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The FV *Carhelmar* beam trawl survey of the western English Channel (1989–2011): History of the survey, data availability and the distribution and relative abundance of fish and commercial shellfish

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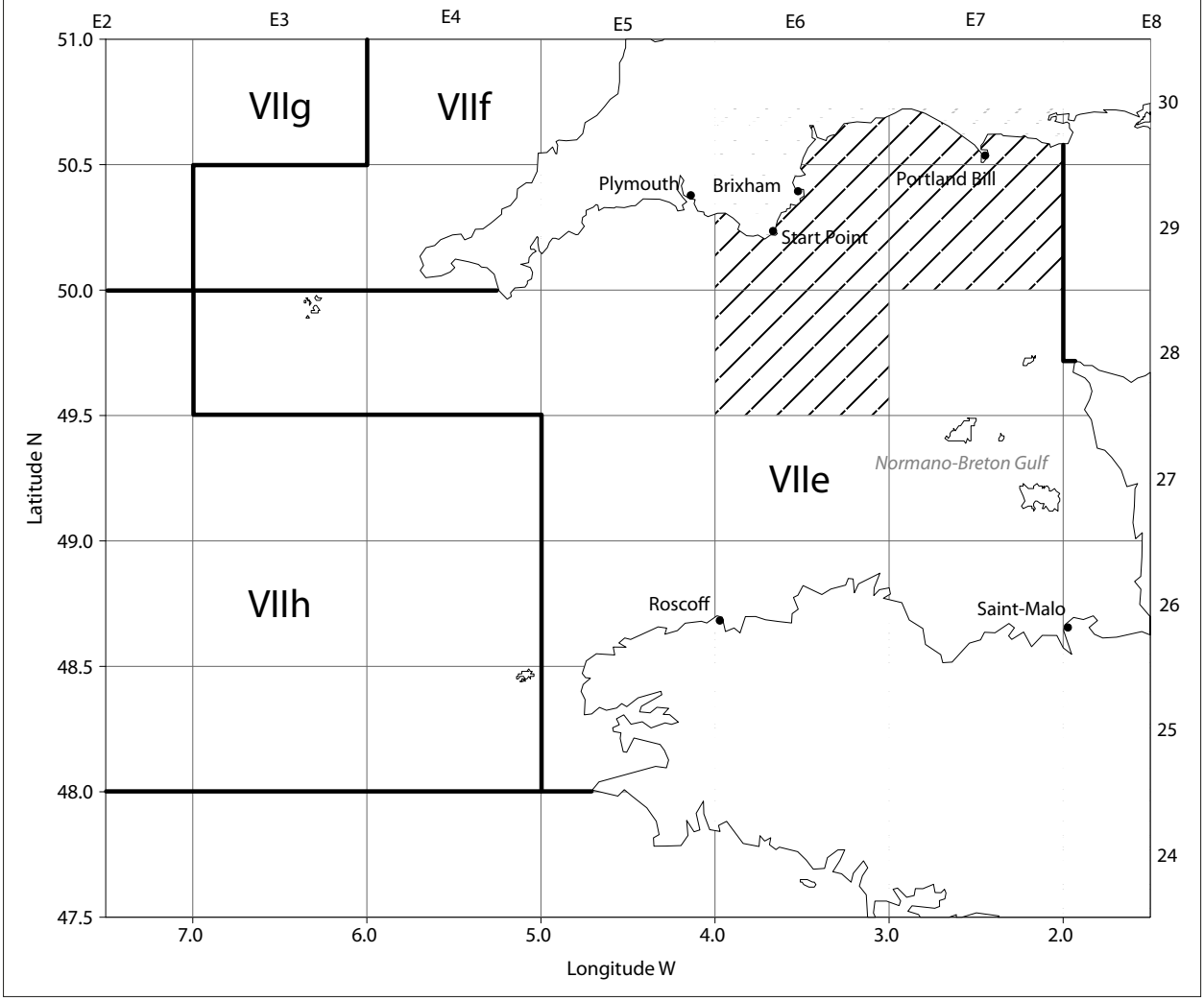
1. Introduction

During the 1980s, the fishing industry in the southwest expressed concerns about the lack of scientific investigations into and knowledge of the stock of sole *Solea solea* in the western English Channel (ICES Division VIIe; Figure 1). These concerns were the catalyst for the initiation of a beam trawl survey in the area. The survey area was in Lyme Bay (also referred to as 'Great West Bay'), a large bay ranging from Start Point in the west to Portland Bill in the east. The survey was designed to use a survey-specific gear that would fish at fixed positions to produce abundance indices for the assessments of the stocks of sole and plaice *Pleuronectes platessa* undertaken under the auspices of the International Council for the Exploration of the Sea (ICES). The survey began in 1984 with a charter of the commercial fishing vessel FV *Bogey 1*, which was replaced by the FV *Carhelmar* in 1989.

The primary aim of this Technical Report is to describe the history of the survey and to show in detail the availability of data collected during the most standardised part of the survey time-series (1989–2011) on board the FV *Carhelmar*. In addition to providing information on the spatial distribution and relative abundance for sole and plaice, the report also discusses how data were collected for other commercial fish, non-commercial fish and shellfish, with information on the distribution and relative abundance also provided for such species.

Figure 1: ICES Divisions and statistical rectangles in the western English Channel. The hatched area shows the ICES rectangles that cover the main area of the survey.



2. Physical characteristics of the western English Channel

The physical characteristics of the western English Channel are well documented (Pawson, 1995; Southward *et al.*, 2004; Stephens *et al.*, 2012), and only a brief summary is given here.

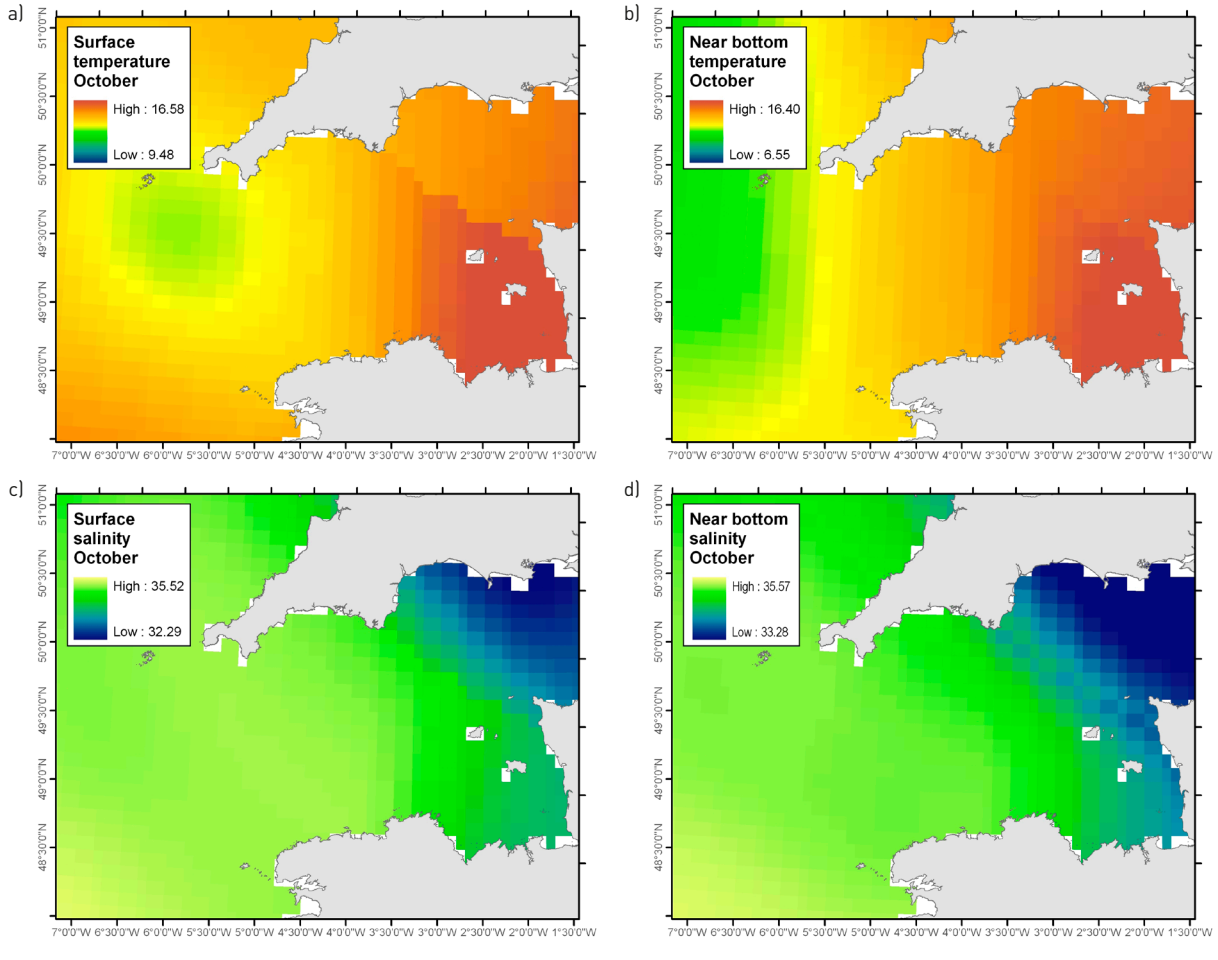
2.1 Temperature

The average surface and bottom water temperatures of the western English Channel in October are shown in Figure 2. The surface water temperatures in the western English Channel typically range from 9 to 10°C in winter to 15 to 18°C in summer. This results in the western English Channel being one of the warmer sea areas around the English coast, and allows for several Lusitanian species to extend their range to southwest England.

2.2 Salinity

The average surface and bottom salinities in the western English Channel (in October) are shown in Figure 2. Much of the western English Channel, which is exposed to oceanic waters, ranges from 34 to 35 psu. Although there are several rivers in both England (e.g. Rivers Fal, Tamar, Dart and Exe) and France (e.g. Sélune and Rance) that feed into the western Channel, areas of lower salinity are generally confined to coastal waters, including parts of Lyme Bay and the Golfe de St Malo.

Figure 2: Physical conditions of the western English Channel, showing (a) surface water temperature, (b) bottom water temperature, (c) surface salinity, and (d) bottom salinity. All values are the mean values observed in October of the years 1971–2000. Data source: ICES, data extracted from data holdings at the ICES Data Centre and supplemented by additional records from the World Ocean Data Centre (WODC).



