lines, and seven sets produced 11 damaged halibut showing signs of shark bites.

Our catch per unit effort (CPUE) was lower than we had expected based on fishery monitoring data from previous years. This was due, in part, to the time of year; catches generally drop off towards the end of the season (May). But, primarily, the weather conditions over the winter affected the seaward extension of the landfast ice sheet and, for the second year in a row, the fishery has been restricted to a less productive area. The total harvest for the 1996 winter fishery for Greenland halibut in Cumberland Sound was 60 tonnes and the projected harvest for 1997 is 65 tonnes. This compares to a harvest which varied between approximately 200 and 400 tonnes between 1989 and 1995 (Mathias and Keast 1996).

CONCLUSION

This project has demonstrated that it is possible to successfully tag and release Greenland halibut during the winter using longlines set through the ice. We now need to modify our methods further so that a large number (1,000 to 2,000) of fish can be tagged in a season. This should be possible if ice conditions are better and if tagging can begin earlier, during late March or early April, when CPUE is higher. This would mean that temperatures will be colder, but modifications to our basic methods should be able to overcome this.

Suggested modifications have included: 1) using a larger, insulated fish tub for transporting fish from the fishing hole to the tagging tent; 2) protecting the fishing hole from the elements with a canvas tent that is portable and easy to set up; and 3) applying acoustic tags to further determine survivability by monitoring the movements of fish after they are released.

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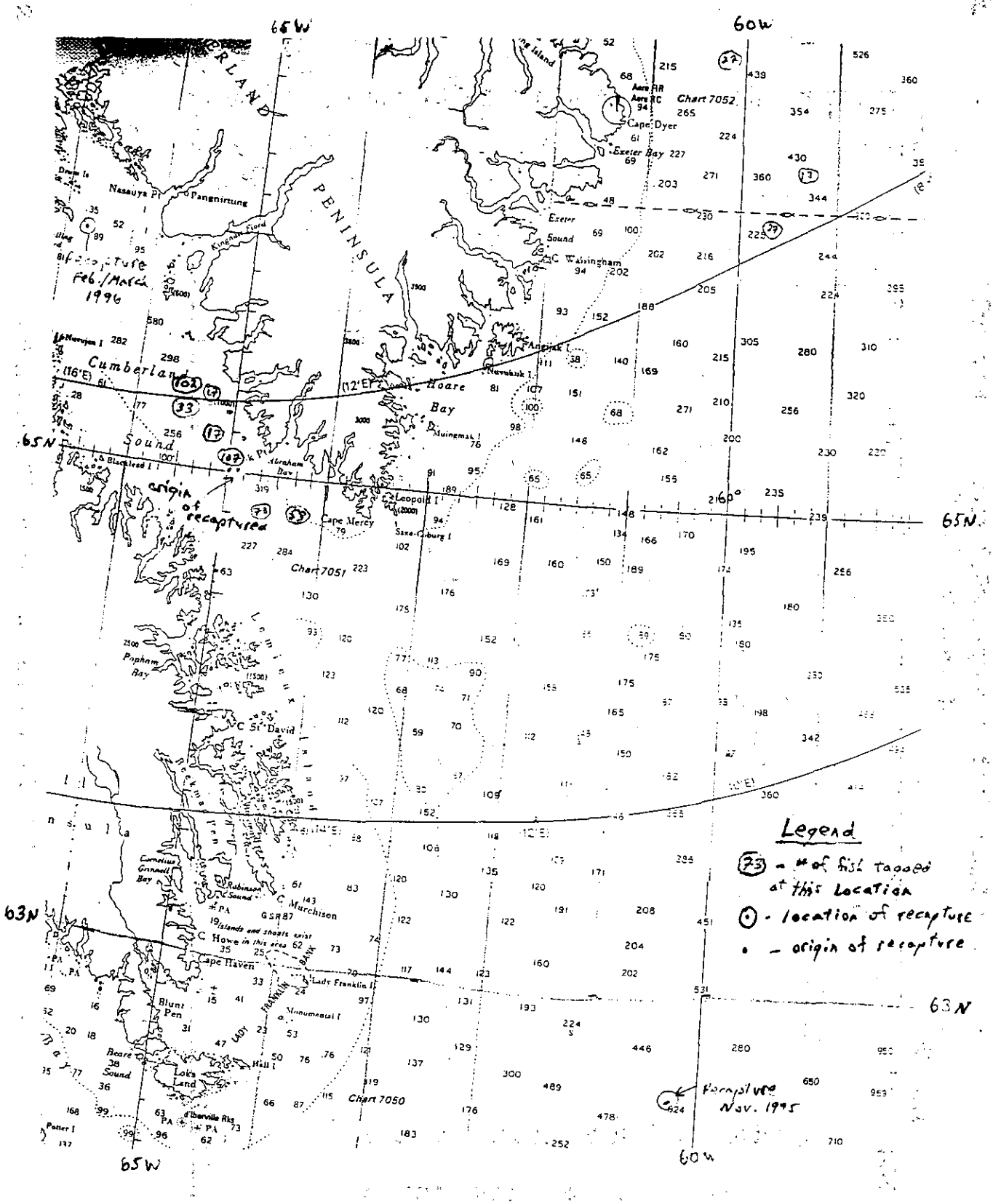

