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## CVO report Number: 07.010

# Discard sampling of the Dutch pelagic freezer fishery in 2006

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Date: 14 January 2008

|                    |    |
|--------------------|----|
| Number of copies:  | 10 |
| Number of pages:   | 40 |
| Number of tables:  | 5  |
| Number of figures: | 16 |

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## Summary

This report contains results of the discards sampling program on the Dutch pelagic trawl fisheries in the North-East Atlantic in 2006, which was instigated as part of the EC regulations 1543/2000 and 1639/2001 on data collection in European fisheries. Twelve trips on board of pelagic vessels were sampled. It has been recognized that sampling of discards is an important element of fisheries statistics and therefore discards sampling schemes have been set up in a European context.

The Dutch fleet of freezer trawlers fishing in the North East Atlantic consists of 13 vessels in 2006 and targets pelagic species: herring (*Clupea harengus*), horse mackerel (*Trachurus trachurus*), mackerel (*Scomber scombrus*), blue whiting (*Micromesistius poutassou*), greater argentine (*Argentina silus*) and pilchard (*Sardina pilchardus*). 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. In 2006 the catch was about 230.000 tonnes with blue whiting as the most important species. Blue whiting was mainly targeted during the first half of 2006, herring during the second half, while mackerel was targeted during the winter.

During the twelve trips a total of 424 hauls were sampled. The composition and abundance of target and bycatch species differed between the trips. The target species included blue whiting, herring, horse mackerel, mackerel and greater argentine.

Overall 6% of the catch in weight was discarded. Mackerel was the most important species in the discards with a discard percentage of 20% in weight. Greater argentine showed a discard percentage of 9%, blue whiting and horse mackerel of 2%, which is lower than in 2005. No pilchards were landed in our observed trips. The discard percentage of herring (3%), on the other hand, is the same as in previous years (2004 and 2005). However care must be taken when comparing discard percentages between years, because of the limited number of trips sampled and the variability in discarding between these trips. The great variability in discarding between the few trips means that the raising of discards numbers to fleet level is problematic, particularly when discarding during those trips is very case specific (e.g. gear damage or pumping back into the sea).

## Samenvatting

Dit rapport bevat de resultaten van het discards bemonsteringsprogramma van de Nederlandse pelagische visserij in het noordoost Atlantisch gebied in 2006, dat is opgezet als invulling van EC regelingen 1543/2000 en 1639/2001 voor gegevensverzameling in Europese visserijen. Twaalf reizen aan boord van pelagische schepen werden bemonsterd. Het is algemeen erkend dat het bemonsteren van discards een belangrijk onderdeel is van de visserij statistiek en om die reden zijn programma's voor de bemonstering van discards in een Europese context opgezet.

De Nederlandse pelagische vriestrawlervloot omvat 13 schepen in 2006 die vissen in het noordoost Atlantisch gebied op een aantal pelagische doelsoorten: haring (*Clupea harengus*), horssmakreel (*Trachurus trachurus*), makreel (*Scomber scombrus*), blauwe wijting (*Micromesistius poutassou*), grote zilversmelt (*Argentina silus*) and pelsers (*Sardina pilchardus*). In het begin van de jaren '90 werden de vangsten gedomineerd door horssmakreel, terwijl in het einde van de jaren '90 het aandeel blauwe wijting groter werd. In 2006 was de totale vangst ongeveer 230.000 ton, waarvan blauwe wijting de belangrijkste soort was. Blauwe wijting werd voornamelijk in het eerste deel van 2006 aangeland, terwijl haring voornamelijk in het tweede gedeelte van het jaar werd aangeland. Makreel werd in de winter aangeland.

Gedurende de twaalf reizen werden in totaal 424 trekken bemonsterd. De samenstelling en de hoeveelheid van doelsoorten en bijsoorten verschilde tussen de reizen. Tot de doelsoorten behoorden blauwe wijting, haring, horssmakreel, makreel en grote zilversmelt.

Gemiddeld 6% van de vangst in gewicht werd gediscard. Makreel was de belangrijkste soort in de discards met een discards percentage van 20% in gewicht. Grote zilversmelt had een discardpercentage van 9% en blauwe wijting en horssmakreel van 2%, wat lager was dan in 2005, terwijl niets van de pelsers vangsten werd aangeland tijdens de bemonsterde reizen. Haring had, daarentegen, hetzelfde discardpercentage (3%) als in voorgaande jaren (2004 en 2005). Voorzichtigheid is echter geboden met het vergelijken van discardpercentages tussen jaren vanwege het beperkte aantal bemonsterde reizen en de variatie in discards tussen deze reizen. De grote variatie in discards tussen de reizen betekent dat de opwerking van discards aantallen naar vloothoeveelheid is problematisch, met name wanneer het discarden van de vangst specifieke oorzaken heeft (beschadiging van vistuig of overboord pompen van de vangst).

# 1 Introduction

## 1.1 Pelagic freezer fishery

The Dutch fleet of freezer trawlers consisted of 13 vessels in 2006. The target species in the North East Atlantic (Figure 1) are herring (*Clupea harengus*), blue whiting (*Micromesistius poutassou*), horse mackerel (*Trachurus trachurus*), mackerel (*Scomber scombrus*), greater argentine (*Argentina silus*) and pilchard (*Sardina pilchardus*).

Pelagic freezer trawlers target schooling fish. The echo-sounding equipment on board of the trawlers provide information on the location, size and position of a shoal in the water column, which makes this fishery very efficient in targeting fish. The net is towed behind the ship. The haul duration can vary enormously. When the net is hauled in, the cod-end, which contains the catch, remains in the water. The catch is pumped out of the cod-end on board where it gets stored in cooling tanks until it can be processed. The storing capacity per tank is 20-40 tonnes.

During processing, the catch is sorted and the unwanted fish is dropped into a gutter and flushed over board. The sorted catch (landings) is transported to frosters where they are frozen into blocks of 20-25 kg fish. The duration of each fishing trip depends mainly on the catch rates and the storage capacity of the ship. The vessels usually return when the freezing stores are full. Smaller vessels make trips of 2-4 weeks, larger vessels of 5-6 weeks. A more detailed description of the fishery is given by (Couperus et al., 2004).

Differences in catch are due to changes in the behaviour of the fish or to changes in the market situation. Since the fishing companies concentrate on different markets and have different quota shares, the fleet is usually spread over a number of different areas. 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. The species composition of the landings (Figure 2) 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.

## 1.2 Discarding

Target species are kept on board while unwanted catches are thrown overboard, a practice called discarding (Van Beek, 1998; ICES, 2004). The global summed discard rate during 1992-2001 was estimated at 8 percent in weight (FAO, 2004), resulting in an estimated 7.3 million tonnes of discards worldwide. Worldwide the annual fish catch was estimated at 84 million tonnes for 1992-2001 (FAO, 2004). In general discarding rates in pelagic fisheries are considered to be low (Alverson et al., 1994; Napier et al., 1999; Pierce et al., 2002; Ter Hofstede and Dickey-Collas, 2006).

There are different reasons for discarding: fish of the wrong size or wrong species, damaged or spoiled fish, high grading, lack of space onboard or species quota reached (Morizuer et al., 1995; Napier et al., 1999; ICES, 2004). Also different ways of handling the catch during sorting can result in discards. During the normal sorting procedure of the catch on board large pelagic vessels, discards are removed from a conveyor belt with which the catch is sorted. However a large part of the total catch can also be discarded through slipping from the net after hauling or pumping the unsorted catch from cooling tanks back into the sea. The catch can also be lost due to gear damage.

## 1.3 Stock assessment

The inclusion of the discard data in stock assessments is considered to reduce bias of the assessment and thus give more realistic values of fishing mortality and biomass (ICES, 2004, 2005). However, including discard data might also increase the noise in the assessment because the quality of the discard data is generally less than for landings (Dickey-Collas et al., 2007).

## **1.4 Objectives**

The aim of this project is to monitor discarding in the Dutch pelagic trawl fisheries in the North-East Atlantic. From 2002 onwards discards data are monitored under the EC Data Collection Regulations 1543/2000 and 1639/2001 (EC., 2000, 2001; Anon., 2002; ICES, 2003). This report gives an overview of the Dutch pelagic discard sampling program for 2006.

## 2 Methods

### 2.1 General information

In 2006 a total of 12 trips were made onboard pelagic freezer trawlers. Selection of the vessels is quasi-random and is based on sampling the first vessel leaving to sea. The choice of fishing area and target species is usually a last minute decision, and may change during the trip. It is also not uncommon that during one trip several fishing and management areas are visited.

### 2.2 Sampling procedures

For each discard sampling trip one observer boarded a trawler, sampling at least 60% of the hauls (Van Beek, 2001). The total catch weight per haul was estimated from the weight of catch in the cooling tanks and the number of boxes with landings. The observer validated the estimates of the total catch by comparing the number of boxes onboard with the landings according to the observer logbook. Total discards weight per haul was derived from total catch weight and the percentage discards. The discard percentage was estimated by the distribution of landings and discards in the catch sample or 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.

For each haul a sub-sample of the catch and discards was taken and weighted. The weight of each species in the samples was recorded and all fish were measured to the cm below. Otoliths were collected from the major species for age readings. All data were entered into a computer program on haul-by-haul basis and later transported into the central database.

Sampling protocol pelagic trawler:

- 1) Estimation total catch. Registration of total catch in volume.
- 2) Take sample of unsorted catch:
  - a. Take a sample of unsorted catch (20-25 kg) (includes landings and discards). To get a representative sample, different sub-samples are taken at different moments whilst sorting the haul.
- 3) Take sample of discards.
  - a. Take a sample of discards (20-25 kg). To get a representative sample, different sub-samples are taken at different moments whilst processing the haul.
- 4) Measuring catch sample:
  - a. Sort all fish species and take length measurements. Register total number by species and length class.
- 5) Measuring discard sample:
  - a. Sort all fish species and take length measurements. Register total number by species and length class.
- 6) Age estimations of unsorted catch:
  - a. Sample of unsorted catch.
  - b. Otoliths are prepared and analysed.
  - c. The sample of age analysis consists of 'sized' and 'undersized' fish. A sample consists of minimal 3 individuals per length class per area (ICES quadrant).
- 7) Registration of total landings:
  - a. Information on total landings is collected at the end of the trip.

### 2.3 Raising procedures

Total catch weight per species and haul ( $CW_{h,s}$ ) was calculated by multiplying the estimated total catch weight ( $CW_h$ ) by the ratio of weight of the catch sample ( $CW_s$ ) to the weight of the species in the catch sample ( $CW_{h,s}$ ):

$$CW_{h,s} = CW_h * (CW_s / CW_{h,s})$$

The total numbers caught at length ( $CN_{l,h,s}$ ) were calculated per species and haul by multiplying the numbers at length in the catch sample ( $Cn_{l,h,s}$ ) by the estimated total catch weight ( $CW_h$ ) and the ratio of weight of the catch sample ( $Cw_h$ ) to the weight of the species in the catch sample ( $Cw_{h,s}$ ):

$$CN_{l,h,s} = Cn_{l,h,s} * CW_h * (Cw_h / Cw_{h,s})$$

Total numbers caught at length per species and trip ( $CN_{l,t,s}$ ) were calculated by summing the numbers at length per species over all hauls.

$$CN_{l,t,s} = \sum_h CN_{l,h,s}$$

Total discards weight per species and haul ( $DW_{h,s}$ ) was calculated by multiplying the estimated total weight of the discards ( $DW_h$ ) by the ratio of weight of the discards sample ( $Dw_h$ ) to the weight of the species in the discards sample ( $Dw_{h,s}$ ):

$$DW_{h,s} = DW_h * (Dw_h / Dw_{h,s})$$

The total numbers discarded at length ( $DN_{l,h,s}$ ) were calculated per species and haul by multiplying the numbers at length in the discards sample ( $Dn_{l,h,s}$ ) by the estimated total weight of the discards ( $DW_h$ ) and the ratio of weight of the discards sample ( $Dw_h$ ) to the weight of the species in the discards sample ( $Dw_{h,s}$ ):

$$DN_{l,h,s} = Dn_{l,h,s} * DW_h * (Dw_h / Dw_{h,s})$$

When discards were not measured (because of e.g. slipping from the net or pumping overboard), the numbers at length in the sampled part of the catch from either the same haul or hauls from the same ICES area, as well as the sample weight of the catch from these hauls, were used. The total numbers discarded at length for these hauls ( $DN_{l,h,s}$ ) were calculated per species by multiplying the numbers at length in the catch sample from other sampled haul(s) ( $Cn_{l,h,s}$ ) by the estimated total weight of the discards ( $DW_h$ ) in the not sampled part and the ratio of weight of the catch sample ( $Cw_h$ ) to the weight of the species in the catch sample ( $Cw_{h,s}$ ): from either the same hauls or other hauls where numbers at length were measured.

$$DN_{l,h,s} = Cn_{l,h,s} * DW_h * (Cw_h / Cw_{h,s})$$

Total numbers discarded at length per species and trip ( $DN_{l,t,s}$ ) were calculated by summing the numbers at length per species over all hauls.

$$DN_{l,t,s} = \sum_h DN_{l,h,s}$$

Landings numbers at length per species were calculated by subtracting discards numbers at length from numbers caught at length.

$$LN_{l,t,s} = CN_{l,t,s} - DN_{l,t,s}$$



## 3 Results

### 3.1 Description of the observed trips

The target species differ by season and area (Figure 3). Blue whiting was mainly targeted during the first half of 2006, while herring was the main target during the second half of the year. Mackerel was caught in the winter. Most blue whiting came from areas VIa and VIIc, while herring was caught in areas IIa, IVa, IVb, VIa and VIId (Figure 4).