2.3 Currents, fronts and oceanographic features

There is a net flow of oceanic Atlantic water through the western English Channel that eventually passes through to the southern North Sea. It has been estimated that this water flux carries, on an average tide, about 17 000 m^3 per second (Pawson, 1995). Although the main surface water movement is from west to east, there is some east-to-west flow in coastal areas, and several eddies associated with the tidal flows around headlands. The Ushant front is an important oceanographic feature in the western English Channel (Le Fèvre, 1986). This frontal system, which is typically found around the coast of Brittany, extends into the southwestern English Channel. There can also be a smaller front in Lyme Bay (Pingree *et al.*, 1983; Le Fèvre, 1986). The main oceanographic features are illustrated in Figure 3.

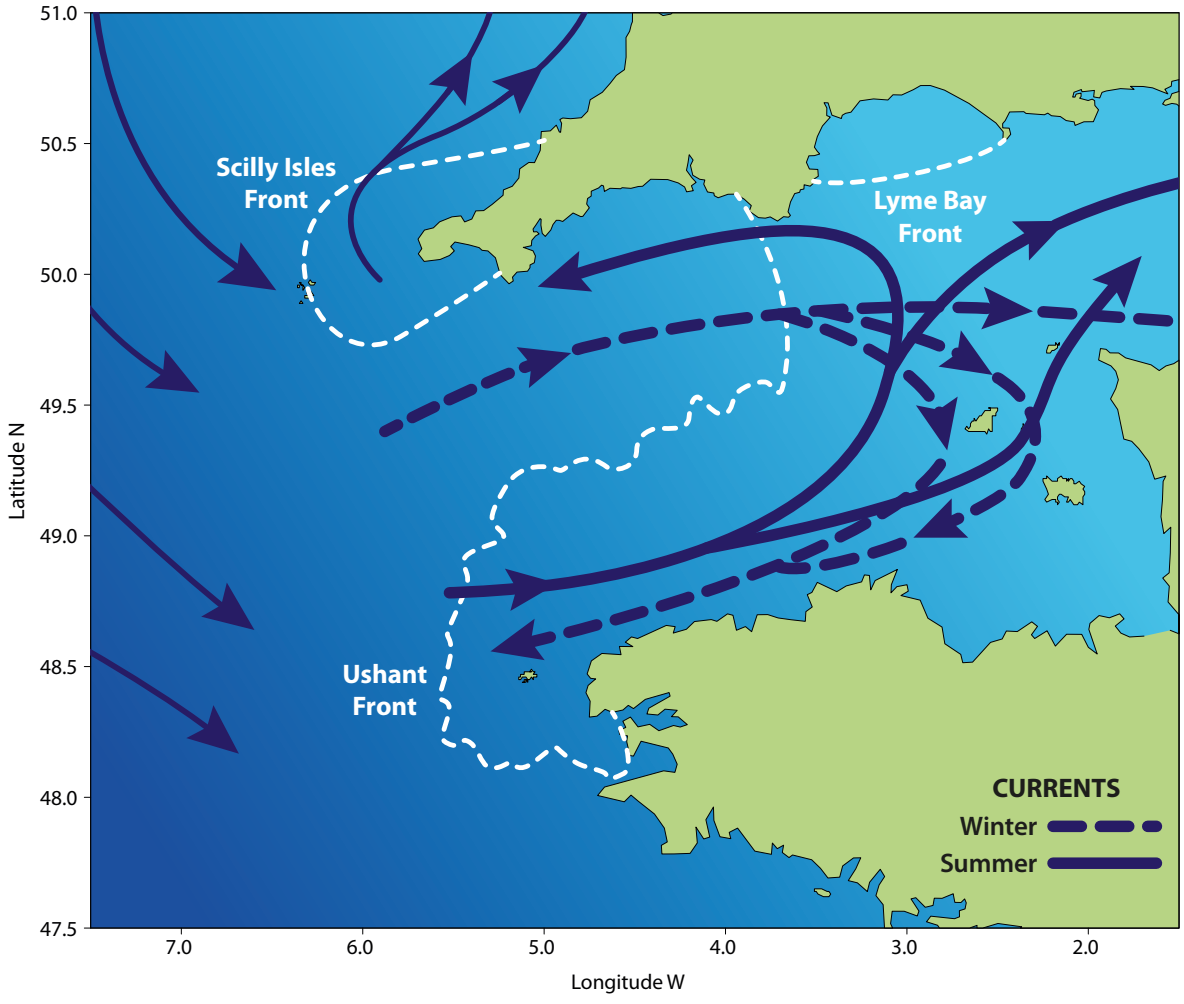
2.4 Depth

Most of the western English Channel is between 50 and 100 m deep (Figure 4). There are extensive areas of shallower water (<50 m) in the Normano-Breton Gulf and in Lyme Bay. Elsewhere, the shallow coastal waters are typically restricted to a narrow band relatively close to shore. A prominent bathymetric feature within the western English Channel is the Hurd Deep, which is a deep water (100 m) trench between 1 and 3 miles wide that runs in a WSW direction.

2.5 Sediments

Information on the sediments of the western English Channel has been provided by several authors (Hamilton, 1979; Johnson *et al.*, 1982; Larsonneur *et al.*, 1982; Wilson, 1982). Within the survey area, there is a variety of different sediment types (Figure 4) that, coupled with other factors such as depth, affect the distribution and composition of benthic communities and demersal fish. Inshore areas are characterised by sandy and muddy substrata, with coarser sediments (e.g. coarse sand and shell gravel) characteristic of the deeper, offshore grounds. There are also some rocky grounds, especially around Start Point and along the north coast of Brittany.

Figure 3: Oceanographic conditions of the western English Channel, showing surface currents and frontal systems. Adapted from Lee and Ramster (1981) and Le Fèvre (1986).



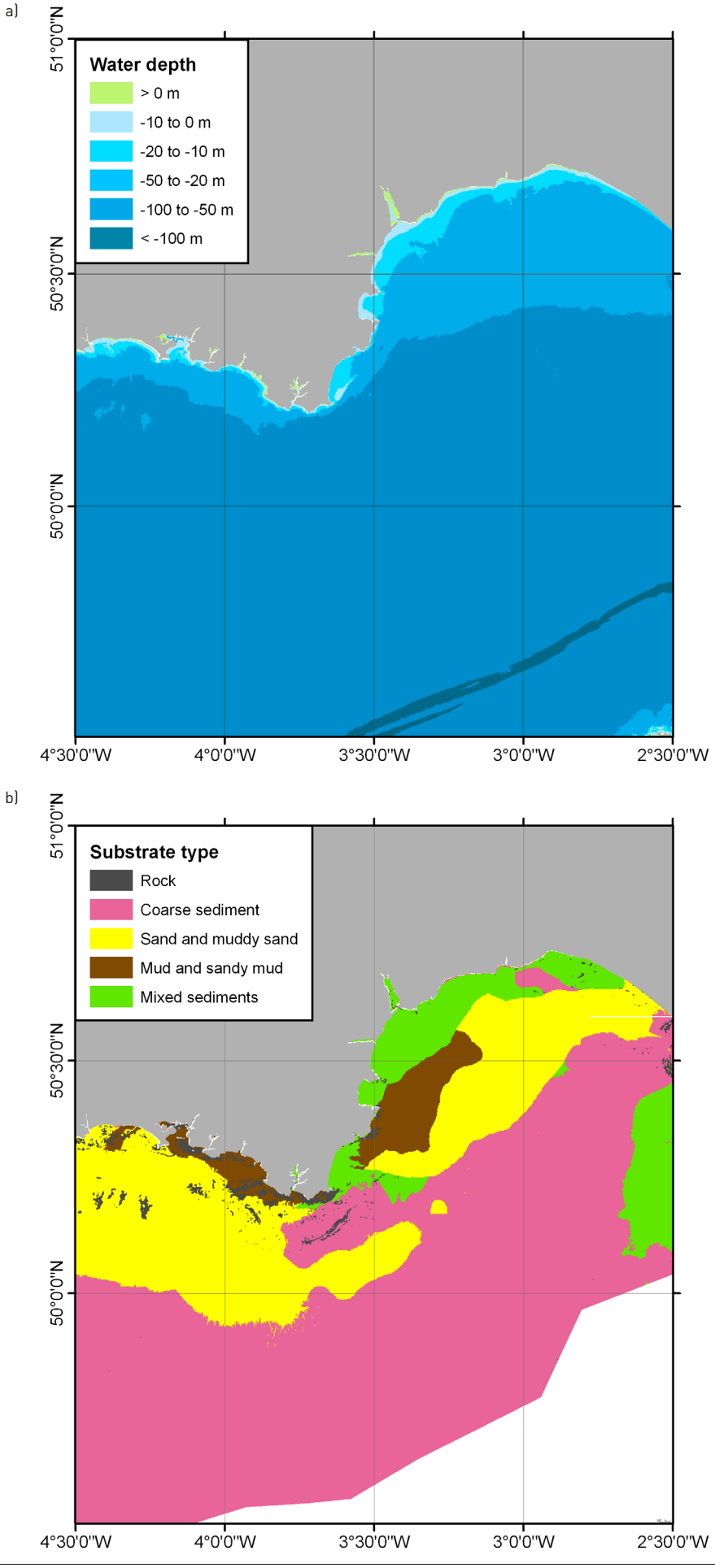


Figure 4: Survey area illustrating (a) the bathymetry (note the more extensive areas of shallow water (<50 m deep) east of Start Point, and Hurd Deep), and (b) the distribution of sediment types. Figure 4a is derived from a digital elevation model created by Astrium Oceanwise (2011) and Figure 4b taken from Diesing *et al.* (2012).

3. Biological characteristics of the survey area

3.1 Invertebrate assemblages

The benthic fauna of the western English Channel has been studied extensively for more than 100 years, especially near the marine laboratories at Plymouth (Allen, 1899; Crawshay, 1912; Ford, 1923; Smith, 1932; Holme, 1953, 1961, 1966; Marine Biological Association, 1957; Holme and Wilson, 1985; Capasso *et al.*, 2010) and Roscoff (Cabioch, 1961; Cabioch *et al.*, 1977; Dauvin *et al.*, 1994).

