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87b (2-2009)

REPORT FRISK
Test fishing with escape panel in the Gulf of Bothnia 2007

Ministry of Agriculture and Forestry 87b (2-2009)

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Tiivistelmä

Projektin "Pakoikkunan käyttö pyydyksissä pienimuotoisessa rannikkokalastuksessa" tavoitteena oli teknisin arviointien sekä dokumentoitujen kenttäkokeiden avulla kehittää innovatiivinen seulova pakoikkuna (jäljempänä paneeli) rannikkokalastuksen käyttöön.

Alle 33 cm ja 300 g siikojen karsimiseen valittiin pehmeä seulova paneeli vihreästä 3 mm paksuisesta polyeteenistä. Paneelin solmullisen hapaan solmuväli oli 59 mm ja se oli pauloitettu 4 x 93 cm köysikehykseen. Neljä köyteen pauloitettua sivua oli leikattu vinoksi.

Paneeli asennettiin pystyyn (kärki ylöspäin) ja havas oli pituussuunnassa puoliksi auki, jolloin se oli 93 cm pitkä (leveä) ja 160 cm syvä. Paneeli asennettiin kalapesän uloimpaan sekä ylempään nurkkaan. Koska myös pyydysten kalapesä oli tehty solmuväliltään 35 mm pystyyn pauloitetusta hapaasta, pesään leikattiin yhtä suuri reikä paneelille. Paneeli ommeltiin tiukasti kiinni kalapesään. Poisleikattu pala käytettiin paneelin peittämiseen silloin kun kalastettiin suljetulla paneelilla.

Neljä kalastajaa hoiti kenttäkokeet sekä datankeruun selektiivisen paneelimetodologian avulla. Kenttäkalastus kesti koko kalastuskauden ja sisälsi koko saalin. Kalastuskauden aikana kalastajat kalastivat yhdessä paikassa yhdellä rysällä, jonka paneeli oli joko kiinni tai auki. Paneelin toimivuuden määrittämiseksi erisuuruisten kalojen seulana, kalastettiin joka toisella kerralla suljetulla paneelilla ja joka toisella kerralla avoimella paneelilla.

Koekalastuskertoja oli 239, joista 120 tehtiin avoimella paneelilla. Yhteensä pyydystettiin 3168 kg siikaa, 221 kg meritaimenta, 87 kg lohta, 64 kg lahnaa sekä alle 15 kg muita kalalajikkeita. Siiasta 2849 kg oli korkealaatuista, kun taas 140 kg hylättiin pyydyksen hapaisiin (35 mm) tarttuneiden ja lokkien aiheuttamien vahinkojen,15 kg hyljevahinkojen, 9 kg liian korkean parasiittipitoisuuden ja 75 kg siikojen pienuuden takia.

Kokonaissaalis vastasi 9954 myyntikelpoista siikaa. Näistä 5275 oli pyydystetty suljetulla paneelilla ja 4679 avoimella paneelilla. Vaikka avoimella paneelilla kalastaessa saalismäärä jäi pienemmäksi, keskisaalis kiloina ei ollut tuntuvasti (< 5 %) pienempi kuin suljetulla paneelilla. Tämä johtui siitä, että pyydystettyjen siikojen keskipaino suljetulla paneelilla (460 g) oli pienempi kuin avoimella paneelilla pyydystettyjen siikojen (470 g).

Kenttäkoejakso osoitti että kohdekalojen hävikki oli pieni. Visuaalisen tarkastelun perusteella todettiin että avoin paneeli seuloi vähintään kolmasosan niistä kaloista, jotka olivat 34 cm lyhyempiä. Seulontakäyrän mukaan seulonta 32 cm pituisille siioille oli 50 %. Paneeli ei vaikuttanut pyydyksen kapasiteettiin pyydystää yli 37 cm mittaisia kaloja. Seulontakäyrä kuvaa 72 % pituuserosta suljetun paneelin sekä avoimen paneelin kanssa pyydystettyjen kalojen välillä. Paneeli ei vaikuttanut saaliin käsittelyaikaan eikä muiden lajien pyyntiin.

Paneelin käytettävyys oli suuri ja se karsi pyydyksistä ulos huomattavan määrän pieniä siikoja sekä luultavasti myös taimenia. Toteutuneen 239 kalastuksen yhteydessä ei raportoitu yhtään paneelivahinkoa, ei yhtään paneeliin tarttunutta kalaa eikä yhtään häiriötä paneelin käytössä. Kalastajien mielestä pehmeä paneeli oli helppo ja erittäin halpa asentaa pyydykseen. Lisäksi vaihto oli helppoa avoimen ja suljetun paneeliasennon välillä.

Sammandrag

Målet med projektet "Gallringspaneler i fångstnät i småskaliga kustfiskeområden" var att genom tekniska granskningar och dokumenterade fältförsök utveckla en innovativ sållande gallringspanel för användning inom kustfiskeområden.

För att gallra ut sikar mindre än 33 cm och 300 g valdes en mjuk sållande panel i grönt polyeten med en tjocklek av 3 mm. Panelens maskstorlek var 59 mm. Som utsträckt mätte panelen 93 x 93 cm. Med nätet horisontellt halvöppet och panelen monterad som en romb på höjden mätte panelen 93 cm på bredden och 160 cm på höjden.

Panelen monterades i det yttersta övre hörnet av fiskhuset. Eftersom även fiskhuset var gjort av 35 mm stående maskor klipptes ett lika stort hål för att ge rum åt panelen. Panelen syddes fast tätt i garnet. Den utklippta biten av fiskhuset användes för att täcka över panelen vid fiske med panelen i stängd position.

Fältförsök och datainsamling genomfördes av fyra försöksfiskare som använde sig av en selektiv panelmetodologi. Försöksfiske utfördes under hela fiskesäsongen och inbegrep hela fångsten. Under fiskesäsongen fiskade fiskarna på ett ställe med ett fångstredskap, som antingen hade panelen öppen eller stängd. För att fastställa huruvida panelen fungerade som gallrare av olika storleks fiskar fiskade man varannan fiskegång med panelen öppen, varannan gång med den stängd.

Provfångsten bestod av 239 provfisken varav 120 gjordes med öppen panel. Totalt fångades 3168 kg sik, 221 kg havsöring, 87 kg lax, 64 kg braxen och mindre än 15 kg övriga fiskarter. Av siken höll 2849 kg hög kvalitet, medan 140 kg kasserades på grund av skador orsakade av måsar, 15 kg på grund av sälskador, 9 kg med anledning av stor parasithalt i fisken och 75 kg eftersom de var för små.

