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Catch composition of the EU pelagic fleet in Mauritania during the year 2002.

Results of the Scientific Observer Program

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Summary

This report describes the total catches of the EU pelagic fleet in the Mauritanian Exclusive Economic Zone during the year 2002. Data have been obtained by the 'Scientific Observer Program', which monitors the catch (both landings and discards) of the EU fishery for small pelagics in Mauritania.

The EU fleet in Mauritania focuses mainly on the group of sardinella *(Sardinella aurita* and *Sardinella maderensis)*. Additional target species are cunene horse mackerel *(Trachurus trecae)*, chub mackerel *(Scomber japonicus)* and pilchard *(Sardina pilchardus)*. The landings in 2002 consisted for 97% of these 5 species, *S. aurita* being the dominant species (55% of the landings).

In the year 2002, 90.5% of the estimated total catch has been landed and 9.5% was discarded, which is a higher amount of discards as in previous years.
The share of *S. aurita* in the total estimated catch decreases little by little from 83.7% in 1999 to only 50.2% in 2002. Catches of the other target species have increased considerably throughout the years, so that the total catch can retain the same order of magnitude. But since the effort in fishing days of the fleet has augmented from 1328 fishing days in 1999 to 1774 in 2002, it means that the catch per unit effort of the EU pelagic fleet in Mauritania is gradually decreasing. An extension of the fishing limits in 2002 has very likely attributed to this observed decline in the catch per unit of effort.

1. Introduction

This report describes the catches of the EU pelagic fleet in the Mauritanian Exclusive Economic Zone during the year 2002. Being the fourth in a row, this report follows the annual reports of 1999 (Benjamins, 2002a), 2000 (Benjamins, 2002b) and 2001 (ter Hofstede, 2002).

The results are derived from the 'Scientific Observer Program', which was initiated in early 1999 as a joint project by the Netherlands Institute for Fisheries Research (RIVO) and the Mauritanian Institute for Oceanographic and Fisheries Research (IMROP) in Nouadhibou, Mauritania.
The Scientific Observer Program is meant to monitor the activities of the EU fishery for small pelagics in Mauritania. In 1996, several vessels from EU member states, notably the Netherlands, started to fish in Mauritanian waters. These ships partly replaced vessels from the former Soviet Union for which the fishery in Mauritania was no longer profitable after the privatisation of the former state-owned companies.
Since 1996, the EU pelagic fleet in Mauritania gradually has developed into a modern fleet that consist of ships that are equipped with highly developed technologies. Its fishing effort is focussed mainly on the group of sardinella *(Sardinella aurita* and *Sardinella maderensis)*. Additional target species are horse mackerel *(Trachurus trachurus*, *Trachurus trecae* and *Decapterus rhonchus)*, mackerel *(Scomber japonicus)* and pilchard *(Sardina pilchardus)*.
The catch is transhipped in the port of Las Palmas, Gran Canaria (Spain) or at sea near Nouadhibou or Nouakchott (Mauritania), before being transported to other countries, notably in West-Africa.

In the framework of the 'Scientific Observer Program', technicians and scientists from the IMROP go on board the EU pelagic trawlers in order to collect information about the amount and composition of the catches, both landings and discards, including the incidental bycatch of pelagic megafauna. The observers determine length-frequency distributions of all species present in the catch and furthermore perform biological analysis on target species. These data combined with landing data obtained from the ship owners give detailed information about the total catch by the EU pelagic fleet in Mauritanian waters.

2. Methods

2.1 Fishing method and treatment of catches on board

The fishermen search for schools of pelagic fish by sonar. In case fish schools are detected, the net is set and the ship starts chasing for the detected schools, again making use of the sonar. As soon as the amount of fish in the net seems sufficient for processing, most of the net is taken on board; only the cod-end, the part were the fish have gathered, stays in the water. The crew connects a fish-pump to the tip of the cod-end, in order that the catch can be pumped directly from the net into the storage-tanks on board the vessel.
Large animals, such as sharks, rays, dolphins, sea turtles, etc. are retained in a specific part of the net (the 'shark fyke'), which consists of large meshes that allow small(er) fish to pass, but prevents the large animals from entering the cod-end. As a result of this, the large animals cannot block the fish pump when the catch is taken aboard the ship. Normally, the captured large animals are released while the net is still in the water. However, during a voyage in the framework of the Scientific Observer Program, the animals are taken on deck in order to get information about the amount, composition and measures of the captured large animals.

After having spent some time in the storage-tanks, the catch is guided through a sorting-machine at the working deck, which divides the catch into different size-classes, and thereby also makes the first separation into different categories (often of different species). Next, the catch is transported onto a conveyer belt, where the crew makes a final sorting into different categories, both landed groups and discards.
The sorted fish are briefly stored in cold water baths, before being put into 'frosters', where they are frozen into blocks of approximately 20 kg. These blocks are sealed in plastic and packed into a carton box of the same size and shape as the packages. All boxes are stored in the large freezing-compartment of the ship, until being disembarked, ready for trade.

2.2 Sampling methods on board

The captain estimates the total catch of a haul on the basis of the number of storage-tanks that have been filled. The crew on the working deck determines the course of processing the catch and sorts the catch into a number of categories, including a category 'discards'. Next, the scientific observers estimate by eye the percentage of each category in the total catch and they collect a sample with a minimum of 20kg from each category for the determination of the length-frequency distributions.
The total weight of landed species in the haul is estimated, based on the total weight of the haul (captain's estimate) and the percentage of that particular species in the haul (observer's estimate). Similarly, the total weight of all discards is estimated. The total weight of each species in the discard fraction is estimated, based on the estimated total amount of discards, and the weight distribution by species in the discard sample.

Besides estimating the catch composition, the observers perform biological analyses on the main target species (sardinellas, sardines, mackerel and horse mackerel) for at least one haul per day. During a biological analysis of a target species, 25 individuals are examined for fork length, total weight, empty weight, sex, maturity stage, stomach content and fat content.

The observers also record the incidental capture of all large animals, such as sharks, rays, dolphins, sea turtles, etc. that are retained in the 'shark fyke' (see 2.1). As far as possible, all catch is determined up to species level and length measurements are taken.

For more details on the sampling methodology, the reader is referred to the manual for the scientific observers on board EU-fishing vessels in the Mauritanian Exclusive Economic Zone (ter Hofstede, 2003a (in Dutch); ter Hofstede, 2003b (in French)).

2.3 Data analysis

All data that have been collected by the observers are entered into a standard Microsoft Excel 97 spreadsheet for further processing with the statistical analysis system SAS for Windows, release 8.01.

The obtained data from the samples ideally consist of total weights and length-frequency distribution of each species present in the sample. The following standard analyses are performed for each voyage:

I. For each haul that has been sampled, the total numbers of each species caught are estimated by raising the numbers in the sample by the ratio:

$$\frac{\text{estimated weight total catch per species}}{\text{weight of the sample per species}}$$

For each species present in the catch, this provides an estimate of the total number, the fractions landed and discarded, and the length-frequency distribution of each fraction.

II. For the entire voyage, the data from all sampled hauls are combined. For each species, this provides an estimation of the total number and weight, the fractions landed and discarded, and the length-frequency distribution of each fraction for all sampled hauls.

Since not all hauls during a voyage are sampled, the sum of all sampled hauls (step II) does not yet represent the total catch taken during that voyage. To estimate the total catch of the entire voyage, further analysis is necessary and the following procedures are employed:

III. For each voyage, all estimated total weight data of the landed fractions per species in the sampled hauls are grouped according to the categories used in the landing data provided by EU shipowners (i.e. sardinellas, pilchard, horse mackerel, mackerel, hairtail, bonito and other).

IV. For each voyage, the weights and numbers of each species for all *landed* fractions (see step II) are raised by the ratio:

$$\frac{\text{total weight per group in landing data}}{\text{total weight per group in sampled hauls}}$$

For each *landed* species, this provides the extrapolated total numbers and weights, and the length-frequency distribution for each voyage.

V. This procedure (step IV) cannot be applied for the discarded fractions since there are no landing data available. Because of this, the estimated weight and number data of the *discarded* fractions per species (see step II) are for each voyage raised by the ratio:

$$\frac{\text{total weight of all conserved species in landing data}}{\text{total weight of all conserved species in sampled hauls}}$$

All discarded species are thus raised by the same factor per voyage.
For each *discarded* species, this provides the extrapolated total numbers and weights, and the length-frequency distribution for each voyage.

The same procedure is employed to estimate the total catches of all ships of the EU fleet during one month. For months in which no sampling has been carried out, the data from the adjacent month with the highest total catches are used for extrapolation:

VI. For each month, the estimated total catch of each *landed* species from the sampled voyages (step IV) is raised by the ratio:

$$\frac{\text{total weigth per group in total landing data of al vessels for that month}}{\text{total weight per group in the sampled voyages for that month}}$$

For each *landed* species, this provides the extrapolated total numbers and weights, and the length-frequency distribution for each month.

VII. For each month, the estimated total catch of each *landed* species from the sampled voyages (step V) is raised by the ratio:

$$\frac{\text{total weigth of all landed species in total landing data of al vessels for that month}}{\text{total weight of all landed species in the sampled voyages for that month}}$$

For each *discarded* species, this provides the extrapolated total numbers and weights, and the length-frequency distribution for each month.

Finally, all monthly estimations for total landings and discards are summed. This yields the total annual catch and discard totals for each species, for the entire EU pelagic fleet in Mauritania.

3. Results

In the year 2002, the EU pelagic fleet in Mauritania consisted of 10 ships that made a total of 61 voyages. Eight of these voyages (13%) were sampled within the framework of the 'Scientific Observer Program' (see table 1). Since there was overlap in months for these (long) voyages, some sampled voyages have been used for extrapolation to total catches of the fleet for multiple months. This accounts for the months January and February, March and April, June and July, and November and December. Because of this, the monthly length-frequency distributions for the main target species have approximately the same shape for these months (see figure 3-12).

3.1 Total catches

Based on the extrapolation procedures described in section 2.3, the data from the 8 sampled voyages have been used to estimate the composition of the total catches by all the EU fishing vessels during the year 2002. The estimated total catches in tons (1000 kg) for 2002 have been summarised per species for both the landed and discarded fractions in tables 2 and 3. The estimated total catch by weight of the EU fleet in 2002 consists for 90.5% of landed fish, 9.5% were discards.
A distinction has been made between (10) target and non-target species. The target species include the important species of the groups of the sardinellas *Sardinella aurita* (round sardinella) and *Sardinella maderensis* (flat sardinella), the sardine *Sardina pilchardus* (pilchard), the mackerel *Scomber japonicus* (chub mackerel), the horse mackerels *Trachurus trecae* (cunene horse mackerel), *Trachurus trachurus* (atlantic horse mackerel) and *Decapterus rhonchus* (false scad), the bonitos *Sarda sarda* (atlantic bonito) and *Katsuwonus pelamis* (skipjack tuna) and finally the hairtail *Trichiurus lepturus* (largehead hairtail).

Large by-catch species such as sharks, rays, dolphins, tunas etc. have not been included in the analyses. The registration of these catches has been of the same low quality in 2002 as in previous years as described in ter Hofstede, 2002c. Therefore, the information about the by-catch in 2002 is considered to be too weak for analysis. Improvements are developed for the future, starting in 2003.

3.2 Species composition

The total estimated catch by weight of the 10 target species for the entire year 2002 is presented in table 2 and figure 1, monthly estimations are shown in table 4 and figures 2a-d.

Clearly, round sardinella *(S. aurita)* was the most common species caught in 2002, it made up 50.2% of the total catch by weight (see table 2), both landings and discards taken in account. Other important species are sardine *(S. pilchardus)* and chub mackerel *(S. japonicus)*, comprising 16.0% and 15.1% of the estimated total catch respectively.
During summertime (July-September, see figure 2c), *S. aurita* is the most important species by far in the catch composition. However, in wintertime the catch of *S. aurita* decreases considerably and the catches in weight of other small pelagics such as *S. pilchardus*, *S. maderensis* and *S. japonicus* are sometimes even higher. In figures 2a-d it can be seen that the sardine *S. pilchardus* dominates the catches in wintertime, due to a clear augmentation during this season.
The other target species are of minor importance in the total catch composition in 2002.

3.3 Length-frequency distributions

The length-frequency distributions on year basis for 2002 of the 10 most important target species in Mauritanian waters, the same species as mentioned in section 3.2, are given in table 5, both the landing data and the discards. These data are visualised in figure 3.
The estimated monthly length-frequency distributions of these 10 target species in 2002 are presented in the figures 4 to 13, also both the landed and discarded fractions.

The length-frequency distribution of the catch of the main target species *S. aurita* shows a bimodal distribution for the year 2002 (see figure 3). On a year basis, the small-sized group has its highest frequencies around a fork length of 14 cm, the large-sized one around 29 cm.
As can be seen in figures 4a-d, the peak of the small-sized round sardinellas finds it origin mainly in May, and a little in the preceding two months. In October, a second peak of small-sized fish appears at a fork length of 19 cm. Assuming it concerns the same length group as in May, the shift suggests a growth of 5 cm in 5 month.
The large-sized group of *S. aurita* shows a constant peak value at a fork length of 29 cm throughout the year 2002 (see figure 4a-d).

The other sardinella species *S. maderensis*, does not show a bimodal distribution as *S. aurita* does (see figure 3). When looking at figures 5a-d, it appears that the highest frequencies of fork length amount to 27 cm throughout the year 2002, except in November and December, in which the highest values are around 24 cm.

Figure 3 shows that *S. pilchardus* has a clear bimodal distribution in 2002 with the first peak in frequency around a fork length of 16 cm, the second around a size of 21 cm fork length. As shown in figures 6a-d, a well-defined distinction can be made in seasonality of these two length groups. Almost all the sardines that belong to the smaller length group are caught in the second part of the year, September to December. The large-sized sardines are on the contrary mainly caught in the period February-May. Only very few sardines have been captured during the summer, June to August.

Also the length-frequency distribution of the cunene horse mackerel *T. trecae* shows an evident division into two length groups in 2002, with modes of fork length 10 and 24 cm (see figure 3). Most of the fish belonging to the small group are caught in the summer months June to August (see figure 7a-d). The large-sized group with the peak value around 24 cm is mainly captured in springtime, March to May. During autumn and wintertime, the catch of *T. trecae* appears to be very low.

The catch of atlantic horse mackerel *(T. trachurus)* has been low in 2002 and in some month (March, April, August, September and October), the species hasn't been observed in the nets at all (see figure 8a-d). The largest part of the total catch in 2002 has occurred in wintertime, mainly in January, but also in November and December, with a peak value of around 31-33 cm fork length. In early summer (June, July) some small fish have been captured, with a peak value of 11 cm.

The false scad *(D. rhonchus)* has mainly been caught in the month September, with a modus of 22 cm fork length (see figure 9a-d). During the rest of the year 2002 catches of *D. rhonchus* took place, but in a very low quantity.

Chub mackerel *(S. japonicus)* has a variable length-frequency distribution throughout the year 2002 (see figure 3). In the first four months of the year 2002, the catches are not very high and the distribution in sizes was reasonable evenly distributed, with a small tendency to peak values of 36 cm (January, February) and 28 cm (March, April) fork length. Largest catches took place in the period May to August with peak values increasing from 20 to 29 cm fork length throughout the summer. In September a bimodal distribution occurs in the catch of *S. japonicus*, one peak at size 19 cm fork length, the other around 30 cm. In the last quarter of

the year 2002, the peak value was in the order of 21 to 25 cm fork length, suggesting the growth of the peak at length 19 cm from September.

The total estimated catches of the atlantic bonito *(S. sarda)* show different monthly length-frequency distributions throughout the year 2002 (see figure 3). From January to April and also a little in May, November and December, so during winter and springtime, the catches have a peak value around fork length 45 cm (see figure 11a-d). In the months June and July, a peak value is shown at 48 cm, possibly the 45 cm peak from January-April, and two new length groups with modes of 28 and 33 cm fork length appear. In August, the peak values of three clear lengths are in the order of 29, 38 and 49 cm. In September, peaks are found at 32, 40 and 50 cm fork length. These length-frequency distributions suggest a growth of three length cohorts during summertime.
Highest catches of S. sarda took place in January and February, and in the late summer July-September.

The skipjack tuna *(K. pelamis)* has only been captured during the autumn and wintertime, having a variety of lengths (see figures 12a-c). In September most of the fish had a fork length range from 24 to 34 cm. During the winter period, the captured skipjack tuna had a larger size range of 44 to 54 cm fork length.

The largehead hairtail *(T. lepturus)* has mainly been caught in 2002 during the periods January-February and August-October. Catches took also place throughout the rest of the year, but of less quantity. Sizes ranged most of the time from 50 to 100 cm fork length, but no clear peak values can be appointed (see figures 13a-d).

4. Discussion

In the year 2002, 13% of the voyages made by EU pelagic trawlers in Mauritania were sampled within the framework of the 'Scientific Observer Program', which is, though little, less than in previous 3 years (respectively 23, 16, and 14%) (Benjamins, 2002a, 2002b; ter Hofstede, 2002). Considering the fact that the observers' data are extrapolated to total catch per month of the entire fleet, a good coverage during the entire year is necessary and therefore it is desirable that in the future at least every month a new voyage will be observed.

The sampling of the bycatch of pelagic megafauna has still been at a very low standard and definitively needs improvements. Recommendations for this are given in ter Hofstede (2003c).
Quite the opposite conclusion can be drawn concerning the sampling procedure for small pelagic fish on board the vessels. This has improved and standardised in detail in the course of the year 2002, which has resulted in data of high quality.

As in previous years, the EU pelagic fleet present in the Mauritania has focussed their fishing effort in 2002 on the target species *Sardinella aurita*. Therefore, fishing mostly has taken place in the part of the water column which sardinellas are known to inhabit, i.e. near the surface.
If sardinellas aren't present in the fishing area, the vessels will target other species. For example pilchard *(S. pilchardus)* was very abundant in the northern part of the Mauritanian Exclusive Economic Zone during wintertime in 2002 and therefore also has been fished heavily, 16% of the yearly total catch (see table 2, figure 1).

As in previous years, *S. aurita* has been the main target species in the year 2002, the species constituted half of the total catch (50.2%). However, the domination of *S. aurita* in the total catch has gradually decreased throughout the years (83.7% in 1999, 73.4 % in 2000, 67.9% in 2001). The amount of the total catch of the EU fleet has nevertheless remained about the same (approximately 170 thousand tons) throughout the years, since the catch of other species than round sardinella has augmented. For example the amount in the total catch of *S. pilchardus* increased from 3% in 1999 to 16% in 2002, and the share of *S. japonicus* from 2% in 1999 to 15% in 2002. According to personal communications with the fishermen, this shift in catch is mainly due to the decline of the amount of *S. aurita*, which really is the preferred target species.
The fact that this target species seems to be getting less abundant is reflected in other matters as well. It leads to a decrease in catch per unit effort: the total catch of the fleet has remained around 170 thousand tons throughout the years, but the fleet has increased its effort (from 1328 fishing days in 1999 up to 1774 in 2002). Furthermore, both the necessity to search for sardinellas and the lack of a 'clean catch' as when the sardinellas are abundant, leads to a rise in the amount of discards from 6.6% in 1999 to 9.5% in 2002.

Not to be neglected is the fact that the fishing limit for the EU pelagic fleet was extended to at least 13 miles off shore in 2002, 1 mile more than in earlier years. Since sardinellas are often found near the coast, it is very likely that the extension of the fishing limit has attributed to the observed decline in catch per unit effort in 2002.

Except for the observed gradual shift from mainly catches of round sardinella towards other species such as pilchard, chub mackerel and cunene horse mackerel, the general perception of the catches remains the same throughout the years 1999-2002. I.e. the amount of *S. aurita* is still highest during the summer since this species follows a warm water front coming from Senegalese waters, going north along the Mauritanian coast during the summer months. Also, the high abundance of the pilchard in the catch during the winter months can be explained because pilchard is associated with relatively cool waters, and therefore disappear from the catches as warm surfaces waters move in from the south in the course of the year.

Finally, it is recommended to perform further exploration of the observers' dataset in search for interesting information about the ecology and biology of the small pelagic species in the Mauritanian Exclusive Economic Zone. For example taking into consideration the trends in the distribution of the catches, the observed length cohort developments throughout the years for some species *(S. aurita*, *S. japonicus* and S*. sarda)*, linking catch data to surface temperatures or depths, and comparison of the observers' data on board the commercial EU fleet with acoustic surveys of research vessels in the area.

5. Conclusions

The number of observer days has reduced slightly throughout the period 1999-2002 and the sampling of the bycatch of pelagic megafauna was below standard. Nevertheless, the sampling method for small pelagic species has improved both in quality and quantity, which results in high quality data.

In the year 2002, 90.5% of the estimated total catch has been conserved and 9.5% was discarded, which is an increase in discards compared with the preceding years.

The catch per unit effort of the EU pelagic fleet has decreased throughout the period 1999-2002, while the total catch retains a magnitude of 170 thousand tons, with the number of fishing days rising from 1328 up to 1774.

As in previous years, the round sardinella *S. aurita* dominated the yearly catch composition (50.2%). However, the dominance of this species was gradually diminishing throughout the years 1999-2002. Most of the catch of round sardinella in 2002 took place during the summer from July to September.
In wintertime, the pilchard *S. pilchardus* appeared to be the dominant species in 2002. The catch of pilchard, as well as those of the chub mackerel *S. japonicus* and the cunene horse mackerel *T. trecae*, continued in 2002 its gradual increase in presence in the catch composition of the EU fleet since 1999.

The extension of the observers' dataset in 2002 with a fourth year in a row enlarged significantly the possibilities to use this database for detailed research on the biology and ecology of small pelagic species in the Mauritanian Exclusive Economic Zone, which is highly recommended to be performed in the near future.

6. Recommendations

The following recommendations are given for the continuation and further development of the Scientific Observer Program on board EU pelagic vessels in the Mauritanian Exclusive Economic Zone. Some of these recommendations are already given in the previous reports (Benjamins 2002a, 2002b; ter Hofstede, 2002), but still apply in the current situation:

- Observers should always be supervised and briefed in detail, both before and after their trips on board the trawlers. This will ensure the quality of the gathered data. In particular, further attention should be given to the sampling of the bycatch of pelagic megafauna.
- Observers should be sent out on trips throughout the entire fishing season with an even distribution throughout the year. In order to avoid large-scale extrapolation of the observers' data, it is highly recommended that these trips will take place every month.
- An effort should be made to place observers on as many different ships as possible, to reduce the uncertainties associated with the extrapolation of data from only a few ships.
- Due to the worldwide use of total length in stead of fork length in the analysis of data, the standard length measurements should be shifted from fork length to total length in the near future.

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Table 1: Schedule of the observer trips in 2002.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
January								SCH302 Willem v/d Zwan																								
February	SCH302 Willem v/d Zwan																														
March			KW171 Maartje Theadora																												
April																															
May						SCH81 Carolien																									
June	SCH81 Carolien																			SCH302 Willem v/d Zwan											
July	SCH302 Willem v/d Zwan																														
August											KW171 Maartje Theadora																				
September				SCH81 Carolien																											
October	SCH81 Carolien												SCH54 Franziska																		
November														SCH302 Willem v/d Zwan																	
December																															

Table 2: Total extrapolated catch in tons for the main target species in 2002, landings and discards. Percentages are based on the total catch (landings + discards) of all species.

species	landings (tons)	discards (tons)	landings (%)	discards (%)
Decapterus rhonchus	793	97	0.4	0.1
Katsuwonus pelamis	18	112	0.0	0.1
Sarda sarda	1757	1799	1.0	1.0
Sardina pilchardus	26602	2409	14.7	1.3
Sardinella aurita	87696	3141	48.5	1.7
Sardinella maderensis	10433	500	5.8	0.3
Scomber japonicus	23753	3549	13.1	2.0
Trachurus trachurus	1289	160	0.7	0.1
Trachurus trecae	9604	1085	5.3	0.6
Trichiurus lepturus	391	646	0.2	0.4

Table 3: Total extrapolated catch in tons for the non-target species in 2002, landings and discards. Percentages are based on the total catch (landings + discards) of all species.

species	landings (tons)	discards (tons)	landings (%)	discards (%)
Acanthurus monroviae		3		0.0
Aklenes lians		7		0.0
Alectis alexandrinus		65		0.0
Argyrosomus regius		25		0.0
Ariosoma balearium		5		0.0
Arius heudoloti		59		0.0
Auxis thazard	265	217	0.1	0.1
Bembrops heterurus		0.7		0.0
Boops boops		0.9		0.0
Brachydeuterus auritus	61	0.9	0.0	0.0
Brama brama	0.7	400	0.0	0.2
Campogramma glaycos	485	472	0.3	0.3
Capios aber		0.5		0.0
Capros aper		12		0.0
Caranx hippos		3		0.0
Caranx spec.		4		0.0
Chloroscombrus chrysurus		12		0.0
Chylonicterus spinosus		0.0		0.0
Coryphaena equisetis		0.3		0.0
Coryphaena hippurus		25		0.0
Dentex macrophthalmus		44		0.0
Diplodus vulgaris		10		0.0
Echelus sagyshynchus		0.1		0.0
Echeneis naucrates		0.8		0.0
Elops lacerta		0.1		0.0
Engraulis encrasicolus		310		0.2
Erytrochs monodi		2		0.0
Euthynnus alletteratus	83	308	0.0	0.2
Helicolenus dactylopterus		17		0.0
Heptranchias perlo		0.1		0.0
Hypacantus amia		11		0.0
Hyperoglyphe moselli		2		0.0
Illex coindetii		0.1		0.0
Illisha africana		0.0		0.0
Lagocephalus laevigatus		33		0.0
Lagocephalus spec.		1.0		0.0
Lepidopus caudatus		3		0.0
Lepidotrigla spec.		2		0.0
Loligo vulgaris		34		0.0
Malacocephalus laevis		0.1		0.0
Malacocephalus spec.		0.1		0.0
Merluccius senegalensis		519		0.3
Mugil capurrii	107	112	0.1	0.1
Mugil cephalus		34		0.0
Mugil monodi	175	201	0.1	0.1
Myctophidae		1.4		0.0
Nauta birostius		5		0.0
Orcynopsis unicolor	93	168	0.1	0.1

Table 3 (continued): Total extrapolated catch in tons for the non-target species in 2002, landings and discards. Percentages are based on the total catch (landings + discards) of all species.

species	landings (tons)	discards (tons)	landings (%)	discards (%)
Pagellus bellottii		5		0.0
Parapenaeus longirostris		0.0		0.0
Penaeus notialis		0.0		0.0
Plectorhyncus mediterraneus		0.3		0.0
Plectorhyncus spec.		0.8		0.0
Pomadasys incisus		3		0.0
Pomadasys rogeri		5		0.0
Pomatomus saltatrix	64	171	0.0	0.1
Pontinus kuhli		3		0.0
Pontinus kuhlii		1.0		0.0
Priacanthus arenatus		0.0		0.0
Priacanthus infirma		0.1		0.0
Prionace glauca		33		0.0
Pterotrissus belloci		2		0.0
Remora remora	2	5	0.0	0.0
Ruvettus petriosus		37		0.0
Schedophilus permaco		0.2		0.0
Scomberomorus tritor		22		0.0
Scorpaena elongata		0.4		0.0
Scorpaena normani		0.1		0.0
Selene dorsalis		10		0.0
Sepia bertheloti		1		0.0
Sepia officinalis		0.5		0.0
Sepiella ornata		20		0.0
Sphyraena guachancho		14		0.0
Sphyraena sphyraena		3		0.0
Spondyliosoma cantharus		0.2		0.0
Stromateus fiatola		9		0.0
Strongyliura senegalensis		19		0.0
Synagrops microlepis		0.9		0.0
Todarodes sagittatus		3		0.0
Todarodes spec.		3		0.0
Trachinotus ovatus		85		0.0
Tylosirus crocodilus		0.1		0.0
Umbrina canariensis		6		0.0
Uranoscopus polli		0.1		0.0
Zenopsis conchifer		43		0.0
Zeus faber		42		0.0

Table 4: Monthly extrapolated catch in tons for the 10 main target species in 2002, landings and discards.

species	**January** landings (tons)	discards (tons)	**February** landings (tons)	discards (tons)	**March** landings (tons)	discards (tons)
Decapterus rhonchus	7	5	5	11		5
Katsuwonus pelamis		25		56		
Sarda sarda	125	188	239	424	69	91
Sardina pilchardus	156	18	3361	41	7552	347
Sardinella aurita	2446	8	3797	17	2599	211
Sardinella maderensis	366	5	568	11	1732	85
Scomber japonicus	960	163	3175	368	1409	310
Trachurus trachurus	656	16	544	36		
Trachurus trecae	867	8	718	18	1572	144
Trichiurus lepturus	11	97	95	219	18	38

species	**April** landings (tons)	discards (tons)	**May** landings (tons)	discards (tons)	**June** landings (tons)	discards (tons)
Decapterus rhonchus		6	5	15		
Katsuwonus pelamis						
Sarda sarda	26	121	52	42	52	45
Sardina pilchardus	5992	462	5767	586		1
Sardinella aurita	6549	281	7995	515	7277	357
Sardinella maderensis	4365	114	132	86	0.1	9
Scomber japonicus	1554	412	1340	1014	1909	155
Trachurus trachurus			81	18		0.3
Trachurus trecae	1488	191	2364	97	1093	112
Trichiurus lepturus	18	50		10		20

species	**July** landings (tons)	discards (tons)	**August** landings (tons)	discards (tons)	**September** landings (tons)	discards (tons)
Decapterus rhonchus			37	20	718	23
Katsuwonus pelamis				14		15
Sarda sarda	199	110	324	510	461	161
Sardina pilchardus		2				109
Sardinella aurita	22132	866	14367	669	16593	19
Sardinella maderensis	0.2	22		2	1325	71
Scomber japonicus	4347	376	5889	349	2057	59
Trachurus trachurus		1				
Trachurus trecae	776	271	436	178	17	7
Trichiurus lepturus		50		47	244	9

species	**October** landings (tons)	discards (tons)	**November** landings (tons)	discards (tons)	**December** landings (tons)	discards (tons)
Decapterus rhonchus	20	7		2		3
Katsuwonus pelamis			8	1	10	1
Sarda sarda	205	12	3	41	3	54
Sardina pilchardus		634	1284	90	2490	118
Sardinella aurita	3433	186	404	5	103	7
Sardinella maderensis	950	58	792	16	202	21
Scomber japonicus	563	142	63	87	488	114
Trachurus trachurus			3	39	5	50
Trachurus trecae	180	47	34	5	58	7
Trichiurus lepturus		40	5	6		7

Table 5: Length-frequency distributions for the catches of 10 major target species in 2002. Numbers in thousands.