During the winter of 2006 (weeks 1-10) three trips were sampled (P29, P32 and P33). The area fished was the Baltic Sea, the south-west of Ireland, the Porcupine Bank, the south part of the Celtic Sea and the Bay of Biscay (ICES areas IIIId, VIId, VIIc, VIIh, VIIj, VIIIb, Figure 6). The target species were blue whiting, horse mackerel and mackerel. During these trips 4-6% of the estimated catch was discarded.

Three trips (P28, P31 and P36) were sampled during the spring (weeks 13-18). The area fished was the Norwegian Sea, the Northern North Sea, the Faroes Grounds, the Northwest coast of Scotland and Ireland and the Bay of Biscay, (ICES areas IIa, IVa, Vb, VIa, VIIIb, Figure 6). The target species were blue whiting, herring, mackerel, greater argentine and horse mackerel. During these trips 0-3% of the estimated catch was discarded.

Three trips (P30, P35 and P37) were sampled during the summer (weeks 25-33). The area fished was the Northern and central North Sea, the Northwest coast of Scotland and Ireland, the southwest and west of Ireland and the western English Channel (ICES areas IVa, IVb, VIa, VIId, VIIe, VIIj, Figure 6). The target species were herring and horse mackerel. During these trips 2-13% of the estimated catch was discarded.

During the autumn of 2006 (weeks 41-51) three trips (P34, P38 and P39) were sampled. The area fished was the Northern North Sea, the Northwest coast of Scotland and Ireland, the Southwest of Ireland, the Channel, the south part of the Celtic Sea and the Bay of Biscay (ICES areas IVa, VIa, VIId, VIIe, VIIh, VIIj, VIIIb, Figure 6). The target species were mackerel, horse mackerel and herring. During these trips 6-31% of the estimated catch was discarded.

### 3.2 Estimated discards from sampled trips

In 2006 the landings were about 230,000 tonnes (Table 1). During the 12 trips a total of 424 hauls were sampled, which was on average 88.9% of all the hauls during these trips (Table 2). Between 92.6% and 100% of the catch was covered by the samples taken. Haul duration ranged between 0.5 and 21 hours with an average of 4 hours (Figure 5). The composition and abundance of target and bycatch species differed between the trips. The species composition is presented in Figure 7 (catch), Figure 8 (landings) and Figure 9 (discards) per trip.

Over all 12 fishing trips about 6% of the catch in weight was discarded (Table 4). With all catches, landings and discards summed over the sampled trips, horse mackerel and blue whiting both showed a discard percentage of 2%, herring of 3%, while greater argentine and mackerel showed a discard percentage of 9% and 20% respectively (Table 5). No pilchards were landed in our observed trips. Two non-target species, black seabream (*Spondylus cantharus*) and saithe (*Polachius virens*) were landed in trips P34 and P36 respectively. Bycatches of haddock (*Melanogrammus aeglefinus*) (caught during 5 trips), whiting (*Merlangius merlangus*) (4 trips), boarfish (*Capros aper*) and grey gurnard (*Chelidonichthys gurnardus*) (3 trips), lump sucker (*Cyclopterus lumpus*) and norway pout (*Trisopterus esmarkii*) (2 trips), and blackfish (*Centrolophus niger*), deal-fish (*Trachipterus arctus*), hake (*Merluccius merluccius*), john dory (*Zeus faber*), oar-fish (*Regalecus glesne*), snake pipefish (*Entelurus aequoreus*) and ribbon barracudina (*Arctozenus risso*) (1 trip) were all discarded.

The length frequency distributions of landed and discarded fish are presented in Figures 10-16 by trip and over all trips combined for herring, horse mackerel, mackerel, blue whiting, greater argentine, saithe and black seabream. For mackerel there are large differences in length frequency distributions between the different trips (Figure 12), whereas for herring, horse mackerel and blue whiting the length frequency distributions agree between the different trips sampled (Figures 10, 11, 13).

## 4 Discussion

Mackerel was the most frequently discarded species with a discards percentage of 20% in weight, followed by greater argentine at 9%, herring at 3%, and horse mackerel and blue whiting at 2%. It appears that the estimated discard percentages of herring and horse mackerel are equal to the estimated percentages that were reported for 2005 while the estimated discard percentage of blue whiting is lower (5% in 2005 against 2% in 2006). Compared to 2005 where no greater argentine discards were observed, 9% discards was observed in 2006. However, care must be taken when interpreting these percentages. While all pilchards were discarded in the sampled trips, the recorded total annual landings of the fleet in 2006 were 770 t (Table 1). This indicates that pilchards were landed in small quantities in other trips not covered by the sampling programme. Therefore caution should always be paid while interpreting discard percentages. In addition, attention must be paid when comparing discard percentages between years, because of the limited number of trips sampled and the variability in discarding between trips.

The seasonal and spatial patterns for target species in 2006 (Figures 3 and 4) are similar to previous years. Blue whiting was the target species in the first half of the year while herring was the most important species during the second half of the year.

The average haul duration of the sampled trips in 2006 increased by half an hour in comparison with 2004 (3.5 hours in 2004 compared to 4 hours in 2006). In 2004 the longest haul took 9 hours (Van Keeken et al., 2005) whereas in 2006 a total of 42 hauls exceeded a 9 hours duration. Trips P28 and P36, mainly directed to blue whiting, were responsible for the longer haul durations (Figure 5). With the use of sensors attached to the net, it is possible for the skipper to roughly estimate the contents of the net when it is still in the water. When the catch is low he may decide to leave the net out which will result in longer haul durations.

A high variability in the length frequency distribution for mackerel was observed between trips (Figure 12). During trips P30, P34, P35 and P37 all mackerel catches were discarded. This may be explained by the fact that there was a lack of quota. It is also possible that the fish did not have the desired quality (e.g. they were damaged) or they were undersized (minimum landing size = 30 cm). The discard percentage over all trips for mackerel presented in this report (20%) is half the percentage that was estimated for 2005 (56%). The estimated 20% for 2006 is within the same range as the percentages that were estimated in 2002, 2003 and 2004. As the high estimated percentage in 2005 (56%) was caused by one trip, during which a lot of undersized mackerel was discarded, this estimation may be regarded an outlier.

In the observer trips it still is a problem that a substantial part of the discards is missed. During the observed trips it occasionally happened that the catch was discarded before sorting took place, an incident that is usually referred to as slippage. In such occasions the weight of the unsorted discarded catch was estimated by the observer. It was, unfortunately, not possible to determine the composition and the length frequency distribution of the discarded catch. Several assumptions were made in order to correct for this. Firstly, it was assumed that when a part of the catch within a haul was discarded before sorting took place, the species composition of this part of the catch was similar to the species composition of the sorted part of the catch. Secondly, when the entire catch within a haul was discarded, it was assumed that the composition of this catch was similar to the composition of catch originating from the same trip and area but from a different haul. It remains questionable whether this is the right way to tackle this problem. It would therefore be advisable to look into this.

In this report it has been shown that the overall discard percentage for the Dutch pelagic freezer fishery in 2006 has been estimated at 6%. It is good to see that this is almost equal to the desired discard percentage of 5% of the Pelagic Freezer Association.

## Acknowledgements

We would like to thank the skippers and crew of the sampled vessels for their co-operation with the project. We would also like to thank Mario Stoker, Bram Couperus, Thomas Pasterkamp, Martien Warmerdam, Ronald Bol and Anne van Duyn for their hard work on board of the vessels.

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## 6 Tables and figures

**Table 1.** Landings (tonnes) per species and ICES area by the Dutch freezer trawler fleet in 2006. For areas see Figure 1.

| Species        | Ila          | IVa          | IVb          | IVc          | Vb          | Vla          | Vlb         | VIIb        | VIIc         |
|----------------|--------------|--------------|--------------|--------------|-------------|--------------|-------------|-------------|--------------|
| Argentines     |              |              |              |              |             | 1062         |             |             |              |
| Herring        | 11244        | 34265        | 9738         | 120          | 95          | 6771         |             | 353         |              |
| Horse mackerel |              | 1929         | 1088         | 11980        |             | 1361         |             | 6850        | 19           |
| Mackerel       | 2            | 4016         |              |              |             | 7126         |             | 1781        |              |
| Pilchard       |              |              |              |              |             |              |             |             |              |
| Blue whiting   | 1168         | 208          |              |              | 1288        | 42300        | 3082        |             | 33097        |
| <b>Total</b>   | <b>12414</b> | <b>40418</b> | <b>10826</b> | <b>12100</b> | <b>1383</b> | <b>58620</b> | <b>3082</b> | <b>8984</b> | <b>33116</b> |

| Species        | VIIId        | VIIe        | VIIg       | VIIh        | VIIj        | VIIk       | VIIlb       | Total         |
|----------------|--------------|-------------|------------|-------------|-------------|------------|-------------|---------------|
| Argentines     |              |             |            |             |             |            |             | 1062          |
| Herring        | 13381        |             | 113        | 10          | 185         |            |             | 76275         |
| Horse mackerel | 3649         | 6840        |            | 5841        | 3822        |            | 5745        | 49124         |
| Mackerel       |              |             |            | 89          | 5991        |            | 447         | 19452         |
| Pilchard       | 339          | 336         |            | 93          |             |            | 2           | 770           |
| Blue whiting   |              |             |            |             |             | 129        |             | 81272         |
| <b>Total</b>   | <b>17369</b> | <b>7176</b> | <b>113</b> | <b>6033</b> | <b>9998</b> | <b>129</b> | <b>6194</b> | <b>227955</b> |

**Table 2.** Overview of sampling per trip.

| Trip nr | Number of hauls during the trip | Number of hauls sampled | % of hauls sampled | % of total catch covered | Average sample size of total catch in kg (dev.) | Average sample size of discards in kg (dev.) |
|---------|---------------------------------|-------------------------|--------------------|--------------------------|-------------------------------------------------|----------------------------------------------|
| P28     | 36                              | 35                      | 97.2               | 97.1                     | 9.9 (0.8)                                       |                                              |
| P29     | 31                              | 28                      | 90.3               | 94.3                     | 14.7 (6.1)                                      | 3.2 (2.8)                                    |
| P30     | 42                              | 39                      | 92.9               | 98.7                     | 19.4 (4.7)                                      | 10.7 (4.1)                                   |
| P31     | 14                              | 6                       | 42.9               | 100.0                    | 27.6 (8.4)                                      | 9.1 (5.8)                                    |
| P32     | 43                              | 32                      | 74.4               | 92.6                     | 31.8 (9.1)                                      | 11.5 (12.6)                                  |
| P33     | 34                              | 33                      | 97.1               | 99.7                     | 19.1 (4.3)                                      | 8.3 (5.0)                                    |
| P34     | 50                              | 40                      | 80                 | 96.6                     | 17.2 (2.9)                                      | 7.8 (4.4)                                    |
| P35     | 44                              | 38                      | 86.4               | 97.5                     | 21.6 (2.0)                                      | 7.4 (9.2)                                    |
| P36     | 55                              | 53                      | 96.4               | 99.5                     | 20.4 (2.5)                                      | 6.3 (5.1)                                    |
| P37     | 59                              | 54                      | 91.5               | 98.6                     | 21.9 (1.2)                                      | 4.5 (2.5)                                    |
| P38     | 35                              | 33                      | 94.3               | 98.4                     | 26.0 (2.3)                                      | 13.8 (4.5)                                   |
| P39     | 34                              | 33                      | 97.1               | 99.9                     | 29.6 (11.6)                                     | 9.1 (9.2)                                    |
| All     | 477                             | 424                     | 88.9%              |                          |                                                 |                                              |

**Table 3.** Period, target species and ICES area's of the trips conducted during this observer programme.

| Trip | Period        | Species landings                                   | ICES area's                |
|------|---------------|----------------------------------------------------|----------------------------|
| P28  | 07/04 – 30/04 | Blue whiting                                       | VIa                        |
| P29  | 18/02 – 07/03 | Horse mackerel, mackerel, blue whiting             | III d                      |
| P30  | 24/07 – 15/08 | Herring, horse mackerel                            | IVa, VIa, VIIb, VIIe, VIIj |
| P31  | 27/03 – 08/04 | Horse mackerel, mackerel                           | VIII b                     |
| P32  | 30/01 – 20/02 | Horse mackerel, mackerel, Blue whiting             | VIIb, VIIc, VIIj           |
| P33  | 02/01 – 22/01 | Horse mackerel, mackerel                           | VIIb, VIIh, VIIIb, VIIj    |
| P34  | 31/10 – 22/11 | Herring, horse mackerel                            | VII d, VIIe, VIIh, VIIIb   |
| P35  | 19/06 – 05/07 | Herring                                            | IVa, IVb                   |
| P36  | 28/04 – 06/06 | Greater argentine, herring, mackerel, blue whiting | IIa, IVa, Vb, VIa          |
| P37  | 05/07 – 05/08 | Herring                                            | IVa, VIa                   |
| P38  | 09/10 – 30/10 | Herring, mackerel                                  | IVa                        |
| P39  | 27/11 – 23/12 | Horse mackerel, mackerel                           | VIa, VIIb, VII d, VIIj     |

