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RIVO report

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Catch composition of the Dutch pelagic fleet in the Mauritanian Exclusive Economic Zone during the year 2003.

Results of the Scientific Observer Program

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Summary

This report describes the total catches of the Dutch pelagic fleet in the Mauritanian Exclusive Economic Zone during the year 2003. Data have been obtained by the 'Scientific Observer Program', which monitors the catch (both landings and discards) of the Dutch fishery for small pelagics in Mauritania.

The Dutch pelagic fleet in Mauritania focuses mainly on the group of sardinella *(Sardinella aurita* and *Sardinella maderensis)*. Additional target species are pilchard *(Sardina pilchardus)* and chub mackerel *(Scomber japonicus)*. The landings by weight in 2003 consisted for 95% of these 4 species, *S. aurita* being the dominant species (58% of the landings).

In the year 2003, 91.6% of the estimated total catch by weight has been landed and 8.4% was discarded, which is reasonably comparable to previous years (1999-2002). The total estimated catch of the Dutch fleet has remained about the same, approximately 170 thousand tons per year.
The dominance of *S. aurita* in the total estimated catch has gradually diminished throughout the years 1999-2003. Pilchard *(S. pilchardus)* and chub mackerel *(S. japonicus)* gradually replaced the round sardinella in the catches of the Dutch fleet since 1999.
As in previous years, the catch of round sardinella mainly took place during the summer from June to September and the pilchard *S. pilchardus* appeared to be the dominant species in wintertime.

The number of observer days has reduced slightly throughout the period 1999-2003. Nevertheless, the sampling method, both for small pelagic species and by-catch of pelagic megafauna, has improved in quality and quantity, which resulted in high quality data.
The extension of the observers' dataset in 2003 with a fifth year in a row enlarged 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 therefore highly recommended to be performed in the near future.

1. Introduction

This report describes the catches of the Dutch pelagic fleet in the Mauritanian Exclusive Economic Zone during the year 2003. Being the fifth in a row, this report follows the annual reports of 1999 (Benjamins, 2002a), 2000 (Benjamins, 2002b), 2001 (ter Hofstede, 2002) and 2002 (ter Hofstede, 2003a).

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 B.V.) 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 *(Caranx 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 Dutch pelagic trawlers in order to collect information about the amount and composition of the catches, both landings and discards, including the incidental by-catch of pelagic megafauna. The observers determine length-frequency distributions of all species present in the catch and furthermore perform biological analysis on the target species *S. aurita S. maderensis, S. pilchardus, S. japonicus, C. rhonchus, T. trachurus* and *T. trecae*.
These data combined with landing data obtained from the ship owners give detailed information about the total catch by the Dutch pelagic fleet in Mauritanian waters.

2. Methods

2.1 Fishing method and treatment of catches on board

The vessel searches for schools of small pelagic fish using sonar. When fish shoals are detected, the net is set and the ship starts a chase, again making use of the sonar. As soon as the amount of fish in the net seems large enough 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, and the catch can be pumped directly from the net into the storage-tanks on board the ship.
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 22 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.

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 prevent these large animals from entering the cod-end. As a result, the pelagic megafauna cannot block the fish pump when the catch is taken aboard the ship. Normally, the captured large species are released while the net is still in the water. However, during a voyage in which observers are on board the vessel, these animals are taken on deck in order to get information about the amount, composition and measures of them.

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 two hauls per day. During a biological analysis of a target species, 25 individuals are examined for total length, 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 Dutch -fishing vessels in the Mauritanian Exclusive Economic Zone (ter Hofstede, 2003b (in Dutch); ter Hofstede, 2003c (in French)).

2.3 Data analysis

All data that have been collected by the observers are entered into a standard Microsoft Excel 2000 Professional 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 Dutch 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 Dutch 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 2003, the Dutch pelagic fleet in the Mauritanian Exclusive Economic Zone consisted of 8 ships that made a total of 68 missions. Nine 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) missions, 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, and June and July. Because of this, the monthly length-frequency distributions for the main target species have approximately the same shape for these months (see figures 10-16).

3.1 Total catches

Based on the extrapolation procedures described in section 2.3, the data from the 9 sampled missions have been used to estimate the composition of the total catches by all the Dutch freezer-trawlers during the year 2003. The estimated total catches in tons (1000 kg) 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 Dutch pelagic fleet in 2003 consists for 91.6% of landed fish, 8.4% were discards.
A distinction has been made between target and non-target species. The target species include the sardinellas *Sardinella aurita* (round sardinella) and *Sardinella maderensis* (flat sardinella), the sardine *Sardina pilchardus* (pilchard), the mackerel *Scomber japonicus* (chub mackerel), and the horse mackerels *Trachurus trecae* (cunene horse mackerel), *Trachurus trachurus* (atlantic horse mackerel) and *Caranx rhonchus* (false scad).

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 reported separately in ter Hofstede *et al.*, 2004.

3.2 Species composition

The total estimated catch by weight of the 7 target species for the year 2003 is presented in table 2 and figure 1, monthly estimations are shown in figures 2a-c.

Clearly, round sardinella *(S. aurita)* was the most common species caught in 2003, it made up 54.8% 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 19.2% and 15.1% of the estimated total catch respectively.
During summertime (June-September, see figure 2b), *S. aurita* is by far the most important species in the catch by weight composition. However, in wintertime the catch of *S. aurita* decreases considerably and the catches in weight of other small pelagics such as *S. japonicus* and *S. pilchardus* are even higher. In figures 2a-c it can be seen that especially the sardine *S. pilchardus* is dominant in the catches in wintertime, in the period December to March. The transition in dominance takes place in the months April-May and October-November, during which the catches of the three species *S. aurita*, *S. pilchardus* and *S. japonicus* are in the same size-range.
The other target species are of minor importance in the total catch composition in 2003.

3.3 Length-frequency distributions

The length-frequency distributions on *year* basis for 2003 of the main target species (the same as mentioned in chapter 3.2), are given in tables 5a-c, both the landing data and the discards. These data are visualised in figures 3 to 9.
The estimated *monthly* length-frequency distributions of these 7 target species in 2002 are presented in the figures 10 to 16, also both the landed and discarded fractions.

The length-frequency distribution of the catch of the main target species *S. aurita* shows a vague bimodal distribution for the year 2003 with a small dip at fork length 27 cm (see figure 3). One might easily mistake this for an error, but since the numbers are high, one cannot neglect the presence of a bimodal distribution. On a monthly basis, the dip can be seen in August and September (figure 10c).
Throughout the year, the peak in fork length gradually changes from 20 cm in January-February to 23 cm in March-April up to 28 cm in May-July. From August onwards this peak diminishes and is replaced by a peak at a fork length of 24 cm. This new peak seems to shift towards 28 cm as months go by (see figures 10a-d).

The other sardinella species *S. maderensis*, does not show a bimodal distribution in the year 2003 (see figure 4). When looking at the monthly length-frequency distributions in figures 11a-d, it appears that the peak of the frequency lies in the range 23-27 cm fork length. In wintertime and spring (December-May) the catch of *S. maderensis* is almost non-existent.

Figure 5 shows that *S. pilchardus* has a clear bimodal distribution in 2003 with the first peak in frequency around a fork length of 17 cm, and the second around a size of 22 cm. As shown in figures 12a-d, both length groups are present throughout the year, but in the last quarter (October-December), the larger length group with the peak around 22 cm is clearly dominant. On the other hand, the small length group with a peak around fork length 17 cm is in numbers by far larger in March and April. Only few sardines have been captured during the summer period, June to September.

Chub mackerel *(S. japonicus)* has a variable length-frequency distribution with a wide range throughout the year 2003 (see figure 6). In the first two months of the year 2003, the peak value lays around 23 cm fork length. In the following two months, a small bimodal distribution appears in the catches, which clearly develops in May, with large catch of peaks around 20 cm and 25 cm fork length. In summer time (June-July), catches reduce and the bimodal distribution has vanished, leaving a peak around 28 cm fork length. Late summer (August-September) highest numbers are around 22-23 cm. In autumn, a bimodal distribution with peaks at 22 and 33 cm fork length is shown, but catches are then of low quantity.

The false scad *(C. rhonchus)* shows a clear group of small, discarded fish around 10 cm fork length, all of them being captured in October (figures 7 and 14a-d). The landed fish (and some discarded larger fish) show a wide range from 18 to 38 cm fork length). These catches took place in the period June-October 2003, in all other months the catches were almost nil.

The little catch of atlantic horse mackerel *(T. trachurus)* occurred in various months throughout the year 2003 (figures 8 and 15a-d). In January and February the catch had a wide range from 21 to 35 cm fork length. The catch in May shows a small range with a clear peak at 25 cm. In early winter, especially in November, the amount of small fish (up to 18 cm fork length) was very high. As with *C. rhonchus*, the catches of *T. trachurus* were almost nothing in the period June to October 2003.

The length-frequency distribution of the cunene horse mackerel *T. trecae* shows a division into two length groups in 2003, with modes of fork length 15 and 25 cm (see figure 9). The division into two length groups is distinct in the first 5 month (see figure 16a-d). Most of the fish belonging to the small group are caught in May, the fish from the length group with a peak value around 25 cm fork length are mainly caught from April to July. In early summer (June-July), the division into two size groups is less distinct since the range is very wide and only the second length group with a peak value of 25 cm is still good visible. From August onwards however, only smaller sized *T. trecae* is caught, though in very low quantity.

4. Discussion

In the year 2003, 9 of the 68 missions made by Dutch pelagic trawlers in Mauritania were sampled within the framework of the 'Scientific Observer Program'. This 13% coverage is less than in 1999 (23%), but about the same as in the last 3 years (2000 to 2002 respectively 16, 14 and 13%) (Benjamins, 2002a, 2002b; ter Hofstede, 2002; ter Hofstede, 2003).
However, only 3 of these 9 missions were performed in the first half of 2003. Considering the fact that the observers' data are extrapolated to total catch per month of the entire fleet, unfortunately it was necessary to use equal observer missions for different months. To avoid this in the future, a good coverage during the entire year is necessary and it is desirable that at least every month an observer mission will be carried out.

The improvements and standardisation of the sampling procedures for small pelagic fish on board the vessels as introduced in 2002 have been continued in 2003, so the collected data can be considered to be of good quality.
Nevertheless, it still appears to be impossible to cover all hauls during an observer mission. This year, it even occurred that some species appeared to be landed according to the shipping companies data, but no length-frequency of the species were taken during the mission. In order to divide the landing data (group of species) into species, it was therefore necessary to use the length frequency distribution per species from an adjacent observer mission.

The sampling of the by-catch of pelagic megafauna has been improved in the year 2003, as described in ter Hofstede *et al.* (2004).

As in previous years, the Dutch pelagic fleet in Mauritanian waters focussed its fishing effort in 2003 on the target species *Sardinella aurita*. Therefore, fishing mostly took place in the part of the water column which sardinellas are known to inhabit, i.e. near the surface.
Whenever sardinellas weren't located in the fishing area, the vessels started targeting other species. For example pilchard *(S. pilchardus)* was very abundant in the northern part of the Mauritanian Exclusive Economic Zone during wintertime in 2003 and has therefore been fished heavily, 19.2% of the yearly total catches in weight (see table 2, figure 1).
Still, *S. aurita* has been the main target species in the year 2003, the species constituted more than half of the total catch in weight (54.8%). Although 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 decrease seems to have stopped since 2002 (50.4%).

Despite of the decline of catches of *S. aurita*, the amount of the total catch by weight of the Dutch fleet in the Mauritanian EEZ has remained about the same throughout the years (approximately 170 thousand tons), since the decrease in catch of round sardinella was substituted by other species. For example the contribution in the total catch by weight of *S. pilchardus* increased from 3% in 1999 to 19% in 2003, and the share of *S. japonicus* from 2% in 1999 to 15% in 2003 (see table 6).
The size of the discards comprised 8.4% in 2003, about the same as in 2000 (9.0%) and 2002 (8.3%), a little more than in 1999 and 2001 (both 6.1%).

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

Finally, after carrying out an observer program during 5 years, it is advisable 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 (especially *S. aurita)*, linking catch data to surface temperatures or depths, and comparison of the observers' data on board the commercial Dutch fleet with acoustic surveys of research vessels in the area.

5. Conclusions

The number of observer days has reduced slightly throughout the period 1999-2003. Nevertheless, the sampling methods, both for small pelagic species and by-catch of pelagic megafauna, have improved in quality and quantity, which resulted in high quality data.

In the year 2003, 91.6% of the estimated total catch by weight has been landed and 8.4% was discarded, which is about the same as in 2000 and 2002, but an slight increase in discards compared the years 1999 and 2001. The total catch of the Dutch fleet has remained about the same as in these previous years, approximately 170 thousand tons.

As in the previous years, the round sardinella *S. aurita* dominated the yearly catch by weight composition (54.8%) and most of the catch of round sardinella took place during the summer from June to September. However, the dominance of this species has gradually diminished throughout the years 1999-2003.
Pilchard *(S. pilchardus)* appeared to be again the dominant species during wintertime in 2003 (November-March). For this species, as well as for chub mackerel *(S. japonicus)*, the percentage of the total catch by weight has gradually increased since 1999.

6. Recommendations

The following recommendations are given for a good continuation of the Scientific Observer Program on board Dutch pelagic vessels in the Mauritanian Exclusive Economic Zone. Some of these recommendations are already given in previous reports (Benjamins 2002a, 2002b; ter Hofstede, 2002; 2003a), but still apply to 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 by-catch 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 and that the observers take care of good species coverage.
- 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 instead of fork length in the analysis of data, the standard length measurements will be shifted from fork length to total length from the first of January 2004 onwards.
- Special attention should be given to possible shifts in CPUE of the Dutch pelagic fleet in the Mauritanian EEZ based on fishing days.
- The extension of the observers' dataset in 2003 with a fifth year in a row enlarged definitely 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 therefore highly recommended to be performed in the near future.

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Tables and Figures

Table 1: Schedule of the observer trips in 2003.

	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																							Mission 1								
February	Mission 1																														
March															Mission 2																
April	Mission 2																														
May													Mission 3																		
June																									Mission 4						
July	Mission 4																					Mission 5									
August	Mission 5																				Mission 6										
September	Mission 6																														
October			Mission 7																	Mission 8											
November	Mission 8																		Mission 9												
December	Mission 9																														

Table 2: Total extrapolated catch in tons for the main target species in 2003, landings and discards. Percentages are based on the total catch (landings + discards) of all species.

	catch in tons			catch in percentages		
Species	**landings**	**discards**	**total**	**landings**	**discards**	**total**
Sardinella aurita	94372.3	2924.8	97297.1	53.1	1.6	54.8
Sardinella maderensis	4454.1	261.3	4715.4	2.5	0.1	2.7
Sardina pilchardus	31867.2	2301.4	34168.6	17.9	1.3	19.2
Scomber japonicus	23479.0	3378.0	26857.0	13.2	1.9	15.1
Caranx rhonchus	1558.9	336.3	1895.1	0.9	0.2	1.1
Trachurus trachurus	860.9	150.8	1011.7	0.5	0.1	0.6
Trachurus trecae	4021.2	676.4	4697.6	2.3	0.4	2.6
Other (see table x)	2128.1	4852.8	6980.9	1.2	2.7	3.9
total	162741	14890	177631	91.6	8.4	100

Table 3: Total extrapolated catch in tons for the non-target species in 2003, landings and discards. Percentages are based on the total catch (landings + discards) of all species.

	catch in tons			catch in percentages		
Species	**landings**	**discards**	**total**	**landings**	**discards**	**total**
Acanthocybium solandri		91.5	91.5		0.1	0.1
Acanthocybium spec.		12.4	12.4		0.0	0.0
Alectis alexandrinus		25.7	25.7		0.0	0.0
Argyrosomus regius		8.8	8.8		0.0	0.0
Arius epaatii		1.8	1.8		0.0	0.0
Arius heudeloti	123.4	62.1	185.5	0.1	0.0	0.1
Arius parkii		63.5	63.5		0.0	0.0
Auxis thazard	246.7	644.7	891.3	0.1	0.4	0.5
Balistes capriscus		0.4	0.4		0.0	0.0
Belone spec.		0.1	0.1		0.0	0.0
Boops boops		0.0	0.0		0.0	0.0
Brachydeuterus auritus		36.8	36.8		0.0	0.0
Brama brama	37.4	43.2	80.6	0.0	0.0	0.0
Brama spec.		7.8	7.8		0.0	0.0
Calamar		0.1	0.1		0.0	0.0
Campogramma glaycos	92.0	374.1	466.0	0.1	0.2	0.3
Caranx hippos		23.6	23.6		0.0	0.0
Centrolophus niger		1.0	1.0		0.0	0.0
Chloroscombrus chrysurus		35.2	35.2		0.0	0.0
Conger conger		0.7	0.7		0.0	0.0
Coryphaena hippurus		20.9	20.9		0.0	0.0
Coryphaena spec.		1.5	1.5		0.0	0.0
Crevette		0.1	0.1		0.0	0.0
Cypselurus pinnatibarkatus		6.7	6.7		0.0	0.0
Dasyatis isolacea		138.7	138.7		0.1	0.1
Dentex canariensis		1.6	1.6		0.0	0.0
Dentex macrophthalmus		0.1	0.1		0.0	0.0
Dentex spec.		2.0	2.0		0.0	0.0
Dicologoglossa cuneata		0.1	0.1		0.0	0.0
Diplodus bellottii		0.1	0.1		0.0	0.0
Echeneis naucrates		2.7	2.7		0.0	0.0
Engraulis encrasicolus		233.3	233.3		0.1	0.1
Euthynnus alleteratus	32.0	161.6	193.6	0.0	0.1	0.1
Gamba		0.1	0.1		0.0	0.0
Helicolenus dactylopterus		11.5	11.5		0.0	0.0
Hemiramphus brasiliensis		0.9	0.9		0.0	0.0
Hyperoglyphe moselli		38.6	38.6		0.0	0.0
Hyperoglyphe spec.		0.1	0.1		0.0	0.0
Illex coindetii		6.4	6.4		0.0	0.0
Katsuwonus pelamis	38.7	17.0	55.7	0.0	0.0	0.0
Lagocephalus laevigatus		8.9	8.9		0.0	0.0
Lagocephalus spec.		19.4	19.4		0.0	0.0
Loligo vulgaris		4.1	4.1		0.0	0.0
Merluccius senegalensis		16.4	16.4		0.0	0.0

Table 3 (continued): Total extrapolated catch in tons for the non-target species in 2003, landings and discards. Percentages are based on the total catch (landings + discards) of all species.

	catch in tons			catch in percentages		
species	**landings**	**discards**	**total**	**landings**	**discards**	**total**
Merluccius spec.		0.1	0.1		0.0	0.0
Microchirus boscanion		0.0	0.0		0.0	0.0
Mugil capurrii		41.2	41.2		0.0	0.0
Mugil cephalus	421.2	234.6	655.8	0.2	0.1	0.4
Mugil monodi		43.0	43.0		0.0	0.0
Mugilidae		6.4	6.4		0.0	0.0
Muraena spec.		2.2	2.2		0.0	0.0
Myctophidae		0.3	0.3		0.0	0.0
Orcynopsis unicolor		37.8	37.8		0.0	0.0
Pagellus bellottii		5.8	5.8		0.0	0.0
Paraconger notialis		0.3	0.3		0.0	0.0
Pomadasys incisus		2.2	2.2		0.0	0.0
Pomadasys jubelini		6.9	6.9		0.0	0.0
Pomadasys rogeri		4.0	4.0		0.0	0.0
Pomatomus saltatrix	306.3	294.3	600.6	0.2	0.2	0.3
Priacanthus arenatus		0.1	0.1		0.0	0.0
Remora remora		47.4	47.4		0.0	0.0
Ruvettus pretiosus		30.9	30.9		0.0	0.0
Ruvettus spec.		0.2	0.2		0.0	0.0
Sarda sarda	488.4	875.3	1363.8	0.3	0.5	0.8
Scomberomorus tritor	16.9	104.8	121.7	0.0	0.1	0.1
Selar crumenophthalmus		0.7	0.7		0.0	0.0
Selene dorsalis		9.4	9.4		0.0	0.0
Sepia officinalis		2.3	2.3		0.0	0.0
Sparus auriga		10.8	10.8		0.0	0.0
Sphoeroides trachygaster		6.6	6.6	0.0	0.0	0.0
Sphyraena afra		23.8	23.8		0.0	0.0
Sphyraena guachancho		58.9	58.9		0.0	0.0
Sphyraena spec.		0.5	0.5		0.0	0.0
Sphyraena sphyraena		0.5	0.5		0.0	0.0
Spondyliosoma cantharus		0.3	0.3		0.0	0.0
Stromateus fiatola		70.0	70.0		0.0	0.0
Strongylura senegalensis		5.5	5.5		0.0	0.0
Synagrops microlepis		0.0	0.0		0.0	0.0
Taractichthys longipinnis		2.5	2.5		0.0	0.0
Thunnus albacares		18.0	18.0		0.0	0.0
Trachinotus ovatus	1.2	95.0	96.2	0.0	0.1	0.1
Trichiurus lepturus	323.8	683.8	1007.6	0.2	0.4	0.6
Umbrina canariensis		2.3	2.3		0.0	0.0
Uranoscopus polli		1.9	1.9		0.0	0.0
Uranoscopus spec.		0.9	0.9		0.0	0.0
Zenopsis conchifer		1.1	1.1		0.0	0.0
Zeus faber		1.6	1.6		0.0	0.0

