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Discard sampling of the Dutch pelagic freezer fishery in 2004

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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 2004, which was instigated as part of the EC regulations 1543/2000 and 1639/2001 on data collection in European fisheries. Six trips on board of pelagic vessels were sampled, of which one was with a pelagic pair trawl. 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 sampling is carried out as a pilot-survey (see annex of EC 1639/2001, chapter III, E1c).

The Dutch fleet of freezer trawlers fishing in the North East Atlantic consists of 15 vessels 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 2004 the catch was about 300.000 tonnes with herring as the most important species. Blue whiting was mainly targeted during the first half of 2004, herring during the second half, while horse mackerel and mackerel were targeted during the winter.

During the six trips a total of 212 hauls were sampled. The composition and abundance of target and bycatch species differed between the trips. Two trips targeted blue whiting northwest and west of Ireland during winter-spring, two trips targeted herring in the North Sea during the summer, one trip targeted horse mackerel in the English Channel during the autumn and one trip targeted horse mackerel and herring west of Brittany during autumn.

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. Herring and horse mackerel showed a discard percentage of 3%, blue whiting of 4%, which were lower than in 2002 while pilchards and greater argentine showed discard percentages of 47% and 40%, which were higher than in 2002. 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. pumping or slippage).

Samenvatting

Dit rapport bevat de resultaten van het discards bemonsteringsprogramma van de Nederlandse pelagische visserij in het noordoost Atlantisch gebied in 2004, dat is opgezet als invulling van EC regelingen 1543/2000 en 1639/2001 voor gegevensverzameling in Europese visserijen. Zes reizen aan boord van pelagische schepen werden bemonsterd, waarvan één schip pelagische spanvisserij beoefende. Het is algemeen erkend dat het bemonsteren van discards een belangrijk onderdeel is de visserij statistiek en om die reden zijn programma's voor de bemonstering van discards in een Europese context opgezet. De bemonstering werd uitgevoerd als een "pilot-survey" (zie annex van EC 1639/2001, hoofdstuk III, E1c)

De Nederlandse pelagische vriestrawlervloot omvat 15 schepen die vissen in het noordoost Atlantisch gebied op een aantal pelagische doelsoorten: haring (*Clupea harengus*), horsmakreel (*Trachurus trachurus*), makreel (*Scomber scombrus*), blauwe wijting (*Micromesistius poutassou*), grote zilversmelt (*Argentina silus*) and pelser (*Sardina pilchardus*). In het begin van de jaren '90 werden de vangsten gedomineerd door horsmakreel, terwijl in het einde van de jaren '90 het aandeel blauwe wijting groter werd. In 2004 was de totale vangst ongeveer 300.000 ton, waarvan haring de belangrijkste soort was. Blauwe wijting werd voornamelijk in het eerste deel van 2004 aangeland, terwijl haring voornamelijk in het tweede gedeelte van het jaar werd aangeland. Horsmakreel en makreel werden voornamelijk in de winter aangeland.

Gedurende de zes reizen werden in totaal 212 trekken bemonsterd. De samenstelling en de hoeveelheid van doelsoorten en bijsoorten verschilde tussen de reizen. Gedurende twee reizen in de winter/voorjaar werd gevist op blauwe wijting noordwest en west van Ierland, tijdens twee reizen werd gevist op haring in de Noordzee gedurende de zomer, tijdens één reis in het najaar werd gevist op horsmakreel in het Engelse Kanaal, en tijdens één reis in het najaar werd gevist op horsmakreel en haring ten westen van Britannië.

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. Haring en horsmakreel hadden een discardspercentage van 3% en blauwe wijting van 4%, wat lager was dan in 2002, terwijl pelser en grote zilversmelt discardspercentages had van 47% and 40%, wat hoger was dan in 2002. Voorzichtigheid is echter geboden met het vergelijken van discardspercentages 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 discards van de vangst specifieke oorzaken heeft (overboord pompen of uit het net laten lopen van de vangst).

1. Introduction

Most pelagic fisheries target schooling fish. 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; Hofstede and Dickey-Collas, In Press).

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 (Morizur 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.

The Dutch fleet of freezer trawlers fishing in the North East Atlantic 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*). Herring has been a relatively constant part of the Dutch pelagic landings since 1990. In the early 1990s, the landings were dominated by horse mackerel whereas in the latter part of the 1990s an increase in blue whiting was observed. The fishing areas differ by season and to a lesser extent by year. Differences 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 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 2004, which was carried out as a pilot-survey (see annex of EC 1639/2001, chapter III, E1c).

2. Methods

2.1 Sampling procedures

In 2004 a total of 6 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. The duration of each fishing trip depends mainly on the catch rates and 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).

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.

2.2 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_p) to the weight of the species in the catch sample ($CW_{h,s}$):

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

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_p) and the ratio of weight of the catch sample (CW_p) to the weight of the species in the catch sample ($CW_{h,s}$):

$$CN_{l,h,s} = Cn_{l,h,s} * CW_h * (CW_p / CW_{h,s})$$

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.

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

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 Fleet description

The Dutch fleet of freezer trawlers consists of 15 vessels. 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*). In 2004 the catch was about 300.000 tonnes (Table 1). The species composition of the catches (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, and was the most important species in 2004 (Table 1).

The target species differed by season (Figure 3 upper panel) and area (Figure 3 lower panel, Figure 4). Blue whiting was mainly targeted during the first half of 2004, while herring was mainly targeted during the second half. Horse mackerel was mainly caught in the winter while mackerel was mainly landed during the first three months. Most blue whiting came from area VIa, while herring was mainly caught in areas IIa, IVa, IVb and VIID (Figure 4).

3.2 Sampling

In 2004 a total of six trips were made onboard pelagic freezer trawlers, of which one was with a pair trawl. During the 6 trips a total of 212 hauls were sampled, which was on average 86.2% of all the hauls during these trips (Table 2). Between 73% and 99.8 % of the catch was covered by the samples taken. Haul duration ranged between 0.5 and 9 hours with an average of 3.5 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.

Trip P10. Winter/spring. Area fished was the west of Ireland along the continental shelf (ICES areas VIa, VIb and VIc, Figure 6), target species were blue whiting, mackerel and horse mackerel (Table 3, Figure 8). The estimated total catch was 3820 tons, of which around 7% was discarded (Table 4). Gear damage occurred during three occasions for an estimated total of 130 tonnes. Discards comprised apart from the target species also of boarfish, haddock and whiting (Table 4, Figure 9).

Trip P11. Spring. Area fished was the northwest and west of Ireland along the continental shelf (ICES area VIa, Figure 6), target species was blue whiting, with some landings of greater argentine (Table 3, Figure 8). The estimated total catch was 2219 tons, of which around 3% was discarded (Table 4). Discards comprised mainly of blue whiting (65%) and greater argentine (30%) (Table 4, Figure 9).

Trip P12. Summer. Area fished was the northern North Sea (ICES area IVa, Figure 6), target species was herring (Table 3, Figure 8). For this fishery a pair trawl was used. The estimated total catch was 404 tons, of which around 2% was discarded (Table 4). Discards comprised of mackerel, herring and haddock (Table 4, Figure 9). Pumping part of the catch back into the sea happened on one occasion for an estimated total of 4 tonnes.

Trip P13. Summer. Area fished was the northern and central North Sea (ICES areas IVa, IVb, Figure 6), target species was herring (Table 3, Figure 8). The estimated total catch was 4060 tons, of which around 7% was discarded (Table 4). Herring was discarded most followed by mackerel (Figure 9). Pumping part of the catch back into the sea happened on one occasion for an estimated total of 55 tonnes.

Trip P14. Autumn. Area fished was the English channel (ICES areas IVc, VIId and VIle, Figure 6), target species was horse mackerel (Table 3, Figure 8). The estimated total catch was 1533 tons, of which around 8% was discarded (Table 4). Discards comprised of mackerel, horse mackerel and pilchards (Table 4, Figure 9).

Trip P15. Autumn. Area fished was west of Brittany (ICES areas VIId, VIle and VIIf, Figure 6), target species were herring and horse mackerel (Table 3, Figure 8). The estimated total catch was 2699 tons, of which around 5% was discarded (Table 4). Discards comprised mainly of pilchards, with also horse mackerel and herring (Table 4, Figure 9).

