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## GRID SORTING SYSTEM TO REDUCE BYCATCH OF FISH IN SHRIMP TRAWL

By

Bjørnar Isaksen  
Institute of Fishery Technology Research  
P.O.Box 1964, N-5024 Bergen, Norway

### ABSTRACT

This note gives a short summary of the results obtained on a fish/shrimp separation system during 1989. The work, which originally was directed towards redfish bycatch in shrimptrawl in the Barents Sea, soon included all kind of fish, both in coastal waters and on offshore shrimp grounds in the Barents Sea and Spitsbergen area. A successful cooperation between different institutions dealing with the fish/shrimp problems led to an introduction of the "Nordmøre" shrimp grid by law inside the twelve nautical mile zone off the Norwegian coast from 1 March 1990.

The following institutions have been involved in this work:

Institute of Fishery Technology Research, Bergen  
Norwegian College of Fishery Science, Tromsø  
Norwegian Institute of Technology, Trondheim  
Directorate of Fisheries, Bergen

## Background

Bycatch of fish in shrimp trawls has for years been an assessment problem in the Barents Sea. While Norway has regarded the bycatch of small and undersized cod and haddock as the most serious problem, the USSR for a long time has claimed that the big bycatch of redfish is very serious for this species. In addition, at the fishing grounds at Spitsbergen, big quantities of undersized Greenland halibut are caught during the shrimp fishery, and this is an unwise harvesting of an overexploited fish resource.

In the last 3-4 years, a separator panel (piece of netting) has been used in the coastal shrimp trawl fishery when the bycatch has exceeded three cod and/or haddock per ten kg of shrimp. This device has helped the fishermen to keep access to shrimp grounds that otherwise would have been closed for fishing. In the off-shore shrimp fishery in the Barents Sea, there has just been a procedure to close and open the shrimp grounds simply according to the number of fish in the catches. This has been achieved by a watch kept by inspectors onboard chartered vessels.

In 1988, the Soviet-Norwegian fishery commission approved that experiments should be performed to find a solution to the problem of redfish bycatch in shrimp trawls. From the Norwegian side, a grant was allocated for such a project in 1989, and a reference group, with participants from research institutions, fishery administration, and fishermen's organizations, was appointed to follow up this project. This report is a short summary of the experiments performed with the fish/shrimp separator grid, and the results achieved during several cruises in 1989.

## Accomplishment

A preliminary experiment in March 1989 was performed with a rectangular (0.65 x 1.35 m) grid, made from aluminium, with a frame of 20 mm aluminium and bars of 12 mm. The distance between the bars was 19 mm. This grid, mounted at an angle of about 45° just in front of the codend, gave very positive results regarding separation of fish, shrimp

loss, and handling. It was therefore decided that further work on redfish bycatch should be concentrated upon this sorting device.

During spring, summer, and autumn, several experiments were performed, both onboard small coastal shrimp trawlers, and onboard big stern trawlers fishing on the offshore shrimp grounds in the Barents Sea and at Spitsbergen (Table 1). Experiments performed onboard research vessels included underwater observation (UTV) of the behaviour of the alu-grid, shrimp, and fish, during trawling.

Table 1. Experiments performed with sorting grid in 1989.

Vessel	Size	Area
M/S "Svenn Arne"	16.3 m, 220 HP	Altafjorden
M/S "Jamo Junior"	18.3 m, 420 HP	Varangerfjorden
M/S "Heidi Vibeke"	15.8 m, 270 HP	Ullsfjorden
M/S "Remifisk"	32.4 m, 660 HP	Mehamnleira
R/V "Fjordfangst"	15.8 m, 160 HP	Balsfjorden
M/Tr "Andøytind"	46.5 m, 1800 HP	Barents Sea/Spitsbergen
M/Tr "Ståltor"	47.6 m, 3000 HP	Spitsbergen
R/V "Johan Ruud"	30.6 m, 1000 HP	Coastal areas/Barents Sea/ Spitsbergen

In addition to these official experiments, many shrimp trawlers have used this sorting grid during fishing on grounds that were closed due to high bycatch of cod/haddock. A very positive development in this connection was that many coastal shrimp trawlers used this grid on grounds open for normal fishing, and the motivation for this was less sorting of trash on deck and a much better quality of shrimp as a whole.