Table 5a: Length-frequency distributions for the catches of the target species Sardinella aurita and Sardinella maderensis in 2003. Numbers in thousands.

length class	*Sardinella aurita*			*Sardinella maderensis*		
(cm)	landings	discards	total	landings	discards	total
8						
9	139		139			
10					0	0
11		3	3			
12		51	51			
13		30	30		0	0
14		190	190		0	0
15		304	304		0	0
16	82	176	258		7	7
17	113	144	257		4	4
18	609	244	853	4	6	10
19	3978	472	4450	171	20	191
20	5179	570	5749	490	53	543
21	5393	1000	6393	1182	59	1242
22	14858	1397	16255	2119	41	2160
23	26005	1963	27968	3114	61	3175
24	32627	1583	34210	3432	69	3501
25	38022	1967	39989	3076	75	3151
26	40129	1334	41463	2489	128	2617
27	35755	638	36394	1816	197	2012
28	44404	636	45040	1252	191	1444
29	42229	450	42679	362	38	400
30	28998	283	29281	65	15	80
31	10597	137	10734	4	4	7
32	3210	36	3246			
33	542	4	546	0		0
34	28		28			
35	18		18		0	0
36						
37						
38						
39						
40						
41						
42						
43						
44						
total	332913	13611	346524	19577	970	20547

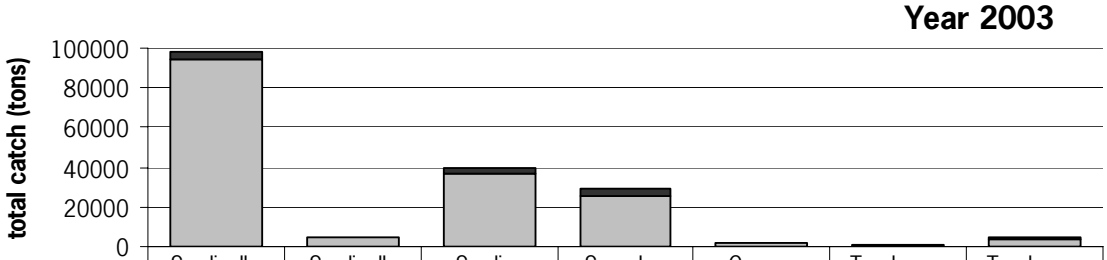
Table 5b: Length-frequency distributions for the catches of the target species Sardina pilchardus and Scomber japonicus in 2003. Numbers in thousands.

length class	*Sardina pilchardus*			*Scomber japonicus*		
(cm)	landings	discards	total	landings	discards	total
8						
9		9	9			
10		19	19			
11		8	8		1	1
12		38	38			
13	4	45	50		7	7
14	402	665	1067		48	48
15	18412	3450	21862	55	100	155
16	50218	6045	56262	337	126	463
17	70703	8426	79129	741	532	1273
18	22765	5439	28204	2338	1860	4199
19	16027	2344	18372	4180	2459	6639
20	34397	1908	36304	8168	3007	11175
21	59140	2500	61640	5162	3180	8343
22	64587	2109	66695	4818	2945	7763
23	27936	566	28501	6102	2065	8168
24	5048	58	5106	8738	1335	10072
25	344	5	349	11798	1450	13248
26	38	2	41	9154	958	10111
27	42	13	55	9679	825	10504
28	9	1	9	10490	585	11076
29	4		4	7933	459	8392
30	1		1	5855	383	6238
31				3423	279	3702
32				2543	266	2810
33				2183	167	2350
34				1404	145	1549
35				1062	116	1179
36				542542	28256	570798
37				255214	14738	269953
38				164544	4051	168595
39				126806	15206	142012
40				198153	17600	215753
41				40996	1862	42858
42				34511	1544	36055
43				4556	1880	6436
44						
total	370079	33649	403727	1473486	108435	1581921

Table 5c: Length-frequency distributions for the catches of the target species Caranx rhonchus, Trachurus trachurus and Trachurus trecae in 2003. Numbers in thousands.

length class	*Caranx rhonchus*			*Trachurus trachurus*			*Trachurus trecae*		
(cm)	landings	discards	total	landings	discards	total	landings	discards	total
8		86	86		1	1		88	88
9		600	600		99	99		215	215
10		2913	2913		206	206	10	217	227
11		1285	1285		213	213	19	630	649
12		428	428	0	399	399	2	443	444
13		685	685	1	265	266	28	332	359
14		258	258	27	198	225	886	390	1276
15		343	343	55	311	366	3843	433	4277
16		344	344	37	364	401	1223	665	1888
17	7	2	9	18	321	339	1189	554	1744
18	109	13	123	7	94	102	749	334	1083
19	310	34	344	2	86	89	162	229	391
20	482	57	540	25	50	76	72	100	172
21	553	69	622	225	40	265	153	95	248
22	683	73	755	217	23	239	399	63	462
23	443	34	476	117	19	136	1528	81	1609
24	415	89	504	184	19	204	2590	153	2743
25	303	82	385	886	26	912	3106	278	3384
26	387	46	434	392	23	415	1255	181	1436
27	485	44	530	314	20	333	1007	128	1135
28	706	42	748	249	43	293	437	57	494
29	472	30	502	143	2	146	536	24	561
30	513	23	536	178	1	179	781	17	799
31	149	27	176	112	4	116	426	12	438
32	152	28	180	93	1	93	482	8	491
33	124	16	140	68	3	71	83	29	111
34	106	9	115	34	4	38	58	34	92
35	66	7	73	48	4	51	80	75	156
36	59985	1486	61471	18763	961	19724	95927	84098	180025
37	24100	279	24379	9026	269	9295	17116	32182	49298
38	2709	3027	5736	2354		2354	7467	25844	33311
39		96	96	773	627	1400	39085	1996	41081
40	21688		21688		224	224	1241		1241
41					627	627	276	18374	18651
42		350	350				276		276
43		96	96						
44							47		47
total	114947	13003	127950	34348	5548	39896	182542	168358	350900

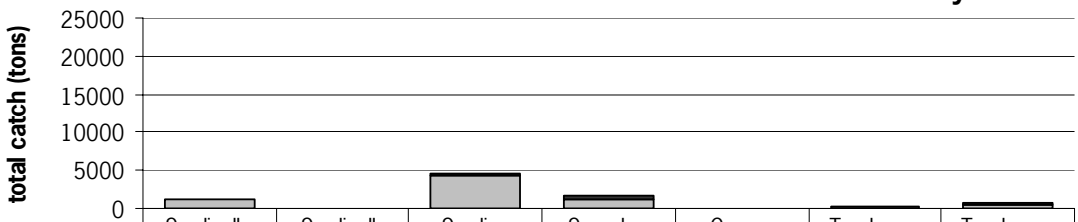
Figure 1: Total catches in tons of the main target species in 2003.



	Sardinella aurita	Sardinella maderensis	Sardina pilchardus	Scomber japonicus	Caranx rhonchus	Trachurus trachurus	Trachurus trecae
discards	2925	263	2639	3493	336	176	677
landings	94726	4499	37033	25583	1559	945	4021

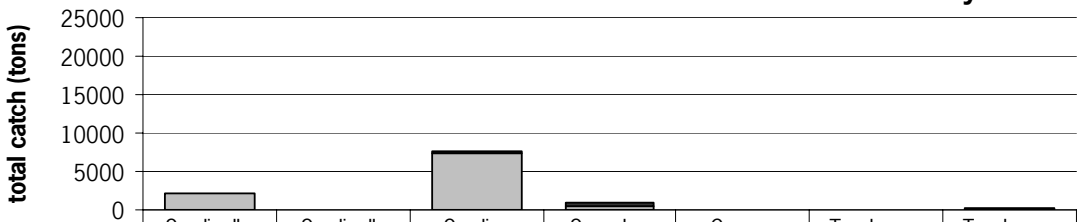
Figure 2a: Monthly catches in tons of the main target species for January, February, March and April 2003.

January 2003



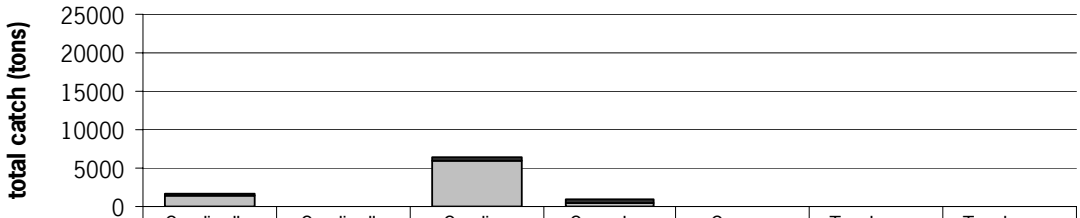
	Sardinella aurita	Sardinella maderensis	Sardina pilchardus	Scomber japonicus	Caranx rhonchus	Trachurus trachurus	Trachurus trecae
discards	46	27	244	373	13	3	67
landings	1094	18	4418	1195		263	579

February 2003



	Sardinella aurita	Sardinella maderensis	Sardina pilchardus	Scomber japonicus	Caranx rhonchus	Trachurus trachurus	Trachurus trecae
discards	61	36	325	496	17	4	89
landings	2118	34	7276	528		64	141

March 2003



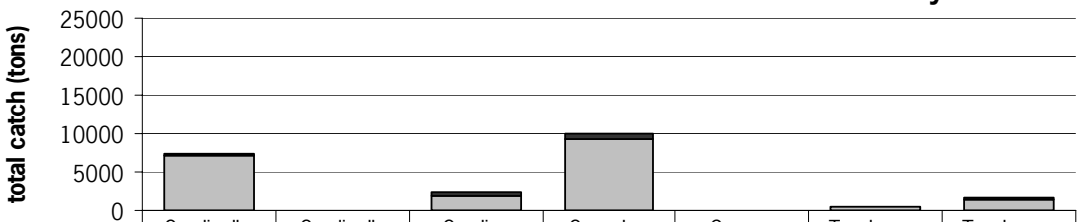
	Sardinella aurita	Sardinella maderensis	Sardina pilchardus	Scomber japonicus	Caranx rhonchus	Trachurus trachurus	Trachurus trecae
discards	330	6	530	452	0	0	25
landings	1357	2	6000	525		0	73

April 2003

	Sardinella aurita	Sardinella maderensis	Sardina pilchardus	Scomber japonicus	Caranx rhonchus	Trachurus trachurus	Trachurus trecae
discards	391	7	629	537	0	0	30
landings	2950	4	3939	2109		2	434

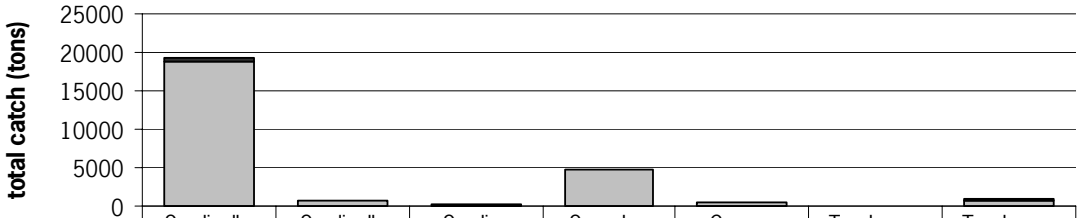
Figure 2b: Monthly catches in tons of the main target species for May, June, July and August 2003.

May 2003



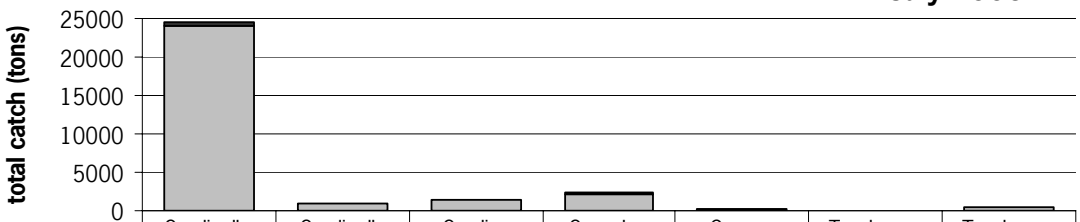
	Sardinella aurita	Sardinella maderensis	Sardina pilchardus	Scomber japonicus	Caranx rhonchus	Trachurus trachurus	Trachurus trecae
discards	123	15	487	849	1	29	114
landings	7141		1879	9178	40	442	1515

June 2003



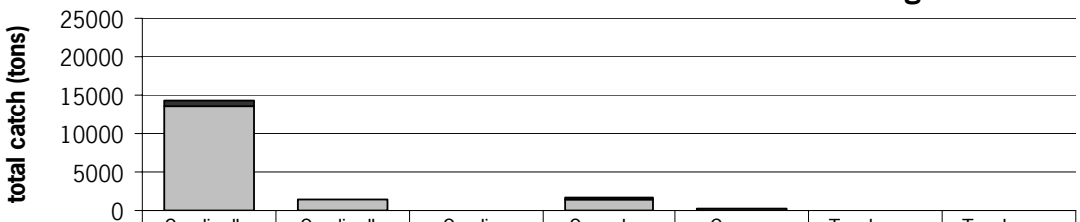
	Sardinella aurita	Sardinella maderensis	Sardina pilchardus	Scomber japonicus	Caranx rhonchus	Trachurus trachurus	Trachurus trecae
discards	507	15	2	152	12		118
landings	18779	744	324	4687	378		790

July 2003



	Sardinella aurita	Sardinella maderensis	Sardina pilchardus	Scomber japonicus	Caranx rhonchus	Trachurus trachurus	Trachurus trecae
discards	578	18	2	173	14		135
landings	23952	949	1462	2092	214		448

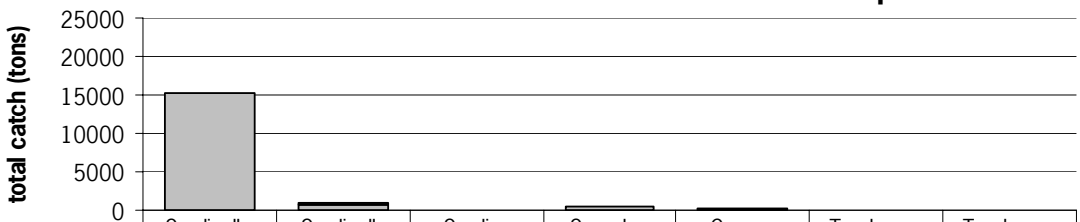
August 2003



	Sardinella aurita	Sardinella maderensis	Sardina pilchardus	Scomber japonicus	Caranx rhonchus	Trachurus trachurus	Trachurus trecae
discards	566	43	33	196	70	3	46
landings	13685	1322	6	1436	250		

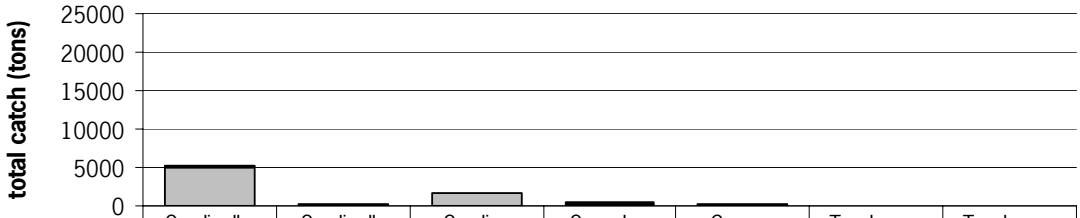
Figure 2c: Monthly catches in tons of the main target species for September, October, November and December 2003.

September 2003



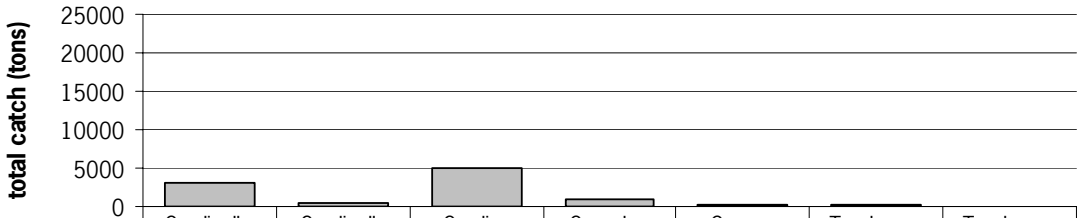
	Sardinella aurita	Sardinella maderensis	Sardina pilchardus	Scomber japonicus	Caranx rhonchus	Trachurus trachurus	Trachurus trecae
discards	56	82		32	25		31
landings	15192	831		497	280		36

October 2003



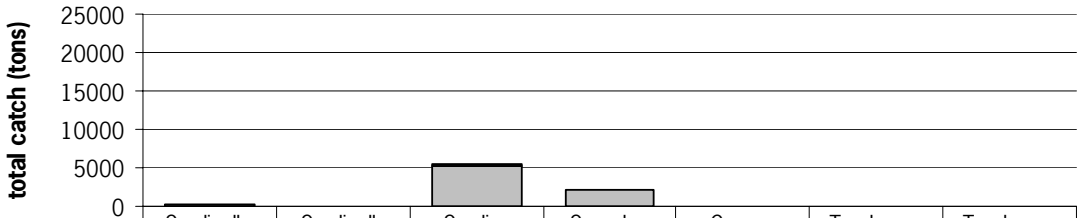
	Sardinella aurita	Sardinella maderensis	Sardina pilchardus	Scomber japonicus	Caranx rhonchus	Trachurus trachurus	Trachurus trecae
discards	185	11		88	35	8	20
landings	5056	160	1602	315	308		

November 2003



	Sardinella aurita	Sardinella maderensis	Sardina pilchardus	Scomber japonicus	Caranx rhonchus	Trachurus trachurus	Trachurus trecae
discards	82	2	50	30	149	104	2
landings	3048	390	4961	917	89	90	6

December 2003



	Sardinella aurita	Sardinella maderensis	Sardina pilchardus	Scomber japonicus	Caranx rhonchus	Trachurus trachurus	Trachurus trecae
discards	0	1	337	115		26	0
landings	354	45	5165	2104		84	

Figure 3: Length-frequency distributions of the catches of the target species Sardinella aurita in 2003.

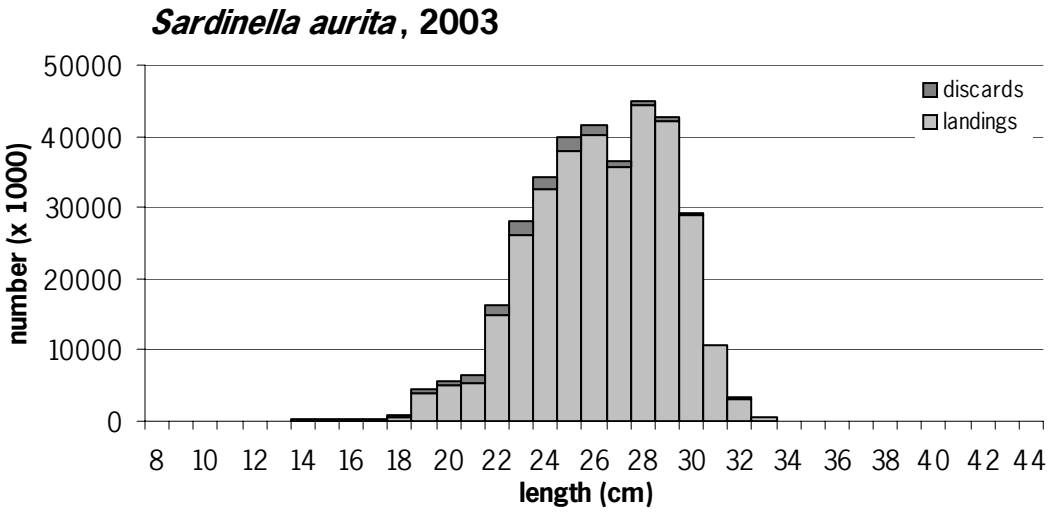


Figure 4: Length-frequency distributions of the catches of the target species Sardinella maderensis in 2003.