Within this broader area, the benthic fauna of Lyme Bay was described by Holme (1951). The fauna of the inner parts of the bay, where Wilson (1982) considered the seabed to comprise a rippled sand sheet of muddy sand, includes various bivalves (*Mactra stultorum*, *Phaxas pellucidus*, *Spisula elliptica*, *S. subtruncata*, *Dosinia lupus* and *Chamelea gallina*), gastropods (*Turritella communis*) and echinoderms (*Amphiura* spp., *Ophiura ophiura* and *Echinocardium cordatum*). The sediments farther offshore are coarser, so the fauna there is different, typified by *Pagurus prideaux,* larger echinoderms (e.g. *Echinus esculentus*, *Psammechinus miliaris*) and *Aequipecten opercularis*. Information on the larger epifauna in the study area was derived when the survey was undertaken on RV *Corystes* in 2002 and 2003. Some of these data were presented by Ellis and Rogers (2004) and brief notes on some of the larger epibenthic invertebrates encountered in the survey area are summarised in Section 7.4.

Other coastal areas of soft-bottom habitat in the western English Channel that have been studied include the Bay of Morlaix (Dauvin and Gentil, 1989; Améziane *et al.*, 1995; Dauvin and Zouhiri, 1996).

3.2 Fish assemblages

The ichthyofauna of the western English Channel has also been studied extensively. Le Danois (1913) provided an early review of the more common fish species in the area, and the Marine Biological Association (1957) gave a taxonomic list of the species observed in the area. There has been a long history of trawl surveys in the area (Genner *et al.*, 2004), including the area covered by the present survey (e.g. Holt, 1898; Stead, 1896; Garstang, 1903; Todd, 1903; Rogers and Ellis, 2000). There are also other Cefas trawl surveys covering other parts of the western English Channel (Warnes and Jones, 1995; Tidd and Warnes, 2006). Notes on some of the shore fish of Channel coasts were provided by de Noter and Hureau (1996), and Le Mao (2009) provided an ichthyofaunal list for the Normano-Breton Gulf.

In terms of demersal fish, the fish assemblages in the area, as indicated in beam trawl surveys, were described by van der Kooij *et al.* (2011). That study ascribed most of the stations in Lyme Bay to either biotope 2 (for which characteristic fish species were solenette *Buglossidium luteum*, scaldfish *Arnoglossus laterna,* plaice, red mullet *Mullus surmuletus* and dab *Limanda limanda*) or biotope 8 (the characteristic fish species being pollack *Pollachius pollachius*, tub gurnard *Chelidonichthys lucerna*, pogge *Agonus cataphractus* and butterfly blenny *Blennius ocellaris*).

Pelagic fish are also abundant in the western English Channel, and they include sprat *Sprattus sprattus*, pilchard *Sardina pilchardus*, anchovy *Engraulis encrasicolus*, mackerel *Scomber scombrus* and horse mackerel *Trachurus trachurus*, with the relative importance of some of these species (e.g. herring and pilchard) reflecting the oceanographic conditions (Southward *et al.*, 1988). There are also important bass *Dicentrarchus labrax* populations in the area (Jennings and Pawson, 1992). In addition to small pelagic fish, some of the UK's larger pelagic fish species are also seasonally abundant in the western Channel, including blue shark *Prionace glauca* (Vas, 1990), basking shark *Cetorhinus maximus* (Sims *et al.*, 1997) and sunfish *Mola mola* (Sims and Southall, 2002).

Given that the western English Channel is influenced by oceanic, Atlantic waters and is one of the warmer sea areas around England, a variety of Lusitanian migrants and vagrant fish are reported regularly from the area (e.g. Swaby *et al.,* 1992; Stebbing *et al.*, 2002).

4. Commercial fisheries

The western English Channel (ICES Division VIIe) contains 21 statistical rectangles (Figure 1), and supports an important, high-value mixed fishery. In 2011, UK vessels landed 37 047t of fish and shellfish worth £63.7 million. Vessels fishing in the five ICES rectangles (28E6, 29E6/E7 and 30E6/E7) that comprise the main study area of the FV *Carhelmar* survey contributed about half (by value) of the total reported VIIe landings (Table 1).

Shellfish are an important component of the fishery and, in the study area, represented two-thirds of the total value of the VIIe catch. The three main shellfish species were scallop (mostly *Pecten maximus*), edible crab *Cancer pagurus* and cuttlefish *Sepia officinalis*. Scallops are caught primarily by dredge; crab, lobster *Homarus gammarus* and whelks *Buccinum undatum* by potters, and cuttlefish mainly by beam trawlers and, to a lesser extent, otter trawlers.

Beam trawlers, all >10m, target cuttlefish, anglerfish *Lophius piscatorius*, sole and plaice, with important bycatch species including other species of flatfish, gurnards and red mullet. By value, about one-third of the total catch in the area was made by beam trawlers. Although plaice landings were much greater than those of sole in terms of quantity, the total value of sole was nearly four times greater. Some 80% of the beam trawl catch was landed at Brixham, and Plymouth landed most of the balance. Most of the non beam trawl catch was made by vessels deploying pots, dredges and otter trawls.

Inshore vessels operating in the area remain an important component of the fishery and contributed an estimated 20% of the total landed catch value, although <10m vessels were about twice as numerous as vessels longer than that. The inshore fleet deployed mostly pots, plus a variety of other gear types, including gillnets and dredges, and to a lesser extent otter trawls and lines.

Table 1: Landings of UK[1] vessels (in 2011) by species, for the main ICES rectangles covering the survey area (28E6, 29E6/E7 and 30E6/E7). Species ranked by total value, with the species listed accounting for 95% of the total reported catch, by weight. + refers to catch < 0.5 tonne. Data as extracted from the Fishing Activity Database (FAD), 26 June 2012.
[1]UK vessels landing into England, Wales and Northern Ireland and English, Welsh and Northern Irish vessels outside of the UK.

Species	Beam trawl		Pots		Dredge		Otter trawl		Gillnets		Lines		Other		Total		VIIe Total		Survey rectangles as a % of VIIe total	
	£1,000	tonnes	£1,000	tonnes	£1,000	tonnes	£1,000	tonnes	£1,000	tonnes	£1,000	tonnes	£1,000	tonnes	£1,000	tonnes	£1,000	tonnes	£1,000	tonnes
Scallops	103	62	4	6	6596	4099	12	8	7	3		+	153	86	6874	4265	11821	7224	58%	59%
Edible crab	20	17	4860	3119	2	1	6	4	118	87	1	1		+	5008	3229	7071	4650	71%	69%
Cuttlefish	3185	1117	143	55	32	12	528	169	4	1	4	2	51	16	3948	1372	5824	2045	68%	67%
Sole	3011	243	1	+	212	17	93	9	154	12	2	+	3	+	3478	283	5207	424	67%	67%
Anglerfish	2051	700		+	106	38	115	40	21	7		+	3	1	2296	787	6219	2056	37%	38%
Whelk		+	1752	2655		1	18	28	8	12		+			1778	2696	1781	2700	100%	100%
Sea-bass	16	2	3	+	1	+	82	11	320	41	100	10	808	107	1329	170	2132	262	62%	65%
Turbot	627	59	1	+	230	22	75	7	93	10			1	+	1026	98	1577	150	65%	66%
Squid	205	41	4	1		+	632	118	6	1	2	1	91	15	941	177	2007	370	47%	48%
Plaice	701	419	1	+	10	5	191	137	18	12		+	5	3	927	575	1464	927	63%	62%
Lemon sole	401	65	1	+	11	2	484	94	4	1		+	2	1	903	162	3072	591	29%	27%
Lobster	6	1	842	83	1	+	10	1	24	2	2	+	4	1	889	88	1622	153	55%	57%
Brill	589	88		+	57	10	52	8	16	2		+	1	+	716	109	1151	172	62%	63%
Sprat	3	19		+	4	24	2	12		+		+	471	3039	480	3095	481	3095	100%	100%
Gurnards	385	485		+	1	1	44	57	1	1		+	48	25	478	569	722	825	66%	69%
Red mullet	119	21		+		+	41	15	15	2		+	300	46	475	84	791	126	60%	67%
Skates and rays	91	46	2	1	6	5	195	104	119	59	2	1	2	1	417	216	896	477	46%	45%
Pollack	20	11	1	+		+	17	11	216	110	72	29	53	22	378	183	1775	823	21%	22%
Horse mackerel							20	40		+		1	343	1232	364	1273	715	2544	51%	50%
Anchovy	3	4				+				+			333	455	336	459	371	503	91%	91%
Bib	217	452		+		1	25	42	2	3		+	11	33	256	531	388	801	66%	66%
John Dory	61	8		+		+	101	21	2	+		+	2	+	166	30	603	92	28%	32%
Spider crab		+	134	107		+	1	1	18	14		+		+	153	122	366	294	42%	41%
Mackerel		+	2	1		+	14	10	6	4	88	61	34	32	144	109	677	444	21%	25%
Sub Total	**11814**	**3861**	**7751**	**6030**	**7270**	**4238**	**2759**	**947**	**1171**	**385**	**276**	**106**	**2718**	**5115**	**33759**	**20681**	**58732**	**31747**	**57%**	**65%**
Other species	**293**	**308**	**43**	**38**	**61**	**29**	**233**	**390**	**140**	**73**	**23**	**13**	**150**	**211**	**944**	**1063**	**4953**	**5300**	**19%**	**20%**
Total	**12107**	**4169**	**7795**	**6068**	**7332**	**4267**	**2991**	**1337**	**1310**	**458**	**299**	**120**	**2869**	**5326**	**34703**	**21744**	**63685**	**37047**	**54%**	**59%**

5. History of the survey

The chronology of the survey time-series is as follows:

1984–1988	The survey was first undertaken by FV *Bogey 1*, a 300 hp beam trawler, deploying twin 6 m beam trawls, each with a chain mat and 75 mm codend, and one trawl was fitted with a 60 mm liner.
1989–1990	The survey used FV *Carhelmar* (BM23) (Figure 5), a newly designed 24 m 300 hp (220 kw) beam trawler, deploying Cefas' dedicated survey beam trawls. These were commercial 4 m beam trawls, each with a chain mat, fitted with standard flip-up ropes and a 75 mm codend. One of the trawls had a 40 mm liner.
1991–present	The FV *Carhelmar* continued to be used, but both beam trawls were standardised, using 80 mm codends and 40 mm liners.
2002	In place of the FV *Carhelmar,* Cefas' own research vessel, RV *Corystes*, was used, deploying a single beam trawl (aft).
2003	Both the RV *Corystes* and FV *Carhelmar* were used.
2004	RV *Corystes* only was used.
2005–present	FV *Carhelmar* used.