FL (cm)	*Sardinella aurita*		*Sardinella maderensis*		*Sardina pilchardus*	
	landings	discards	landings	discards	landings	discards
9						4
10		169				74
11		244				215
12		332	52		22	1062
13		821			1375	6262
14		3286			6029	8848
15		2357			16528	4554
16		1395		8	21691	2070
17		1029	3	19	8954	1032
18		1290	13	11	5732	827
19		1262	72	16	13552	2117
20	19	1008	126	117	46974	3317
21	21	183	143	86	70715	3501
22	127	197	279	110	46384	2013
23	563	206	739	139	10818	663
24	4268	201	2298	100	250	62
25	10434	415	3268	174		1
26	10949	552	6090	227		
27	22088	1137	8796	414		
28	39621	1621	6839	236		
29	46850	1052	2672	85		
30	40761	819	612	21		1
31	24093	399	366	2		
32	7269	156	25			
33	763	20	23	0.1		
34	44	3				
35						
36		5				
37						
38						
39		5				
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
Total	207868	20163	32415	1764	249023	36622

Table 5 (continued): Length-frequency distributions for the catches of 10 major target species in 2002. Numbers in thousands.

FL	*Trachurus trecae*		*Trachurus trachurus*		*Decapterus rhonchus*	
(cm)	landings	discards	landings	discards	landings	discards
6		23				
7		613				
8		2103				
9		6208		59		
10		13198		106		
11		3354		147		
12		457				
13		75				
14	13	79		2		
15	5	96				
16	5	27				
17	76	84		8		
18	223	163	7		31	1
19	298	159			96	6
20	313	190	1	24	235	13
21	1169	158	40	27	642	12
22	3563	552	54	4	1082	35
23	7131	854	97	6	833	9
24	9062	460	141	7	526	15
25	6817	327	186	3	188	11
26	3335	101	224	8	48	13
27	1843	33	190	3	54	6
28	1400	133	186	13	44	8
29	1241	77	223	26	54	14
30	1029	71	324	22	96	9
31	1104	16	505	53	46	12
32	922	34	488	101	8	1
33	932	81	363	180	10	30
34	789	48	209	139	8	11
35	517	21	104	42	3	18
36	236	40	27	7	3	4
37	138	26	4	4	5	3
38	43	24	1		4	
39	27	5	2		4	
40	9					10
41	5	27				
42	6	0.4				
43	10	4				
44	0.4	5				
45						
46						
47						
48						
49						
50						
total	42259	29928	3376	992	4019	242

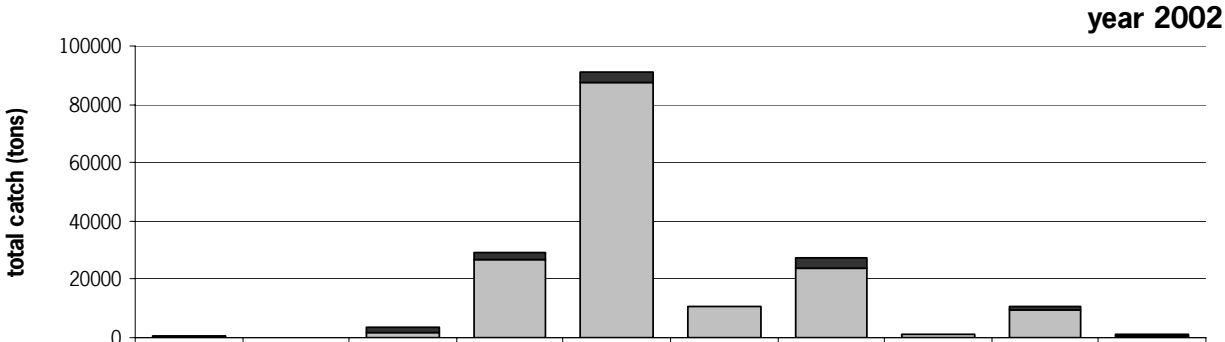
Table 5 (continued): Length-frequency distributions for the catches of 10 major target species in 2002. Numbers in thousands.

FL	*Scomber japonicus*		*Sarda sarda*		*Katsuwonus pelamis*	
(cm)	landings	discards	landings	discards	landings	discards
12		189				
13		180				
14		119				
15	94	267				
16	130	116				
17	488	328				
18	1494	1427				
19	2419	1948		10		
20	3752	2928				
21	5649	893				
22	4098	1717				0.1
23	4470	1859				
24	5057	1060		8		0.3
25	5330	938		16		1
26	4323	585		28		2
27	4109	406		41		0.3
28	4217	774		76		2
29	6210	417	0.2	126		0.4
30	5799	556	2	93		2
31	5527	364	4	47		3
32	4528	231	8	70		2
33	3384	332	15	43		1
34	2108	302	16	55		2
35	1767	199	16	33		0.4
36	1193	151	14	25		
37	1089	96	14	55		
38	1137	163	30	86		1
39	400	59	31	51		1
40	329	13	48	24		
41	341	7	37	43		0.3
42	104	1	28	99		3
43	16	18	57	46		1
44	13	2	113	52	1	0.1
45	0.4	0.0	81	137	2	4
46			60	73	2	1
47	6		77	13	1	
48			107	74	1	
49			155	81		8
50			84	54	2	3
51			35	20		
52			42	12		11
53			22	2		4
54			12	6		
55			7	19	1	
56			4	8		
57			20	2		
58			9	1		
59			10	2		
60			11	9		
61			8	7		
62			0.2	9		
63						
64			2	1		
65			3			
66			0.3			
67						
68						
69				12		
70				1		
total	79582	18647	1185	1670	9	54

Table 5 (continued): Length-frequency distributions for the catches of 10 major target species in 2002. Numbers in thousands, length classes of 5 cm.

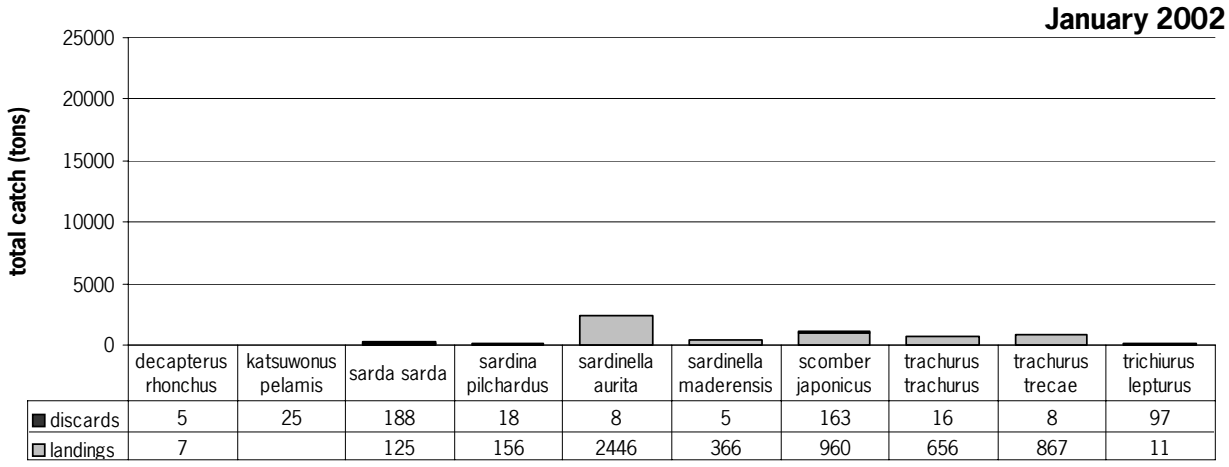
length class (cm)	*Trichiurus lepturus* landings	discards
20	30	
25		32
30	0.3	16
35	4	
40	1	
45	32	
50	131	
55	113	1
60	86	8
65	34	72
70	135	40
75	76	99
80	116	118
85	59	91
90	74	82
95	107	152
100	28	59
105	55	36
110	19	1
115	5	
120	6	5
125	10	
130		1
total	1119	813

Figure 1: Total catches in tons of the 10 most important target species in 2002.

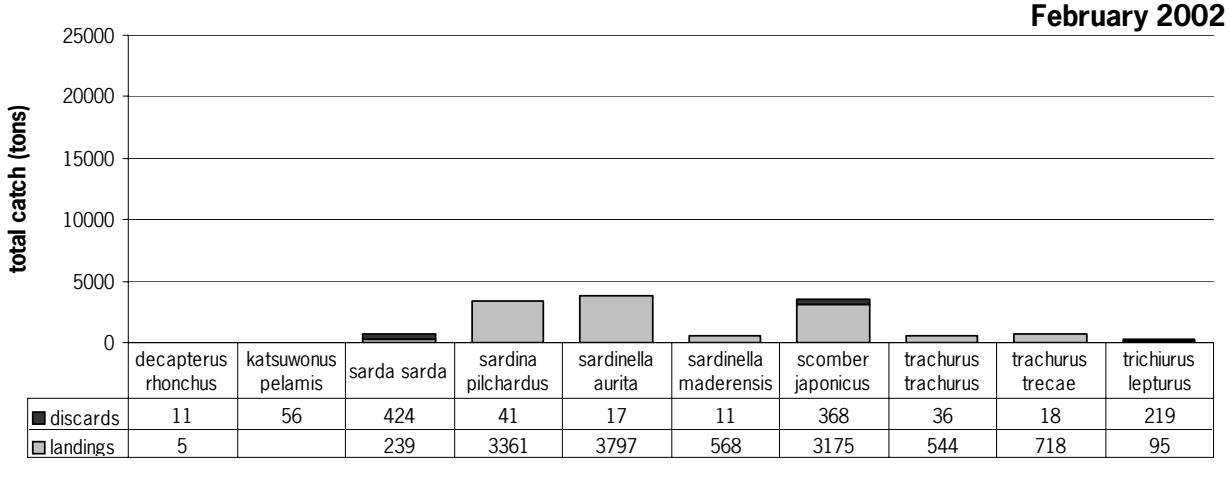


	decapterus rhonchus	katsuwonus pelamis	sarda sarda	sardina pilchardus	sardinella aurita	sardinella maderensis	scomber japonicus	trachurus trachurus	trachurus trecae	trichiurus lepturus
discards	97	112	1799	2409	3141	500	3549	160	1085	592
landings	793	18	1757	26602	87696	10433	23753	1289	9604	391

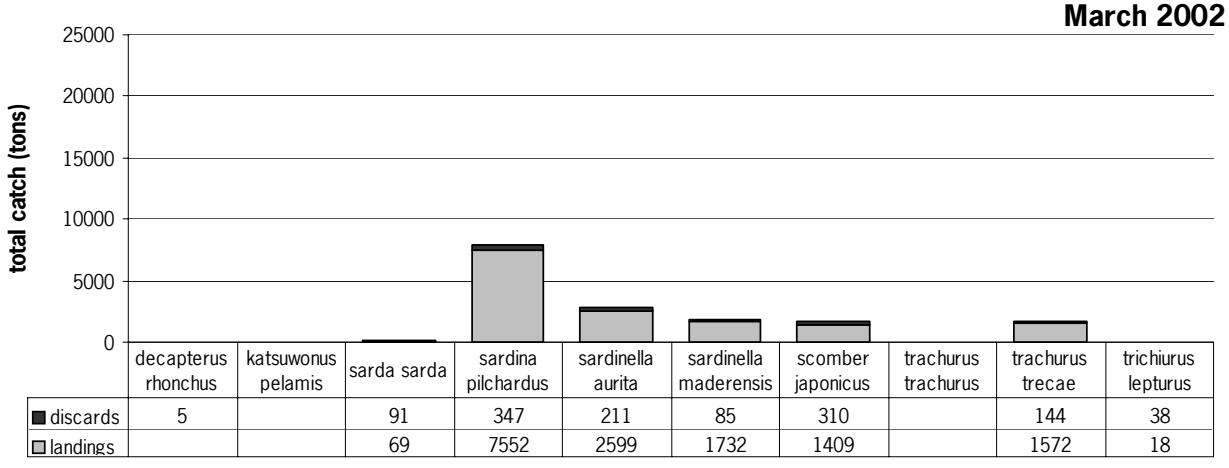
Figure 2a: Monthly catches in tons of the 10 most important target species for January, February and March 2002.



	decapterus rhonchus	katsuwonus pelamis	sarda sarda	sardina pilchardus	sardinella aurita	sardinella maderensis	scomber japonicus	trachurus trachurus	trachurus trecae	trichiurus lepturus
discards	5	25	188	18	8	5	163	16	8	97
landings	7		125	156	2446	366	960	656	867	11

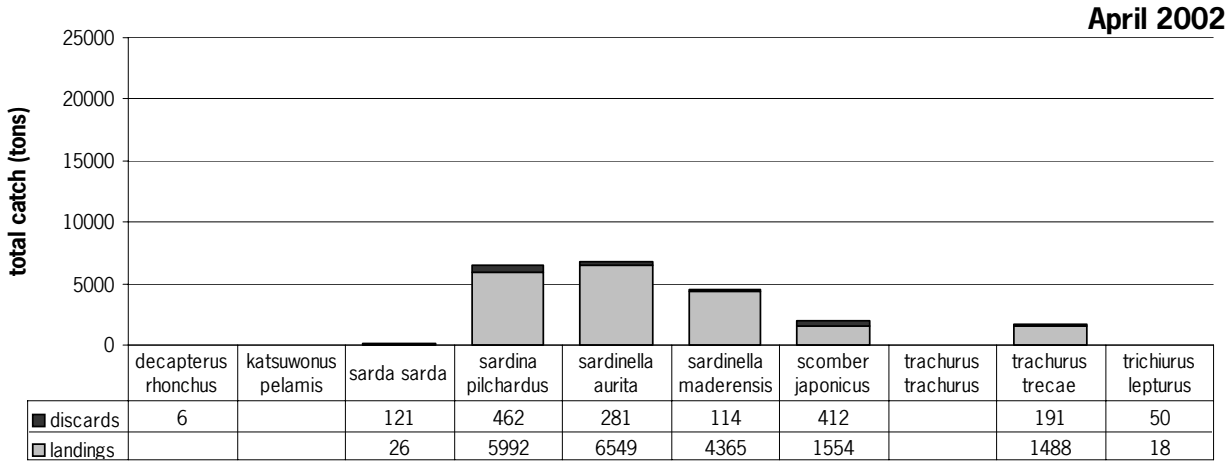


	decapterus rhonchus	katsuwonus pelamis	sarda sarda	sardina pilchardus	sardinella aurita	sardinella maderensis	scomber japonicus	trachurus trachurus	trachurus trecae	trichiurus lepturus
discards	11	56	424	41	17	11	368	36	18	219
landings	5		239	3361	3797	568	3175	544	718	95

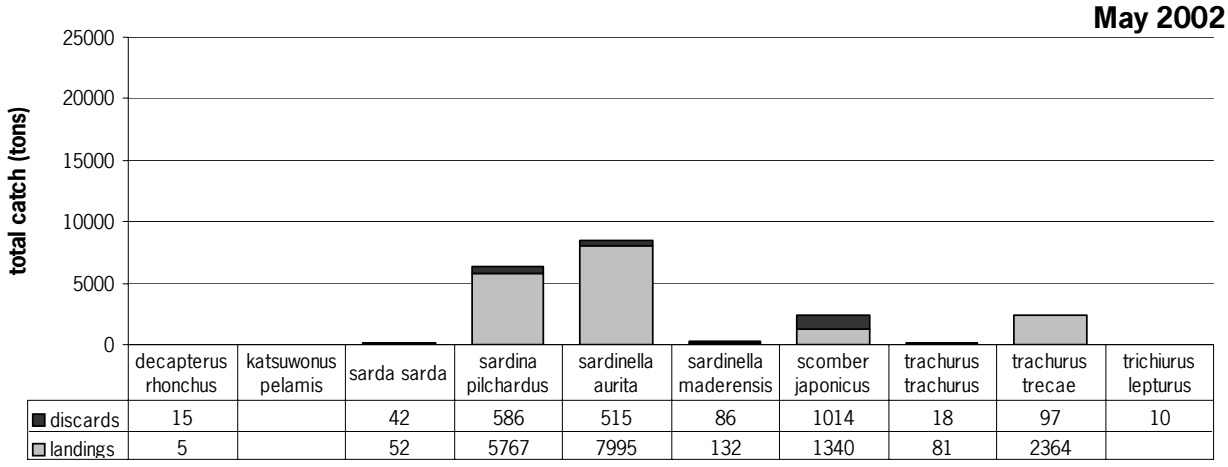


	decapterus rhonchus	katsuwonus pelamis	sarda sarda	sardina pilchardus	sardinella aurita	sardinella maderensis	scomber japonicus	trachurus trachurus	trachurus trecae	trichiurus lepturus
discards	5		91	347	211	85	310		144	38
landings			69	7552	2599	1732	1409		1572	18

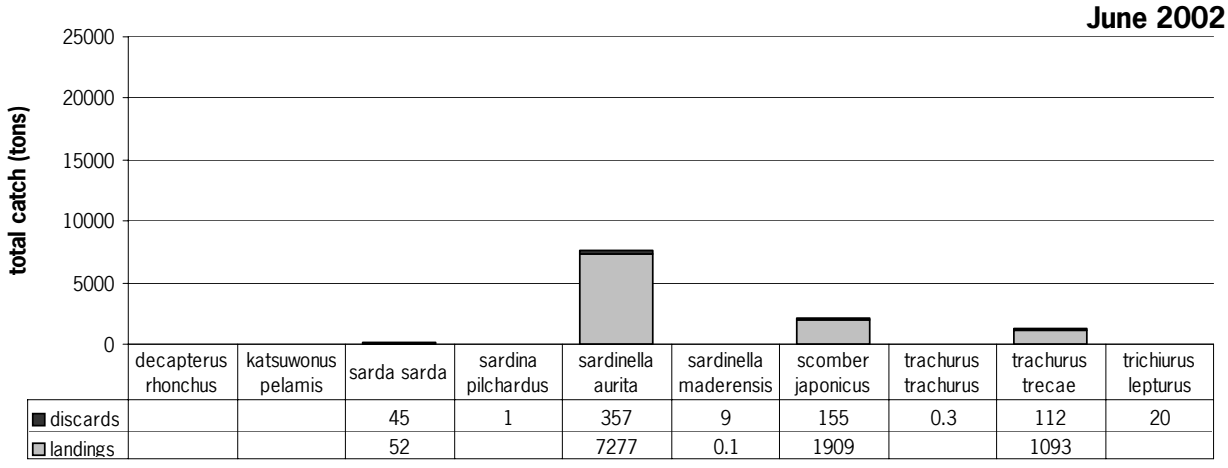
Figure 2b: Monthly catches in tons of the 10 most important target species for April, May and June 2002.



	decapterus rhonchus	katsuwonus pelamis	sarda sarda	sardina pilchardus	sardinella aurita	sardinella maderensis	scomber japonicus	trachurus trachurus	trachurus trecae	trichiurus lepturus
discards	6		121	462	281	114	412		191	50
landings			26	5992	6549	4365	1554		1488	18



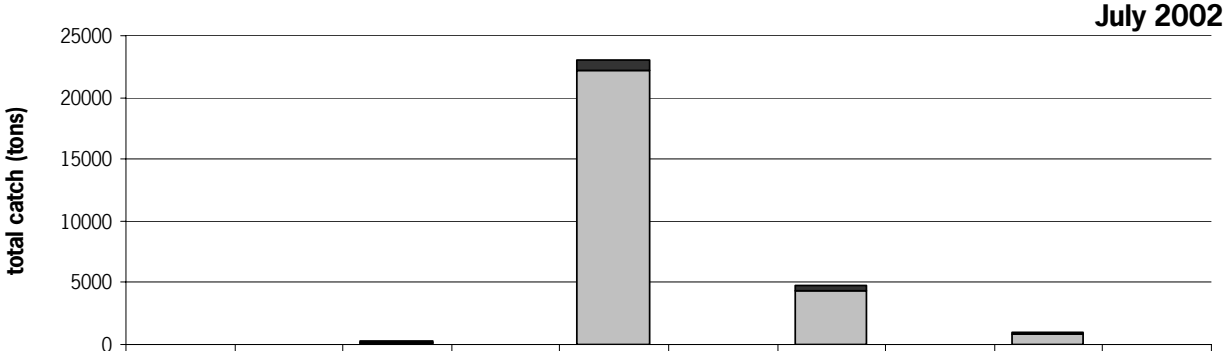
	decapterus rhonchus	katsuwonus pelamis	sarda sarda	sardina pilchardus	sardinella aurita	sardinella maderensis	scomber japonicus	trachurus trachurus	trachurus trecae	trichiurus lepturus
discards	15		42	586	515	86	1014	18	97	10
landings	5		52	5767	7995	132	1340	81	2364	



	decapterus rhonchus	katsuwonus pelamis	sarda sarda	sardina pilchardus	sardinella aurita	sardinella maderensis	scomber japonicus	trachurus trachurus	trachurus trecae	trichiurus lepturus
discards			45	1	357	9	155	0.3	112	20
landings			52		7277	0.1	1909		1093	

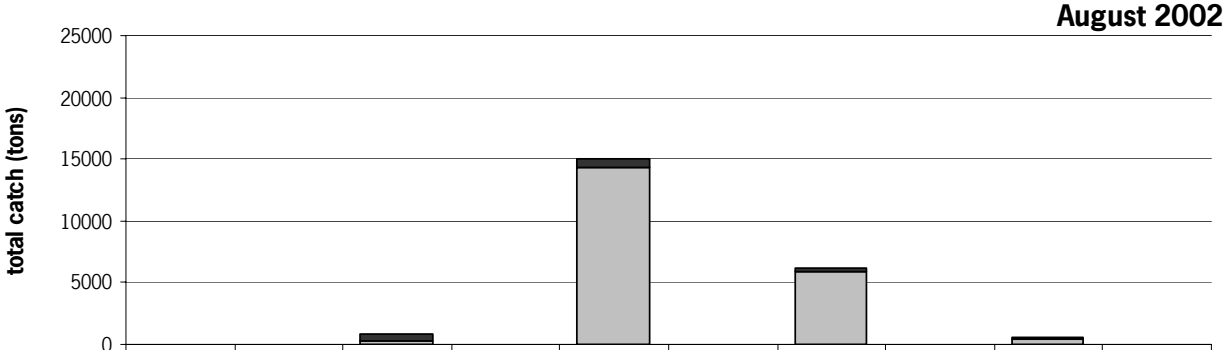
Figure 2c: Monthly catches in tons of the 10 most important target species for July, August and September 2002.

July 2002



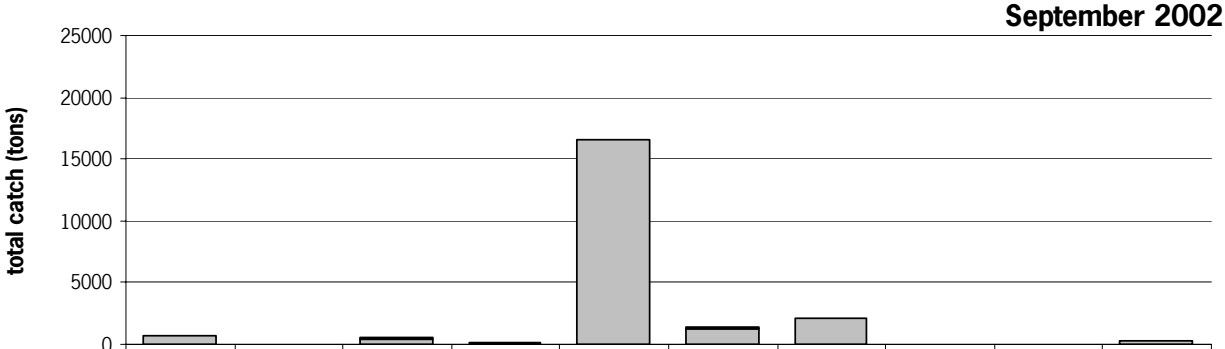
	decapterus rhonchus	katsuwonus pelamis	sarda sarda	sardina pilchardus	sardinella aurita	sardinella maderensis	scomber japonicus	trachurus trachurus	trachurus trecae	trichiurus lepturus
discards			110	2	866	22	376	1	271	50
landings			199		22132	0.2	4347		776	

August 2002



	decapterus rhonchus	katsuwonus pelamis	sarda sarda	sardina pilchardus	sardinella aurita	sardinella maderensis	scomber japonicus	trachurus trachurus	trachurus trecae	trichiurus lepturus
discards	20	14	510		669	2	349		178	47
landings	37		324		14367		5889		436	

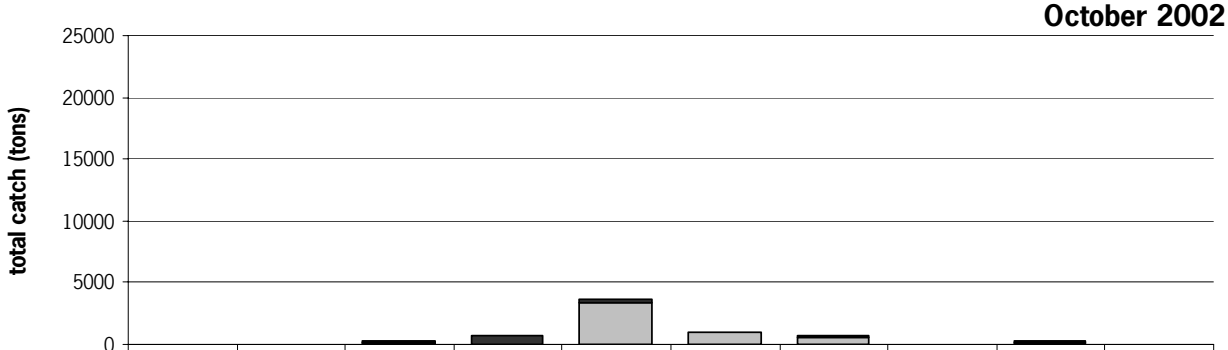
September 2002



	decapterus rhonchus	katsuwonus pelamis	sarda sarda	sardina pilchardus	sardinella aurita	sardinella maderensis	scomber japonicus	trachurus trachurus	trachurus trecae	trichiurus lepturus
discards	23	15	161	109	19	71	59		7	9
landings	718		461		16593	1325	2057		17	244

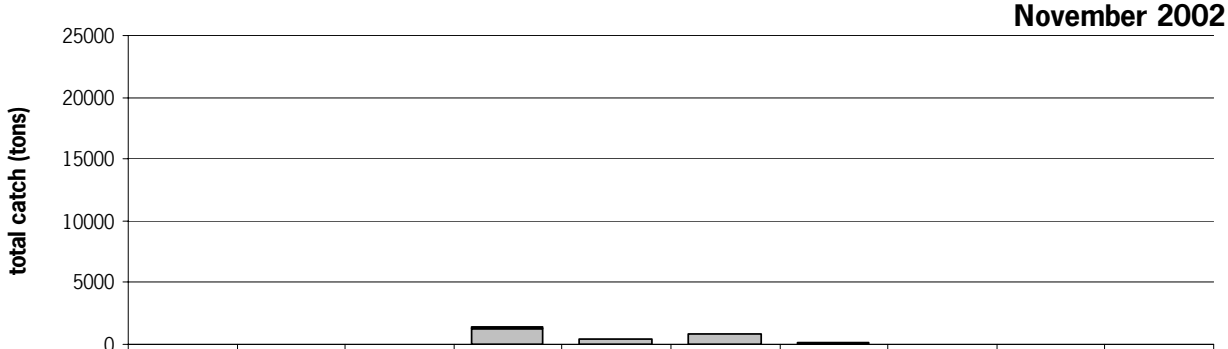
Figure 2d: Monthly catches in tons of the 10 most important target species for October, November and December 2002.

October 2002



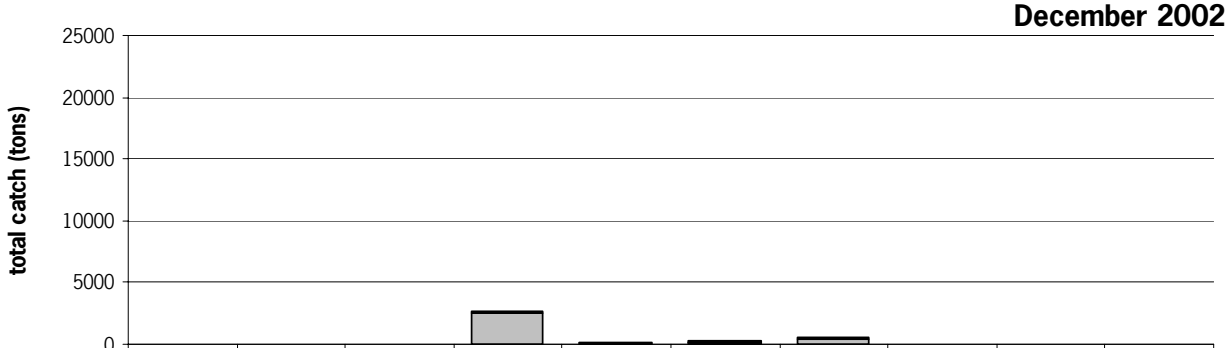
	decapterus rhonchus	katsuwonus pelamis	sarda sarda	sardina pilchardus	sardinella aurita	sardinella maderensis	scomber japonicus	trachurus trachurus	trachurus trecae	trichiurus lepturus
discards	7		12	634	186	58	142		47	40
landings	20		205		3433	950	563		180	

November 2002



	decapterus rhonchus	katsuwonus pelamis	sarda sarda	sardina pilchardus	sardinella aurita	sardinella maderensis	scomber japonicus	trachurus trachurus	trachurus trecae	trichiurus lepturus
discards	2	1	41	90	5	16	87	39	5	6
landings		8	3	1284	404	792	63	3	34	5

December 2002



	decapterus rhonchus	katsuwonus pelamis	sarda sarda	sardina pilchardus	sardinella aurita	sardinella maderensis	scomber japonicus	trachurus trachurus	trachurus trecae	trichiurus lepturus
discards	3	1	54	118	7	21	114	50	7	7
landings		10	3	2490	103	202	488	5	58	

Figure 3: Length-frequency distributions of the catches of 10 major target species in 2002.