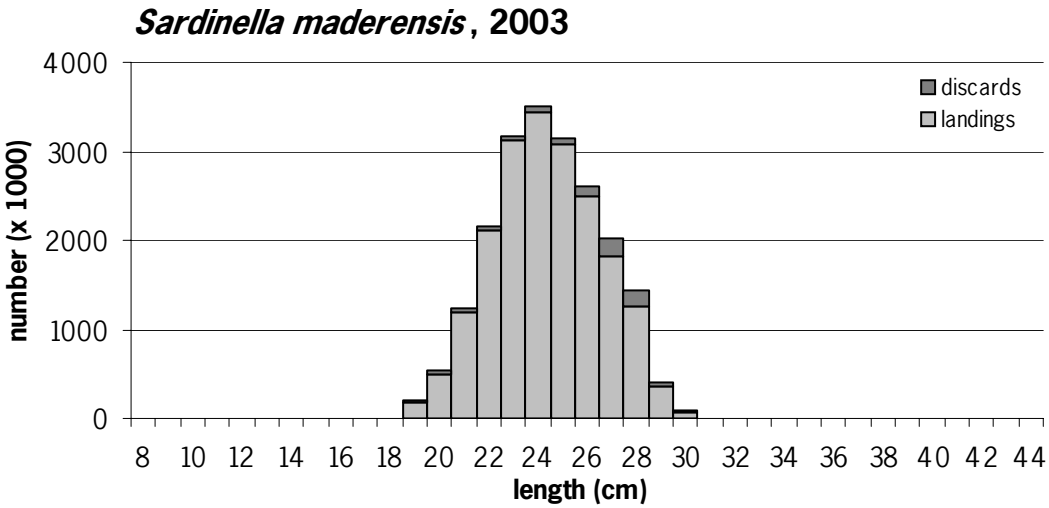


Figure 5: Length-frequency distributions of the catches of the target species Sardina pilchardus in 2003.

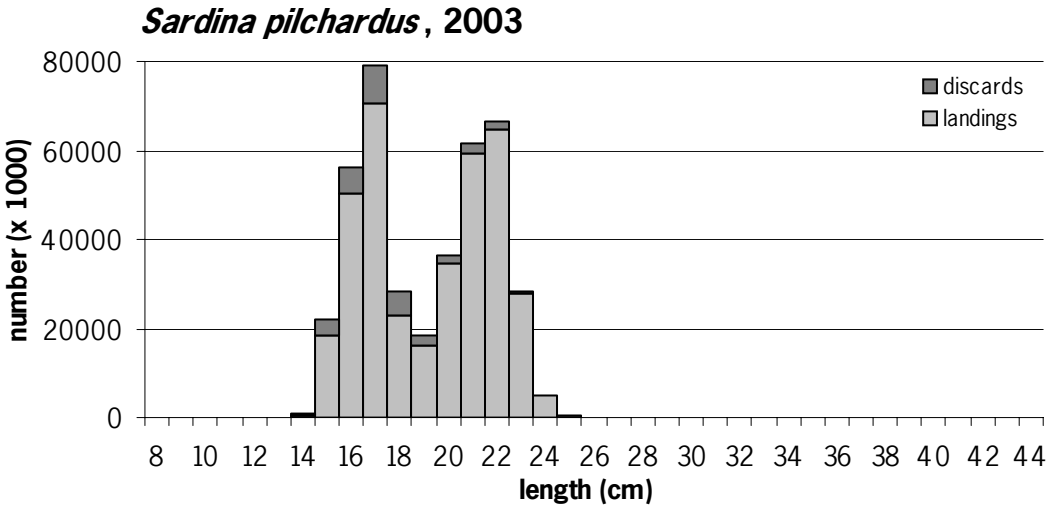


Figure 6: Length-frequency distributions of the catches of the target species Scomber japonicus in 2003.

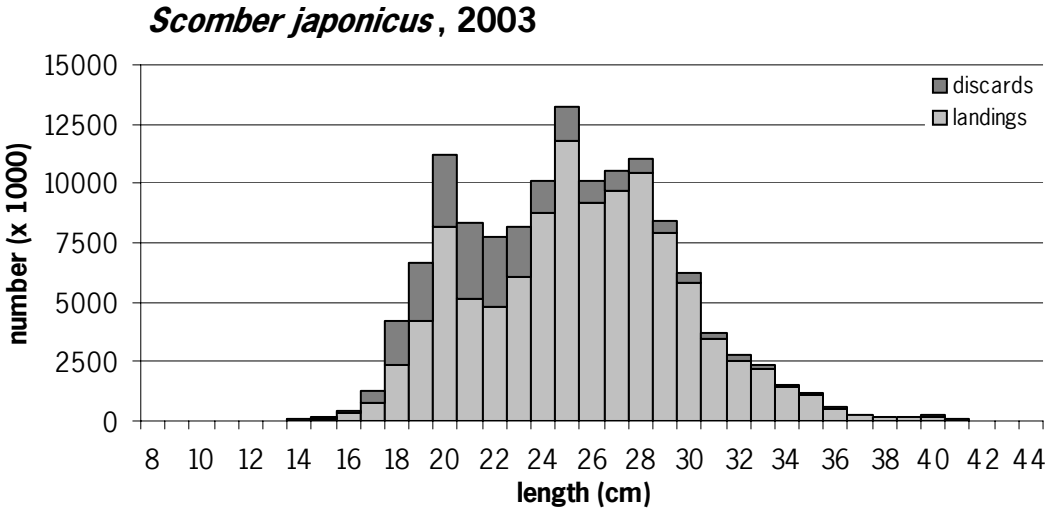


Figure 7: Length-frequency distributions of the catches of the target species Caranx rhonchus in 2003.

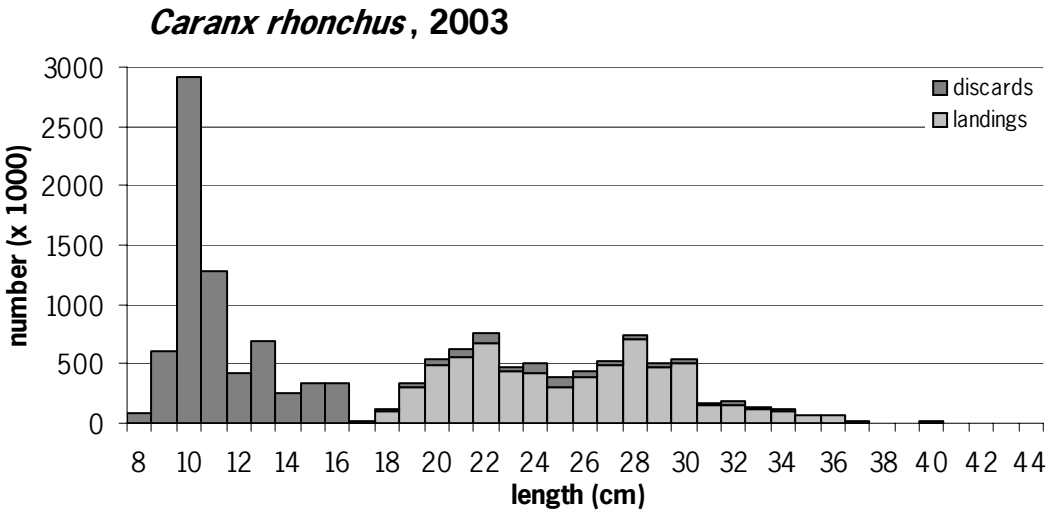


Figure 8: Length-frequency distributions of the catches of the target species Trachurus trachurus in 2003.

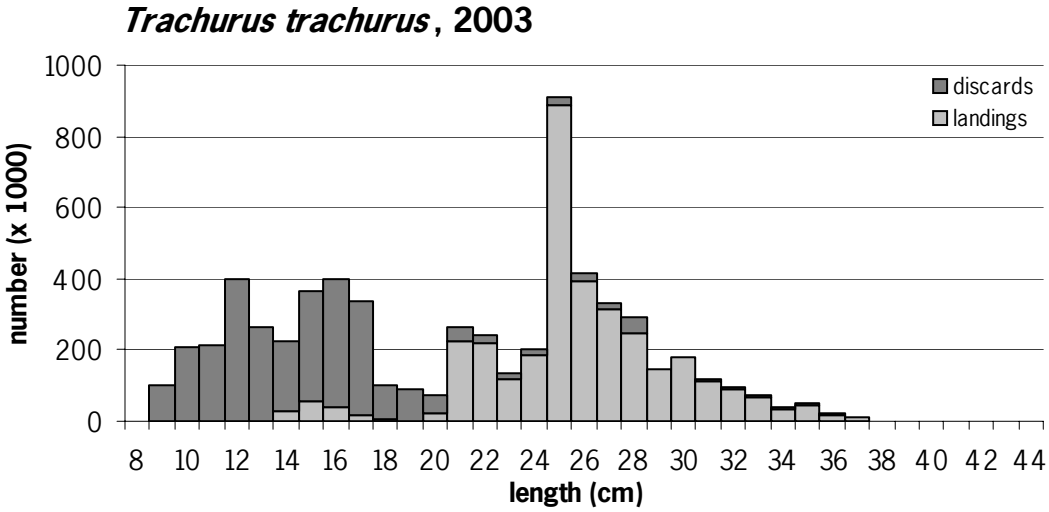


Figure 9: Length-frequency distributions of the catches of the target species Trachurus trecae in 2003.

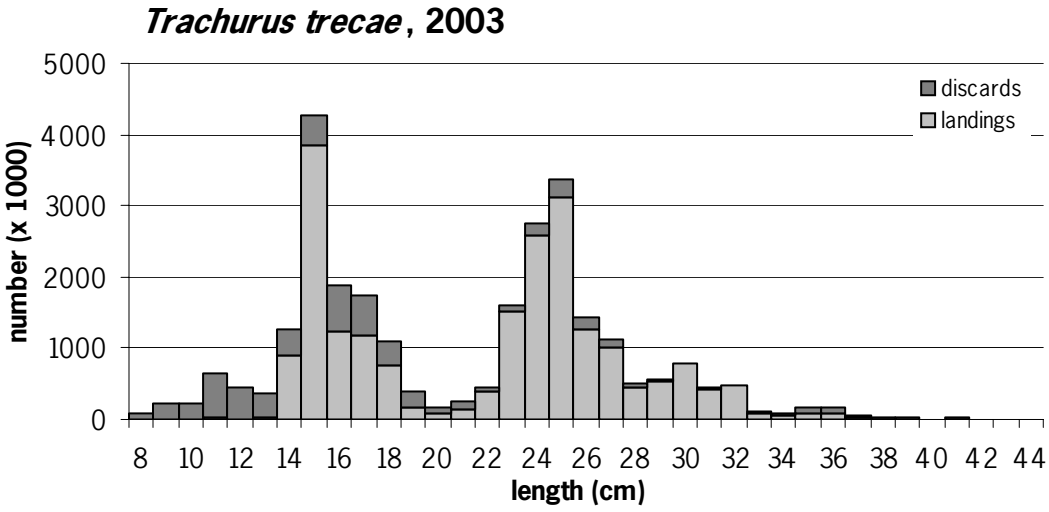


Figure 10a: Monthly length-frequency distributions for the catches of Sardinella aurita for January, February and March 2003.

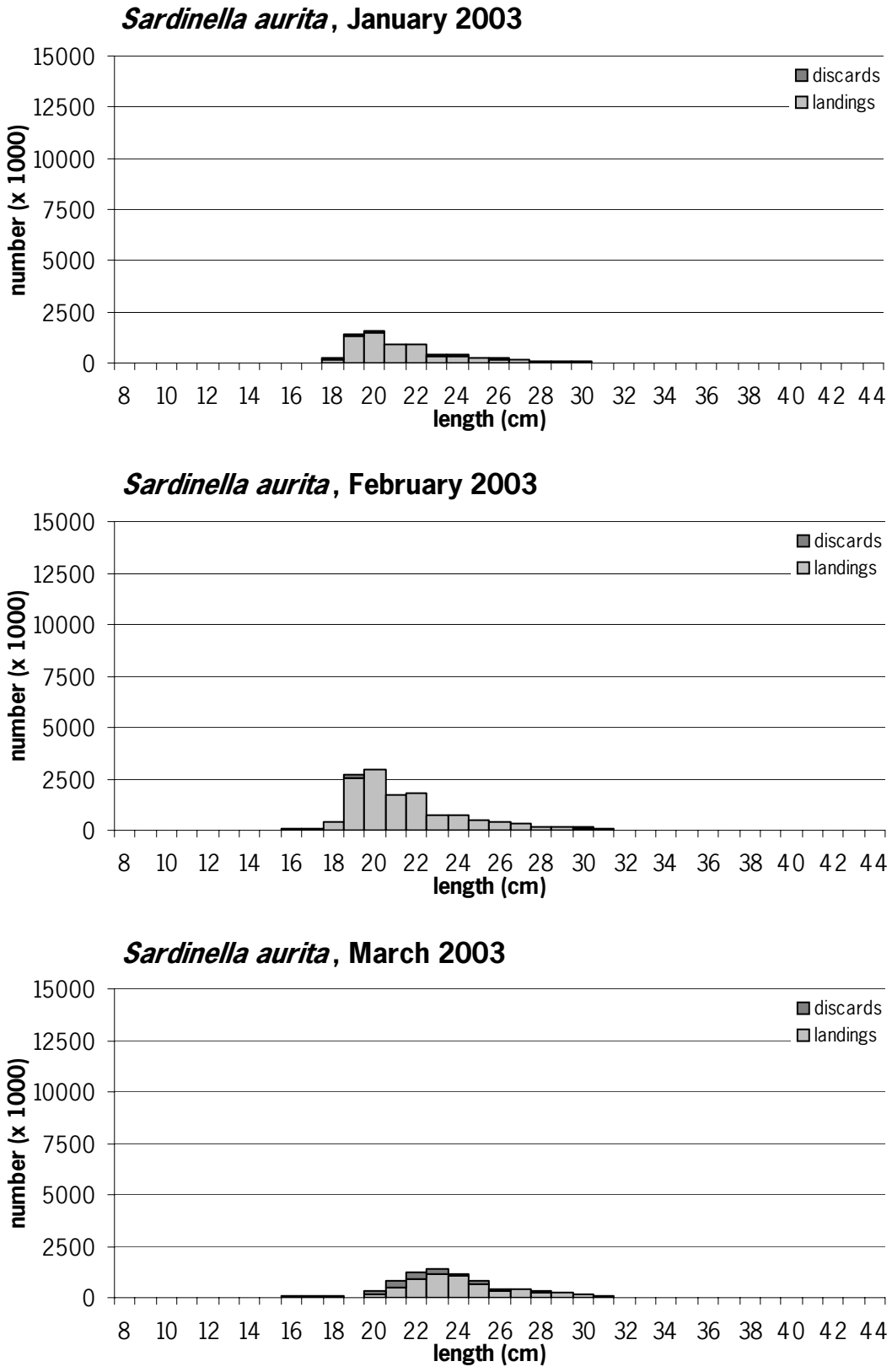


Figure 10b: Monthly length-frequency distributions for the catches of Sardinella aurita for April, May and June 2003.

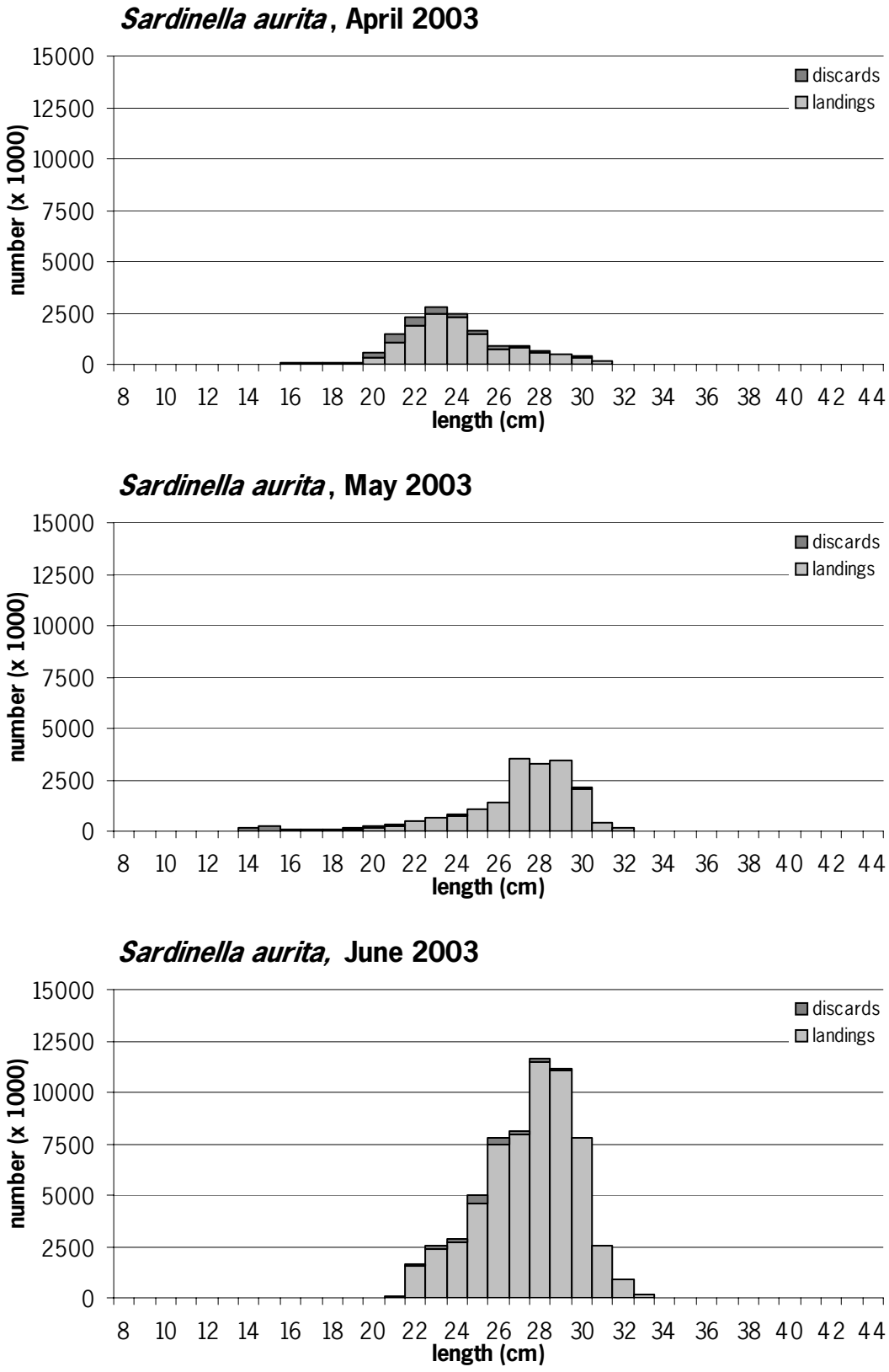


Figure 10c: Monthly length-frequency distributions for the catches of Sardinella aurita for July, August and September 2003.

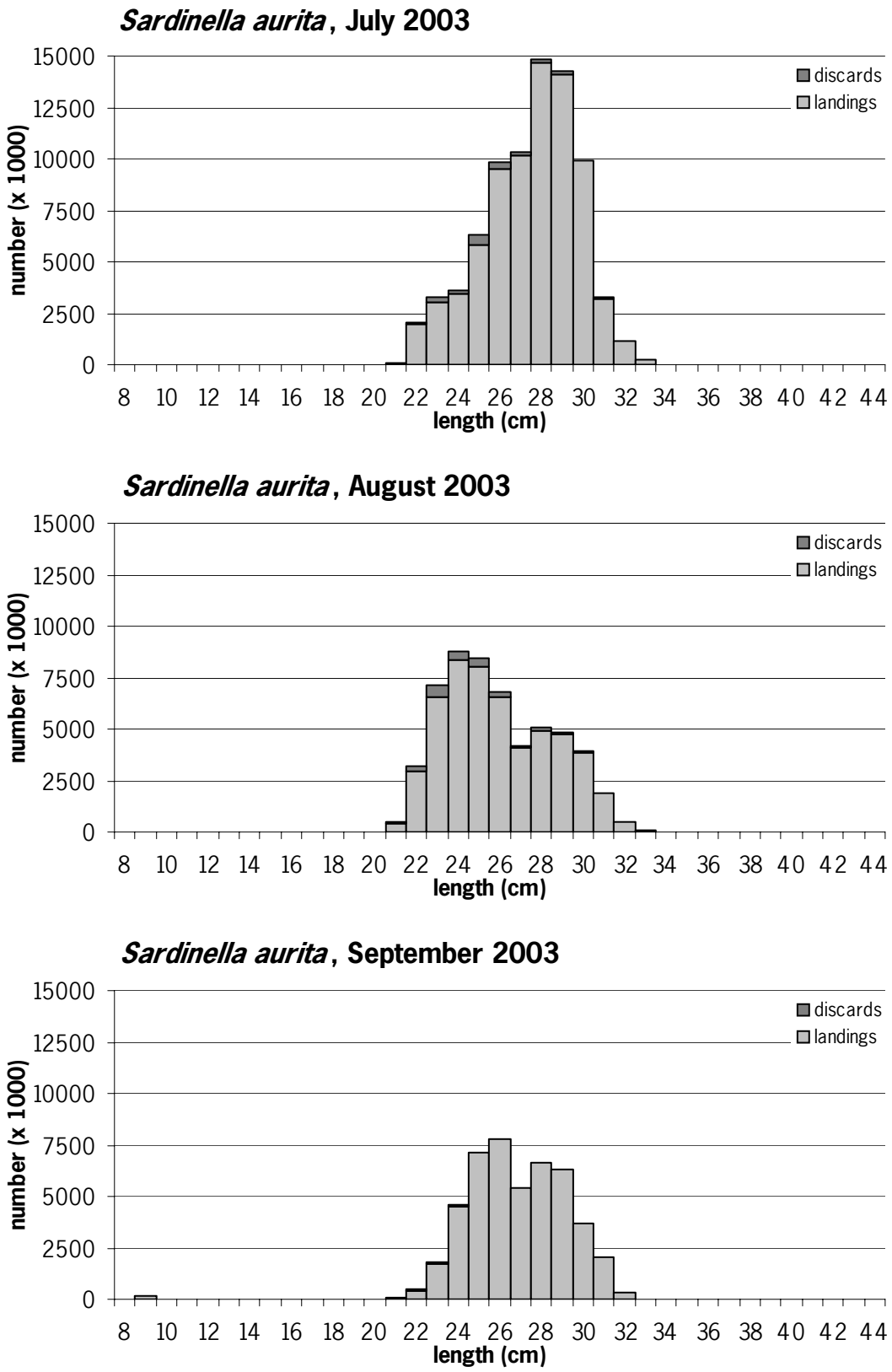


Figure 10d: Monthly length-frequency distributions for the catches of Sardinella aurita for October, November and December 2003.

