

# Stichting DLO Centre for Fishery Research (CVO)

P.O. Box  
1970 AB IJMUIDEN  
Phone: 0255 564600  
Fax: 0255 564765  
Visitor address: Haringkade 1, IJmuiden

## CVO report

Number: CVO 04.022

## Discard sampling of the Dutch pelagic freezer fishery in 2002

A.S. Couperus, W. Patberg, O.A. van Keeken & M.A. Pastoors

Commissioned by: Ministerie van Landbouw, Natuur en Voedselkwaliteit  
Drs. R.J.T. van Lint  
Postbus 20401  
2500 EK DEN HAAG

Project number: 3.22.12130.02

Approved by: Drs. F.A. van Beek  
Head WOT, Centre for Fishery Research

Signature: \_\_\_\_\_

Date: May 2004

Number of copies: 10  
Number of pages: 35  
Number of tables: 7  
Number of figures: 13

Stichting DLO  
Centre for Fishery Research

We are registered in trade  
register of the Chamber of  
Commerce Centraal Gelderland  
Nr. 09098  
VAT nr. NL 8089.32.184.B01

This report is drafted at the request of the commissioner indicated above and is his property. Nothing from this report may be reproduced and/or published by print, photoprint microfilm or any other means without the previous written consent from the commissioner of the study.

# Table of Contents

Table of Contents .....	2
Summary .....	3
Samenvatting .....	4
1. Introduction .....	5
1.1 Objectives .....	5
1.2 Description of the Dutch freezer trawler fleet .....	5
1.3 Description of types of discards .....	6
2. Methods .....	8
2.1 Observation periods and number of tows observed .....	8
2.2 Registration of catches .....	8
2.3 Data processing .....	9
3. Results .....	10
3.1 Description of the observer trips .....	10
3.2 Estimated discards from sampled trips .....	10
4. Discussion .....	12
5. References .....	14
6. Tables and Figures .....	15

---

## Summary

This report presents the results of the five observer trips, carried out in 2002 in order to assess the discards in the Dutch pelagic fishery. The observer program is an implementation of the data-requirements set by the EU regulations Nr. 1543/2000 and 1639/2001.

During the observer five trips a total 172 hauls (varying between 19-49 hauls per trip) were sampled during 139 fish days, which represents around 5% of the total effort of the pelagic fleet in the North East Atlantic. During each trip different fish species were targeted. During two trips horse mackerel was targeted, during the other trips herring, pilchards or blue whiting/greater argentine were targeted. The overall discard percentage of all trips combined was 18% of the total catch. The most frequently discarded species was mackerel of which around 50% of the catch was discarded.

The five trips that have been observed in 2002 show that there are large differences between trips and that discarding is highly dependent on processes which may be very case specific. Since the ultimate objective of the discards programme is to enhance fishery assessment models, it is discussed whether the present results would be sufficient for that goal. Discrepancy between the raised landings from the sampled trips and the landings from the VIRIS database varies from 30% for blue whiting and North Sea horse mackerel to almost 100% for pilchards. The target species and fishing areas differ considerably by year and by season. If discards are to be estimated by area and or season, the number of trips may be insufficient.

## Samenvatting

Dit rapport bevat de resultaten van vijf bemonsteringsreizen, die in 2002 zijn uitgevoerd aan boord van Nederlandse pelagische schepen om discards te bemonsteren. Het bemonsteringsprogramma is opgezet als invulling van EC regelingen 1543/2000 en 1639/2001 voor gegevensverzameling in Europese visserijen

Tijdens de vijf bemonsteringsreizen werden in totaal 172 trekken (tussen 19-49 per reis) bemonsterd gedurende 139 visdagen, wat overeen kwam met ongeveer 5% van de totale inspanning van de gehele pelagische vloot in het noordoost Atlantisch gebied. Tijdens elk van de reizen werd gevist op andere vissoorten. Tijdens twee reizen werd gevist op met name horsmakreel, tijdens de andere reizen op haring, pilchards, of blauwe wijting/grote zandspiering. Het discardpercentage over alle reizen was 18% van de totale vangst. Makreel werd het meest gediscard met een discardpercentage van ongeveer 50%

De vijf bemonsterde reizen in 2002 vertoonden grote variatie tussen de reizen. Het discardpercentage was in grote mate afhankelijk van specifieke processen aan boord. Omdat het uiteindelijke doel van discardsbemonstering het verbeteren van bestandschattingen is, werd besproken in hoeverre de gegevens van de bemonsterde discardreizen geschikt zijn voor dit doel. Verschillen tussen de geschatte hoeveelheid aanlandingen vanuit de bemonsterde discardreizen met aanlandingen geregistreerd in de VIRIS database lieten varieerden van 100% voor populaties die niet werden gedekt and 30% voor blauwe wijting en horsmakreel. De vissoorten waarop werd gevist en visgebieden varieerden aanzienlijk per jaar en per seizoen. Bij het berekenen van discards per gebied en seizoen kan het aantal reizen onvoldoende zijn om een betrouwbare schatting te krijgen.

# 1. Introduction

## 1.1 Objectives

The aim of the project is to assess discards in the Dutch pelagic trawl fisheries in the North-East Atlantic by means of an observer programme. The discards data are collected under the EC Data Collection Regulations 1543/2000 and 1639/2001 (EC 2000, 2001; ICES 2003). Long lasting contacts exist between the Dutch firms of ship owners and the Netherlands Institute for Fisheries Research, which has facilitated the collection of discards data. Earlier discards studies on Dutch pelagic fisheries have been reported by Corten (1991), Morizur et al. (1995) and Couperus (1997). The pelagic discards sampling in 2002 was carried out as a pilot survey (see annex of EC 1639/2001, chapter III, E1c) and may therefore not be representative of the whole fishery.

## 1.2 Description of the Dutch freezer trawler fleet

At the end of 2002, the Dutch fleet of freezer trawlers consisted of 16 vessels. The target species in the North East Atlantic are (in descending order of tonnage landed in 2002) herring (*Clupea harengus*), horse mackerel (*Trachurus trachurus*), mackerel (*Scomber scombrus*), blue whiting (*Micromesistius poutassou*), greater argentine (*Argentina silus*) and pilchard (*Sardina pilchardus*). The gear used is the pelagic trawl. The catch is frozen in blocks of 20 - 25 kg and wrapped in cardboard. In 2002, a substantial part of the Dutch pelagic fleet fished in Mauritanian waters (estimate 40% of the landings). In addition to the 16 Dutch vessels, there are 4 German, 3 English and 3 French trawlers owned by Dutch firms via partnership companies (situation January 2003). Most of these vessels have crews that are partly Dutch. All these vessels, except for one of German origin, are built in the Netherlands and are of the same type as the Dutch trawlers.

Since 1970 the size and the engine power of the Dutch pelagic trawlers has increased but the number of vessels has decreased. The largest trawlers at the end of the 1970s had engines of around 2000 Hp and a storing capacity of 400 ton. Trawlers with 3000 Hp engine power and 900 ton storing capacity were built from the 1980s onwards and the smaller ships rapidly disappeared from the fleet. In 2002 only two trawlers remained with engines of 3200 Hp. 11 trawlers are over 100 m length and the two newest trawlers, built in 1999 and 2000, are over 140 m length with a capacity of 5000 tons and engine power over 10.000 Hp. On average half the engine power is used for propulsion, the rest is used for freezing.

The Dutch freezer trawler fleet (the trawlers under Dutch flag only) catches about 300.000 tonnes of fish each year. The species composition of the catches (figure 1) has gradually changed over the years. In the early part of the 1990s, the landings were dominated by horse mackerel whereas in the latter part of the 1990s an increase in blue whiting is observed. Herring has been a relatively constant part of the Dutch pelagic landings since 1990. The most important fishing grounds are situated on the continental slope west of the British Isles, in the Channel, along the British east coast and in the northern North Sea. Usually several freezer trawlers are fishing together in close vicinity near concentrations of the target species. The fish shoals are so far apart that they have to be searched for, using sonar and echo sounder. By staying together the skippers enlarge the chance of finding the shoals. Most skippers are very cooperative in providing their colleagues with information about fishing positions and catches.

The fishing areas differ by season and to a lesser extent by year. The annual differences are due to changes in the behaviour of the fish or to changes in the market situation. Since the firms concentrate on different markets and have different quota shares, the fleet is usually spread over a number of different areas. Before a ship leaves the harbour it is difficult or

impossible to predict the fishing area. The choice of fishing area and target species is usually a last minute decision, and may change during the trip. The duration of each fishing trip depends mainly on the catch rates. Usually the vessel will return only if the freezing stores are full. Smaller vessels make trips of 2-4 weeks. Larger vessels stay at sea for three to five weeks. If catches are really poor, trips may also extend beyond five weeks.

The pelagic trawls have large dimensions. The height of the opening varies from 30 to 60 m, the horizontal spread of the wings from 80 to 120 m. Mesh size in the front part of the net may be up to 30 m. Towards the codend the meshes become gradually smaller and in the codend the stretched mesh size is 4 cm. The trawl is generally towed a few meters above the bottom, but often the ground rope touches the bottom. Trawling depths vary from about 600-800 m (greater argentine), 300-500 m (blue whiting), 100-400 m (mackerel and western horse mackerel) to 50 - 200 m (herring and North sea horse mackerel). The duration of one tow may vary from five minutes to more than ten hours. The duration depends on the recordings seen on the netsounder and the signals received from the sensors in the codend.

Hauling starts with winding up the fishing line till the doors have surfaced. The doors are picked out and the net is wound up till only the codend - with the catch - is in the water. The catch is nowadays usually pumped out of the codend. The catch is pumped through a tube with a diameter of about 35 cm into the gutter. A separator is connected to the tube approximately halfway. Here the water flows off through a grading. During pumping the codend remains in the water. In the smaller sized trawlers under foreign flag, the catch is often still brought aboard by tying off "boxes". When tying off boxes the uttermost end of the codend is hoisted aboard. Since one box measures about four tons, a catch of 50 ton is brought aboard by tying off ten to fifteen boxes. Each box is opened above a gutter on deck.

Since the rate at which the fish can be processed (sorted, frozen, wrapped and labelled) is limited, part of the catch is stored for a maximum of three days in cooling tanks at a temperature of 0°C. The fish falls through an opening (diameter 50 cm) at the bottom of the gutter into one of the tanks. Storing capacity per tank is 20-40 tons. A middle-sized trawler is able to store about 500 tons in the tanks. The part of the catch which is to be processed immediately is kept in a tank which is not cooled or in the gutter on deck, both called "the hold".