Den totala fångsten motsvarade 9954 försäljningsdugliga sikar. Av dessa hade 5275 fångats med stängd panel och 4679 med öppen panel. Även om färre fiskar fångades med öppen panel var inte medelfångsten i kg nämnvärt mindre (< 5%) med öppen panel än med stängd panel. Detta berodde på att sikar fångade med stängd panel i medeltal var mindre (460 g) än sikar fångade med öppen panel (470 g).

Fältförsöksperioden utvisade att det skedde ett litet spill av önskad fisk. På basen av en visuell granskning kunde vi konstatera att den öppna panelen gallrade bort åtminstone en tredjedel av de fiskar som var kortare än 34cm. Gallringskurvan visade att gallringen var 50 % för sikar med en totallängd på 32cm. Panelen påverkade inte fångstredskapets kapacitet att fånga fiskar längre än 37 cm. Gallringskurvan beskriver 72 % av skillnaderna i längddistribution mellan de fiskar som fångades med stängd panel och de som fångades med öppen panel. Panelen påverkade inte hanteringstiden av fångsten eller fångsten av andra fiskarter.

Panelens brukbarhet var hög. Under 239 fisketurer rapporterades inga skador på panelen, inga fiskar som fastnat i panelen och inga missöden med själva användningen av panelen. Fiskarna fann den mjuka panelen lätt att montera på fångstredskapet och ansåg att det var lätt att växla mellan den öppna och stängda positionen.

Abstract

The aim of the project "Escape panels in trap nets in small scaled coastal fisheries" was to trough technical evaluations and documented field tests develop an innovative escape / selective panel for the coastal fisheries.

We chose a soft selection panel in green 3 mm PE for field tests to select out whitefish smaller than 33 cm and 300 g. The length between knots in the panel was 59 mm. Stretched the panel was 93 x 93 cm and mounted as a standing rhomb, so that mesh was horizontally half open, the size of the panel was 93 cm wide horizontally and vertically 160 cm high.

The panel was mounted in the outermost upper corner of the fish house. As also the fish house was built with standing 35 mm meshes a similar sized hole was cut in the fish house net to give place for the panel. The panel was sawn tight to the mesh in the fish house. The piece cut out was used to cover the panel when fishing in with the panel in closed position.

Field data collection was conducted using selective panel methodology by 4 test fishermen. Test fishing lasted for the whole fishing season and included all caught fish. During the fishing season fishermen fished in one location with one fishing gear with the panel open and closed, every second fishing turn in order to testify if selection of fish by size occurs in catch.

The test fishing included 239 sets of fishing of witch 120 with open panel. In total we caught 3168 kg whitefish, 221 kg sea trout, 87 kg salmon, 64 kg bream and less than 15 kg of other species. Of the whitefish 2849 kg held high quality, whereas 140 kg was discharged due to the seagull damages, 15 kg due to the seal damages and 9 kg due to high prevalence of parasites in the fish, 75 kg due to small size.

Total catch equalled to 9954 sellable whitefish; 5275 with panel closed and 4679 with panel open. Even if we caught less fish with the panel open, the average catch (kg) was not considerable smaller (<5 %) with the panel open as, on average, whitefish were smaller (460 g) with the panel closed than the panel open (470 g).

The field testing period demonstrated that there was a low loss of targeted fish. Based on a visual inspection we were able to select out at the least one third of fish smaller than 34 cm in length with the panel open. According to the selection curve the selection was 50% for white fish 32 cm in total length. The panel did not affect the catch ability of fish larger than 37 cm in total length. The selection curve could be used to describe 72 % of the difference in the length distributions with the panel closed and open. The panel did not affect the handling time of the catch or the catch of any other species.

The applicability of the panel was high. During 239 sets of fishing no damages on the panel, stuck fish in the panel, or failure related to the panel was recorded. Fishermen found the soft panel easy to mount on the fishing gear, and easy to shift between open and closed position.

1 Introduction

The aim of the project "*Flyktpaneler för ryssjefiske i småskaligt kustfiske* – FRISK" escape panels in trap nets in small scaled coastal fisheries was to trough technical evaluations and documented field tests develop an innovative escape / selective panel for the coastal small scaled trap net fisheries. The project was an extension of the project "Utvecklande av flyktpaneler för ryssjefiske" (Dnr 1477/3516/2004 31.5.2004), financed by the Employment and Economic Development Centre, TE Centre for Ostrobothnia.

The salmon and whitefish trap net fishery is well developed in the Gulf of Bothnia, both on Finnish and the Swedish waters. As the seal and cormorant population have expanded fishermen have experienced an increasing degree of gear damages and catch losses. To ensure a vivant fishery the industry has in co-operation with authorities and other stakeholders developed new fishing gears. As this work has proceeded a latent conflict has though emerged.

Figure 1. Transistor radio plays music to keep seals off the gear – a pro active technical measure taken by the fishery.

The development of new trap/trap nets has lead to a use of smaller mesh sizes. At the same time Pan European technical measures aim at safeguard small and juvenile fish. These technical measures to ensure sustainable fisheries include:

- Size and species selective fishing gears, with minimum mesh size and escape panels, to avoid catching small and non-targeted species.
- Minimum size of landed fish as a complement to size selective fishing gears to aid fishery controls
- Closed seasons and areas, i.e. fishing stops for some type of gears during certain seasons and areas.

These measurements have also been discussed for the whitefish in the Gulf of Bothnia. The aim of the Natural Resource Council that works under the Finnish Ministry of Agriculture and Forestry, is to ensure a sustainable and plural use of the natural resources and at the same time enhance the management and protection of the resources

A cornerstone in the project was that FRISK is guided by the reality of fishery. Any technical measurement should therefore strive at improving the economic result and EHS-conditions (Environment Health and Safety) of the industry and at the same time ensure the fisheries need for a sustainable fisheries management. FRISK was conducted by Technology Centre Ketek, in collaboration with WPS Environmental Oy. The project was guided by the steering committee in which we sought advice from leading Nordic fishing gear manufacturers, researches and managers.

2 Outline of the project

2.1 Aim of the project

The aim of the project was to produce useful information to the independent fishermen so that they could choose to use any selection panel for whitefish with:

- Low loss of targeted fish
- No additional or lower fishing costs
- High applicability; a safe, simple and practical measure

To achieve this goal the project was divided into three steps

- State of art
- Workshop
- Field testing

This approach was chose to firstly see what has been done on selective panels, and then take this knowledge to a local level to see what we believe in and lastly test this hypothesis in a real fishery.