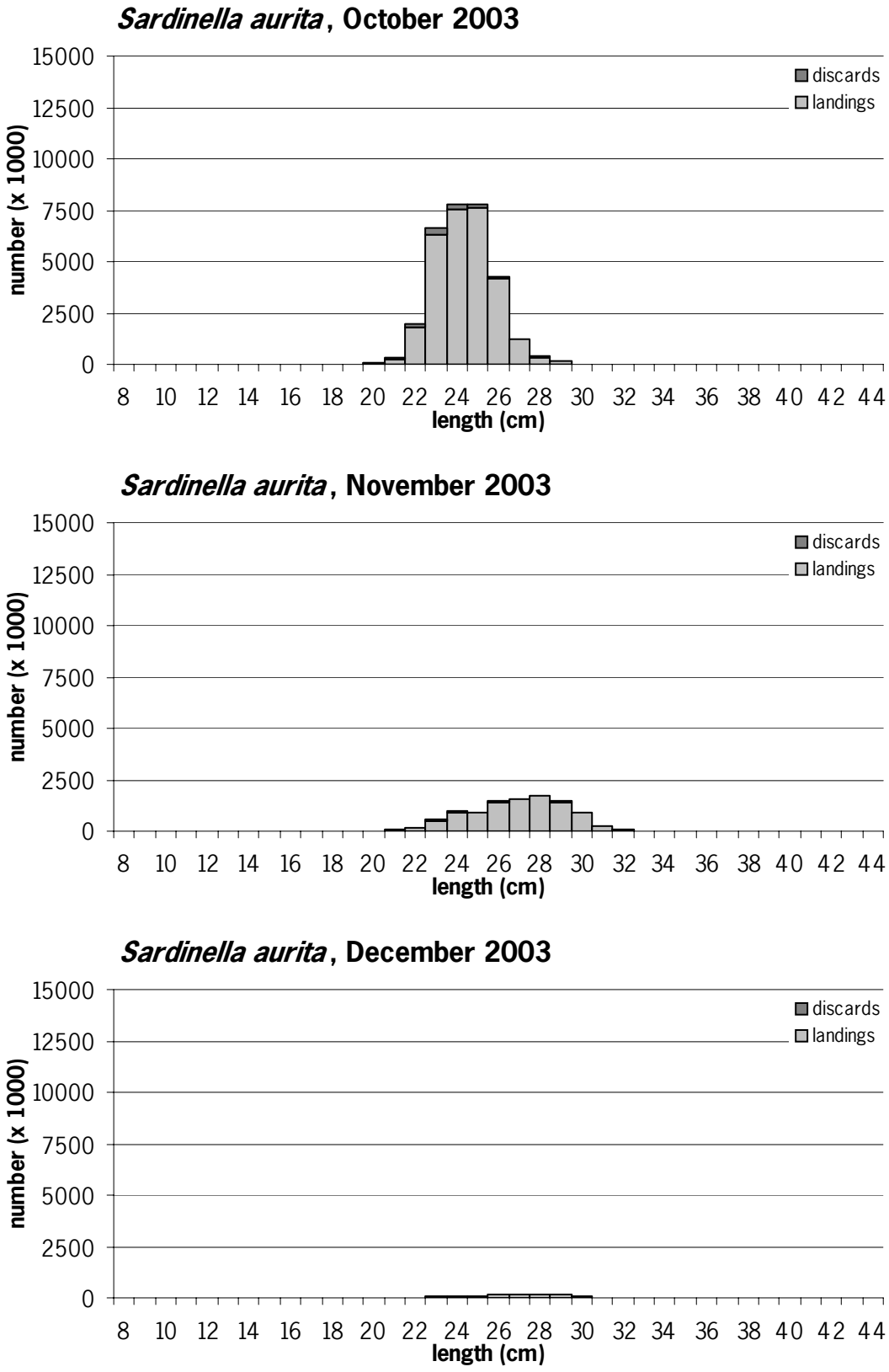


Figure 11a: Monthly length-frequency distributions for the catches of Sardinella maderensis for January, February and March 2003.

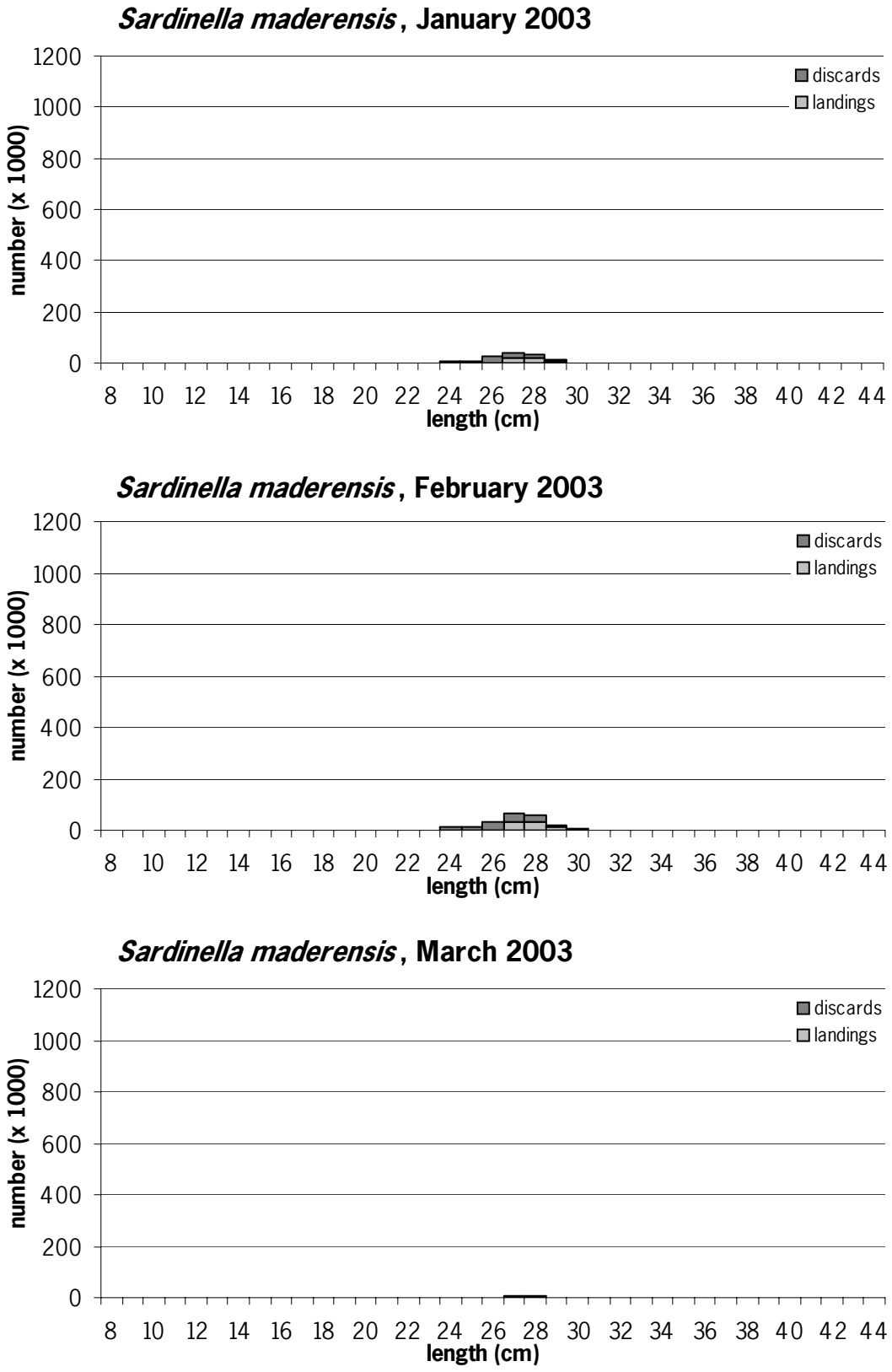


Figure 11b: Monthly length-frequency distributions for the catches of Sardinella maderensis for April, May and June 2003.

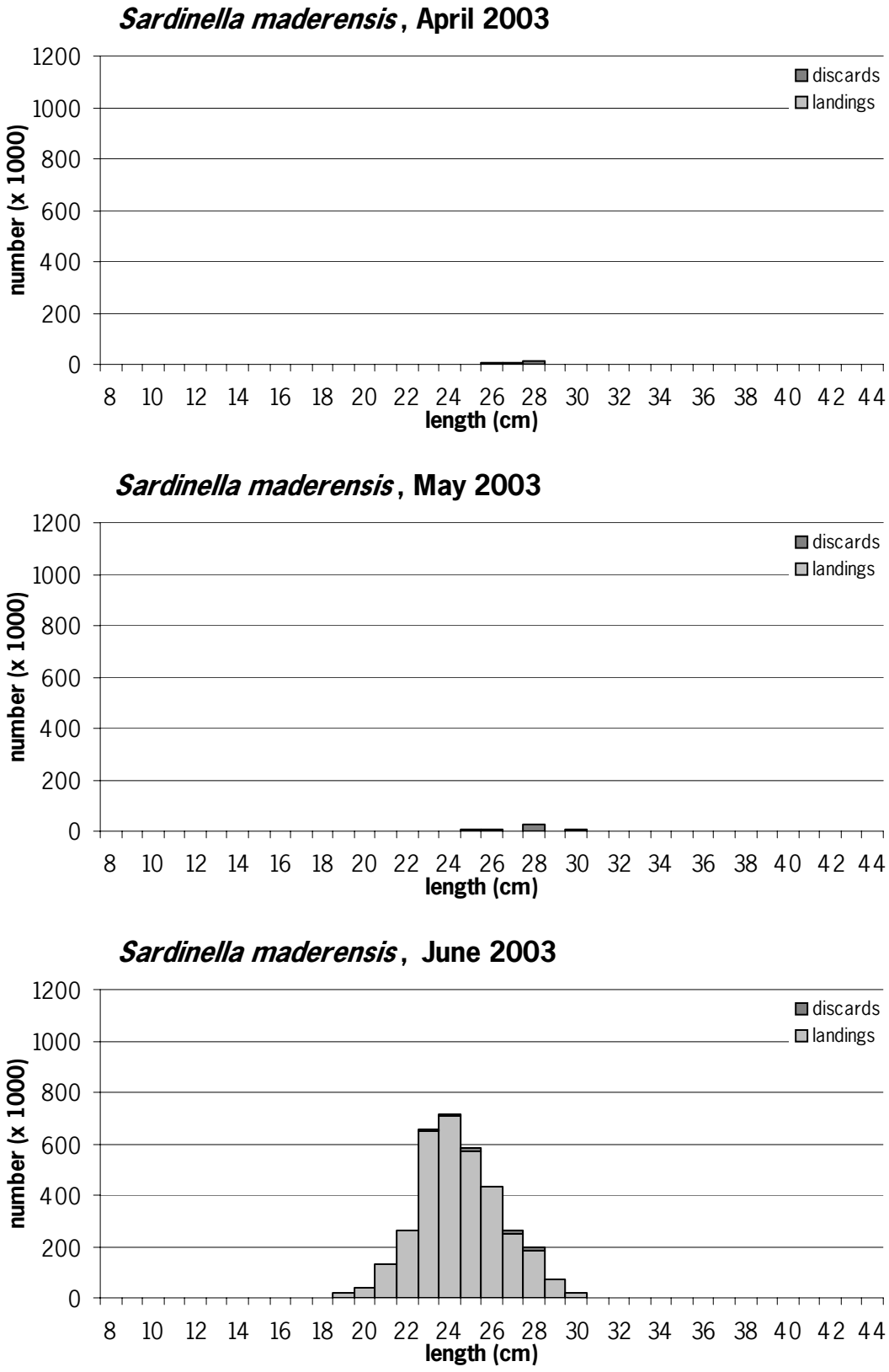
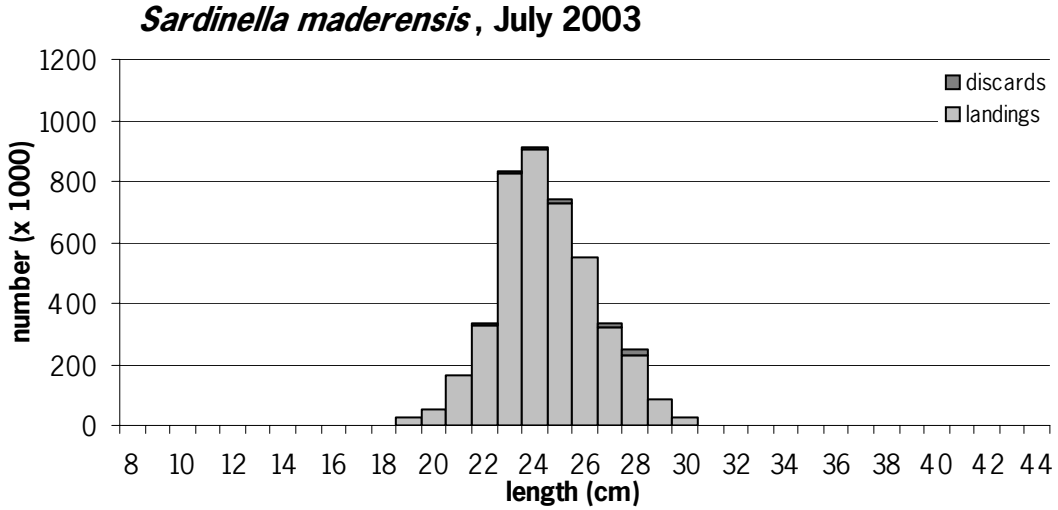
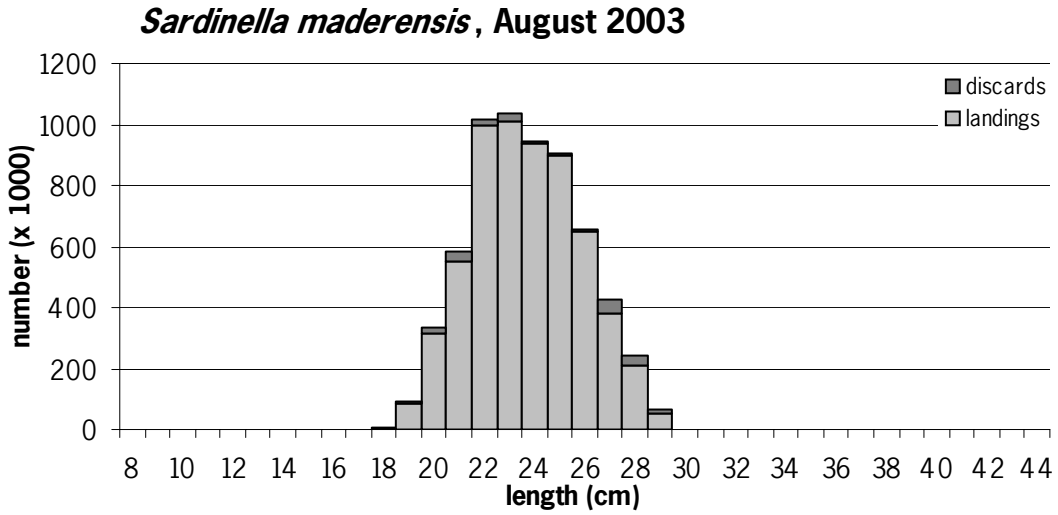


Figure 11c: Monthly length-frequency distributions for the catches of Sardinella maderensis for July, August and September 2003.





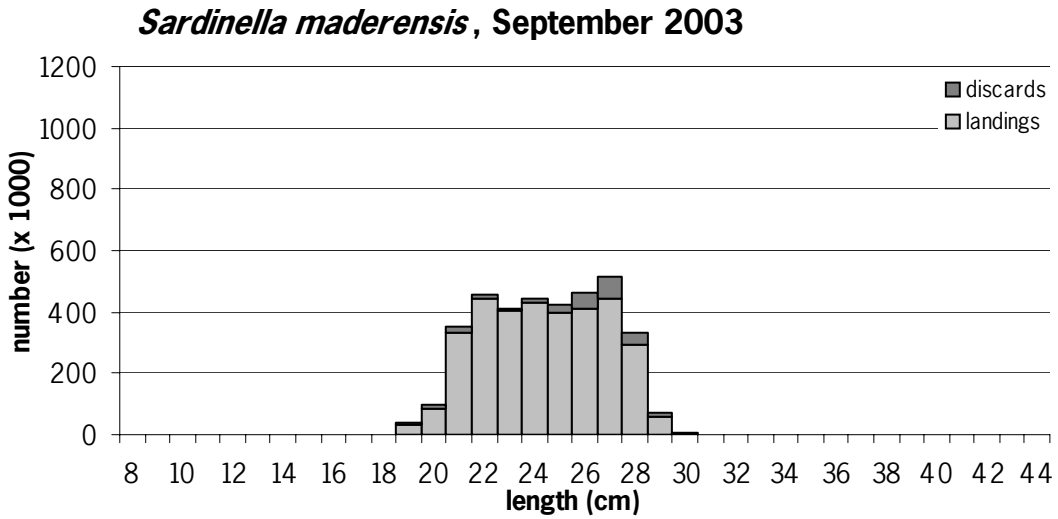


Figure 11d: Monthly length-frequency distributions for the catches of Sardinella maderensis for October, November and December 2003.

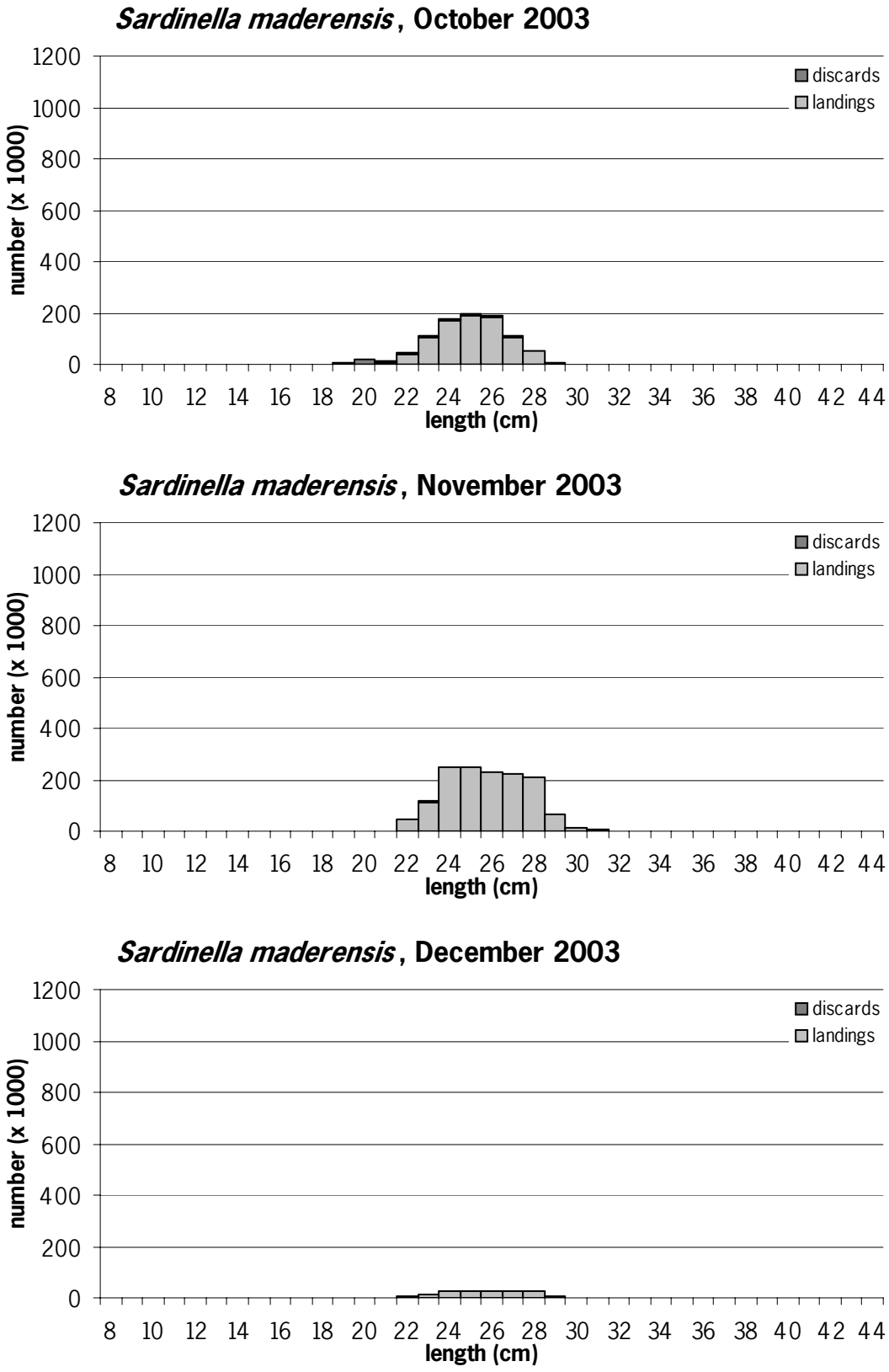


Figure 12a: Monthly length-frequency distributions for the catches of Sardina pilchardus for January, February and March 2003.