#### *The production-line*

The catch is led from the cooling tanks to a grading machine, which sorts the fish by body width. Crewmembers then sort the fish by size, species and quality at a conveyor belt. Part of the catch (consisting of unwanted species, damaged fish etc.) is removed from the conveyor belt and discarded: it drops in another gutter and is washed overboard with a flow of water.

The sorted fractions of the catch are transported by conveyor belts towards a number of "frosters", each consisting of 40 or 52 plate freezers. These freezers produce frozen blocks of about 20-25 kg fish in about 4 hours. In full production, a middle-sized trawler can produce approximately 10.000 of these blocks per day. The blocks are wrapped with cardboard and labelled in the midship and are then stored at a temperature of -20°C in the front part of the ship. The smallest trawler has a storing capacity of 70.000 packages, while the largest trawlers can store 250.000 packages.

### 1.3 Description of types of discards

The discards produced by freezer trawlers can be divided in different types (see paragraph 2.3 Registration of the catches). Anonymous (2003) lists a number reasons for discarding: fish of the wrong size or wrong species, damaged or spoiled fish, high grading, lack of space onboard, species quota reached, year-class variation, season. In the daily practice on freezer trawlers, the reasons for discarding are normally overlapping and very complex, as has been discussed by Couperus (1995) and Couperus (1997).

The traditional target species, herring, horse mackerel, mackerel and blue whiting are always marketable if it is of good quality (any size, undamaged and fresh). However, the quota of some species, notable mackerel, is too low to avoid discards, even if only caught as by-catch.

#### Fishing area and target species by month

Fishing areas and target species differ by month, by year and by company, depending for instance on the actual market situation, catch rates changes in migration and the weather. The following is the general monthly pattern of the last few years for trawlers fishing in the North East Atlantic (see also table 1).

January: Some trawlers are fishing north of Scotland and Shetland for mackerel or for horse mackerel in the Channel.

February: the mackerel trawlers are following the mackerel shoals along the shelf edge on their way to the spawning area southwest of Ireland. Towards the end of the month they will meet the other part of the fleet still fishing for horse mackerel in the western approaches of the Channel.

March: part of the fleet is fishing (south) west of Ireland along the edge of the continental shelf for mackerel and horse mackerel, in the Bay of Biscay for horse mackerel and in the Channel for horse mackerel and pilchard. By the end of the month, some trawlers will start fishing for blue whiting at the Porcupine Bank to save their horse mackerel and mackerel quota.

April: the fishery for horse mackerel and mackerel in the Bay of Biscay and southwest of Ireland continues, but the majority of the fleet fishes for blue whiting west of Scotland.

May: some trawlers are still fishing for horse mackerel and mackerel southwest of Ireland and in the Bay of Biscay. The trawlers west of Scotland start to catch greater argentine along with blue whiting. Blue whiting fishery also occurs north of Scotland. The Wiron pair trawlers may fish for herring in the central North Sea at the end of the month. A few trawlers are heading for Smudhavet to catch Norwegian spring spawning herring.

June: All vessels fish for herring in the central and northern North Sea and north of Scotland. Some vessels still target Norwegian spring spawners in Smudhavet.

July: All trawlers are targeting herring in the North Sea, along the shelf edge north of Shetland and north and west of Scotland.

August: the fishery for spawning herring at the east coast of Britain and in the central North Sea starts. If the catches are disappointing, the vessels will try to catch herring west of Scotland.

September: The whole fleet may be found south of Cornwall and in the northern Bay of Biscay, fishing for horse mackerel for the Japanese market (high fat content).

October: the fishery for wintering mackerel in the northern North Sea and (north) west of Shetland starts. Some trawlers may catch horse mackerel, often mixed with mackerel and herring west of Ireland. The fishery for horse mackerel under Cornwall and in the northern Bay of Biscay is going on.

November: the situation remains more or less the same as in October. At the end of the month, the fishery for spawning herring starts in the Channel. Some trawlers may fish for pilchards in the channel

December: in order to be home the last two weeks of the year, the trawlers only make short trips. The main target is spawning herring in the Channel. Some trawlers may catch horse mackerel and pilchards in (the western approaches of) the channel.

## 2. Methods

### 2.1 Observation periods and number of tows observed

This study covers the year 2002. Data have been collected during 5 trips with the observers spending 139 days on board. The coverage of the total effort of the fleet in the North East Atlantic was roughly 5%. Target species and fishing areas are presented in table 2. Figure 2 shows the trawl positions. A description of the sampled vessels is presented in table 3.

### 2.2 Registration of catches

For each tow, the observer was present on the bridge during shooting and hauling of the net. Position and time were noted at the beginning of each haul. The time was noted again when hauling started. Total weight of the catch of each haul was estimated by counting the number of boxes or by counting full cooling tanks.

#### *Total catch and sorted out discards*

Catch compositions were sampled for 73% of the hauls and 85% of the catch in weight. The catch compositions of unsampled hauls were derived from earlier or later hauls, based on the general impression at first sight, depth, time of the day and geographical composition.

The discard percentage was estimated by visual inspection of the conveyor belt from one or two fixed points. In this way, the proportion of the discards path(s) relative to the landings paths was estimated. The observer validated the estimates of the total catch and the percentage discards by comparing the number of packages on board with the landings according to the observer logbook.

Samples were taken from the total catch and the discard-fraction separately. A sample of the total catch was taken with a fish basket out of the hold or at the outlet of a cooling tank. If this was not possible, a sample was taken randomly from the conveyor belt before the grading machine. A sample of the discards fraction was taken by collecting a basket of fish sorted out for discarding by the crew. In some cases it was necessary to collect discarded fish randomly from the conveyor belt.

The weight of each species in each sample was estimated using a weight-beam (max. 50 kg) or with a stabilized weight-balance (max. 10 kg). From both the catch and discards samples the sampled weight per species were recorded. Each specimen was measured to the cm-below. The aim was to measure at least 50 specimens of all major species in each length sample.

#### *Incidental discarding*

A distinction was made between discards that were removed from the conveyor belt during processing (sorted out discards) and other releases of the total catch (incidental discards). Incidental discards were divided into three categories:

- gear damage: a complete trawl net may tear or because the catch is too heavy. It is assumed that these fish in the net die. A rough estimate of the total catch was made, taking into account the expected species, depth and weather conditions.
- Slipping from the net after hauling. A rough estimate of the weight and the composition of the catch is made with the help of crewmembers on the upper deck.
- Pumping (or running via the conveyor belt): this is catch which is discarded at once after it has been stored in the hold or in a cooling tank. An estimate was derived from the known volume of a cooling tank.



## 2.3 Data processing

Catch and discards samples were raised to total landings and discards numbers at length per species. From both the catch and discards samples the sampled weight per species was recorded and fish were measured. Total discards weight was calculated by applying the estimated discard percentage to the total catch weight. The total numbers caught at length per species per haul were calculated by multiplying the numbers caught per length in the sample by the ratio of total catch weight to sampled catch weight per species per haul. The total numbers discarded at length per species per haul were calculated by multiplying the numbers discarded per length in the sample by the ratio of total discards weight to sampled discards weight per species per haul. Total numbers caught or discarded at length per species per trip were calculated by summing the numbers at length per species over all hauls. Landings numbers at length per species were calculated from subtracting discards numbers at length from numbers caught at length.

From the total landings weight per trip, the total landings weight for the entire fleet was estimated and compared to the recorded landings weight from the VIRIS database. Total landings weight per species per trip was summed over the 5 trips to obtain total landings weight per species over the sampled trips. For these 5 trips the total number of fishing days were determined. Total fleet landings weight per species was calculated by multiplying the total landings weight over the 5 trips with the ratio of total number of fishing days of fleet (from VIRIS) to the total number of fishing days from the sampled trips. The estimated landings weight of the fleet was compared with the total fleet landings weight recorded in the VIRIS database.

## 3. Results

### 3.1 Description of the observer trips

Trip 1. Period: week 12-19, 2002. The estimated total catch was 2400 tons (Table 4). The target species was horse mackerel (Figure 4). The estimated discards (530 ton, 22%) consisted mainly of mackerel (Figure 5, 6). Most mackerel was damaged as result of the catching and storing process and was therefore discarded (sorted out). Mackerel was also discarded because of quota-limitations. All blue whiting was heavily damaged and therefore discarded during processing. Horse mackerel was discarded because of small size, damage, grading limitations and storage capacity.

Trip 2. Period: week 15-18, 2002. The estimated total catch was 1800 tons. The target species were blue whiting and greater argentine. The sorted out discards were very low (< 1%) (Figure 5, 6). All discards were due to four gear damage incidents. For one haul the catch was already at the surface and visible for the crew on the rear deck, so an estimate of the lost catch could be made. For three other hauls, the net must have "exploded" as a result of winding too fast. In those cases the observer assumed 75 tons for each haul.

Trip 3. Period: week 28-32, 2002. The estimated total catch was 2600 tons, of which around 19% was discarded. Discards of herring were mainly caused by the last haul, which was pumped overboard because the cooling tanks were full. Damaged herring was also discarded. One third of the discards consisted of mackerel, which was sorted out at the conveyor belt because of quota limitations. The remaining part of the discards consisted of whiting and haddock. No incidental releases of large quantities were observed.

Trip 4. Week 40-42. The estimated total catch was 840 ton of which 130 tons (16%) was discarded. The major part of the catch consisted of pilchards, horse mackerel and blue whiting (Figure 4, 6). About 80% of the discards consisted of pilchard, mainly from three incidents where the whole catch was slipped from the net.

Trip 5. Period: week 44-47. The estimated total catch was 2800 tons, mainly consisting of horse mackerel (Figure 4). Most hauls contained small percentages of mackerel and (much less) pilchard (Figure 6). The discards (425 tons, 17%) consisted of sorted out mackerel and damaged pilchards and horse mackerel (Figure 5). Mackerel was sorted out for various reasons (damage, size and grading limitations).

### 3.2 Estimated discards from sampled trips

In total 172 hauls (varying between 19-49 hauls per trip) were sampled (Table 4) during 139 fish days, with an average duration of 3 hours and 15 minutes. The frequency of haul durations is shown in Figure 3. The total number of fishing days of the fleet in the North East Atlantic in 2002 was 2741, resulting in a fleet coverage of around 5%.

Overall 18% of the total catch was discarded (Table 5). The approximate contributions of the different sources of discarding were: 58% sorted out at the conveyor belt, 12 % slippage from the net, 17 % pumped overboard and 14 % gear damage. (Figure 7). Mackerel was the most frequently discarded species: around 50% of all mackerel was discarded. For herring about 25 % was discarded. Almost all discarded herring (12% of the total catch) were from a trip where herring was the target species (Figure 8).