### Sorting principle

A sketch of the grid mounted in a trawl is shown in Figure 1. As can be seen, a funnel in front of the grid leads all kinds of organisms down to the lower part of the grid. The water current carries passive organisms right through the openings between the bars, and backwards to the codend. Shrimps have very limited ability to make direction oriented movements, and almost without exception they pass through the grid. Bigger organisms are led upwards along the grid and out through an opening just in front of the grid's upper end (fish release). Fish will normally react by swimming away from obstacles (like the

grid), so that even small fish that could physically pass between the bars of the grid have good possibility to escape.

During the experiments performed this year, effects of the following parameters have been investigated:

- Distance between bars: 16-21 mm
- Dimensions of grid: 0.65 x 1,35 m - 1.0 x 1,5 m
- Single or double grid
- Material: aluminium and stainless steel
- Fish/shrimp depressor: Flapper and funnel type
- The physical size of the fish release opening
- Distance between flapper/funnel and grid

## Results

Both the experiments performed and the practical experience achieved by fishermen have shown that the shrimp sorting grid is very suitable for avoiding most of the fish bycatch in shrimp trawls without unacceptable loss of shrimp.

Depending on the distance between the bars and the form of the fish body, all fish bigger than a given size will be released from the trawl. For a given bar distance of 19 mm, the size is about 23 cm for cod, 16 cm for redfish (Fig. 2 and 3), and 30 cm for greenland halibut (Fig. 4 and 5).

The separation of small fish varies with the construction of grid and leading channel (flapper/funnel). Although the effect on small redfish (< 10 cm) must at the moment be regarded as poor, there are, however, indications that the design could be improved to better the release of fish that physically can pass through the grid. The distance between the funnel exit and the grid is probably not yet at a design optimum.

If the grid is working properly, that is with a grid angle of 40-45°, and with no obstacles (stone, sponges) blocking up the grid, the loss of shrimp can be regarded as very low, even with catch rates of 1 ton shrimp per hour, which might have been expected to cause grid

blockage. To prevent loss of shrimp up to 12 cm (commercial length), it is necessary to use a bar distance of 19 mm.

The handling of the sorting/separating grid has given very few handling problems onboard the shrimp trawlers. It is, however, very important that the trawl be set out with no turn in the belly in front of the grid.

### Conclusion

The grid separation system is a simple, practical and effective device to avoid fish bycatch in shrimp trawls. An approximately 100% separation is achieved for cod and haddock older than 1 year, and for redfish older than two years. The separation of younger fish is less good, but the experience so far indicates that improved design could better the release of small fish. The shrimp loss is experienced to be far below an acceptable limit of 5%. While using this sorting grid, no big objects pass back in the codend, consequently the quality of the shrimp remains very good.

The results achieved by using the "Nordmøre" shrimp grid were so positive that the Directorate of Fisheries decided to introduce the use of the grid by law from 1 March 1990 within 12 nautical miles off the coast of northern Norway, and most probably for the whole Norwegian EEZ from 1991. In this way, shrimp trawling will change status from being a "juvenile killer" to be one of the most species selective gears that is used in Norwegian waters.