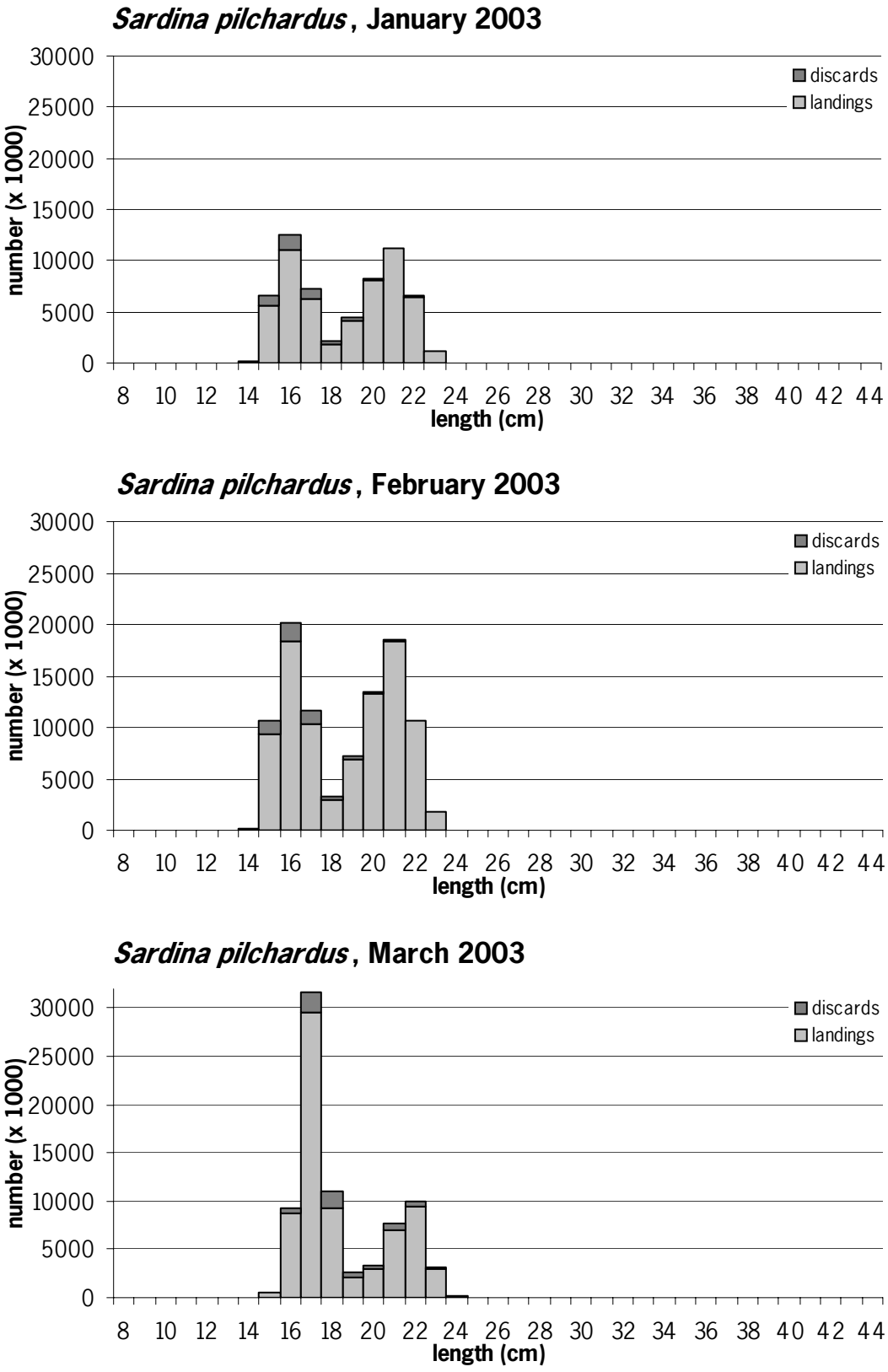


Figure 12b: Monthly length-frequency distributions for the catches of Sardina pilchardus for April, May and June 2003.

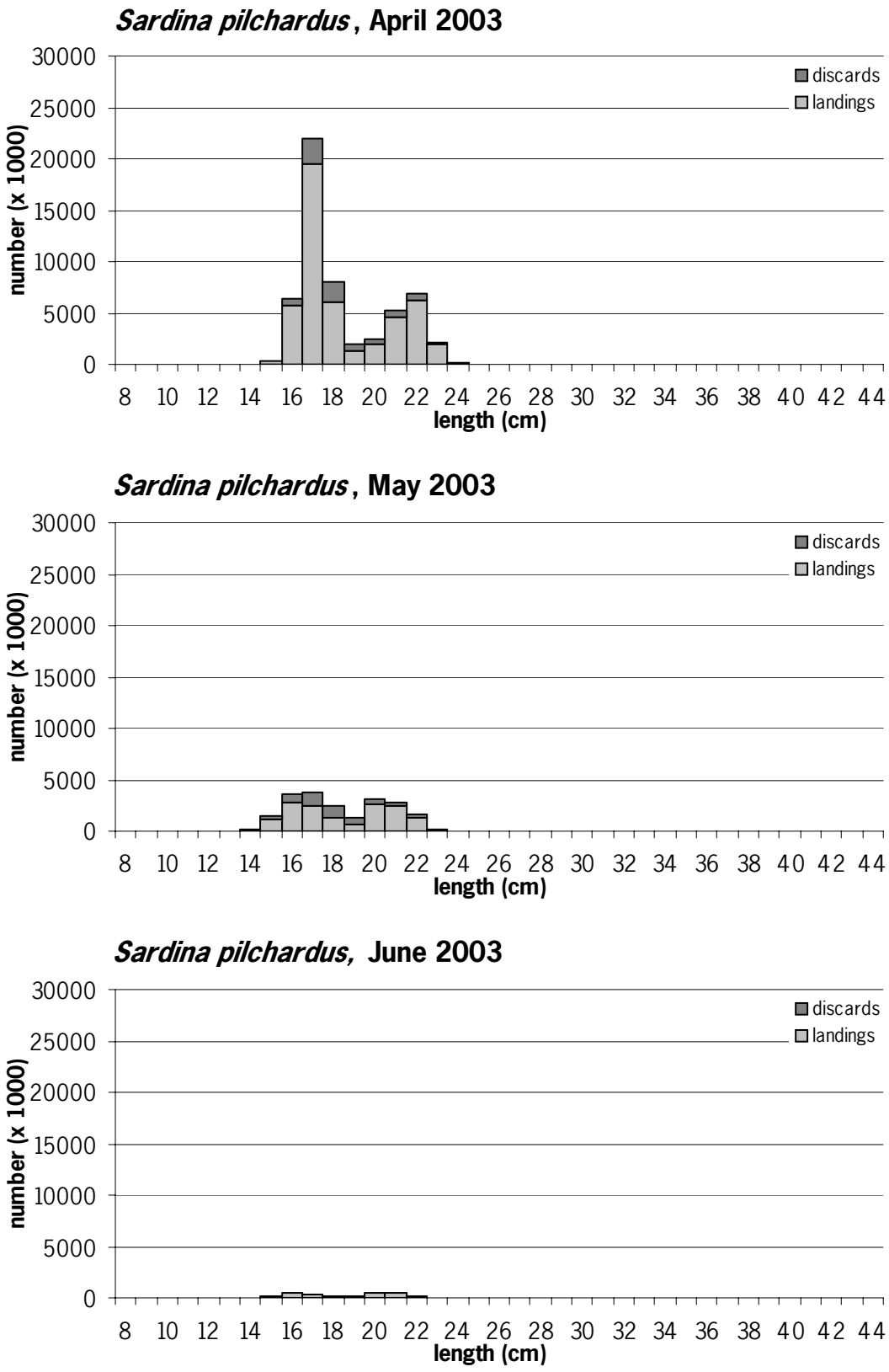


Figure 12c: Monthly length-frequency distributions for the catches of Sardina pilchardus for July, August and September 2003.

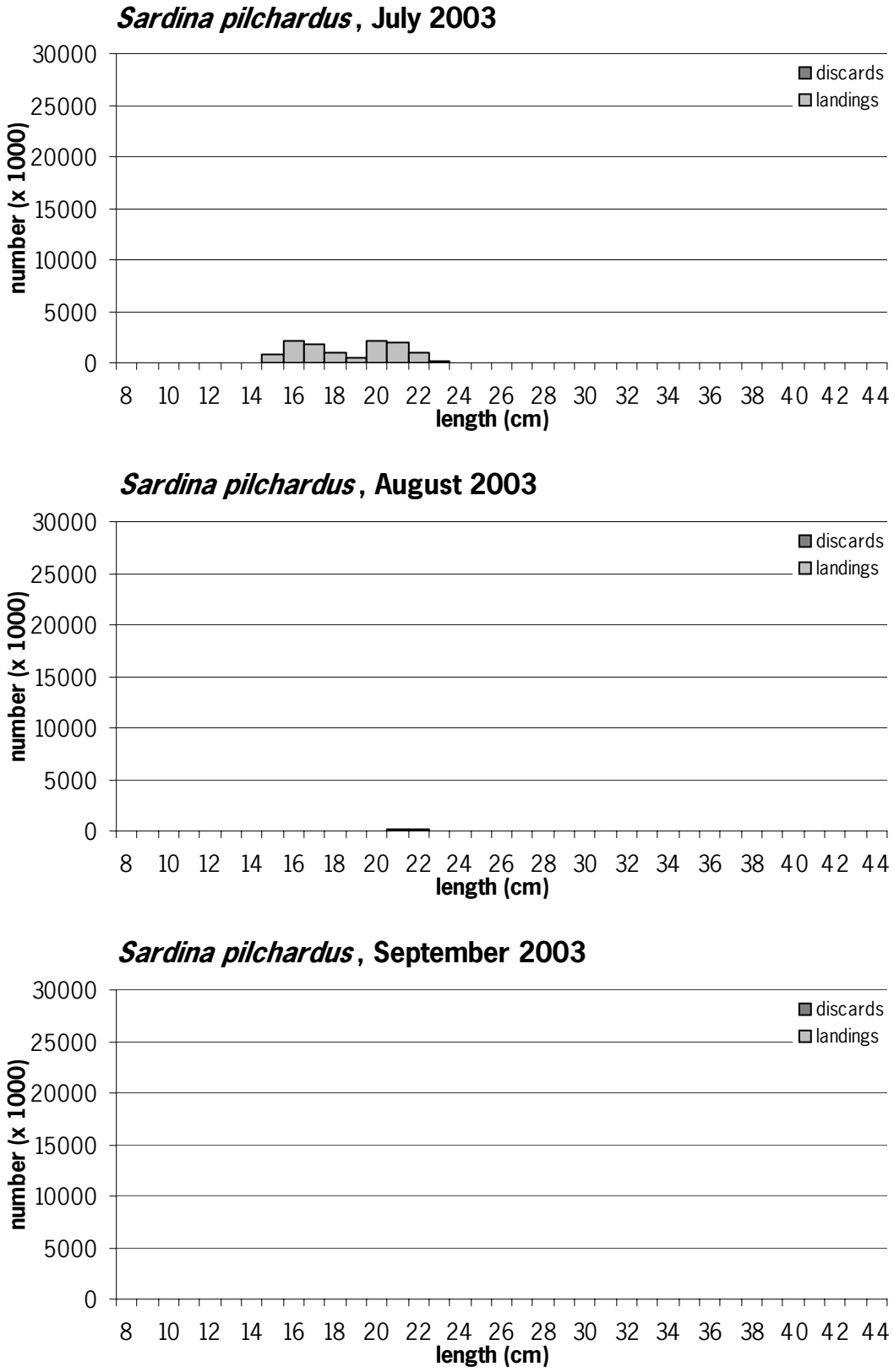


Figure 12d: Monthly length-frequency distributions for the catches of Sardina pilchardus for October, November and December 2003.

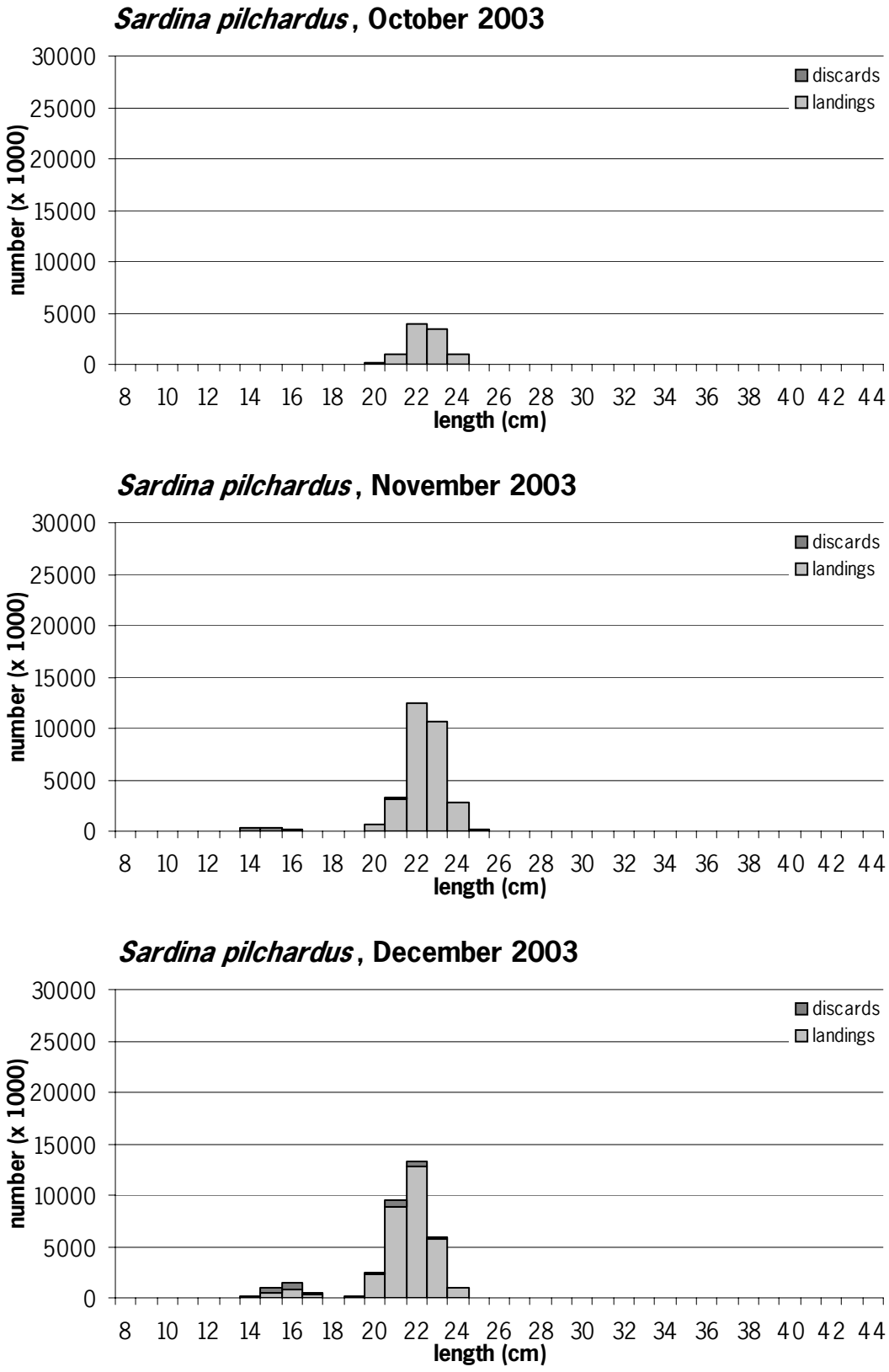


Figure 13a: Monthly length-frequency distributions for the catches of Trachurus trecae for January, February and March 2003.

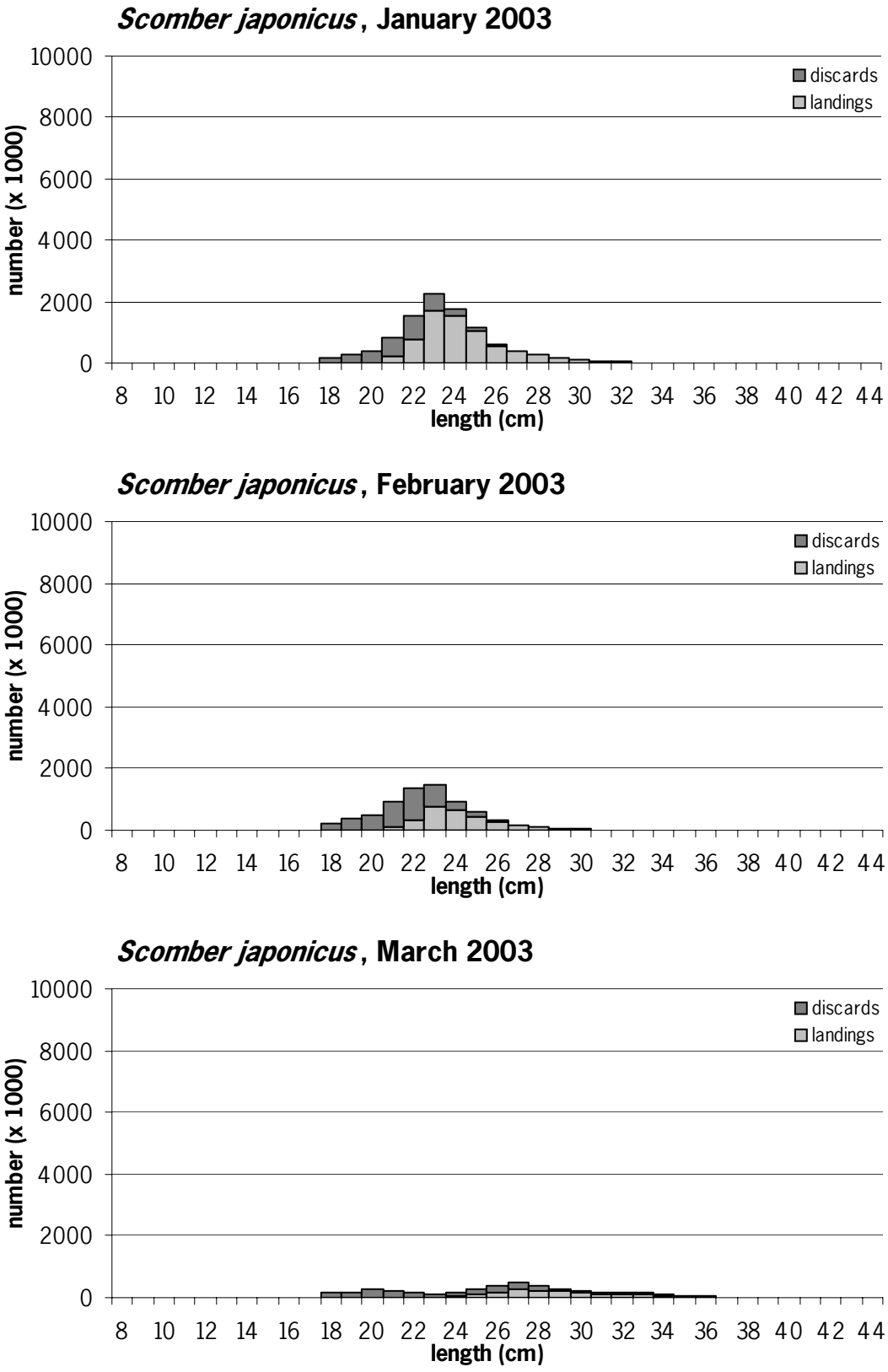


Figure 13b: Monthly length-frequency distributions for the catches of Trachurus trecae for April, May and June 2003.