2.2 State of art

2.2.1 Swedish Board of Fisheries

Based on experiments made by the Swedish Board of Fisheries selectivity of the trap nets were considered potential. The Swedish Board of Fisheries had in 2004 tested two types of selectivity panels in push up type trap nets. For a more detailed description of the trap net see Hemmingsson, Fjälling and Lunneryd (2008). In their experi-

Figure 2. The panel is being mounted in the active fishery.

Figure 3. The selecting panel mounted in the rear of the pontoon trap net in the experiments by Swedish Board of Fishers 2004 (Swedish board of fisheries).

ments a selection panel was mounted in the rear of the fish-house. The panel consisted of a solid frame (400 mm Ø or 300 x 500 mm) where either steel wires (1,2 mm Ø) were wires or aluminium bars (20 mm Ø) were mounted with 30-45 mm column width. In the experiment fish that were able to pass trough the selection panel were compared to the size distribution of the catch. The functionality of the panel was furthermore documented by under water videos. In a second experiment a squared panel (300 x 500 mm) with steel wires was used. This panel was mounted on the side of the trap net.

This selectivity of the round wire panel was 7 % for whitefish < 310 mm in total length when the column width was 30 mm and 44 % for whitefish < 440 mm in total length when the column with was 40 mm. The value of the catch, however, only decreased by 10 %. The fish that passed the panel was clearly smaller and had a lower condition of the fish remaining in the trap net.

In the video recordings it was clearly demonstrated that the whitefish actively sought a way out of the trap. At one time there was a 4,5 h sequence of a single fish seeking its way out. Only a small fraction of this time was, however, spent by the panel. Furthermore the fish approached the panel several times but turned away as it touched or got in vicinity of the wires. Most of the time in the trap this fish spent at a depth of approximately 1 m, in the corners of the entrance to the fish house.

On the workshop it was concluded that

– whitefish seek a way out of trap nets

– positive selection of small whitefish is possible

– whitefish may pass the panel if fish width is smaller then the column width

– economic loss is smaller than fish selection

– fish behaviour determines passive selection

– field testing is costly, especially if documented with video

2.2.2 Other trap nets

The need to develop escape panels is not specific to the Baltic Sea. Stewart and Farrell (2003) studied the selectivity of trap nets in Australia. They placed an escape panel (50 x 70 mm square) in the bottom of fish house (37 mm, hexagon; Figure 4).

Based on the length distribution of the catch equipped with panels and traps without escape panels Stewart and Farrell (2003) found that a stiff panel prevented fish from being squeezed in the panel. The selection width was also small (SW = 2 * ln(3)/b), i.e. fish that can escape also are able to escape. Based upon their results Stewart and Farrell were convinced (2003) that the panel should be mounted in the rear of the trap, to enable passive selection during the lift up of the fishing gear.

Shepard and Jackson (2004) also found in their in vivo experiment on cat fish (*Ictalurus punctatus*) with slat traps that selection foremost was a mechanical result if slat width and fish size. In situ the results were though not as clear.

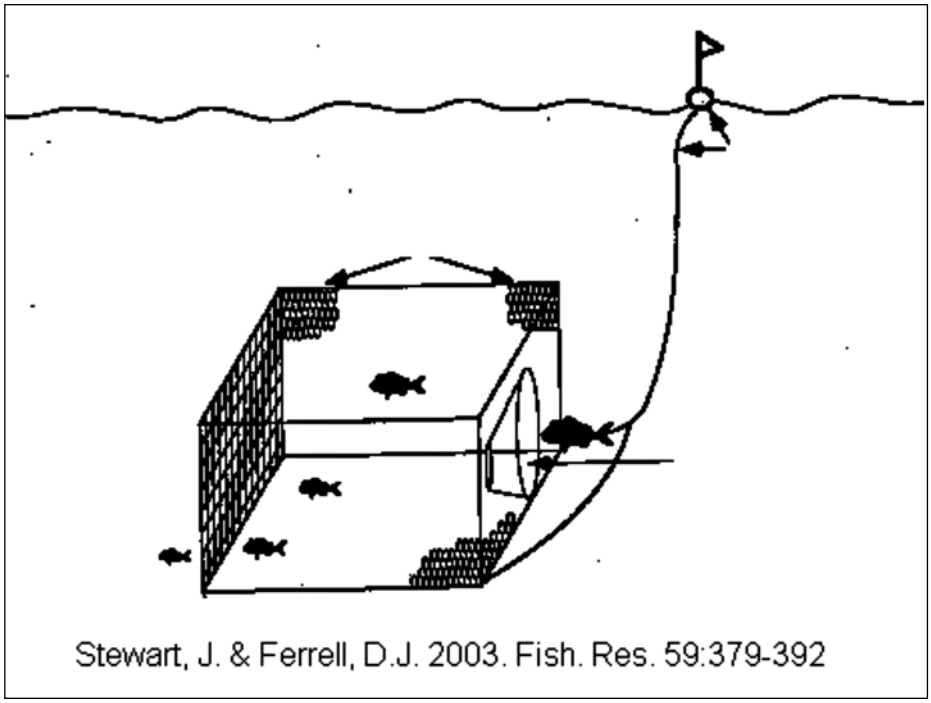

Figure 4. Schematic layout of Stewart and Ferrells study with escape panel in the rear of the trap.

More indications, to support that selection does not have to be a function of fish size and mesh width, are given by Gobert (1998). He found that with the same trap selection differed between 5 locations. Gobert reasoned that as SW and mean size of catch correlated small fish is squeezed out of the fish house when catch is big. The positive relation between size of catch and selection could however also be an effect of smaller fish avoiding entering the fishing gear when large fish are present.

2.3 Workshop

The workshop was held in Vaasa 15.–16.4.2004. During the workshop industry representatives (fishermen and manufactures), researches and mangers agreed on three types of panels that could win acceptance in the industry. These panels were:

1. stiff steel wires in a frame
2. a wired panel of soft material
3. a soft panel without any frame,

The materials found suitable for further development were Nylon, HD Polyethylene and steel wires. There was also a general agreement on the need for flexibility in the selectivity. Due to the market situation and plasticity of whitefish fishermen have different need at different locations and at different times. Whitefish holds a high degree of morphological differences where the various forms of whitefish are only partly spatially and temporally segregated. Traditionally fishermen have reacted to the high degree of plasticity by changing fishing gear and site with fishing season.

The high degree of plasticity also raised another concern. Whatever technical measurement tested we must make sure that the outcome was valid with different types of trap nets at different sites, i.e. we should make sure that results valid for one fishing also was valid for an other.