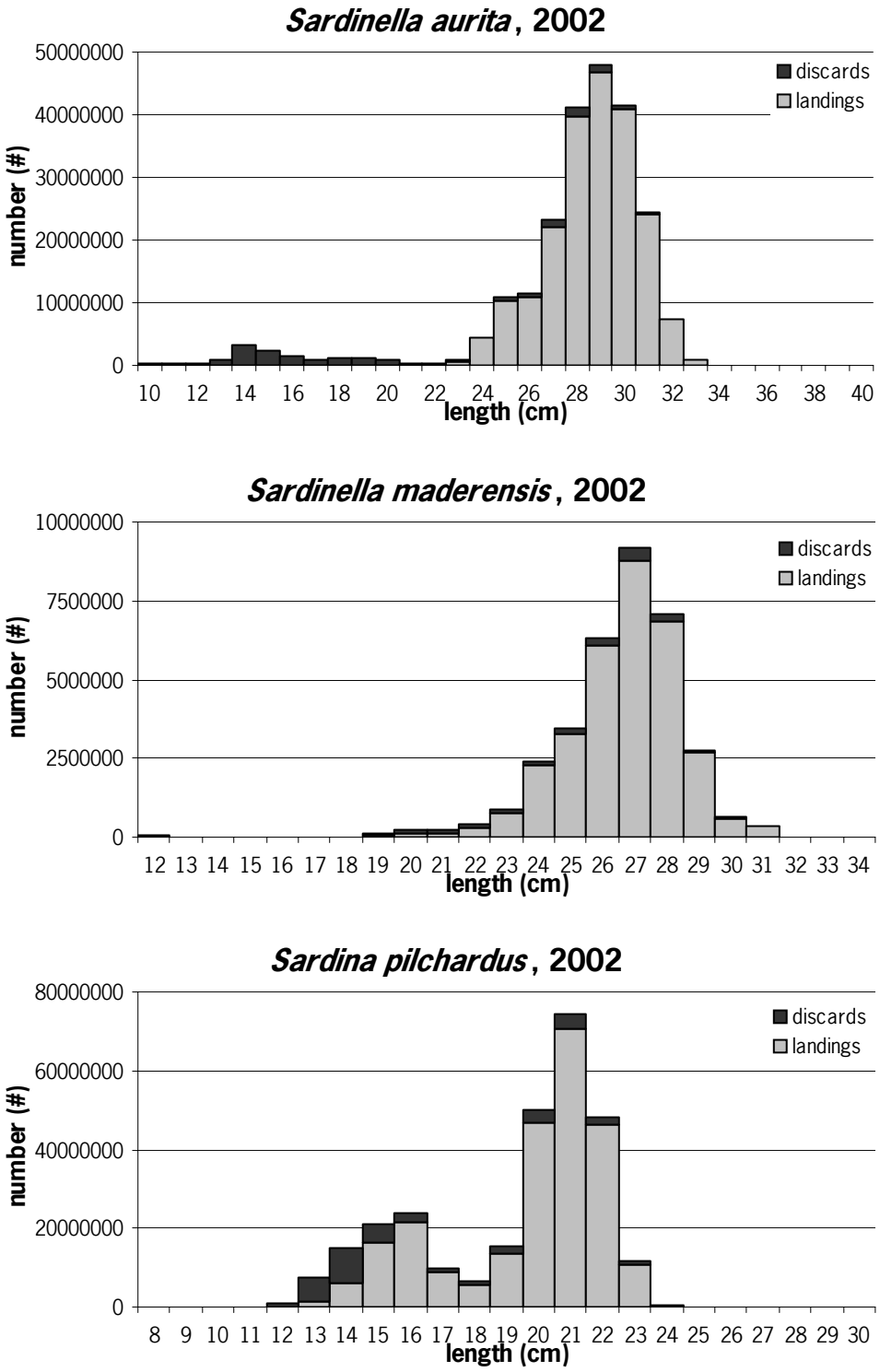
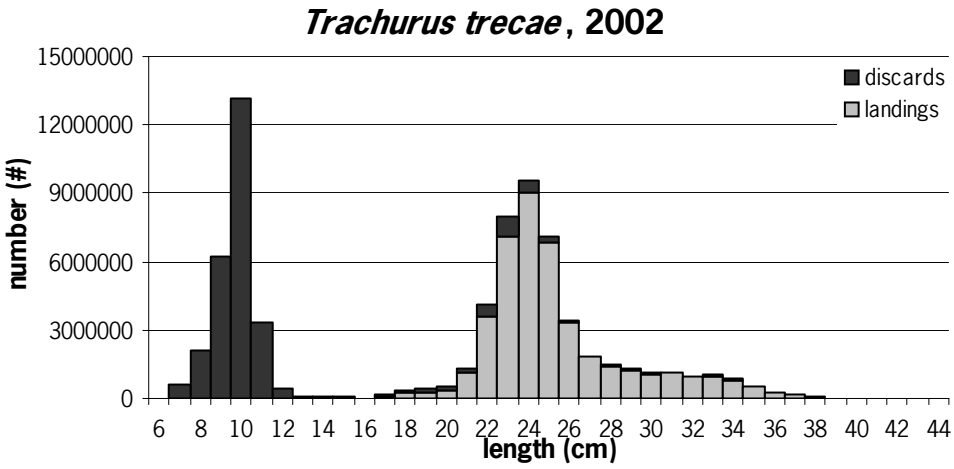
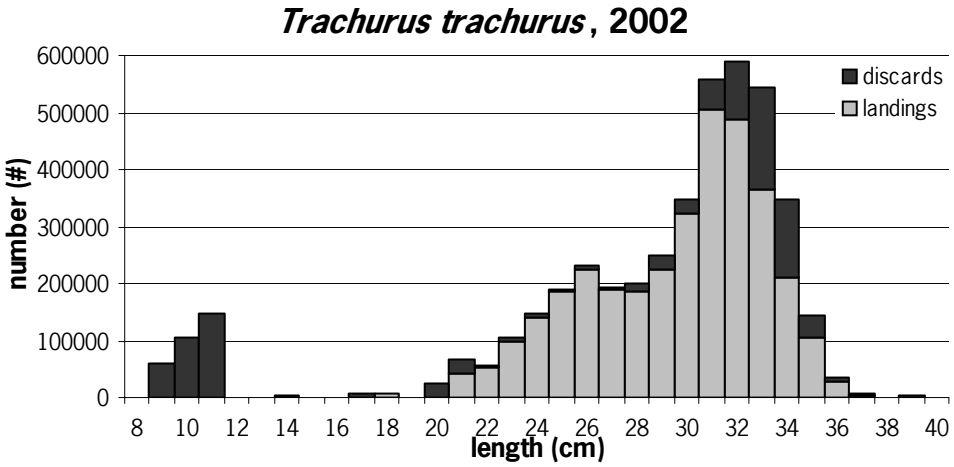


Figure 3 (continued): Length-frequency distributions of the catches of 10 major target species in 2002.





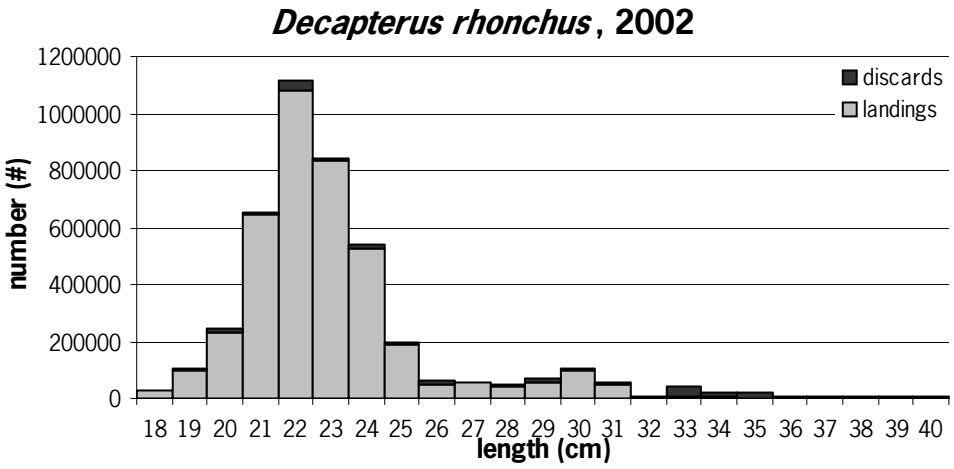
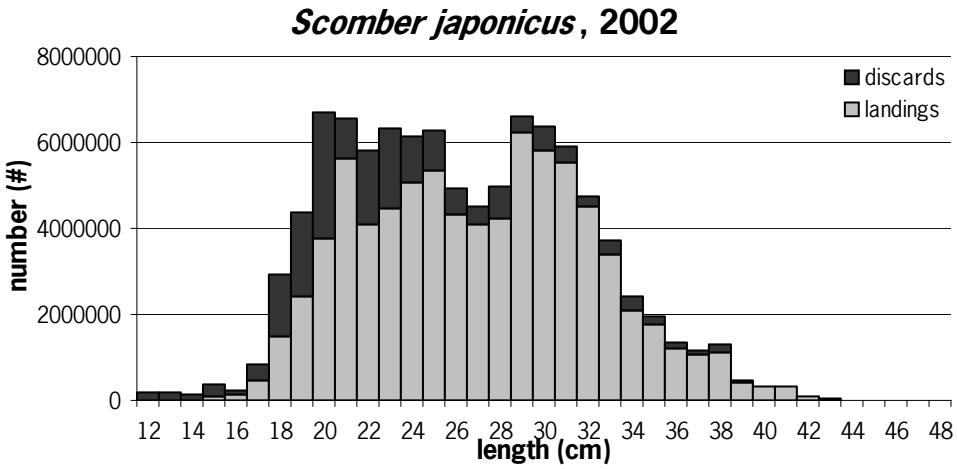
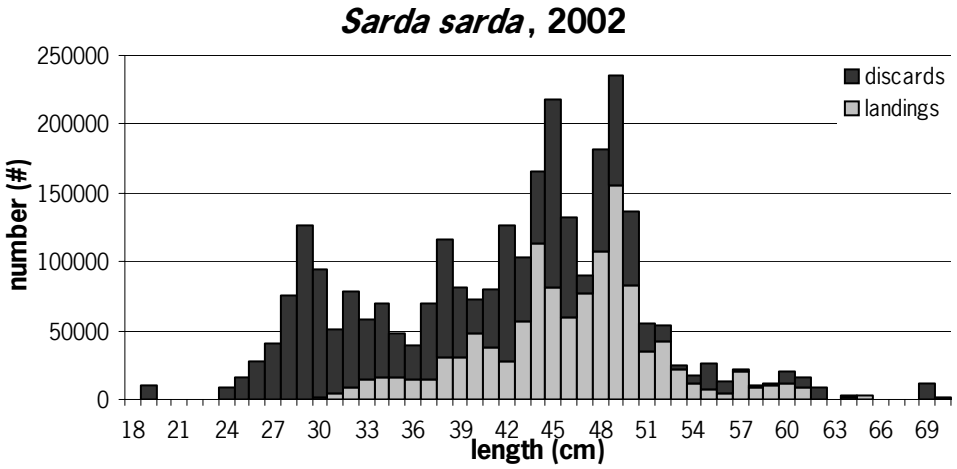


Figure 3 (continued): Length-frequency distributions of the catches of 10 major target species in 2002.





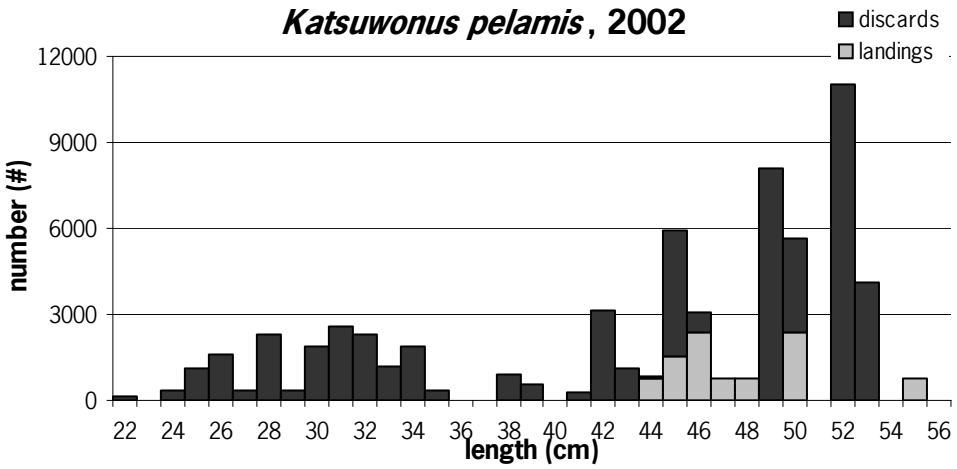


Figure 3 (continued): Length-frequency distributions of the catches of 10 major target species in 2002.

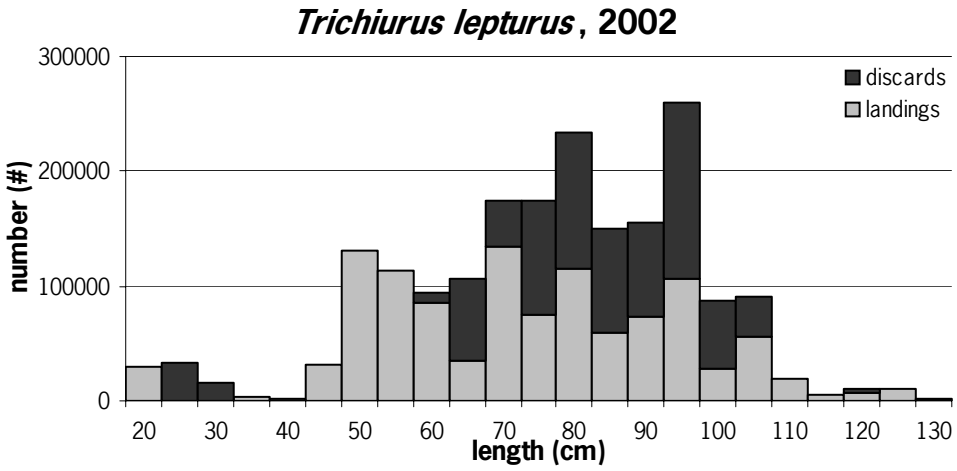
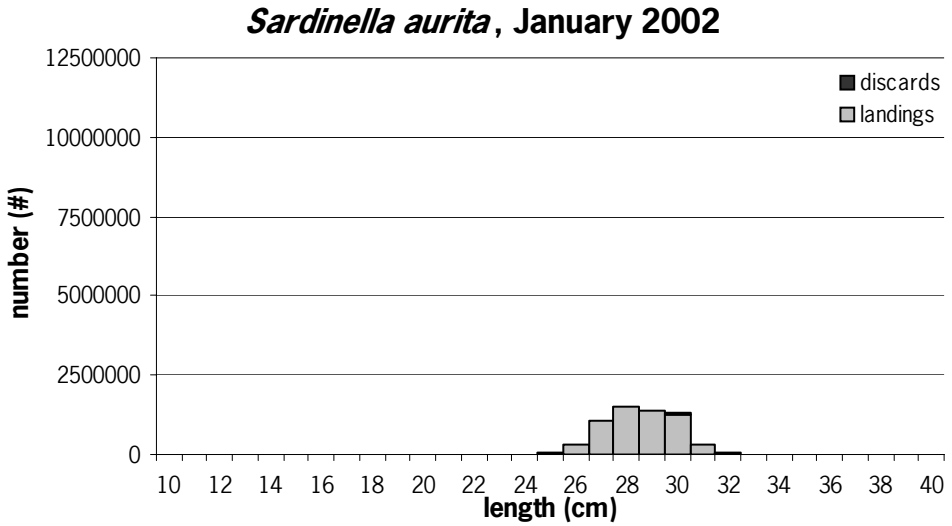
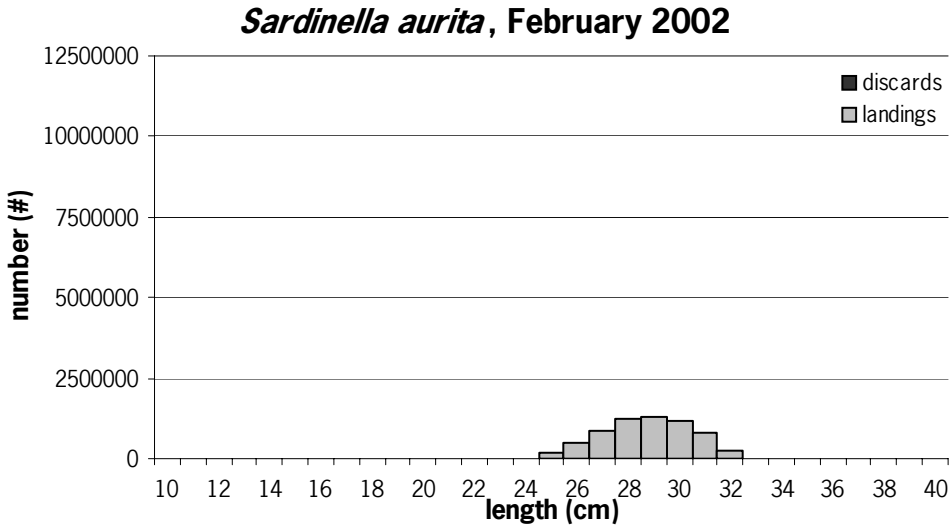


Figure 4a: Monthly length-frequency distributions for the catches of Sardinella aurita for January, February and March 2002.





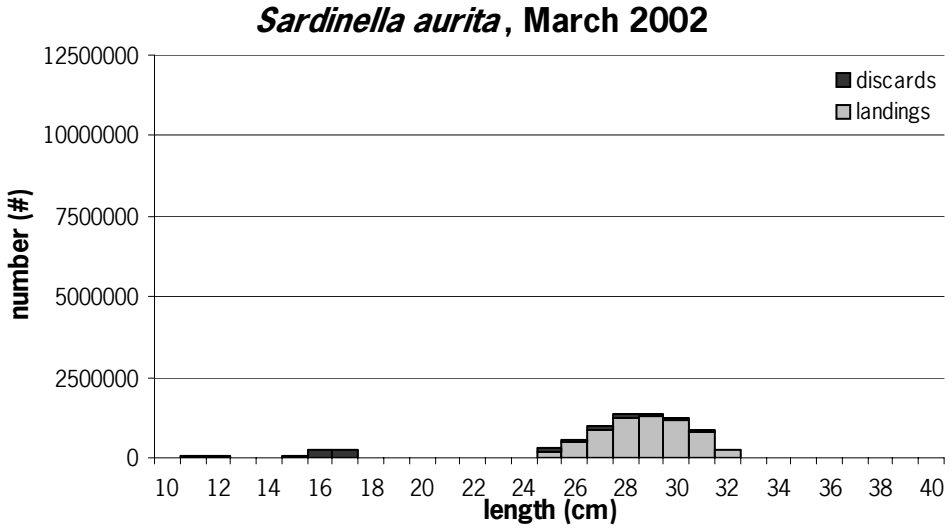
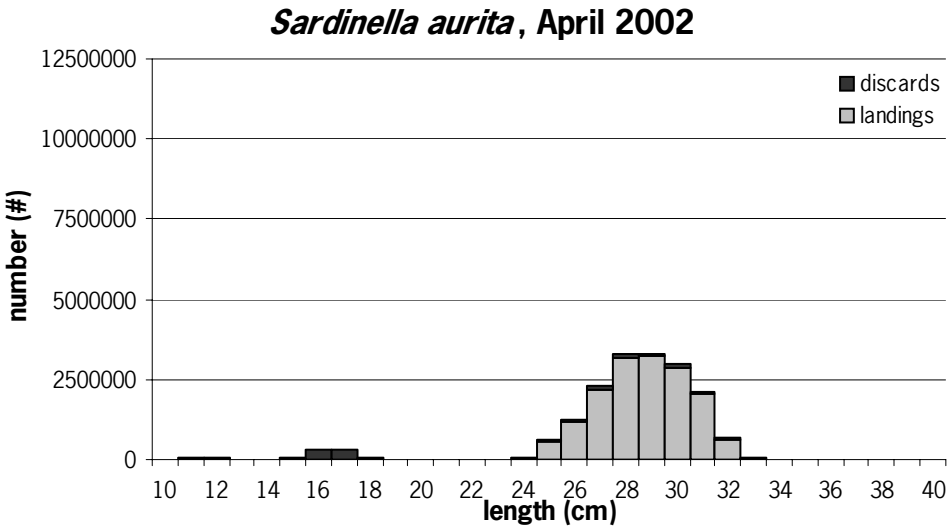
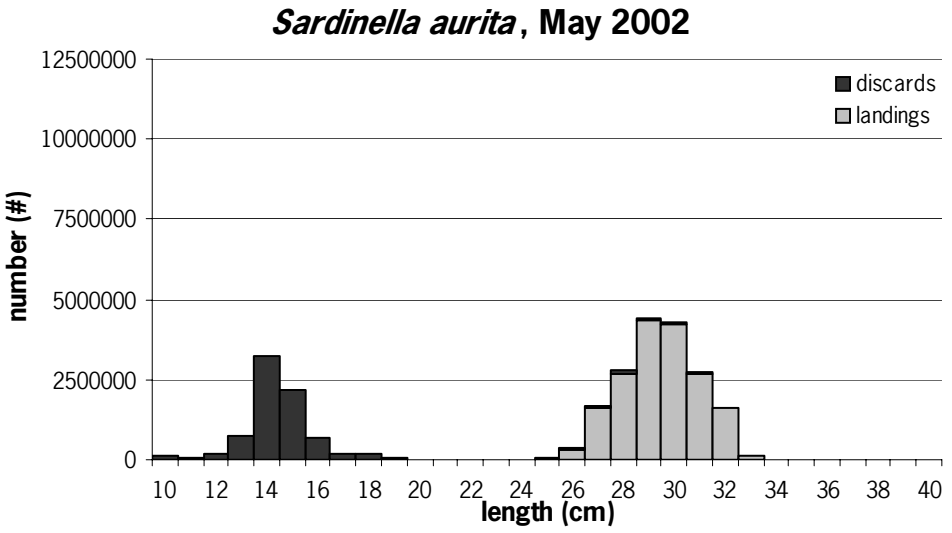


Figure 4b: Monthly length-frequency distributions for the catches of Sardinella aurita for April, May and June 2002.





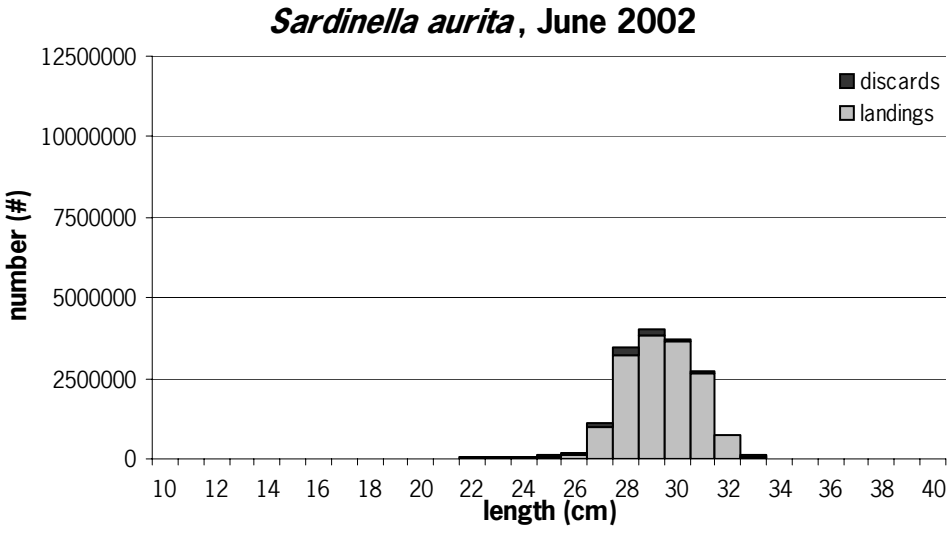
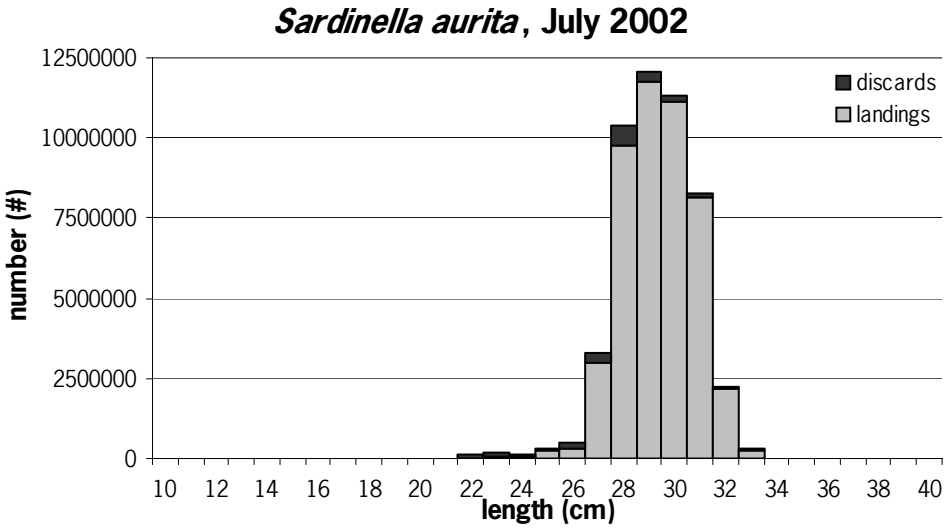
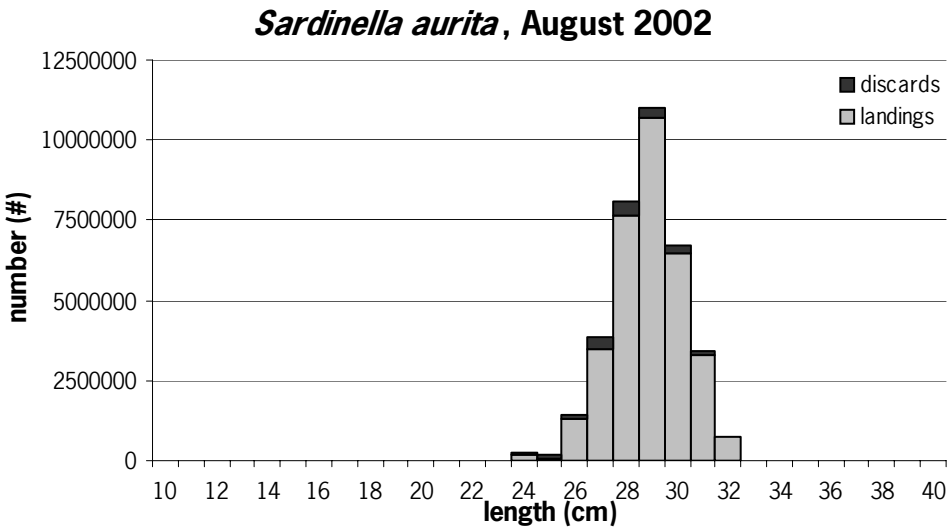


Figure 4c: Monthly length-frequency distributions for the catches of Sardinella aurita for July, August and September 2002.





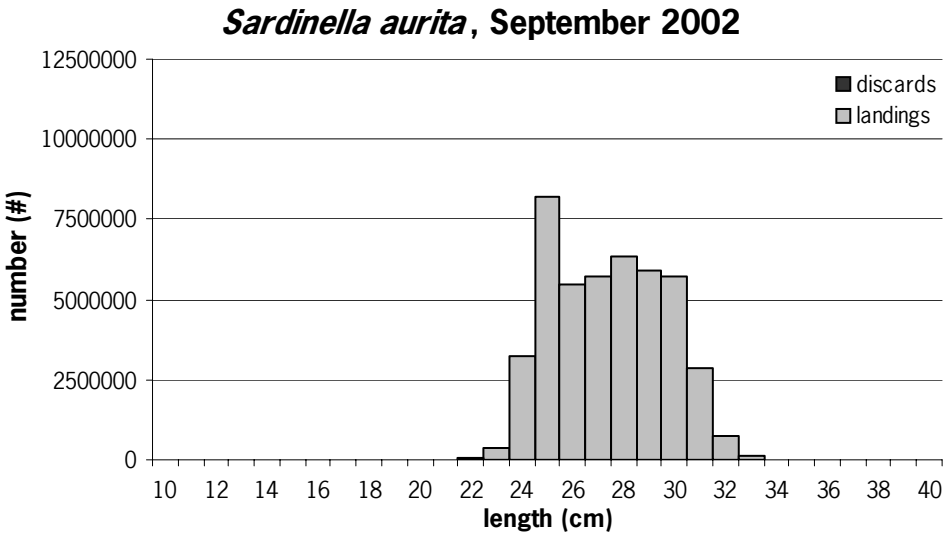
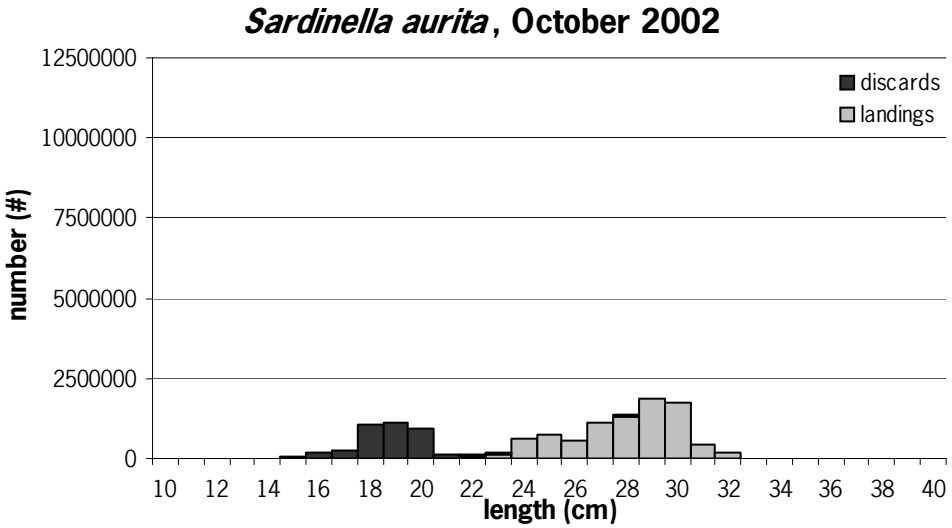
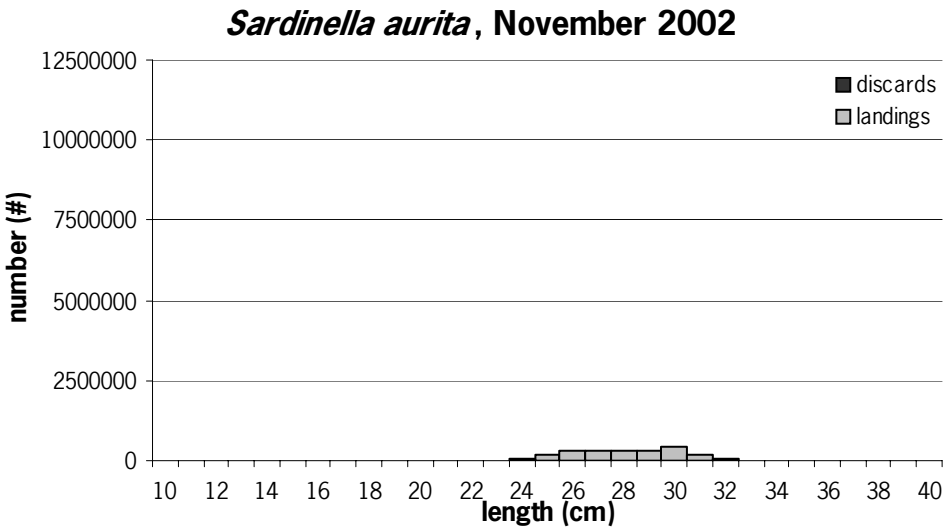


Figure 4d: Monthly length-frequency distributions for the catches of Sardinella aurita for October, November and December 2002.