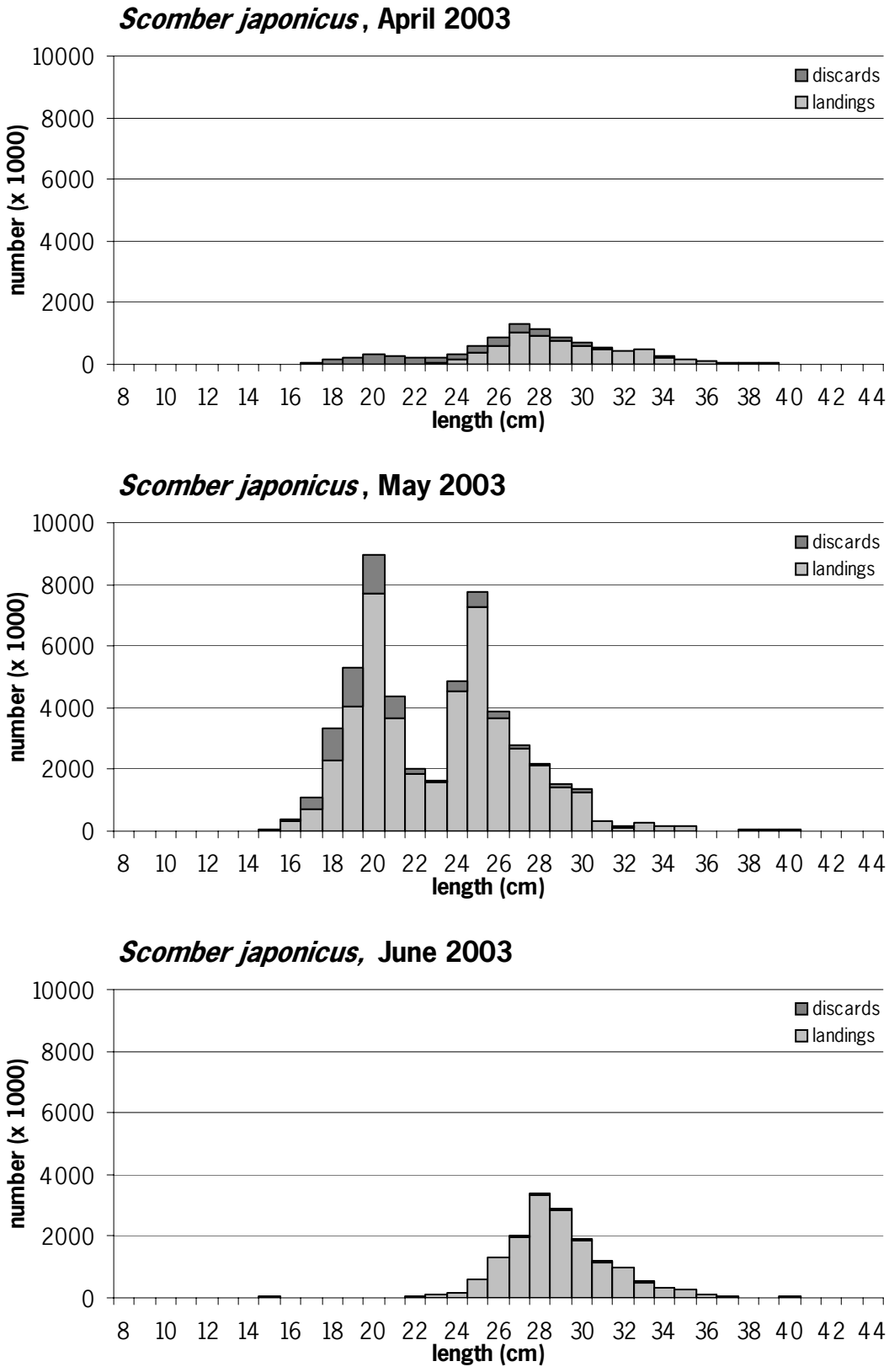


Figure 13c: Monthly length-frequency distributions for the catches of Trachurus trecae for July, August and September 2003.

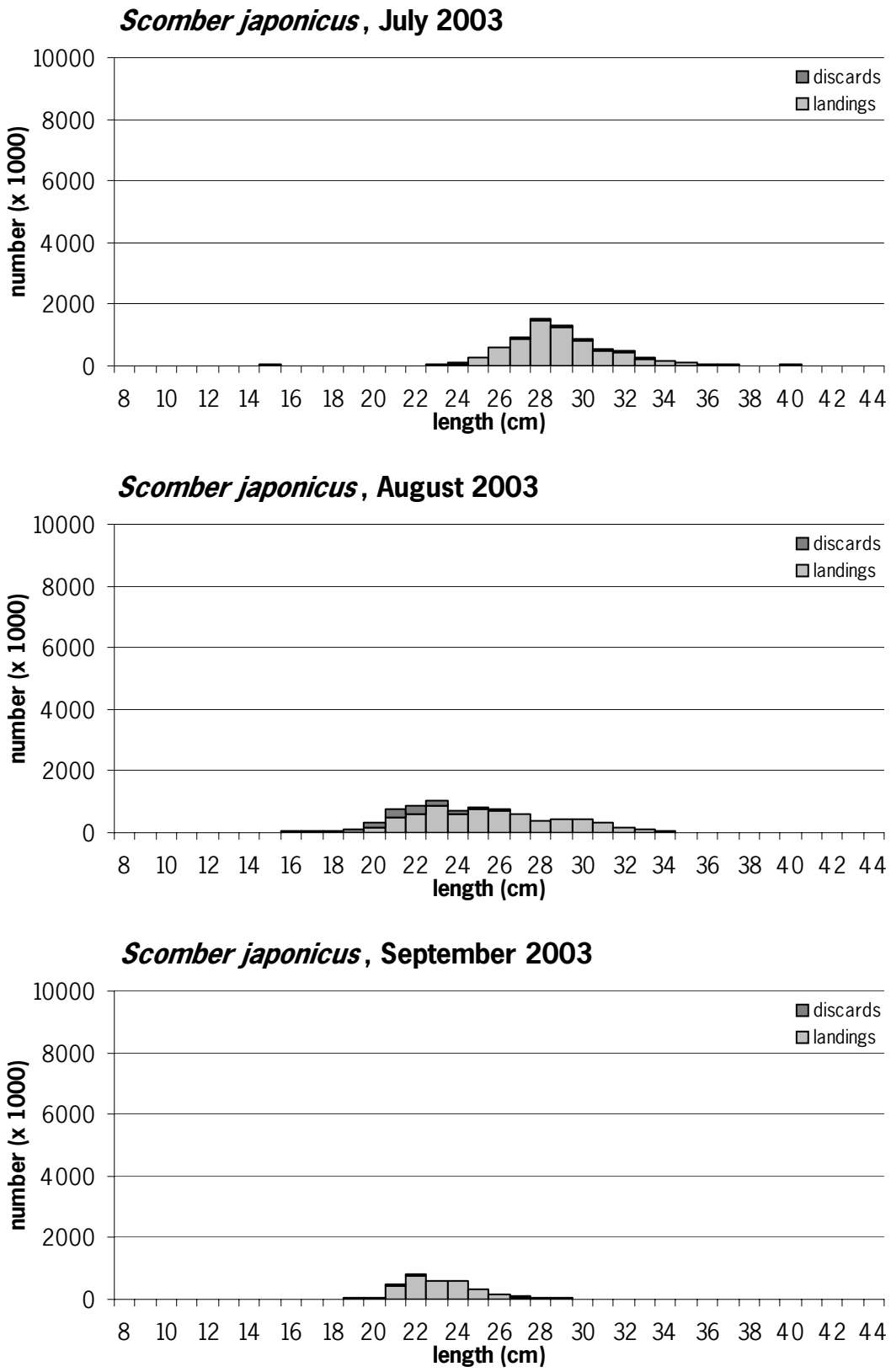


Figure 13d: Monthly length-frequency distributions for the catches of Trachurus trecae for October, November and December 2003.

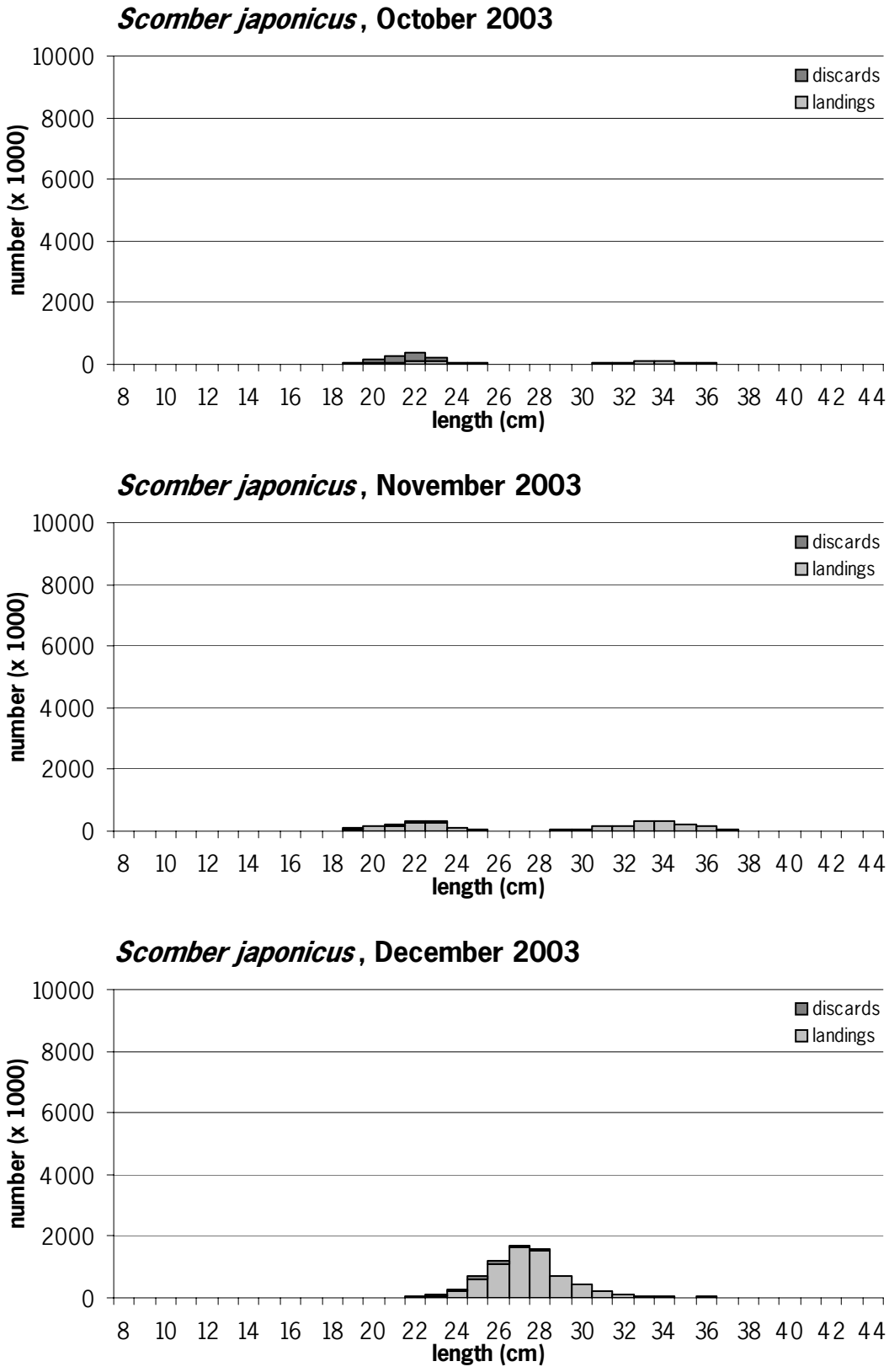


Figure 14a: Monthly length-frequency distributions for the catches of Caranx rhonchus for January, February and March 2003.

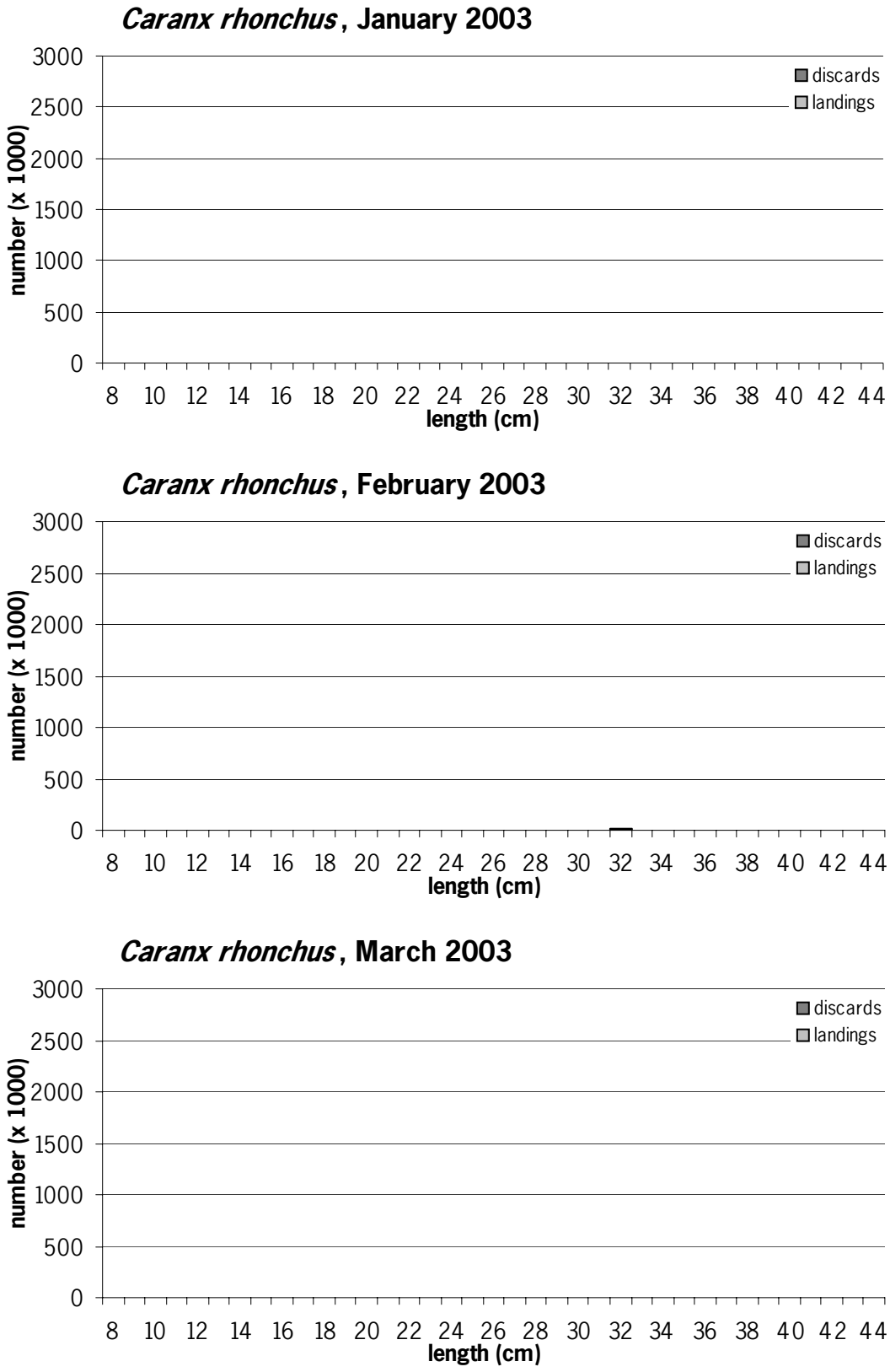


Figure 14b: Monthly length-frequency distributions for the catches of Caranx rhonchus for April, May and June 2003.

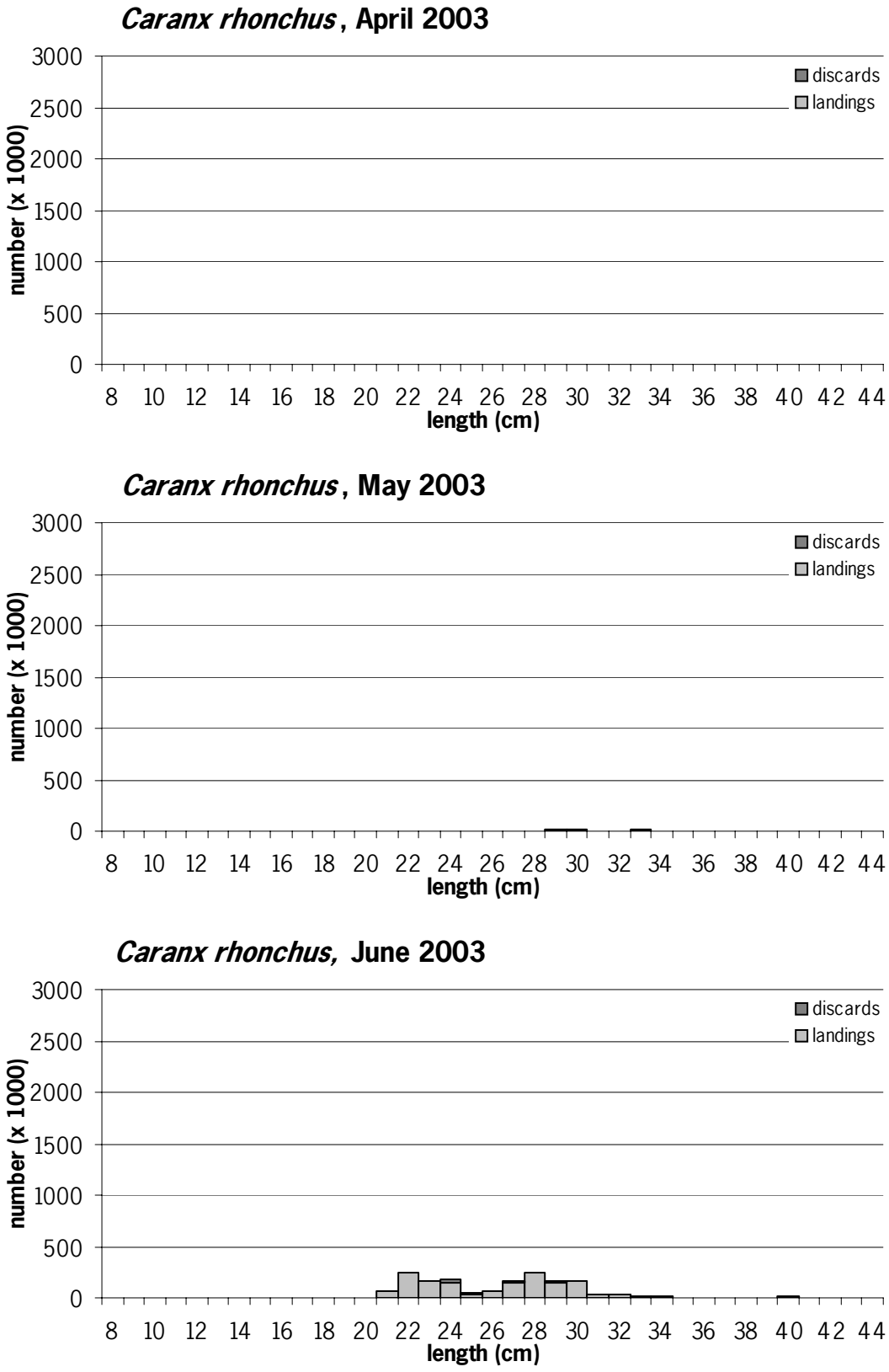


Figure 14c: Monthly length-frequency distributions for the catches of Caranx rhonchus for July August, September 2003.