Table 1. Different panels considered

Type	Material	Shape of mesh	Size of mesh	Strength of panel	Constrains considers
Steel wires	Wires in frame	Strings	30–40 bar width	Pull strength equal to fish house	Cost Mass Safety
Wired net	Nylon	Hexagon Square	50, 55, 60 mm height / bar length	Pull strength equal to fish house	Cost Effect Strength
	HD Polyethylene	Hexagon Square	50, 55, 60 mm height / bar length	Pull strength equal to fish house	Cost Effect Strength
Loose net	Nylon (knotless)	Hexagon Square	50, 55, 60 mm height / bar length	Pull strength equal to fish house	Strength Effect
	HD Polyethylene	Hexagon Square	50, 55, 60 mm height / bar length	Pull strength equal to fish house	Strength Effect

3 Materials and Methods

3.1 Methods

3.1.1 The panel

We chose a soft selection panel in green 3 mm PE for the field test period. The bar length (not-to-not) was 59 mm. The panel was cut along the bars. Stretched the panel was 93 * 93 cm and mounted as a standing rhomb, so that mesh was horizontally half open, the size of the panel was 93 cm wide horizontally and vertically 160 cm high (Figure 5).

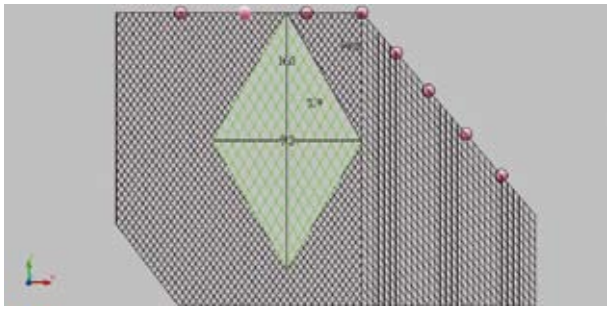

Figure 5. Drawing of the panel

The mesh size in the panel was chosen to select out whitefish smaller than 33 cm and 300 g.

Based on discussions with the fishermen the panel was mounted in the outermost upper corner of the fish house. The panel was attached to the upper rope of the fishing house. As also the fish house was built with standing meshes a similar sized hole was cut in the fish house net to give place for the panel. The panel was sawn tight to the mesh in the fish house. The piece cut out was later on, in the test fishing, used to cover the panel when fishing in with the panel in closed position.

Two things guided the place to mount the panel. Fishermen gave the information that whitefish; especially small whitefish tends to swim in the uppermost corner of the fish house. Furthermore, we wanted to distinguish passive selection from active selection. The outermost corner was thus chosen to be the corner that the fishermen lifted first when emptying the fish house. Thus all fish that were able to exit the fish house through the panel passed the panel of free will, not by force during the fishing procedure.

Figure 6. Mounted selective panel in open position.

3.1.2 Test fishing

Field data collection was conducted using selective panel methodology by 4 test fishermen. Test fishing lasted for the whole fishing season and included all caught fish. During the fishing season fishermen fished in one location with one fishing gear with the panel open and closed, every second fishing turn.

Selective panel position was changing during fishing from open to closed position in order to testify if selection of fish by size occurs in catch. The position of the panel was recorded closed when the panel was covered, tightly sawn, with the pieces cut out of the net of the original fishing house or any tighter material. When the panel was closed no fish could exit the fish house through the panel.

For each fishing turn we recorded, time, as date and time of setting and lifting of the gear, selection panel position, as panel open or closed during the fishing effort and interruptions to the fishery as damages to the fishing gear and similar damages to the selection panel explicitly.

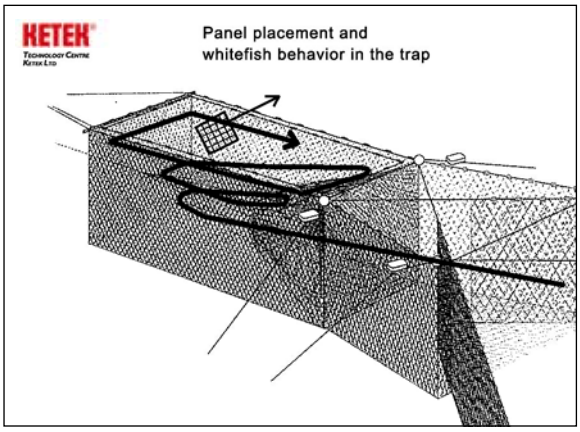

Figure 7. Schematic panel placement and behaviour of the fish in the trap.

Figure 8. The trap net used in the test fishing off Oulu.

3.1.3 Catch recording

For each set of fishing we recorded site, as co-ordinates, time and setting and lifting the gears as well as catch as mass and number of fish of caught per species. For white fish, trout and salmon we recorded mass of gutted fish (or equivalent mass if gutted) as the fishermen either got this number from their sells reports or said that they were much better in estimating mass as gutted compared to round fish for these species. For other species we recorded mass of ungutted catch. Mass was taken from the sells reports or if not sold estimated with a 100 g accuracy. The number of fish was counted.

We recorded sellable fish separately from discharged fish. The mass of the discharged fish was estimated as it had been sellable and separately according to the reason for discharge. There reasons could be e.g. stuck in the selective panel or the meshes of the gear, undersized catch, parasites, bird or seal eaten fish. Fish stuck in the panel was recorded independently of the fish was sellable or not.

We furthermore recorded catch treatment time, as time (h, min) to handle the catch from lifting the gear to sellable fish packed for retail delivery was recorded for each set of fishing. Treatment time included sorting, gutting, and icing but not transportations at sea or land.

Bycatches of bird or seals were recorded as number of specimens caught by species.

Of the whitefish we took length samples, rounded to the nearest cm. If the catch was smaller than 150 specimens, fishermen took the length distribution of all fish. If the number was larger than 150 specimens a random sample of approximately 120 fish were measured for length.

3.1.4 Material

Fisherman Roland Semskar was fishing with selective panel from 7.8.2006 till 15.8.2007 in the Quark area, location in geographic coordinates: North 63^0 45' 9", East 22^0 33' 2", direction 270°. Henrik Söderlund was fishing with selective panel from 30.9.2006 till 4.11.2006 in the Åland area, geographic coordinates: North 60^0 08' 50", East 19^0 59' 20", direction 120 °. Tapio Perätalo was fishing with selective panel from 5.10.2006 till 21.10.2007 in the Bothnian Bay area, geographic coordinates: North 64^0 59' 35", East 25^0 25' 19", direction 220 °.Benny Hol-

Figure 9. Small trot stuck in a mesh of the fishing house.