Figure 1. Tagging and recapture locations for Greenland halibut tagged in the 1994 Cumberland Sound and Davis Strait Exploratory Fishery (Northlands Consulting 1994).

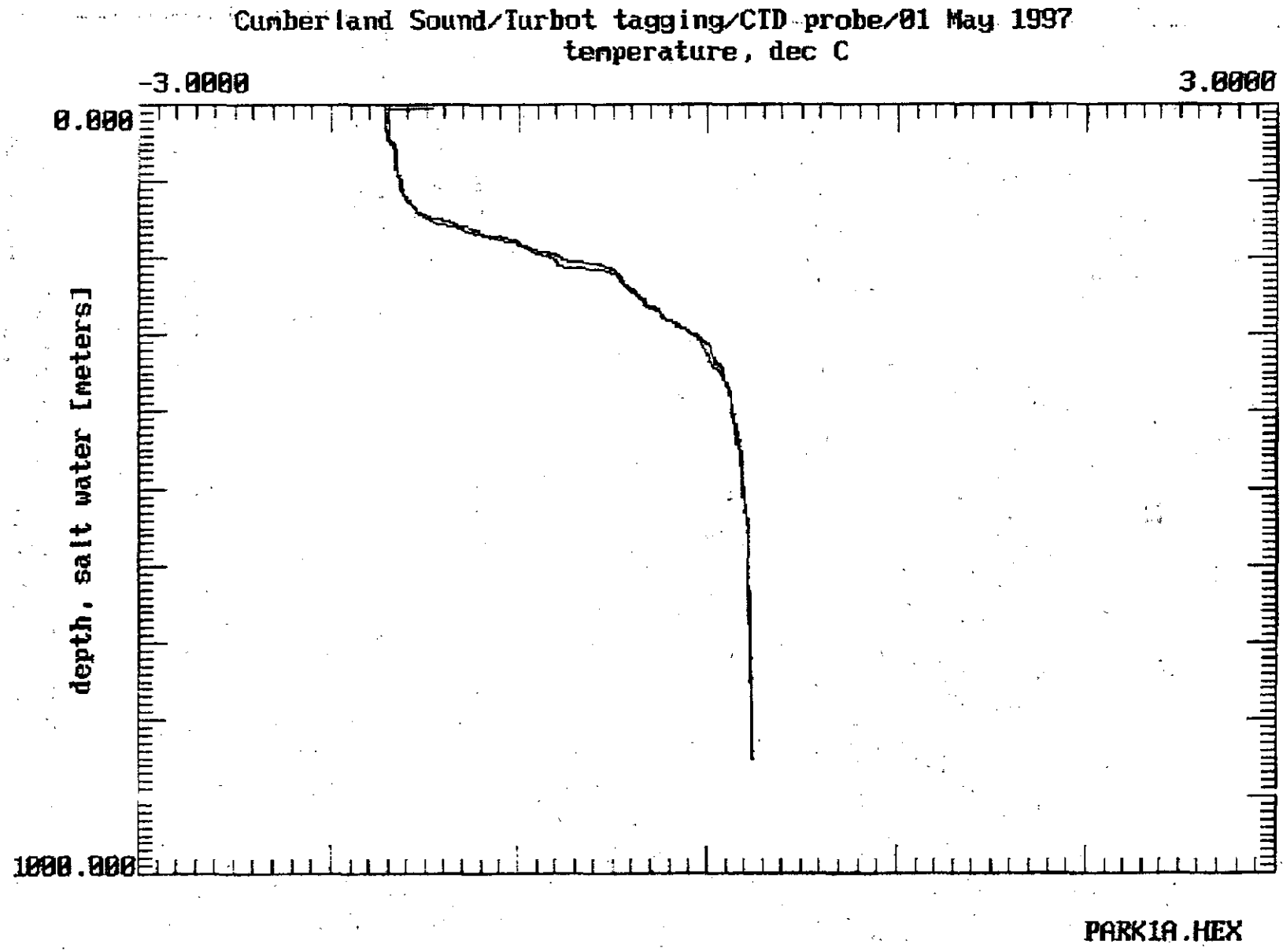