Over the duration of the survey, there have been slight changes in the number of stations sampled, which are discussed in Section 6.2.

Figure 5: FV *Carhelmar* in Sutton Harbour, Plymouth.

6. Current survey

6.1 Survey objectives

The primary objectives of the survey are to collect fishery-independent, annual abundance indices by age for sole and plaice stocks in the western English Channel. These data are supplied to the ICES Working Group for Celtic Seas Eco-region (ICES, 2012) for stock assessment purposes. Additional survey aims are to collect data on the relative abundance, distribution, size frequency and, in some cases, biological data, for other fish and commercial shellfish.

6.2 Stations sampled

Over the time-series, a total of 60 prime (fixed) stations within a 35 nm radius of Start Point, including the area around Lyme Bay, have been sampled. Survey positions are stratified by distance from shore. The survey strata, in distance from the shore, are 0–3, 3–6 and 6–12 nautical miles (nm), and >12 nm (inshore, north of 50°N) and >12 nm (offshore, south of 50°N).

Station positions are fixed and each station is given a unique alpha-numeric prime number. The survey was originally divided into 16 blocks, each identified by a letter (A–P), with 1–6 stations in each block. A full block of six stations equates to 15' longitude and 30' latitude. Over the time-series, several stations have been introduced or dropped, and the survey now consists of 58 stations. Figure 6 shows the positions of these prime stations and their stratification. The locations of place names mentioned in the text are provided in Figure 7.

The survey is normally conducted in mid-October, and usually takes eight sea-days, although in some years surveys have started in late September. All 58 stations are aimed for completion each year, but for the purposes of creating annual relative abundance indices for plaice and sole, a small number of stations can be omitted as a contingency for poor weather, provided that the main 49 'grid' stations are completed. The stations that can be excluded without affecting the calculation of the stock assessment indices are the two inshore stations off Teignmouth (D0o and D0i), the four stations in block F, the one in block G and the two in block L. The two stations in block O (situated to the far west of the grid) were dropped after the first two years, although they were sampled again in 1994 and 2005. A summary of the stations sampled over time, and the number of valid gear deployments at each prime station are provided in Table 2.

Over the survey period, there have been a small number

Figure 6: Prime station positions fished over the survey period. Colour coding shows the stratification of each station by distance from shore (nm): 0–3 (red); 3–6 (green); 6–12 (purple); >12 (inshore) (orange); >12 (offshore) (blue).

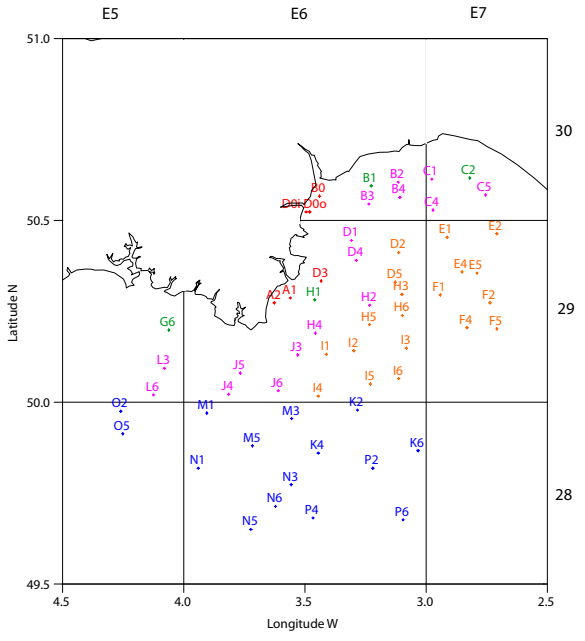


Figure 7: The location of places mentioned in text.

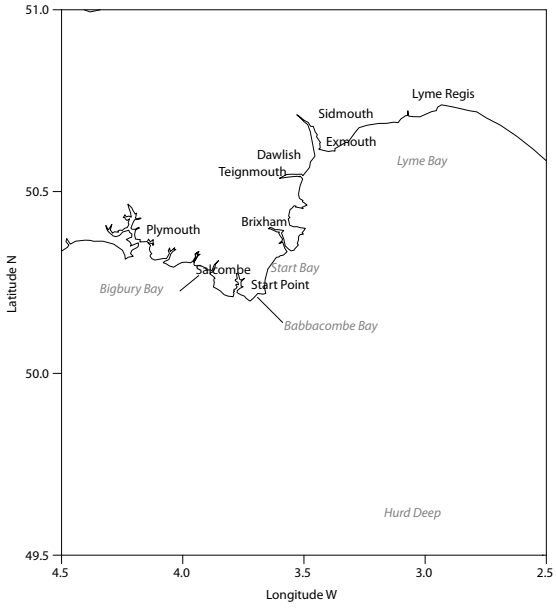


Table 2: The number of valid trawl deployments per station over the time-series. Stations fished by the FV *Carhelmar* for which it was only possible to achieve a valid sample for one trawl are denoted in parenthesis. Other anomalies are shaded grey (see text for these anomalies).

Prime	Stratum	Grid station	Current station	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003		2004	2005	2006	2007	2008	2009	2010	2011
				Chmr	Chmr	Chmr	Chmr	Chmr	Chmr	Chmr	Chmr	Chmr	Chmr	Chmr	Chmr	Chmr	Cory	Chmr	Cory	Cory	Chmr	Chmr	Chmr	Chmr	Chmr	Chmr	Chmr
A1	0-3	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
A2	0-3	✔	✔				2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
B0	0-3	✔	✔				2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
B1	3-6	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	(1)	2	(1)
B2	6-12	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
B3	6-12	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
B4	6-12	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
C1	6-12	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
C2	3-6	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
C4	6-12	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
C5	6-12	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
D0i	0-3		✔							2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
D0o	0-3		✔							2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
D1	6-12	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
D2	>12 (inshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
D3	0-3	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
D4	6-12	✔	✔	2	2	2	2	2	2	2	2	(1)	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
D5	>12 (inshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
E1	>12 (inshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
E2	>12 (inshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2			2	2
E4	>12 (inshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2		2	2	2
E5	>12 (inshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
F1	>12 (inshore)		✔	2	2	2	2	2	2		2	2	2	2	2	2	1	2	1	1	2	2	2		2	2	(1)
F2	>12 (inshore)		✔	2	2	2	2	2	2		2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
F4	>12 (inshore)		✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
F5	>12 (inshore)		✔	2	2	2	2	2	2		2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
G6	3-6		✔	2	2		2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
H1	3-6	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
H2	6-12	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
H3	>12 (inshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2
H4	6-12	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2

Table 2: continued.

Prime	Stratum	Grid station	Current station	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002		2003		2004	2005	2006	2007	2008	2009	2010	2011
				Chmr	Chmr	Chmr	Chmr	Chmr	Chmr	Chmr	Chmr	Chmr	Chmr	Chmr	Chmr	Chmr	Cory	Chmr	Cory	Cory	Chmr	Chmr	Chmr	Chmr	Chmr	Chmr	Chmr	Chmr
H5	>12 (inshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
H6	>12 (inshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
I1	>12 (inshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
I2	>12 (inshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
I3	>12 (inshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
I4	>12 (inshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
I5	>12 (inshore)	✔	✔	2	2	2		2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
I6	>12 (inshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
J3	6-12	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
J4	6-12	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
J5	6-12	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
J6	6-12	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
K2	>12 (offshore)	✔	✔	2	2	2	2	2	2	2		2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
K4	>12 (offshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
K6	>12 (offshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
L3	6-12		✔	2	2		2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
L6	6-12		✔	2	2		2		2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
M1	>12 (offshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
M3	>12 (offshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
M5	>12 (offshore)	✔	✔	2	2	2	2	2	2	2	2	(1)	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
N1	>12 (offshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
N3	>12 (offshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
N5	>12 (offshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	(1)	2	2	2	2	2	2	2
N6	>12 (offshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
O2	>12 (offshore)			2	2				2													2						
O5	>12 (offshore)			2	2				2													2						
P2	>12 (offshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
P4	>12 (offshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
P6	>12 (offshore)	✔	✔	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2
Total no. of stations fished				56	56	51	55	55	58	55	57	58	58	58	58	58	58	58	58	58	60	58	58	55	57	58	58
Total no. of current stations fished				54	54	51	55	55	56	55	57	58	58	58	58	58	58	58	58	58	58	58	58	55	57	58	58
Total no. of current grid stations fished				47	47	47	48	49	49	49	48	49	49	49	49	49	49	49	49	49	49	49	49	47	48	49	49

of sampling anomalies (Table 2), including some hauls that yielded only a single trawl of data (with the other trawl not providing a valid catch, so not processed). Also, in 1997, catches from two adjacent stations in one strata were combined, and in 1990, the catches of both port and starboard beams were combined at one station. Note again too that only one beam trawl was deployed when the survey was conducted by RV *Corystes*. During the surveys on board RV *Corystes* all fish and commercial shellfish were sampled fully.

Analyses of the survey data undertaken in the current report are only for the current prime stations surveyed, so exclude data collected at the stations in block O. In addition, although the survey was conducted by both vessels in 2003, only the data from FV *Carhelmar* are used here.

6.3 Survey gear: description and deployment

The standard sampling gear used for the survey is a 4 m beam trawl, as used by Cefas in beam trawl surveys in other areas (Parker-Humphreys, 2004a, b, 2005). Two commercially rigged 4 m beam trawls (each fitted with a chain mat, flip-up ropes, 80 mm codends and 40 mm liner) are deployed to port and starboard. A photograph and a description of the beam trawl are given in Figures 8 and 9, respectively. The liner is sufficiently long that when attached to the forward end of the codend, it extends to about 1 m below the codline. The dimensions are:

Headline:	4 m x 22 mm combination wire rope
Ground rope:	10.8 m x 22 mm 6/19 construction wire rope
Twin flip-up:	10.4 m x rubber on 26 mm corlene rope
Distance from centre of beam for:	Frame chain – 4.8 m, ground rope – 5.6 m, fishing line – 5.8 m
Mesh sizes:	125 mm braided nylon (top) and 120 mm polybraid (belly) and 80 mm codend with 40 mm liner
Bridles:	2.9 m x 5/8" Grade 40 drag alloy chain
Width:	4.5 m (4 m inside shoes)
Weight:	Approx 2.5 t

FV *Carhelmar* uses blocks on the derrick heads and beam bridles for double-purchase warps, so the usual triangular towing plates used to bring the three bridles together are not used. In addition to the blocks, each of the four main towing bridles are extended in length by a nine-link length of chain retained aboard the FV *Carhelmar* specifically for this purpose. The initial skipper of the FV *Carhelmar* initiated the bridle length extension when the Cefas beams where first used to improve the towing stability of the beams when used on FV *Carhelmar*.

