Length distribution of bass discards in the UK trawl fishery

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Introduction

Cefas has been using trained scientific observers to sample the catch of UK (England and Wales) fishing vessels, in accordance with EC Data Collection Regulations, since 2000. During the first two years of the programme, sampling was undertaken in the North Sea only, but since 2002 the sampling programme has covered other ICES Divisions in which the UK has an interest (Figure 1). Prior to 2006, the programme collected data on the catches of the >10 m fleet, but sampling was extended to vessels <10 m from July 2006.

This report uses data collected by this catch sampling programme to describe the length distribution of bass caught using a variety of mesh sizes in trawls, and to indicate the effect of an increase in minimum landing size (MLS) on the proportion of bass retained or discarded. Additional information on commercial landings is also presented.

Cefas data

Data collection

Catch sampling levels are determined quarterly for each ICES Division, based on the available sampling effort (days at sea) and the fishing effort of vessels using each gear in the same quarter of the previous year, using data from the FAD system. Vessels to be sampled are drawn at random from a list of fishing vessels that fit the sampling criteria. During a trip, at least 60% of all hauls are sampled and the species composition and length distributions of the retained and discarded components of the catch are recorded. There has been no targeted sampling of vessels fishing specifically for bass.

Data analysis and results

Information on the number of bass, by length class, and whether they were retained or discarded, was extracted from the Cefas discard database for all trawl hauls in which bass were caught, along with trawl position, date, gear type and mesh size. These data were used to provide information on the length distribution of retained and discarded bass by mesh size and bass stock area, namely Divisions IVb+c (North Sea); Division VIId (Eastern English Channel); Divisions VIIe+h (Western English Channel) and Divisions VIIa+f+g (Irish and Celtic Seas).

There was insufficient information for most bass stock area/mesh size combinations by sampling year to investigate the influence of recruitment variability on discarding patterns. For the same reason, only 8 bass stock area/mesh size combinations had sufficient data to obtain meaningful results. These were: 80 mm mesh in all four stock areas, 90 mm mesh in Divisions VIIe+h and Divisions VIIa+f+g, and 100 mm mesh in Divisions IVb+c and Division VIId. The length distributions of retained and discarded bass caught using 80 mm, 90 mm and 100 mm mesh are given in Figures 2, 3 and 4, respectively.

The data show that the size composition of catches is markedly different around the UK coast, even when using the same mesh size in trawls. For example, vessels in

Divs IVb+c catch a wide range of sizes (21 - 66 cm) when using an 80 mm mesh net, whereas vessels operating in Div. VIId or VIIe+h with the same mesh size catch a much narrower size range of fish, with modal lengths of 32 and 38 cm, respectively. A wide range of sizes were caught by vessels using 90 mm mesh in Divs VIIe+h, all above the current minimum landing size (36 cm), whereas in Divs VIIa+f+g the length range of fish caught was much narrower, with a peak at 37 cm. At 100 mm mesh, a wide range of sizes was again observed in the North Sea (Divs IVb+c), whilst the length distribution of fish caught in the eastern English Channel (Div. VIId) was much narrower, with all fish recorded being above 36 cm.

The strongest evidence for a relationship between mesh size and the size of bass caught in trawls is in Div. VIId, where the size range of fish and mean size caught using the larger (100 mm mesh) were notably larger than with the 80 mm mesh. Elsewhere, it seems that mesh selection is less influential than the location of the fishing area.

Figures 5, 6 and 7 allow us to visualise what proportion of these bass catches are discarded in relation to fish size, for 80 mm, 90 mm and 100 mm mesh sizes respectively. Div. VIId shows a high proportion of undersized fish in the catches made using 80 mm mesh nets, with 64 % being below 36 cm. In all other areas and mesh sizes, discards below 36 cm were negligible.

The effect of the proposed increase in MLS to 40 cm is illustrated in Figures 8, 9 and 10, for 80 mm, 90 mm and 100 mm mesh sizes, respectively, using pairs of length distributions for each stock area/mesh size combination. The first graph shows the current retained/discarding patterns for each bass stock area/mesh size combination. The second graph shows how the new minimum landing size is expected to affect discards, assuming that the mesh size does not change and the fishery continues to operate as before.

These results are summarised in Table 1, which shows the percentage, by number and weight, of the total catch that is currently discarded and the percentage of the catch that would have to be discarded with a 40 cm MLS. Whilst the highest level of discarding might be expected in Div. VIId, it would appear that the most significant increase in the proportion of fish discarded will be in Divs VIIe+h when using a 80 mm mesh and in VIIa,f,g using a 90 mm mesh. Even the relatively low levels of discarding observed there at present will increase to over 80 % of the total catch numbers and over 70 % of the catch weight.

Fish merchant/FPO data

Data collection
Data on bass landings were available from three sources: into Plymouth between 2003 and 2005; from a Bideford twin-rig demersal trawler between August and December 2006; and by pair-trawlers into Scarborough in 2006.

Plymouth
The Plymouth data were supplied as landings by two categories of vessels (up to 7 pair trawl team, and up to 150 other vessels), broken down by bass size grade, which is dependant on the weight rather than length of the fish (Table 2). Information on the average price for each size grade of bass and the total value of the landings was also supplied, along with information on the number of vessels that the data represented. Length ranges were assigned to each of the size categories, using the same length-

weight regression as in the analysis of Cefas data and, for each year, the landings made by pair trawlers and other vessels were plotted by length range to show the size structure of bass landings into this port (Figure 11).

For pair trawlers, the highest proportion (44 - 51 %) of landings was in the 46-55 cm length range, with proportionately fewer at 36-45 cm. For other vessels, the 36-45 cm size class was the most important (42 - 52 %) of landings, though fish below 36 cm were negligible.

Bideford
The weight of bass in 9 landings made by a single Bideford twin-rig demersal trawler operating in the Bristol Channel between August and October 2006 was supplied, by size category. These size grades were assigned corresponding length ranges (Table 3) that were different to those used for the Plymouth data.

Figure 12 shows the bass landings by length range (top panel) and contribution of each length class to each landing (bottom panel). There is no obvious pattern in either the landings or the size composition of landings during this period, though fish of 36-41 cm made up a substantial proportion of some landings.

Scarborough
The Scarborough data were composed of the weight of bass and of all species in each landing by two pair teams between January and April 2006. The data were not separated into size categories, and no length data were provided. The contribution of bass to landings of both pair teams in January-April 2006 was highly variable, ranging from negligible to 35% of the total landing. Table 4 shows the weight of bass, the weight of the landing and the percentage of bass in the aggregated landings of the four vessels individually, of the two pair teams, and of all four vessels together. The data supplier estimated that 90% of the catch was < 40 cm TL, thus only 0.4 t of the 4.0 t caught could be legally landed in the future.

Discussion

Trawling is a relatively unselective method of fishing (compared to gill netting, for example), and this can result in considerable discarding of undersized target species, non-target fish and other benthos. The results of this study suggest that all trawl fisheries around the English coast catch undersized bass, and that mesh size and, perhaps more importantly, fishing area have an influence on the size composition of the catch and therefore on the levels of undersized bass subsequently discarded. Trawlers in the eastern English Channel in particular catch an extremely narrow size range and, as a result, catch a high proportion of bass <36 cm and a very high proportion of bass < 40 cm. North Sea trawlers, in contrast, catch a wide range of size classes.