**Table 4.** Total catch, landings, discards (tonnes) and discard percentage per trip

|     | Greater<br>argentine | Herring | Horse<br>mackerel | Mackerel | Pilchard | Blue whiting | Others | Total  |
|-----|----------------------|---------|-------------------|----------|----------|--------------|--------|--------|
| P28 | Catch                |         |                   |          |          | 3475.0       |        | 3475.0 |
|     | Landings             |         |                   |          |          | 3475.0       |        | 3475.0 |
|     | Discards             |         |                   |          |          | 0.0          |        | 0.0    |
|     | % Discards           |         |                   |          |          | 0%           |        | 0%     |
| P29 | Catch                |         | 76.6              | 632.2    | 0.1      | 3155.7       | 2.5    | 3867.1 |
|     | Landings             |         | 54.7              | 542.6    | 0.0      | 3036.7       | 0.0    | 3634.0 |
|     | Discards             |         | 21.9              | 89.6     | 0.1      | 119.0        | 2.5    | 233.1  |
|     | % Discards           |         | 29%               | 14%      | 100%     | 4%           | 100%   | 6%     |
| P30 | Catch                | 1399.2  | 792.7             | 142.1    | 3.3      | 1.5          | 16.3   | 2355.1 |
|     | Landings             | 1257.8  | 792.7             | 0.0      | 0.0      | 0.0          | 0.0    | 2050.5 |
|     | Discards             | 141.4   | 0.0               | 142.1    | 3.3      | 1.5          | 16.3   | 304.6  |
|     | % Discards           | 10%     | 0%                | 100%     | 100%     | 100%         | 100%   | 13%    |
| P31 | Catch                |         | 37.5              | 458.0    |          |              |        | 495.5  |
|     | Landings             |         | 36.1              | 449.9    |          |              |        | 486.0  |
|     | Discards             |         | 1.4               | 8.1      |          |              |        | 9.5    |
|     | % Discards           |         | 4%                | 2%       |          |              |        | 2%     |
| P32 | Catch                |         | 352.9             | 551.3    |          | 3529.5       |        | 4433.7 |
|     | Landings             |         | 348.2             | 478.9    |          | 3382.2       |        | 4209.3 |
|     | Discards             |         | 4.7               | 72.4     |          | 147.3        |        | 224.4  |
|     | % Discards           |         | 1%                | 13%      |          | 4%           |        | 5%     |
| P33 | Catch                |         | 2541.4            | 836.4    | 36.4     |              | 2.8    | 3417.0 |
|     | Landings             |         | 2528.4            | 747.1    | 0.0      |              | 0      | 3275.5 |
|     | Discards             |         | 13.0              | 89.3     | 36.4     |              | 2.8    | 141.5  |
|     | % Discards           |         | 1%                | 11%      | 100%     |              | 100%   | 4%     |
| P34 | Catch                | 97.3    | 1471.7            | 76.5     | 39.7     |              | 34.0   | 1719.2 |
|     | Landings             | 97.3    | 1416.9            | 0.0      | 0.0      |              | 2.0    | 1516.2 |
|     | Discards             | 0.0     | 54.8              | 76.5     | 39.7     |              | 32.0   | 203.0  |
|     | % Discards           | 0%      | 4%                | 100%     | 100%     |              | 94%    | 12%    |

Table 4. Continued.

|           |            | Greater<br>argentine | Herring | Horse<br>mackerel | Mackerel | Pilchard | Blue whiting | Others | Total  |
|-----------|------------|----------------------|---------|-------------------|----------|----------|--------------|--------|--------|
| P35       | Catch      |                      | 1787.9  | 0.0               | 25.5     |          |              | 8.3    | 1821.7 |
|           | Landings   |                      | 1787.9  | 0.0               | 0.0      |          |              | 0.0    | 1787.9 |
|           | Discards   |                      | 0.0     | 0.0               | 25.5     |          |              | 8.3    | 33.8   |
|           | % Discards |                      | 0%      |                   | 100%     |          |              | 100%   | 2%     |
| P36       | Catch      | 193.8                | 655.9   |                   | 29.4     |          | 2692.7       | 31.8   | 3603.6 |
|           | Landings   | 176.0                | 643.3   |                   | 8.2      |          | 2676.8       | 9.5    | 3513.8 |
|           | Discards   | 17.8                 | 12.6    |                   | 21.2     |          | 15.9         | 22.3   | 89.8   |
|           | % Discards | 9%                   | 2%      |                   | 72%      |          | 1%           | 72%    | 3%     |
| P37       | Catch      |                      | 3835.0  |                   | 48.4     |          |              | 14.2   | 3897.6 |
|           | Landings   |                      | 3759.0  |                   | 0.0      |          |              | 0.0    | 3759.0 |
|           | Discards   |                      | 76.0    |                   | 48.4     |          |              | 14.2   | 138.6  |
|           | % Discards |                      | 2%      |                   | 100%     |          |              | 100%   | 4%     |
| P38       | Catch      |                      | 371.4   | 0.3               | 2652.8   |          |              | 3.2    | 3027.7 |
|           | Landings   |                      | 336.4   | 0.0               | 2504.1   |          |              | 0.0    | 2840.5 |
|           | Discards   |                      | 35.0    | 0.3               | 148.7    |          |              | 3.2    | 187.2  |
|           | % Discards |                      | 9%      | 100%              | 6%       |          |              | 100%   | 6%     |
| P39       | Catch      |                      | 5.4     | 966.1             | 605.6    | 0.0      |              |        | 1577.1 |
|           | Landings   |                      | 0.0     | 962.4             | 124.4    | 0.0      |              |        | 1086.8 |
|           | Discards   |                      | 5.4     | 3.7               | 481.2    | 0.0      |              |        | 490.3  |
|           | % Discards |                      | 100%    | 0%                | 79%      |          |              |        | 31%    |
| All trips | Catch      | 193.8                | 8152.1  | 6239.2            | 6058.2   | 79.5     | 12854.4      | 113.1  | 33686  |
|           | Landings   | 176.0                | 7881.7  | 6139.4            | 4855.2   | 0.0      | 12570.7      | 11.5   | 31633  |
|           | Discards   | 17.8                 | 270.4   | 99.8              | 1203.0   | 79.5     | 283.7        | 101.6  | 2053   |
|           | % Discards | 9%                   | 3%      | 2%                | 20%      | 100%     | 2%           | 90%    | 6%     |



**Table 5.** Total catch, landings and discards (tonnes) summed over sampled trips with number of trips.

| Name               | Dutch name          | Catch   | Landings | Discards | Percentage | N trips |
|--------------------|---------------------|---------|----------|----------|------------|---------|
| Greater argentine  | Grote zilversmelt   | 193.8   | 176.0    | 17.8     | 9%         | 1       |
| Herring            | Haring              | 8152.1  | 7881.7   | 270.4    | 3%         | 7       |
| Horse mackerel     | Horsmakreel         | 6239.2  | 6139.4   | 99.8     | 2%         | 9       |
| Mackerel           | Makreel             | 6058.2  | 4855.2   | 1203.0   | 20%        | 11      |
| Pilchard           | Pelser              | 79.5    | 0.0      | 79.5     | 100%       | 5       |
| Blue whiting       | Blauwe wijting      | 12854.4 | 12570.7  | 283.7    | 2%         | 5       |
| Black seabream     | Zeekarper           | 2.2     | 2.0      | 0.2      | 9%         | 1       |
| Blackfish          | Zwart vis           | 0.5     | 0.0      | 0.5      | 100%       | 1       |
| Boarfish           | Evervis             | 43.8    | 0.0      | 43.8     | 100%       | 3       |
| Deal-fish          | Bandvis             | 1.0     | 0.0      | 1.0      | 100%       | 1       |
| Grey gurnard       | Grauwe poon         | 2.6     | 0.0      | 2.6      | 100%       | 3       |
| Haddock            | Schelvis            | 21.7    | 0.0      | 21.7     | 100%       | 5       |
| Hake               | Heek                | 0.7     | 0.0      | 0.7      | 100%       | 1       |
| John Dory          | Zonnevis            | 0.1     | 0.0      | 0.1      | 100%       | 1       |
| Lumpsucker         | Snotolf             | 0.8     | 0.0      | 0.8      | 100%       | 2       |
| Norway pout        | Kever               | 5.8     | 0.0      | 5.8      | 100%       | 2       |
| Oar-fish           | Riemvis             | 0.8     | 0.0      | 0.8      | 100%       | 1       |
| Saithe             | Zwarte koolvis      | 21.7    | 9.5      | 12.2     | 56%        | 3       |
| Snake pipefish     | Adderzeenaald       | 0.1     | 0.0      | 0.1      | 100%       | 1       |
| Whiting            | Wijting             | 10.2    | 0.0      | 10.2     | 100%       | 4       |
| Ribbon barracudina | Risso's barracudina | 0.0     | 0.0      | 0.0      |            | 1       |

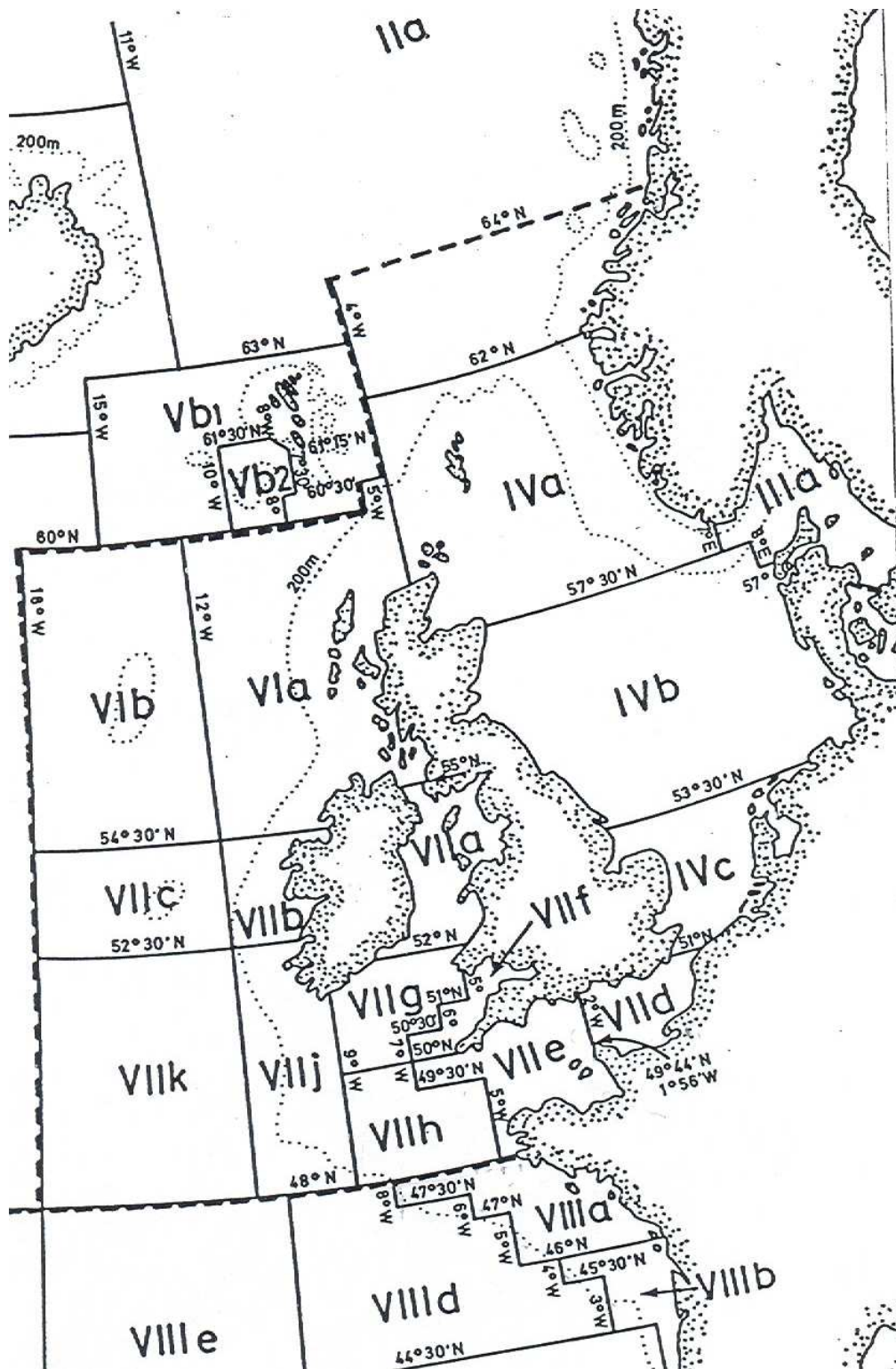


Figure 1. Map of ICES rectangles.