The trawls are towed at a speed of 4 knots over the ground. Although commercial fishing vessels generally fish at a slower speed for a longer period, 4 knots is considered appropriate for shorter tows. Towing can be either with or against the tide, although it is usually with the tide because this is the direction that the vessel takes around the survey grid.

Figure 8: The retrieval of the port-side beam trawl. Note the attachment of the CTD unit to the underside of the header rope.

A warp length to depth of water ratio of 3:1 is used. However, depending on the type of ground to be fished, and at the discretion of the fishing skipper, the ratio is occasionally decreased slightly.

The trawl is towed for 30 min and covers a distance of 2 nm. The start of the trawl is noted as when the warps have stopped paying out, and the end of the tow as the time that hauling commences. A tow of <30 min is deemed valid if, for example, the trawl is beginning to fill and is difficult to bring aboard, but hauls are not deemed valid if <15 min.

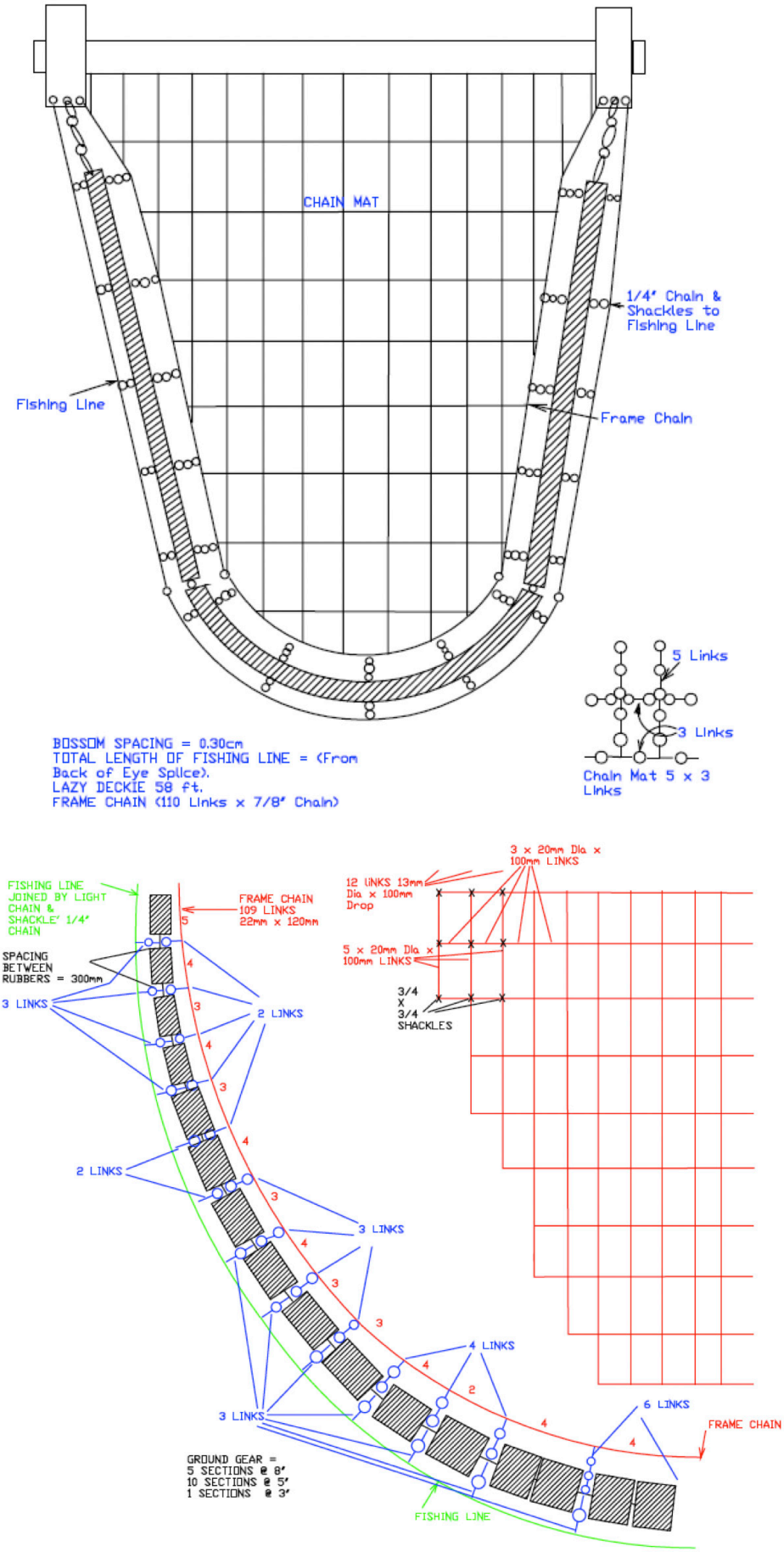
Ideally, trawling is conducted in daylight, as defined as the time between 15 min before sunrise and 15 min past sunset. In some years, however, if there were time constraints attributable to poor weather, some fishing outside this time-period has been undertaken.

6.4 Sampling protocols

Up to 2011, at each prime station, both gear deployments were allocated the same sequential station number that identifies the order that stations were fished, including any tows considered as invalid. For each station, a station log was completed, which recorded the shot and haul time, position and depth, as well as information about the tide and the distance travelled over the ground.

Once on board, the catches from the port and starboard

Figure 9: A gear diagram for the 4 m beam trawl.



trawls were sampled separately. All commercial fish, shellfish and cephalopods were removed and quantified, in accord with the sampling protocols detailed in Table 3. At each station, non-commercial fish species were observed, and at one randomly selected station each day, all fish species were measured so that length frequency data were being collected for non-commercial species. All species were identified to species where possible, or if not to the highest taxon possible using standard identification guides (e.g. Wheeler, 1978). The main epibenthic invertebrates were also noted at each station, for port and starboard sides combined.

Biological samples were collected for selected species, including length, weight, sex and maturity, and the otoliths were removed for age determination. For plaice and sole, the biological samples were collected in accord with specified targets by length group and strata (see Section 7.3 for further information), and also by sex in the case of plaice. The collection of biological samples, in this respect, was designed to produce area-specific age-length keys that would account for any differences in the growth rates of fish from the different stratified survey areas. For other commercial species, nearly all the fish caught were sampled for biology, because they were usually captured in smaller numbers.

Additionally, environmental data were collected. A conductivity, temperature and density (CTD) unit was attached to one of the beam trawls to collect temperature and salinity data during the tow; this information was used to calculate the average surface and bottom temperatures and salinities.

Upon completion of the survey, recorded data were entered into the Fishing Survey System (FSS) database under the '*Carhelmar*' cruise series. The FSS is a purpose-built database used to hold and maintain Cefas fish survey data. Combined port and starboard observations for epibenthic species were input to the database for port side gear only.

A number of changes were implemented in 2011. The principal ones were to stop collecting length measurements for non-commercial fish species at a randomly selected station each day (although information would still be collected for any rare or unusual fish species). Also because of the importance of cuttlefish to the VIIe fishery, the decision was made to collect length frequency data for all commercial cephalopods (*Sepia* and *Loligo* spp.). In addition, there have been some changes made over time to the collection protocol for biological samples; the targets for sole were reduced slightly for some of the length groups, and lemon sole *Microstomus kitt* became the only additional species sampled biologically.

Table 3: Sampling protocols for species caught at a station, where O = observed, C = counted, M = measured. Species are measured as L_T (total length), L_C (carapace length), W_C (carapace width), H_S (shell height) or L_M (mantle length).

Species category	Total catch			Measuring interval (below)	Biological sample				
Common name	M	C	O		Sexed	Length	Weight	Sex	Maturity	Age
Commercial fin-fish										
Sharks and rays	✔			L_T (cm)	✔					
European eel	✔			L_T (cm)						
European conger eel	✔			L_T (cm)						
Pilchard	✔			L_T (0.5 cm)						
Sprat	✔			L_T (0.5 cm)						
European anchovy	✔			L_T (0.5 cm)						
Argentines	✔			L_T (cm)						
Atlantic cod[1]	✔			L_T (cm)		✔	✔	✔	✔	✔
Haddock	✔			L_T (cm)						
Whiting	✔			L_T (cm)						
Blue whiting	✔			L_T (cm)						
Pollack	✔			L_T (cm)						
Bib	✔			L_T (cm)						
Common ling	✔			L_T (cm)						
Greater forkbeard	✔			L_T (cm)						
European hake	✔			L_T (cm)						
Black-bellied anglerfish[1]	✔			L_T (cm)		✔	✔	✔	✔	✔
Anglerfish (monk)[1]	✔			L_T (cm)		✔	✔	✔	✔	✔
John Dory	✔			L_T (cm)						
Gurnards	✔			L_T (cm)						
European sea-bass	✔			L_T (cm)						
Horse mackerel (scad)	✔			L_T (cm)						
Sea-breams	✔			L_T (cm)						
Red mullet	✔			L_T (cm)						
Sandeels	✔			L_T (cm)						
Mackerel	✔			L_T (cm)						
Megrim	✔			L_T (cm)						
Turbot	✔			L_T (cm)						
Brill	✔			L_T (cm)						
Dab	✔			L_T (cm)						
Lemon sole	✔			L_T (cm)		✔	✔	✔	✔	✔
Flounder	✔			L_T (cm)						
European plaice	✔			L_T (cm)	✔	✔	✔	✔	✔	✔
Sand sole	✔			L_T (cm)						
Sole	✔			L_T (cm)		✔	✔	✔	✔	✔
Commercial shellfish										
European lobster	✔			L_C (mm)	✔					
Spiny spider crab	✔			L_C (mm)	✔					
Edible crab	✔			W_C (mm)	✔					
Great scallop	✔			H_S (cm)						
Common cuttlefish[2]		✔		L_M (cm)						
Squids[2]		✔		L_M (cm)						
Non-commercial fin-fish[3]	(✔)		(✔)							
Epibenthos			✔							

[1] Subject to biological sampling up to 2010. Not biologically sampled from 2011 onwards.
[2] Counted prior to 2011. Measured since 2011.
[3] Commonly occuring non-commercial species generally observed, measured at randomly selected stations (refer to text). Unusual species measured.