Figure 10. Gutted whitefish is being measured for total length.

mström was fishing with selective panel from 30.8.2007 till 23.10.2007 in Åland area.

The test fishing included 239 sets of fishing of witch 120 with open panel.

The catch represented the following species: white fish, salmon, trout, bream, perch, ide, roach and flounder. The total catch was 3168 kg whitefish, 221 kg sea trout, 87 kg salmon, 64 kg bream and less than 15 kg of other species. Of the whitefish 2849 kg held high quality, whereas

140 kg was discharged due to the seagull damages, 15 kg due to the seal damages, 9 kg due to high prevalence of parasites in the fish and 75 kg due to small size.

Six fishing sets were disturbed by seals tearing the fishing gear and 2 sets by wind induced waves or currents. These sets were not included in further analysis.

Henrik Söderlund caught 394 whitefish; 191 with panel closed and 203 with panel open, caught white fish length range is 26–50 cm. Roland Semskar caught 2429 whitefish; 1162 with the panel closed and 1267 with an open panel, caught whitefish length range is 27–50 cm. Tapio Perätalo caught 2321 whitefish; 1412 with panel closed and 909 with panel open in length range 30–50 cm. Benny Holmström caught 4284 whitefish, 2210 with panel closed and 2074 with open panel, in length range 28–50 cm.

3.1.5 Statistics

In a fixed fishing gear the selectivity is foremost dependent on the meshes in the gear. The probability of a fish to get caught in the fish house after entrance is a logistic asymptotic function based on the size of the fish (Millar and Fryer 1999).

Our experiment did not allow us to study the length distribution of the prevailing population. We only collected samples of the caught part population in a vivid fishery. This means that we were not able to study the selectivity of the fishing gear as such. By fishing with the panel closed vs. open we were on the other hand able to study the selectivity of the panel by comparing the length distributions of the fish caught with the panel open and closed (Figure 12).

$$r(l) = \left(\frac{\exp(a + b\ )}{1 + \exp(a + b\ )} \right)^{1/\delta}$$

Assuming that the catch with the panel closed and panel open were drawn from the same population we studied if the selected catch could be modelled with a selection curve taking the logistic function:

r(l) probability of fish to remain the catch as a function of length given that the fish has entered the fish house.

a, b, δ parameters to be estimated.

The parameters were estimated by means of standard statistical analysis tools (SSE) to establish the selection pattern.

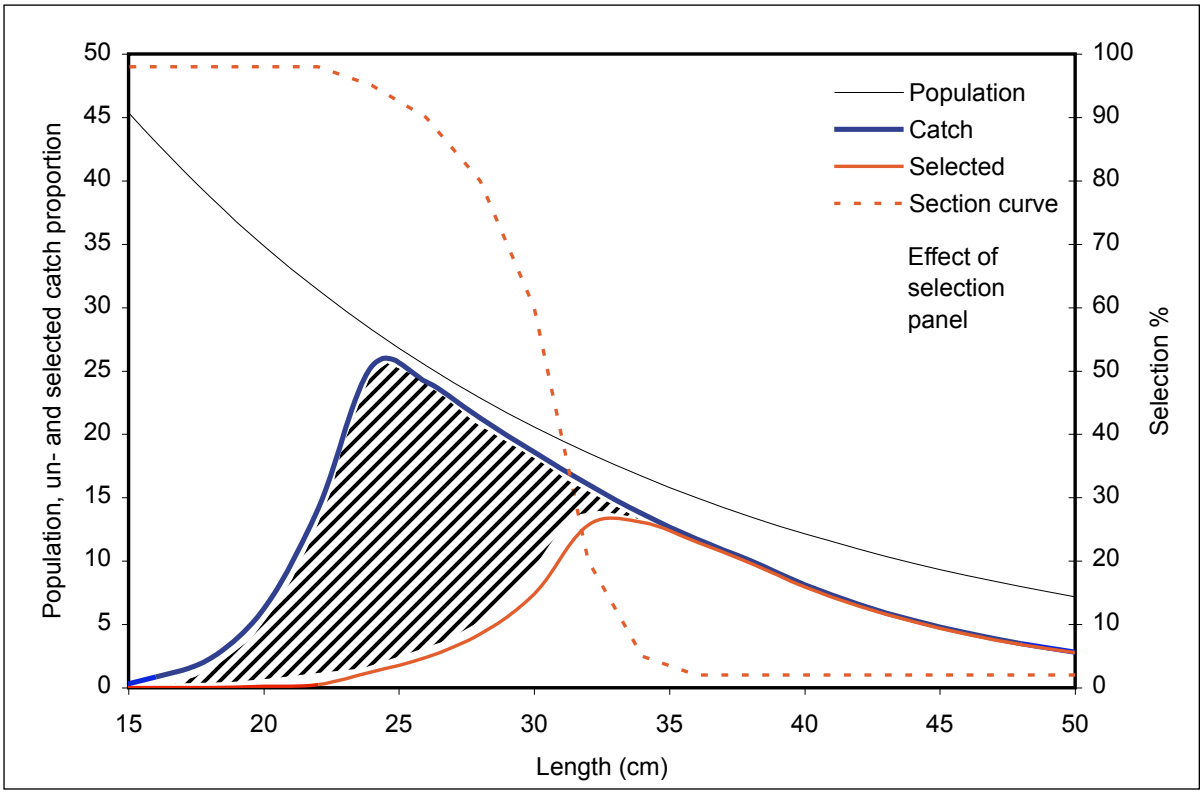

Figure 12. Schematic figure of length distribution of a fish population and the lenght distribution of the catch in a fishing gear without any selection panel (blue line) and the lenght distribution of the catch when using a selection panel.

4 Results

4.1 Whitefish selectivity

Fisherman crew's total catch equalled to 9954 sellable whitefish; 5275 with panel closed and 4679 with panel open. Even if we caught less fish with the panel open, the average catch (kg) was not considerable smaller (<5 %) with the panel open. This was due to the fact that whitefish caught with the panel closed were, on average, smaller (460 g) than the whitefish caught with the panel open (470 g).

Based on a visual inspection we were able to select out at the least one third of fish smaller than 34 cm in length with the panel open. According to the selection curve the selection was 50% for white fish around 32 cm in total length. The panel did not affect the catch ability of fish larger than 37 cm in total length.

The selection curve could be used to describe 72 % of the difference in the length distributions with the panel closed and open (Figure 14).