Based on the data available, it is clear that discarding in trawls will have to increase (to keep within the law) if a 40 MLS is introduced, to an extent that will depend chiefly on the location of the fishery in question. The most notable impacts will be on trawlers using 80 mm mesh nets in Div. VIId and vessels using 90 mm mesh in Divs VIIa+f+g. However, the absolute increase in discarding will obviously depend on the number vessels that use these meshes, and whether they are able to increase mesh size sufficiently to avoid discarding and still make a living.

It is not obvious from the available data what mesh size would be most appropriate to use in order to avoid catching undersized bass. Even in the North Sea, where the greatest size range of bass was recorded in trawl catches, 20% of the catches of vessels using 100 mm mesh may be under 40 cm. In all other areas, trawlers using nets of 90 mm and 100 mm are likely to have to discard half or more of their bass catch by numbers. It is obvious that more data are required to better understand trawl net selectivity for bass. Discarding impacts are also affected by whether bass are returned to the sea alive and their subsequent survival. Unfortunately, there are no data available on the survival of bass as a result of commercial trawling (though Cefas has tagged trawl-caught bass that showed relatively low survival).

It might be possible to reduce or minimise discarding by increasing mesh size, or by using modified gears such as square mesh panels, but these may not be viable for fisheries in which bass is a bycatch species and where mesh sizes for trawls are determined by European regulations (including mixed species and days-at-sea issues). Another solution is to avoid fishing with trawls in areas where bass are predominantly under the MLS. This was the intention behind the bass nursery area legislation, which proved successful with an MLS of 36 cm, but the distribution of bass of 36 – 40 cm is much more extensive. A review of the bass nursery area legislation is being carried out, with a view to see if it is still relevant (in terms of bass conservation) and/or could be extended to protect bass < 40 cm from trawling and netting where mesh size selection is likely to be a problem.

Literature cited

Pawson, M. G. and Pickett, G. D., 1996. "The annual pattern of condition and maturity in bass (*Dicentrarchus labrax* L) in waters around the UK." J. Mar. Biol. Assoc. UK, **76:** 107-126.

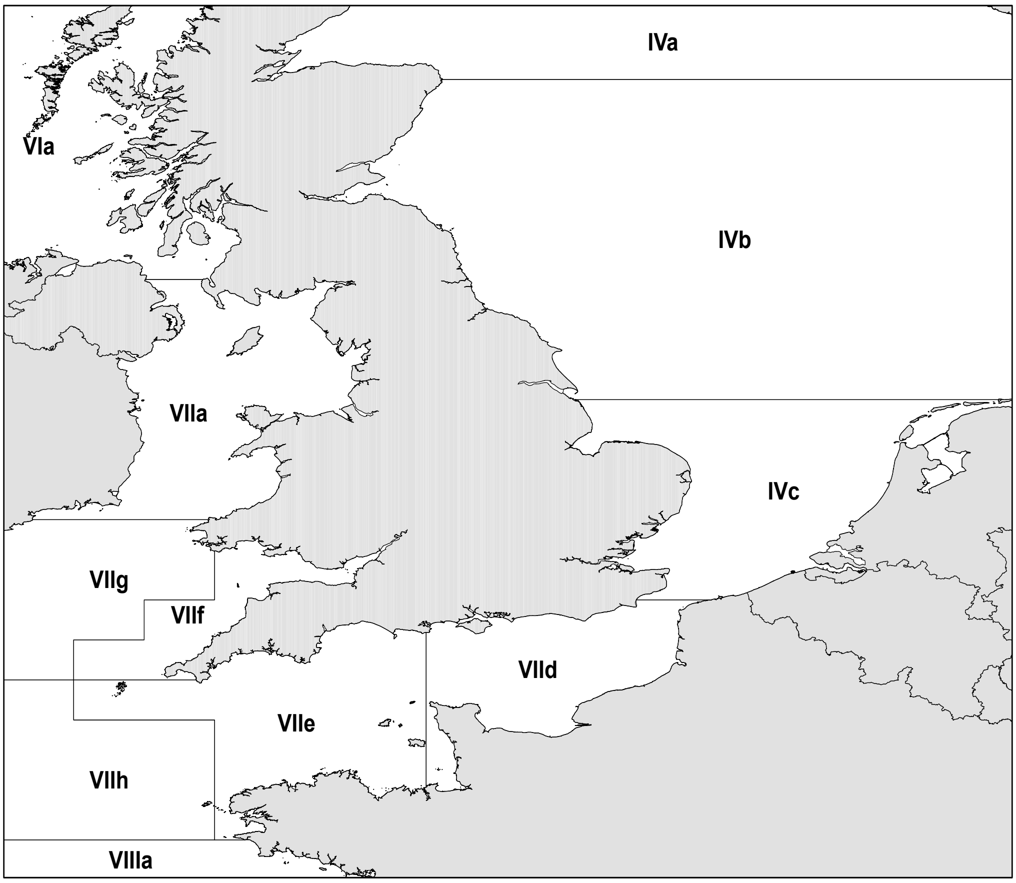


Figure 1: Map of the UK showing the ICES Divisions mentioned in the text.