7. Species recorded for the survey

7.1 Species observed

Since 1989 a total of 94 fish taxa from 43 families have been recorded, as well as commercial crustaceans (three species), bivalves (one commercial species) and cephalopods (three commercial species). For some taxa, where identification to species level was not possible, or if the identification to species was considered unreliable, catches were grouped to the lowest taxonomic level (Appendix I).

The taxa observed during the survey and their percentage occurrences, by year, are listed in Table 4. Only a few species persisted and were categorised as common (at >60% of fixed stations each year). The high value commercial species caught most regularly were plaice, sole and cuttlefish. The more commonly encountered low value commercial and non-commercial species included lesser-spotted dogfish *Scyliorhinus canicula*, poor cod *Trisopterus minutus*, common dragonet *Callionymus lyra*, scaldfish and thickback sole *Microchirus variegatus*. Epibenthic species have been recorded (as observed only) since 2004 for the combined catch, although with a variable level of identification.

7.2 Data availability

The quantification of species, as either observed, counted or measured (referred to as the catch component) over the survey period, has not necessarily been consistent, because the main emphasis of the survey has been to focus on commercial species, particularly plaice and sole. In addition, there have also been some inconsistencies that have likely resulted from the experience of the accompanying staff, and on some occasions because of the limited time between hauls available to process the catch.

In general, commercial species have been measured at every station, whereas non-commercial species have predominantly been merely observed, sometimes counted or, at selected stations, measured. For the two years when the RV *Corystes* conducted the survey as part of the Cefas Irish Sea beam trawl survey, all fish species were measured in accord with that survey's standard operating procedure (Parker-Humphreys, 2004a, b). It is worth mentioning that catch data obtained for the years that the survey was conducted on the RV *Corystes* are available to provide additional abundance and length frequency distribution data for species that were mainly observed aboard the FV *Carhelmar*.

A detailed breakdown of the total numbers (and percentage of occasions) that a catch component was measured, counted or observed for each species is presented in Appendix II. Note that on a few occasions, more than the one catch component was recorded for a species at a station, if it was quantified differently for the two gears deployed, e.g. a species counted from the port trawl and observed for the starboard trawl.

7.3 Biological samples

Biological samples were collected primarily for age determination, and over the course of the survey, 15 279 samples were taken from 12 different fish species. For all biological samples, length, sex and maturity information was collected and, since 2002, individual weights have also been collected. A summary of the number of biological samples collected and the corresponding number of samples aged and the total numbers of fish measured are provided in Appendix III.

As discussed in Section 6.4, biological samples for plaice and sole were collected in accord with specified targets by strata (Table 2, Figure 6). However, over the survey time-series, the stratification of biological samples has varied. During 1989 and 1990, targets for biological samples were for the whole survey, but since then, samples were collected in accord with the stratification of prime stations (see Section 6.2).

Between 1991 and 2005 there were five strata, 0–3, 3–6, 6–12, >12 (inshore), and >12 nm (offshore), although the 3–6 and 6–12 nm strata were combined for calculating indices. Since 2006 there have been three strata (0–6, 6–12 and >12 nm from shore). Since 1994, biological samples for plaice and sole have been collected by 1 cm length groups but prior to that date, biological sampling was by 2 cm length groups.

The way that the biological samples are captured in the database has changed slightly too. In recent years (since 2005, and for the two years that the survey was conducted on RV *Corystes*), the gear (port, starboard or aft) that the samples were collected from at a station was attributed to an individual biological sample. For the years 1993–2001, all samples at a station were attributed to the port side, unless there was no portside catch (in which case the sample was attributed to the starboard side). For the years 1989–1992 and 2003, biological samples were attributed to a gear retrospectively, by cross-referencing the sample to fish measurement records. In 2000, biological samples were measured to the mm below, but this protocol was subsequently amended to the cm below to make these data compatible with all other data.

Table 4: Taxa recorded for each year of the survey, with their taxonomic hierarchy, shown as the % occurrence (number of stations in which the species occurred / total number of stations). Blank = not recorded, '1' = <10%, '2' = 10–39%, '3' = 40–59%, '4' = >60%. Their minimum (Lmin) and maximum (Lmax) lengths recorded for the survey and the zone that the species occupies (P=pelagic, D=demersal, B=benthic) are also shown. The identification of species denoted * may be questionable, refer to Section 9 for further explanation.

Family	Common name	Scientific name		Lmin (cm)	Lmax (cm)	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Squalidae	Spurdog	*Squalus acanthias*	BP	27	75	1	1		1	1	1	1		1	1			1		1					1		1	
Scyliorhinidae	Lesser-spotted dogfish	*Scyliorhinus canicula*	D	5	74	3	4	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Greater-spotted dogfish	*Scyliorhinus stellaris*	D	22	104								1	1	1	1	1		1				1	1	1	1		1
Triakidae	Starry smooth-hound	*Mustelus asterias*	D	26	98		1	1	1	1	1	1		2	2	1	1		1	1	1	1	1	1	1		2	1
Torpedinidae	Marbled electric ray	*Torpedo marmorata*	D	28	50							1		1														
	Common electric ray	*Torpedo nobiliana*	D	32	32																			1				
Rajidae	Cuckoo ray	*Leucoraja naevus*	D	22	66	1		1										1						1				
	Blonde ray	*Raja brachyura*	D	20	107	1	1	1	1		1	2	1	1	1	1	1	1		1		1	1	1	1	1	1	1
	Thornback ray	*Raja clavata*	D	11	88	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	Small-eyed ray	*Raja microocellata*	D	27	88				1	1			1	1	1	1	1	1		1	1	1	1	1		1	1	
	Spotted ray	*Raja montagui*	D	20	68	3	2	3	2	2	2	2	2	2	2	2	2	2	1	2	1	1	2	1	2	2	2	2
	Undulate ray	*Raja undulata*	D	26	97	1	1	1	1	1	1		1	1	1	1	1	1		1	1						1	
Dasyatidae	Stingray	*Dasyatis pastinaca*	D	55	61													1										
Anguillidae	European eel	*Anguilla anguilla*	D	35	99								1					1	1	1		1		1				
Congridae	European conger eel	*Conger conger*	D	58	122	1						1			1											1		1
Clupeidae	Pilchard	*Sardina pilchardus*	P										1		1													
	Sprat	*Sprattus sprattus*	P	12	28		1			1				1	1					1			1	1		1	1	1
Engraulidae	European anchovy	*Engraulis encrasicolus*	P								1																	
Gadidae	Atlantic cod	*Gadus morhua*	D	39	71	1			1					1	1	1	1	1	1				1	1	1	1	1	1
	Haddock	*Melanogrammus aeglefinus*	D	24	51							1											1		1	1	2	2
	Whiting	*Merlangius merlangus*	D	6	53	2	2	3	3	2	2	2	2	3	2	2	2	2	2	2	2	2	2	3	3	2	3	2
	Blue whiting	*Micromesistius poutassou*	BP	23	30			1							1	1				1	1		1	1	1		1	
	Pollack	*Pollachius pollachius*	D	30	70		1	1	1			1	1					1					1	1				
	Norway pout	*Trisopterus esmarki*	D	3	4	1															1						1	

Table 4: continued

Family	Common name	Scientific name		Lmin (cm)	Lmax (cm)	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Gadidae	Bib	*Trisopterus luscus*	D	5	44	2	3	3	2	2	2	2	2	4	3	2	2	2	2	2	1	2	2	2	3	2	3	2
	Poor cod	*Trisopterus minutus*	D	6	23	3	4	4	4	4	4	4	4	4	4	4	4	4	3	4	3	4	4	4	4	4	4	3
Lotidae	Five-bearded rockling	*Ciliata mustela*	D	9	15		1							1					1	1		1		1		1	1		
	Four-bearded rockling	*Enchelyopus cimbrius*	D	18	28				1		1	1			1	1		1										
	Three-bearded rockling	*Gaidropsarus vulgaris*	D	21	37		1										1	1			1						1	1
	Common ling	*Molva molva*	D	33	98	1	1		1		1				1							1		1					
Phycidae	Greater forkbeard	*Phycis blennoides*	D	16	17														1									
Merluccidae	European hake	*Merluccius merluccius*	D	24	54		2	1		1	1		1				1	1	1			1	1		2	1		
Lophiidae	Black-bellied anglerfish	*Lophius budegassa*	D	42	77	1																		1	1			
	Anglerfish	*Lophius piscatorius*	D	12	110	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	3	2	2	3	4	4	4
Gobiesocidae	Small-headed clingfish	*Apletodon microcephalus*	D	3	3														1									
	Two-spotted clingfish	*Diplecogaster bimaculata*	D	2	4										1		1		2		2							
Atherinidae	Sand smelt	*Atherina presbyter*	P																	1								
Scomberesocidae	Saury pike	*Scomberesox saurus*	P	30	33		1																			1		
Belonidae	Garfish	*Belone belone*	P	11	60	1	1	1			1	1			1	1	1	1		1	1		1	1	1	1	1	
Zeidae	John Dory	*Zeus faber*	D	2	45	2	1	2	2	3	2	1	1	2	2	2	2	3	2	2	2	2	2	2	3	2	2	2
Gasterosteidae	Three-spined stickleback	*Gasterosteus aculeatus*	D	4	4													1										
Syngnathidae	Snake pipefish	*Entelurus aequoreus*	P																					1				
	Greater pipefish	*Syngnathus acus*	D	13	42	1	1	1	1	1	1	2	1	1	1	2	1	1	2	1	1	1	1	1	1	1	1	1
	Nilsson's pipefish	*Syngnathus rostellatus*	D																								1	
	Sea-horse	*Hippocampus* spp.	D																						1	1		
Triglidae	Red gurnard	*Chelidonichthys cuculus*	D	1	53	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Tub gurnard	*Chelidonichthys lucerna*	D	8	55	1	2	1	2	2	2	2	2	2	2	2	2	2	2	3	2	2	3	3	4	3	4	3
	Long-finned gurnard	*Chelidonichthys obscurus*	D	19	27																	1			1	1	1	1
	Grey gurnard	*Eutrigla gurnardus*	D	7	39	2	3	2	3	2	4	3	3	2	2	3	3	3	2	2	2	3	2	2	2	3	3	3
	Streaked gurnard	*Trigloporus lastoviza*	D	5	29	1	1	1	1	1	1	1	1	1	1	1	1				2	1	1	1	1		1	1