Figure 2. Temperature Profile for our tagging site, Cumberland Sound, May 1997.

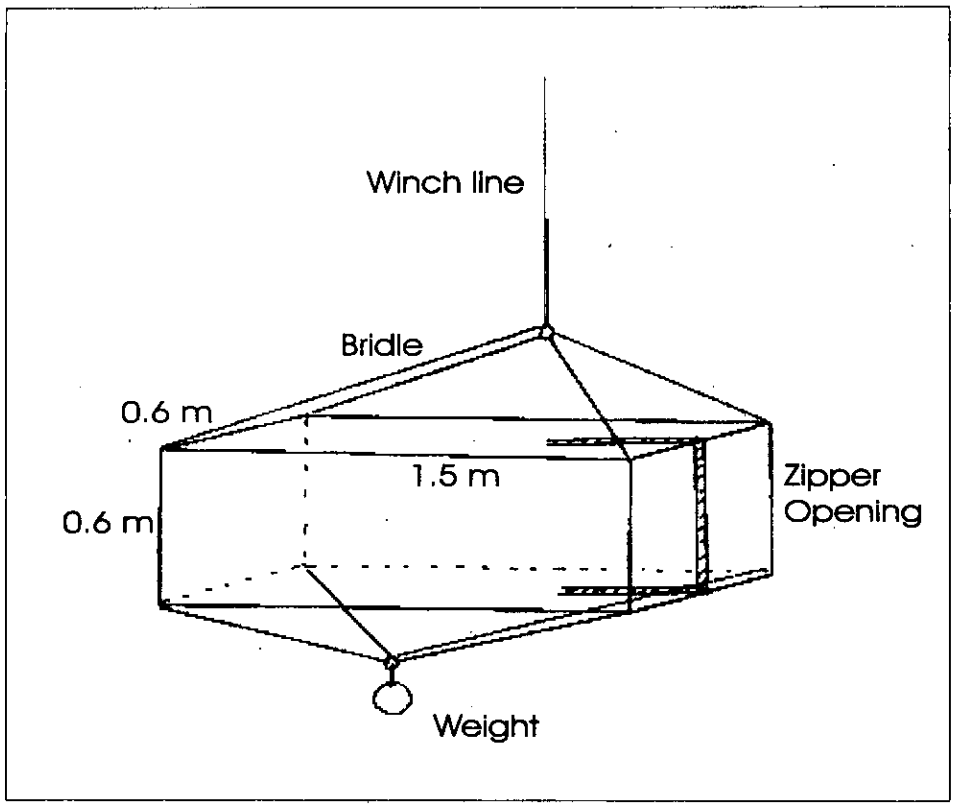

Figure 3. Representation of the cage used to hold Greenland halibut at depth following tagging.