The horse mackerel (Figure 9) and mackerel (Figure 10) catches in the northern Gulf of Biscay (trip 5) in October/November showed two main size groups. The smallest of these size groups

(16-22 for horse mackerel and 17-21 for mackerel) were not caught in the southwest of Ireland (trip 1).

Blue whiting (Figure 11) and pilchard (Figure 12) were discarded in those hauls where it was caught together with other species (trip 1 and 5). Blue whiting was the main target species on trip 2 and it was only discarded in a few incidents (gear damage). In trip 4 pilchards were caught in some clean hauls and kept on board.

Some small-sized greater argentine (Figure 13) were discarded in trip 1, where it was caught together with horse mackerel and mackerel. In the blue whiting/argentine fishery, larger size classes of greater argentine were caught and kept on board.

The estimates of landings at fleet level from the Dutch logbook database VIRIS were compared with estimated landings from the sampled trips (Table 7). The discrepancy between the raised landings from the sampled trips and the landings from the VIRIS database varies from 30% for blue whiting and North Sea horse mackerel to almost 100% for pilchards.

## 4. Discussion

The Discards sampling program for the Dutch pelagic fleet in 2002 was instigated as part of the EC regulations 1543/2000 and 1639/2001 on data collection in European fisheries. Results were presented of the five discard trips that were carried out onboard of Dutch pelagic vessels in 2002 fishing in the North East Atlantic. The sampling was carried out as a pilot-survey (see annex of EC 1639/2001, chapter III, E1c). Because of the high costs of sampling, it is only possible to sample a limited number of vessels each year. As a result the coverage of the entire fleet was around 5%.

Overall 18 % of the total catch was discarded in the sampled trips. The approximate contributions of the different sources of discarding were: 58% sorted out at the conveyor belt, 12 % slippage from the net, 17 % pumped overboard and 14 % gear damage (figure 6). Mackerel was the most frequently discarded species: around 50% of all mackerel was discarded. For herring about 25 % was discarded. Almost all discarded herring (12% of the total catch) were from a trip where herring was the target species.

The reasons for discarding different parts of the catch in the pelagic fishery are variable (Morizur et al, 1995). Although it is tempting to guess on the incentives to discard fish (Couperus, 1997; Anonymous, 2003), it is difficult to make clear distinctions between incentives like "high-grading", quota-limitations, fish quality and lack of storing capacity. For example, fishers may keep the most marketable fish because they anticipate on the quota limitations later that year, but this may be difficult to derive from the observed discard rates. In mixed catches the quality of part of the catch can be very low. Since The Dutch freezer trawler fleet carries out a fishery for human consumption. When fish are caught as part of a mixed catch, the quality of the catch may be low which will lead to discarding.

Couperus (1997) noted substantial discarding of mackerel in the horse mackerel fishery, caused by an imbalance between the Dutch quota of horse mackerel (high) and mackerel (low), while both species are caught in a mixed fishery. It was predicted that mackerel discards would decrease after a decrease of the horse mackerel quota and an increasing effort in Mauritanian waters. Both developments occurred: from 1999 onwards; the TAC of western horse mackerel has decreased from 300 thousand tonnes to 150 tonnes in 2002 (ICES, 2003), while the mackerel TAC remained more or less stable. Furthermore, a substantial part of the Dutch pelagic fleet fishes part of the year in Mauritanian waters since 1996. Annual landings of 150.000 tons of pelagic fish have been recorded for this area (data RIVO). The observations during the 2002 discards trips showed that mackerel discards are still high (30-50% discards of the mackerel total catch) with horse mackerel as target species, contrary to the expectation. The original expectation (Couperus, 1997) may have been too optimistic, because the effect of damage of the mackerel (caused by the spinier horse mackerel) was not taken into account. The small size of mackerel in the Channel (in autumn) and the low fat content along the continental edge (in spring) may also have been underestimated.

The ultimate aim of collecting discards information is to enhance stock assessment models, which are currently only based on landings data. In order to allow discards data to be incorporated into stock assessment models a number of requirements need to be fulfilled:

- estimates of discarded numbers at age (international, by assessment area)
- estimates of uncertainty in numbers at age (are the discards numbers comparable to landings numbers in terms of uncertainty)
- historical reconstruction of discards to be able to build up a time series of discards.

At present these requirements cannot be fulfilled for the Dutch pelagic discards sampling. In principle the numbers at length that have been estimated from the observed trips could be converted into numbers at age, using the age-length information that is collected during the discard trips and from the market sampling. The raising from the sampled trips to the fleet level

is more problematic. The five trips that have been observed in 2002 show that there are large differences between trips and that discarding is highly dependent on processes which may be very case specific (e.g. incidental loss of nets). If discards are to be estimated by area and or season, the number of trips may be insufficient (see Table 7). A possible method to address the drawbacks listed above, would be to collate discards information over a number of years (e.g. three years).

## 5. References

Anonymous. 2003. Workshop on discards sampling methodology and raising procedures, 2-4 september 2003, Charlottenlund.

Corten, A. 1991. Discards sampling programme in the North Sea. European Commission Study contract 1990/12, 10 pages + appendices.

Couperus, A.S. 1997. By-catch of marine mammals and discards in pelagic fisheries (MAMDIS). Contract EC CFP 94/018.

EC. 2000. COUNCIL REGULATION (EC) No 1543/2000 of 29 June 2000 establishing a Community framework for the collection and management of the data needed to conduct the common fisheries policy. No. 1543/2000.

EC. 2001. COUNCIL REGULATION (EC) No 1639/2001 of 25 July 2001 establishing the minimum and extended Community programmes for the collection of data in the fisheries sector and laying down detailed rules for the application of Council Regulation (EC) No 1543/2000. No. 1639/2001.

ICES. 2003. Report of the ICES Advisory Committee on Fishery Management, 2002. ICES Cooperative Research Report, No. 255.

Morizur, Y., Tregenza, N., Heessen, H., Berrow, S. and Pouvreau, S. 1995. By-catch and discarding in pelagic trawl fisheries. Contract EC DG XIV-C-1, study BIOECO 93/017.

## 6. Tables and Figures

**Table 1.** Seasonal distribution and target species of Dutch freezer trawlers by fishing area. Species between brackets: secondary/occasional target or bycatch.

area*month:	Northern Bay of Biskay	Southwest of Ireland	West of Ireland	Porcupine Bank	West of Scotland	North of Scotland	North of the Shetland's	Northern North sea	Central North sea	British East coast	Channel
January						mackerel	mackerel				horse mackerel
February		(horse mackerel)	(horse mackerel)		mackerel (horse mackerel)	mackerel					horse mackerel pilchard
March	horse mackerel	(horse mackerel) (mackerel)	(horse mackerel) (mackerel)	blue whiting							horse mackerel pilchard
April	(horse mackerel) mackerel	(horse mackerel) (mackerel)			blue whiting						
May	mackerel horse mackerel	(horse mackerel) (mackerel)			blue whiting greater argentine	blue whiting		(herring)	(herring)		
June						herring	herring	herring	(Herring)		
July					herring	herring	herring	herring	herring		
August					herring				herring	herring	
September	(horse mackerel)										horse mackerel
October	horse mackerel					(mackerel)	(mackerel)	mackerel			
November	horse mackerel		horse mackerel (mackerel)		(mackerel)	(mackerel)	(mackerel)				horse mackerel herring pilchard
December	horse mackerel										herring horse mackerel pilchard

**Table 2.** Period, target species and ICES area's of the trips conducted during this observer programme.

<b>Trip nr</b>	<b>Period</b>	<b>Target species</b>	<b>Bycatch &amp; secondary target</b>	<b>ICES area's</b>
1	23/03 - 08/05	Horse mackerel	Mackerel Pilchard	VIIj, h, VIIIa, b
2	12/04 - 01/05	Blue whiting	Blue whiting Greater argentine	VIa
3	13/07 - 10/08	Herring	Mackerel	IIa, IVa, VIa
4	01/10 - 19/10	Horse mackerel Mackerel Pilchard	Whiting	IVc
5	31/10 - 19/11	Horse mackerel	Mackerel Pilchard	VIIh, VIIIa



**Table 3. Description of the vessels. Storage capacity in packages (1 package = 20–25 kg). Power in kW (1 kW = 0.7355 hp).**

<b>Trip nr</b>	<b>Built</b>	<b>Length (m)</b>	<b>Power (kW)</b>	<b>Cooling tanks</b>	<b>Plate freezers</b>	<b>Storage capacity (packages)</b>	<b>Crew</b>	<b>Remarks</b>
1	1986	90	6866	7	26	75000	27	trip duration <3 weeks
2	1988	114	12957	12	-	150000	40	-
3	1984	88	5982	12	-	82000	30	-
4	2002	56	3929	6	-	22000	16	Half of a pair trawler 29 plate freezers used during trip
5	1989	115	13425	12	34	15000	40	

**Table 4.** Overview of samples taken per trip.

<b>Trip nr</b>	<b>Number of hauls during the trip</b>	<b>Number of hauls sampled</b>	<b>% of hauls sampled</b>	<b>% of total catch covered</b>	<b>Average sample size of total catch in kg (dev.)</b>	<b>Average sample size of discards in kg (dev.)</b>
1	48	42	88%	84%	24.3 (7.6)	14.1 (6.3)
2	37	25	68%	74%	18.5 (6.6)	15.9 (24.0)
3	59	49	83%	81%	24.1 (1.9)	3.8 (2.9)
4	20	19	95%	85%	22 (2.5)	9 (3.9)
5	43	37	86%	90%	92.9 (38.4)	6.4 (5.7)
<b>All</b>	<b>207</b>	<b>172</b>	<b>83%</b>			

**Table 5.** Overview of all landings and discards for each trip (tons). Total discards were 18%. Others = Boarfish, Whiting, Saithe, Squid, Hake, Sprat, Haddock and Anchovy.