DEEP SEA SHRIMP TRAWL WITH THE "NORDMØRE-GRATE"  
 FISH-SHRIMP SEPARATION SYSTEM

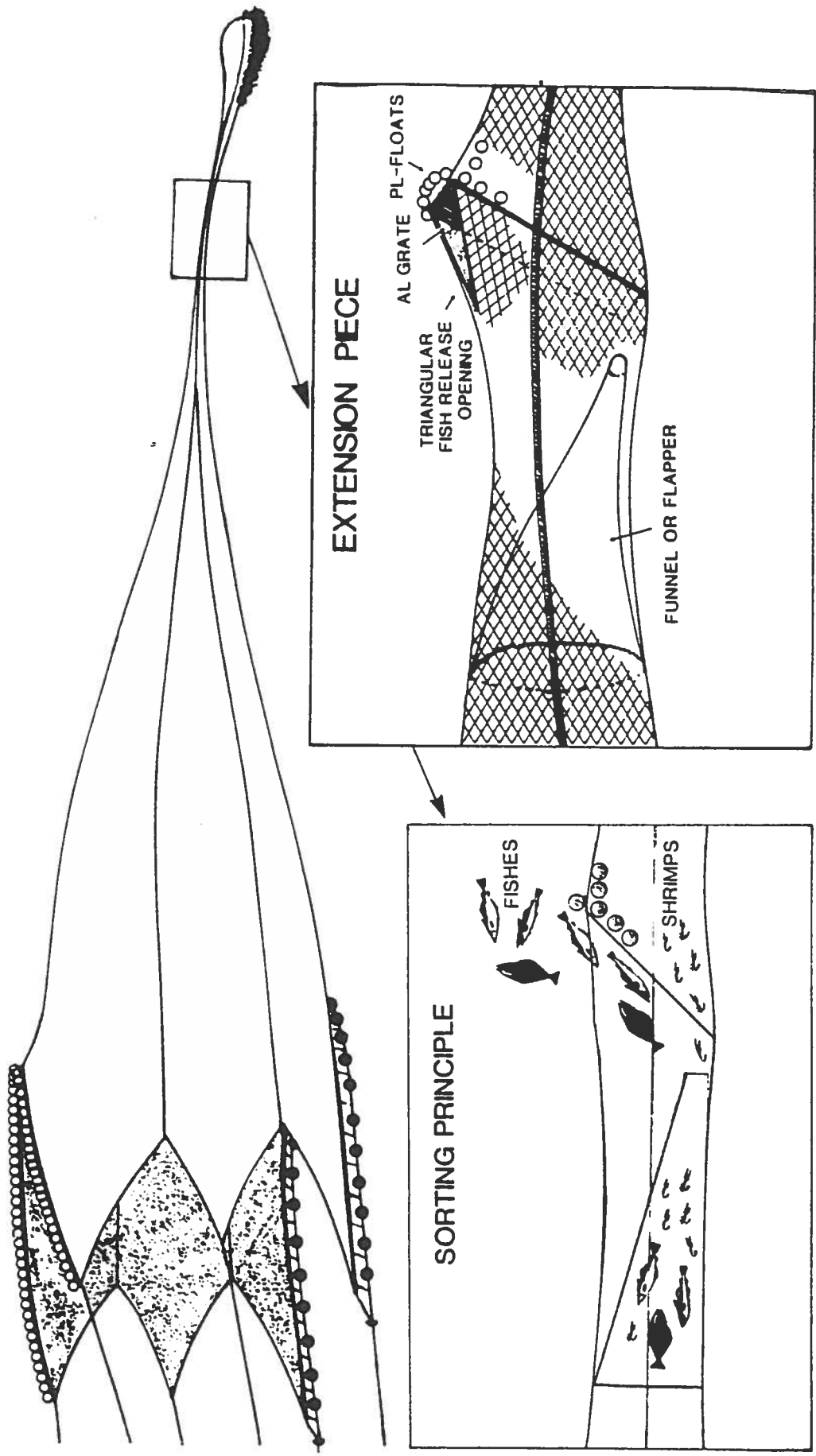


Figure 1. Sketch of a three-bridle high opening shrimp trawl with the "Nordmøre-grid" mounted in the aft belly.