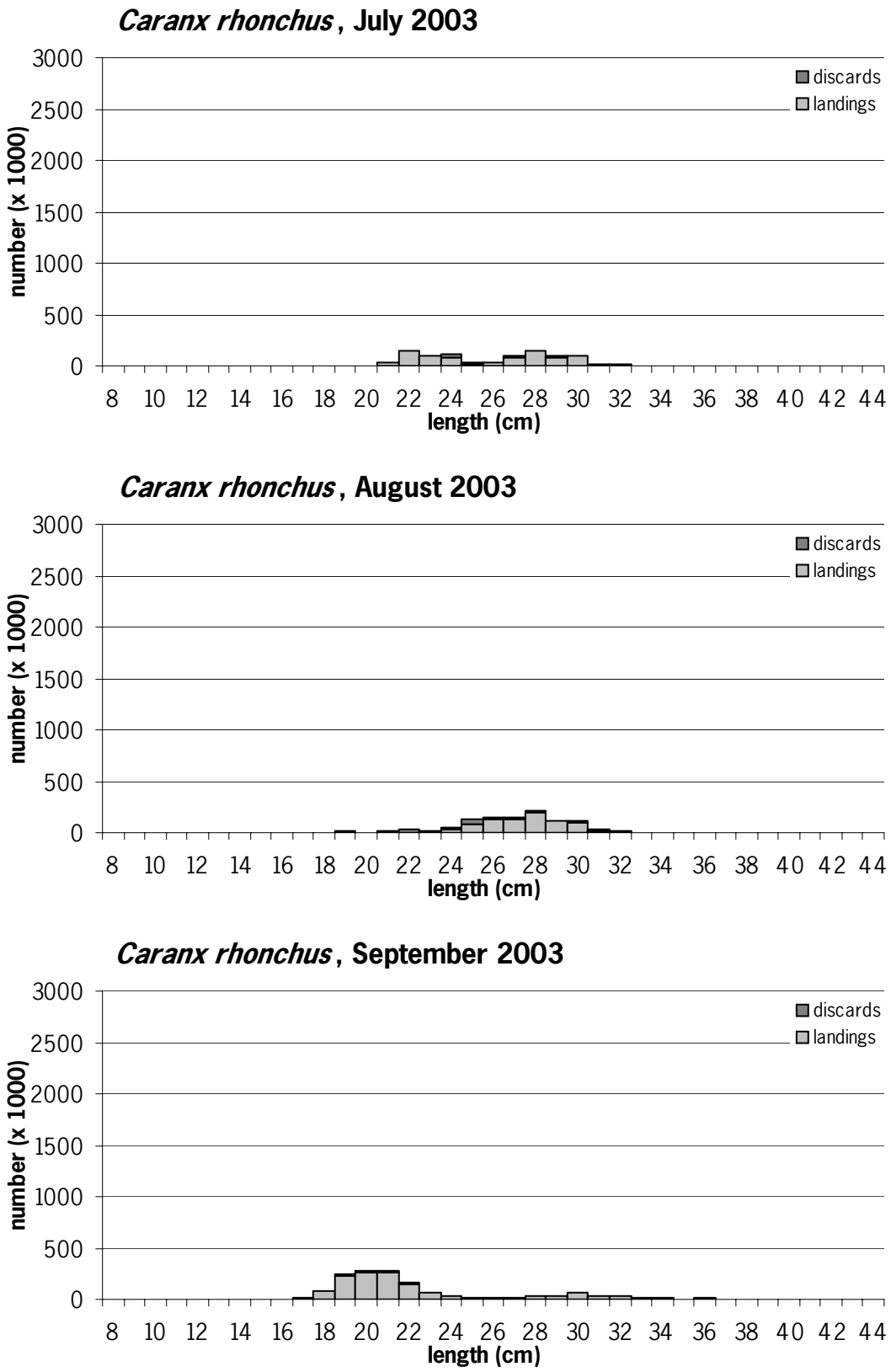


Figure 14d: Monthly length-frequency distributions for the catches of Caranx rhonchus for October, November and December 2003.

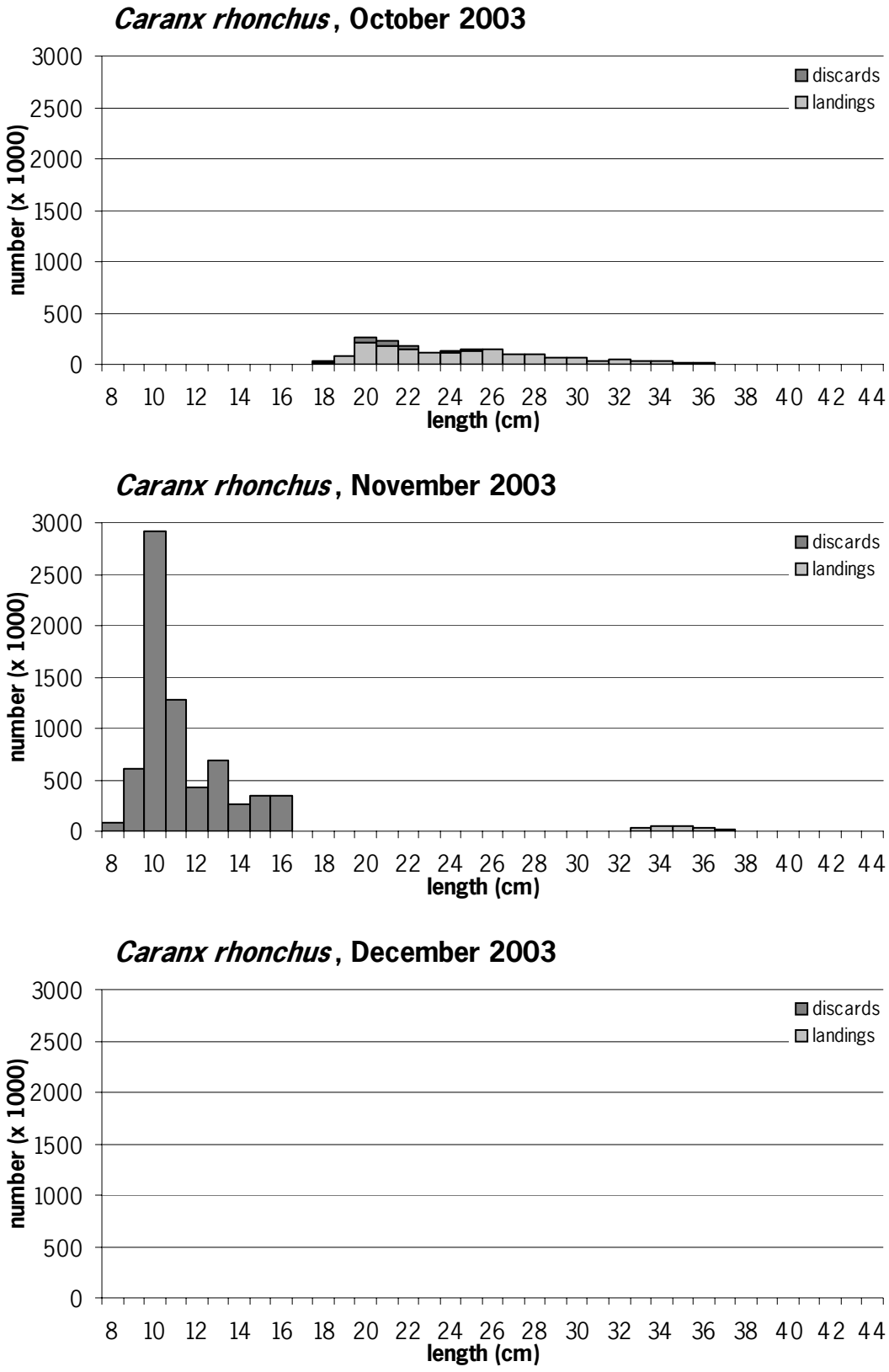


Figure 15a: Monthly length-frequency distributions for the catches of Trachurus trachurus for January, February and March 2003.

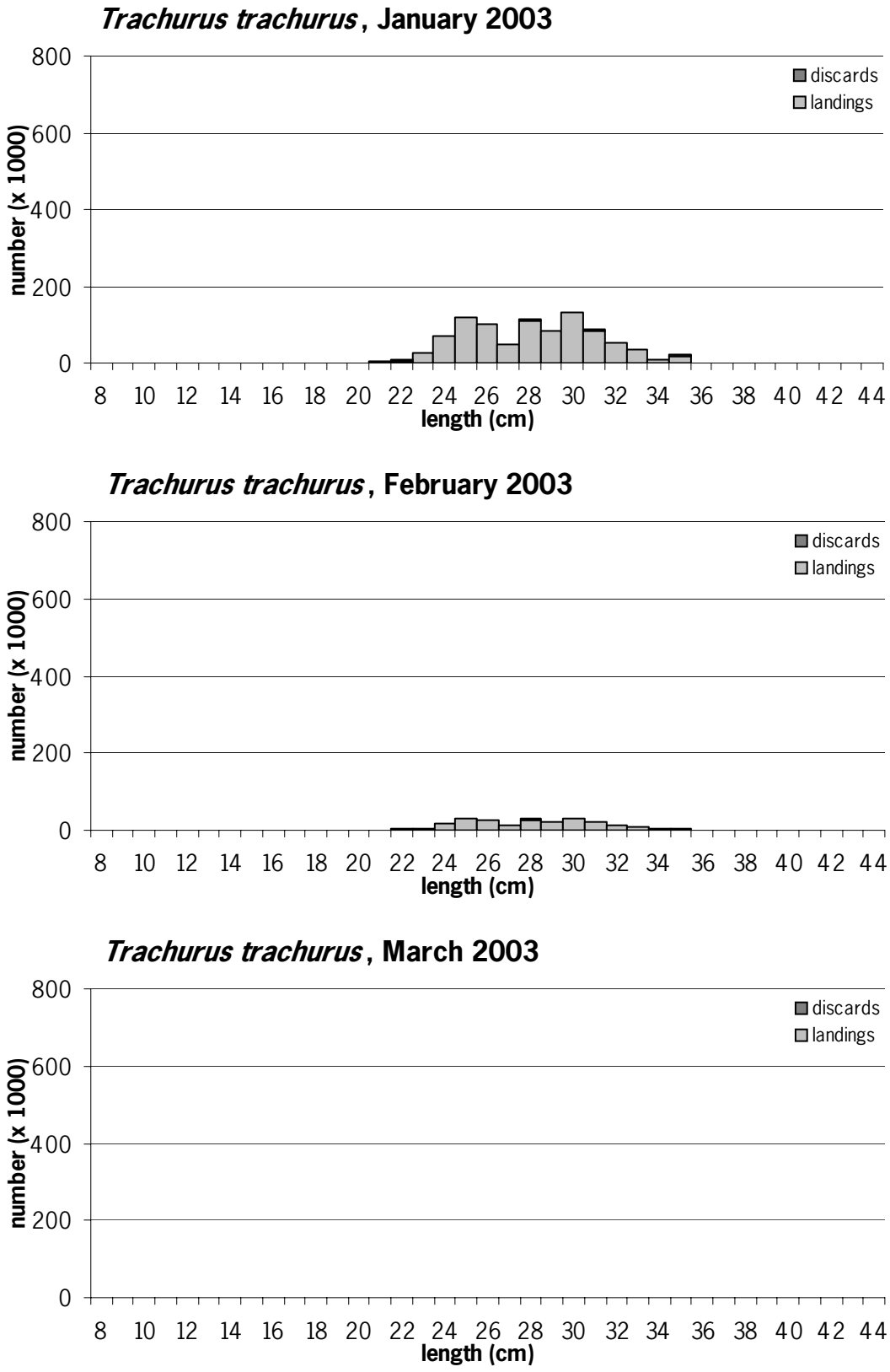


Figure 15b: Monthly length-frequency distributions for the catches of Trachurus trachurus for April, May and June 2003.

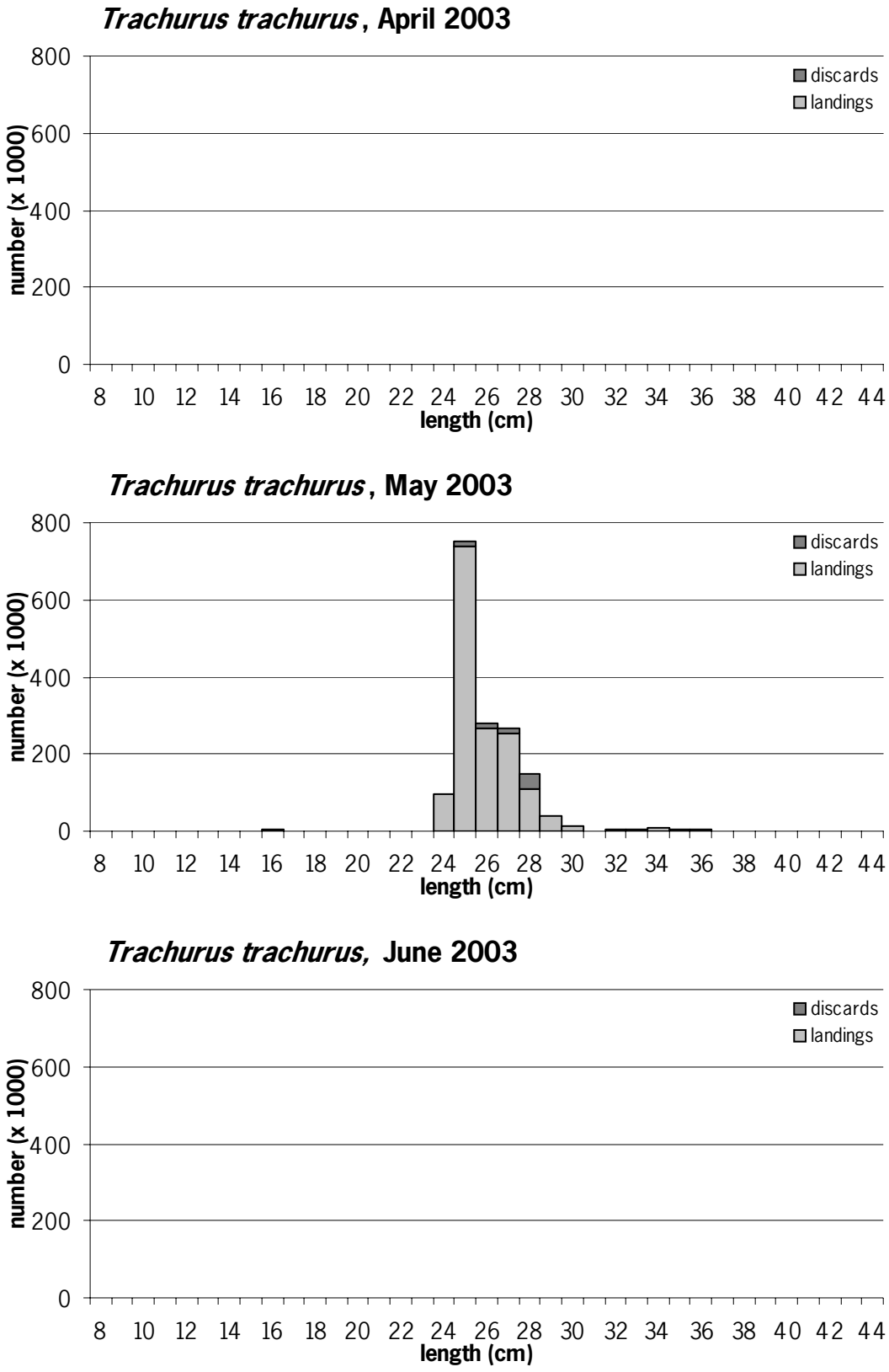


Figure 15c: Monthly length-frequency distributions for the catches of Trachurus trachurus for July, August and September 2003.

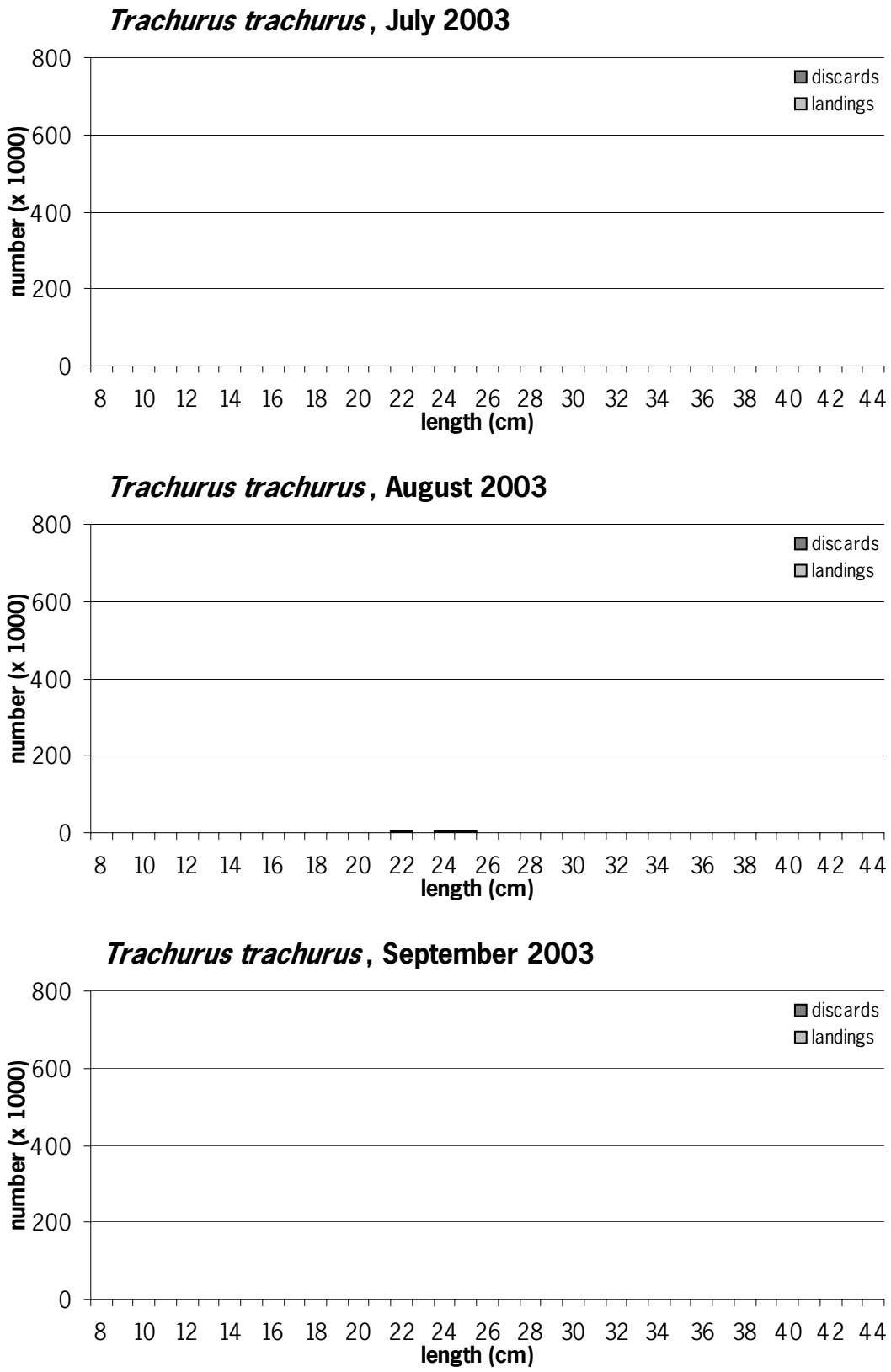


Figure 15d: Monthly length-frequency distributions for the catches of Trachurus trachurus for October, November and December 2003.

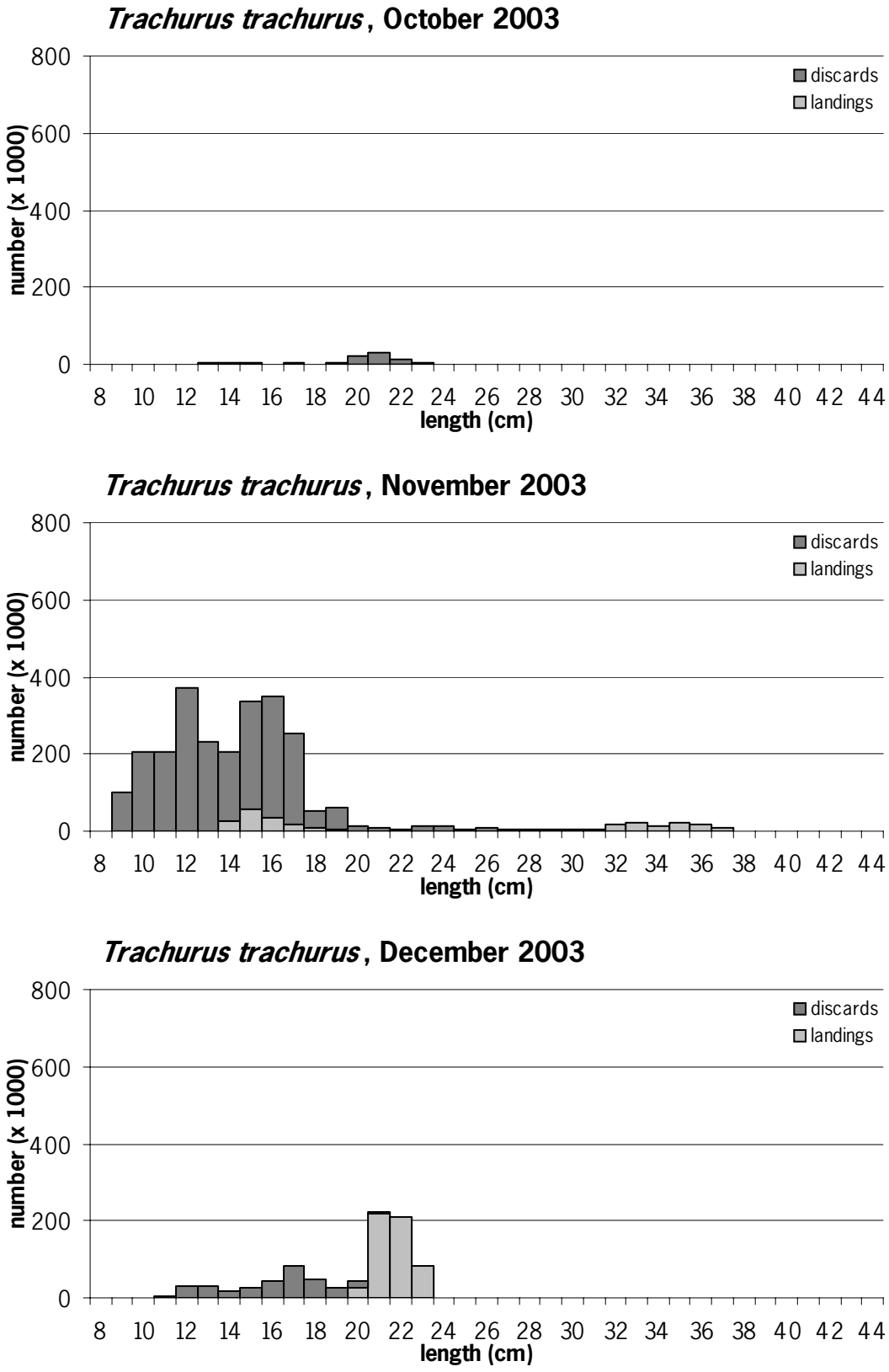


Figure 16a: Monthly length-frequency distributions for the catches of Trachurus trecae for January, February and March 2003.