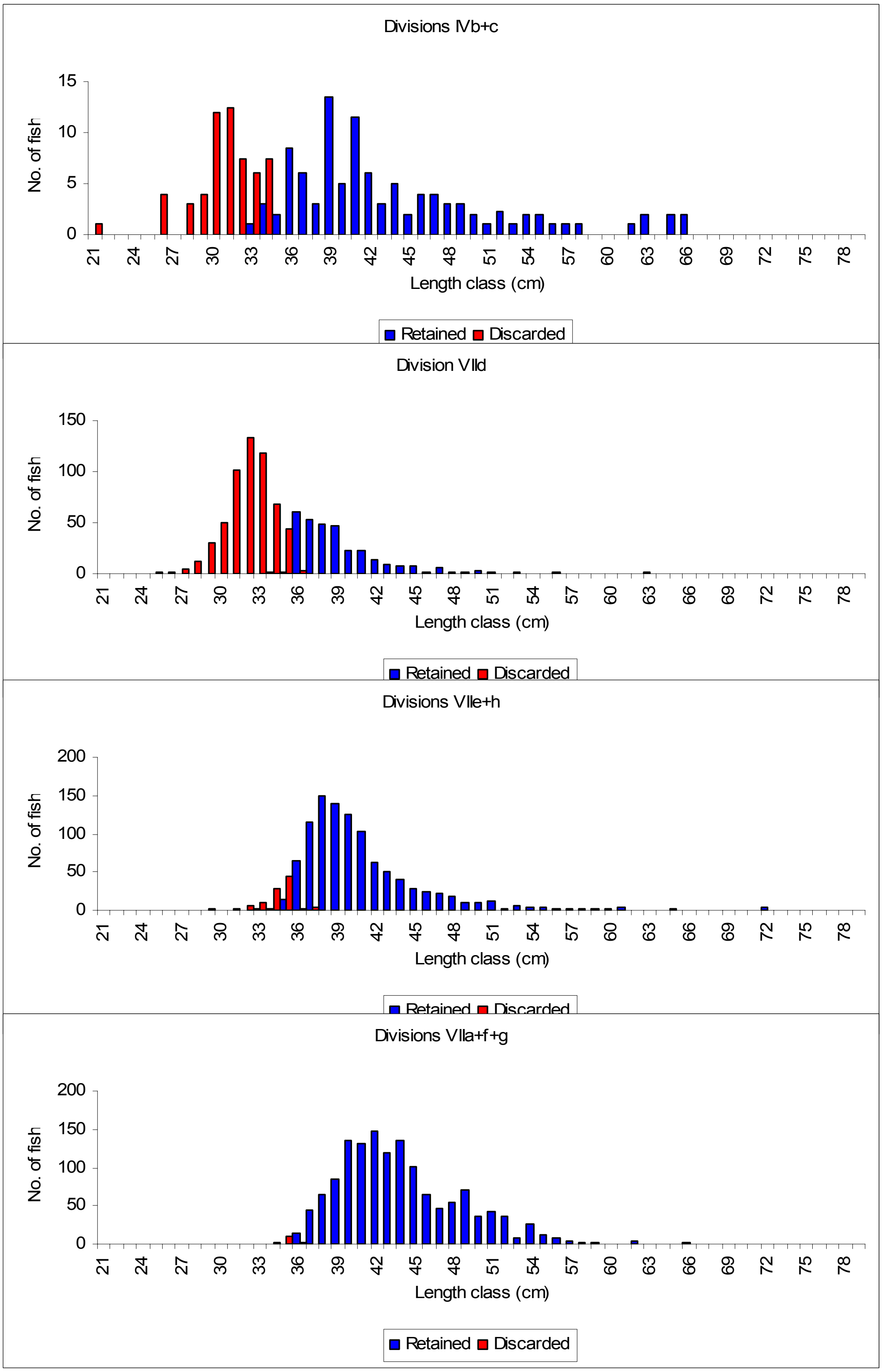


Figure 2. Length distribution of retained and discarded bass caught by trawlers using 80 mm mesh, by bass stock area.

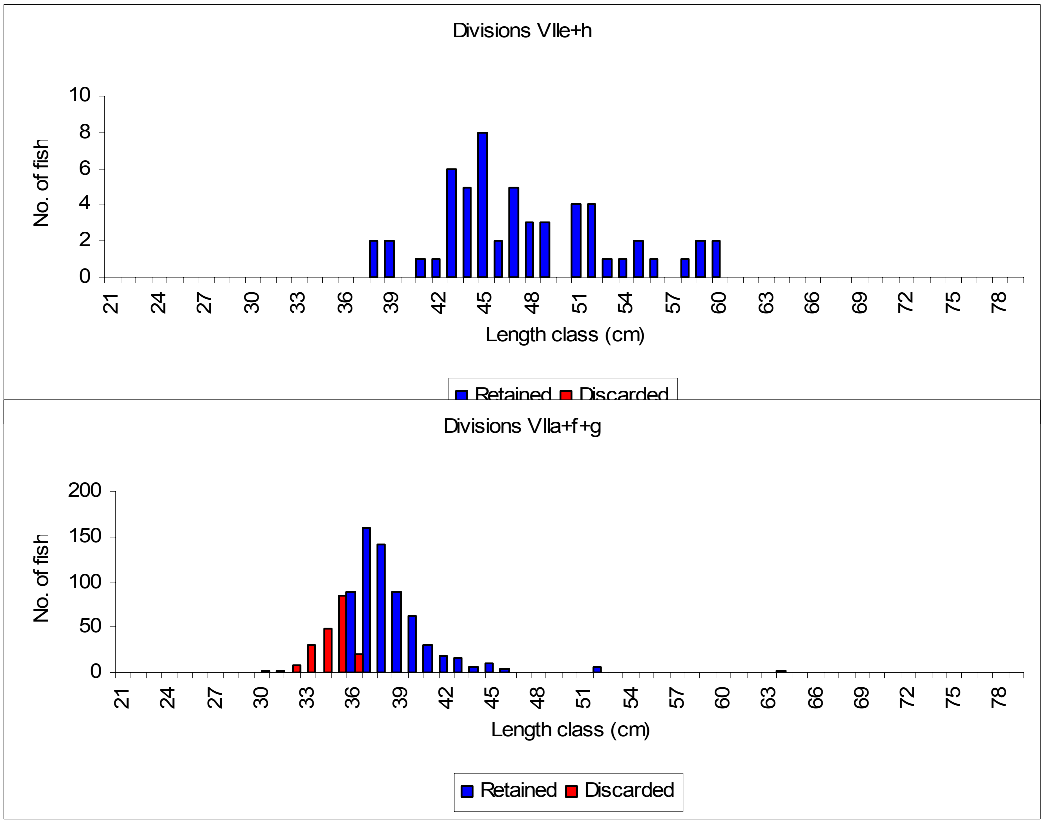


Figure 3. Length distribution of retained and discarded bass caught by trawlers using 90 mm mesh, by bass stock area.

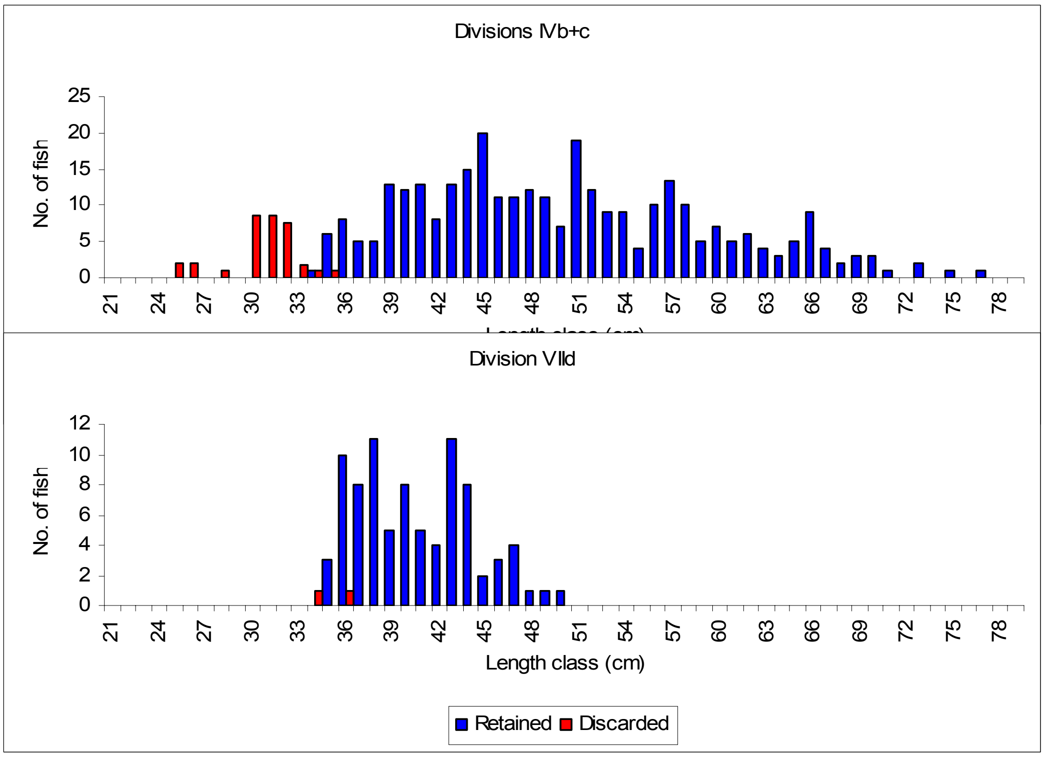


Figure 4. Length distribution of retained and discarded bass caught by trawlers using 100 mm mesh, by bass stock area.