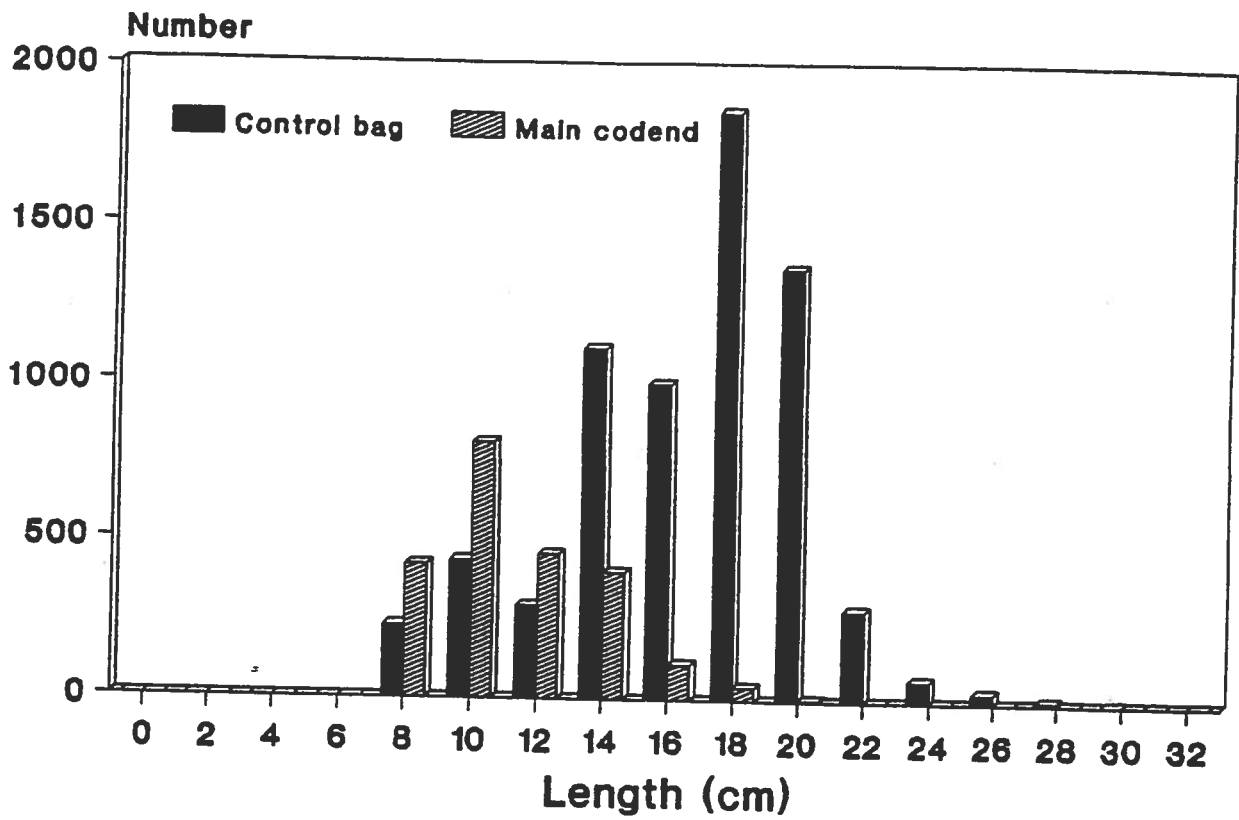


Figure 2. Length distribution of redfish in the main codend and the control bag.