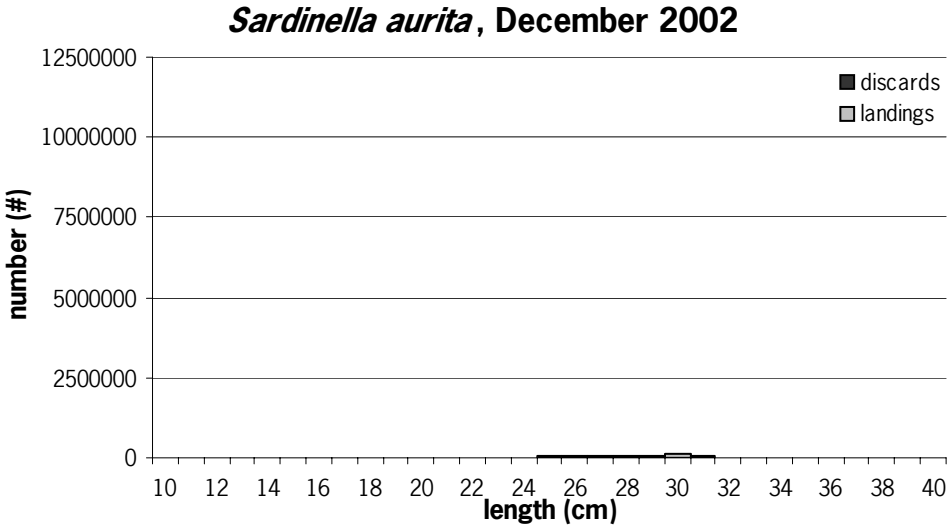
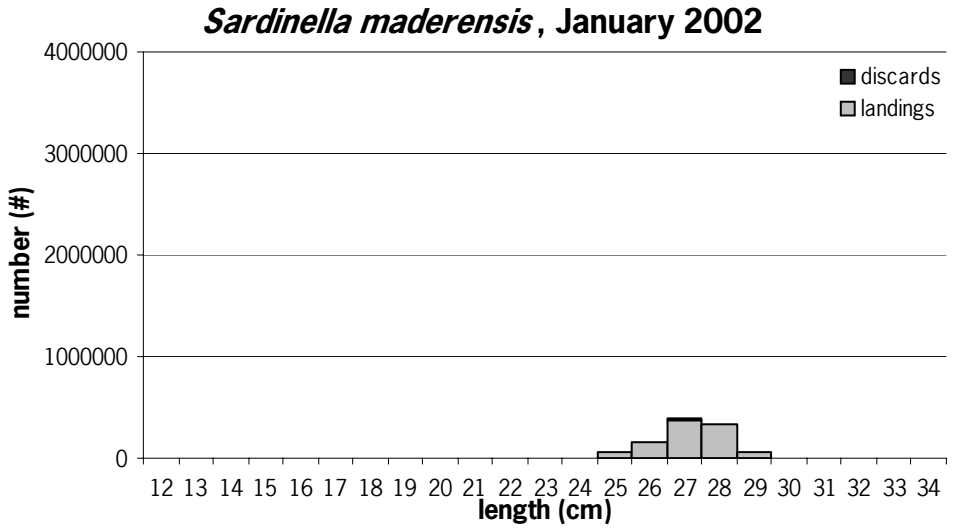
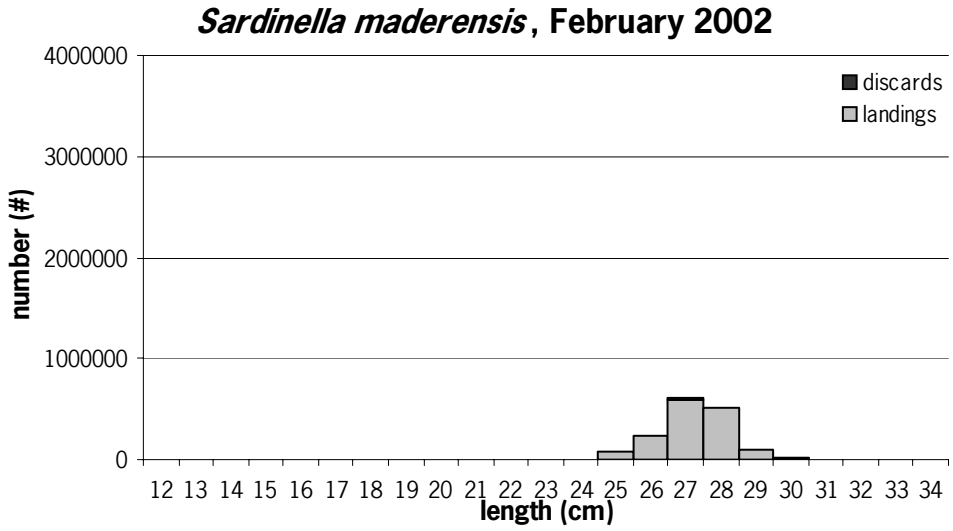


Figure 5a: Monthly length-frequency distributions for the catches of Sardinella maderensis for January, February and March 2002.





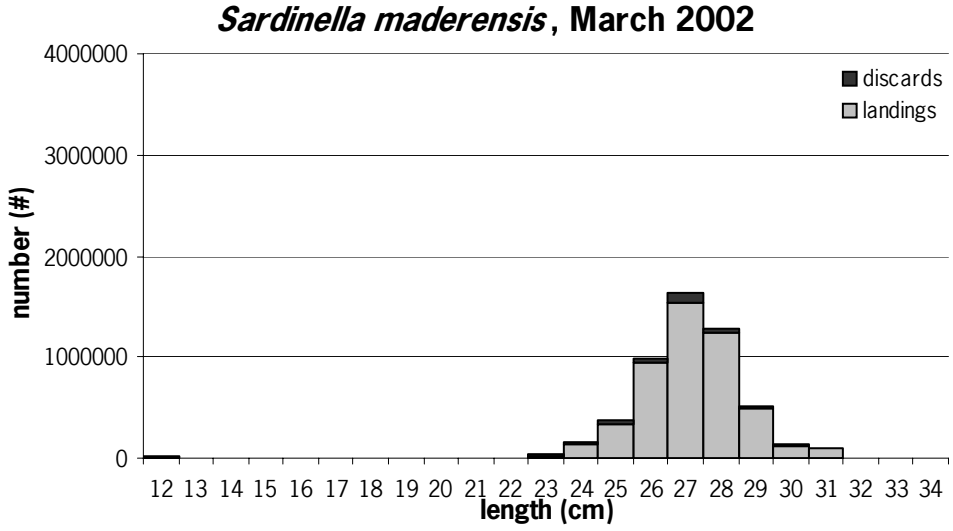
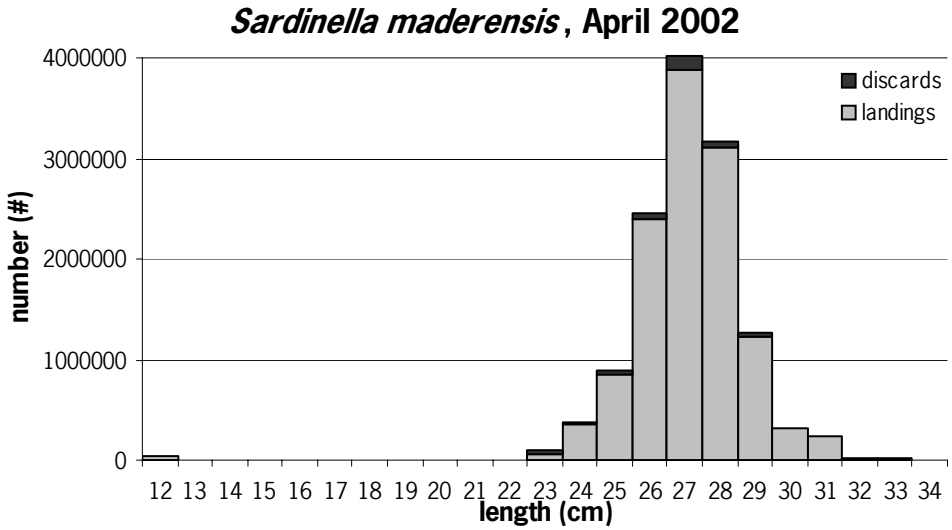
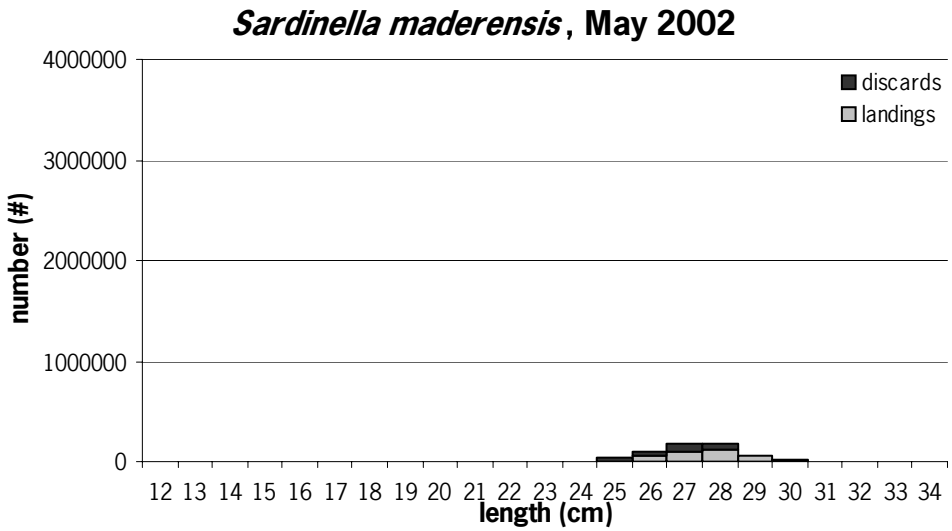


Figure 5b: Monthly length-frequency distributions for the catches of Sardinella maderensis for April, May and June 2002.





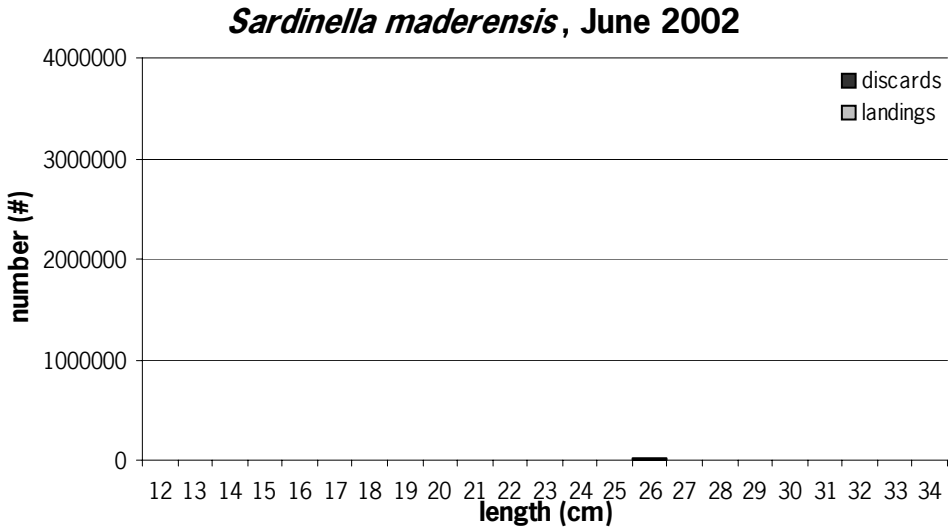
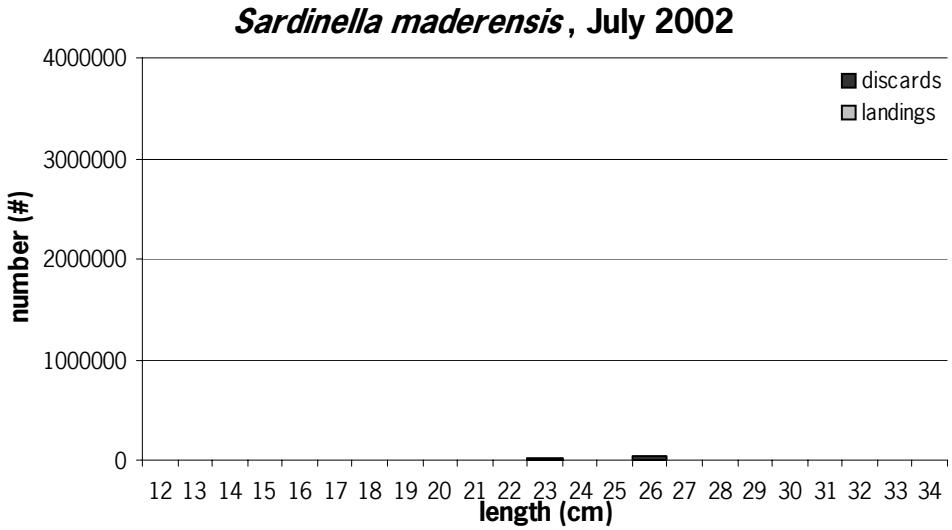
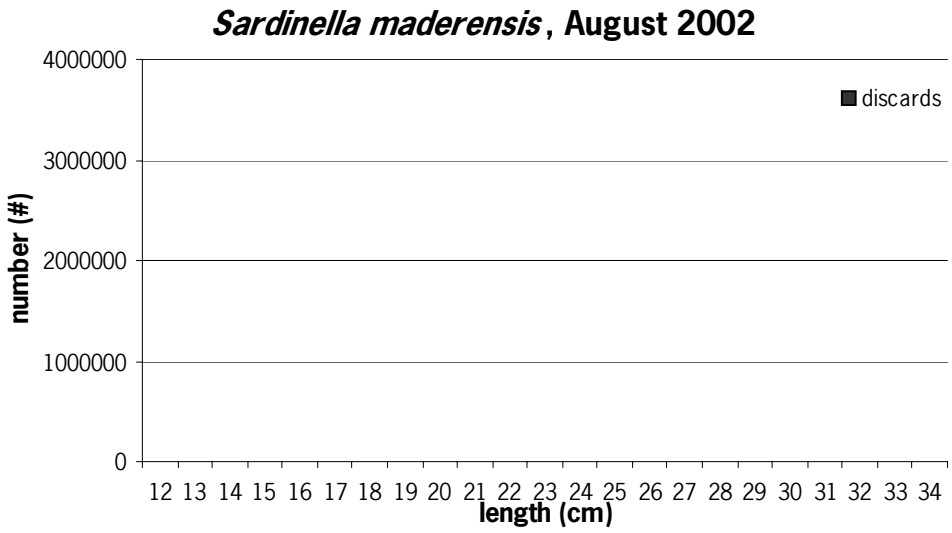


Figure 5c: Monthly length-frequency distributions for the catches of Sardinella maderensis for July, August and September 2002.





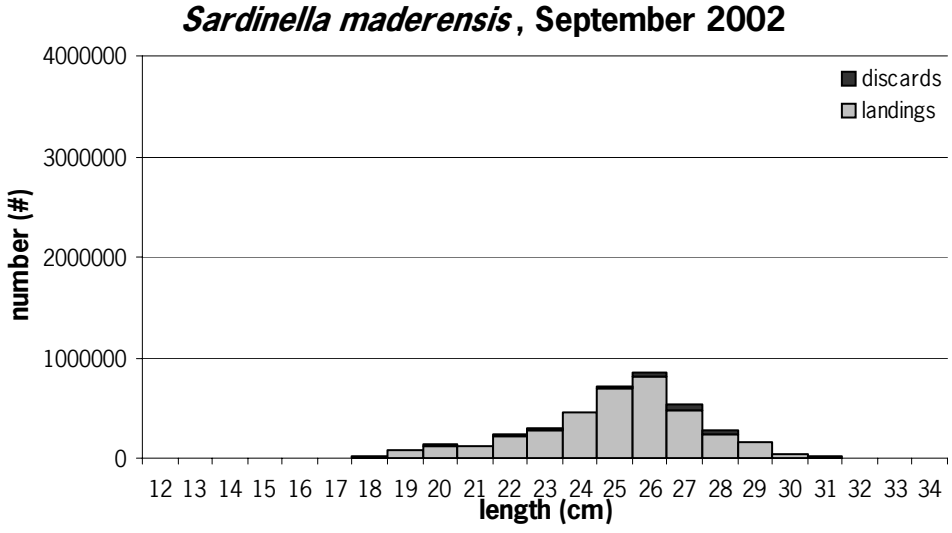
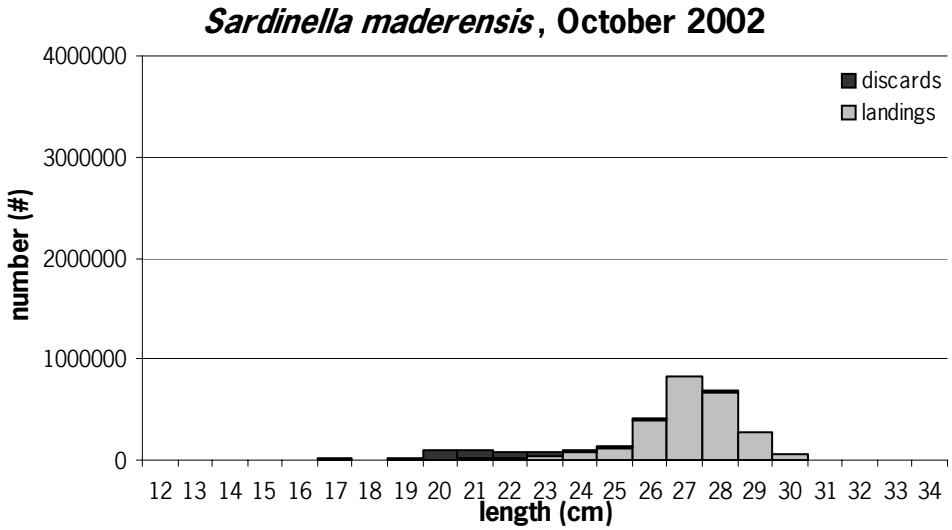
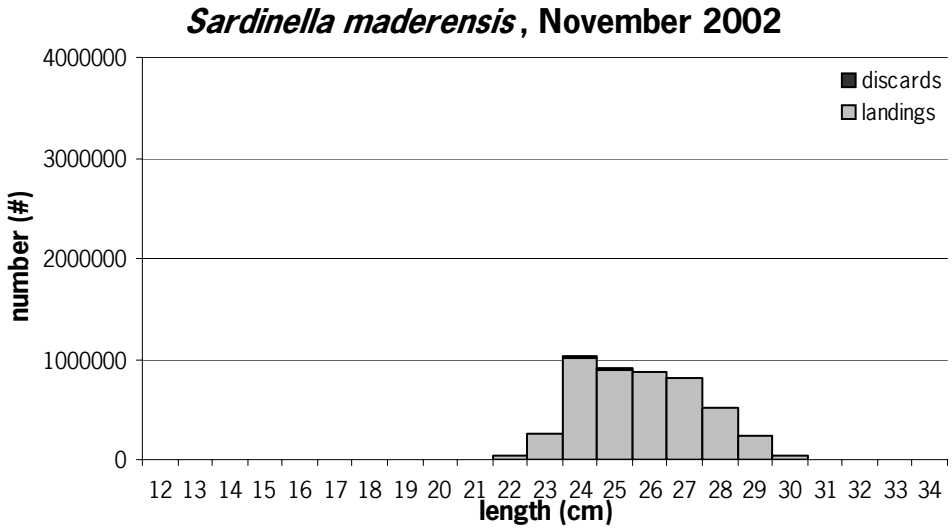


Figure 5d: Monthly length-frequency distributions for the catches of Sardinella maderensis for October, November and December 2002.





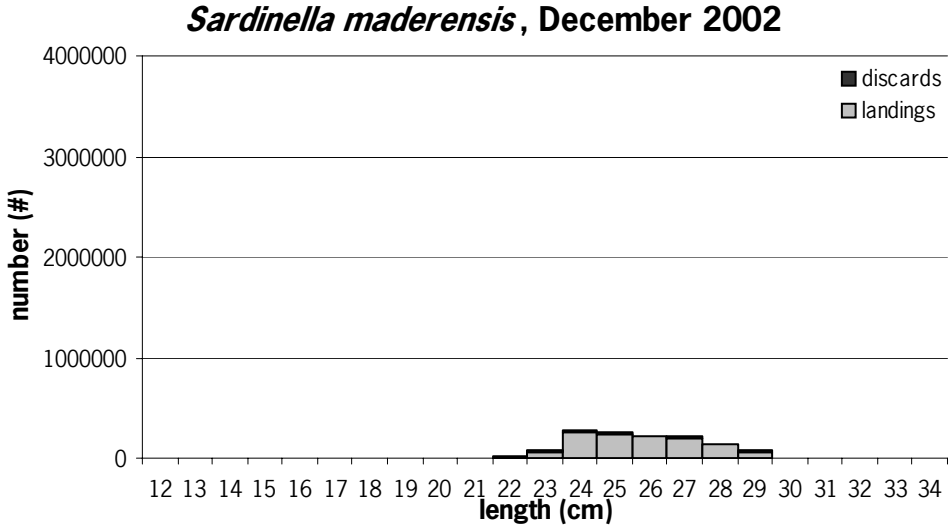
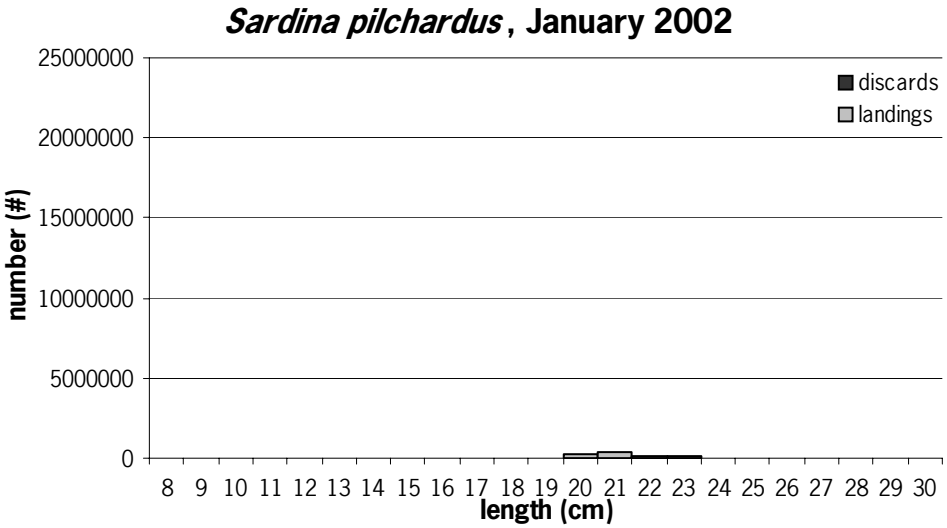
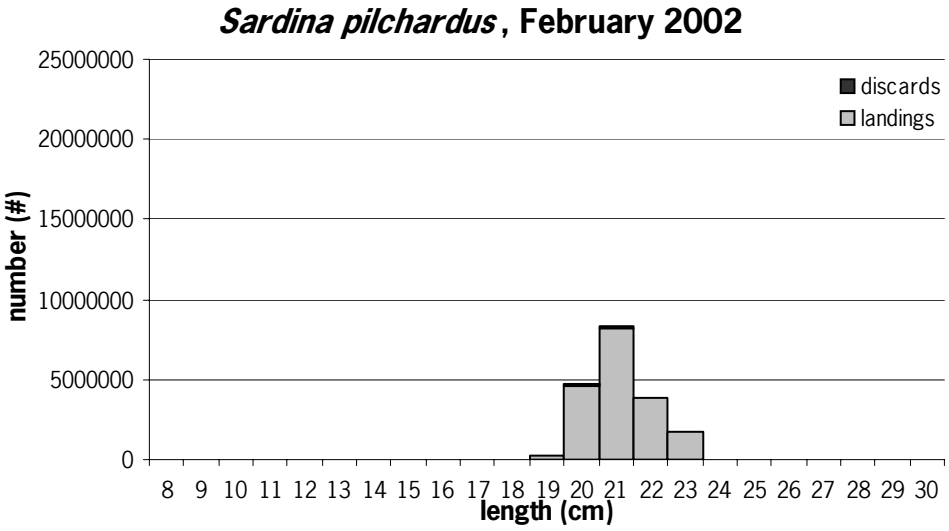


Figure 6a: Monthly length-frequency distributions for the catches of Sardina pilchardus for January, February and March 2002.





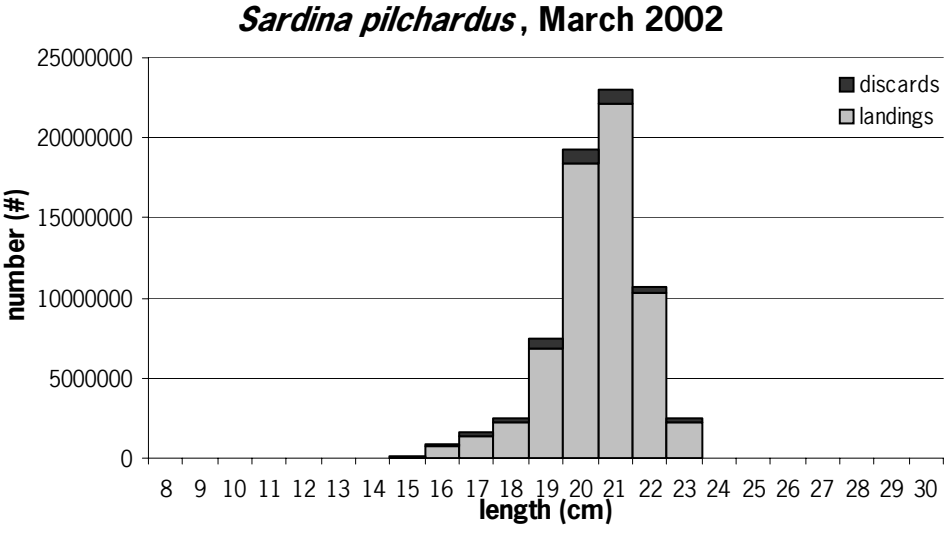
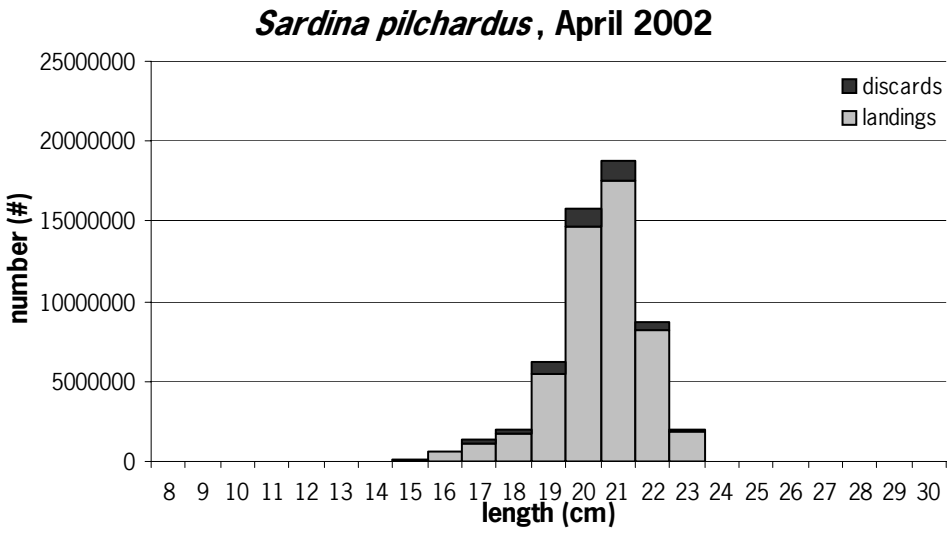
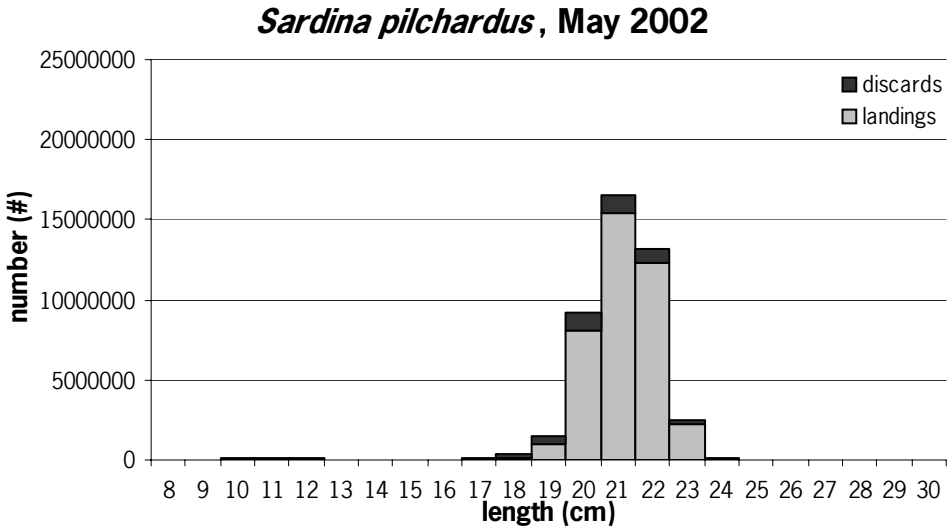


Figure 6b: Monthly length-frequency distributions for the catches of Sardina pilchardus for April, May and June 2002.