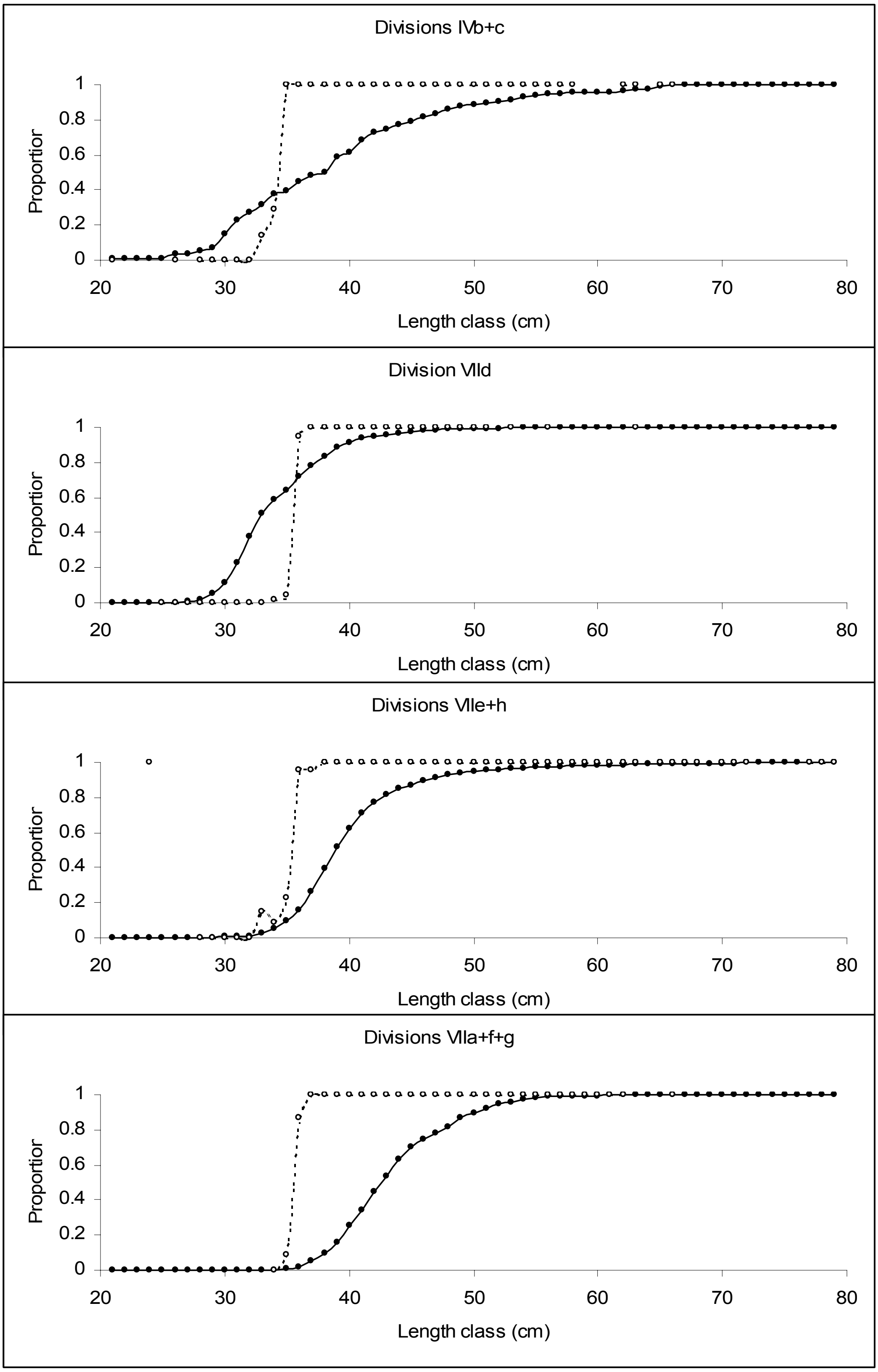


Figure 5. The cumulative proportion of bass to the total catch (solid line, closed circle) and the proportion of bass retained at each length class (dotted line, open circle) by trawlers using 80 mm mesh nets.

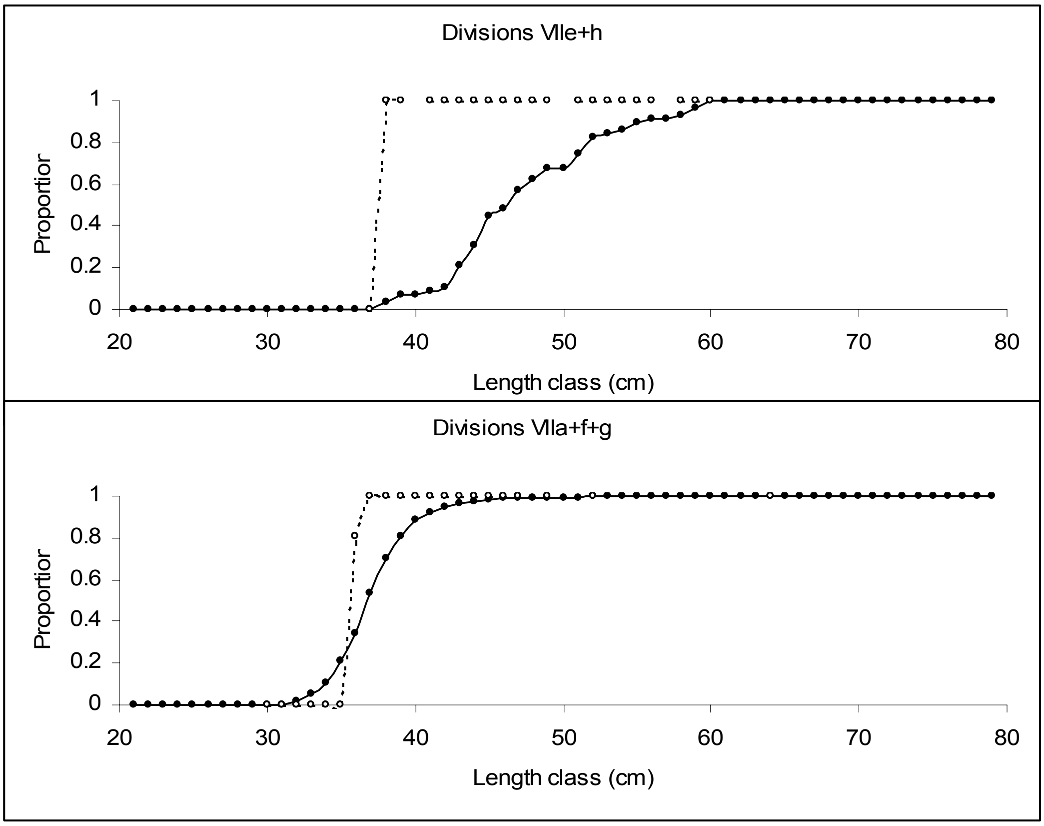


Figure 6. The cumulative proportion of bass at each length class in the total catch (solid line) and the proportion retained (dotted line, open circle) by trawlers using 90 mm mesh nets.