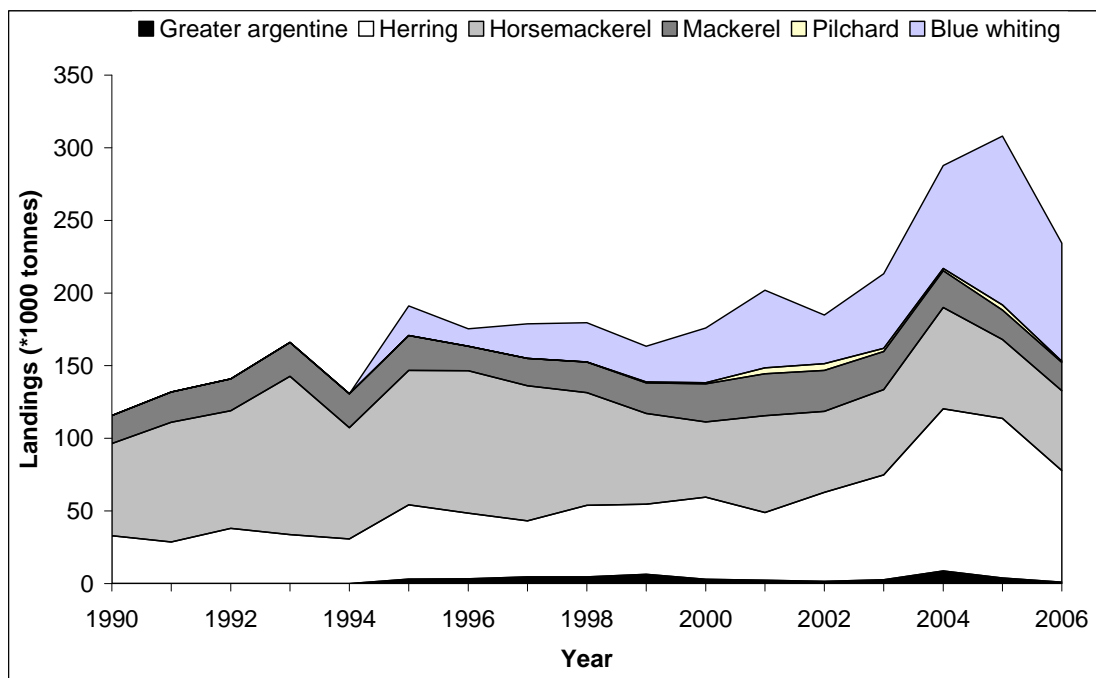
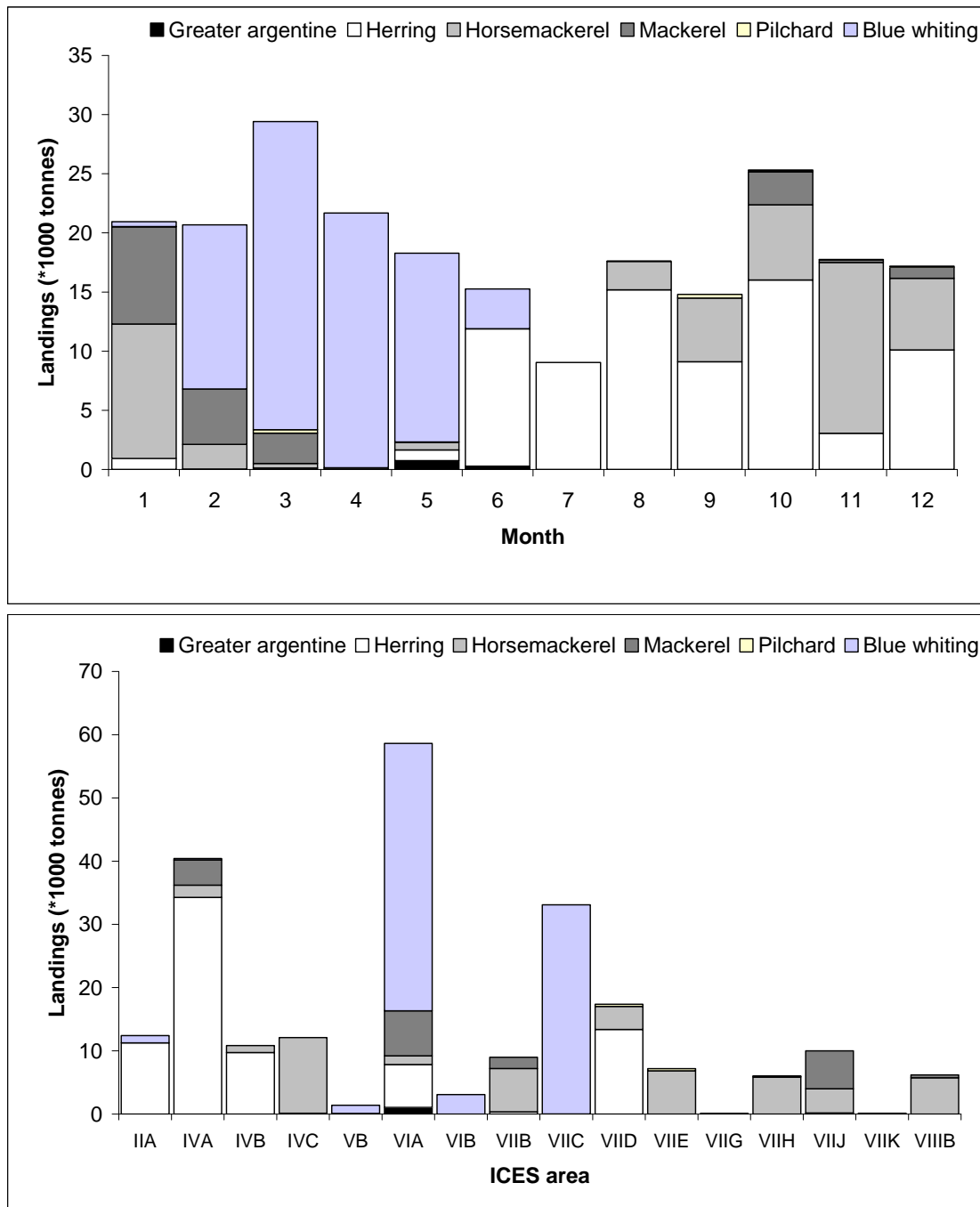
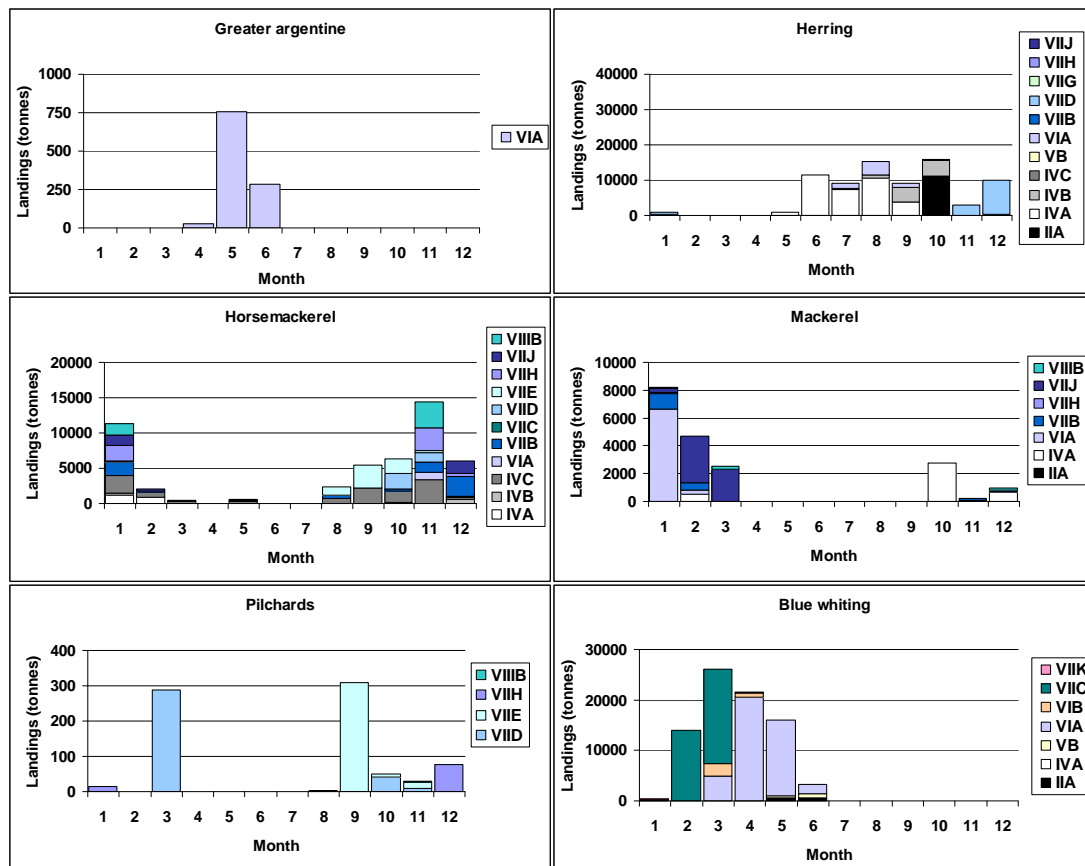


Figure 2. Landings from the Dutch freezer trawler fleet during 1990-2006 by species. Data from VIRIS database.



**Figure 3.** Landings (\*1000 tonnes) from the Dutch freezer trawler fleet during 2006. Upper panel shows monthly landings by species, lower panel shows landings per ICES area (Figure 1) by species. Data from the VIRIS database.



**Figure 4.** Monthly landings in tonnes per species from the Dutch freezer trawler fleet during 2006 for the most important ICES rectangles (Figure 1). Data from the VIRIS database.

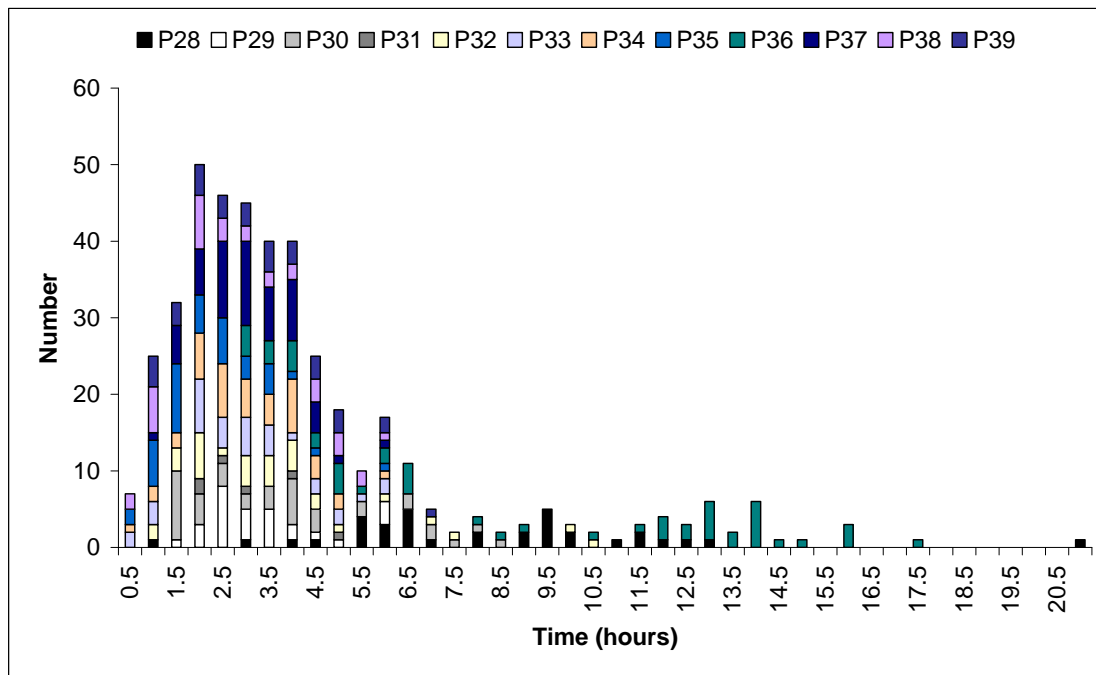


Figure 5. Frequency of haul durations.

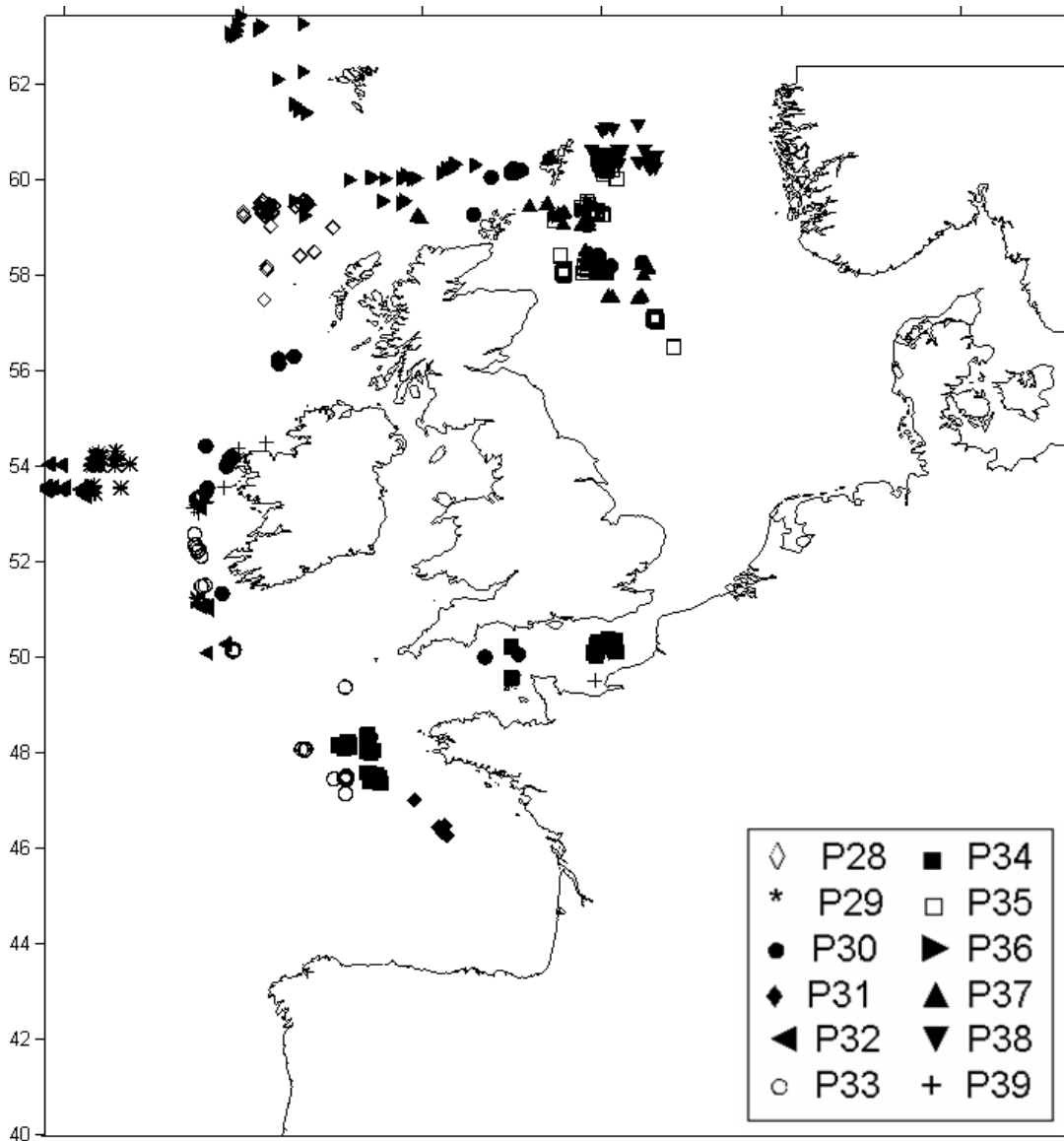


Figure 6. Trawl positions per haul for each trip.

