Fisheries Research 93 (2008) 357–359

Contents lists available at ScienceDirect

Fisheries Research

journal homepage: www.elsevier.com/locate/fishres

Technical note

The pontoon trap: Description and function of a seal-safe trap-net

Malin Hemmingsson*, Arne Fjälling, Sven-Gunnar Lunneryd

Swedish Board of Fisheries, Box 423, S-40126 Göteborg, Sweden

ARTICLE INFO

Article history:
Received 10 March 2008
Received in revised form 17 June 2008
Accepted 23 June 2008

Keywords:
Trap-net
Salmon
Grey seal
Baltic
Conflict
Pontoon
Seal-safe
Mitigation

ABSTRACT

During recent decades almost all kinds of coastal fishery in the Baltic have been hit hard by seal interference, causing catch losses and gear damage among other negative effects. To solve this problem a new fish chamber was developed in the late 1990s. It has a double wall of firmly stretched net panels of the super-strong polyethylene material Dyneema and is called pontoon fish chamber. Since the introduction a number of positive effects of this chamber have been observed. A majority of the fishermen using the pontoon fish chamber are very satisfied with it and at the time of writing, over 300 such fish chambers are in use in Sweden.

This paper describes the construction and operation of the fish chamber, some preliminary results on fishing efficiency and its reception by fishermen.

1. Introduction

The fixed gear fishery for salmon (*Salmo salar*), sea-trout (*Salmo trutta*) and whitefish (*Coregonus* spp.) has, together with the herring fishery, long dominated the small scale coastal fisheries of the northern Baltic (the Gulf of Bothnia).

Seal damage is a major problem in the set trap fisheries for salmon, sea-trout and whitefish along the Swedish Baltic coast (Hemmingsson and Lunneryd, 2007; Kauppinen et al., 2005; Suuronen et al., 2006; Westerberg et al., 2000). Seal interference affects many aspects of the fishery: the catch (reduced, damaged, lost; Fjälling, 2005), the gear (damaged, tangled, its life span shortened, more expensive materials required) and the whole fishing operation (best fishing spots abandoned, frequent lifting, increased operational costs, difficult handling of by-caught seals).

One active method of mitigating the conflict which has been tried and which has had some effect is the deployment of Acoustic Harassment Devices (Fjälling et al., 2006). Passive methods that have shown some effect include more frequent lifting of gear, changing to other fishing grounds and using stronger materials in the traps. Modifications of gear design have demonstrated good potential, for example with the large mesh salmon trap (Lunneryd et al., 2003) that is in commercial use. With this innovation, seals experience limited hunting success since the fish being chased towards the trap walls in the first sections of the traps are able to pass through the large meshes, while the seals are not (Fig. 2). Traps and other confining gear however all remained vulnerable to attacks on the fish chamber netting and on the accumulated catch within. A new fish chamber was thus needed and work on such a construction, called the pontoon or push-up fish chamber, was begun in the late 1990s.

This paper describes the construction and operation of the pontoon chamber, some preliminary results on its fishing efficiency and its reception by fishermen.

2. Materials and methods

2.1. Construction and operation of the pontoon fish chamber

The pontoon fish chamber is an independent module which can be attached to trap-nets of several kinds. The fishing gear as a whole is then usually referred to as a pontoon trap. The chamber is basically a large cylinder of strong netting. It has two sections; the entrance part and the fish holding chamber itself (Fig. 1). The entrance part consists of a single layer of netting (Dyneema® CN2 twine, 100 mm stretched mesh) supported by three 2.9 m diameter aluminium hoops. It is funnel-shaped at the inner end where the diameter reduces to 450 mm. The frame of the opening is made of 20 mm diameter 1.5 mm gauge stainless steel tubing, and a 2.5 mm stainless steel wire is secured under tension vertically across the middle of the opening, in order to prevent seals from entering the holding chamber.

* Corresponding author. Tel.: +46 317 430 367; fax: +46 317 430 444.
E-mail address: malin.hemmingsson@fiskeriverket.se (M. Hemmingsson).

0165-7836/$ – see front matter © 2008 Elsevier B.V. All rights reserved.
doi:10.1016/j.fishres.2008.06.013

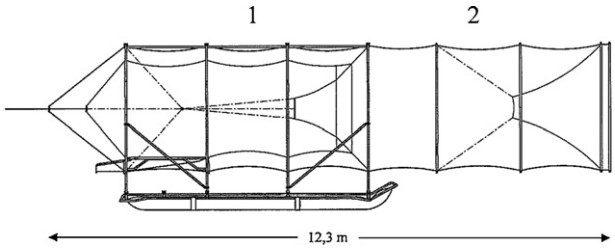

Fig. 1. Side view of pontoon fish trap with entrance part (2) and the fish holding chamber (1).