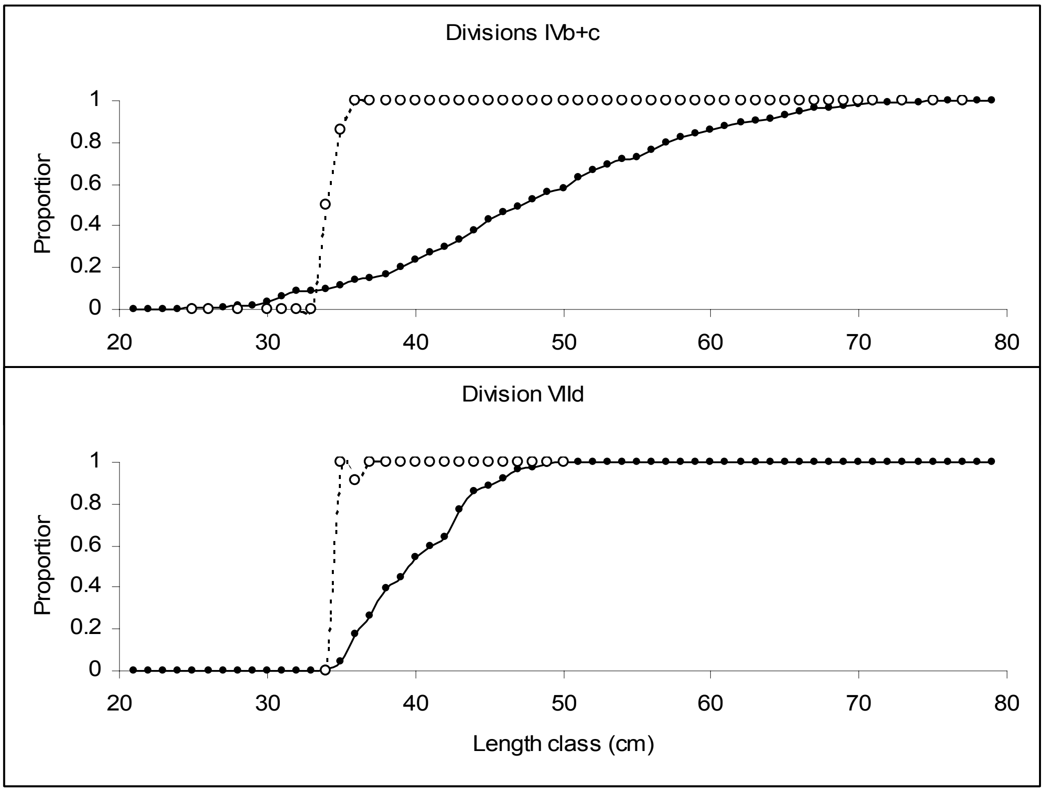


Figure 7. The cumulative proportion of bass at each length class in the total catch (soli 0

mm

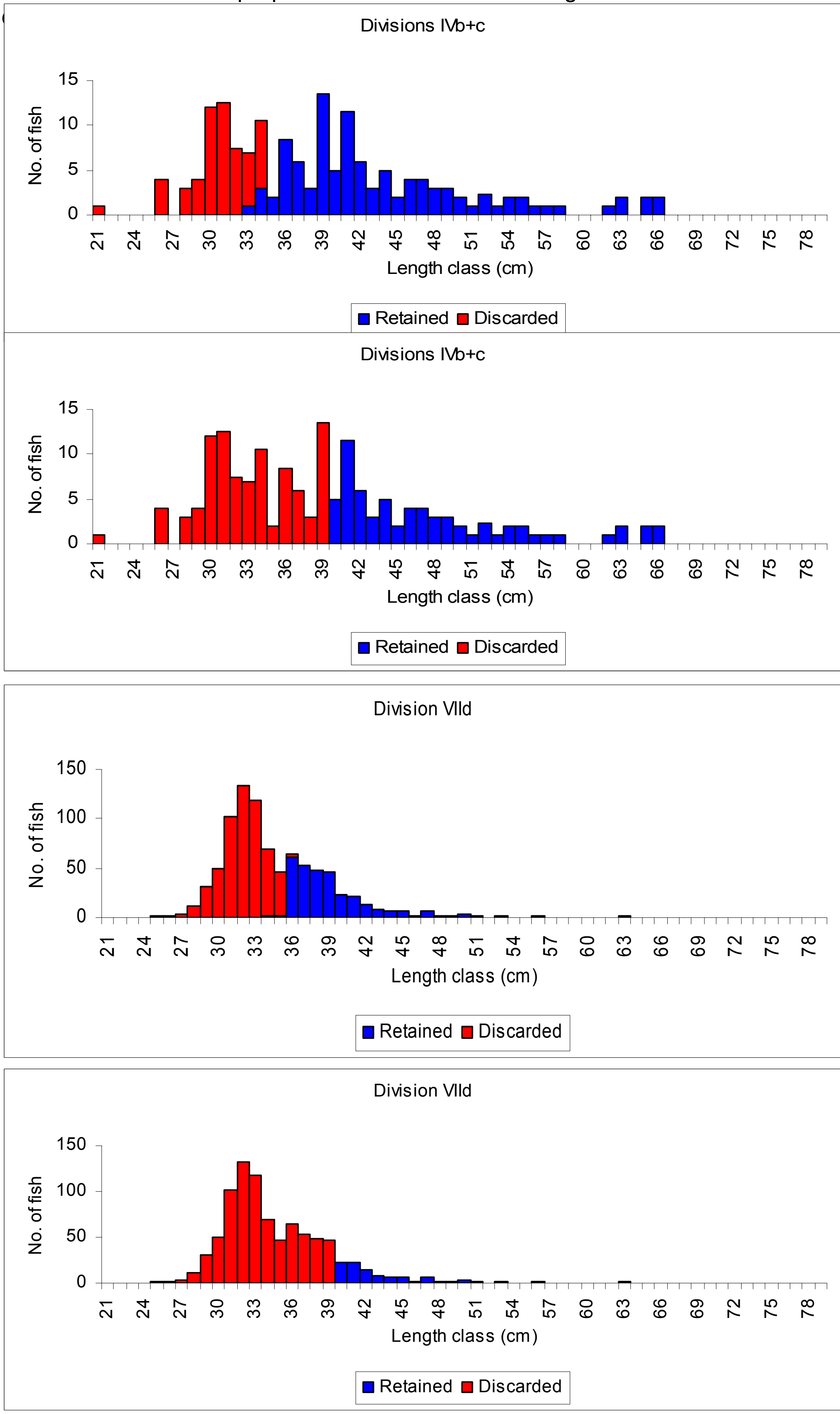


Figure 8. Pairs of length distributions showing the current patterns of retention/discarding and the effect that a 40 cm MLS may have on catches, for bass caught in 80 mm mesh trawls.