Table 4: continued

Family	Common name	Scientific name		Lmin (cm)	Lmax (cm)	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Agonidae	Pogge	*Agonus cataphractus*	D	4	17	2	2	2	2	3	3	3	3	2	2	3	2	3	3	2	4	2	3	2	2	2	2	2
Liparidae	Common sea-snail	*Liparis liparis*	D	4	4																1							
Moronidae	European sea-bass	*Dicentrarchus labrax*	BP	26	63				1			1				1	1			1		1	1			1		1
Carangidae	Horse mackerel	*Trachurus trachurus*	P	4	28	1				2	2	1		1	2	1	1	2	1	2	1	1	2	2	2	1	2	1
Sparidae	Gilthead sea-bream	*Sparus auratus*	D	5	5											1												
	Black sea-bream	*Spondyliosoma cantharus*	D	4	19	1			1	1	1	1	1	1	1	2	1		1	2	2	2	2	1		1	2	
Mullidae	Red mullet	*Mullus surmuletus*	D	5	40	3	2	2	2	2	2	2	2	2	2	2	3	4	2	3	2	3	4	3	2	2	3	2
Cepolidae	Red bandfish	*Cepola rubescens*	D	32	67	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	2
Labridae	Goldsinny wrasse	*Ctenolabrus rupestris*	D	8	14		1		1	1	1	1			1	1	1	1	1	1	1		1	1	1	1	1	1
	Cuckoo wrasse	*Labrus mixtus*	D	22	22				1						1								1					
	Corkwing wrasse	*Symphodus melops*	D	5	7										1				1								1	
	Wrasses	Labridae (indet.)	D	10	13																	1						
Pholidae	Butterfish	*Pholis gunnellus*	D	6	6																1					1		
Ammodytidae	Sandeels	Ammodytidae (indet.)	BP	9	39	2	2	1		2	2	1	1		1	1	1	2	2	1	1	1	2	1	2	1	1	1
Trachinidae	Lesser weever fish	*Echiichthys vipera*	D	8	17	2	1	2	2	2	3	3	3	2	2	2	2	3	2	3	2	2	2	2	2	3	2	2
	Greater weever fish	*Trachinus draco*	D	23	40				1	1	1							1	1				1			1		1
Blennidae	Butterfly blenny	*Blennius ocellaris*	D	4	16	1	1		1	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
Callionymidae	Common dragonet	*Callionymus lyra*	D	3	29	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Spotted dragonet	*Callionymus maculatus*	D	4	14							1	1	1	1	2	1	2	1		2	1	1		1	1	1	
	Reticulated dragonet	*Callionymus reticulatus*	D	4	10								1		1	1	1		1		2							
Gobiidae	Jeffrey's goby	*Buenia jeffreysii*	D	3	10														1		1							
	Black goby	*Gobius niger*	D	9	14												1	1	1						1	1		
	Rock goby	*Gobius paganellus*	D	8	9																1							
	Gobies	*Gobius* spp.	D	10	12												2						1	1			1	
	Fries's goby	*Lesueurigobius friesii**	D	6	10																1							
	Sand gobies	*Pomatoschistus* spp.*	D	2	10				1		1	1	2		2	2	1	2	2	2	3	2	2	2	2	2	2	2

Table 4: continued

Family	Common name	Scientific name		Lmin (cm)	Lmax (cm)	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Scombridae	Mackerel	*Scomber scombrus*	P	25	37											1					1				1		1	1
Caproidae	Boarfish	*Capros aper*	BP	8	9	1			1	1	1	1		1		1					1				2	1	1	1
Scophthalmidae	Megrim	*Lepidorhombus whiffiagonis*	D	25	48	1	1				1		1			1							1				1	2
	Norwegian topknot	*Phrynorhombus norvegius*	D	4	10	2	2	1	2	2	2	2	2	2	2	2	1	2	2	1	2	1	2		2	1	1	1
	Turbot	*Scophthalmus maximus*	D	25	74	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2
	Brill	*Scophthalmus rhombus*	D	17	67	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	Ekström's topknot	*Phrynorhombus regius*	D	5	12							1		1	1	1	1	1		1	1				1	1		1
	Common topknot	*Zeugopterus punctatus*	D	12	12				1							1				1			1	1	1	1		
Bothidae	Imperial scaldfish	*Arnoglossus imperialis**	D	10	24						1	2	2	2	2	2	2	2	3	4	2	2	2	2	2	2	2	2
	Scaldfish	*Arnoglossus laterna**	D	2	30	3	3	3	4	4	4	4	4	4	4	3	4	4	3		4	4	4	4	4	4	4	4
Pleuronectidae	Dab	*Limanda limanda*	D	4	39	3	3	3	3	3	3	3	3	3	3	3	3	4	3	3	2	3	3	2	3	3	3	3
	Lemon sole	*Microstomus kitt*	D	11	46	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	2	3
	Flounder	*Platichthys flesus*	D	23	41					1		1	1		1	1	1	1		1			1	1		1	1	1
	European plaice	*Pleuronectes platessa*	D	7	68	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Soleidae	Solenette	*Buglossidium luteum*	D	3	15	3	3	2	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3
	Thickback sole	*Microchirus variegatus*	D	3	21	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Sand sole	*Pegusa lascaris*	D	14	37	1	1	1	1		1	1	1	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2
	Sole	*Solea solea*	D	11	53	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Crustacea	European lobster	*Homarus gammarus*	D	6.1	15.3		1		1				1	1	1	1						1			1	1	1	
	Spiny spider crab	*Maja brachydactyla*	D	6.3	18.0	2	2	2	3	3	3	3	4	4	3	3	3	4	4		4		4	4	4	3	4	4
	Edible crab	*Cancer pagurus*	D	5.7	23.9	2	2	3	3	2	2	3	2	3	3	3	3	3	2	3	3	2	2	3	4	3	4	3
Bivalvia	Great scallop	*Pecten maximus*	D	2	15	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	4	3
Cephalopoda	Common cuttlefish	*Sepia officinalis*	D	2	25	3	4	2	3	4	2	4	4	4	4	4	2	4	4	4	4	4	4	4	4	4	4	4
	Squids	Loliginidae	BP	3	43	2	2	2	3	3	3	1	2	3	2	2	1	2	2	2	2	2	3	2	2	2	2	2

7.4 Epibenthic data

Although data on non-commercial invertebrates are not collected routinely on FV *Carhelmar*, conducting the survey on RV *Corystes* allowed for the epibenthic bycatch to be sorted and identified in 2002 and 2003. Many of the marine invertebrates recorded in the beam trawl catches in the study area (Table 5) are widespread along the southern and western waters of the British Isles (see Kaiser *et al.*, 1999; Ellis *et al.*, 2000, 2002; Ellis and Rogers, 2004). There were, however, some noteworthy records, as detailed below.

The fan mussel *Atrina fragilis* (Bivalvia; Pinnidae) is rare in British waters and is a species of nature conservation importance, being protected on the Wildlife and Countryside Act (WCA) and a priority species for the UK Biodiversity Action Plan (BAP). A single specimen was observed at prime station D5 in 2003. Pink sea-fan *Eunicella verrucosa* (Cnidaria; Gorgonacea) is also of conservation interest (Hiscock *et al.*, 2010), protected on the WCA and a BAP species. Although not recorded in the survey grid in 2002 and 2003, occasional sea-fans were encountered in the 2003 survey at additional sampling sites on the grounds west of Start Point.

The tube-forming polychaete *Serpula vermicularis* (Serpulidae) is widespread in UK waters. Although observed frequently on Cefas beam trawl surveys, this encrusting species was not typically recorded during surveys examining the epibenthic bycatch, because it is most often found as individual tubes on broken shells and rocks. However, large aggregations of *S. vermicularis* (Figure 10) were encountered at prime station B1 in both 2002 and 2003. These large aggregations, which were also described in the area by Gosse (1877) as *Serpula contortuplicata,* may not form the complex reef habitats that may be encountered in certain Scottish sea lochs (e.g. Poloczanska *et al.*, 2004), but are nevertheless an interesting feature of the grounds.

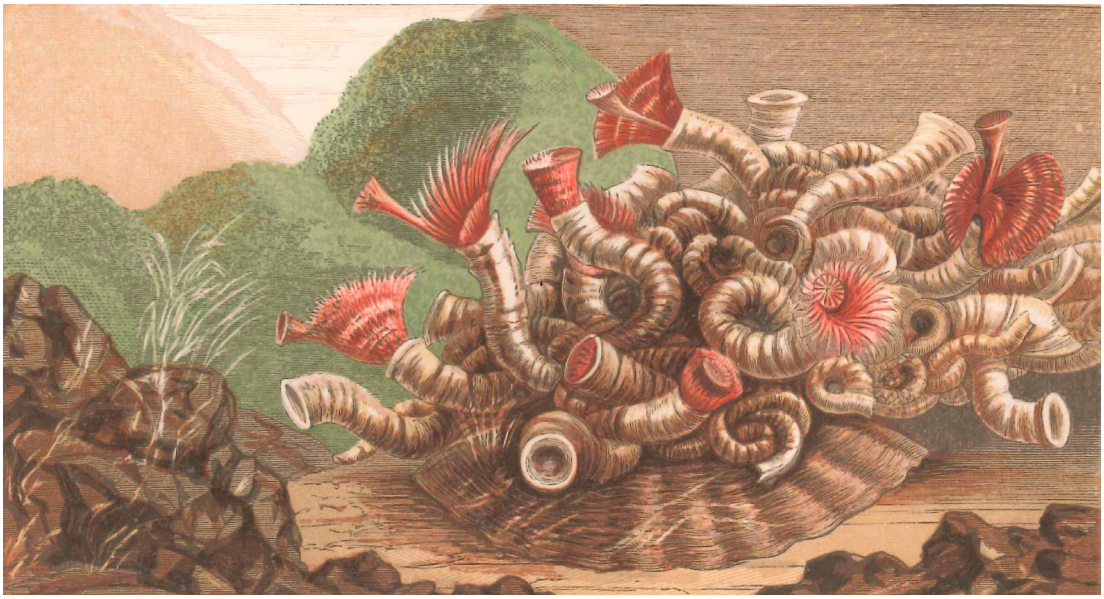
The anemone *Paraphellia expansa* (Cnidaria; Hormathiidae) is a little known sea anemone. Although frequently encountered in the Celtic Sea (Ellis *et al.*, 2002), it was also observed at prime stations L3 (2002) and M1 (2003) and was also reported at two additional trawl stations (Y1 and Y4) west of Start Point in 2003. The thumbnail crab *Thia scutellata* (Crustacea; Brachyura) is reported infrequently in British seas, likely because of its specialised habitat requirements (Rees, 2001) and single individuals were recorded at prime stations I4 (2002) and M3 (2003). *Lutraria angustior* (Bivalvia; Mactridae) is also a relatively infrequent find in UK waters, being generally caught off southwestern coasts (Holme, 1959), and single individuals were reported at prime stations I3 and G6 in 2003.