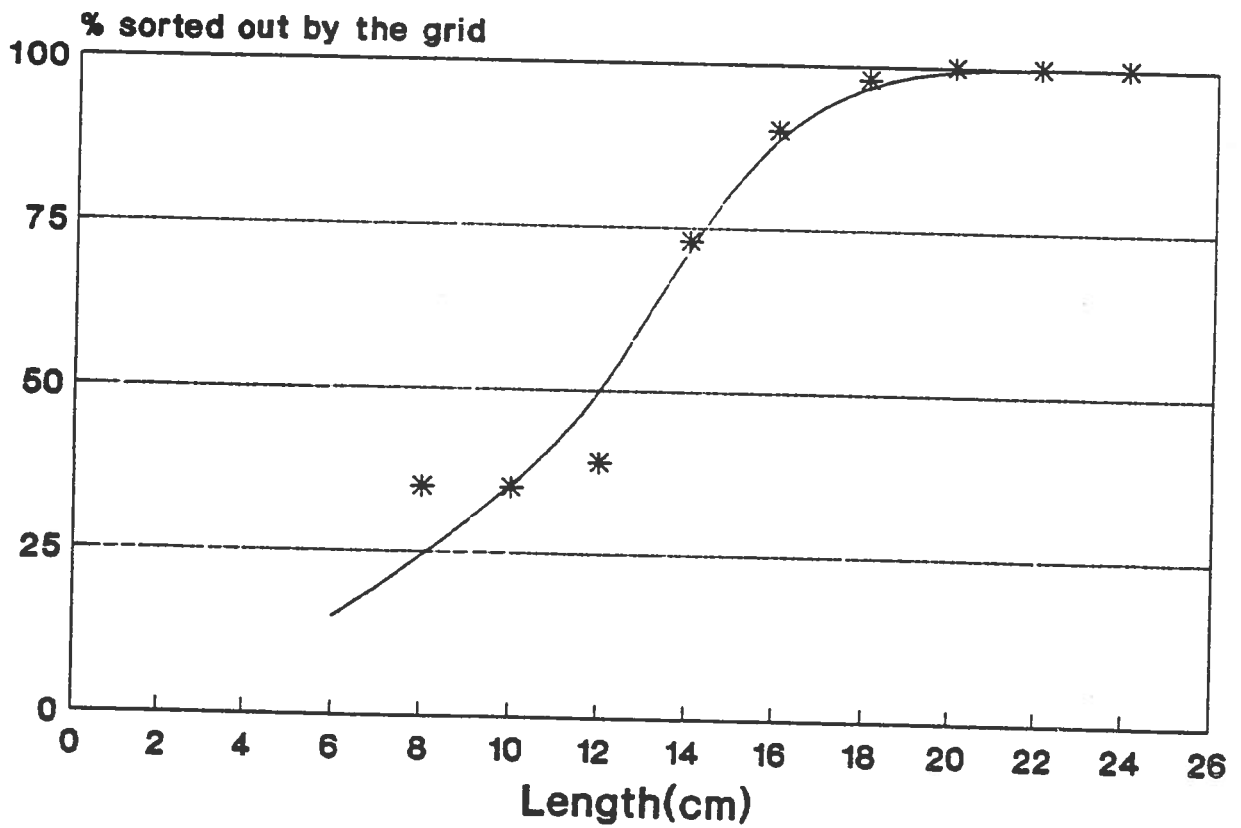


Figure 3. "Selection ogive" for redfish by using the fish/shrimp separator grid.