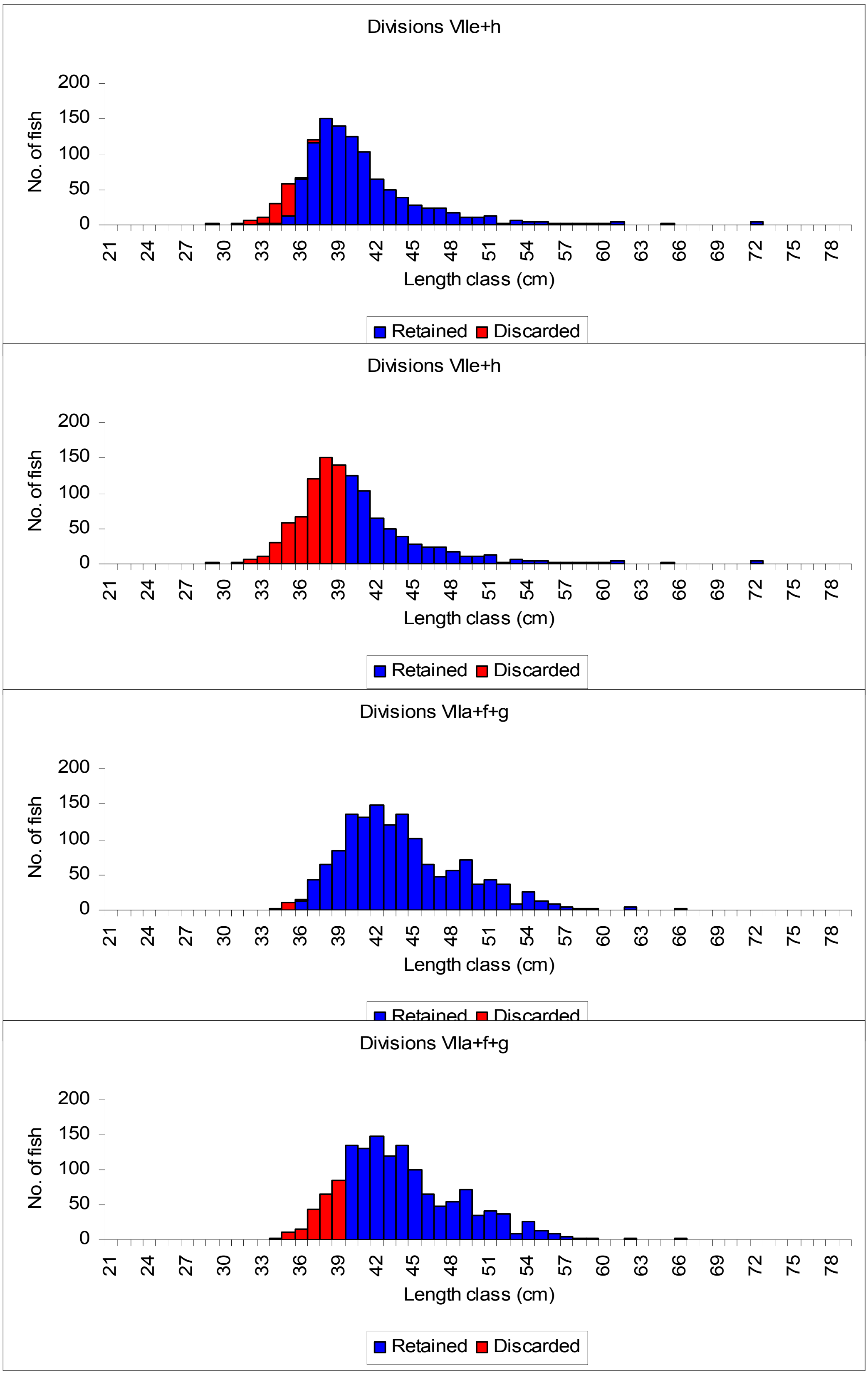


Figure 8 (Continued). Pairs of length distributions showing the current patterns of retention/discarding and the effect that a 40 cm MLS may have on catches, for bass caught in 80 mm mesh trawls.

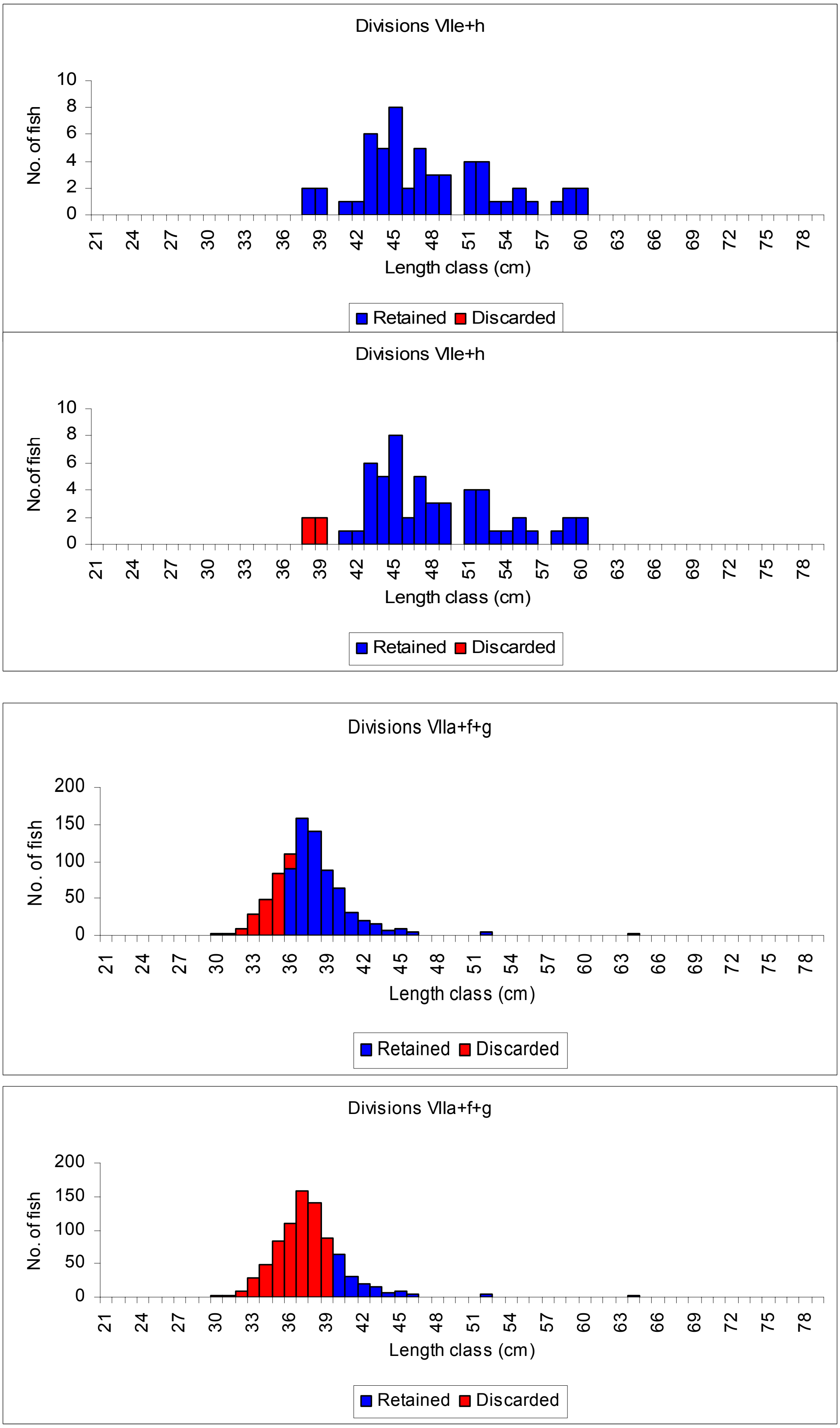


Figure 9. Pairs of length distributions showing the current patterns of retention/discarding and the effect that a 40 cm MLS may have on catches, for bass caught in 90 mm mesh trawls.