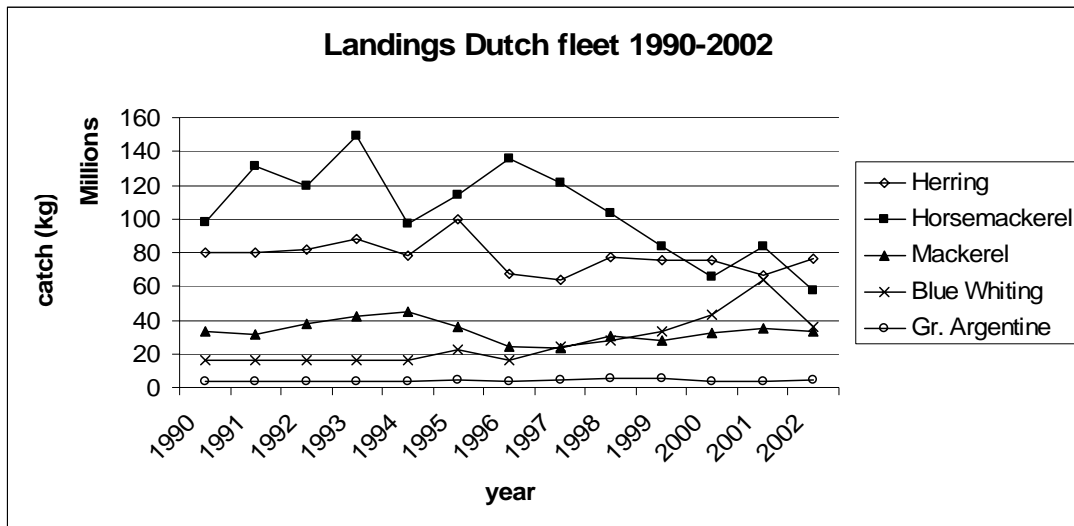
	Horsemackerel	Mackerel	Pilchards	Herring	Blue whiting	Greater argentine	Others	Total
<b>Trip 1</b>								
Landings	1641	223	5	0	2	0	2	
Discards - sorted out	96	273	28	0	12	10	42	
Run	10	0	0	0	0	0	0	
Pumping	58	0	0	0	0	0	2	
Gear damage	0	0	0	0	0	0	0	
Total discards	163	273	28	0	12	10	44	367
Total discards (%)	9%	55%	86%	0	83%	100%	96%	15%
Total catch	1804	496	33	0	15	10	46	2404
<b>Trip 2</b>								
Landings	0	0	0	0	1347	175	9	
Discards - sorted out	0	0	0	0	0	0	5	
Run	0	0	0	0	0	0	0	
Pumping	0	0	0	0	0	0	0	
Gear damage	0	0	0	0	225	25	0	
Total discards	0	0	0	0	225	25	5	255
Total discards (%)	0%	0%	0	100%	14%	13%	37%	14%
Total catch	0	0	0	0	1572	200	14	1786
<b>Trip 3</b>								
Landings	5	13	0	2127	7	0	0	
Discards - sorted out	4	120	0	32	0	0	38	
Run	0	11	0	41	0	0	0	
Pumping	0	15	0	224	0	0	6	
Gear damage	0	0	0	0	0	0	0	
Total discards	4	145	0	298	0	0	44	492
Total discards (%)	44%	92%	0	12%	0%	0	100%	19%
Total catch	8	158	0	2426	7	0	44	2643
<b>Trip 4</b>								
Landings	207	111	385	0	0	0	0	
Discards - sorted out	7	9	17	0	0	0	0	
Run	2	9	89	0	0	0	0	
Pumping	0	0	0	0	0	0	0	
Gear damage	0	0	0	0	0	0	0	
Total discards	9	19	106	0	0	0	0	134
Total discards (%)	4%	14%	22%	0	0	0	100%	16%
Total catch	216	130	492	0	0	0	0	838
<b>Trip 5</b>								
Landings	2123	232	7	0	0	0	12	
Discards - sorted out	197	143	15	0	1	0	9	
Run	57	1	1	0	0	0	0	
Pumping	0	0	0	0	0	0	0	
Gear damage	0	0	0	0	0	0	0	
Total discards	254	145	16	0	1	0	9	425
Total discards (%)	11%	38%	69%	0	86%	0	45%	15%
Total catch	2377	376	23	0	1	0	21	2798
<b>TOTALS per species (tons)</b>								
Landings	3976	579	397	2127	1356	175	22	8633
Discards - sorted out	303	545	60	32	13	10	94	1058
Run	68	21	91	41	0	0	0	222
Pumping	58	15	0	224	0	0	9	306
Gear damage	0	0	0	0	225	25	0	250
Total discards	430	582	150	298	238	35	103	1836
Total catch	4405	1161	547	2426	1595	210	125	10469
<b>TOTALS per species (%)</b>								
Landings	90	50	73	88	85	83	18	82
Total discards	10	50	27	12	15	17	82	18

**Table 6. Biological samples for the determination of length, weight, age, maturity and sex, collected during trip 1-5.**

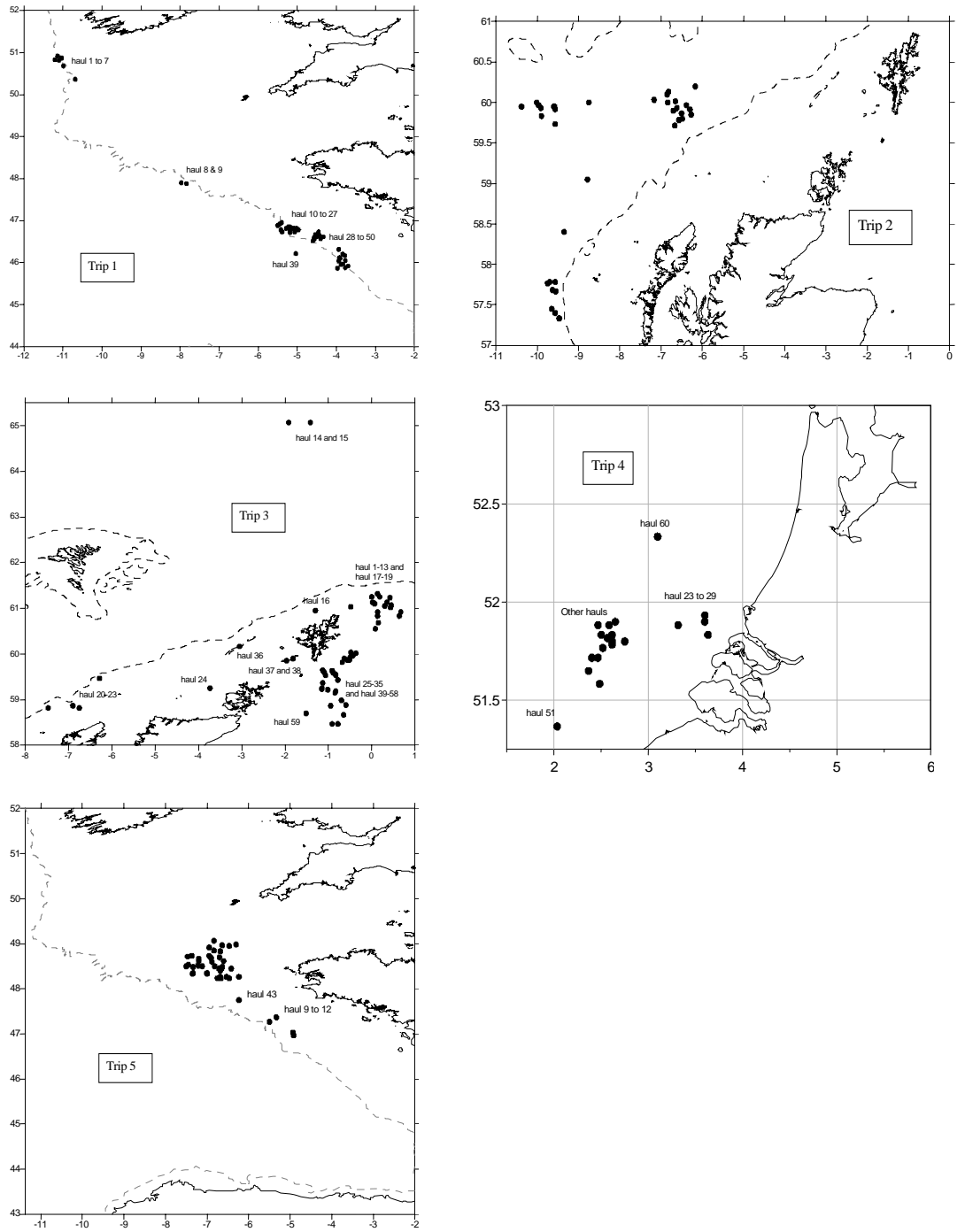
Species	weight (kg)	# measured	# aged	vessel		gear	catch date	latitude	longitude	rectangle
				number						
Herring	26.1	110	25	3		Pelagic trawl	15/Jul/98	60.05	0.25	49/F0
Herring	26.2	86	25	3		Pelagic trawl	17/Jul/98	61.14	0.25	51/F0
Herring	24.3	142	25	3		Pelagic trawl	24/Jul/98	58.52	-6.54	46/E3
Herring	24.4	154	25	3		Pelagic trawl	02/Aug/98	59.15	-0.11	47/E9
Mackerel	23.1	138	25	1		Pelagic trawl	20/Apr/98	50.5	-11.07	30/D8
Mackerel	22.4	48	25	1		Pelagic trawl	22/Apr/98	50.4	-11	30/D8
Mackerel	22.3	56	25	1		Pelagic trawl	23/Apr/98	46.51	-5.12	22/E4
Mackerel	21.9	53	25	1		Pelagic trawl	02/May/98	45.56	-3.46	20/E6
Mackerel	23.3	50	25	1		Pelagic trawl	04/May/98	46.44	-4.27	22/E5
Mackerel	20.8	58	25	4		Pair trawl	01/Oct/98	51.54	3.43	32/F3
Mackerel	6.2	25	25	5		Pelagic trawl	04/Nov/98	47.17	-5.32	23/E4
Mackerel	4.2	25	25	5		Pelagic trawl	05/Nov/98	47.09	-4.55	23/E5
Mackerel	7.1	25	25	5		Pelagic trawl	08/Nov/98	48.21	-7.2	25/E2
Mackerel	1.3	25	25	5		Pelagic trawl	13/Nov/98	48.47	-6.31	26/E3
Mackerel	7.4	25	25	5		Pelagic trawl	14/Nov/98	48.31	-7.19	26/E2
Horse mackerel	23.1	84	25	1		Pelagic trawl	20/Apr/98	50.5	-11.07	30/D8
Horse mackerel	21.4	83	25	1		Pelagic trawl	22/Apr/98	50.4	-11	30/D8
Horse mackerel	20.5	151	25	1		Pelagic trawl	23/Apr/98	46.51	-5.12	22/E4
Horse mackerel	19.8	165	25	1		Pelagic trawl	28/Apr/98	46.5	-5.23	22/E4
Horse mackerel	21.3	268	25	1		Pelagic trawl	29/Apr/98	46.14	-3.51	21/E6
Horse mackerel	17	196	25	1		Pelagic trawl	02/May/98	45.56	-3.46	20/E6
Horse mackerel	21.8	244	25	1		Pelagic trawl	04/May/98	46.44	-4.27	22/E5
Horse mackerel	21.5	291	25	4		Pair trawl	01/Oct/98	51.54	3.43	32/F3
Horse mackerel	20.9	291	25	4		Pair trawl	08/Oct/98	51.44	2.28	32/F2
Horse mackerel	2	25	25	5		Pelagic trawl	01/Nov/98	48.41	-7.01	26/E2
Horse mackerel	2.7	25	25	5		Pelagic trawl	01/Nov/98	48.39	-6.56	26/E3
Horse mackerel	4	25	25	5		Pelagic trawl	02/Nov/98	48.57	-6.18	26/E3
Horse mackerel	2.4	25	25	5		Pelagic trawl	02/Nov/98	48.23	-6.41	25/E3
Horse mackerel	2.9	25	25	5		Pelagic trawl	06/Nov/98	48.21	-7.02	25/E2
Horse mackerel	3.1	25	25	5		Pelagic trawl	06/Nov/98	48.15	-6.44	25/E3
Horse mackerel	3.8	25	25	5		Pelagic trawl	08/Nov/98	48.21	-7.2	25/E2
Horse mackerel	2.1	25	25	5		Pelagic trawl	12/Nov/98	48.44	-6.37	26/E3
Horse mackerel	1.4	25	25	5		Pelagic trawl	13/Nov/98	48.47	-6.31	26/E3
Horse mackerel	3.3	25	25	5		Pelagic trawl	14/Nov/98	48.27	-7	25/E2
Horse mackerel	3.8	25	25	5		Pelagic trawl	13/Nov/98	48.38	-7.1	26/E2
Horse mackerel	3.5	25	25	5		Pelagic trawl	08/Nov/98	48.32	-7.17	26/E2
Horse mackerel	3.7	25	25	5		Pelagic trawl	14/Nov/98	48.31	-7.19	26/E2
Blue whiting	2	25	25	2		Pelagic trawl	16/Apr/98	57.41	-9.38	44/E0
Blue whiting	3.2	25	25	2		Pelagic trawl	18/Apr/98	59.49	-9.39	48/E0
Blue whiting	3.6	25	25	2		Pelagic trawl	20/Apr/98	59.5	-9.54	48/E0
Greater argentine	26.4	164	25	1		Pelagic trawl	23/Apr/98	46.51	-5.12	22/E4
Greater argentine	17.8	25	25	2		Pelagic trawl	26/Apr/98	59.51	-6.16	48/E3