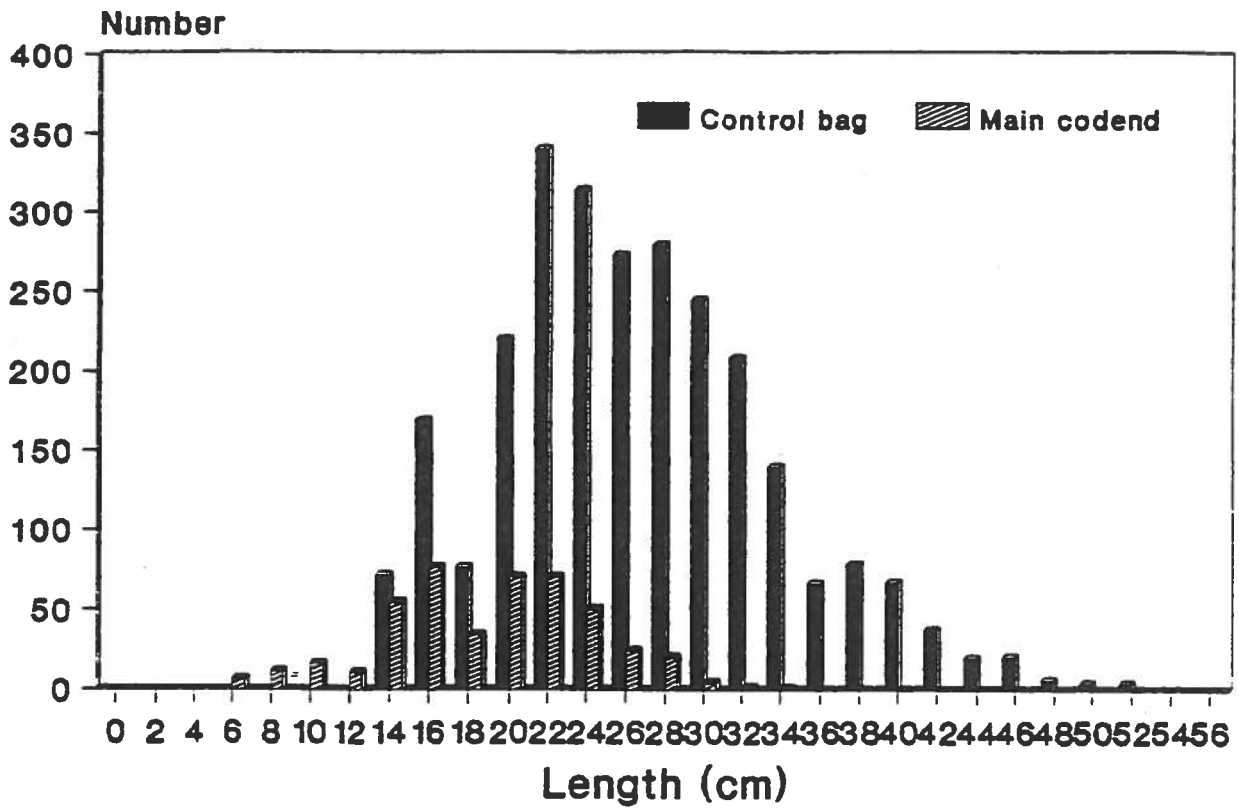


Figure 4. Length distribution of Greenland halibut in the main codend and the control bag.

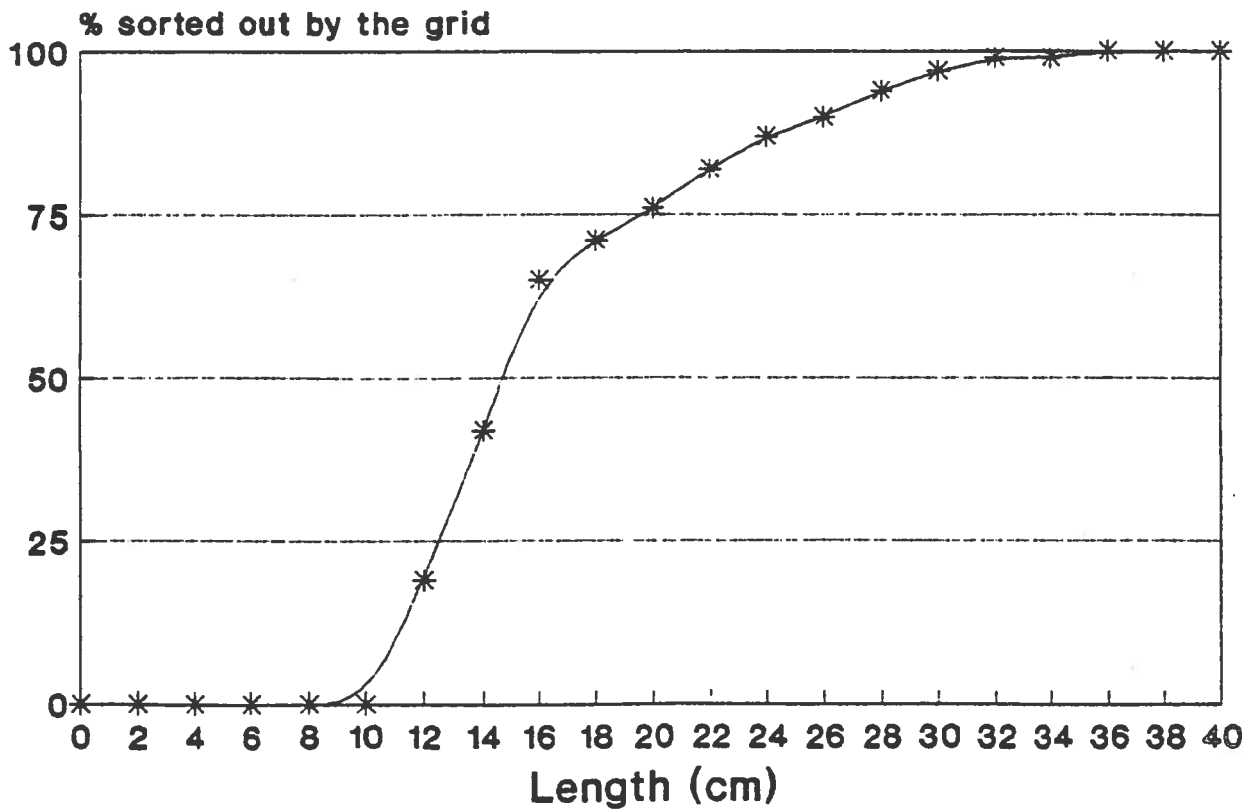


Figure 5. "Selection ogive" for Greenland halibut by using the fish/shrimp separator grid.