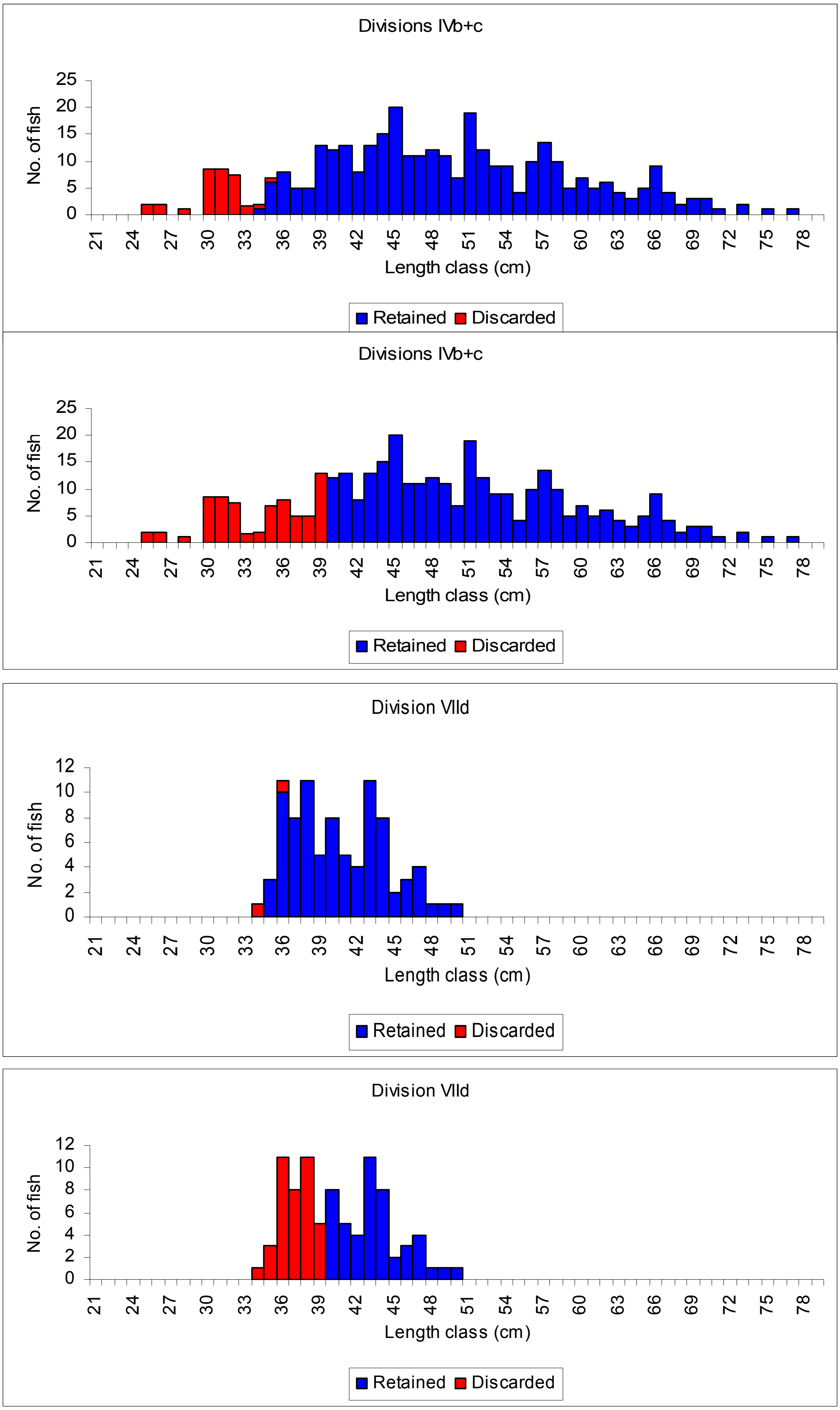


Figure 10. Pairs of length distributions showing the current patterns of retention/discarding and the effect that a 40 cm MLS may have on catches, for bass caught in 100 mm mesh trawls.

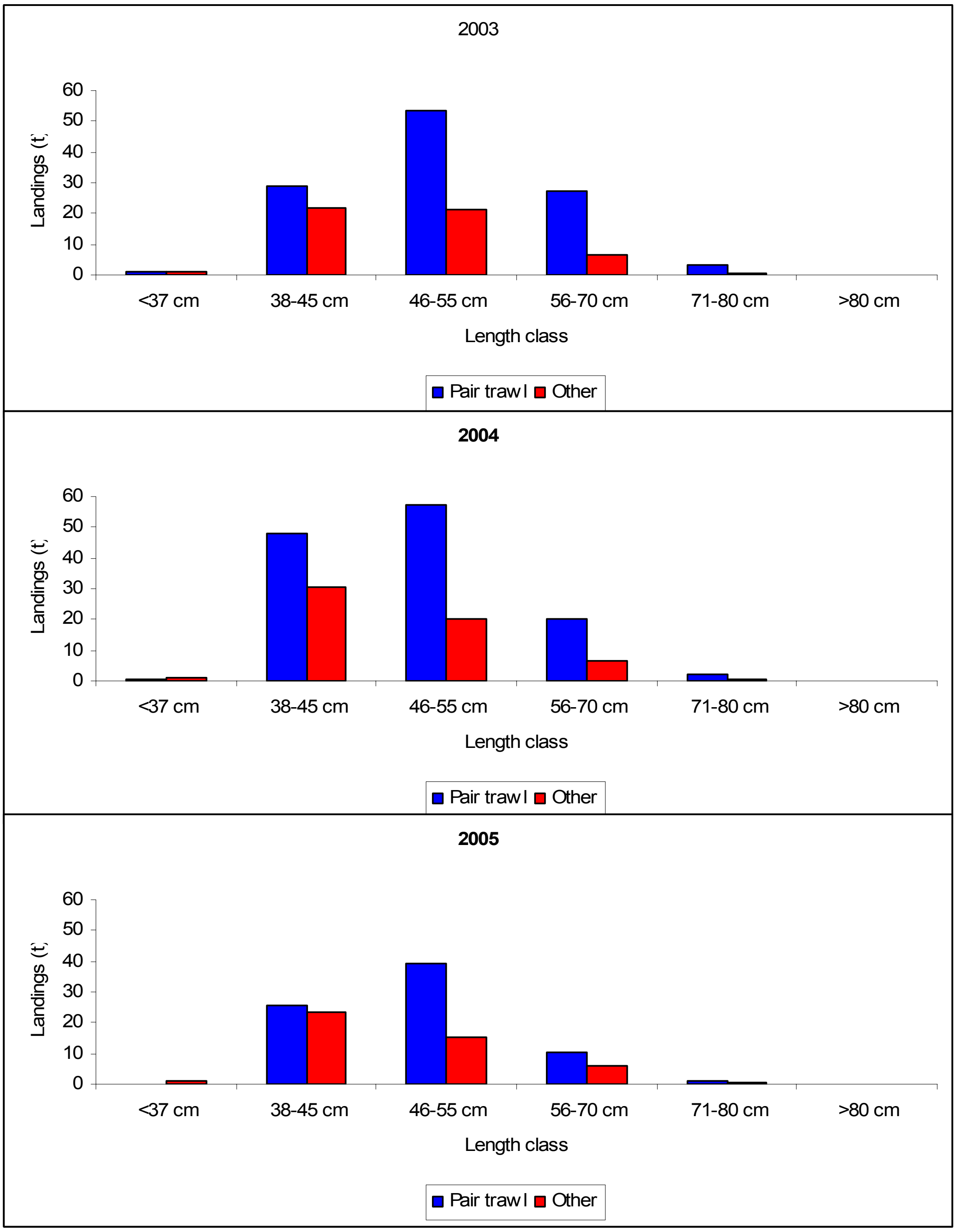
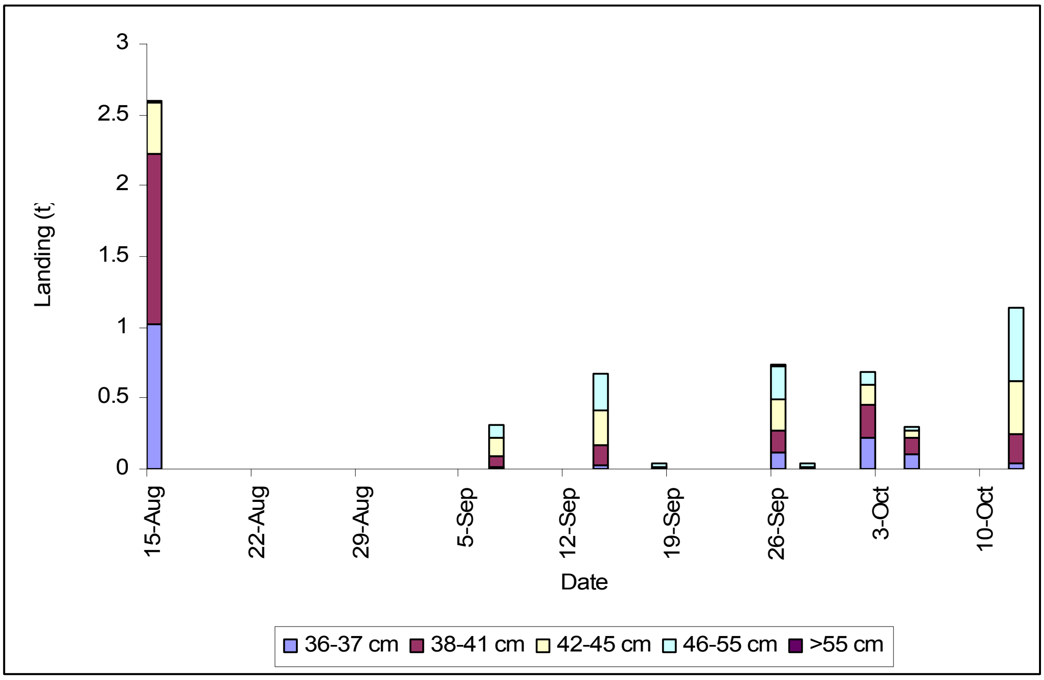