Overall six fishing trips about 6% of the catch in weight was discarded (Table 4). With all catches, landings and discards summed over the sampled trips, herring and horse mackerel showed a discard percentage of 3%, blue whiting of 4%, while mackerel showed a discards percentage of 20% (Table 5). About half of the blue whiting discards came from gear damage, while 28% of the herring discards came from pumping (Figure 10). Pilchards and greater argentine showed discards percentages of 47% and 40% respectively. On one trip also white seabream was landed, showing a discard percentage of 16% during this trip. Bycatches of haddock (caught during 3 trips), hake and whiting (2 trips), and boarfish, grey gurnard and silver pomfret (1 trip), in total 87 tonnes, were all discarded.

Length frequency distributions of landed and discarded fish are presented in Figures 11-17 by trip and over all trips combined for herring, horse mackerel, mackerel, blue whiting, pilchards, greater argentine and sea bream. Length frequency distributions of fish that are only discarded are presented in Figure 18. For mackerel there are large differences in length frequency distributions between the different trips (Figure 13), whereas for blue whiting the length frequency distributions agree between both trips sampled (Figure 14).

4. Discussion

The Discards sampling program for the Dutch pelagic fleet in 2004 was instigated as part of the EC regulations 1543/2000 and 1639/2001 on data collection in European fisheries. Results of six discard trips that were carried out onboard of Dutch pelagic vessels fishing in the North East Atlantic were presented. The sampling was carried out as a pilot-survey (see annex of EC 1639/2001, chapter III, E1c).

Overall 6% of the total catch was discarded in the sampled trips in 2004. Mackerel was the most frequently discarded species with a discards percentage of 20% in weight, blue whiting was discarded at 4%, while herring and horse mackerel were discarded at 3%. In 2002 mackerel was discarded at around 50% (data from 4 trips ranging between 14%-92%) (Couperus et al., 2004), with most mackerel discards sorted from the catch. In 2002 herring was discarded at 12%, however this percentage was derived from only one trip when most discards were pumped overboard during few occasions. Discards for blue whiting and horse mackerel were lower than in 2002 (10% and 15% in 2002) while for pilchards and greater argentinines the percentages were higher (27% and 17% in 2002 against 47% and 40% in 2004). 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 reasons for discarding different parts of the catch in the pelagic fishery are highly variable (Alverson et al., 1994; Morizur et al., 1995; Berrow et al., 1998; Napier et al., 1999; Pierce et al., 2002; Hofstede and Dickey-Collas, In Press). For some species the major part of the discard fraction consist of undersized or damaged fish (Morizur et al., 1995). While most of the discards were sorted for all species in the 2004 Dutch pelagic discard sampling program, slippage or pumping back into the sea could also results in large quantities of discarding (e.g. for herring). Most observed discarding in the Scottish and Norwegian herring/mackerel fishery in northern EU and Norwegian waters (ICES areas IVa and VIa) during the end of the 1990's was due to slippage of bycatch species (e.g. discarding of mackerel during herring fishery due to limited quota/single species regulation) (Napier et al., 1999). Also mixed catches can result in discarding of the bycatch species because of quota limitation or undesired quality (Berrow et al., 1998; Napier et al., 1999; Pierce et al., 2002). Higher discard rates can occur when the fish are sorted because of low quota for bycatch species, but also when the target species have to meet certain specifications or yield higher prices like the "matjes herring" (Napier et al., 1999; Pierce et al., 2002). When the total catch is too large to be processed before the quality of the fish is lost, part of the catch will be discarded, which is applicable to fish species whose quality deteriorates quickly such as sardinella (*Sardinella aurita*) and pilchard in Mauritanian waters (Hofstede and Dickey-Collas, In Press).

The inclusion of discarded catch 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. The sampling level for discards is usually much lower than that for landings (ICES, 2005; Morizur et al., 1995; Pierce et al., 2002; Couperus et al., 2004). The large variability in discarding between the trips means that the raising of discards numbers to fleet level is problematic, particularly when the way of discarding during those trips is very case specific (e.g. pumping or slippage) but also because the reasons for discarding is case specific (over quota, price, quality). If discards are to be estimated by area and or season, the number of trips may be insufficient. To overcome this problem, it is recommended that discards should be estimated based on a international coordinated fleet sampling programme instead of the present national programmes.

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7. Tables and Figures

Table 1. Landings (*1000 tonnes) per species and ICES area by the Dutch freezer trawler fleet in 2004. For areas see Figure 1.

Species	IIA	IIIA	IVA	IVB	IVC	VA	VB	VIA	VIB	VIIA
Blue whiting	3276		35	9			2998	39649	5357	
Herring	23517	265	39182	21096	3985			8063		680
Horse mackerel			4107	883	15056			3686		
Mackerel	30		4812					5276		
Argentines	4599		40			1532	730	3626	11	
Total	31423	265	48176	21987	19041	1532	3728	60300	5368	680

Species	VIIIB	VIIIC	VIIID	VIIIE	VIIIF	VIIIH	VIIJ	VIIK	VIIIB	Total
Blue whiting	218	18483						338	6671	77034
Herring			19046	459		786	1396	1125		119599
Horse mackerel	6838	372	6168	1678	161	14322	594	7885		61749
Mackerel	8101	21	167			88	203	7426		26124
Argentines		6					23			10567
Total	15157	18882	25381	2137	161	15196	16773	6671	2215	295073

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.)
P10	55	48	87.3	94.6	22.6 (8.3)	7.2 (8.2)
P11	42	27	64.3	72.7	17.1 (2.9)	6.5 (4.8)
P12	10	8	80.0	99.0	23.9 (0.8)	5.5 (7.1)
P13	64	58	90.6	98.6	22.8 (1.4)	10.2 (8.6)
P14	41	38	92.7	99.8	22.4 (3.4)	10.0 (5.1)
P15	34	33	97.1	99.1	23.7 (4.2)	1.5 (3.7)
All	246	212	86.2			

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

Trip	Period	Species landings	ICES area's
P10	04/03 – 27/03	Blue whiting, mackerel, horsemackerel	VIa, VIIb, VIIc
P11	27/03 – 10/04	Blue whiting, argentines	VIa
P12	01/07 – 24/07	Herring, mackerel	IVa
P13	30/07 – 28/08	Herring, mackerel	IVa, IVb
P14	11/10 – 05/11	Horsemackerel, herring, pilchards	IVc, VIId, VIIe
P15	03/12 – 21/12	Horsemackerel, herring, pilchards	VIId, VIIe, VIIh

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

	Blue whiting	Herring	Horse mackerel	Mackerel	Pilchard	Greater argentine	White sea bream	Others	Total
P10	Catch	2017	506	1235				61	3820
	Landings	1917	473	1162				0	3552
	Discards	100	34	73				61	267
	% Discards	5%	7%	6%				100%	7%
P11	Catch	2191	2			49		1	2243
	Landings	2137		0		29		0	2166
	Discards	54		2		20		1	77
	% Discards	2%		100%		40%		100%	3%
P12	Catch		367	34				3	404
	Landings		365	29				0	394
	Discards		2	5				3	10
	% Discards		1%	13%				100%	2%
P13	Catch		3920	119				21	4060
	Landings		3751	35				0	3786
	Discards		169	83				21	274
	% Discards		4%	70%				100%	7%
P14	Catch		157	1220	41	90	25		1533
	Landings		156	1192	0	39	21		1408
	Discards		0	28	41	51	4		125
	% Discards		0%	2%	100%	57%	16%		8%
P15	Catch		1444	1126	111	19		0	2699
	Landings		1432	1101	0	18		0	2551
	Discards		12	25	111	0		0	148
	% Discards		1%	2%	100%	2%		0%	5%
All trips	Catch	4208	5888	2852	1542	109	25	87	14759
	Landings	4054	5704	2765	1227	58	21	0	13857
	Discards	154	184	87	315	52	4	87	902
	% Discards	4%	3%	3%	20%	47%	40%	16%	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
Blue whiting	Blauwe wijting	4208.0	4054.2	153.8	4%	2
Herring	Haring	5887.8	5703.6	184.2	3%	4
Horse mackerel	Horsmakreel	2851.9	2765.1	86.8	3%	3
Mackerel	Makreel	1541.8	1226.9	314.9	20%	6
Pilchard	Pelser	109.1	57.5	51.6	47%	2
Greater argentine	Grote zilversmelt	48.7	29.1	19.5	40%	1
White seabream	Bandzeebrasem	25.2	21.1	4.1	16%	1
Boarfish	Evervis	41.0	0.0	41.0	100%	1
Haddock	Schelvis	37.0	0.0	37.0	100%	3
Hake	Heek	1.1	0.0	1.1	100%	2
Whiting	Wijting	5.4	0.0	5.4	100%	2
Grey gurnard	Grauwe poon	1.8	0.0	1.8	100%	1
Silver pomfret	Zilverbraam	0.2	0.0	0.2	100%	1