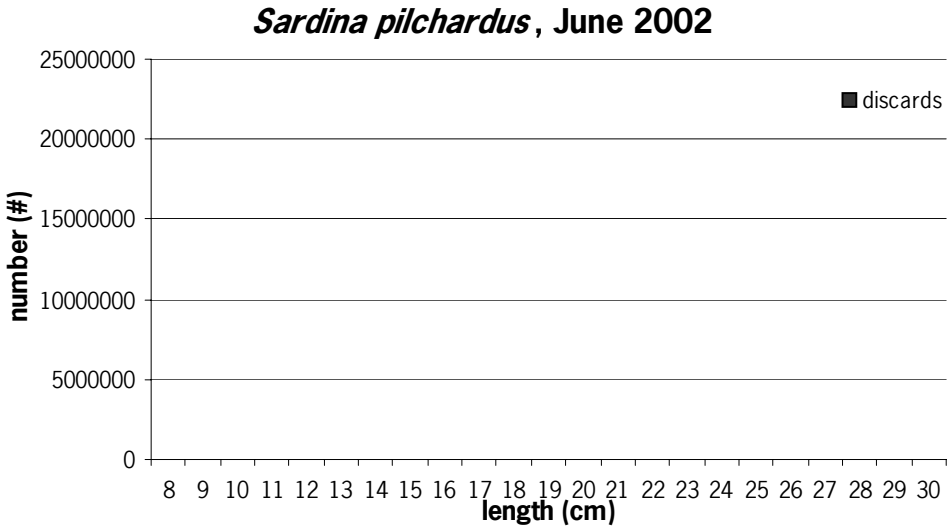


Figure 6c: Monthly length-frequency distributions for the catches of Sardina pilchardus for July and September 2002.

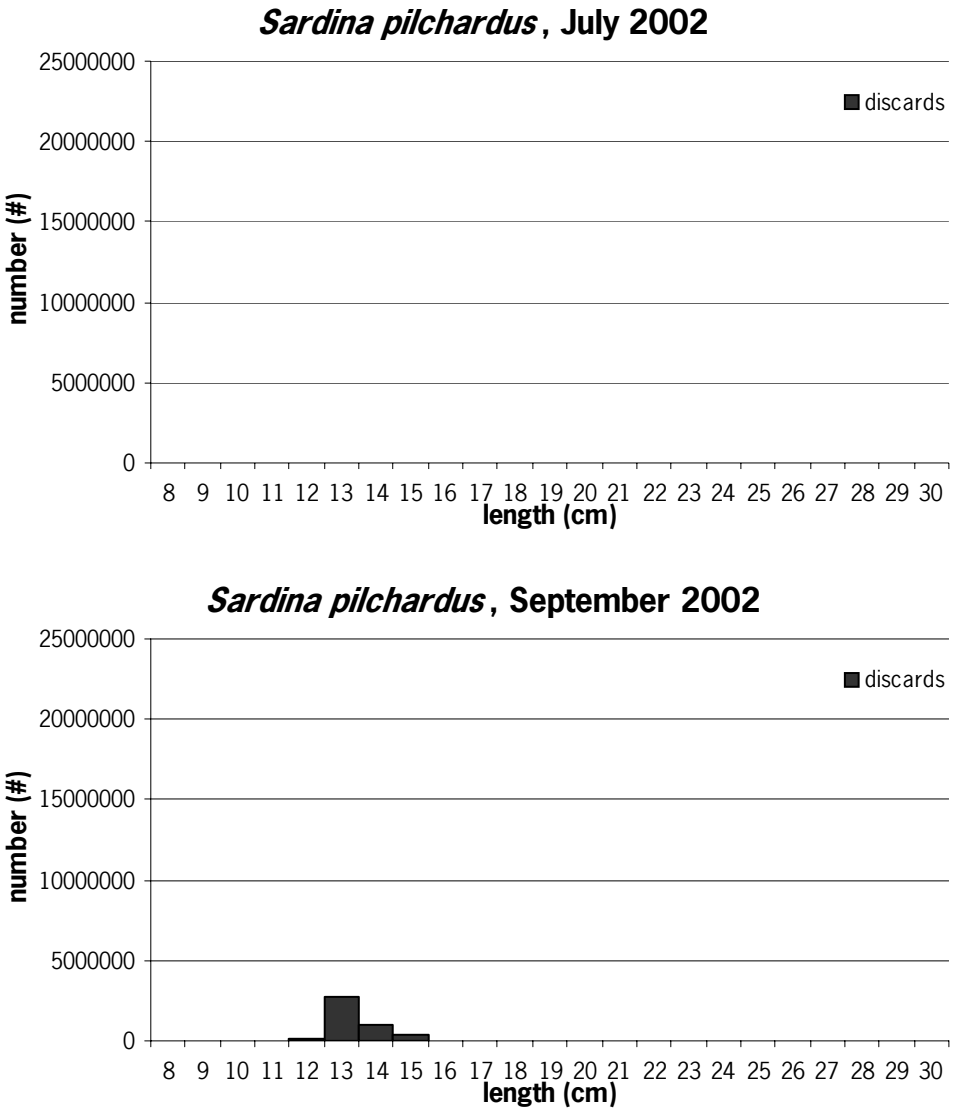
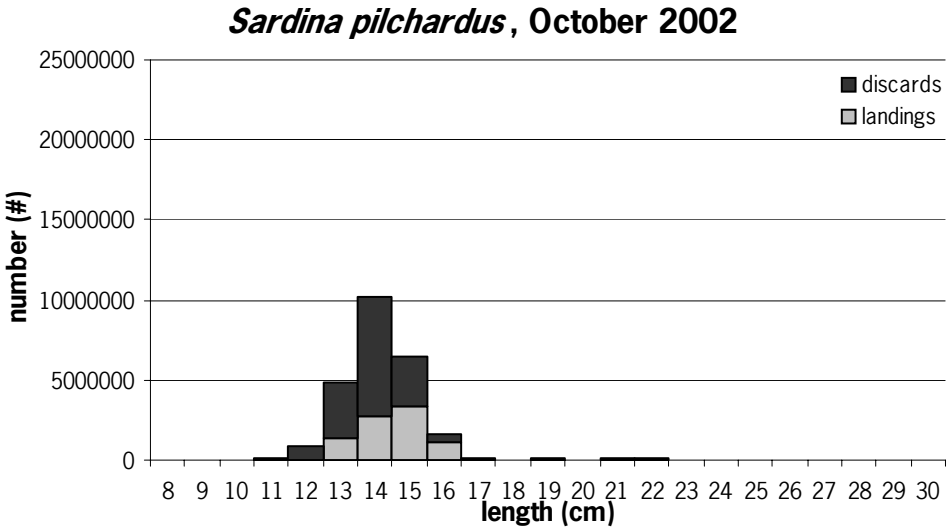
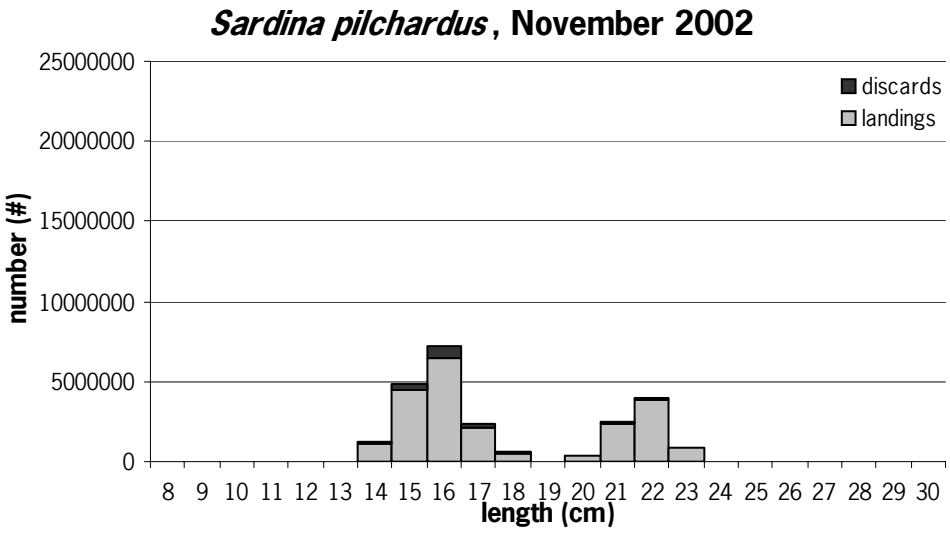


Figure 6d: Monthly length-frequency distributions for the catches of Sardina pilchardus for October, November and December 2002.





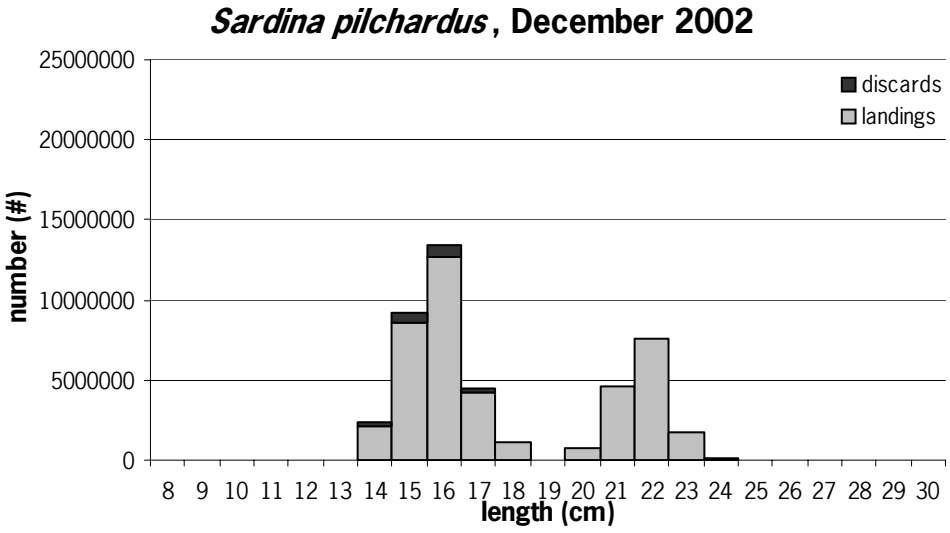
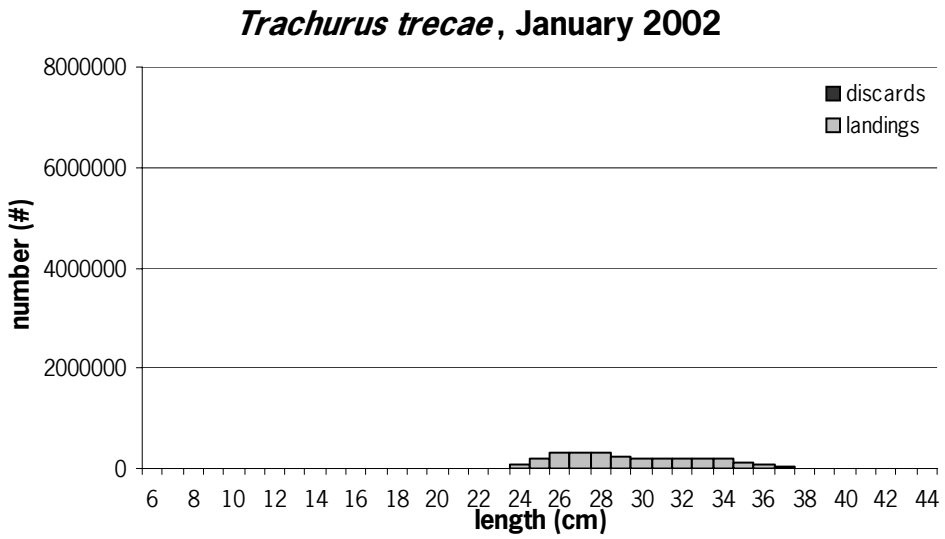
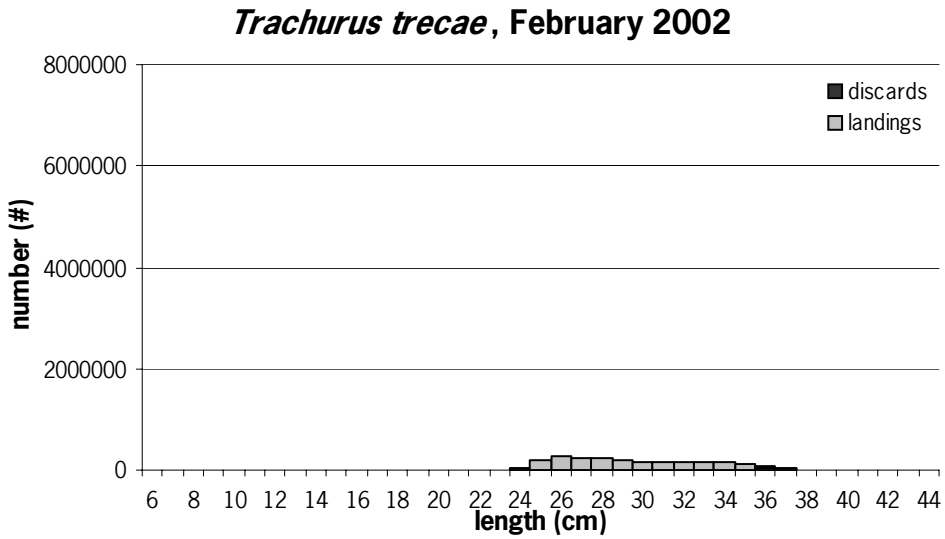


Figure 7a: Monthly length-frequency distributions for the catches of Trachurus trecae for January, February and March 2002.





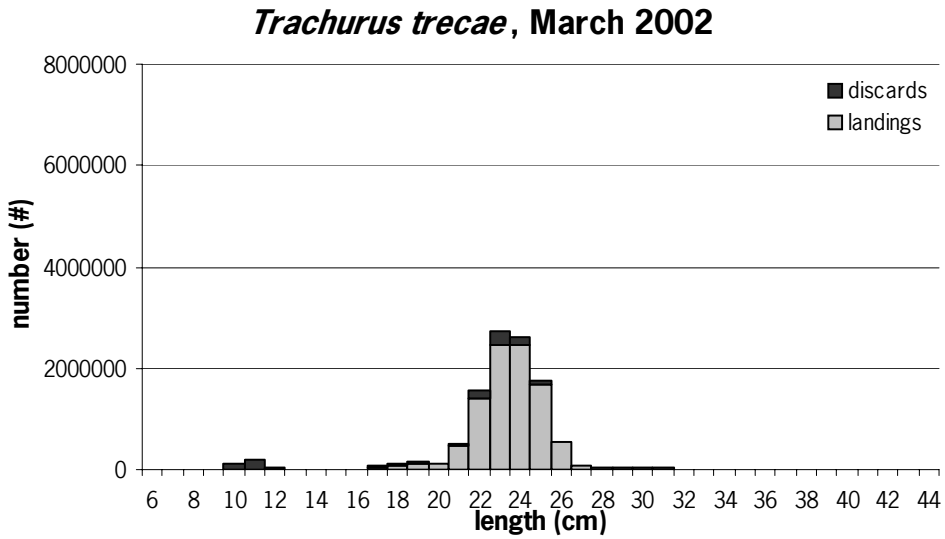
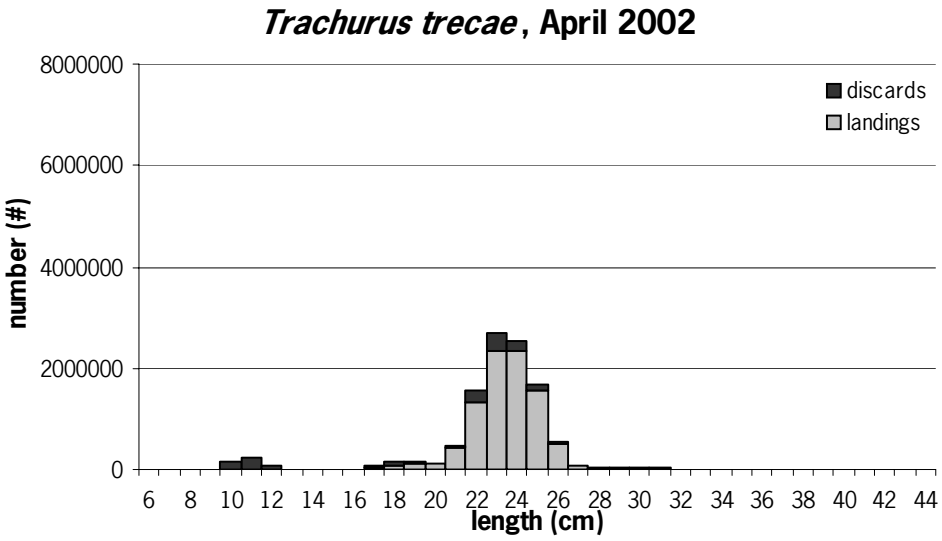
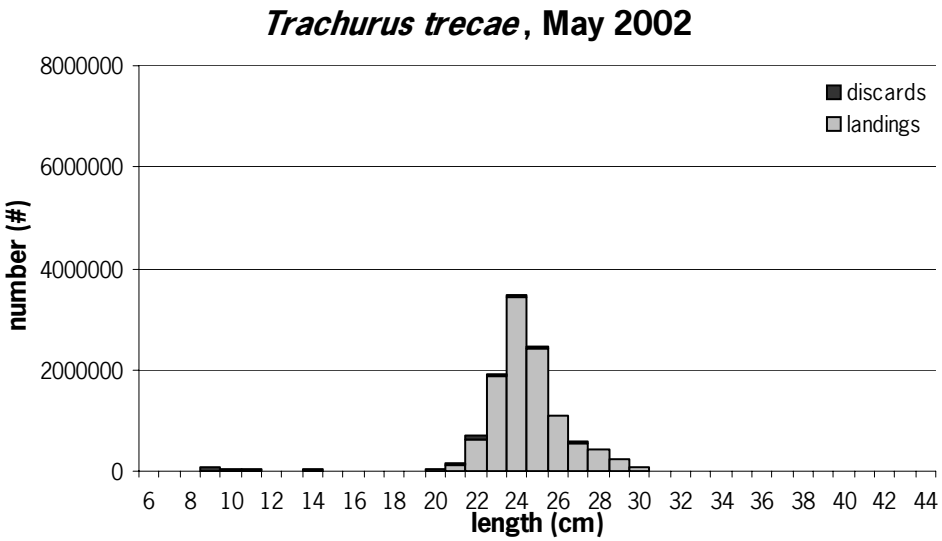


Figure 7b: Monthly length-frequency distributions for the catches of Trachurus trecae for April, May and June 2002.





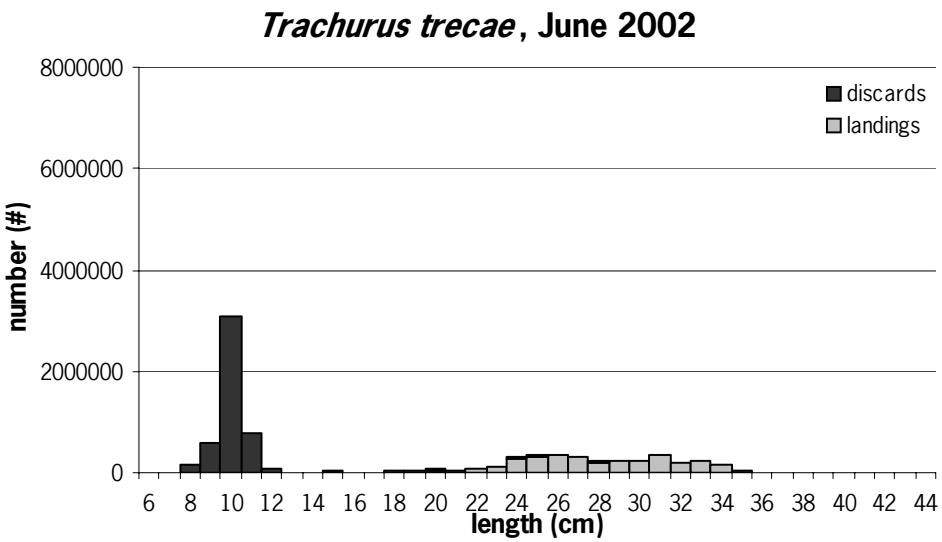


Figure 7c: Monthly length-frequency distributions for the catches of Trachurus trecae for July, August and September 2002.

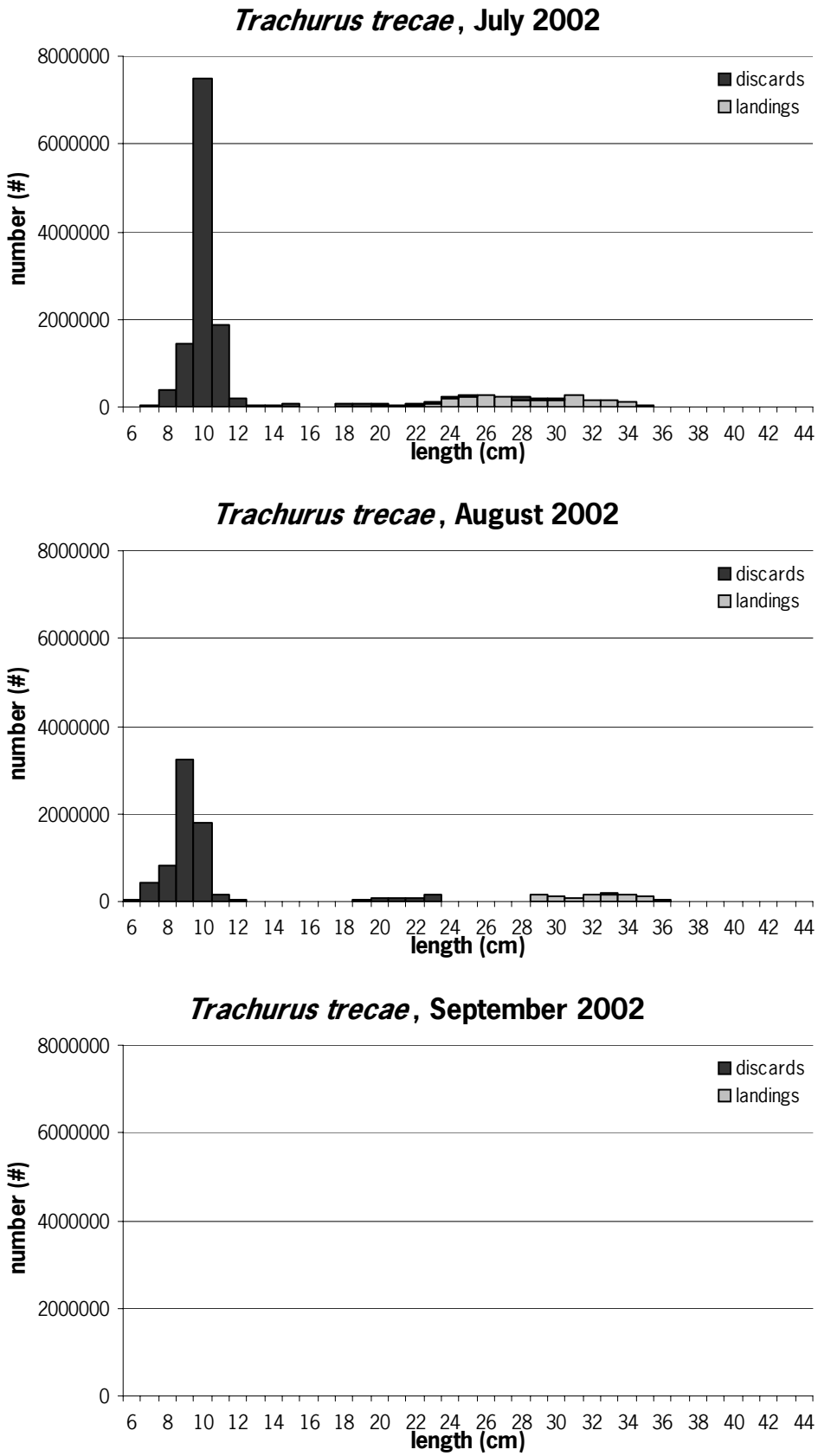
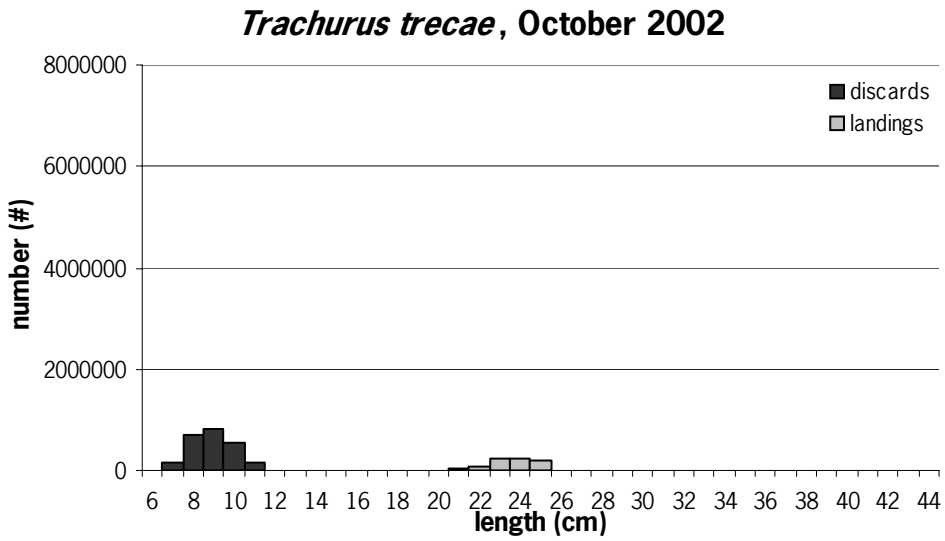
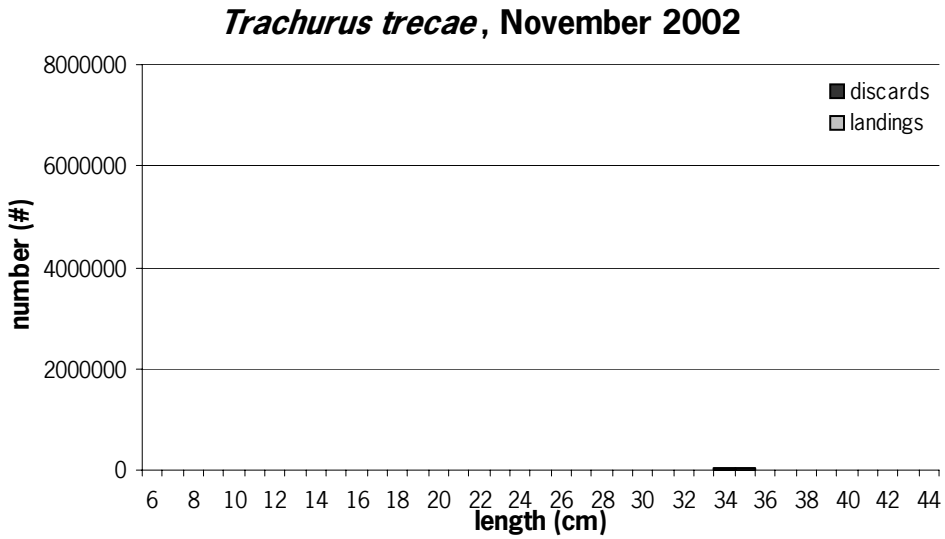


Figure 7d: Monthly length-frequency distributions for the catches of Trachurus trecae for October, November and December 2002.





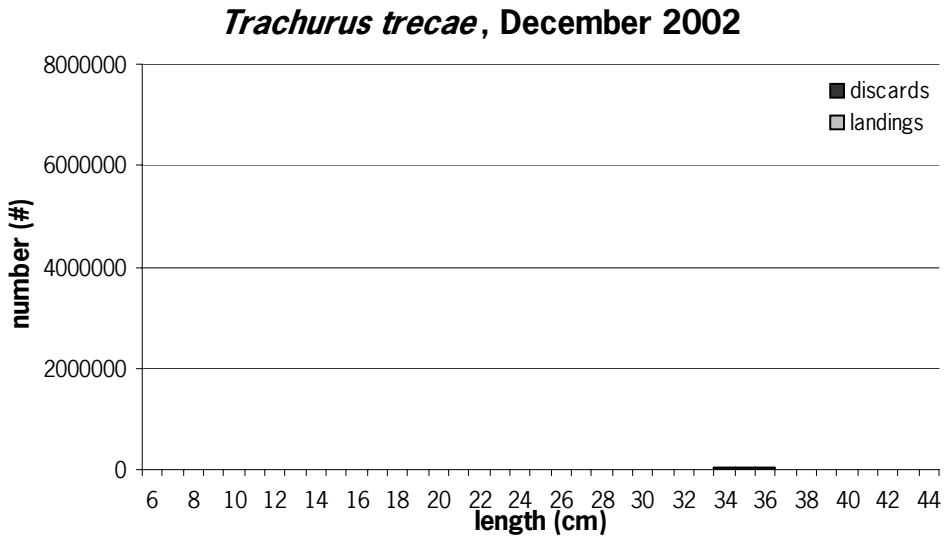


Figure 8a: Monthly length-frequency distributions for the catches of Trachurus trachurus for January and February 2002.