The holding chamber (Fig. 1) has two layers of netting which are spaced 300 mm apart and fastened to four supporting aluminium hoops. The outer net is made from 160 mm stretched mesh 1.7 mm gauge green Dyneema® CN2 twine, with a breaking strength of 190 kg. The inner net panels of the holding chamber are made from 70 mm mesh 1.1 mm diameter green Dyneema® CN1 twine, breaking strength 106 kg. The supporting hoops are spaced 1.75 m apart and fastened to a rigid but easily disassembled framework of 30 mm diameter, 2 mm gauge aluminium tubing, quality AW 6082 T6 and T4. The supporting structure has two longitudinal inflatable pontoons (308 mm heavy-duty polyester-reinforced polyurethane industrial hose) underneath. A flexible 19 mm diameter hose of 15 m length is attached to each pontoon. For inflating the pontoons, a portable petrol-driven compressor is used, operating at 2 bar. The pontoon fish chamber is fastened to the seaward end of the original trap, in this case a large mesh trap (Fig. 2). At the other end of the holding chamber there is a fibreglass chute with an emptying hatch.

Migrating fish are first corralled into and through the trap via a series of gradually narrowing flutes. Then they are guided into the entrance part, which during fishing is largely submerged, and finally into the fish holding chamber. The fish are hindered from exiting the chamber by tickler lines attached to the entrance frame. When emptying the trap, the compressor is connected to the air hose and the pontoons are inflated. Filling is controlled and balance is maintained by manually operated valves, one for each pontoon. When the fish holding chamber is fully raised to the surface, the compressor is turned off and the fish in the chute are emptied directly into the boat. The compressor is then re-started, the valves are reversed and air is drawn out of the pontoons until the fish chamber settles in position underwater again. External buoys are attached to adjust the flotation depth.

The pontoon fish chamber was designed and patented by a private fisherman (Swe. Pats. no 9800703-02, 9800704-0, 9800705-7 and Fin. 19990876). It is produced by a commercial supplier (Harmångers Maskin & Marin AB). The life expectancy of the chamber is expected to be in excess of ten years. The pontoon fish chamber was officially approved as a seal-safe fishing gear by the Swedish Environmental Protection Agency in 2001. Between 2001 and 2007, 330 pontoon fish chambers were supplied to over 100 fishermen along the Baltic coast. During the first years of introduction 50% of the poonton fish chambers were attached to a large mesh trap-net, later there are no statistics.

2.2. Evaluation of the introduction

In total 54 fishermen were enrolled to keep voluntary log-books with records of fish catches as well as of seal and bird damage during the period 2001–2005. Records were kept for both traditional combination traps and pontoon traps. In a further evaluation, a questionnaire was sent out to all known pontoon trap owners in 2005. The survey asked for the fishermen's personal assessments of the trap during fishing operations.

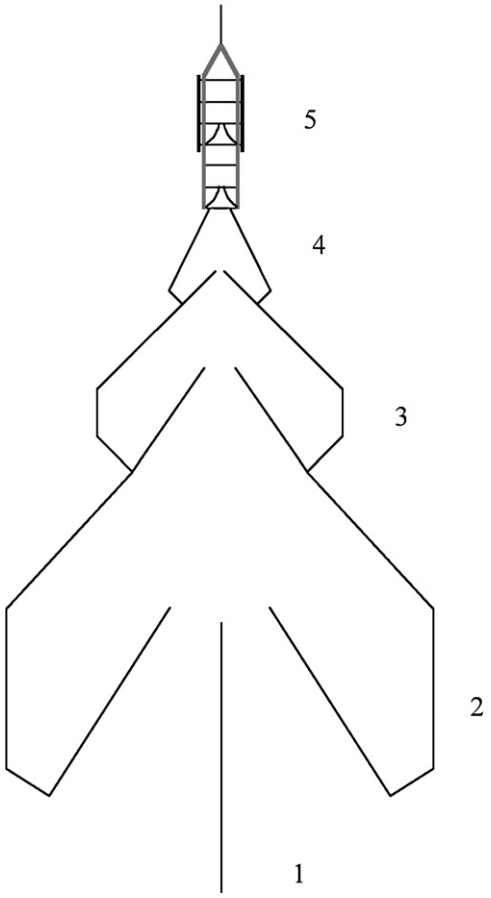

Fig. 2. Top view of a pontoon fish chamber (5) attached to a large mesh salmon trap consisting of: (1) leader net, (2) wings (mesh size 400 mm), (3–4) middle chambers (mesh size 100 mm).