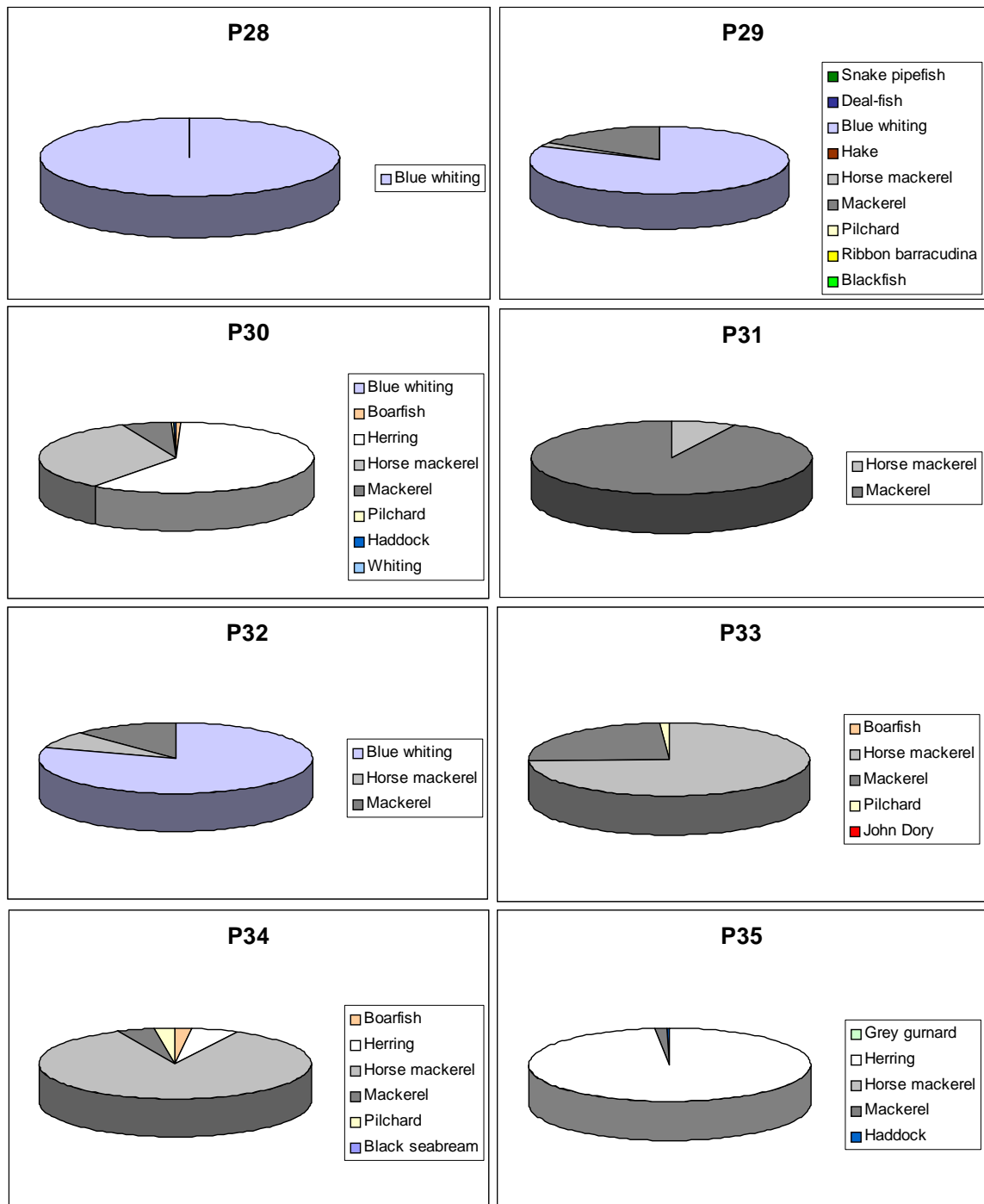


Figure 7. Composition of the total catches per trip.



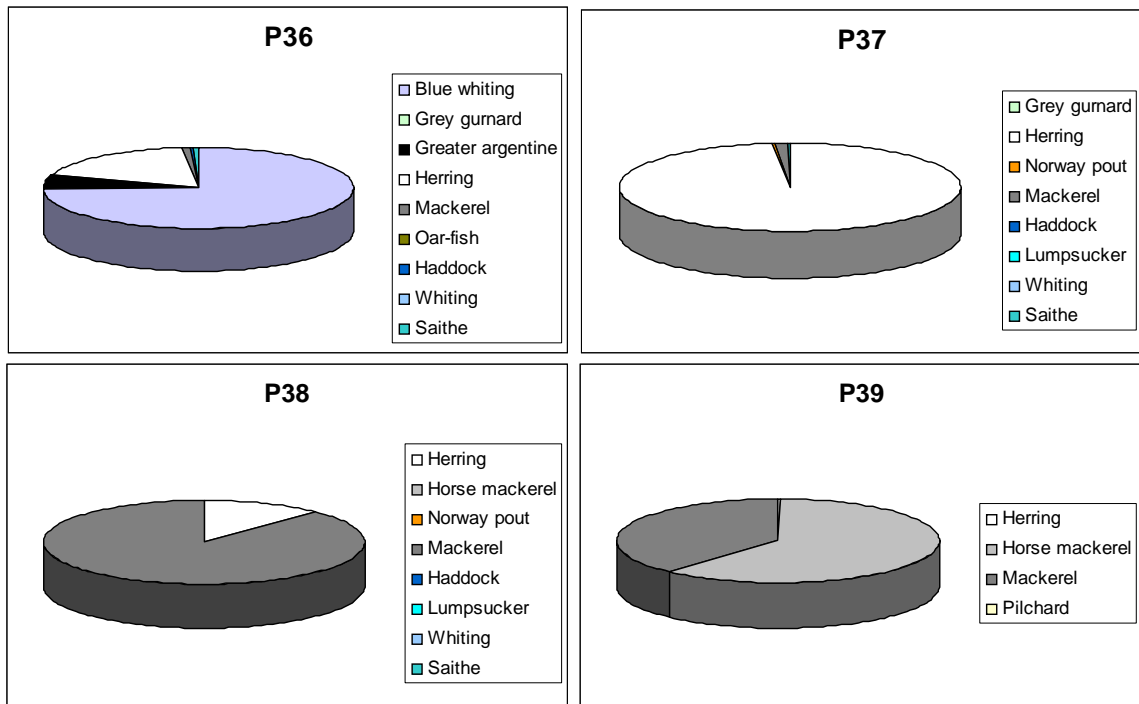


Figure 7. Continued.

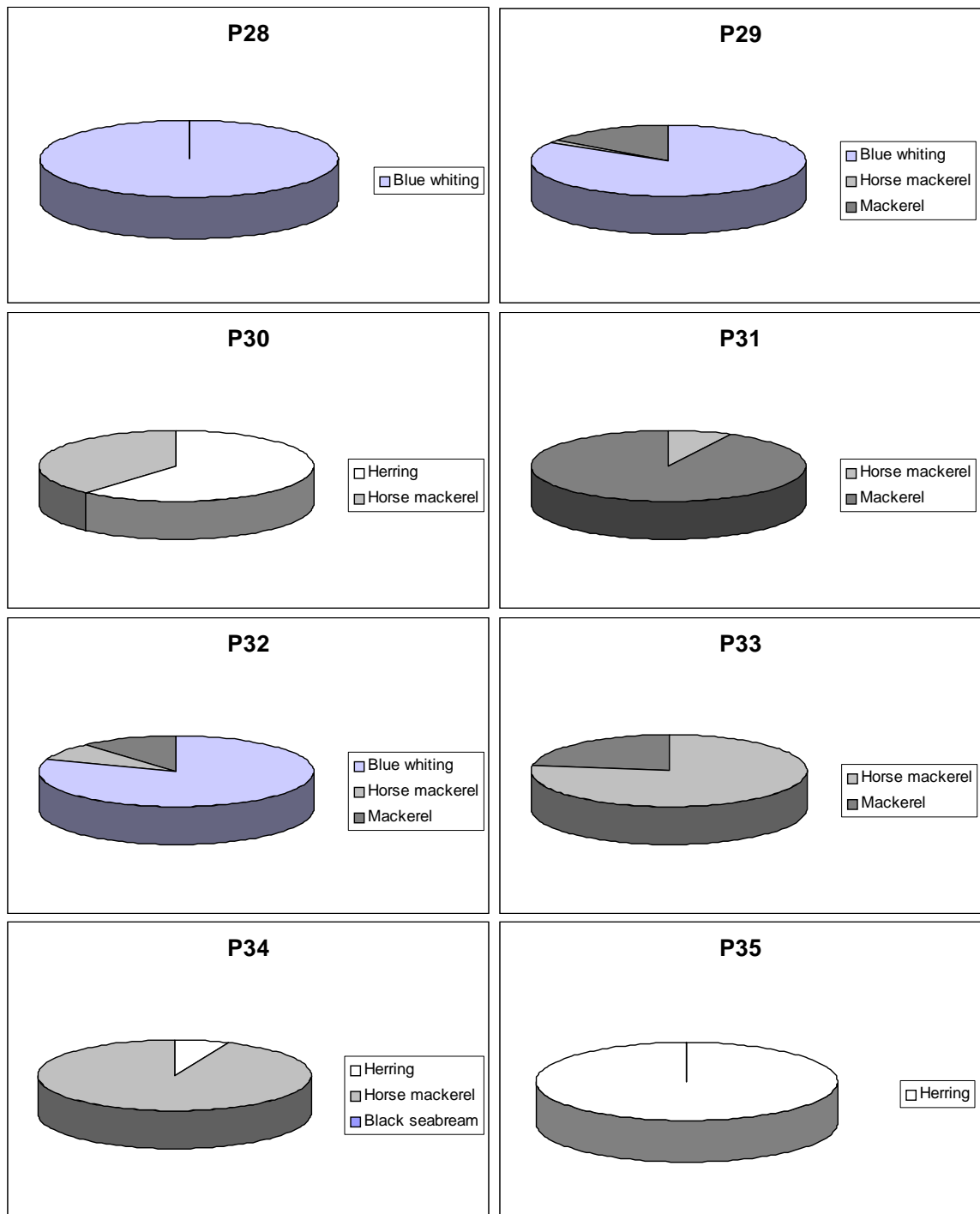


Figure 8. Composition of the landings per trip.

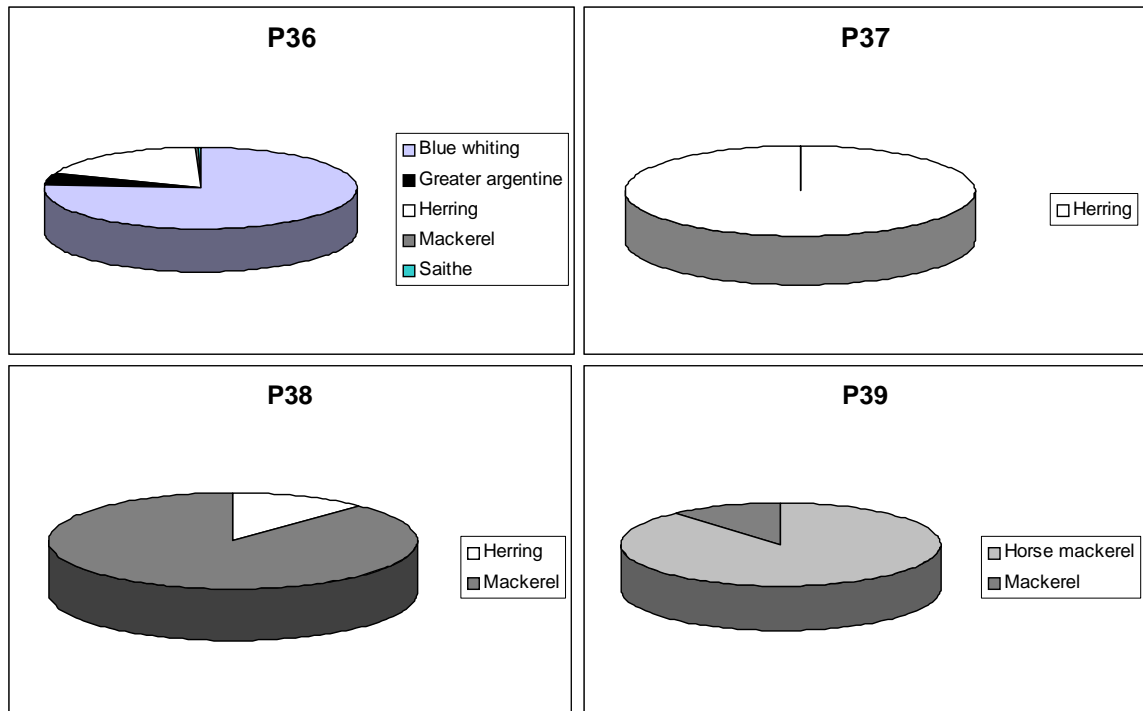


Figure 8. Continued.