**Table 7.** Difference between landings of the whole fleet (according to the VIRIS database) and landings of the sampled vessels (converted to total fleet days) (see table 5). Differences are indicated in tons and percentages. The closer the percentage approaches 0% the more the landings and discards of the sampled vessels resemble the entire fleet.

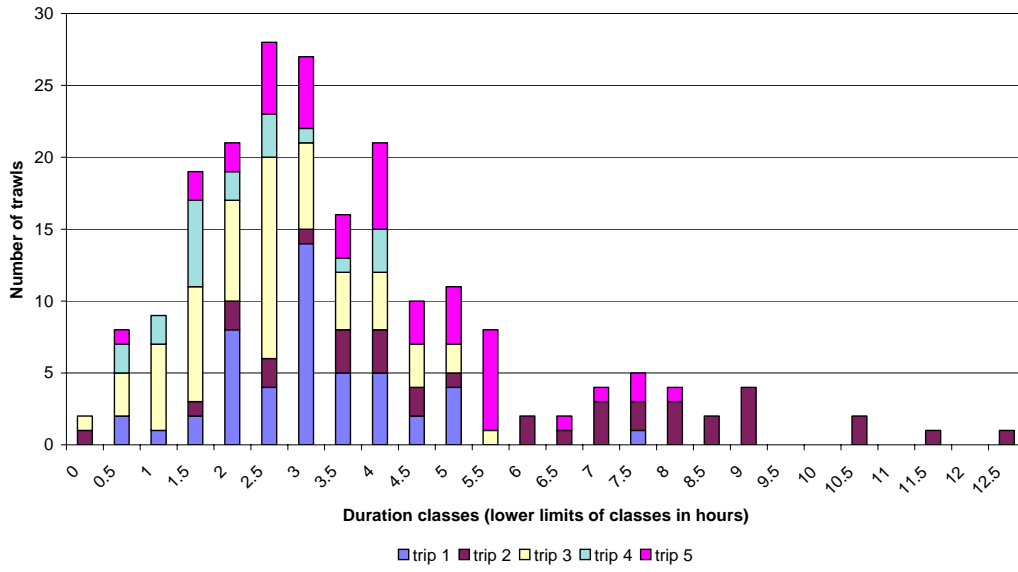
<b>species</b>	<b>landings</b>	<b>fishing</b>	<b>landings</b>	<b>landings</b>	<b>landings</b>	<b>difference</b>	<b>%</b>
	<b>total fleet VIRIS (tons)</b>	<b>days total fleet (VIRIS)</b>	<b>sampled trips (tons)</b>	<b>days (sampled trips)</b>	<b>trips raised to total fleet</b>	<b>(tons)</b>	<b>difference</b>
Herring (Atlando scandic)	7489	42	280	1	11765	4276	57%
Herring (North Sea)	54910	992	1708	57	29717	25193	46%
Herring (West of Scotland)	4581	245	545	21	6364	1783	39%
Herring (VIA(S) and VII BC)	633	44	-	0	-	-	-
Herring (Celtic Sea and VIJ)	922	318	-	16	-	-	-
Horse mackerel (Western)	44974	1328	4345	79	73032	28058	62%
Horse mackerel (North Sea)	11599	511	217	14	7911	3688	32%
Mackerel (Western)	22391	1325	394	64	8156	14235	64%
Mackerel (North Sea)	10705	553	108	31	1926	8779	82%
Pilchards	3950	957	454	56	7765	3815	97%
Blue Whiting	35624	1320	1490	81	24281	11343	32%
Gr. Argentine	4216	683	60	60	682	3534	84%
<b>Total</b>	<b>201994</b>	<b>8318</b>	<b>9600</b>	<b>480</b>	<b>166368</b>	<b>35626</b>	<b>18%</b>