Thus results revealed that selective panel had the desired bottle neck effect on the catch, but the effect was not the same in all gears.

Figure 13. A targetedfish and a small whitefish that did not find its way out trough the panel.

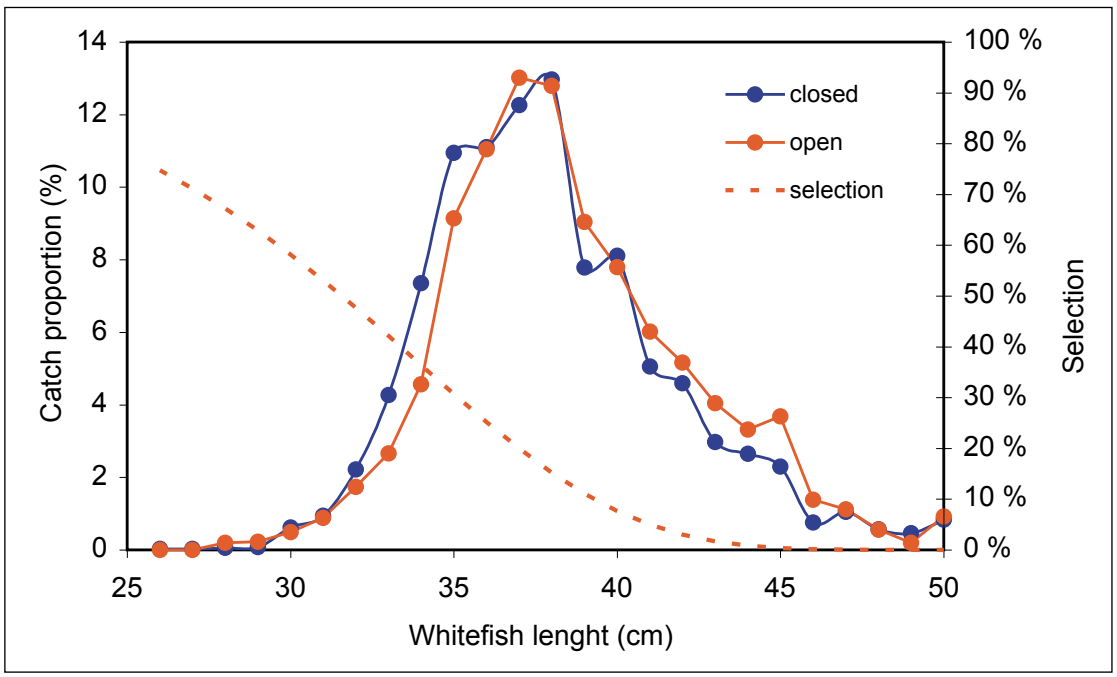

Figure 14. Whitefish selection curve of –10 000 caugh whitefish in trap nets with a selection panel in closed and open positions.

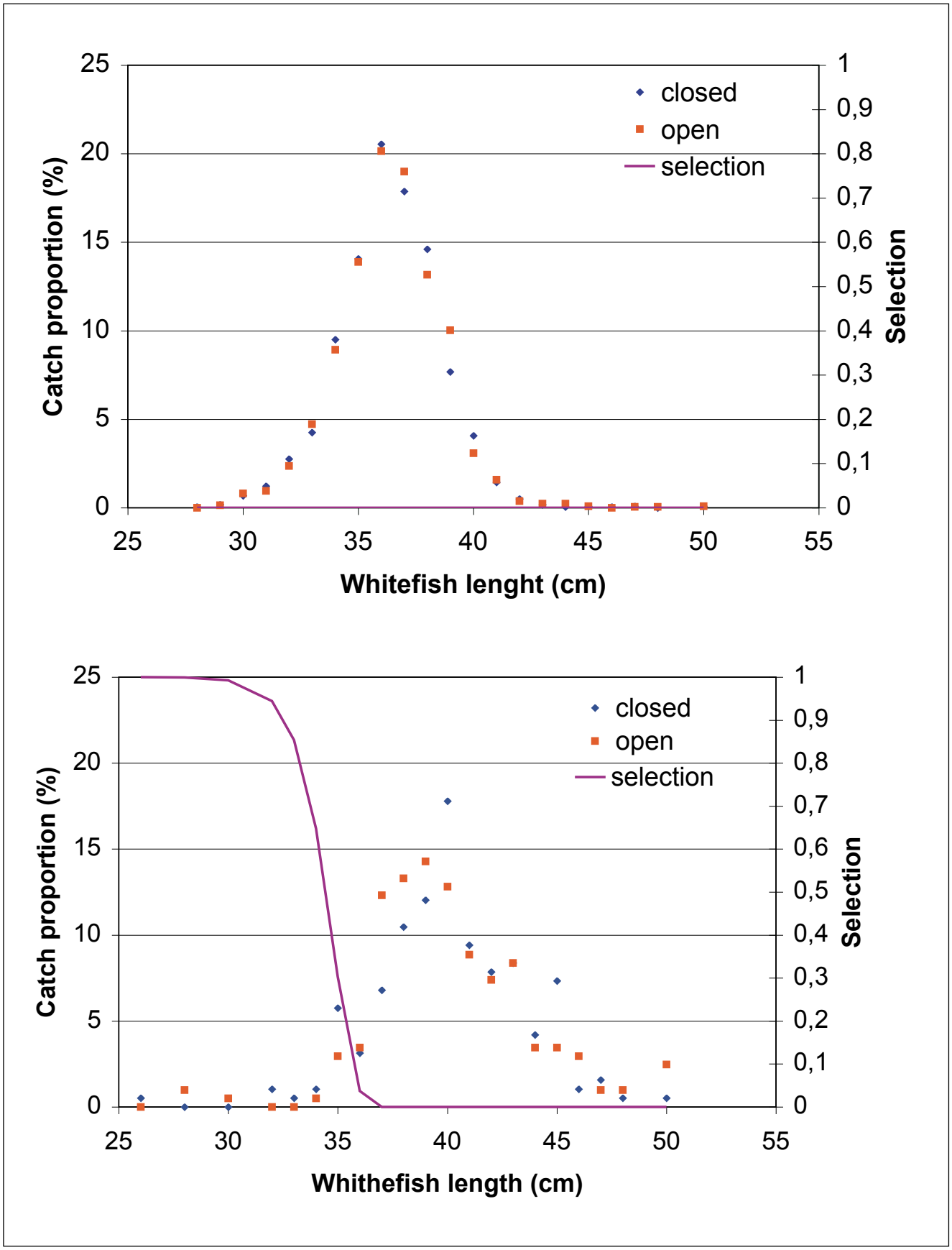

Figure 15. Whitefish selection curve of form two different push-up nets. Both gears were used at Åland Islands.