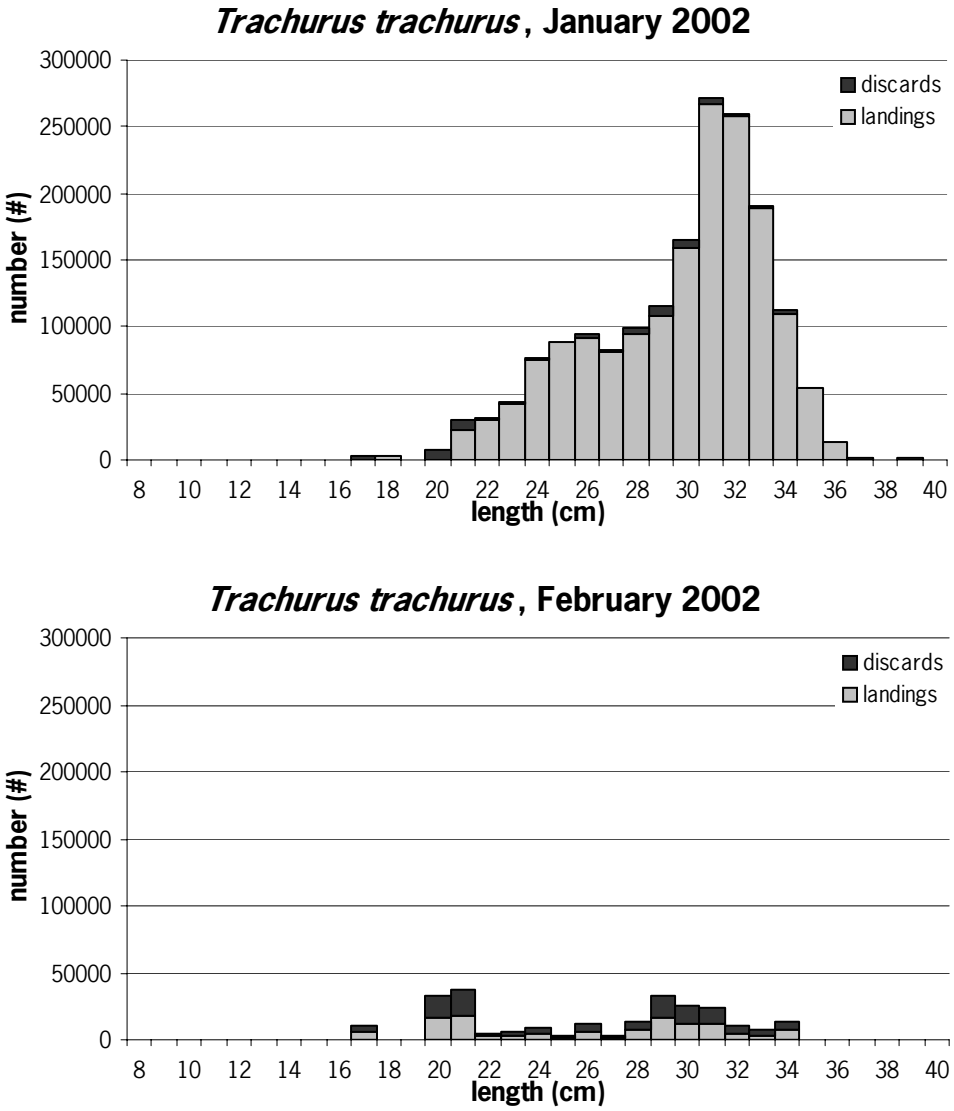
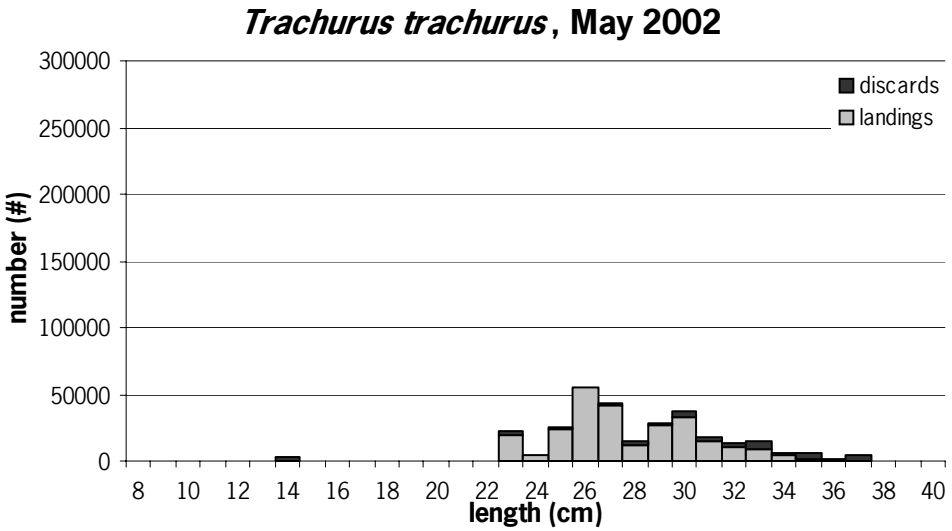
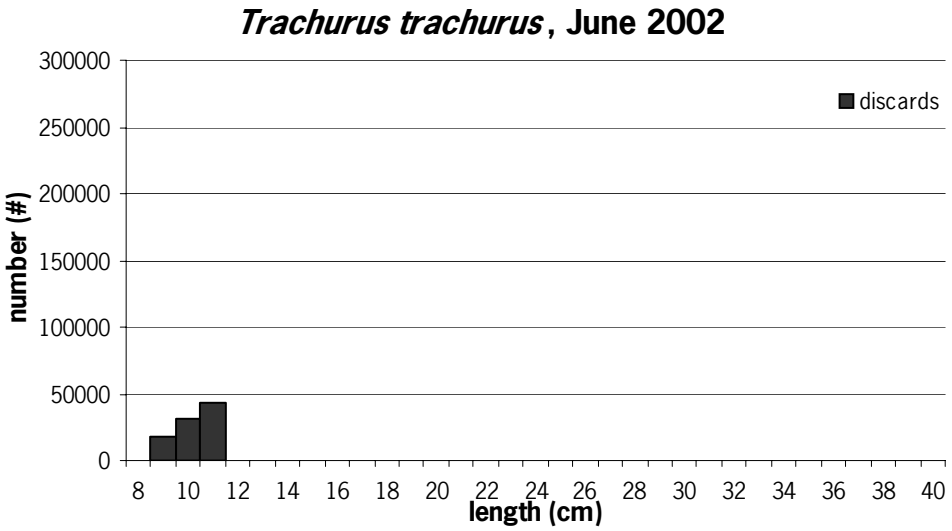


Figure 8b: Monthly length-frequency distributions for the catches of Trachurus trachurus for May, June and July 2002.





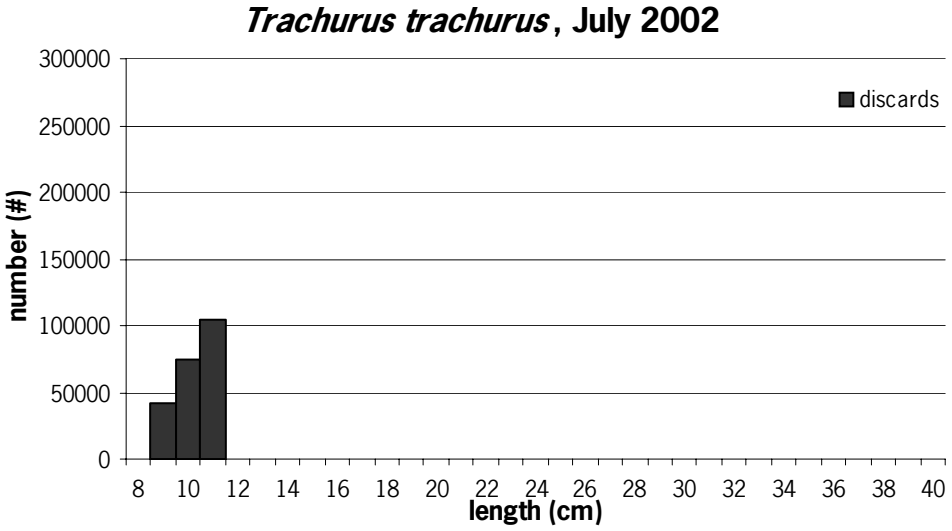


Figure 8c: Monthly length-frequency distributions for the catches of Trachurus trachurus for November and December 2002.

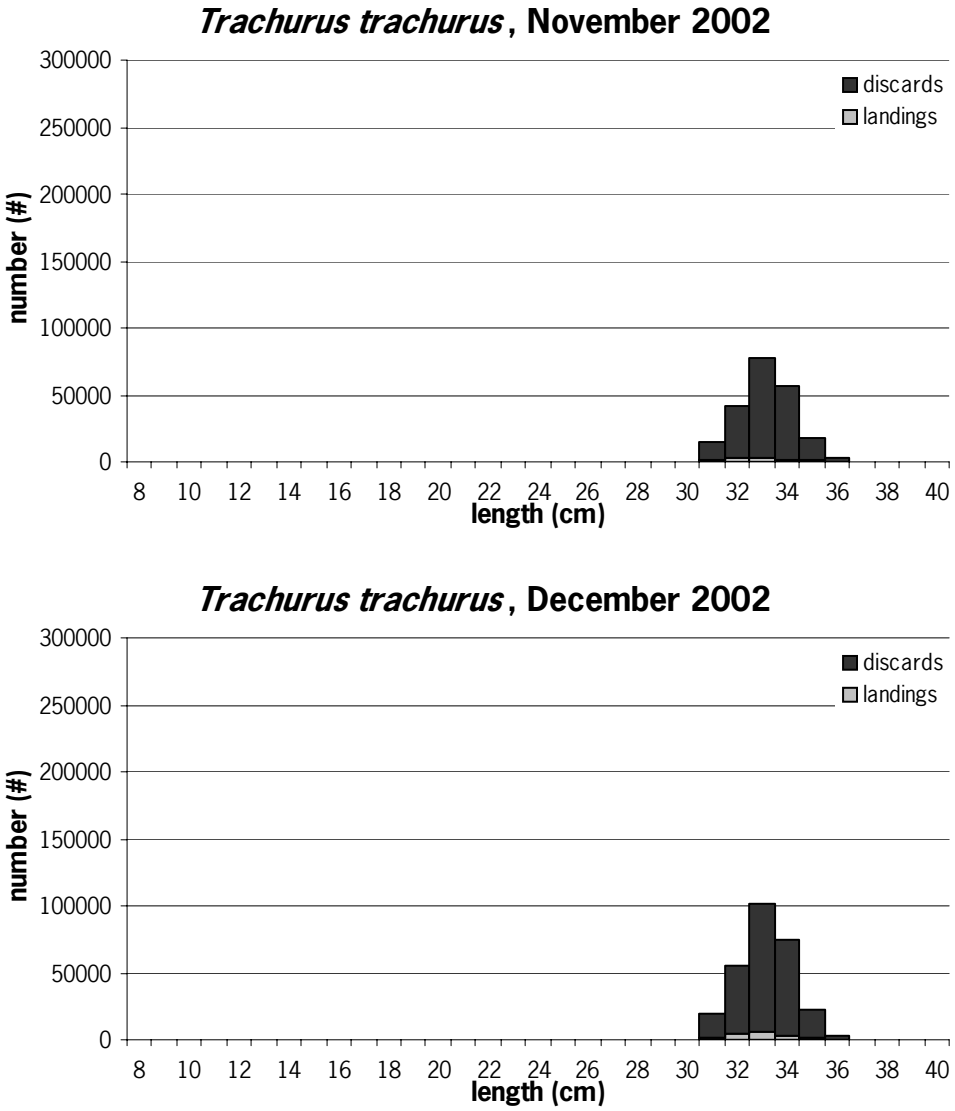
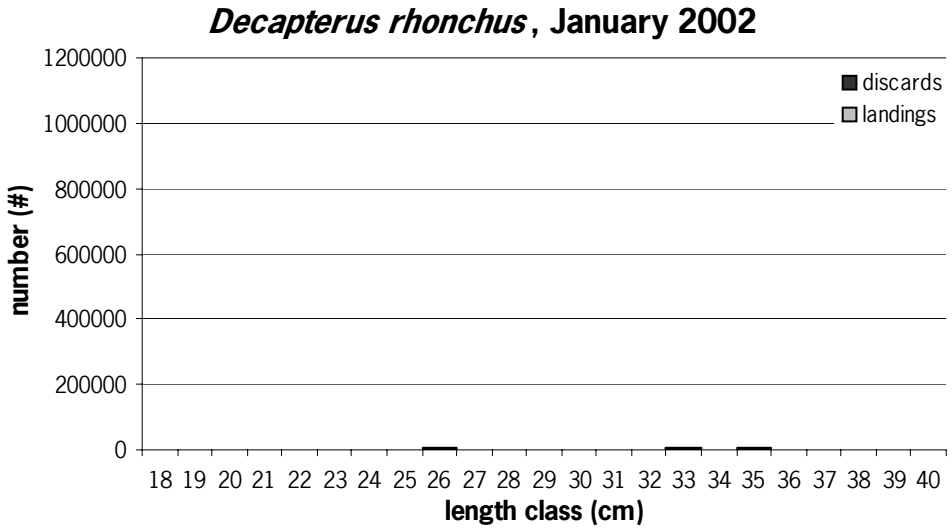
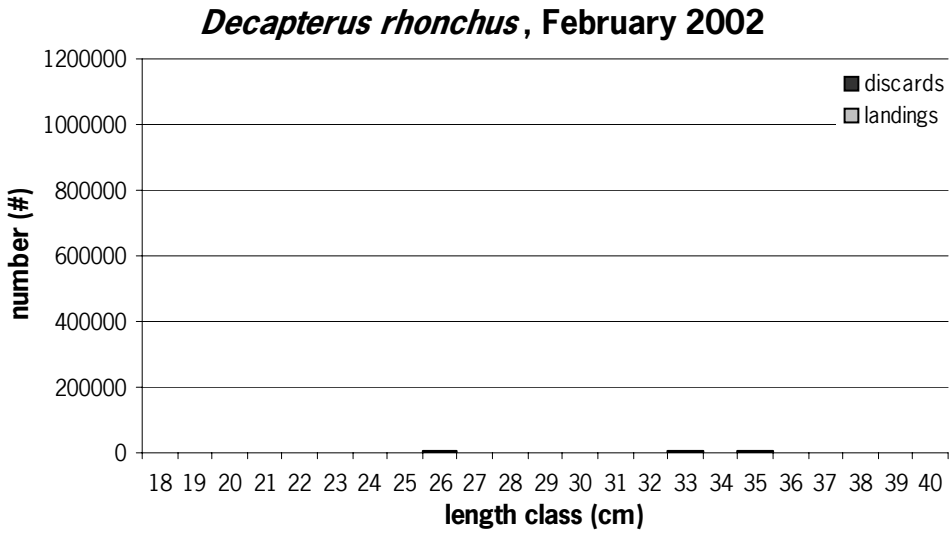


Figure 9a: Monthly length-frequency distributions for the catches of Decapterus rhonchus for January, February and March 2002.





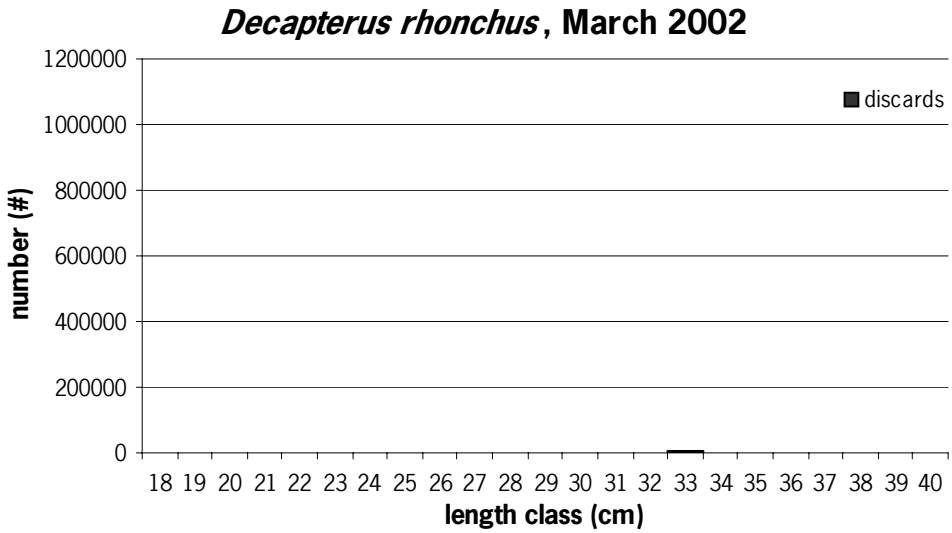


Figure 9b: Monthly length-frequency distributions for the catches of Decapterus rhonchus for April and May 2002.

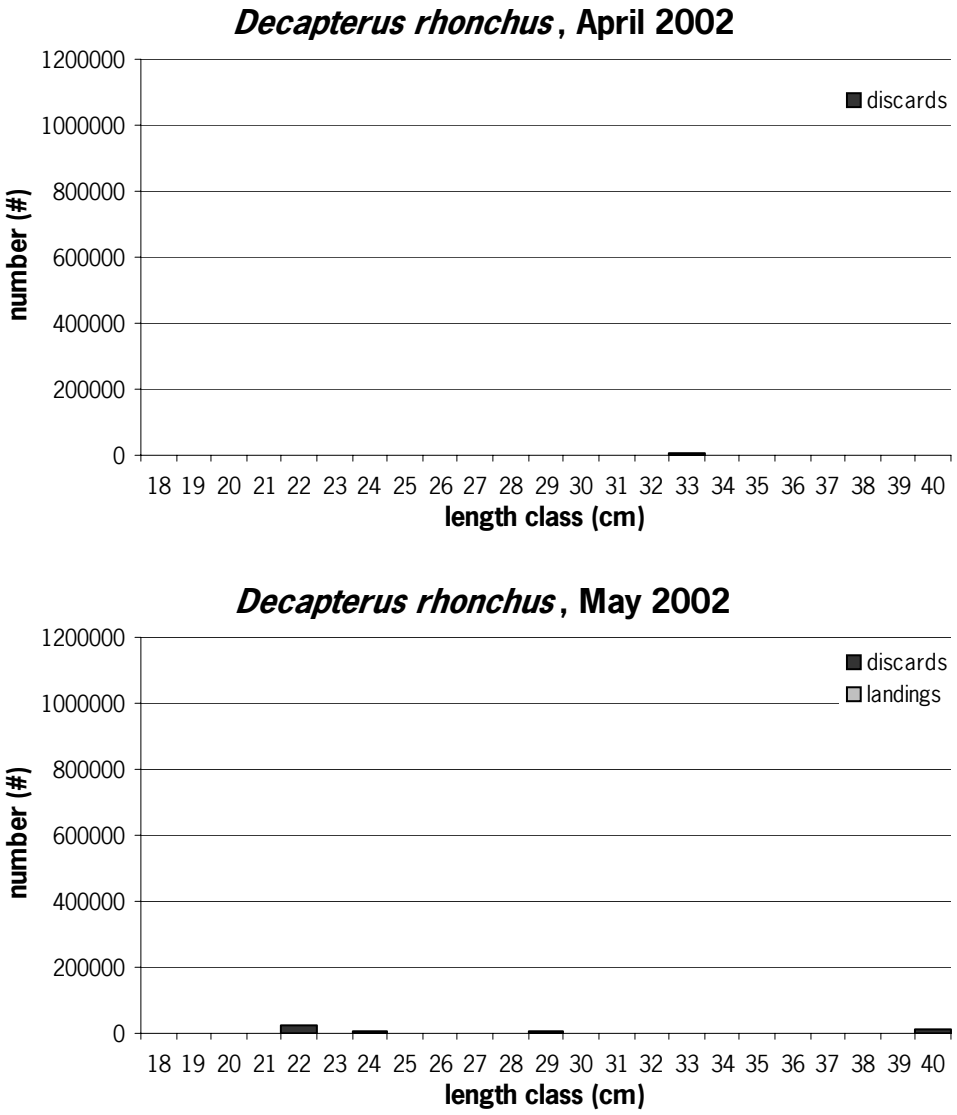


Figure 9c: Monthly length-frequency distributions for the catches of Decapterus rhonchus for August and September 2002.

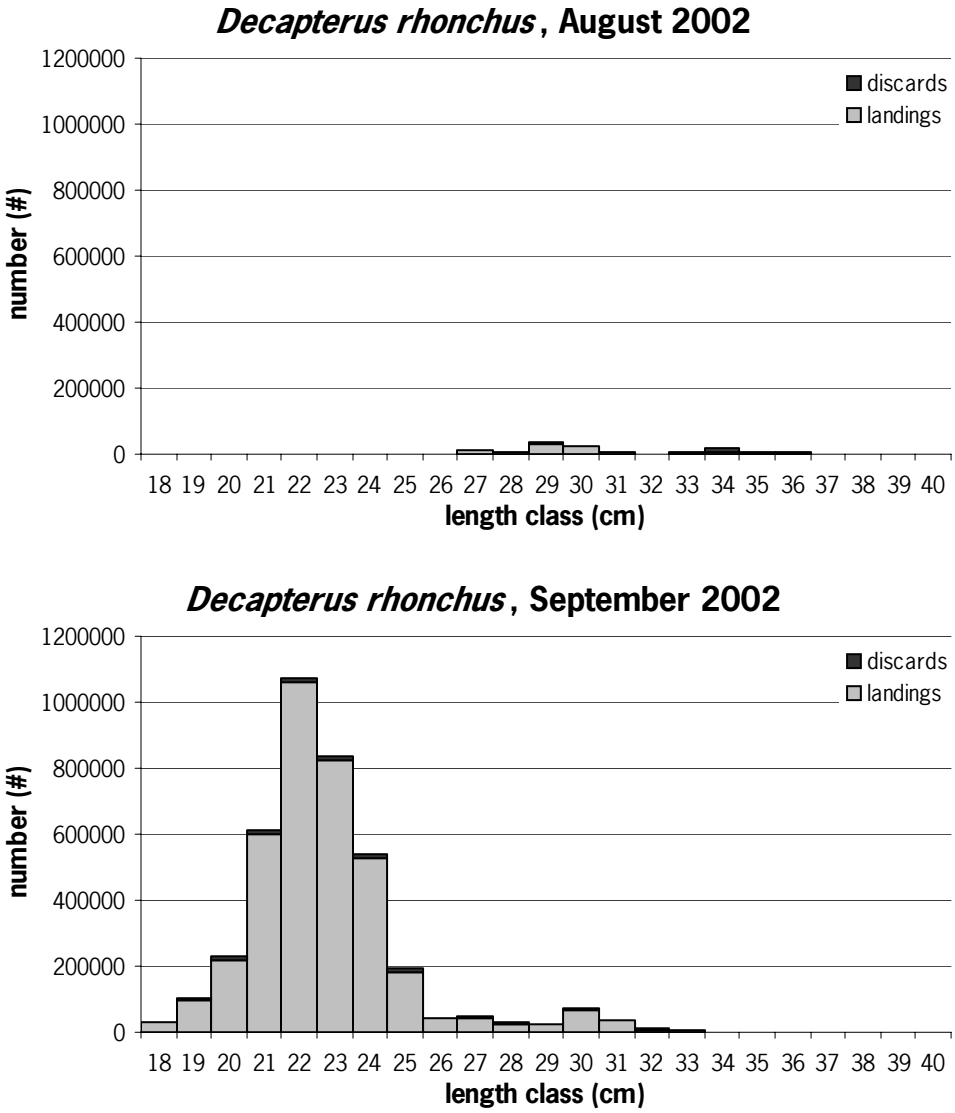
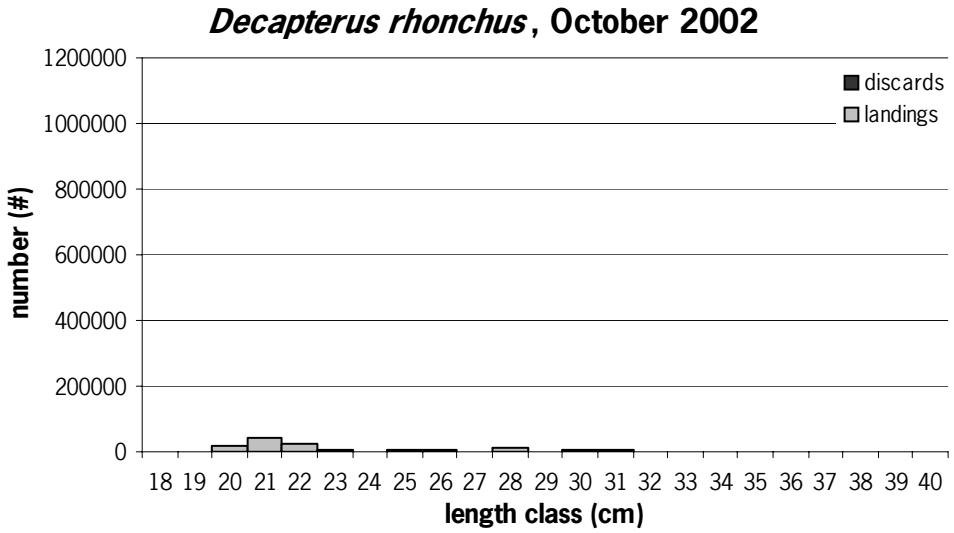
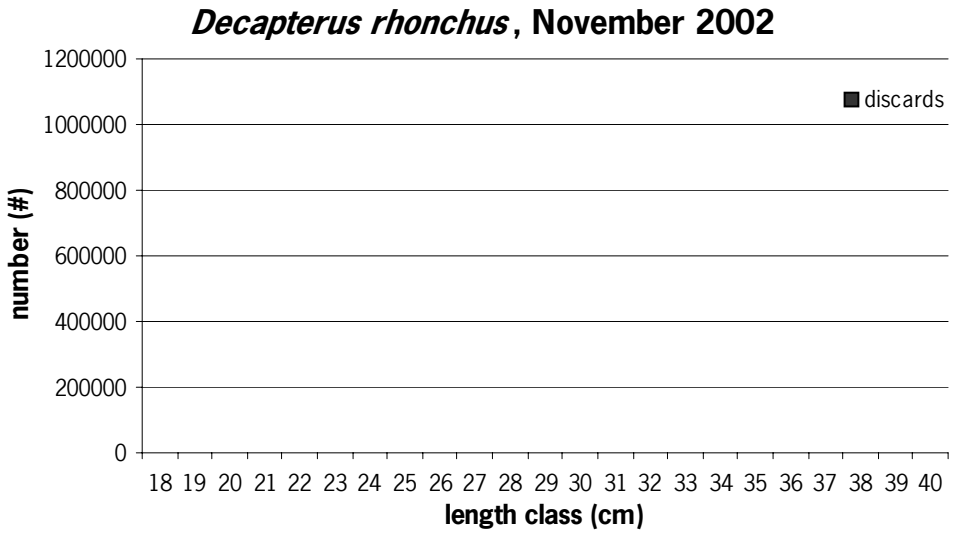


Figure 9d: Monthly length-frequency distributions for the catches of Decapterus rhonchus for October, November and December 2002.





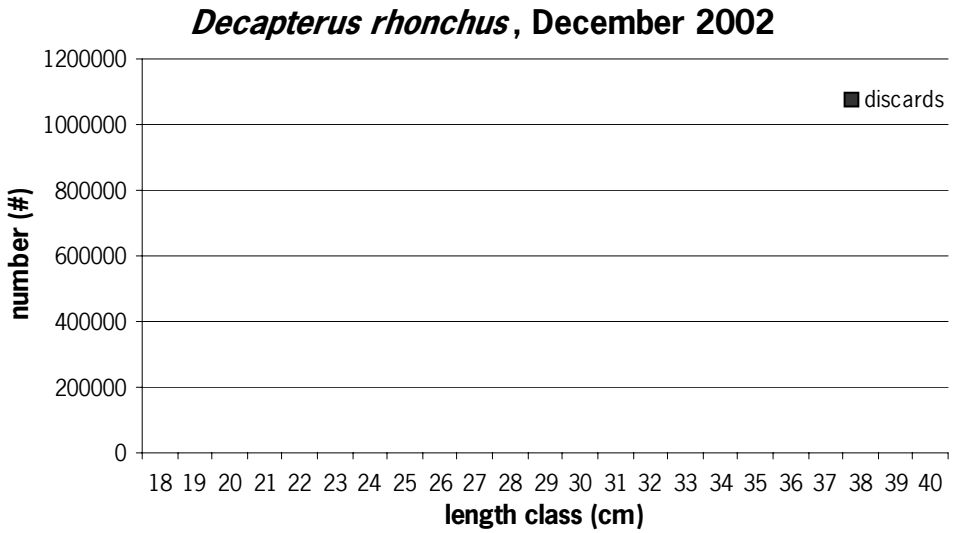
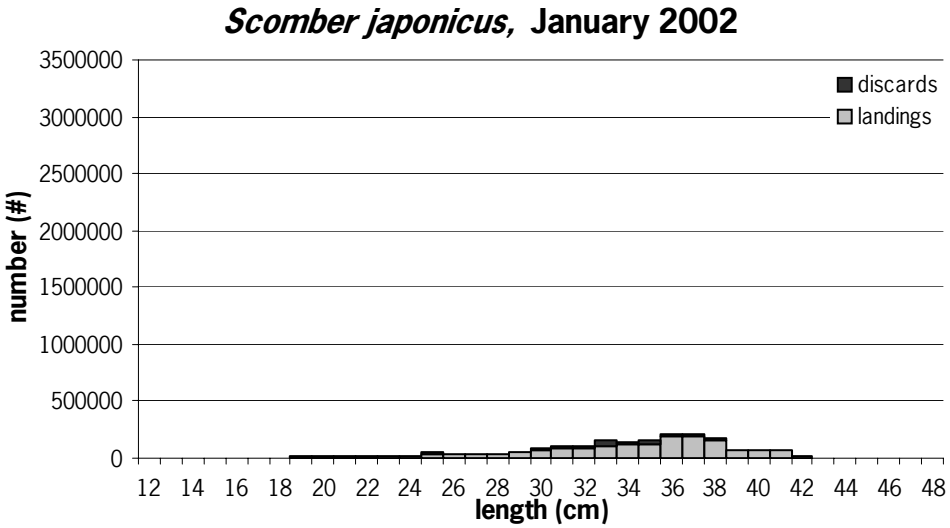
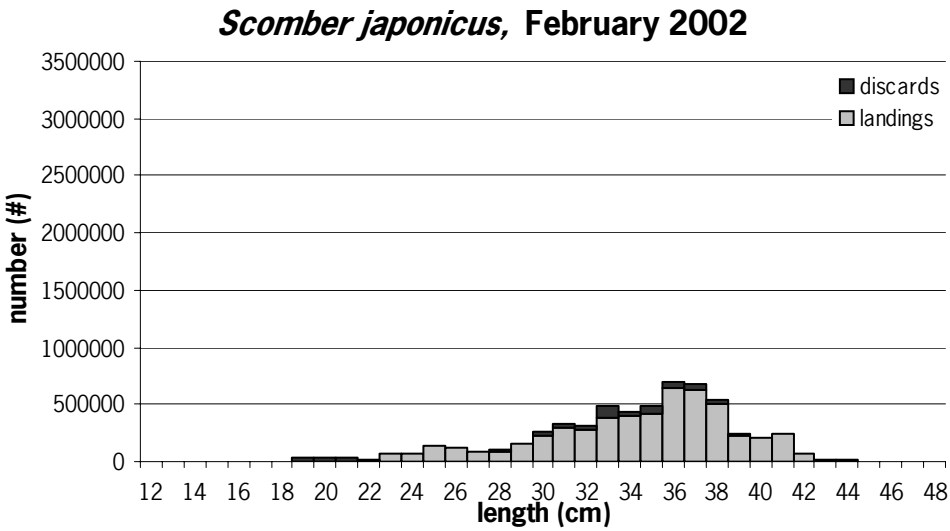


Figure 10a: Monthly length-frequency distributions for the catches of Scomber japonicus for January, February and March 2002.