**Figure 1.** Landings of the Dutch freezer trawler fleet from 1990-2002.

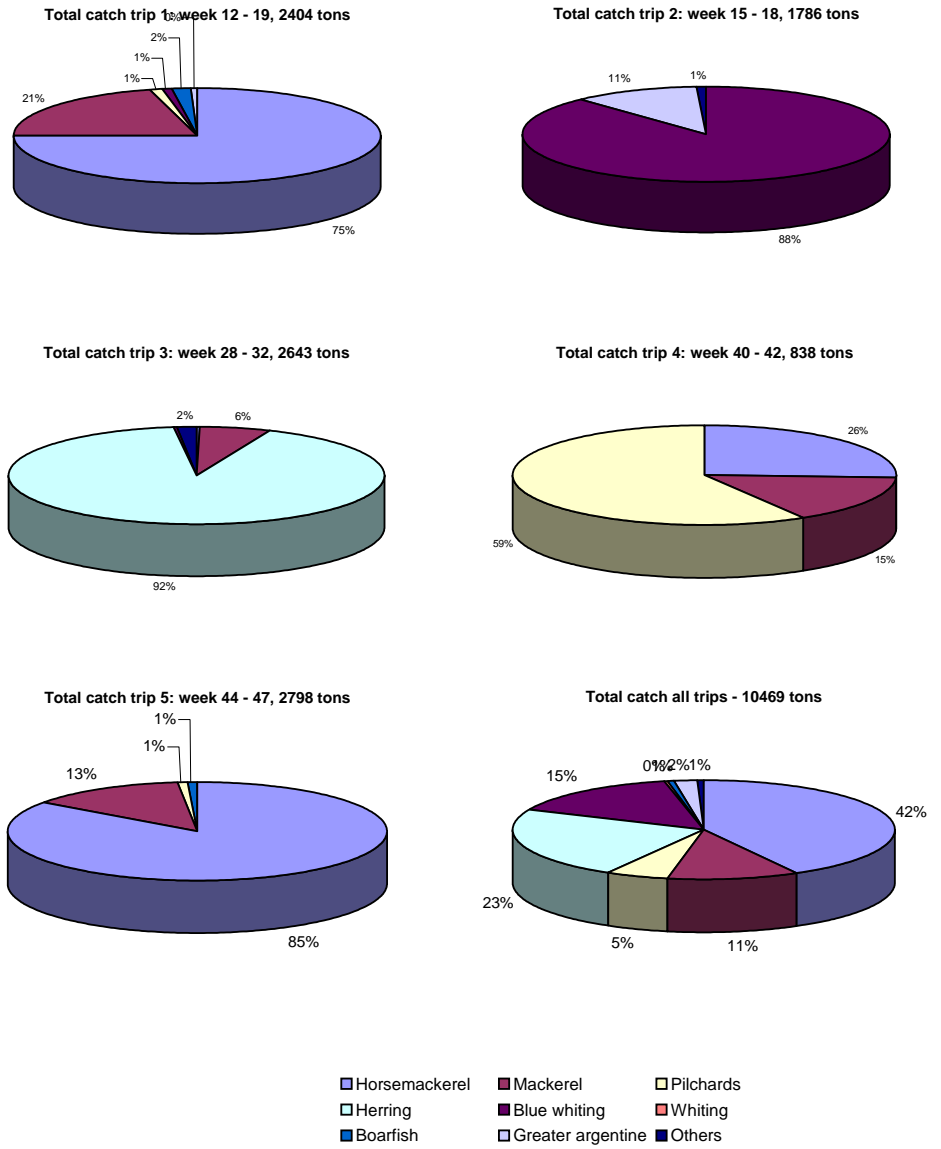


**Figure 2.** Trawl positions during trips 1-5.

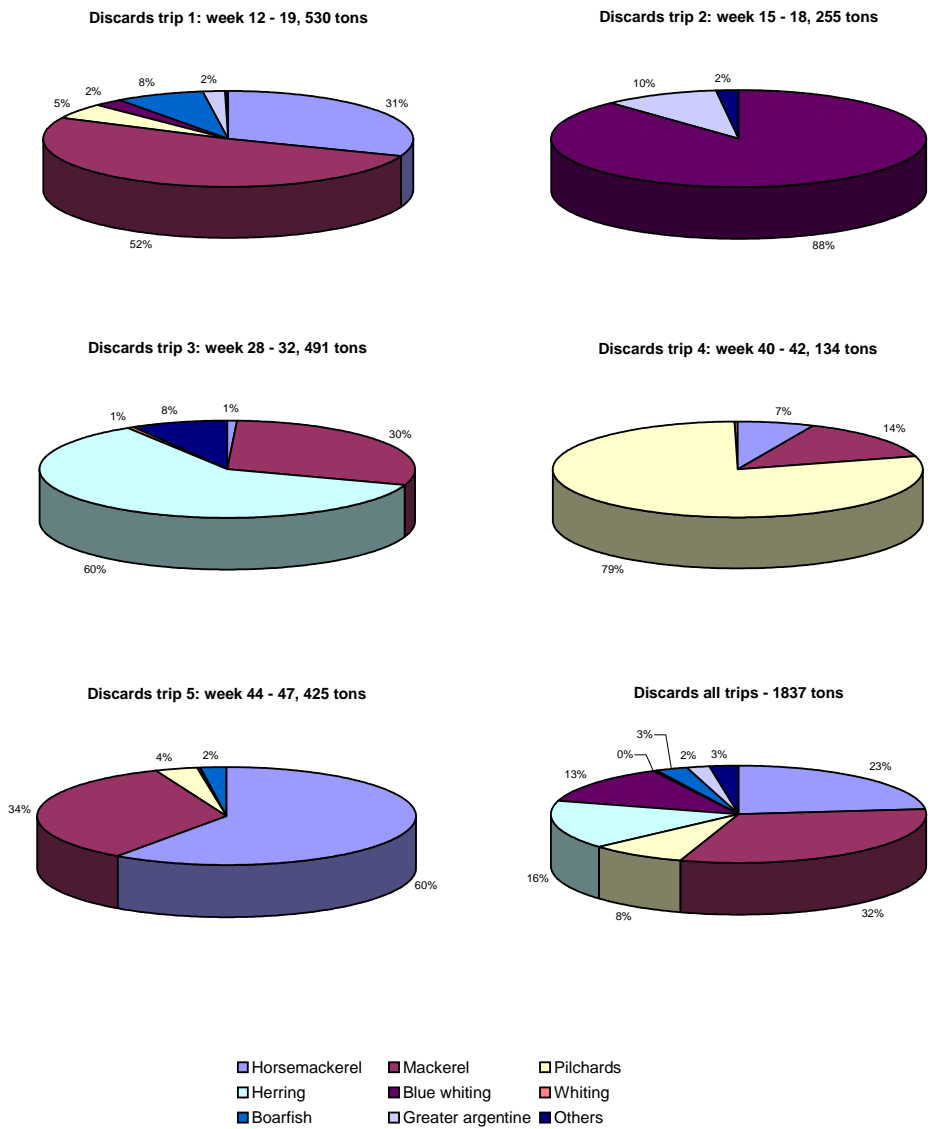


**Figure 3.** Frequency of haul durations.





**Figure 4.** Compositions of the total catches.



**Figure 5.** Compositions of the discards.

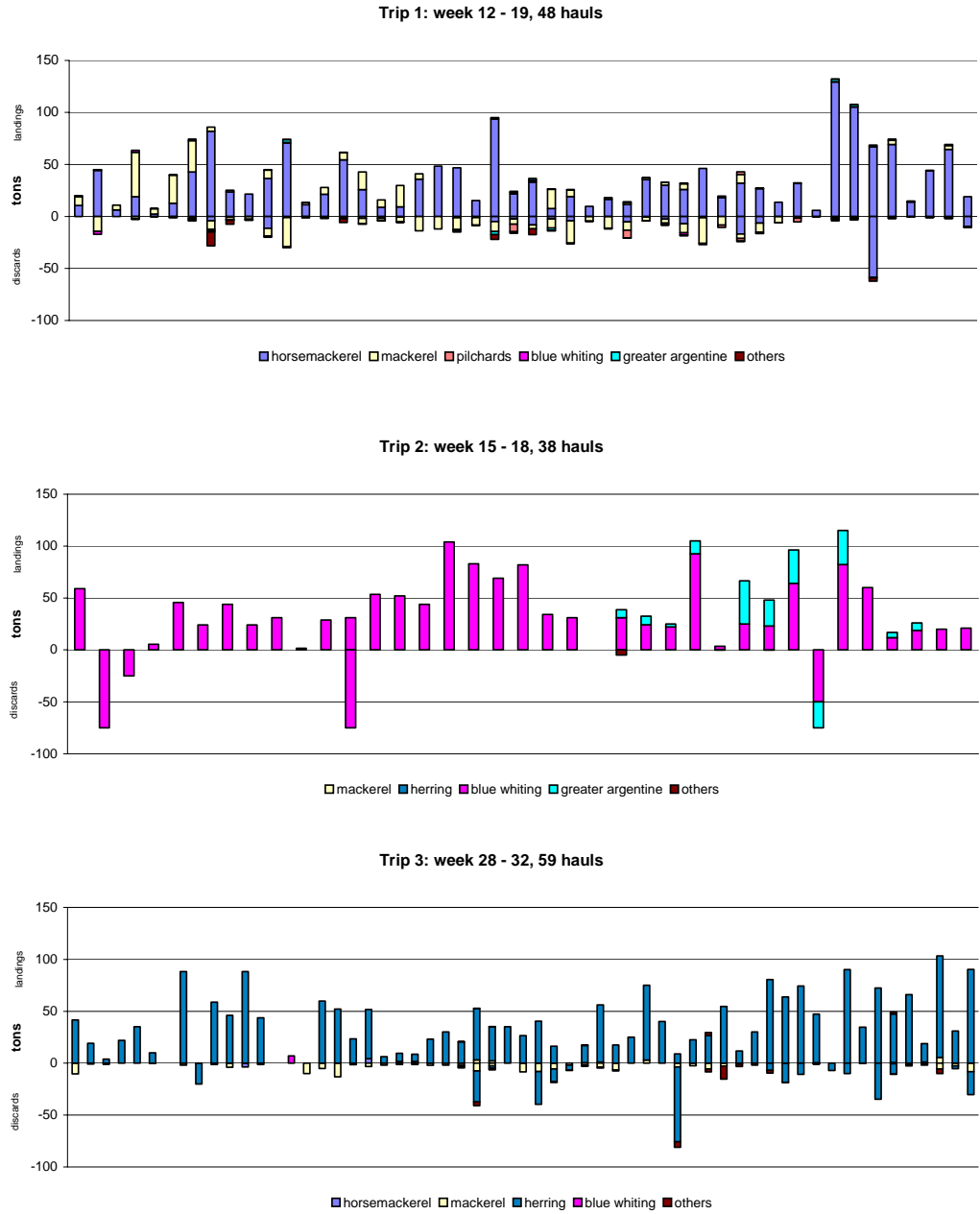


Figure 6. Landings and discards per haul during trip 1–3.

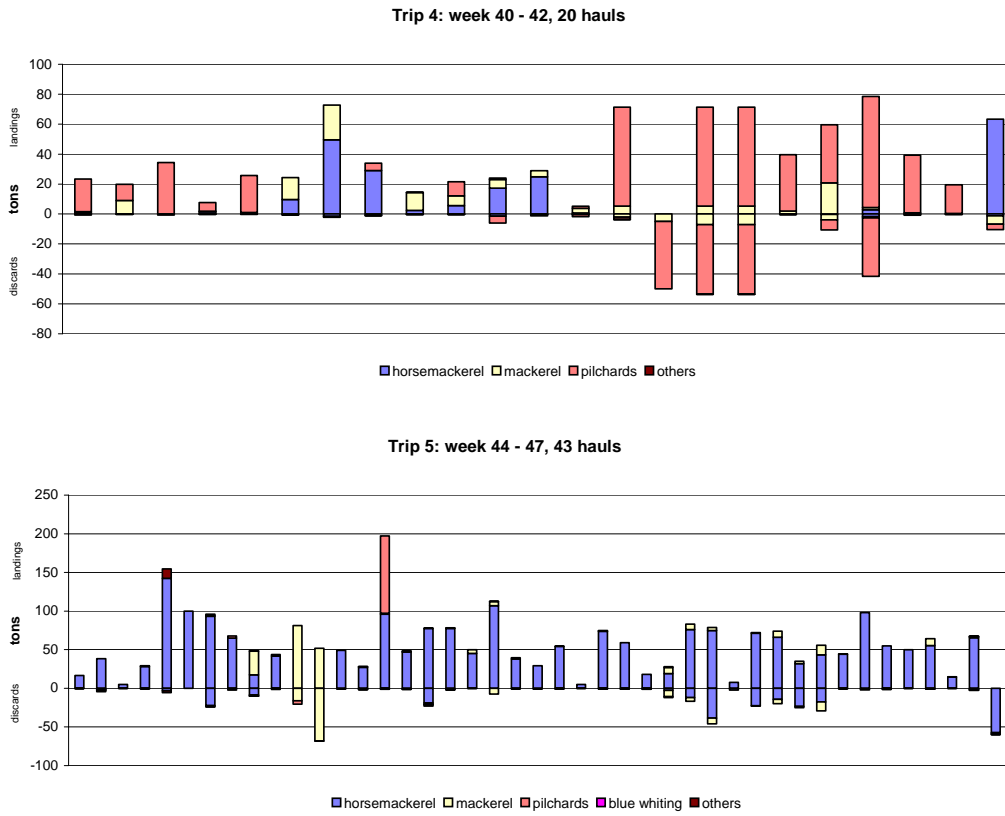
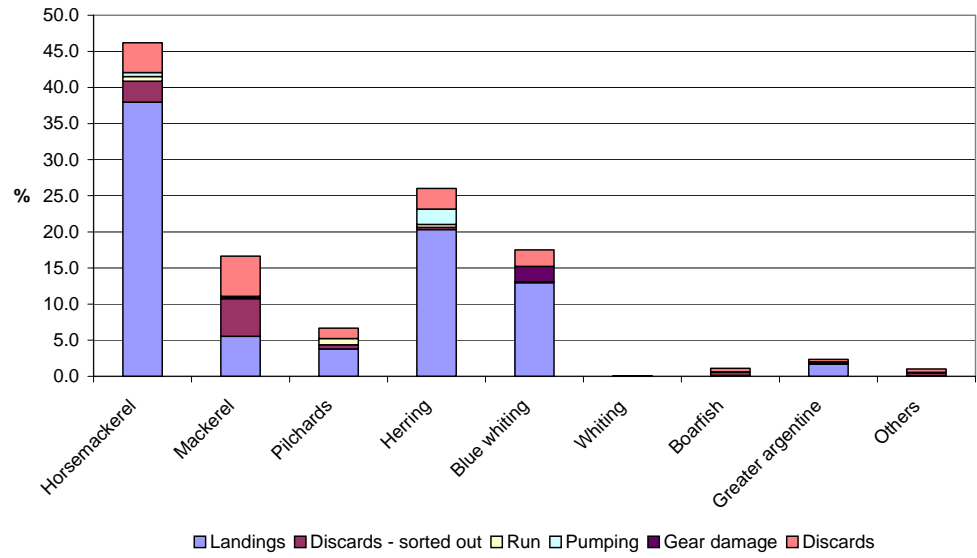
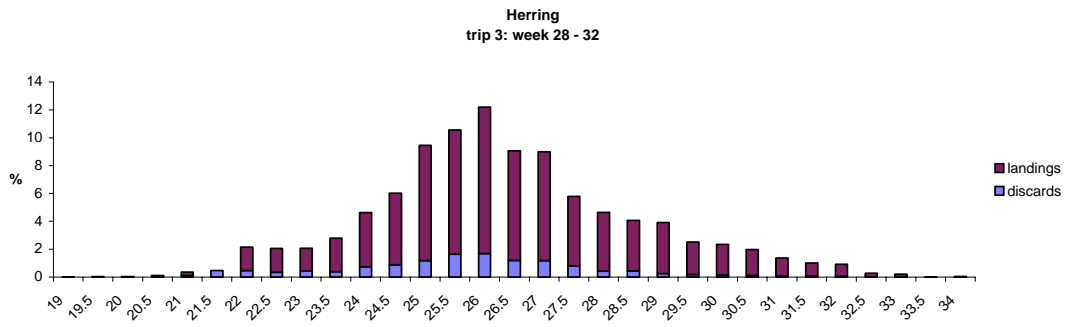