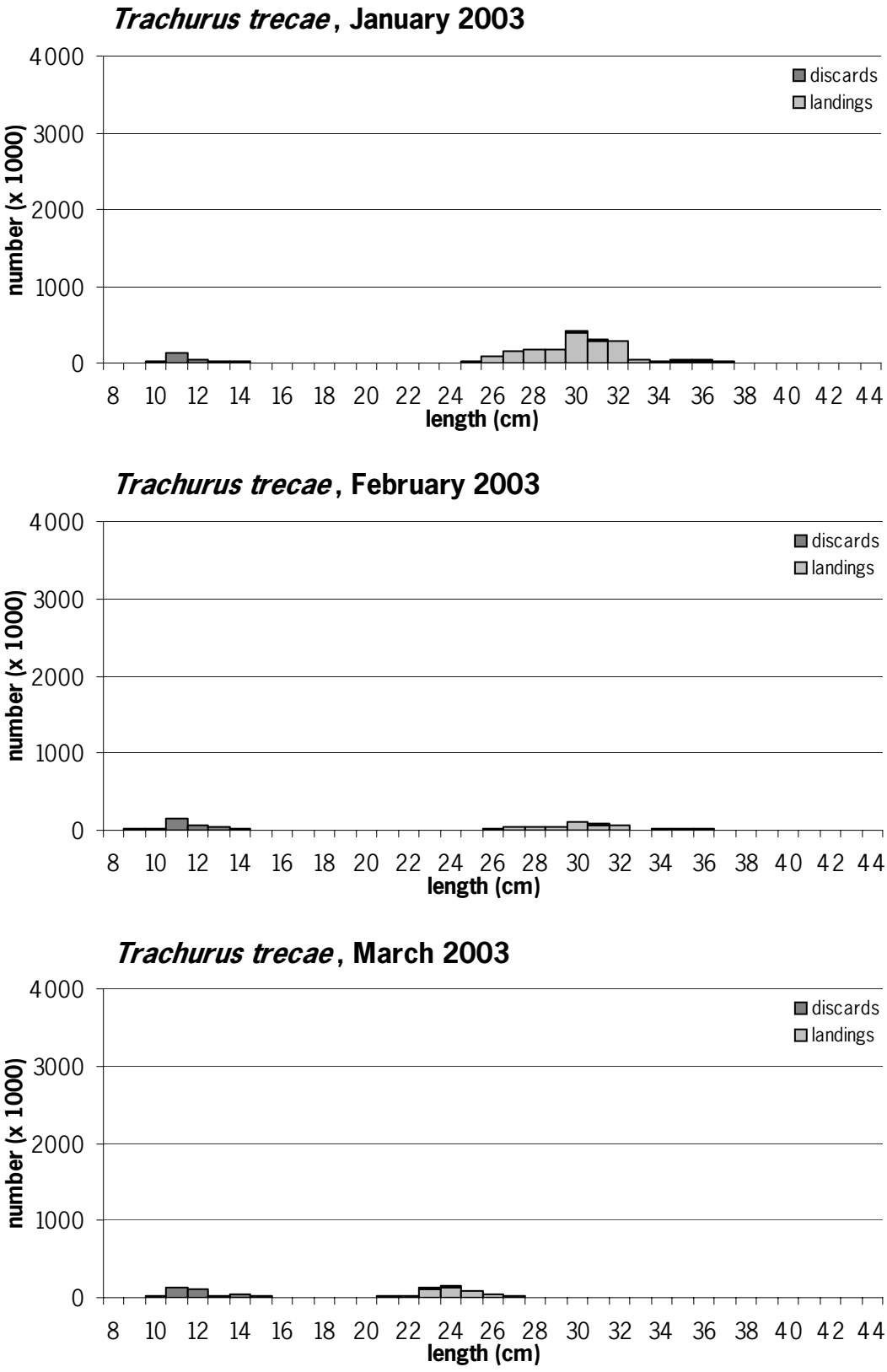


Figure 16b: Monthly length-frequency distributions for the catches of Trachurus trecae for April, May and June 2003.

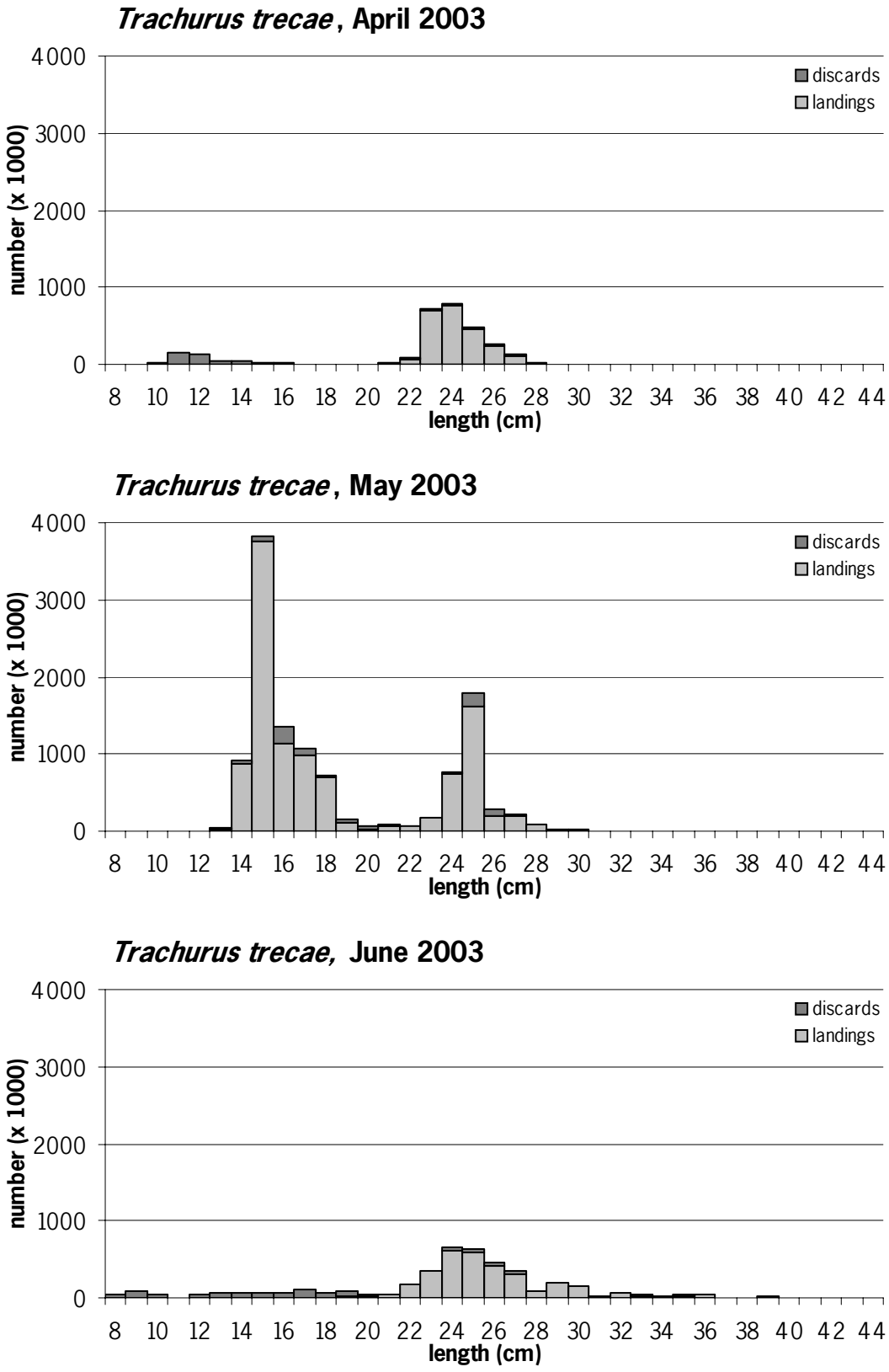


Figure 16c: Monthly length-frequency distributions for the catches of Trachurus trecae for July, August and September 2003.

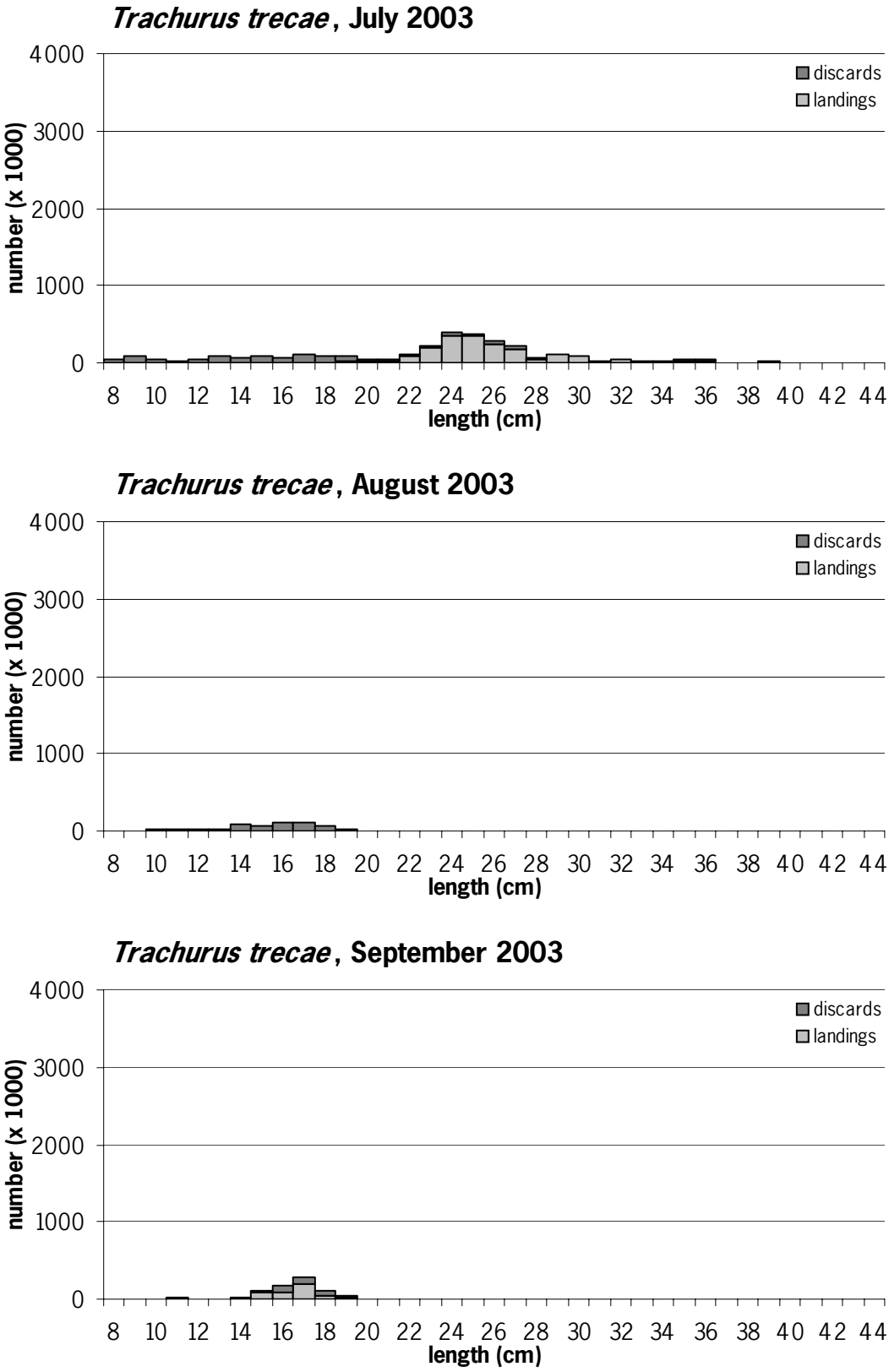


Figure 16d: Monthly length-frequency distributions for the catches of Trachurus trecae for October, November and December 2003.

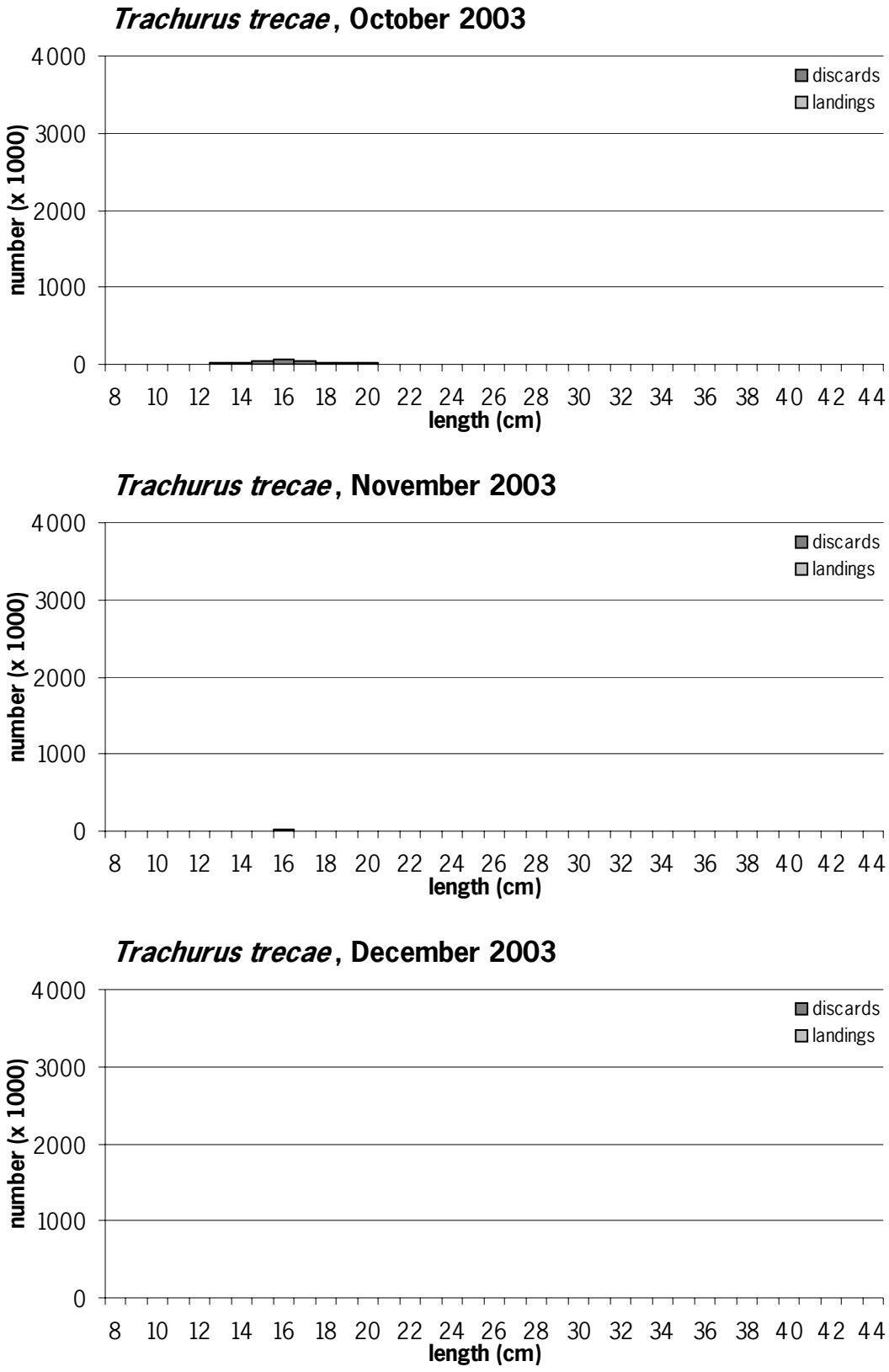


Table 6: Total extrapolated landings in tons per year for the main target species during the period 1999-2003. Percentages are based on the total catch (landings + discards) of all species.

	landings 1999		landings 2000		landings 2001		landings 2002		landings 2003	
Species	**tons**	**%**	**tons**	**%**	**tons**	**%**	**tons**	**%**	**tons**	**%**
Sardinella aurita	135192	80.9	109299	69.8	112224	66.2	87696	48.8	94372	53.1
Sardinella maderensis	9391	5.6	2580	1.6	13396	7.9	10433	5.8	4454	2.5
Sardina pilchardus	4134	2.5	8954	5.7	10981	6.5	27789	15.5	31867	17.9
Scomber japonicus	2553	1.5	11082	7.1	9041	5.3	23753	13.2	23479	13.2
Caranx rhonchus	909	0.5	2567	1.6	1568	0.9	793	0.4	1559	0.9
Trachurus trachurus	188	0.1	170	0.1	373	0.2	1299	0.7	861	0.5
Trachurus trecae	2416	1.4	5202	3.3	7505	4.4	9593	5.3	4021	2.3
Other	2181	1.3	2670	1.7	4095	2.4	7736	2.0	2128	1.2
Total	156965	93.9	142524	91.0	159183	93.9	164899	91.7	162742	91.6

Table 7: Total extrapolated discards in tons per year for the main target species during the period 1999-2003. Percentages are based on the total catch (landings + discards) of all species.

	discards 1999		discards 2000		discards 2001		discards 2002		discards 2003	
Species	**tons**	**%**	**tons**	**%**	**tons**	**%**	**tons**	**%**	**tons**	**%**
Sardinella aurita	4045	2.4	3269	2.1	2524	1.5	2481	1.4	2925	1.6
Sardinella maderensis	452	0.3	274	0.2	404	0.2	471	0.3	261	0.1
Sardina pilchardus	517	0.3	63	0.0	1558	0.9	2320	1.3	2301	1.3
Scomber japonicus	901	0.5	1777	1.1	1291	0.8	3196	1.8	3378	1.9
Caranx rhonchus	287	0.2	377	0.2	185	0.1	84	0.0	336	0.2
Trachurus trachurus	77	0.0	117	0.1	55	0.0	209	0.1	151	0.1
Trachurus trecae	810	0.5	1139	0.7	673	0.4	885	0.5	676	0.4
Other	3289	1.8	7031	2.4	3641	2.1	5267	2.9	4861	2.7
Total	10378	6.1	14047	9.0	10332	6.1	14914	8.3	14890	8.4

Table 8: Total extrapolated catch (landings + discards) in tons per year for the main target species during the period 1999-2003. Percentages are based on the total catch (landings + discards) of all species.

	catch 1999		catch 2000		catch 2001		catch 2002		Catch 2003	
Species	**tons**	**%**	**tons**	**%**	**tons**	**%**	**tons**	**%**	**tons**	**%**
Sardinella aurita	139236	83.3	112567	71.9	114749	67.7	90177	50.2	97297	54.8
Sardinella maderensis	9843	5.9	2854	1.8	13800	8.1	10904	6.1	4715	2.7
Sardina pilchardus	4651	2.8	9017	5.8	12539	7.4	30110	16.7	34169	19.2
Scomber japonicus	3454	2.1	12859	8.2	10332	6.1	26949	15.0	26857	15.1
Caranx rhonchus	1196	0.7	2944	1.9	1753	1.0	877	0.5	1895	1.1
Trachurus trachurus	265	0.2	287	0.2	429	0.3	1508	0.8	1012	0.6
Trachurus trecae	3226	1.9	6342	4.1	8178	4.8	10478	5.8	4698	2.6
Other	5470	3.1	9701	6.2	7736	4.6	8808	4.9	6989	3.9
Total	167343	100	156571	100	169515	100	179812	100	177632	100