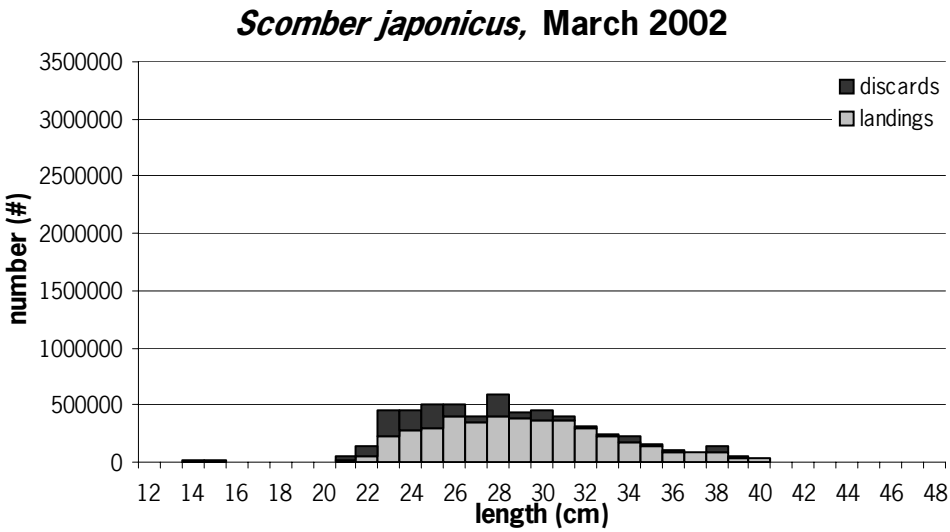
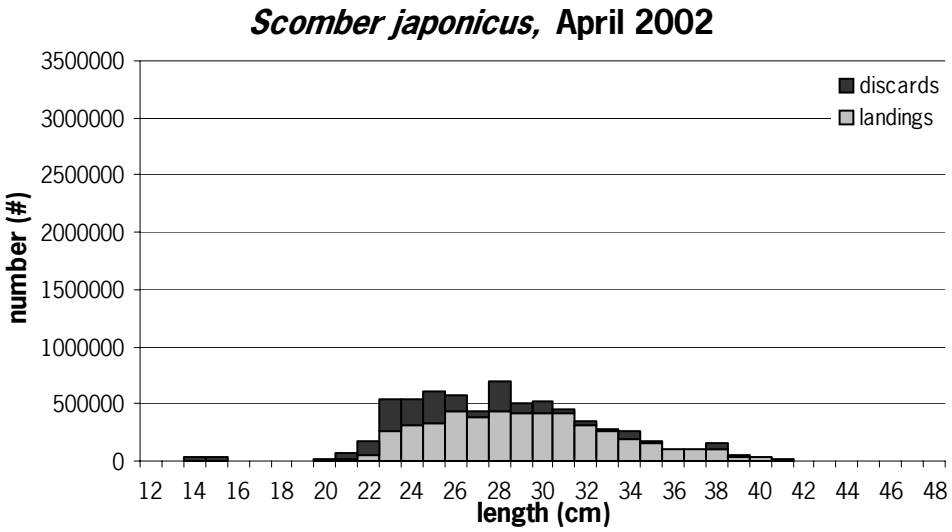
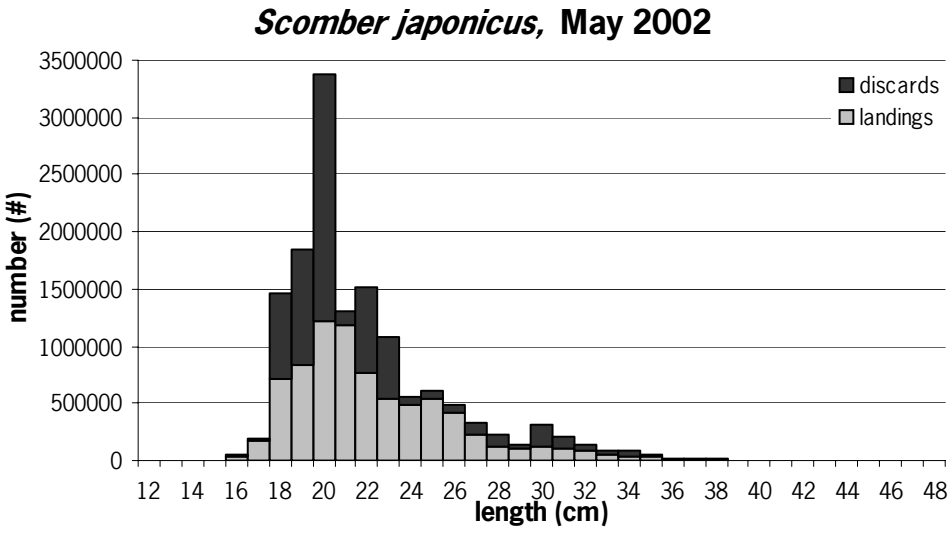


Figure 10b: Monthly length-frequency distributions for the catches of Scomber japonicus for April, May and June 2002.





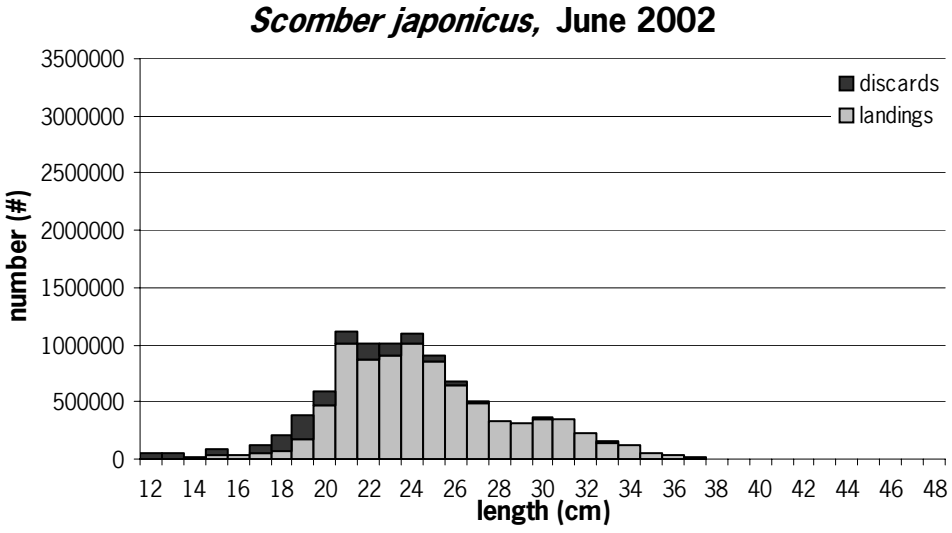
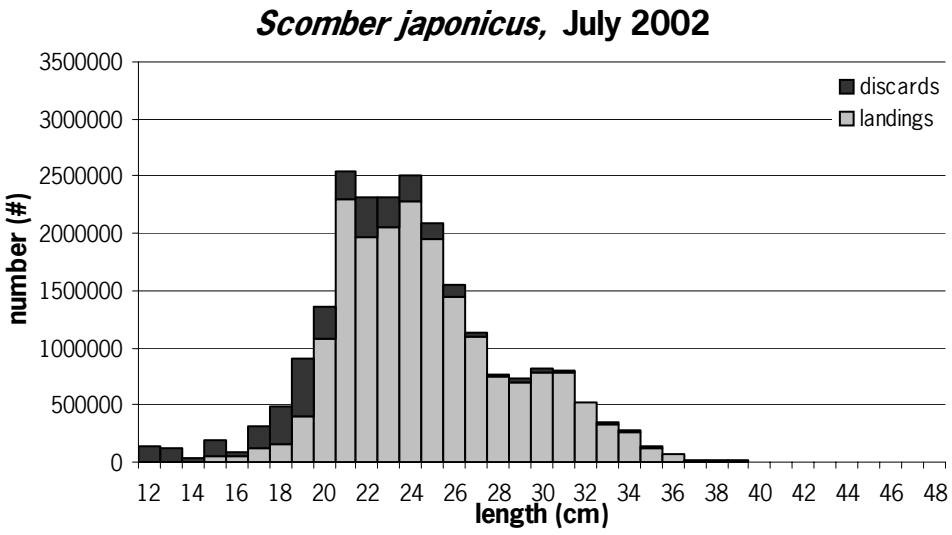
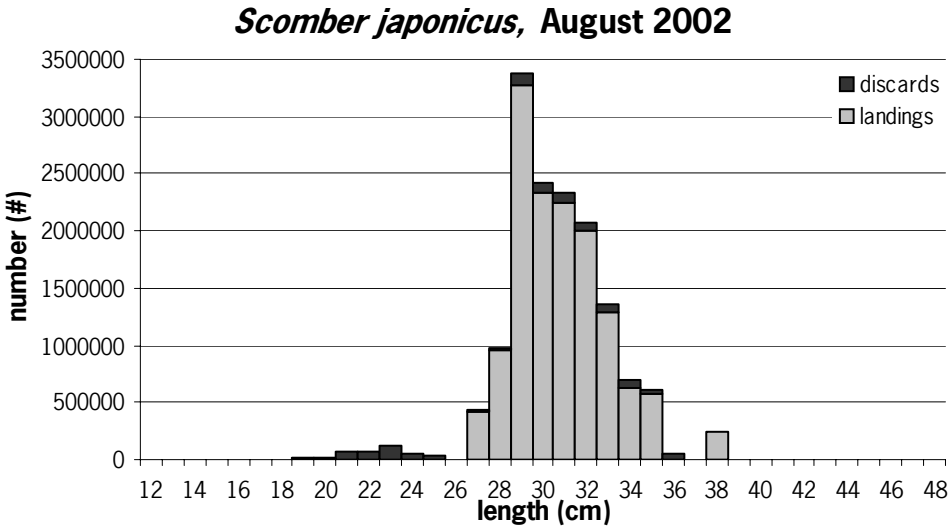


Figure 10c: Monthly length-frequency distributions for the catches of Scomber japonicus for July, August and September 2002.





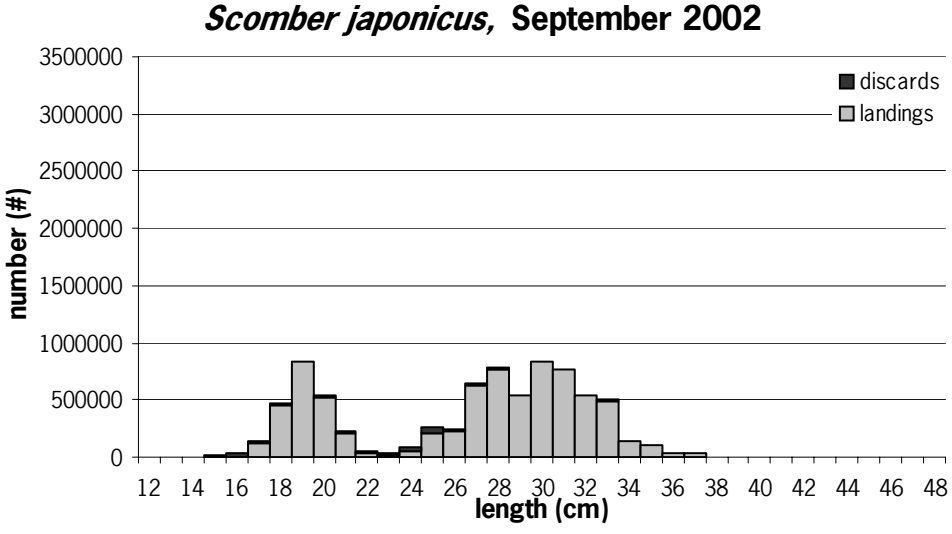
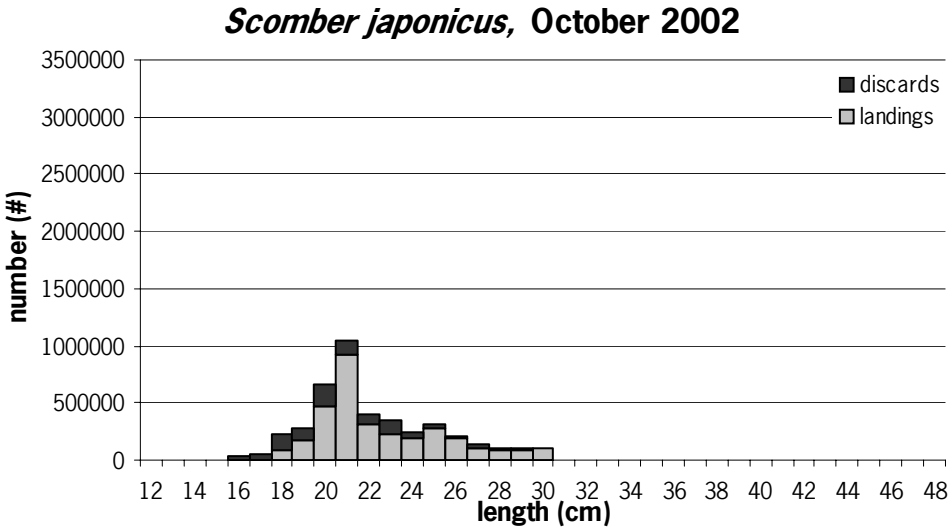
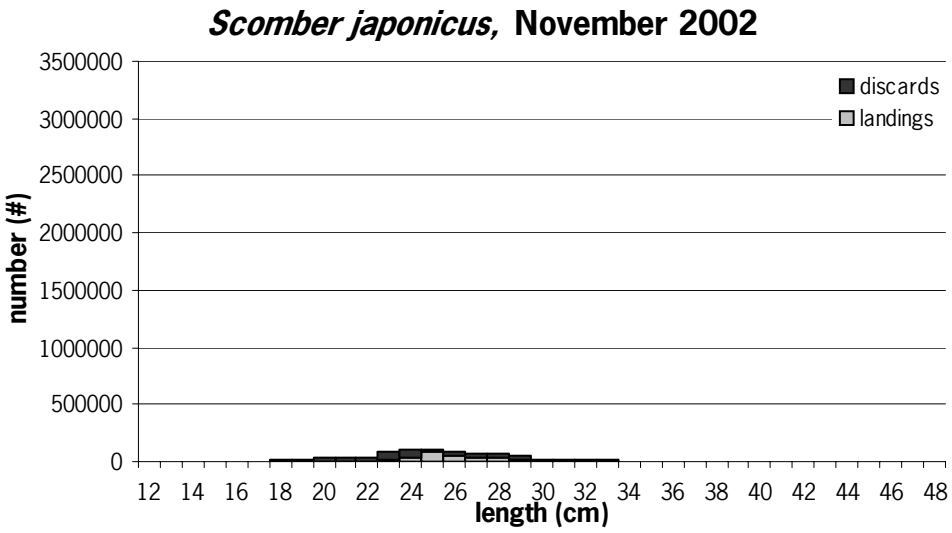


Figure 10d: Monthly length-frequency distributions for the catches of Scomber japonicus for October, November and December 2002.





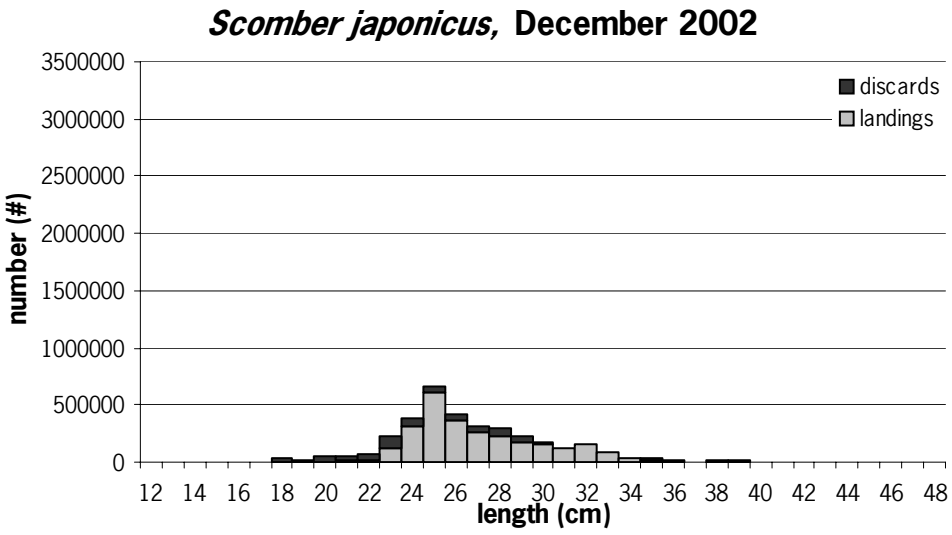


Figure 11a: Monthly length-frequency distributions for the catches of Sarda sarda for January, February and March 2002.

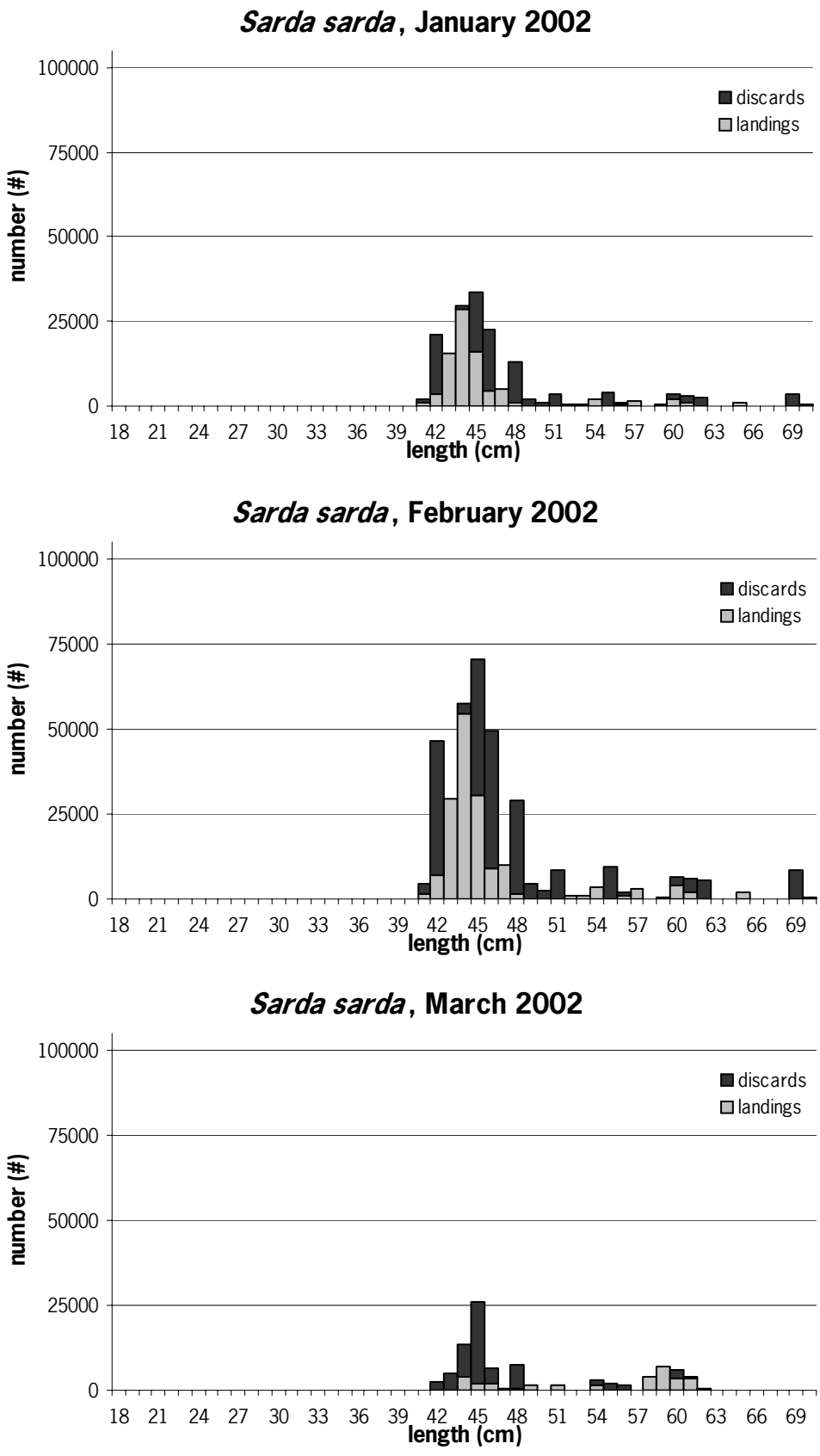
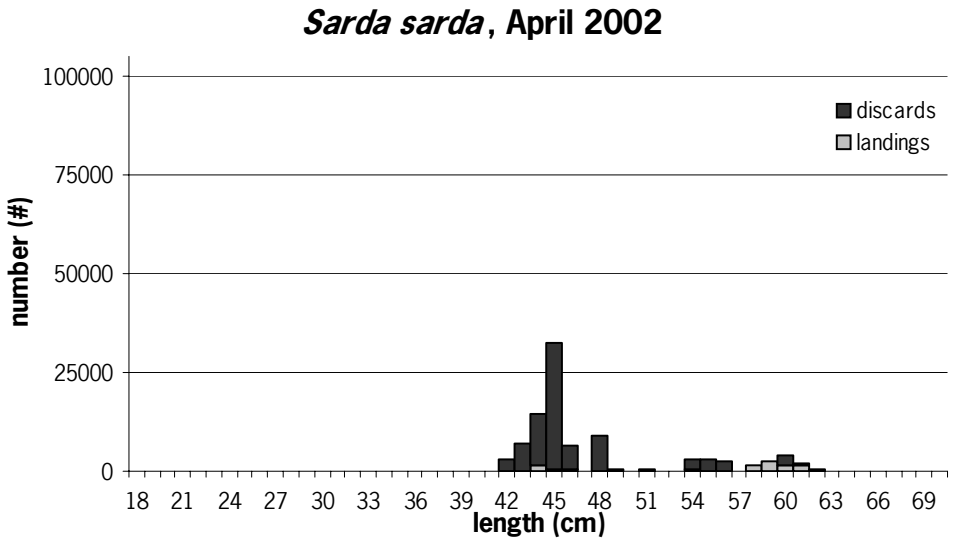
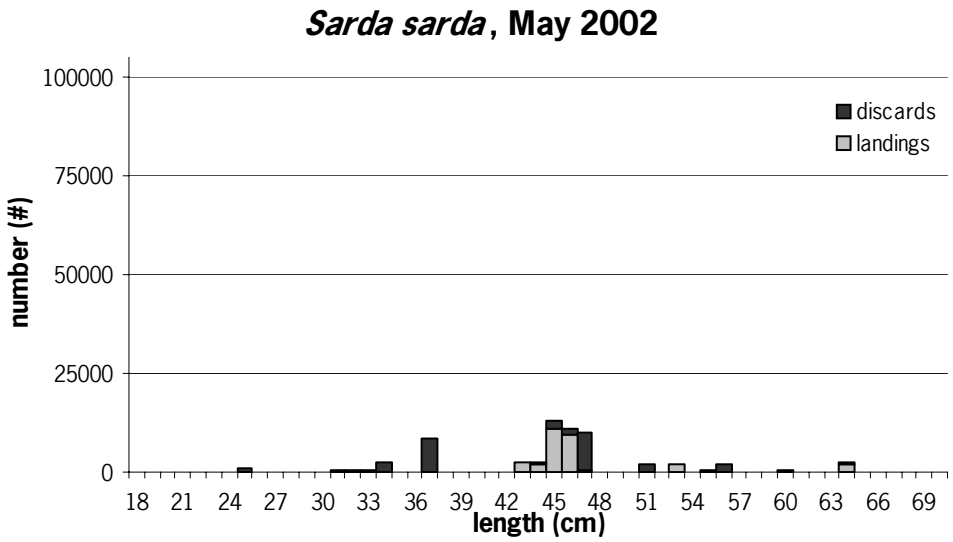


Figure 11b: Monthly length-frequency distributions for the catches of Sarda sarda for April, May and June 2002.





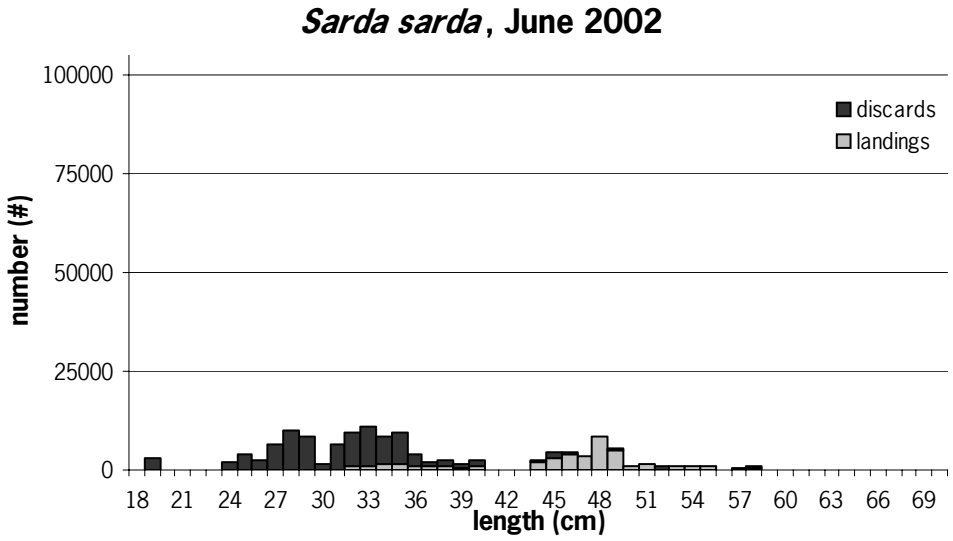


Figure 11c: Monthly length-frequency distributions for the catches of Sarda sarda for July, August and September 2002.