Figure 6 cont. Landings and discards per haul during trip 4–5.

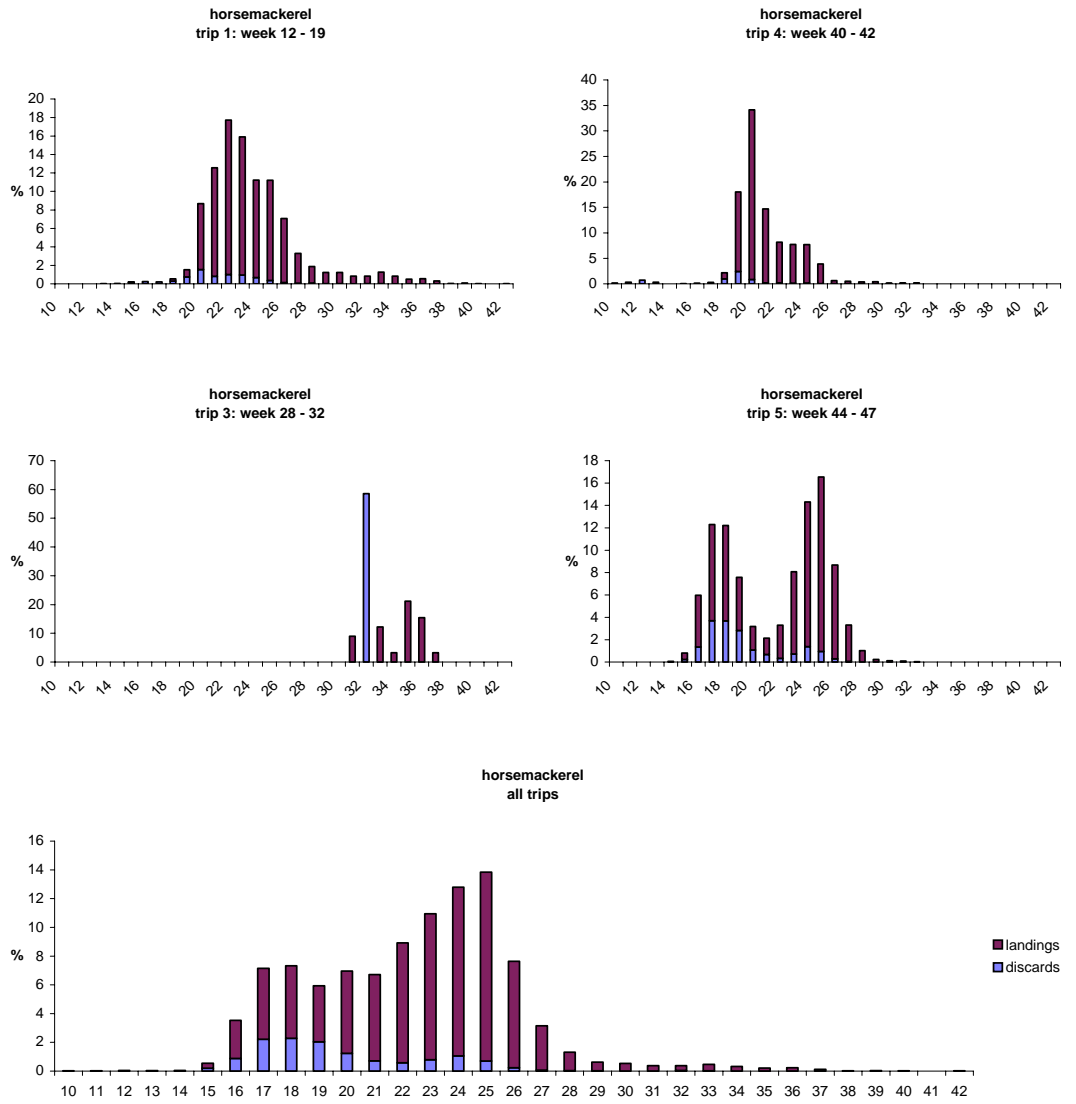


**Figure 7.** Landings and discards categories by species.



**Figure 8.** Length/frequency distribution of herring.

Trip 3:  $N(\text{total catch}) = 8782$ ,  $N(\text{discards}) = 2420$ .



**Figure 9** Length/frequency distribution of horse mackerel.

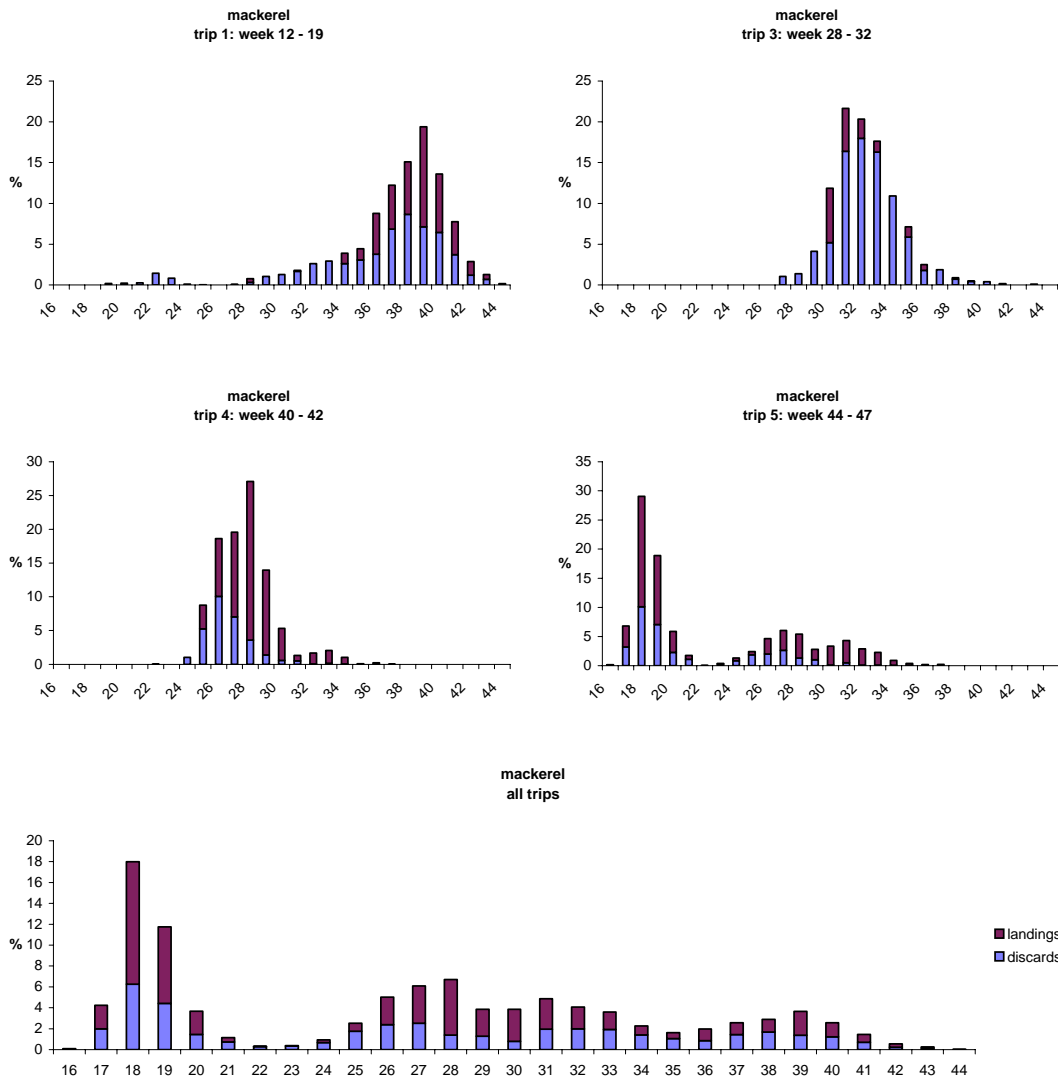
Trip 1: N(total catch) = 6076, N(discards) = 1132.

Trip 3: N(total catch) = 0, N(discards) = 2.

Trip 4: N(total catch) = 1141, N(discards) = 724.

Trip 5: N(total catch) = 8818, N(discards) = 2111.

All trips: N(total catch) = 16035, N(discards) = 3969.



**Figure 10.** Length/frequency distribution of mackerel.

Trip 1: N(total catch) = 802, N(discards) = 1130.