Figure 11. Landings of bass made by pair trawlers and other vessels into Plymouth in 2003, 2004 and 2005, by size range.

a)



b)

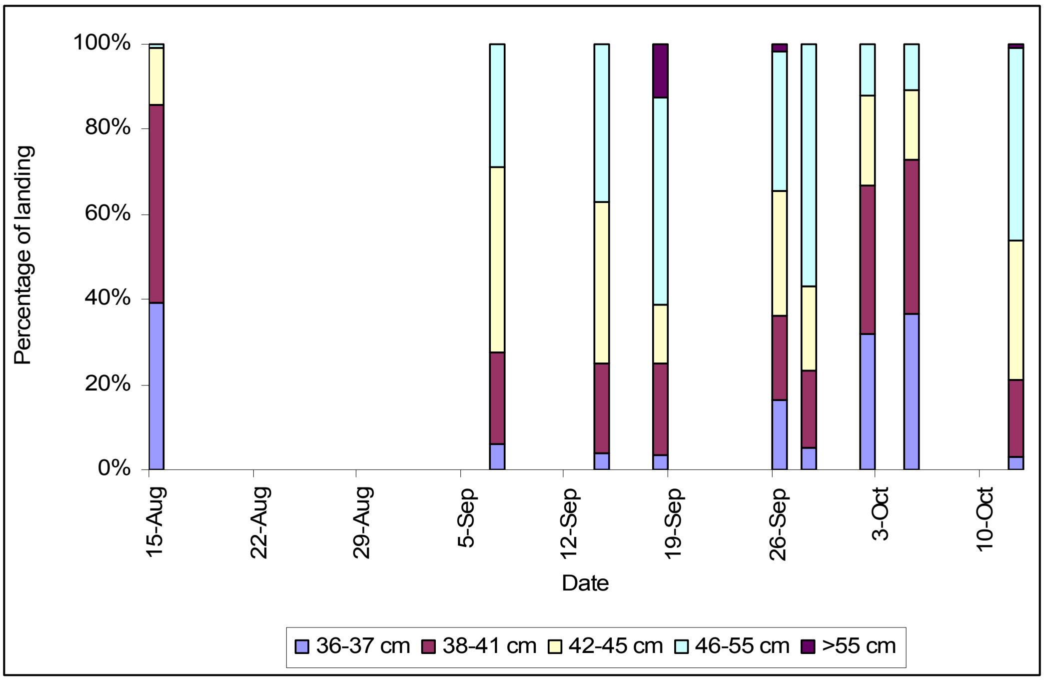


Figure 12. a) Total landings of bass made by a Bideford twin-rig demersal trawler between August and October 2006, by length class. b) Percentage contribution of each length class to the same landings.

Table 1. Table showing the percentage of bass catch (by number) that is currently discarded and the estimated percentage of the catch that will be discarded under a 40 cm MLS, by trawl mesh size and bass stock area, based on figures from the Cefas at-sea sampling scheme. Weights were estimated using the length-weight regression of Pawson and Pickett (1996)

		By Number		By Weight	
Mesh size	Stock area	% currently discarded	% that will be discarded (<40 cm)	% currently discarded	% that will be discarded (<40 cm)
80 mm	IVb+c	35.7	58.6	15.2	32.1
	VIId	64.4	88.4	49.2	77.8
	VIIe+h	9.0	51.5	5.1	37.1
	VIIa+f+g	1.1	15.7	0.6	9.9
90 mm	VIIe+h	0.0	1.1	0.0	3.7
	VIIa+f+g	23.6	81.0	17.7	73.4
100 mm	IVb+c	9.5	20.3	2.2	6.6
	VIId	2.3	44.8	1.5	33.7

Table 2. The estimated length ranges of bass size grades used at Plymouth market. Length ranges were estimated using the length-weight regression of Pawson and Pickett (1996).

Grade	Size (kg)	Length range (cm)
6	< 0.5	< 37
5	0.5 - 1	38 - 45
4	1 - 2	46 - 55
3	2 - 4	56 - 70
2	4 - 6	71 - 80
1	> 6	> 80

Table 3. The estimated length ranges of bass weight ranges used by a Bideford twin-rig demersal trawler. Length ranges were estimated using the length-weight regression of Pawson and Pickett (1996).

Weight range (kg)	Length range (cm)
0.5 - 0.6	36 - 37
0.6 - 0.8	38 - 41
0.8 - 1	42 - 45
1 - 2	46 - 55
> 2	> 55

Table 4. The weight of bass and the total weight of fish landed and the percentage of the catch that was bass for landings made between January and April 2006, by two pair trawl teams operating from Scarborough.

	Bass landing (t)	Total landing (t)	Percentage bass of landing
Vessel 1	1.7	38.6	4.5
Vessel 2	0.6	16.0	3.8
Pair team 1	2.3	54.6	4.3
Vessel 3	1.2	87.5	1.4
Vessel 4	0.4	24.1	1.8
Pair team 2	1.7	111.5	1.5
All vessels	4.0	166.2	2.4