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The efficiency of selection grids in perch pontoon traps

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ABSTRACT

In commercial fishing, minimizing the bycatch of undersized fish or non-target species is highly beneficial, to avoid unnecessary fish mortality and to save time for the fishers. Two pontoon traps developed for perch fishing were equipped with size selection grids, and the efficiency with which under-sized fish could escape was tested. Average size of perch, roach, and whitefish was larger in traps with selection grids compared to in control traps without grids. Selection efficiencies using these comparisons were 82–86% for perch, 33% for whitefish and 100% for roach. The selection grids were filmed with an underwater video camera over the daily cycle, to estimate timing, and total number of exits from the traps. Selection efficiencies, calculated by extrapolating number of escapes observed to the total time of trap submergence, were 94–100% for perch and 100% for roach. The discrepancy in the selection efficiency estimates for perch probably depends on an uncertainty in the extrapolation, because of the variation in escape rate across time periods. Perch and roach differed in time of day for escapes. For perch most escapees was seen in the evening, and for roach most fish escaped at night, probably reflecting the general activity cycles of the two species. Over a fishing season, several thousands of fish would be able to escape from each trap, and an increase in the use of size selection grids could potentially be an efficient tool for fish population management.

1. Introduction

The stocks of many commercial fish species in our seas are decreasing at an increasing rate due to changes in the environment and to overfishing (Pauly et al., 2002; Worm et al., 2006; Costello et al., 2012). It is very important to develop methods of managing the fish resources in order to keep populations at sustainable levels (Alverson et al., 1994; Hall et al., 2000; Pitcher and Cheung, 2013). A big problem with commercial fishing is the bycatch of undersized fish or non-target species that, even if sorted out, experience a huge mortality rate when returned to the water (Alverson et al., 1994; Hall et al., 2000; Davis, 2002).

The Eurasian perch (*Perca fluviatilis* L.) is a common freshwater species, also occurring in the brackish waters of the Baltic Sea and the Gulf of Bothnia. The species is a popular target for both commercial and recreational fishing. There is no reliable information on the status of the perch populations along the coasts of Sweden (Swedish Board of Fisheries, 2011). Trends of both increases and decreases of perch abundance can be seen at the local level (Ljunggren et al., 2010). However, at the international level, commercial catches has decreased to half the size compared to those in mid 1990s, and questionnaire studies indicate that there is also a decrease in catch per unit effort (Olsson et al., 2012). This decrease may be explained by a combination of factors such as changes in the ecosystem (Casini et al., 2008; Ljunggren et al., 2010), increased populations of cormorants (Östman et al., 2012, 2013) and an increase in recreational fishing (Olsson et al., 2012). The annual landing of perch in the Swedish commercial fisheries is currently approximately 85 t (Swedish Agency for Marine and Water Management (SwAM), 2013), but catches from recreational fishing is many times higher (Persson, 2010).

Suuronen et al. (2012) included traps in a compilation of LIFE fishing gear (low impact and fuel efficient) as a fishing gear that possess several attractive characteristics compared to many other fishing gears: low energy use, minimal habitat impact and high

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quality of the fish. In line with this, a new pontoon trap was recently developed for the commercial small-scale perch fishery, with the aim to be catch-effective while at the same time protect the caught fish from seal predation (Harmångers Maskin & Marin AB in collaboration with Programme Seals & Fisheries). The function and properties of the pontoon trap for perch is similar to the pontoon traps developed for the salmonid fishery (Suuronen et al., 2006; Hemmingsson et al., 2008) and the herring fishery (Lundin et al., 2011a) but is approximately half the size of the aforementioned. One drawback is that traps sometimes get large bycatches of undersized fish and non-target species. With a mesh size of 20 mm, also small, unwanted perch remain in the trap and have to be sorted out and returned to the water, a procedure that is time consuming for the fishers and may lead to mortality of the discarded fish. Even small individual roach (*Rutilus rutilus*) and whitefish (*Coregonus maraena*) are caught in this trap. It is desirable to decrease the catch of small fish, in order to lower the ecological impact of fishing, by improving the possibility for escape and survival of these non-commercial sizes. This would be positive both from an ethical perspective and for a long-term prospect of the populations.