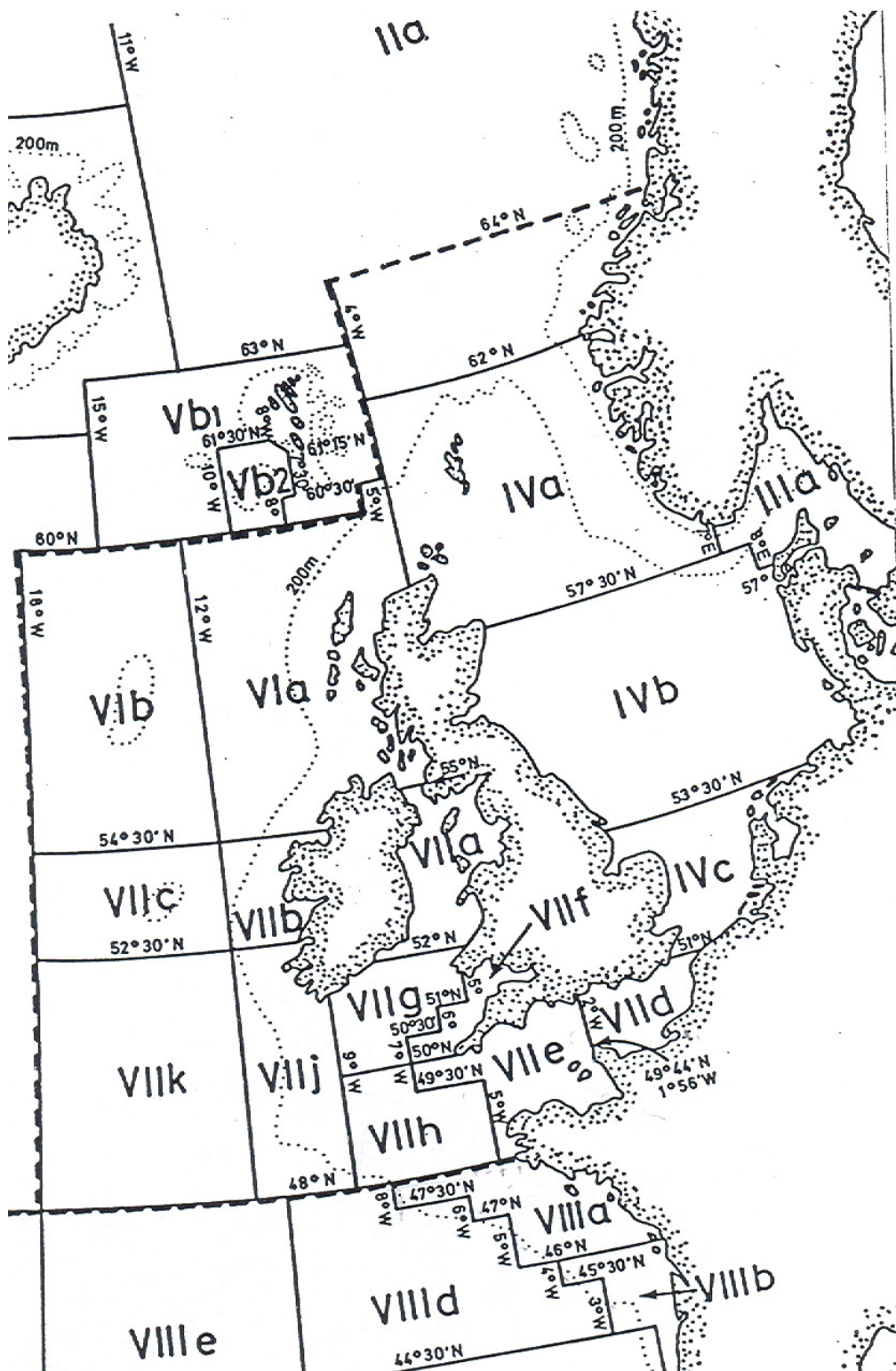


Figure 1. Map of ICES rectangles.

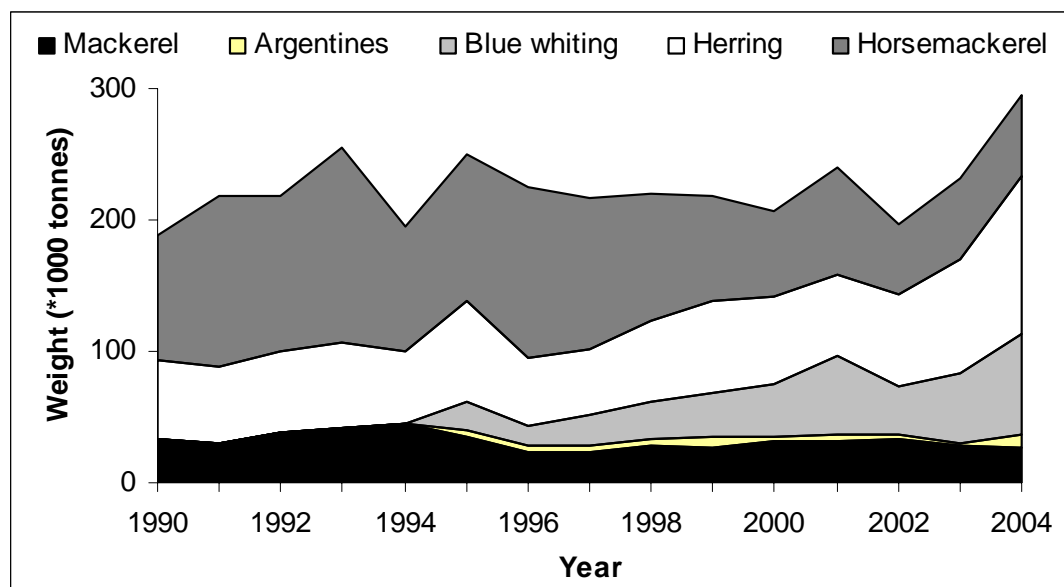


Figure 2. Landings from the Dutch freezer trawler fleet during 1990-2004 by species. Data from the VIRIS database.