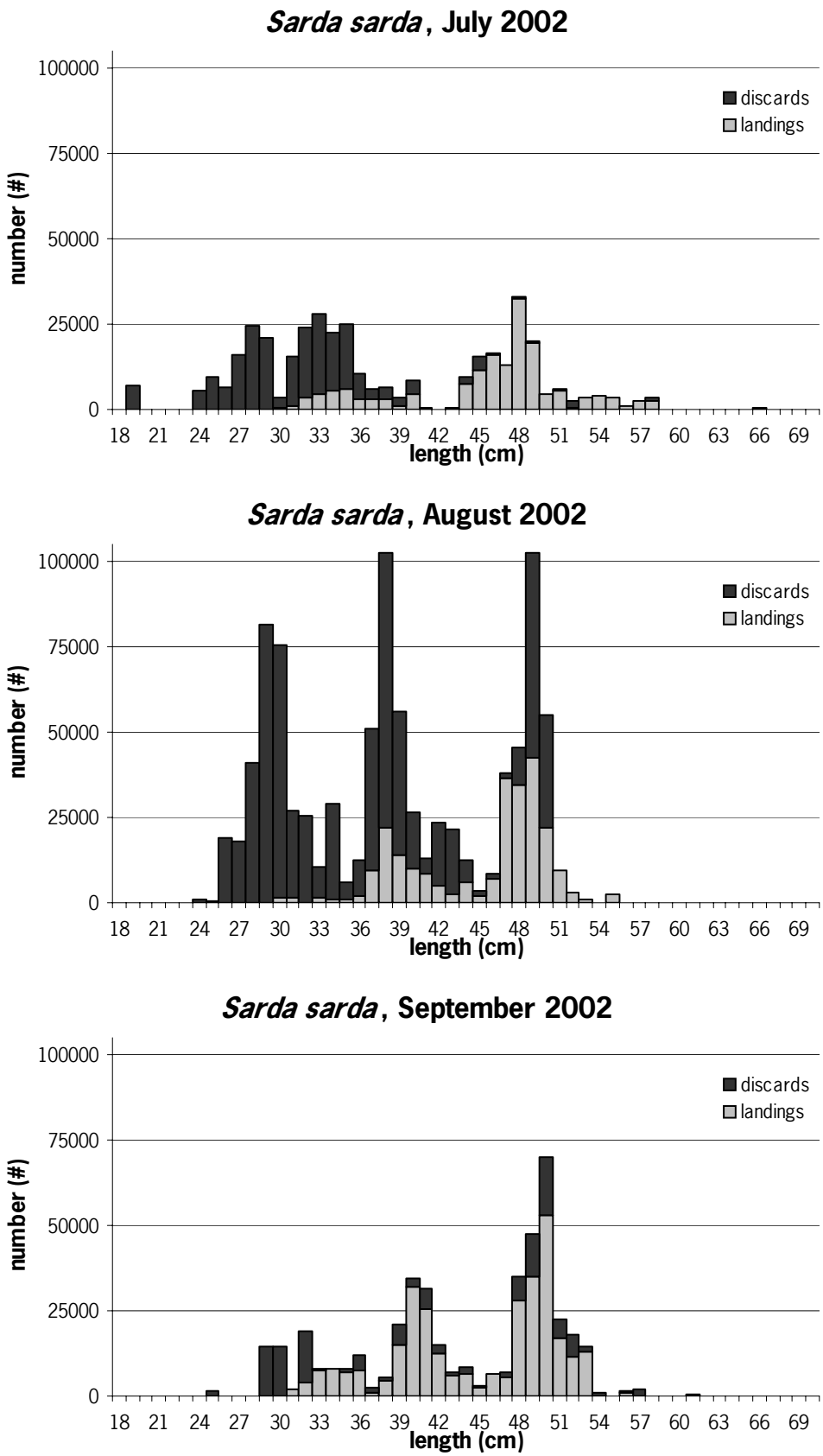
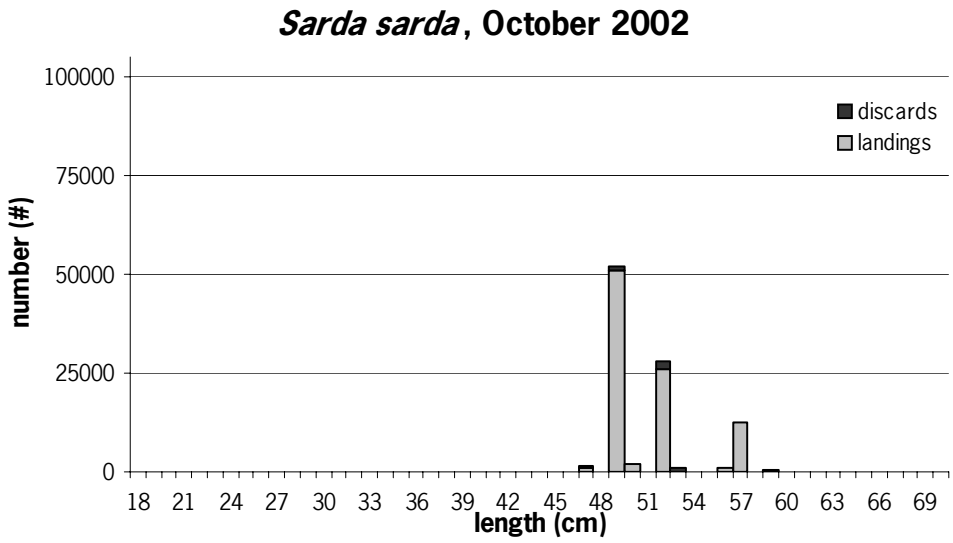
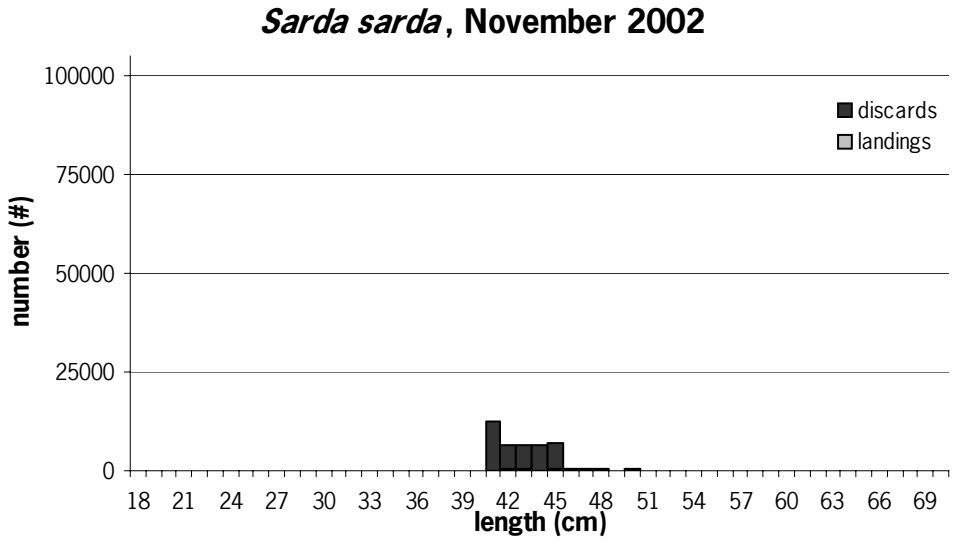


Figure 11d: Monthly length-frequency distributions for the catches of Sarda sarda for October, November and December 2002.





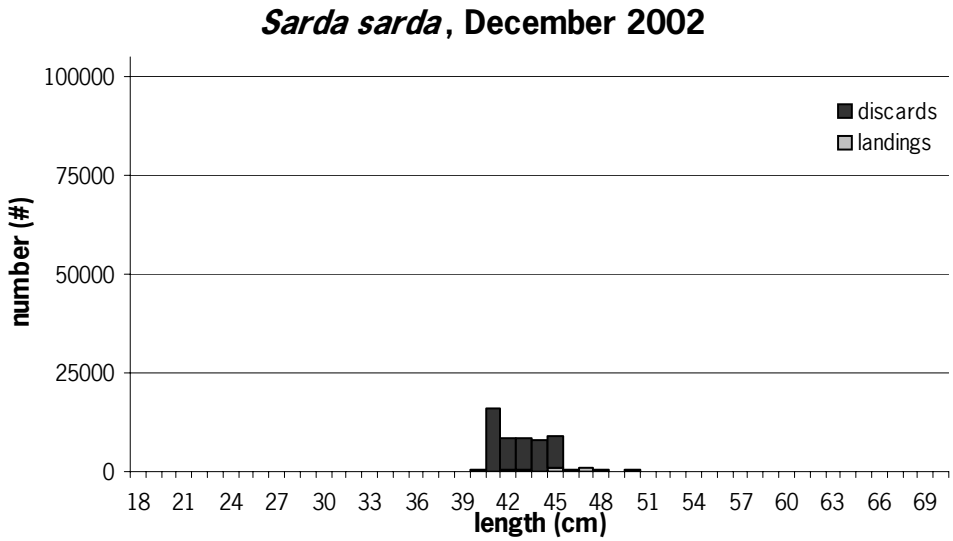


Figure 12a: Monthly length-frequency distributions for the catches of Katsuwonus pelamis for January and February 2002.

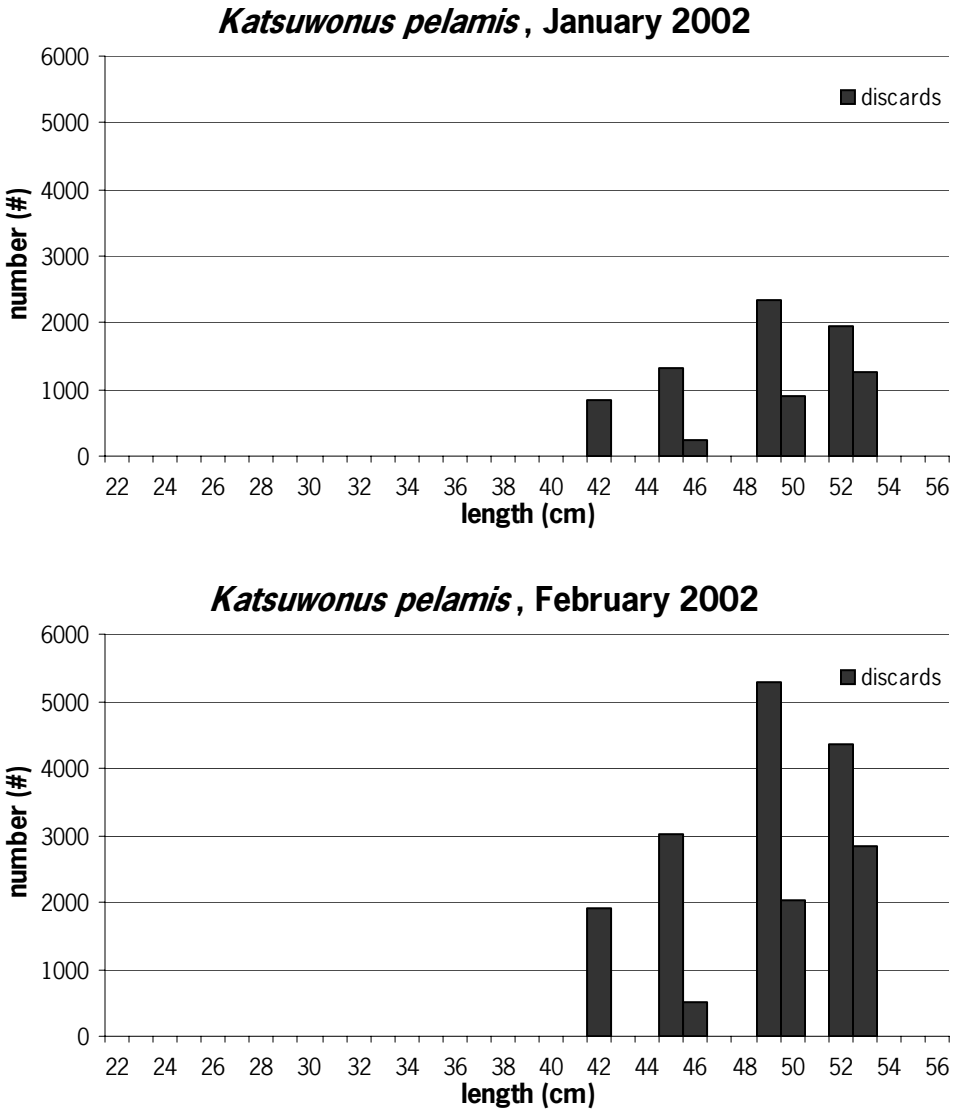


Figure 12b: Monthly length-frequency distributions for the catches of Katsuwonus pelamis for August and September 2002.

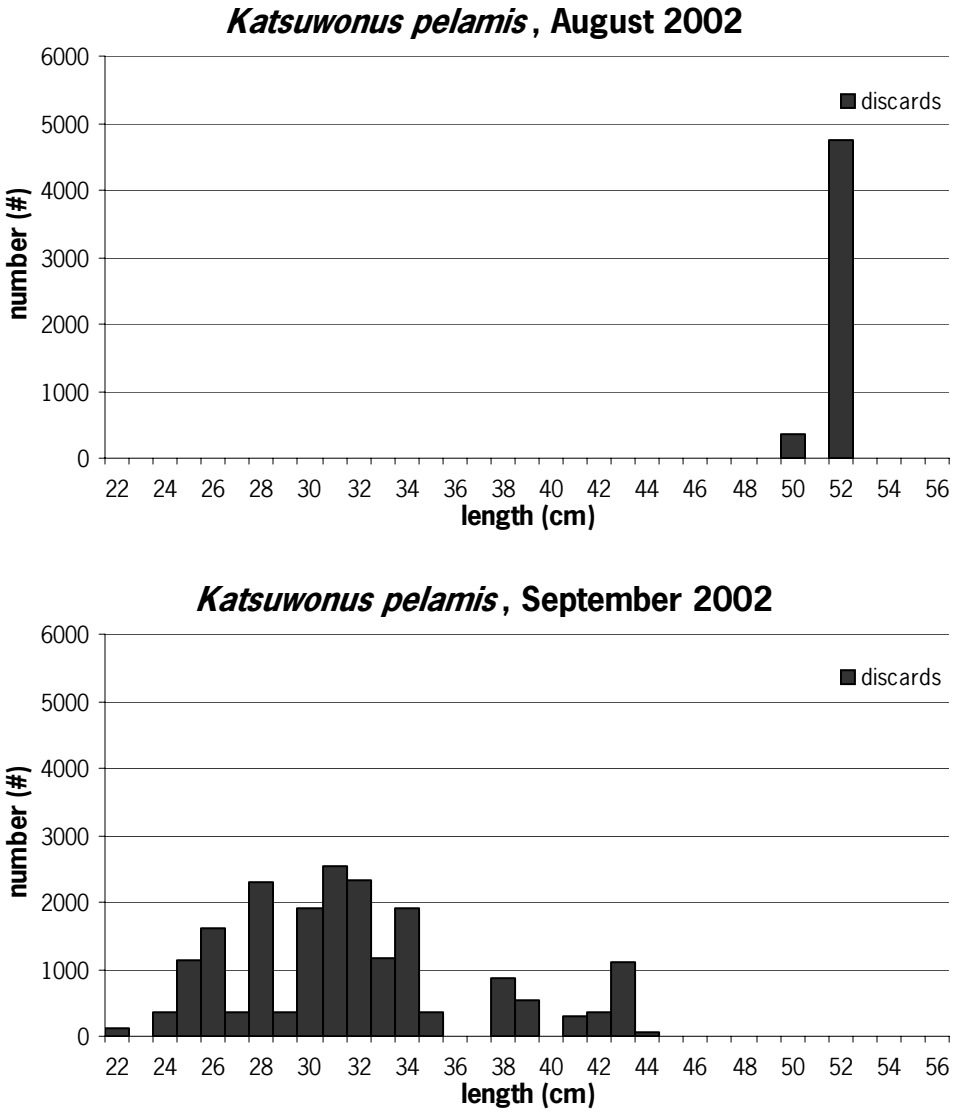
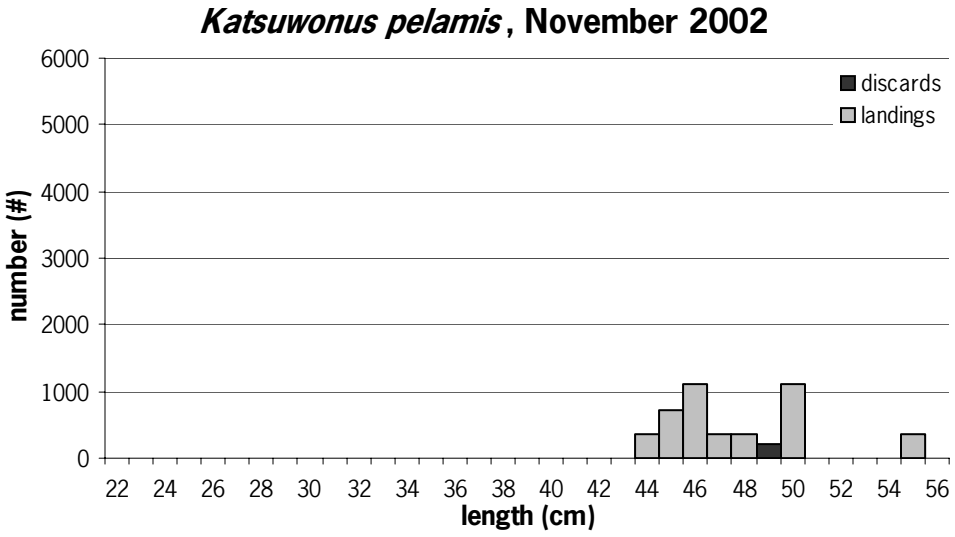


Figure 12c: Monthly length-frequency distributions for the catches of Katsuwonus pelamis for November and December 2002.



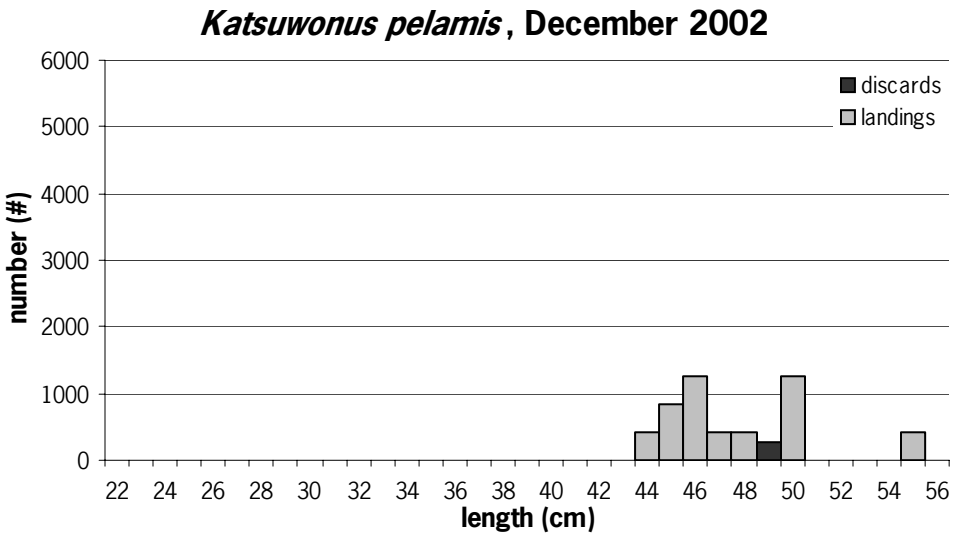
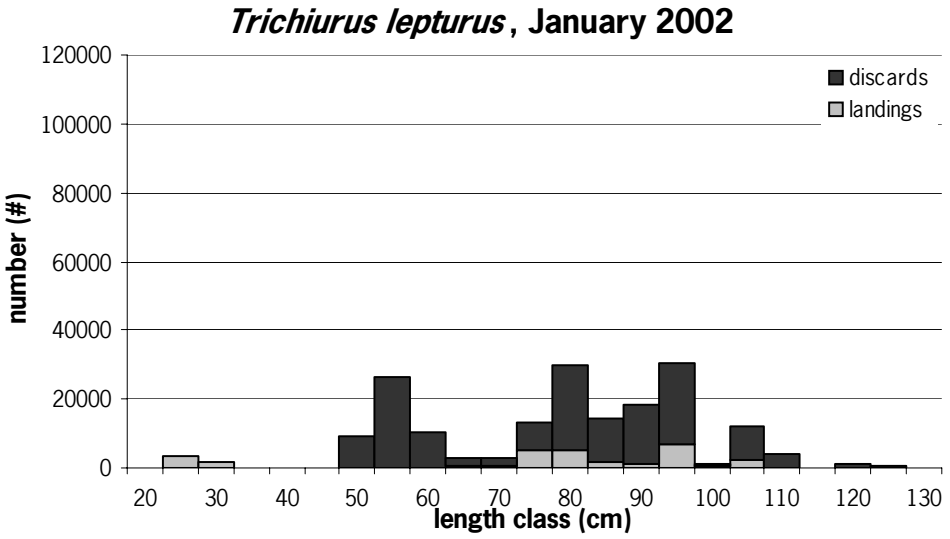
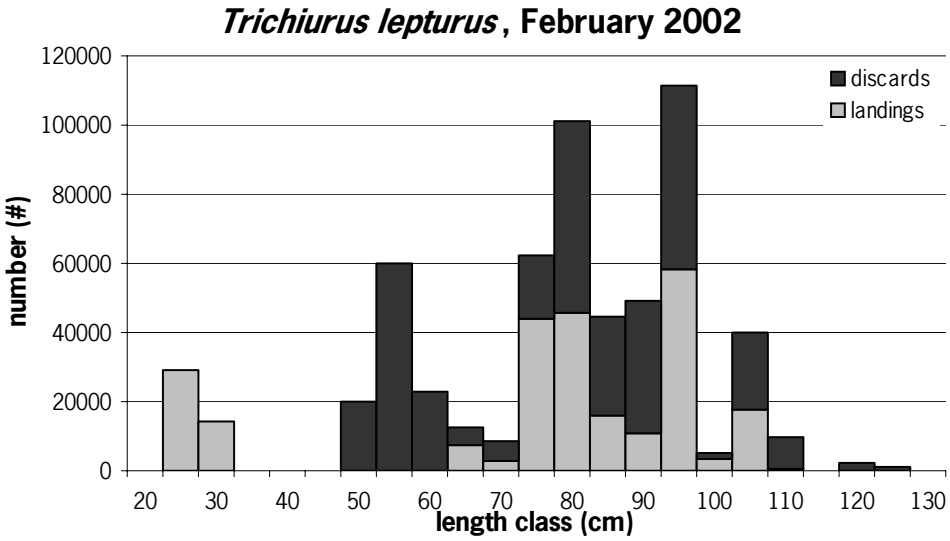


Figure 13a: Monthly length-frequency distributions for the catches of Trichiurus lepturus for January, February and March 2002 (given are length classes of 5 cm).





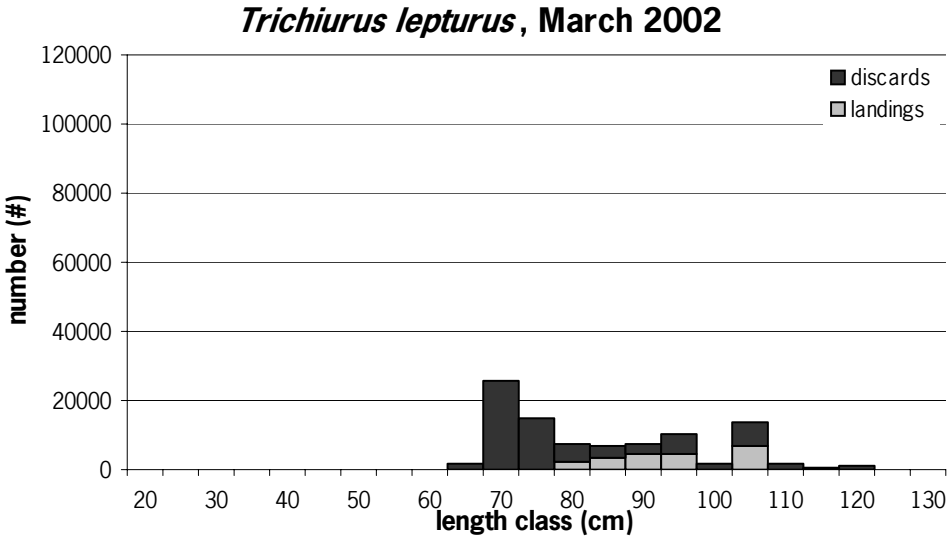


Figure 13b: Monthly length-frequency distributions for the catches of Trichiurus lepturus for April, May and June 2002 (given are length classes of 5 cm).

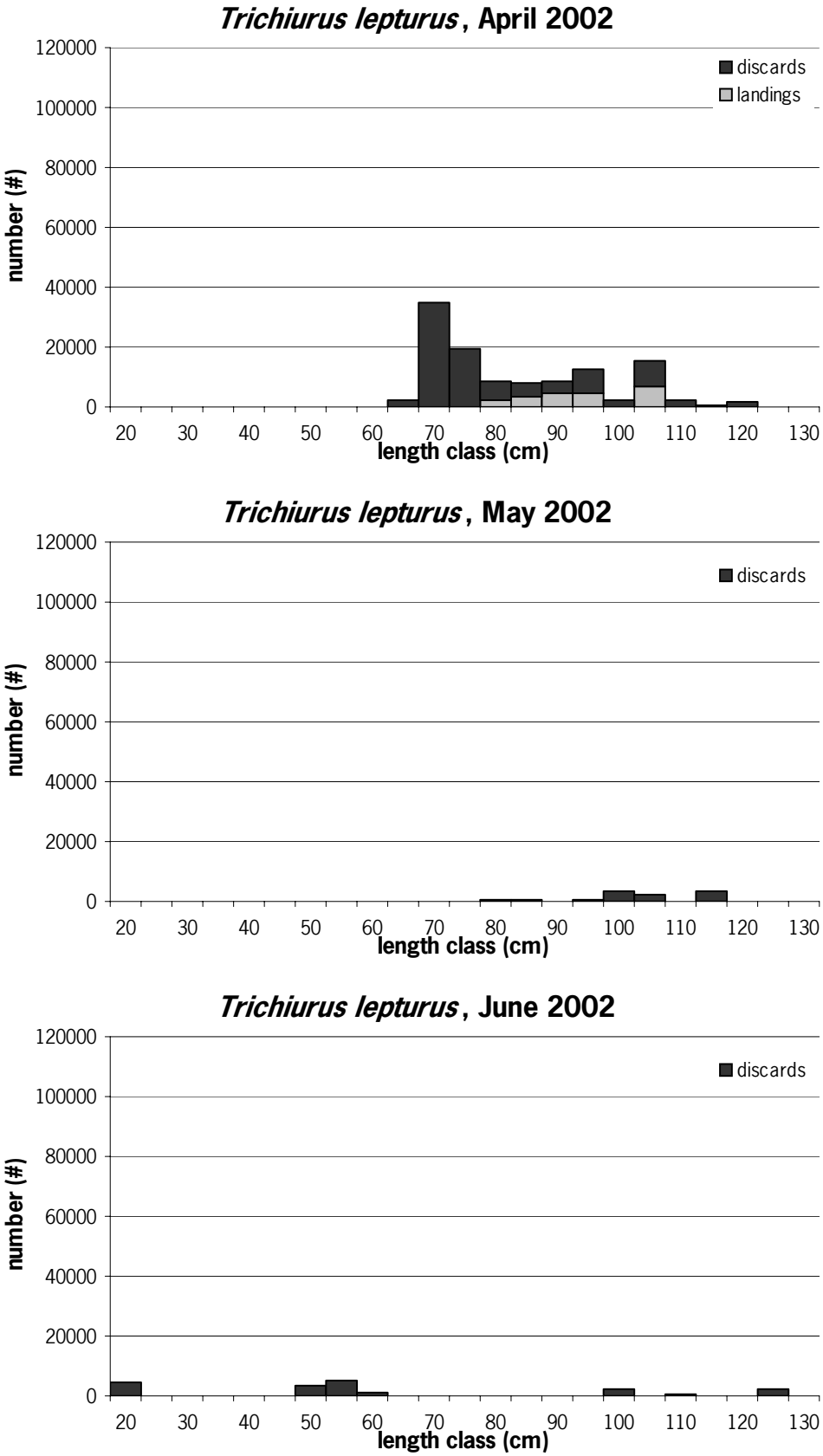
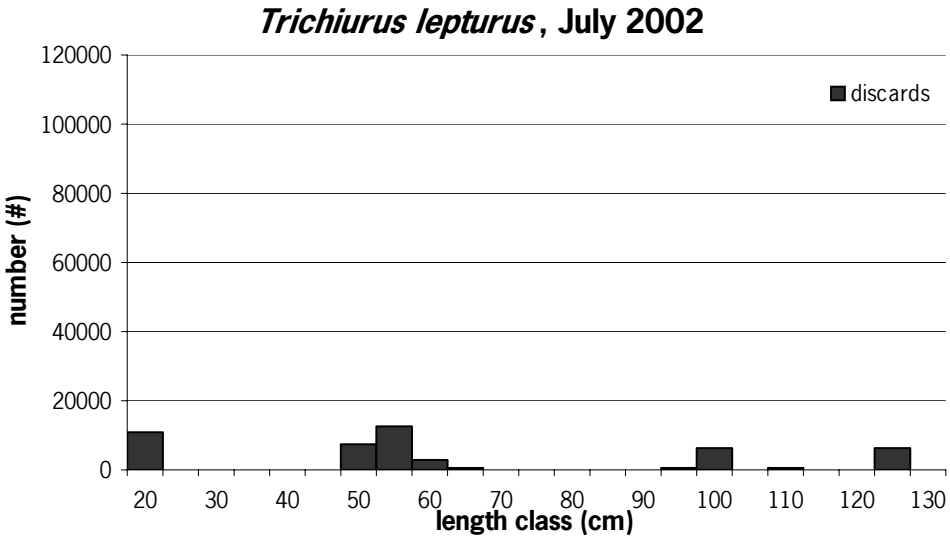
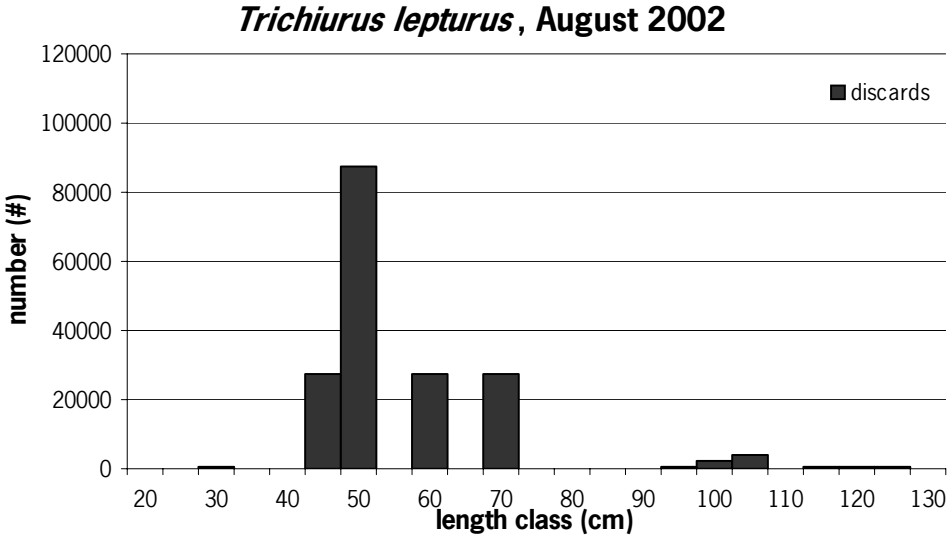


Figure 13c: Monthly length-frequency distributions for the catches of Trichiurus lepturus for July, August and September 2002 (given are length classes of 5 cm).





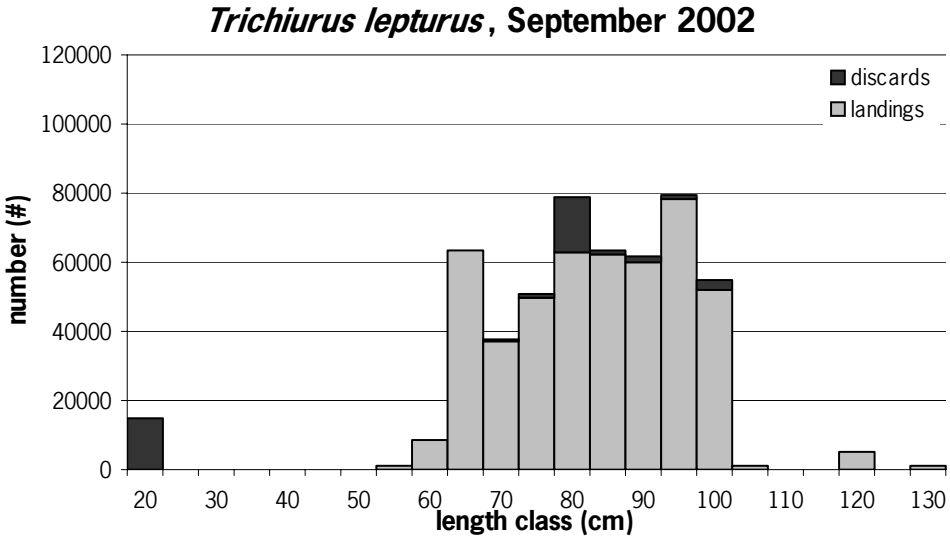


Figure 13d: Monthly length-frequency distributions for the catches of Trichiurus lepturus for October, November and December 2002 (given are length classes of 5 cm).