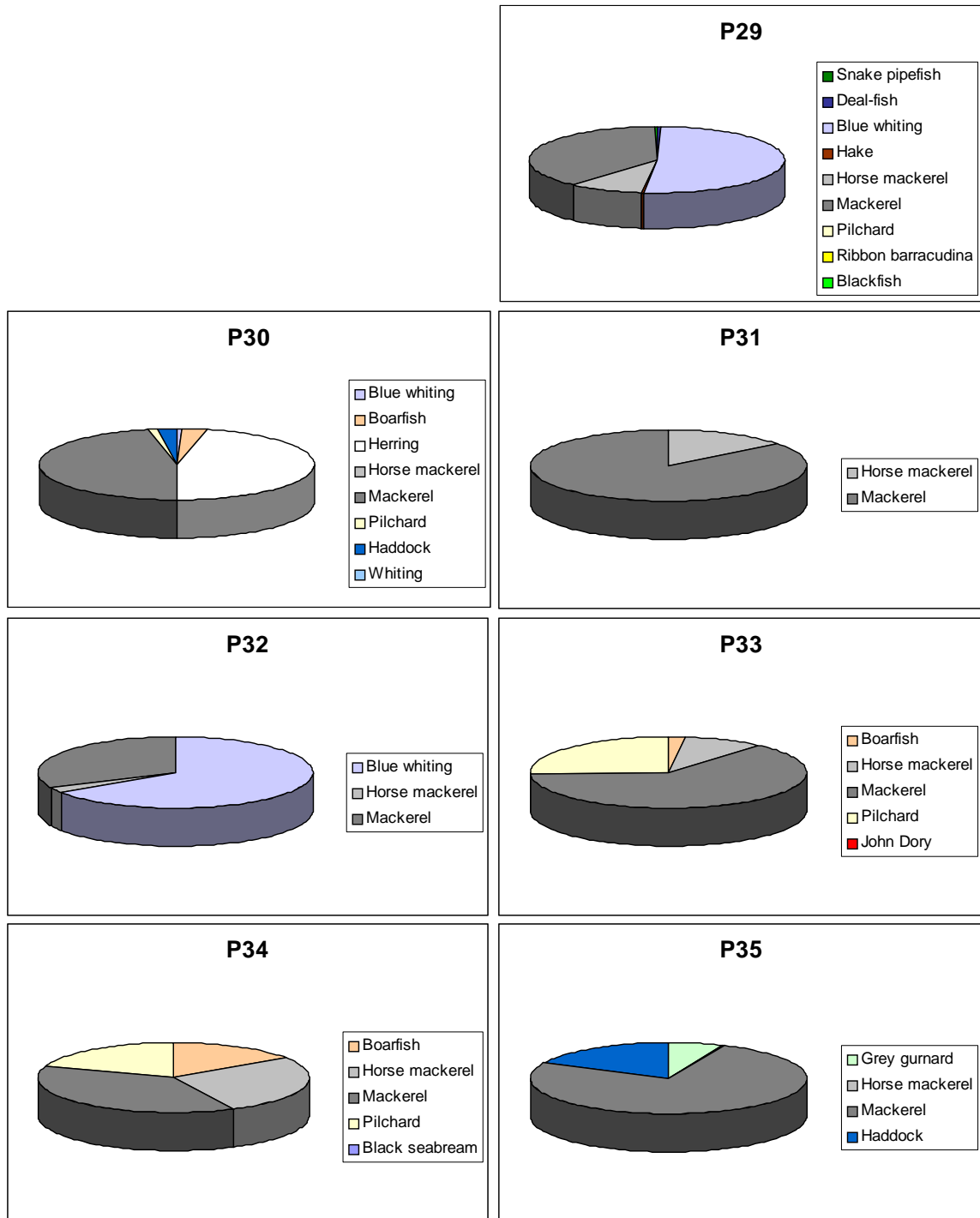


Figure 9. Composition of the discards per trip.

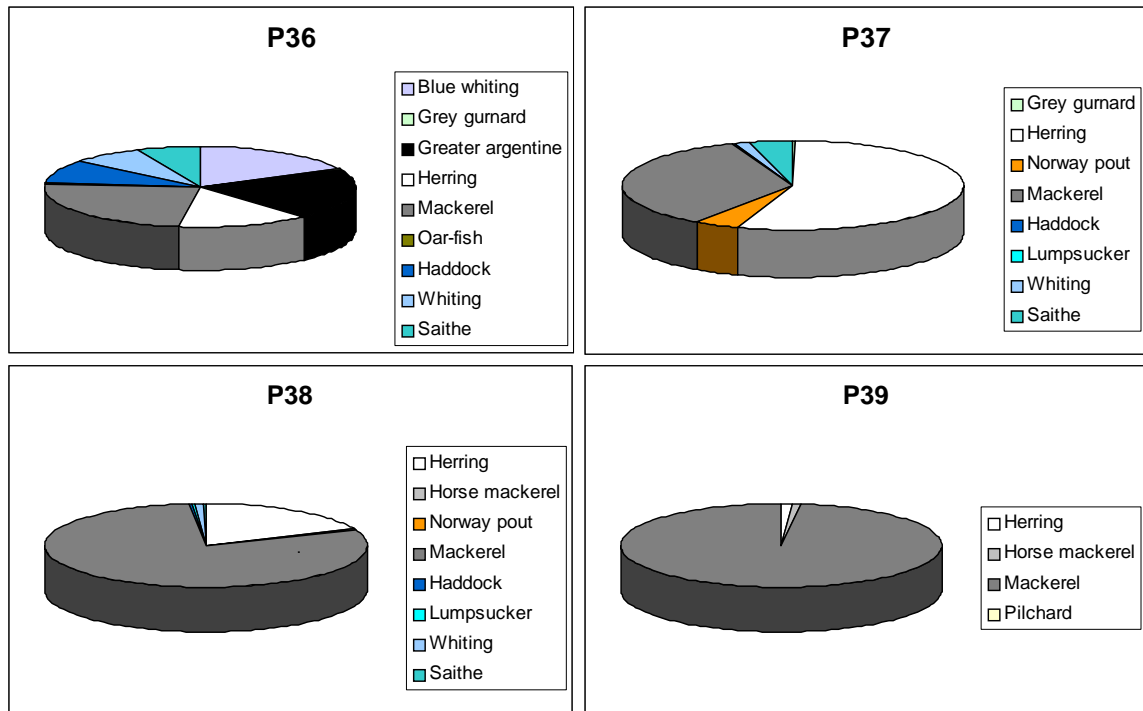


Figure 9. Continued.

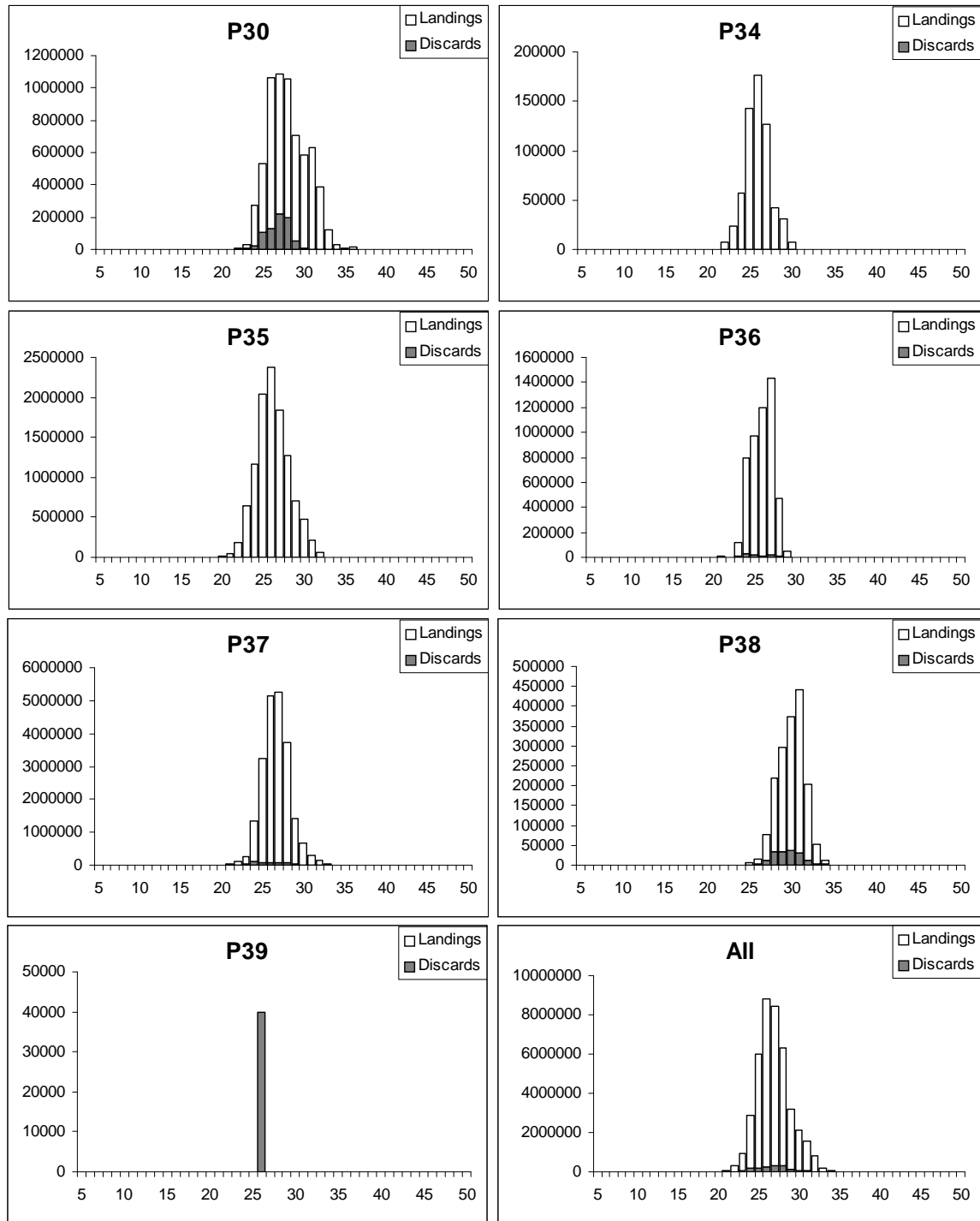
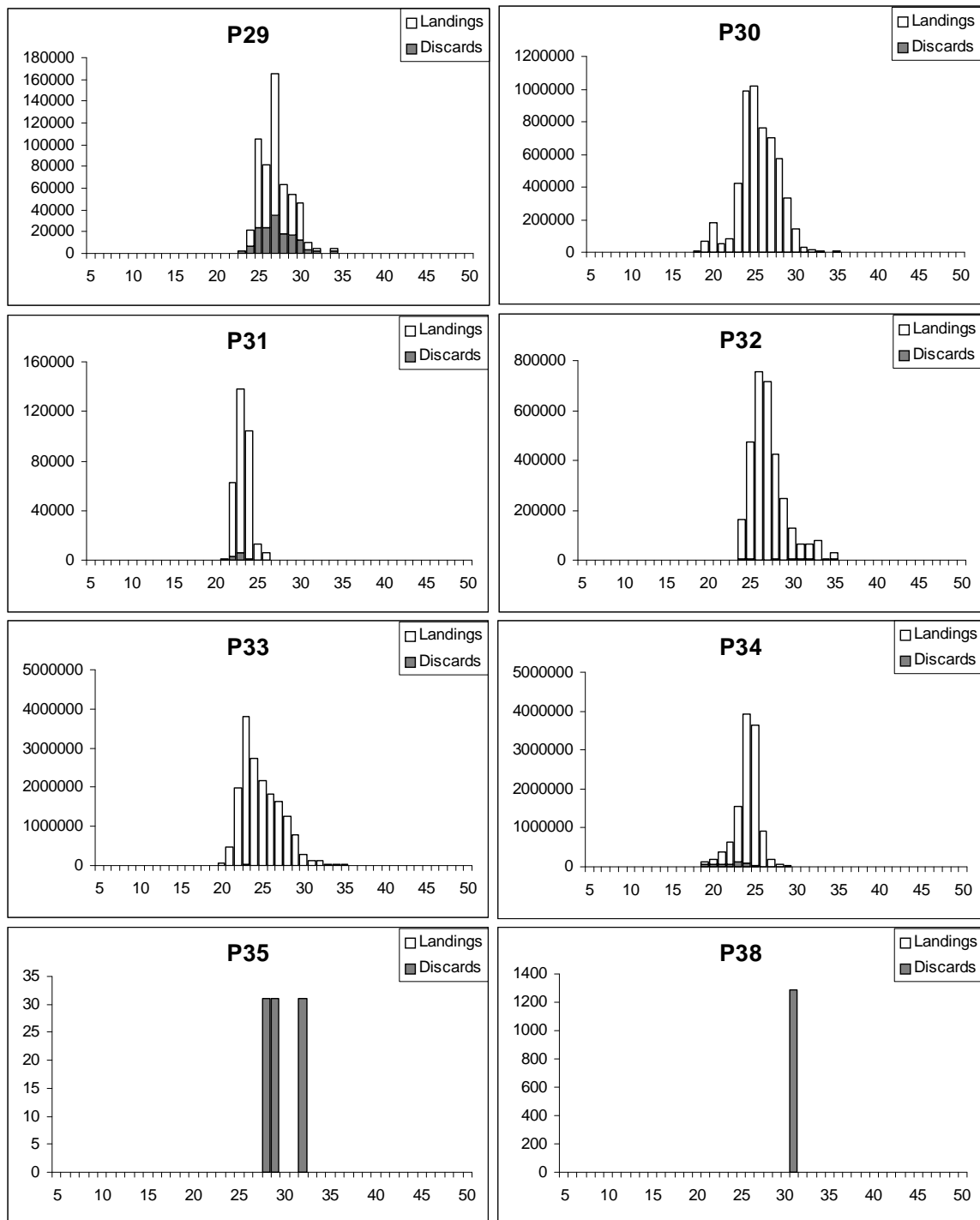


Figure 10. Numbers of herring landed and discarded against length (cm) per trip and for all trips combined.