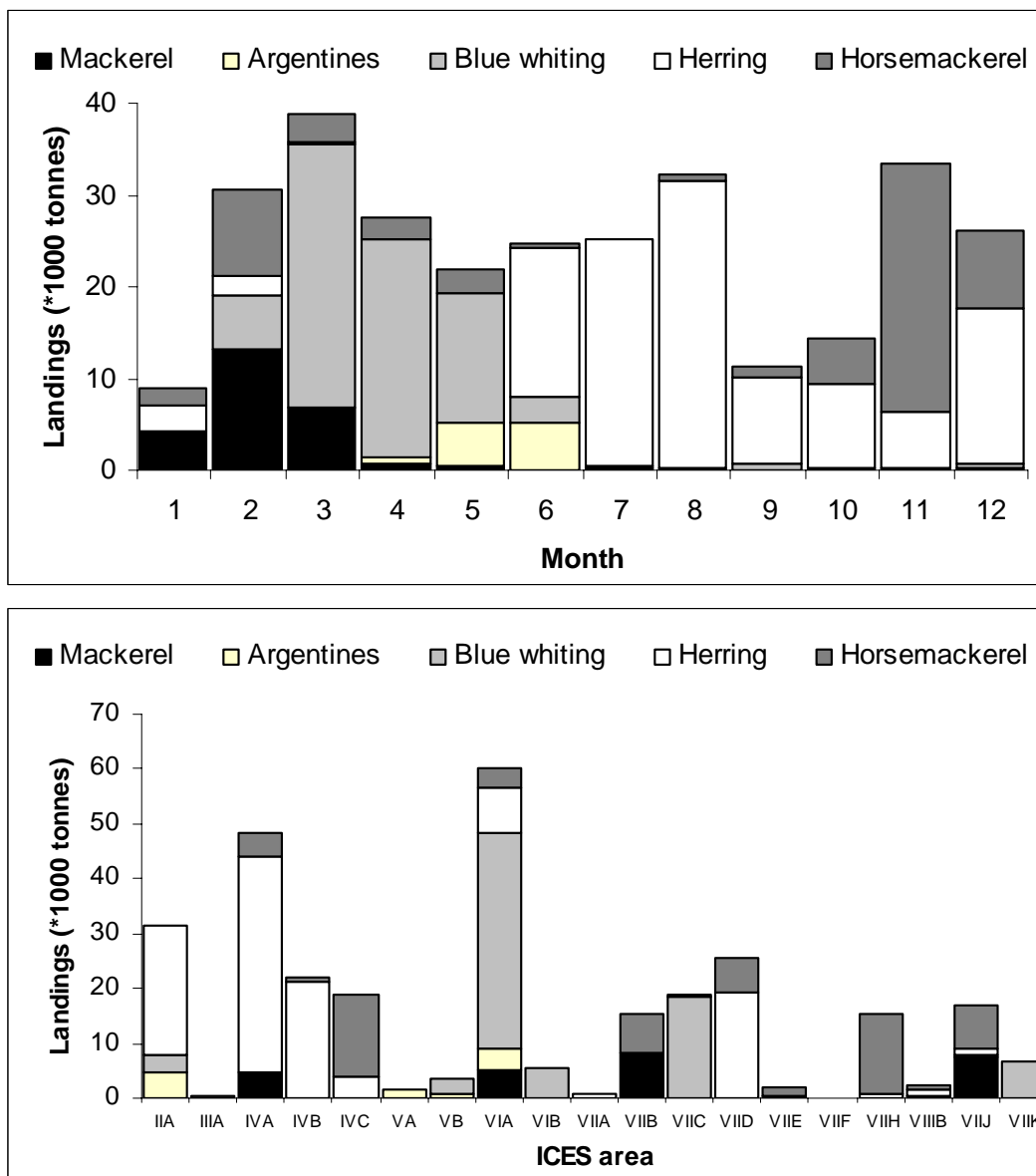


Figure 3. Landings (*1000 tonnes) from the Dutch freezer trawler fleet during 2004. Upper panel shows monthly landings by species, lower panel shows landings per ICES area (Figure 1) by species. Data from the VIRIS database.

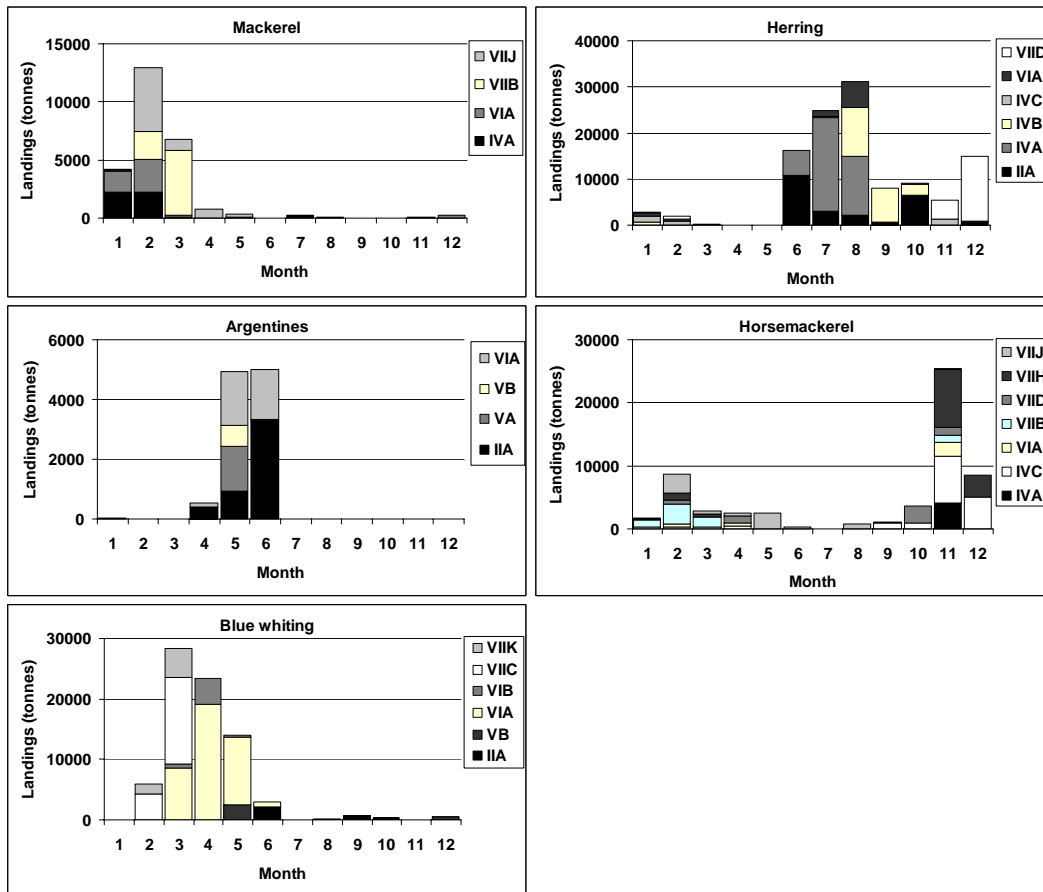


Figure 4. Monthly landings in tonnes per species from the Dutch freezer trawler fleet during 2004 for the most important ICES rectangles (Figure 1). Data from the VIRIS database.

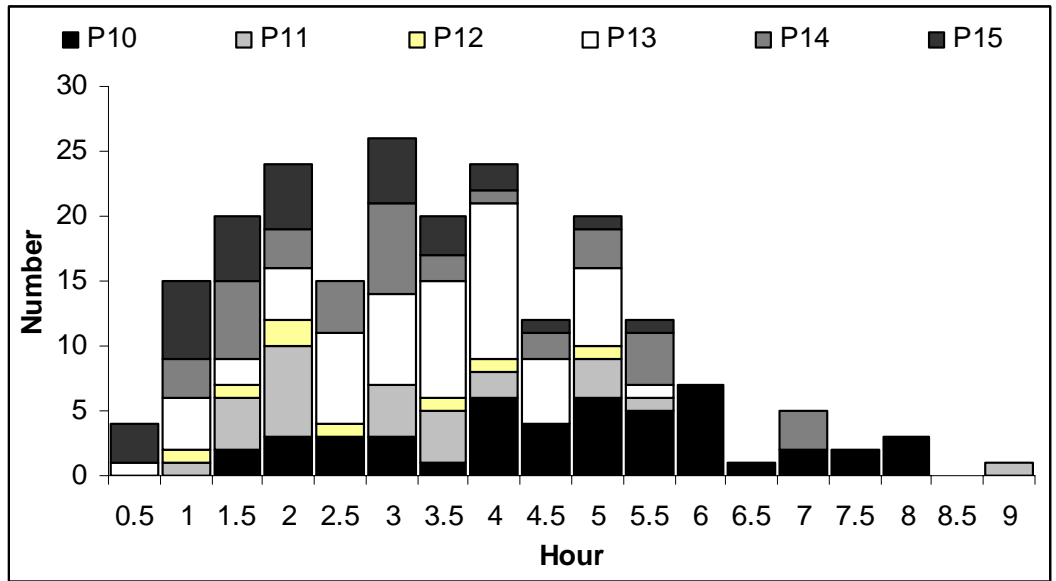


Figure 5. Frequency of haul durations.