3. Results

Preliminary data from voluntary log-books indicates that pontoon traps reduced the number of observed damaged fish with 80% compared to traditional traps, and that over a five-year period, fishermen achieved higher catches of salmon and sea-trout in traps that had a pontoon fish chamber than in traditional traps.

The fishermen who used pontoon traps enjoyed a longer fishing season and were obliged to empty their traps less frequently than the others. The fishermen's comments in the 2005 survey were positive. Most respondents were satisfied (75%) or very satisfied (22%) with most aspects of the pontoon traps ($n = 51$). Many fishermen (54%, $n = 51$) did however express their concerns over a high seal presence around the pontoon traps, as they felt that this would frighten fish away.

4. Discussion

An indirect effect of seal attacks, and one which is inconvenient for the fishermen, is that fishing gear generally has to be lifted much more frequently in order to minimize losses. This increases their fuel consumption and other costs. The pontoon fish chamber however allows a more infrequent lifting, even compared to the time before seal conflicts escalated, which is a significant bonus. Another important aspect is the ergonomic improvement. Empty-

ing the fish chamber of a traditional trap is extremely hard work; using compressed air to raise the pontoon chamber over the water surface lessens work significantly and is much appreciated. A third advantage of the new design is evident in some areas along the coast where algal growth on the net panels at times reduces the catch efficiency. The pontoon fish chamber can be cleaned simply by leaving it raised to the surface with the pontoons inflated and letting the sun dry the net, whereupon the algal growth falls off.

A negative aspect of the pontoon fish chamber is the high purchase price (€7500 in 2007) which in principle necessitates large catches or a high catch value. However, subsidies for the purchase of the seal-safe trap, amounting to up to 80% of the costs for the first traps and accepted by the EU, have been paid by the Swedish government. This has been an important factor in their rapid market acceptance.

The reduced number of seal-inflicted injuries to trapped fish with the improved gear results in a higher market value of the catch, and lower labour costs also contribute favourably to the economic outcome. The pontoon fish chamber must therefore be considered a great success within the challenging field of mitigating seal-fisheries conflicts. We believe pontoon traps will replace most of the traditional salmon and whitefish traps in the foreseeable future. However, although the seals cannot get hold of the catch easily with the new gear, previous experience shows that seals are highly resourceful and are likely to develop new foraging strategies. It is vital to maintain a constant programme of counter-measures, including the on-going monitoring and further development of the pontoon trap, taking seals' natural behaviour into consideration.

Acknowledgements

Thanks to all the fishermen who contributed with information in the voluntary log-book scheme and the survey, to Christer Lundin and the others at Harmångers Maskin och Marin AB, to all of our colleagues involved in the work of mitigating seal-fisheries conflicts and to Graham Timmins who corrected the language.

References

Fjälling, A., 2005. The estimation of hidden seal-inflicted losses in the Baltic Sea set trap salmon fisheries. ICES J. Mar. Sci. 62, 1630–1635.

Fjälling, A., Wahlberg, M., Westerberg, H., 2006. Acoustic harassment devices reduce seal interaction in the Baltic salmon-trap net fishery. ICES J. Mar. Sci. 63, 1751–1758.

Hemmingsson, M., Lunneryd, S.-G., 2007. Pushup-fällor i Sverige - Introduktionen av ett nytt sälsäkert fiskeredskap (Push-up traps in Sweden—the introduction of a new seal-safe fishing gear). FINFO, 8 (in Swedish, with English summary).

Kauppinen, T., Siira, A., Suuronen, P., 2005. Temporal and regional patterns in seal-induced catch and gear damage in the coastal trap-net fishery in the northern Baltic Sea: effect of netting material on damage. Fish. Res. 73, 99–109.

Lunneryd, S.-G., Fjälling, A., Westerberg, H., 2003. A large-mesh salmon trap: a way of mitigating seal impact on a coastal fishery. ICES J. Mar. Sci. 60, 1194–1199.

Suuronen, P., Siira, A., Kauppinen, T., Riikonen, R., Lehtonen, E., Harjunpää, H., 2006. Reduction of seal-induced catch and gear damage by modification of trap-net design: design principles for a seal-safe trap-net. Fish. Res. 79, 129–138.

Westerberg, H., Fjälling, A., Martinsson, A., 2000. Sälskador i det svenska fisket (Seal damage in the Swedish fishery). Fiskeriverket Rapport No. 3. pp. 4–38.