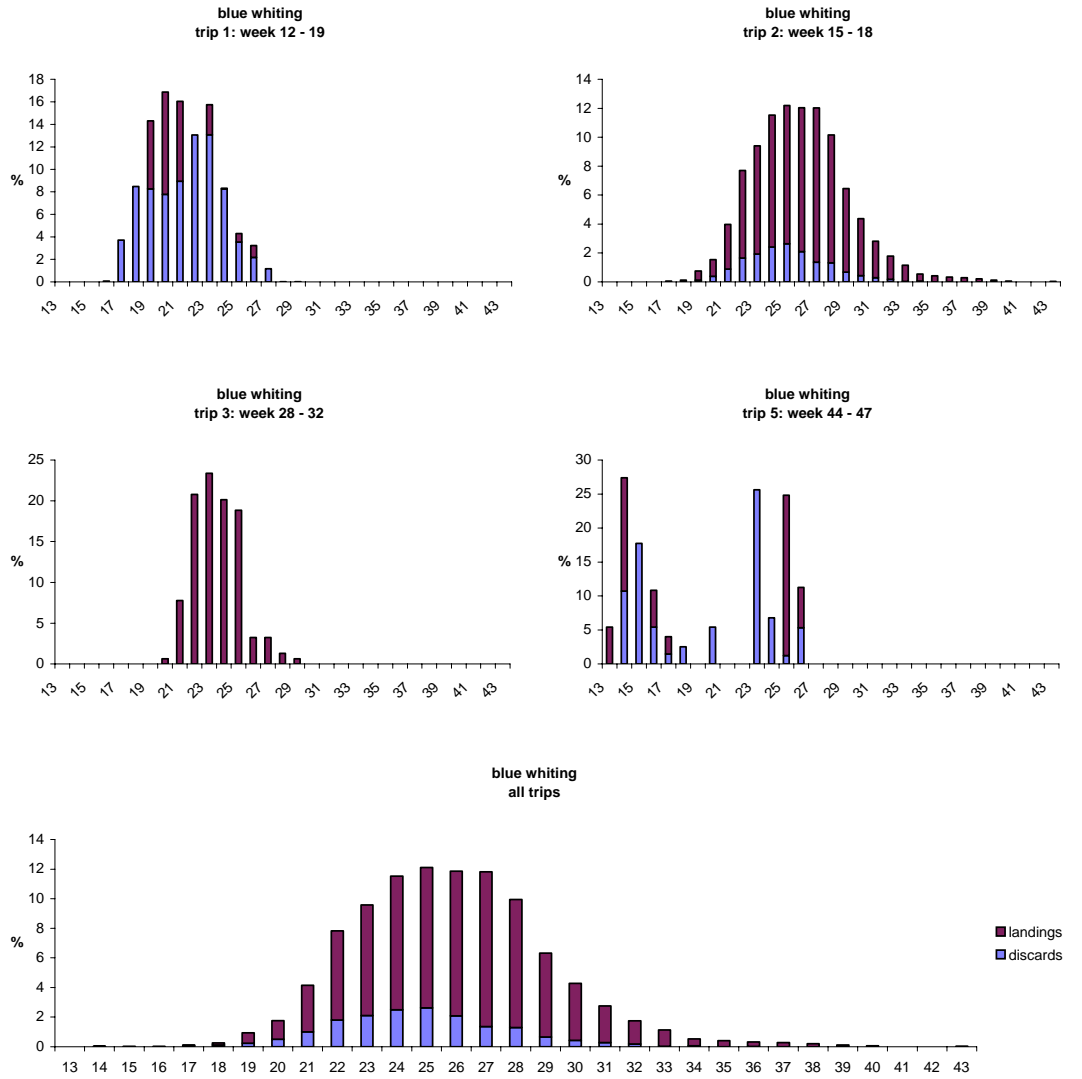
Trip 3: N(total catch) = 365, N(discards) = 365.

Trip 4: N(total catch) = 550, N(discards) = 224.

Trip 5: N(total catch) = 1069, N(discards) = 792.

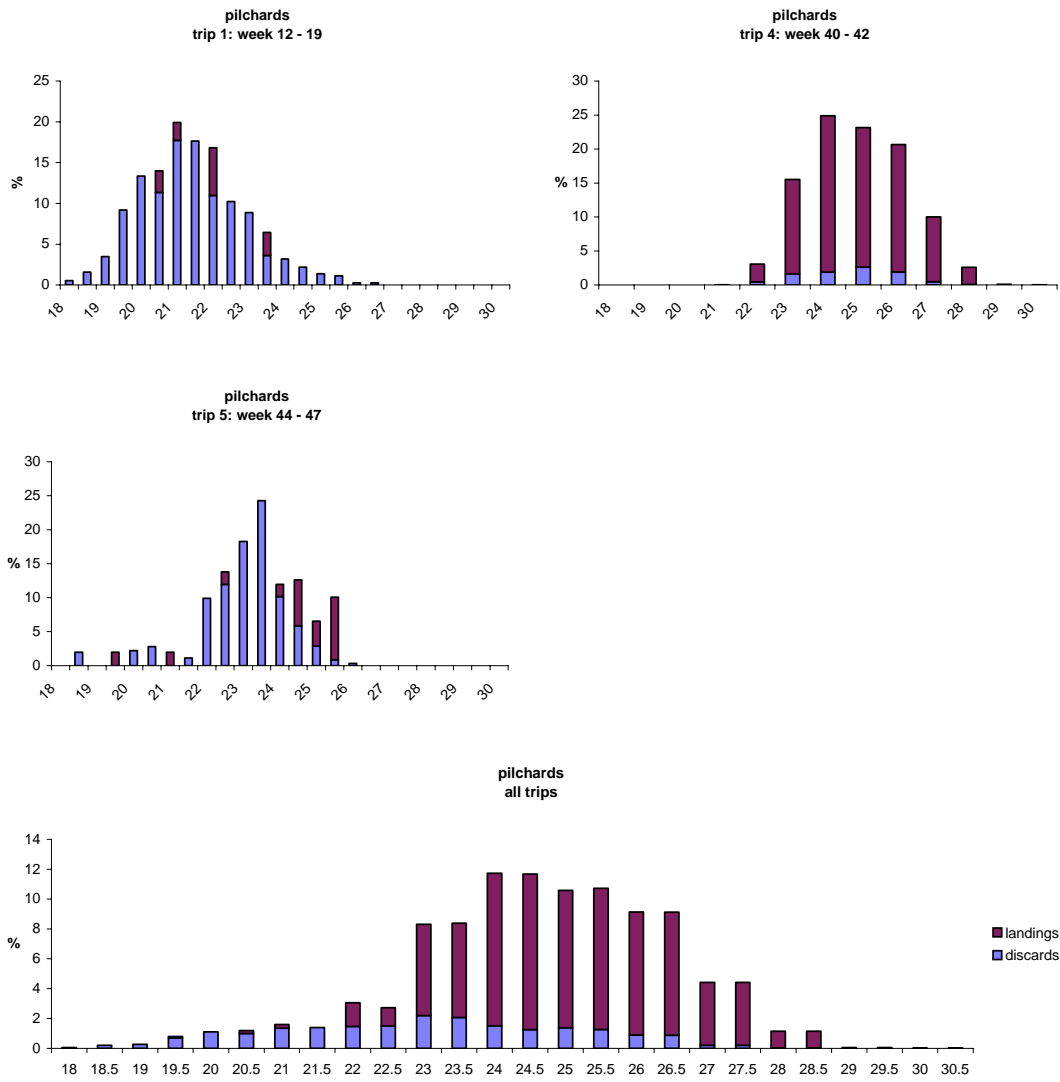
All trips: N(total catch) = 2786, N(discards) = 2511.





**Figure 11.** Length/frequency distribution of blue whiting.

Trip 1: N(total catch) = 128, N(discards) = 415.  
 Trip 2: N(total catch) = 5547, N(discards) = 528.  
 Trip 3: N(total catch) = 154, N(discards) = 0.  
 Trip 5: N(total catch) = 16, N(discards) = 26.  
 All trips: N(total catch) = 5845, N(discards) = 969.



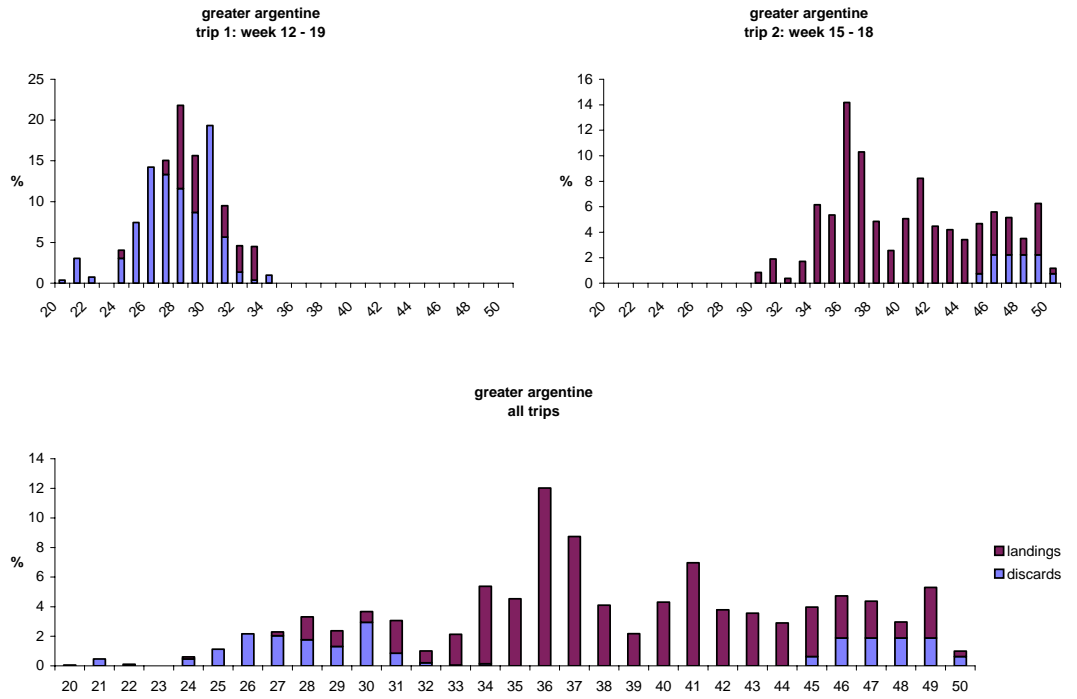
**Figure 12.** Length/frequency distribution of pilchards.

Trip 1: N(total catch) = 182, N(discards) = 380.

Trip 4: N(total catch) = 1746, N(discards) = 798.

Trip 5: N(total catch) = 75, N(discards) = 178.

All trips: N(total catch) = 2003, N(discards) = 1356.



**Figure 13.** Length/frequency distribution of greater argentine.

Trip 1: N(total catch) = 34, N(discards) = 101.

Trip 2: N(total catch) = 158, N(discards) = 14.

All trips: N(total catch) = 192, N(discards) = 101.