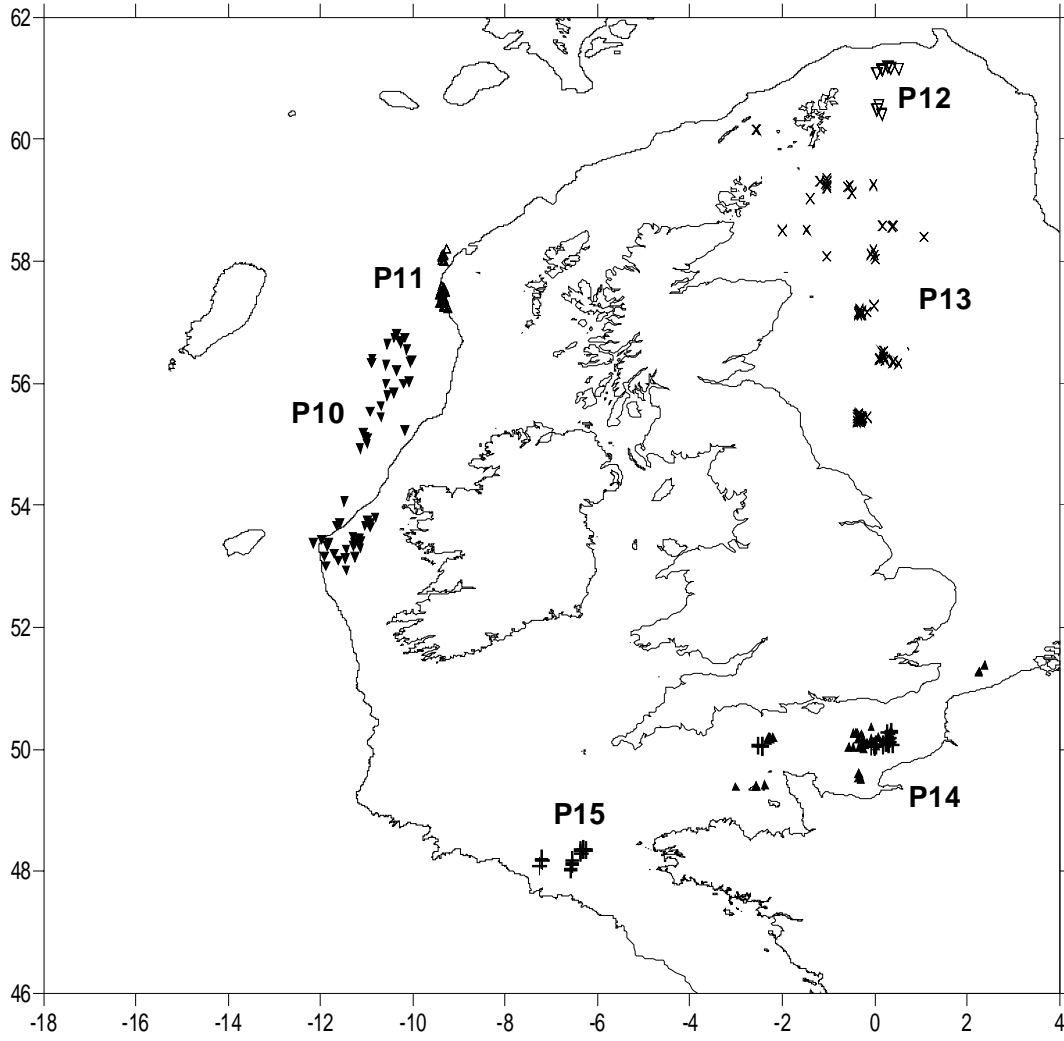


Figure 6. Trawl positions per haul for each trip. Trips are indicated by trip number P10 – P15.

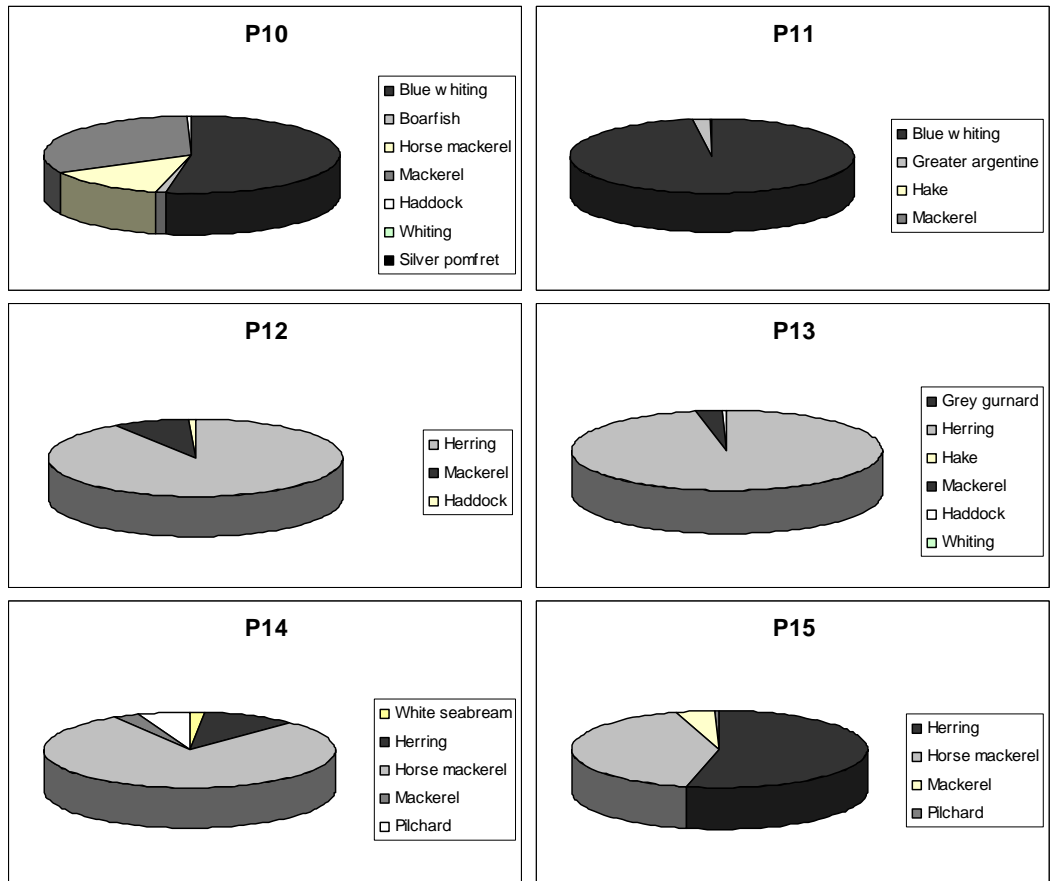


Figure 7. Compositions of the total catches per trip.

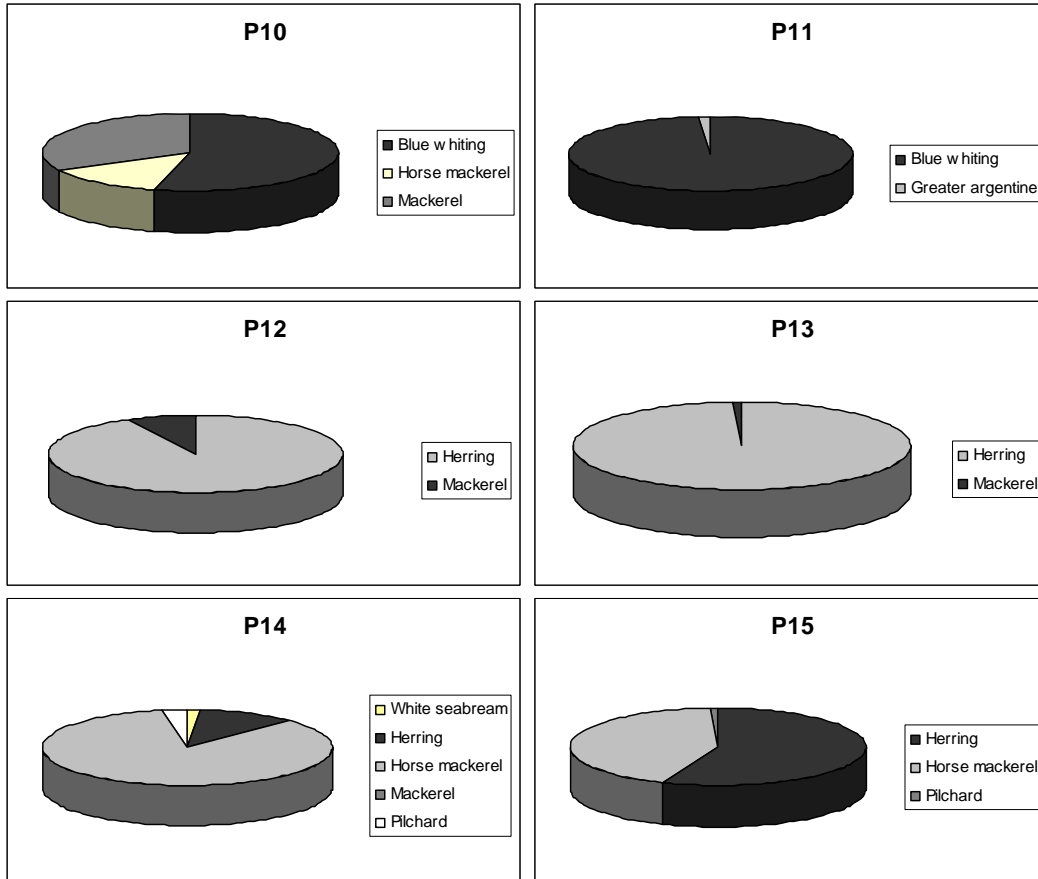


Figure 8. Compositions of the landings per trip.