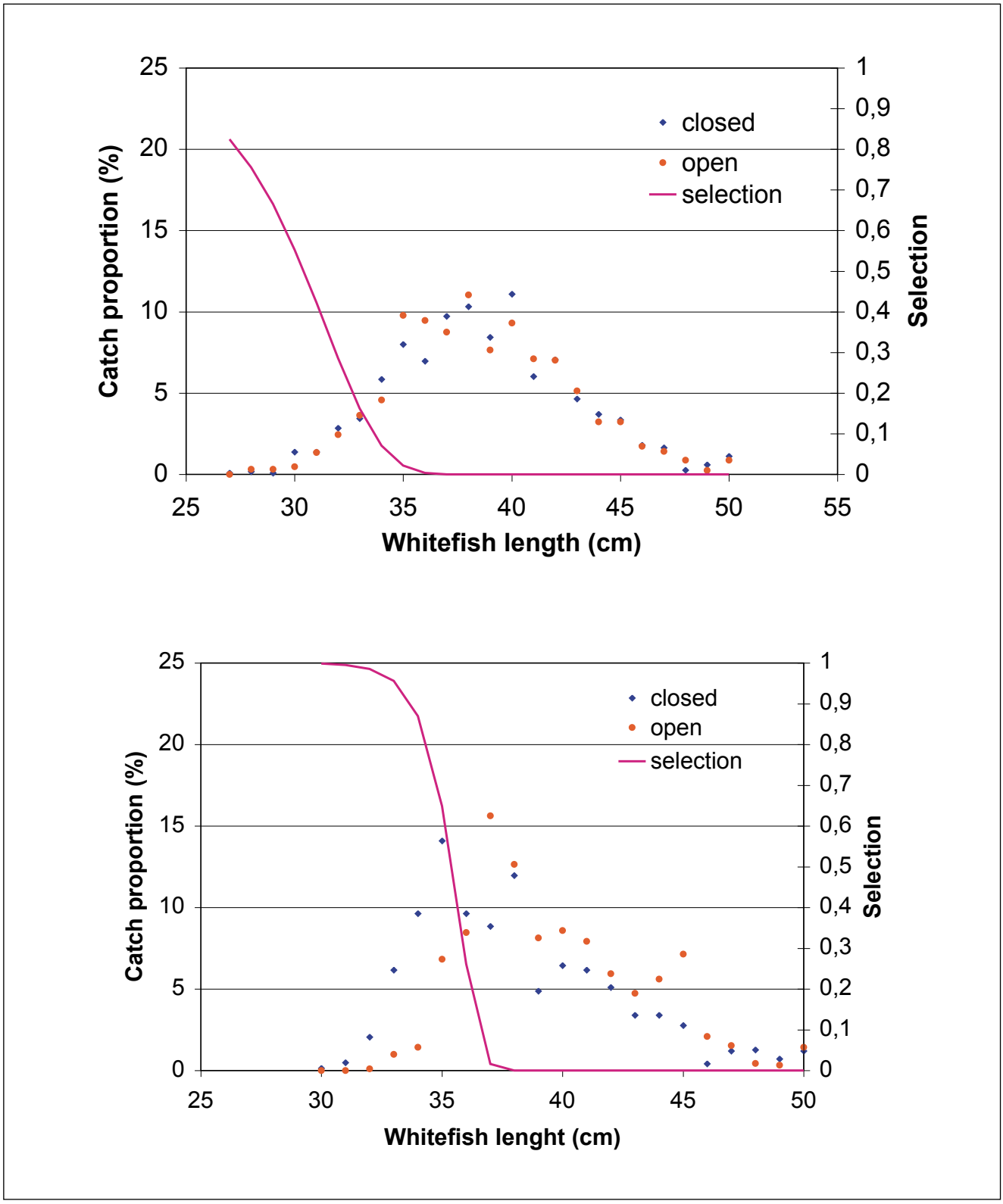

Figure 16. Whitefish selection curve of from two different trap nets in the Gulf of Bothnia.

At Åland we were fishing with two identical push-up trap-nets. In the push-up with higher catch the selectivity was insignificant, whereas the selectivity was the desired in the other gear (Figure 15). Likewise we recorded a much smaller selectivity in the Kvarken region than we did in the Bothnian Bay (Figure 16).

4.2 Other effects on whitefish

The panel did not affect the handling time of the catch. It was on average 12 min and varied between 30 min and 8 min depending on the catch.

Nor did the panel affect the discharge. With the panel open the fishermen estimated the discharge of whitefish due to bird damages to 89 kg with the panel closed and 72 kg with the panel open. The same was true for seal damaged whitefish and discharges due to parasites. With the panel close we recorded no seal damages whereas seals damaged the catch at two times with the panel open. The mass of whitefish discharged due to parasites was 4 kg in both cases.

Even if we id not succeed to improve the immediate economic return of the fishery we cause no new problems either. No fish were stuck in the panel. Nor did the panel cause any harm to the fishery or get damaged during the fishery.

4.3 Other effects

Besides whitefish, the only other fish of economical value in the fishery were sea trout and salmon. The panel did not affect these two species. With the panel open we recorded 80 sea trout and with the panel closed 74 sea trout. The mass of the fish were virtually the same 1, 7 kg and the discharges due to damages were neglect able 0, 7 kg and one fish during the whole fishery.

A larger problem for the Salomonides is that they get trapped at a too small size. The panel could however not resolve this. Fishing with the panel open the fishermen released 14,6 kg trout. With the panel closed 12,7 kg.

Figure 17. The catch of one set fishing.

Figure 18. Sea trout was not able to pass trough the panel.

5 Discussion

Did it work? Yes and No.

Small whitefish were able to pass the panel. All did not, but with a <1 m^2 panel with 59 mm bar length, standing mesh some 50 % of the whitefish smaller than 35 cm were able to find their way out of the trap trough the panel.

As a whole the results are encouraging. Studied in more detail the results are more puzzling. For some the panel worked for others it did not.

Millar and Fryer (1999) argued that selection is a function based on the size of the fish. When testing passive selection it is also a function of opportunity to find the way out. In their experiments Fiskeriverket showed that whitefish is moving actively in the fish house, but also that the fish attempted to exit the panel several times before they actually made their way trough (A. Fjälling per com).

Figure 19. The panel mounted in a trap net used at Åland Islands.