The use of selection panels have been tested and evaluated in other types of pontoon traps, with good results (Lundin et al., 2011a,b, 2015). In these tests non-commercial fish have been able to escape from the trap. There are also indications of a good survival rate after escape through a selection grid (Lundin et al., 2012). The captured fish have to find the escape route and manage to pass through the grid, by making active choices. It is therefore important to place the selection grid where most of the fish are located and where they can easily detect and escape through the grid. Here we describe a development of a pontoon trap for perch, aimed at allowing small fish to escape and survive after a trapping event.

The use of selection grids in smaller perch traps has so far not been evaluated. The aim of this study was to test and estimate the escape efficiency of a selection grid in perch traps by comparing size distribution in traps with and without grids and by looking at fish behaviour in the traps by continuous video recordings.

2. Material and methods

2.1. The traps

In this study two different types of traps were used (A and B) (Fig. 1). Trap A was manufactured by Ab Scandi Net Oy and consisted of a leading net and adapter combined with wings. Trap B was manufactured by Harmångers Maskin & Marin AB and consisted of a leading net, wings and adapter. Both traps were made of Polyethylene netting with 40 mm mesh size. The wings and adapter in trap B were separated by an additional entrance. Both traps were equipped with pontoon fish chambers of Dyneema® netting with 20 mm mesh size. The fish chambers were produced by Harmångers Maskin & Marin AB. The location for trap A was near Sundsvall, Sweden (62°23′N, 17°32′E), trap B was placed near Forsmark, Sweden (60°28′N, 18°04′E) and was used in collaboration with a commercial fisher. Both traps were placed at a final depth of 6 m.

2.2. Selection grids

The selection grids used were made of vertical 2 mm stainless steel bars covering an area of 300 × 400 mm, with 30 mm wide gaps between the steel bars. The grid was attached with cable ties in the far end of the fish chamber near the final entrance where the selection efficiency has been high in other types of traps targeting other species (Lundin et al., 2011b, 2013, in prep) (Fig. 2).

2.3. Data collection and analyses

Trap A was used between 12 June and 21 August, and trap B between 27 June and 27 July. The number of fishing periods (from submersion until harvesting of the trap) were 18 for trap A and 9 for trap B. To be able to measure the effect of the selection grids on size distribution of caught fish, the grids were covered with fine-meshed netting during certain fishing periods. For trap A, the grid was covered during the first four fishing periods and at two additional periods in the end of the season. For trap B, the grid was covered during the first three fishing periods. The aim was to measure at least 100 perch from each trap caught without the grids, to get reliable background data. All fish caught in the traps were measured (total length to the nearest lower 0.5 cm length class), and the length distributions with and without grid, were compared for each trap separately, using independent sample *t*-tests. The difference in the proportions of small fish caught with and without selection grid was tested using χ^2 tests comparing number of small and large fish, respectively, caught in each of the traps with the grid present and absent. The definitions of small fish were <24.5 cm for perch, <25.5 cm for whitefish and <30 cm for roach (see below).

The grids were video-recorded from a distance of 50 cm with an underwater camera connected to a recorder in a water-proof case

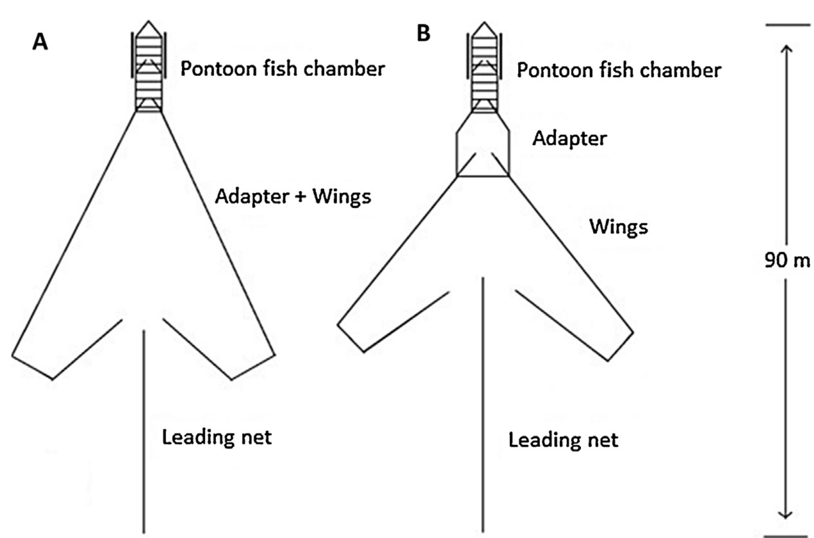

Fig. 1. Perch traps used in the experiment.