**Figure 11.** Numbers of horse mackerel landed and discarded against length (cm) per trip and for all trips combined.

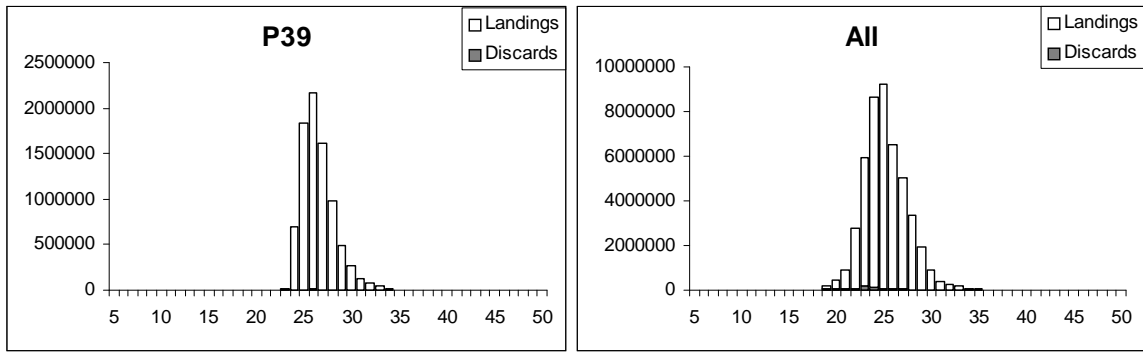


Figure 11. Continued.



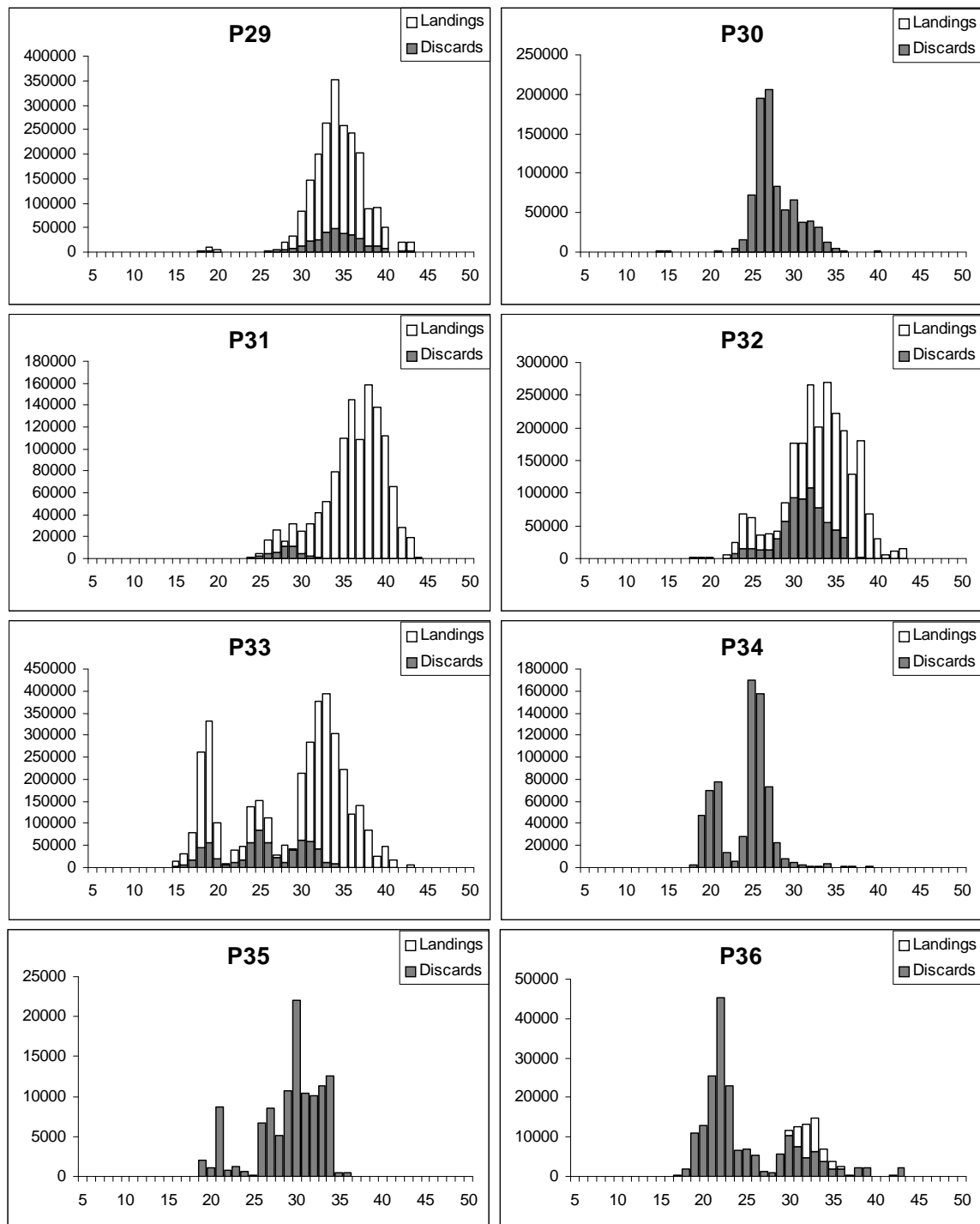


Figure 12. Numbers of mackerel landed and discarded against length (cm) per trip and for all trips combined.

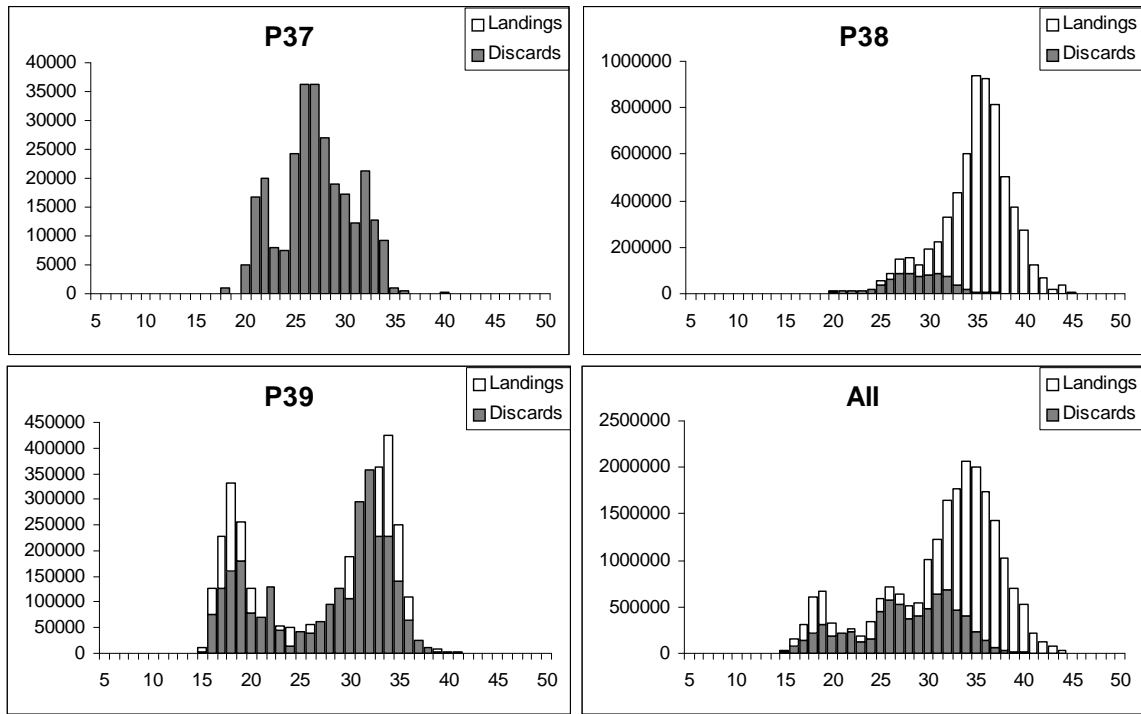


Figure 12. Continued.

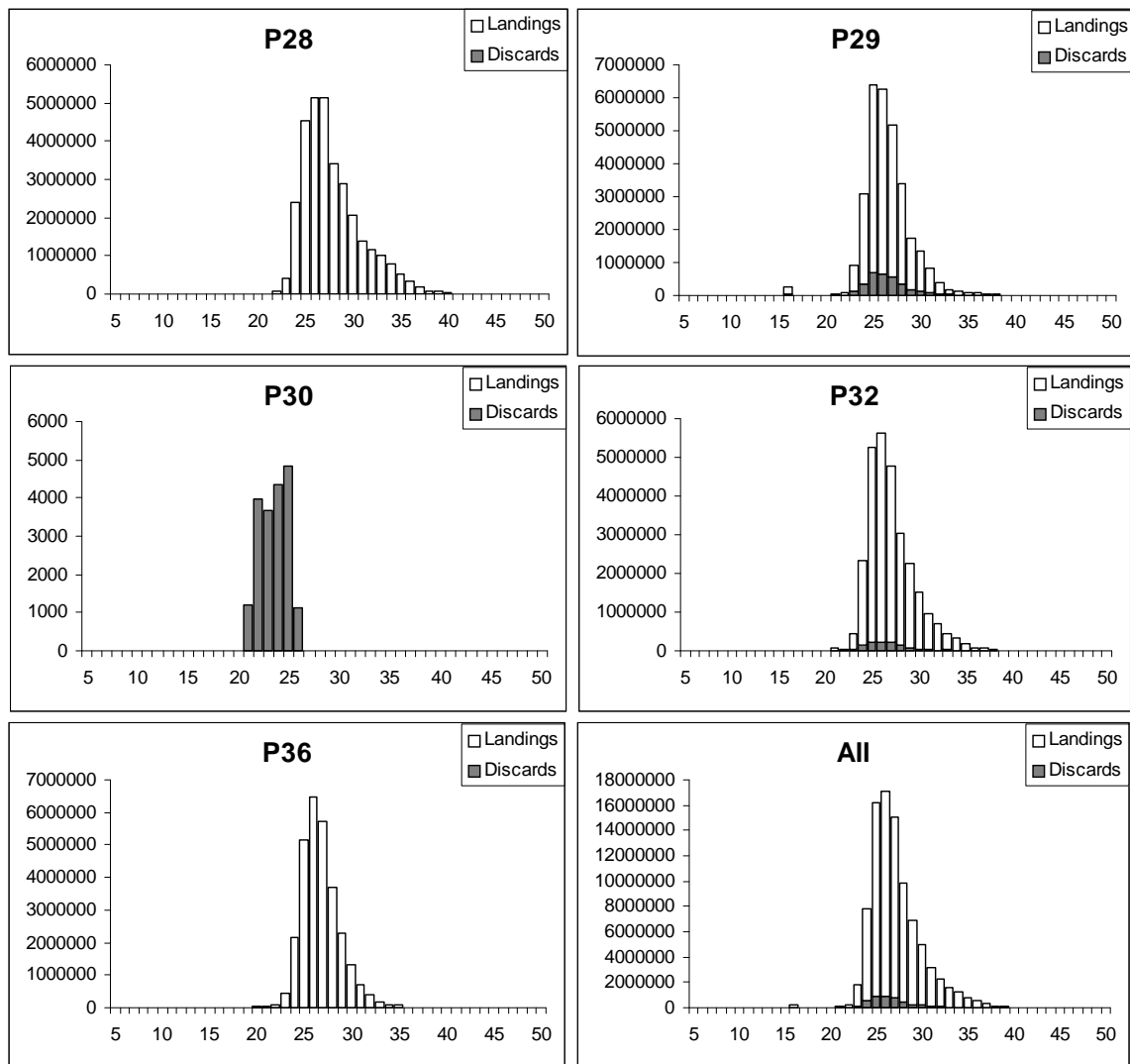
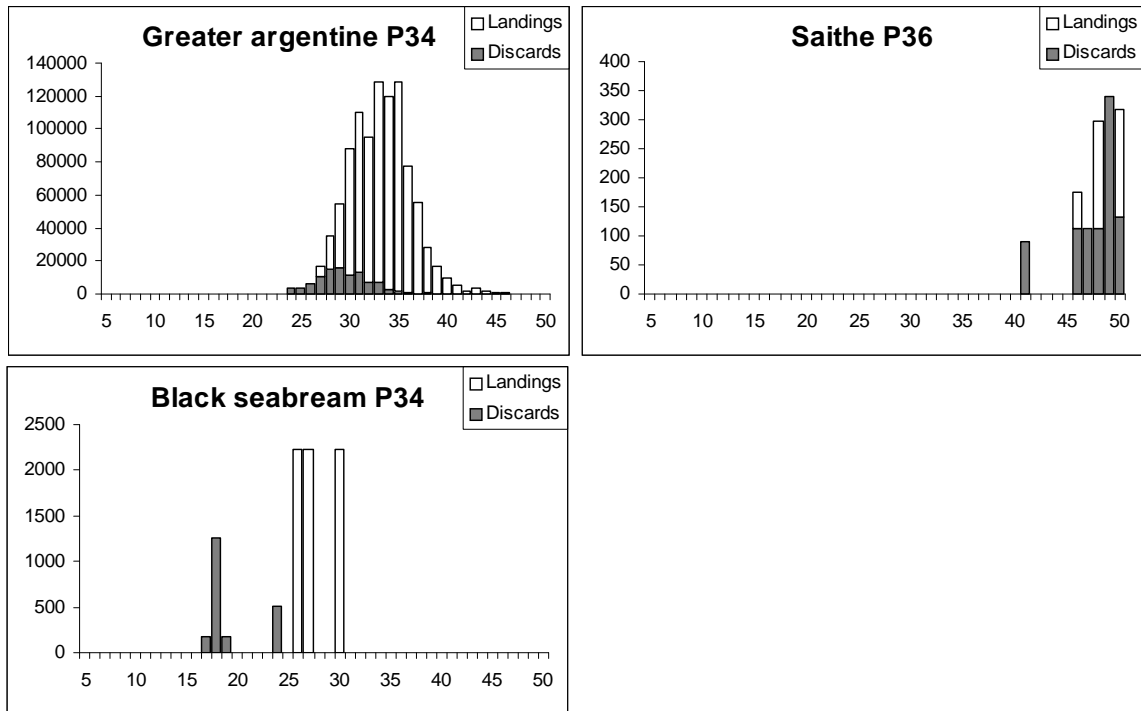


Figure 13. Numbers of blue whiting landed and discarded against length (cm) per trip and for all trips combined.