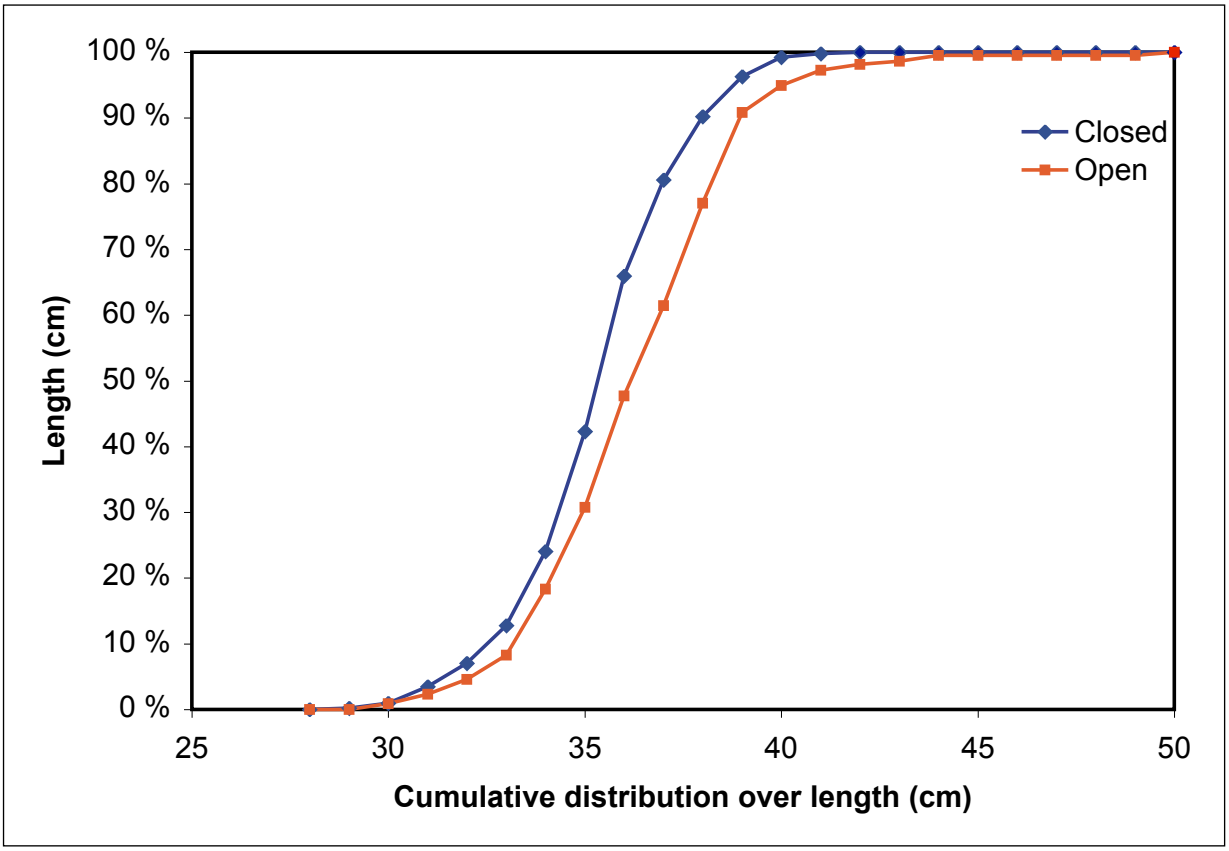

Figure 20. Cumulative length distribution of whitefish in a push-up trap net with the selective panel closed and open when the time between setting and lifting was two days.

Figure 21. Fishing boast used in the near shore fishery.

When comparing the two push-up trap nets the difference between high and low selection may well be, in our case, opportunity to encounter the panel, i.e. time spent in the gear. When only studying the sets when the time between setting and lifting was two days there was a clear shift in length distribution of the catch towards larger fish when the panel was open (Figure 20). A result further strengthened by that in the single set of three days between setting and lifting the gear with the panel open, no whitefish smaller than 34 cm was caught in the gear.

We may conclude that whitefish could find their way out of the fish house if they were given the time to do so. Time is, however, working against selection.

When there is much fish the fishermen empty their gears almost daily. This is also the time the fishery could be served by passively selecting out the small fish. If the panel is less effective when fish is in abundance there is little comfort in assuming that it works with longer fishing periods. Selecting out the small fish when there is less fish is not laborious. Nor is it feasible to assume that any fisherman would be served by a selective panel in times of small catches and low incomes.

The aim of the project was to produce useful information to the independent fishermen so that they could choose to use any selection panel for whitefish with:

- Low loss of targeted fish
- No additional or lower fishing costs
- High applicability; a safe, simple and practical measure

The field testing period demonstrated that there was a low loss of targeted fish. The fish larger that 37 cm were hardly affected by the panel. Even if we failed to show lower fishing costs the panel did not cause any additional costs.

The applicability was also high. During 239 sets of fishing no damages on the panel, stuck fish in the panel, or failure related to the panel was recorded. Fishermen found the soft panel easy to mount on the fishing gear, and easy to shift between open and closed position. And yes, the fishermen continued to use the panel after the test fishing period was over.

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Appendix: Caught whitefish length data as number of fish in each length class (cm)

	Fisherman /Panel								
	BH		HS		RS		TP		Total
Length(cm)	Closed	Open	Closed	Open	Closed	Open	Closed	Open	
26			1						1
27					1				1
28	1			2	2	4			9
29	4	3			1	4			12
30	15	17		1	16	6	2		57
31	27	20			16	17	10		90
32	61	49	2		33	31	41	1	218
33	94	98	1		40	46	114	9	402
34	210	185	2	1	68	58	159	14	697
35	311	288	11	6	93	124	243	82	1158
36	454	418	6	7	81	120	173	111	1370
37	395	394	13	25	113	111	164	174	1389
38	323	273	20	27	120	140	190	141	1234
39	170	208	23	29	98	97	87	101	813
40	90	64	34	26	129	118	116	107	684
41	32	33	18	18	70	90	98	87	446
42	11	8	15	15	82	89	76	66	362
43	4	5	16	17	54	65	58	51	270
44	1	5	8	7	43	41	53	57	215
45	2	2	14	7	39	41	48	73	226
46	1		2	6	21	22	9	20	81
47	2	1	3	2	19	18	21	15	81
48		1	1	2	3	11	21	6	45
49				2	7	3	10	3	25
50	2	2	1	3	13	11	19	17	68
Total	2210	2074	191	203	1162	1267	1712	1135	9954

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