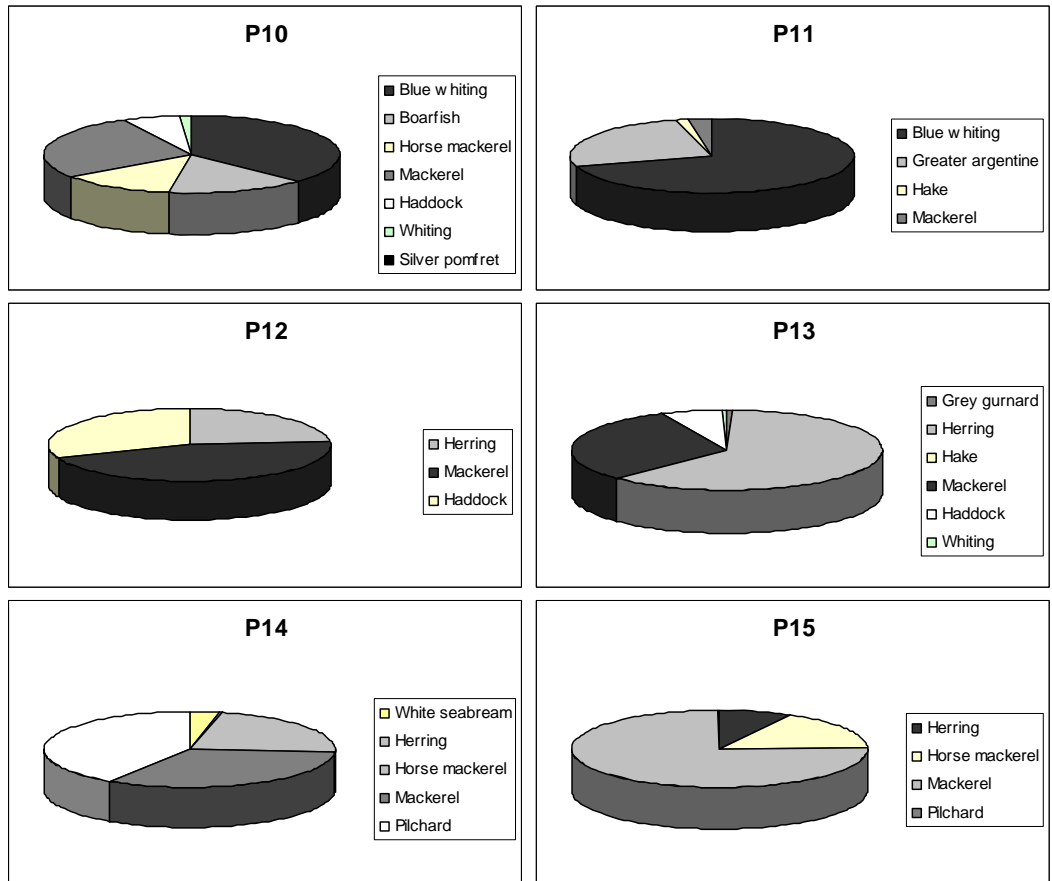


Figure 9. Compositions of the discards per trip.

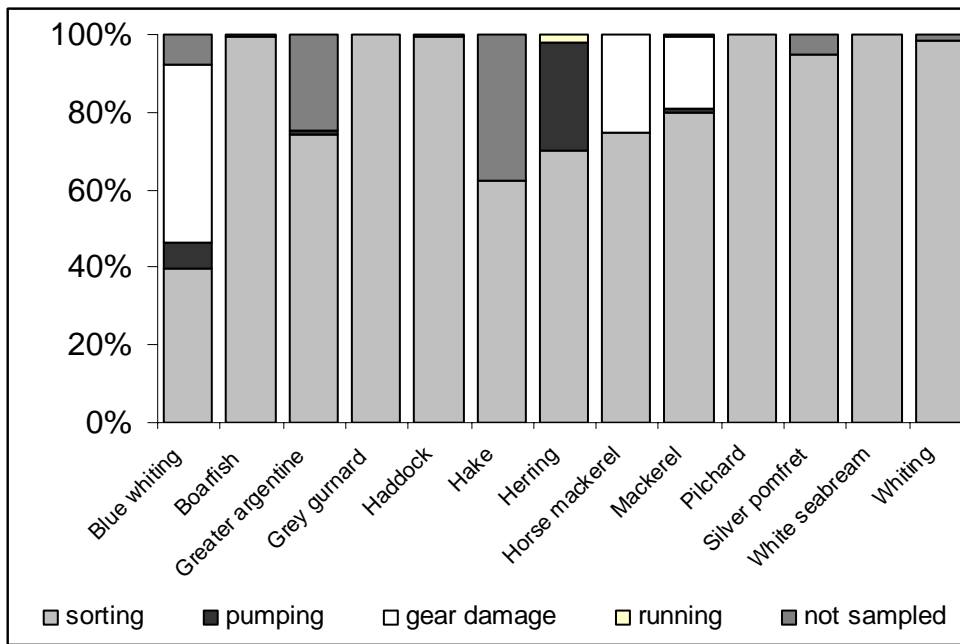


Figure 10. Discards by category per species combined over all trips.

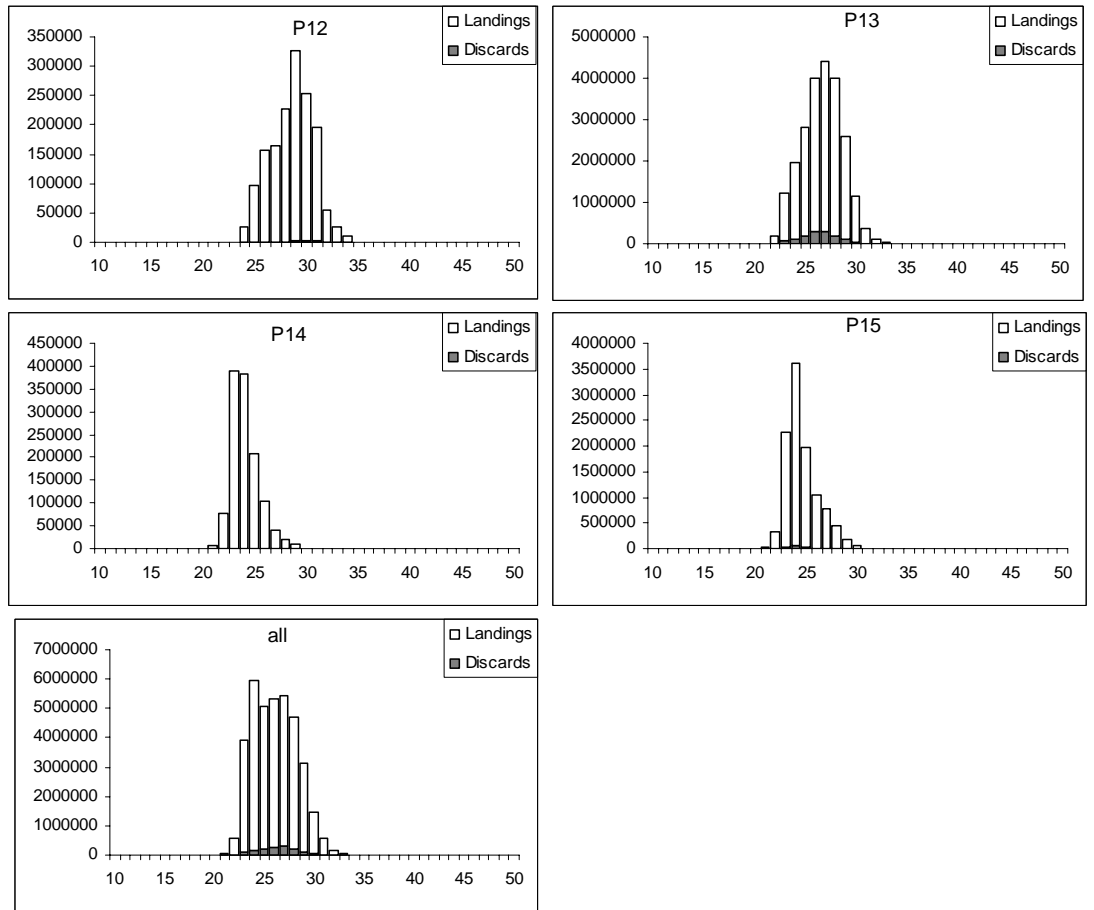


Figure 11. Numbers of herring landed and discarded against length (cm) per trip and for all trips combined.