**Figure 14.** Numbers of greater argentine, saithe and black seabream landed and discarded against length (cm) for trips P34 and P36.

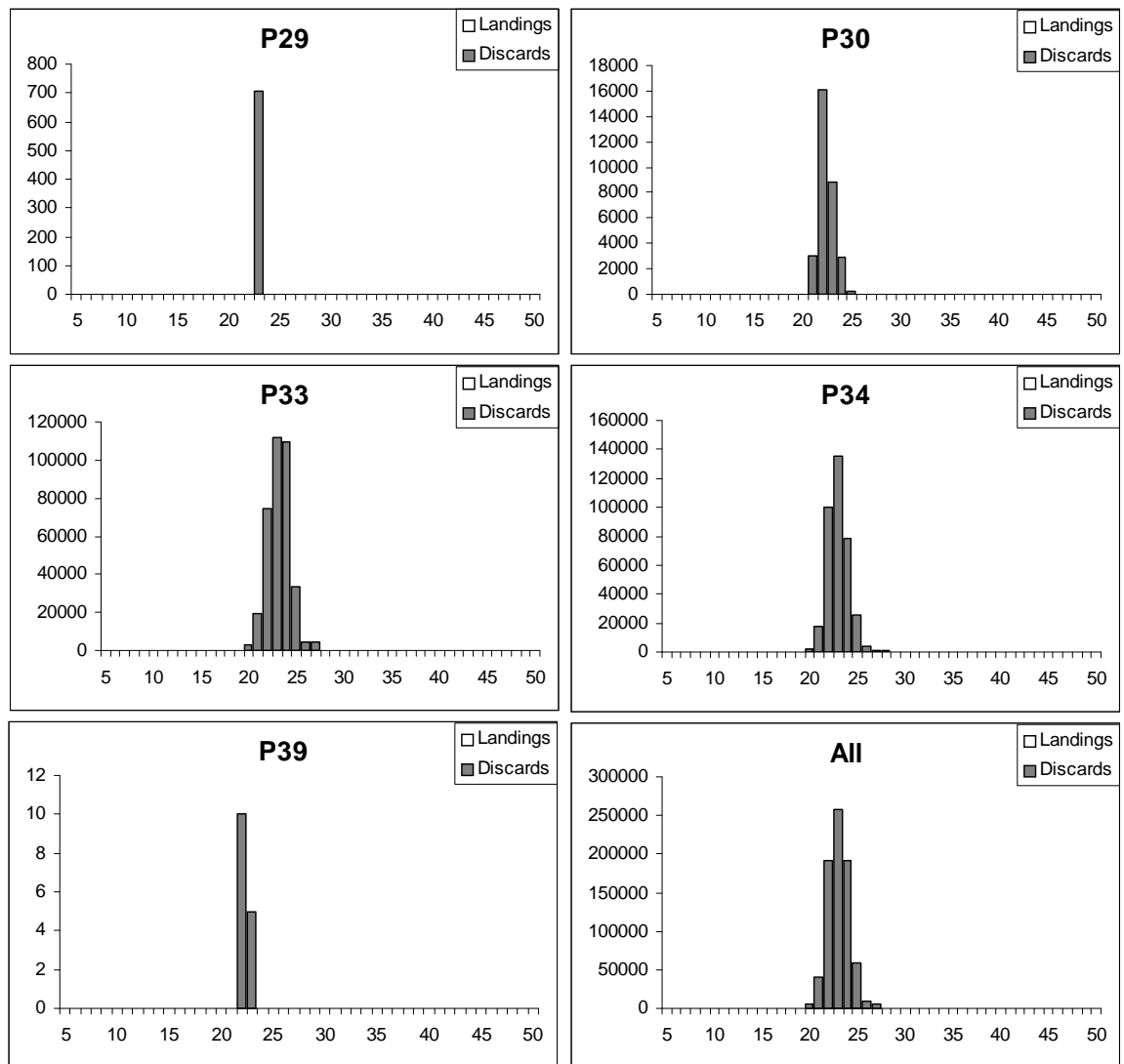


Figure 15. Numbers of pilchards landed and discarded against length (cm) per trip and for all trips combined.

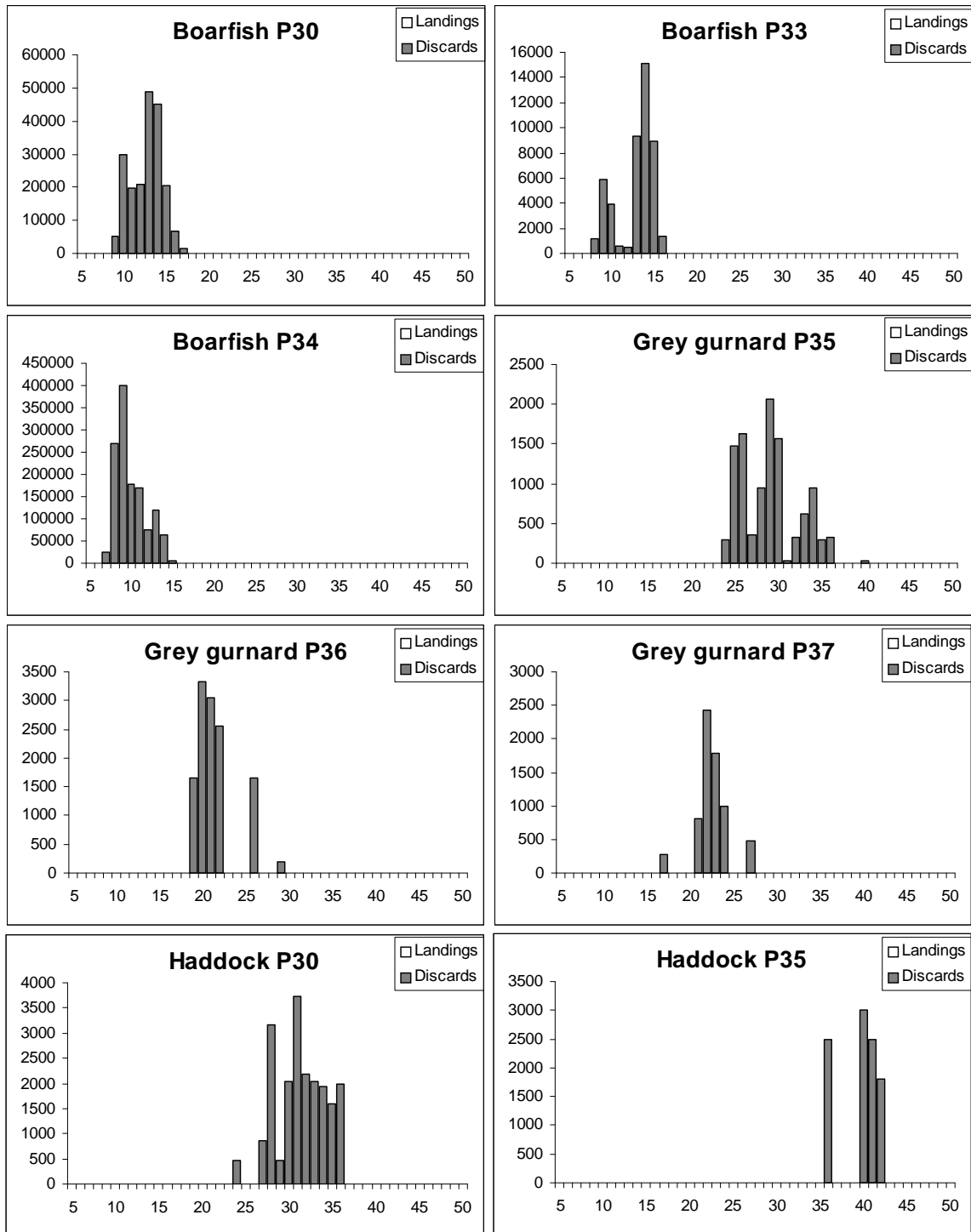


Figure 16. Number discards against length (cm) per trip for discarded species.

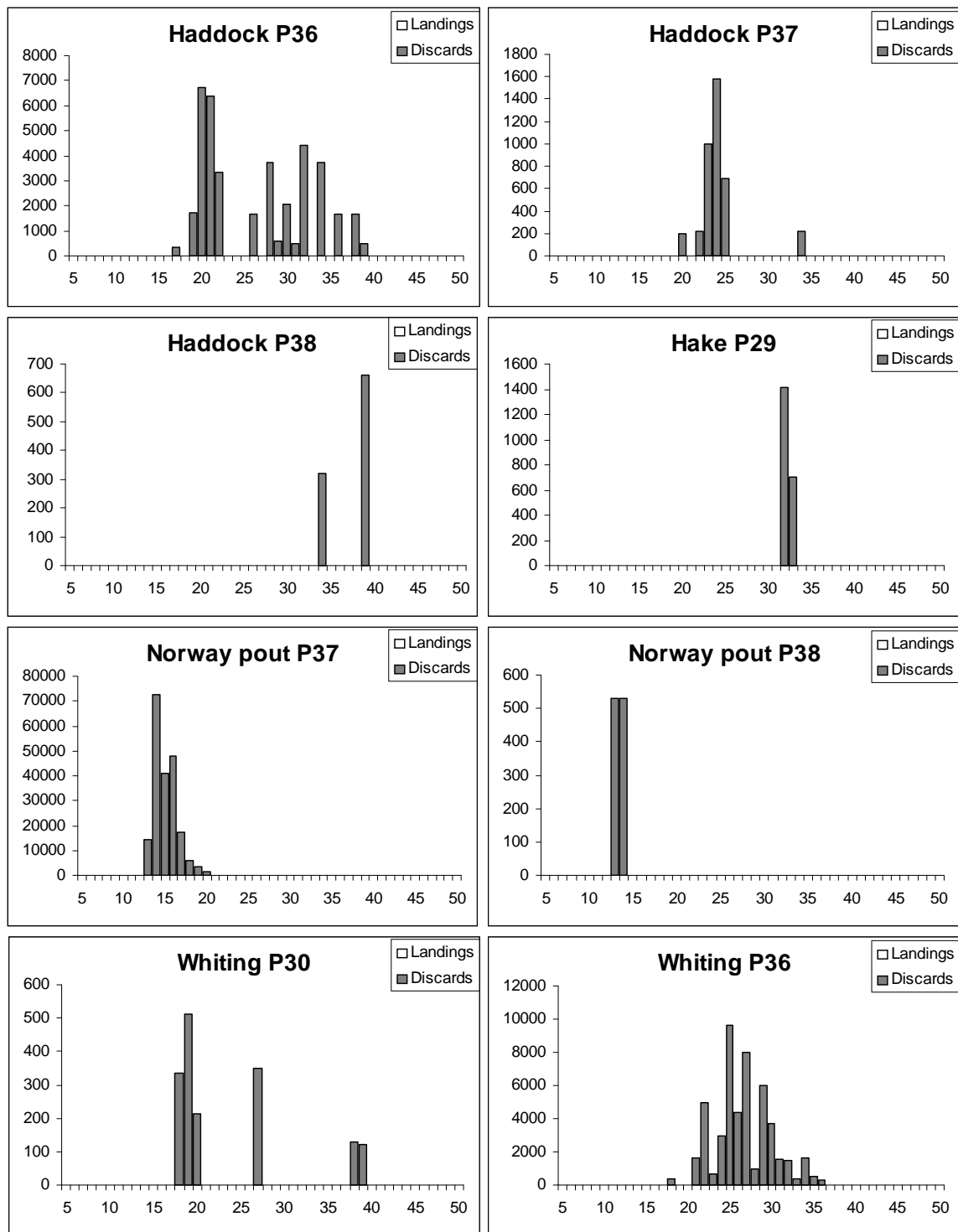


Figure 16. Continued.

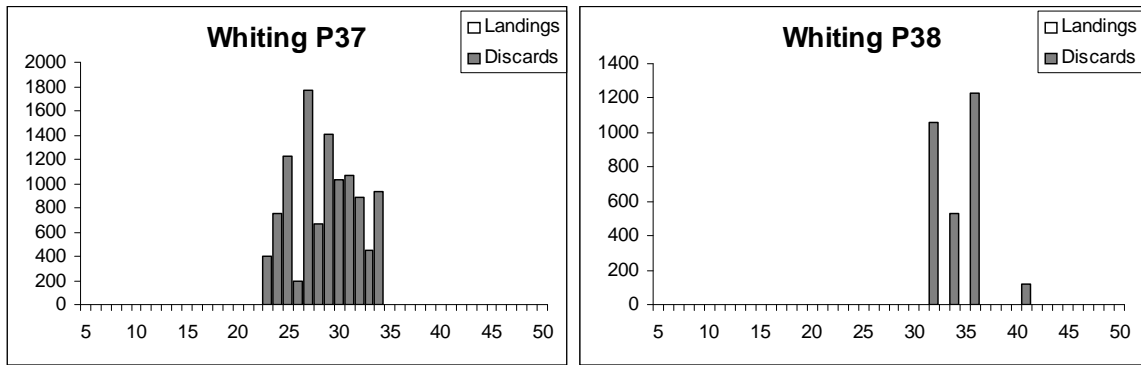


Figure 16. Continued.