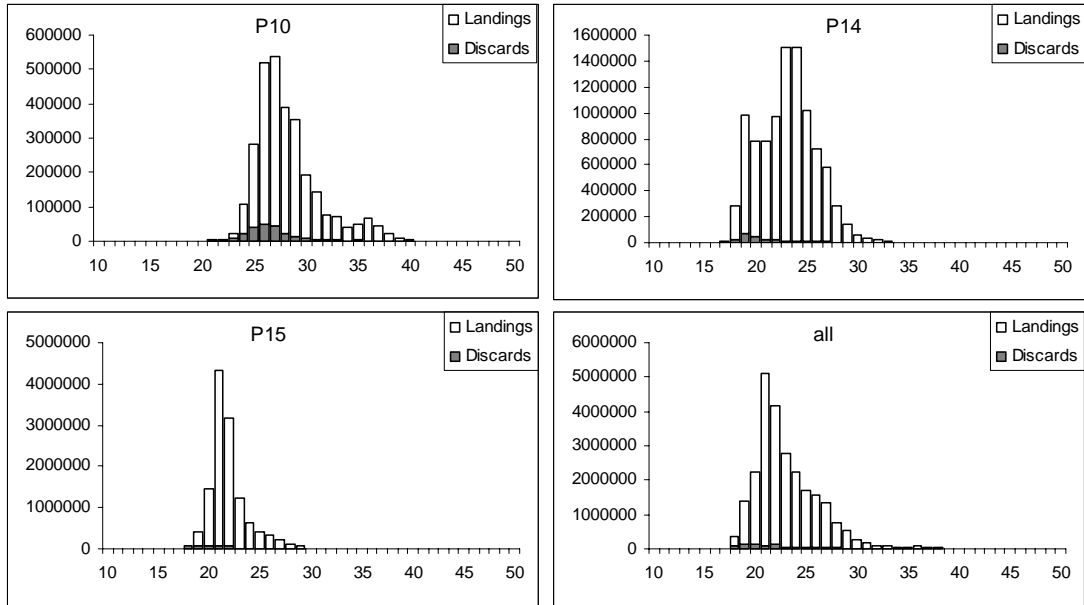


Figure 12. Numbers of horse mackerel landed and discarded against length (cm) per trip and for all trips combined.

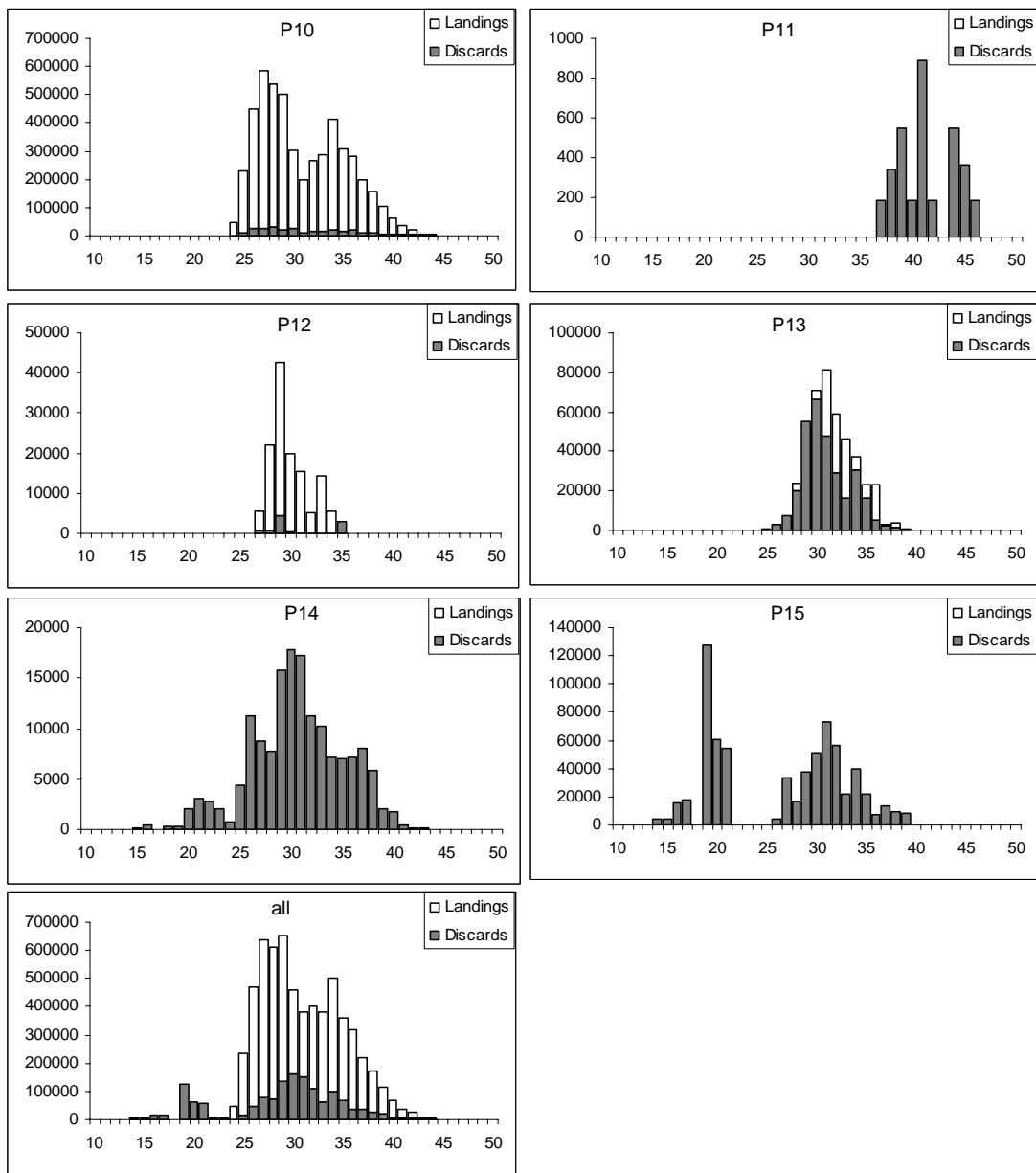


Figure 13. Numbers of mackerel landed and discarded against length (cm) per trip and for all trips combined.

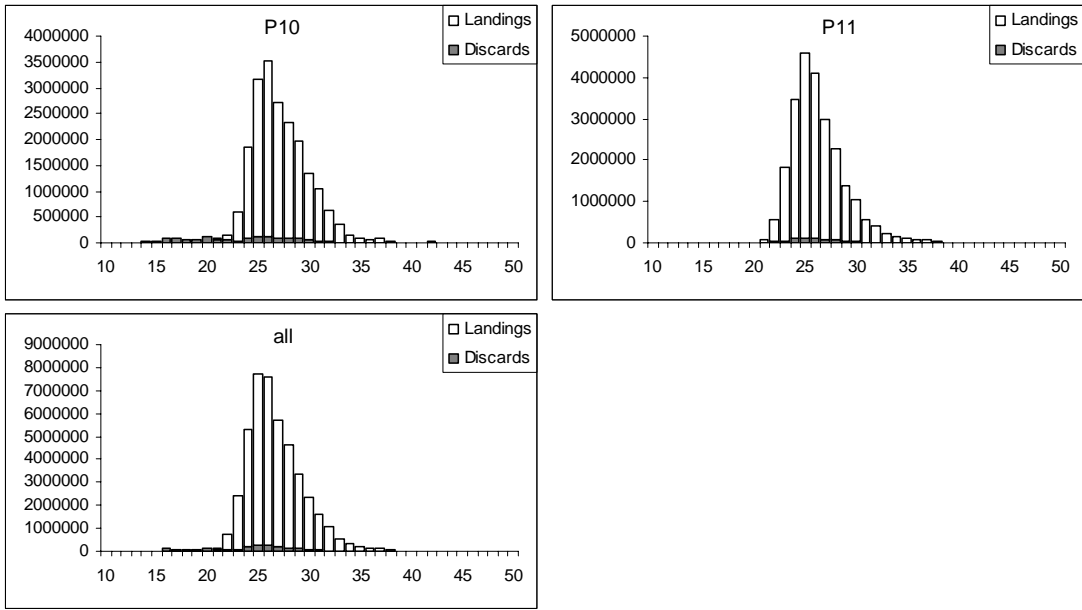


Figure 14. Numbers of blue whiting landed and discarded against length (cm) per trip and for all trips combined.

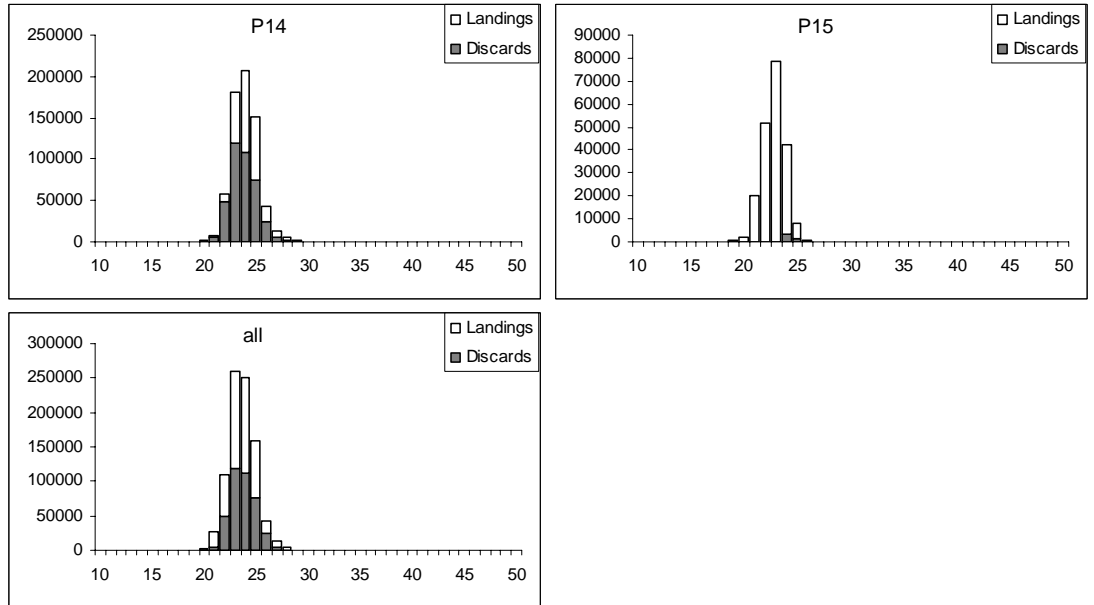


Figure 15. Numbers of pilchards landed and discarded against length (cm) per trip and for all trips combined.

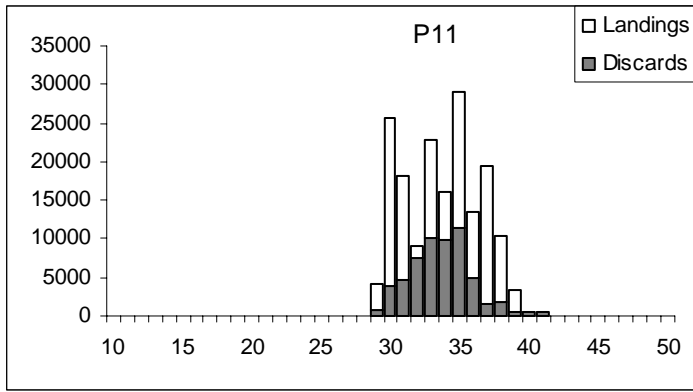


Figure 16. Numbers of greater argentines landed and discarded against length (cm) for trip P11.

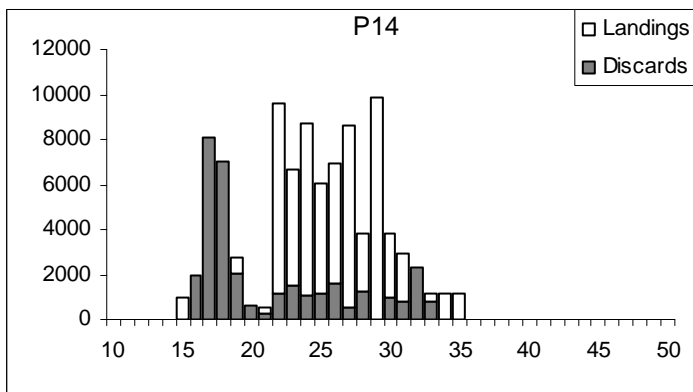


Figure 17. Numbers of white seabream landed and discarded against length (cm) for trip P14.

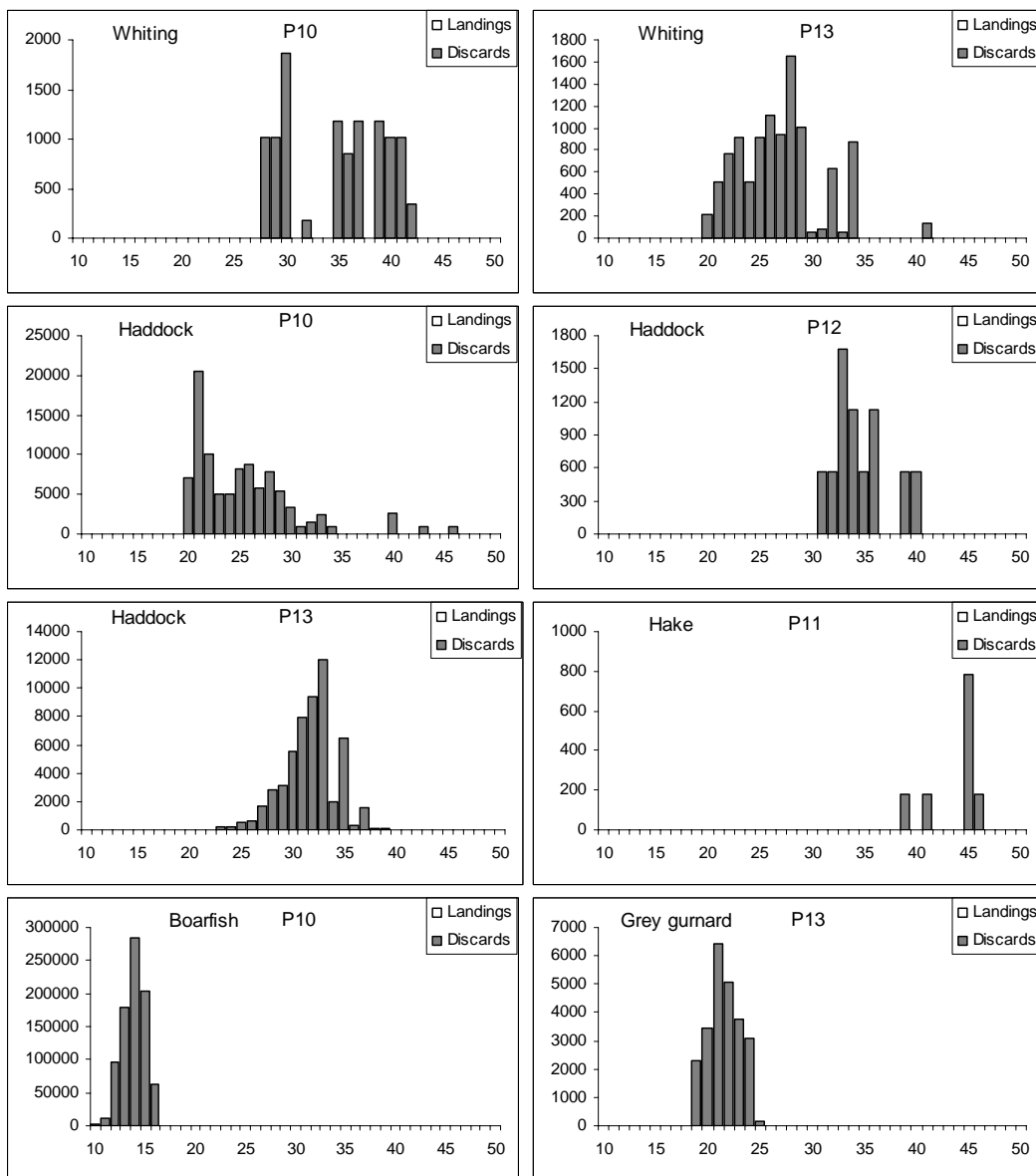


Figure 18. Numbers of discards against length (cm) per trip for discarded species.