Table 5: Taxonomic list of invertebrates recorded in the survey area, as recorded on RV *Corystes* in 2002/2003.

Higher taxa	Taxa recorded
Porifera	Porifera (indet.)
	Suberites spp.
Cnidaria	Hydrozoa (indet.)
	Alcyonium digitatum
	Caryophyllia smithii
	Epizoanthus incrustatus
	Zoanthidea (indet.)
	Anemone (indet.)
	Urticina felina
	Metridium senile
	Calliactis parasitica
	Adamsia carciniopados
	Paraphellia expansa
Polychaeta	*Aphrodita aculeata*
	Hermione hystrix
	Chaetopterus spp.
	Hyalinoecia tubicola
	Sabellaria spinulosa
	Serpula vermicularis
Cirripedia	*Scalpellum scalpellum*
Isopoda	*Idotea baltica*
Decapoda (Natantia)	*Palaemon serratus*
	Alpheus glaber
	Processa spp.
	Pandalina brevirostris
	Crangon allmanni
	Pontophilus spinosus
Decapoda (Anomura)	*Upogebia deltaura*
	Anapagurus laevis
	Pagurus bernhardus
	Pagurus prideaux
	Galathea spp.
	Pisidia longicornis
Decapoda (Brachyura)	*Ebalia tuberosa*
	Ebalia tumefacta
	Eurynome aspera
	Hyas coarctatus
	Inachus dorsettensis
	Inachus leptochirus
	Macropodia linaresi
	Macropodia rostrata
	Macropodia tenuirostris
	Corystes cassivelaunus
	Atelecyclus rotundatus
	Thia scutellata
	Carcinus maenas
	Liocarcinus depurator
	Liocarcinus holsatus
	Liocarcinus marmoreus
	Liocarcinus pusillus
	Necora puber
	Polybius henslowi
	Pilumnus hirtellus
	Goneplax rhomboides
Pycnogonida	*Pycnogonum littorale*
Scaphopoda	*Antalis* spp.
Gastropoda	*Diodora graeca*
	Callliostoma zizyphinum
	Turritella communis
	Epitonium clathrus
	Aporrhais pespelecani
	Crepidula fornicata
	Simia patula
	Polinices polianus
	Polinices catena
	Ocenebra erinacea
	Buccinum undatum
	Colus gracilis
	Hinia reticulata
	Scaphander lignarius
	Philine aperta
	Pleurobranchus membranaceous
	Archidoris pseudoargus
	Tritonia hombergi
	Nudibranchia (indet.)
Bivalvia	*Nucula sulcata*
	Glycymeris glycymeris
	Mytilus edulis
	Atrina fragilis
	Aequipecten opercularis
	Astarte sulcata
	Arctica islandica
	Acanthocardia spp.
	Laevicardium crassum
	Chamelea gallina
	Clausinella fasciata
	Timoclea ovata
	Spisula elliptica
	Lutraria angustior
	Lutraria lutraria
	Abra spp.
	Ensis siliqua
	Phaxas pellucidus
	Corbula gibba
Bryozoa	*Flustra foliacea*
	Chartella spp.
	Cellaria spp.
	Bugula spp.
	Pentapora fascialis
	Alcyonidium diaphanum
	Alcyonidium parasiticum
Echinodermata	*Astropecten irregularis*
	Luidia ciliaris
	Luidia sarsi
	Anseropoda placenta
	Crossaster papposus
	Henricia oculata
	Asterias rubens
	Marthasterias glacialis
	Ophiura albida
	Ophiura ophiura
	Ophiothrix fragilis
	Echinus esculentus
	Psammechinus miliaris
	Echinocyamus pusillus
	Echinocardium cordatum
	Spatangus purpureus
	Holothuroidea (indet.)
Ascidiacea	Ascidiacea (indet.)
	Botryllus schlosseri

Figure 10: Aggregations of *Serpula vermicularis* showing (a) the aggregations described in the area by Gosse (1877), (b) samples observed in the northwestern parts of Lyme Bay on RV *Corystes*.

a)



b)

8. Analysis of survey catch data

The limitations associated with inconsistent data collection for the various species over the time-series (as discussed in Section 7.2) dictates how the catch data can be analysed, as follows:

- If a species was consistently measured or counted at the majority of stations (nearly all) each year, it is possible to show spatial distributions and time-series trends as standardised catch numbers per unit effort. Length distributions are also provided.
- A number of species were predominantly counted or measured, but not on every occasion. Hence, for such species, the use of catch numbers and length frequency data are maximised by including as many data as possible based on defined selection criteria (see below).
- If a species was predominantly observed only, then it was only possible to record the proportion of occurrence.

A detailed description of the types of analysis performed on each data category are discussed further and summarised for each species in Table 6, together with an indication of any data that were omitted or not presented (e.g. because the sample size was deemed too small, i.e. <20 individuals).

Nine species of fish considered to be primarily pelagic (pilchard, sprat, anchovy, sand-smelt *Atherina presbyter*, garfish *Belone belone*, saury pike *Scomberesox saurus*, snake pipefish *Entelurus aequoreus*, horse mackerel and mackerel) were excluded from the analyses, because they are not considered to be sampled effectively by a beam trawl.

Data category A (plaice and sole)

As the prime focus of the survey has always been sole and plaice, more detailed analyses, by age and/or sex, are presented here. For these species the following analyses of the data are provided:

(a) Spatial distributions by age: shown as the average relative abundance (mean number caught per 30 min tow, for all years) at prime stations. Numbers corrected to the deployment of two beam trawls at a station. Data for plaice are provided by sex.
(b) Length frequency distributions, shown as the total numbers of fish caught by 1 cm length groups. Numbers caught at each station are standardised to numbers per 30 min tow, corrected to the deployment of two beam trawls at a station.
(c) Mean length at age by sex, derived from the biological sample data for all years.
(d) Temporal trends in relative abundance, shown as the mean number of total fish caught per 30 min tow (with numbers corrected to the deployment of two beam trawls at a station), and frequency of occurrence (% of occasions that a species was recorded) per year.
(e) Temporal trends in relative abundance by age, and the relationship of age groups to older age groups in the following year(s).

To obtain information on the numbers caught annually at age, variable stratified age-length data (consistent with annual biological sample collections as discussed in Section 7.3) were applied to the catch by grouping fish into 2 cm length groups (0–1 cm, 2–3 cm, etc). As age data for fish caught by 2 cm length groups and strata were not always available, the analyses proportionally assigned those fish caught to the adjacent 2 cm length groups (above and below). When adjacent length groups also lacked age information, ages were either seeded to assign an age based on length, or excluded if no definitive age could be derived. Station-based age-length keys were applied to obtain numbers at age by station and summed to annual age compositions.

Data category B (mostly other commercial fish species)

This category consisted of 42 (mainly commercial) species sampled in the survey that were either measured or counted at >90% of the total hauls, and were rarely merely observed. For years that a species was encountered, abundance data for that year were excluded if the species was observed at >10% of the stations. Similarly, length data for a given year were excluded for that year if the number of stations at which the species was measured was <80%. If the species was measured at <50% of the stations, then no length distribution data are provided.

For these species the following analyses of the data were provided:

(a) Spatial distributions, shown as the average relative abundance (mean number caught per 30 min tow, for all years) at prime stations, with numbers corrected to the deployment of two beam trawls at a station.
(b) Temporal trends in relative abundance, shown as the mean number of fish caught per 30 min tow (numbers corrected to the deployment of two beam trawls at a station), and frequency of occurrence (% of occasions that a species are recorded) per year.

Table 6: A summary of the type of analyses performed on the data, the corresponding data category (refer to text) and any data exclusions. *Denotes that data for low numbers of fish are available but not presented in the report.

		Analyses presented for:						Exclude data for years, applicable to analysis by:			
Common name	Data category	Age	Distribution by number	Distribution by incidence	Trend by number	Trend by incidence	Length distribution	Incidence	Abundance	Length	Comment
Spurdog	B		✔		✔	✔	✔				
Lesser-spotted dogfish	B		✔		✔	✔	✔		91, 92	91, 92	
Greater-spotted dogfish	B		✔		✔	✔	✔				
Starry smooth-hound	B		✔		✔	✔	✔		91, 05	91, 92, 03, 05	
Marbled electric ray	D			✔							
Common electric ray	D			✔							
Cuckoo ray	B		✔		*	*	*				
Blonde ray	B		✔		✔	✔	✔				
Thornback ray	B		✔		✔	✔	✔				
Small-eyed ray	B		✔		✔	✔	✔				
Spotted ray	B		✔		✔	✔	✔				
Undulate ray	B		✔		✔	✔	✔			03	
Stingray	D			✔							
European eel	B		✔		*	*	*				
European conger eel	B		✔		*	*	*				
Pilchard	n/a										
Sprat	n/a										
European anchovy	n/a										
Atlantic cod	B		✔		✔	✔	✔				
Haddock	B		✔		✔	✔	✔				
Whiting	B		✔		✔	✔	✔		93, 98	93, 98	
Blue whiting	B		✔		*	*	*			99	
Pollack	B		✔		*	*	*				
Norway pout	D			✔							
Bib	C			✔		✔					
Poor cod	C			✔		✔					
Five-bearded rockling	D			✔							
Four-bearded rockling	D			✔							
Three-bearded rockling	D			✔							
Common ling	B		✔		*	*	*				
Greater forkbeard	D			✔							
European hake	B		✔		✔	✔	✔				
Black-bellied anglerfish	D			✔							

Table 6: continued.

Common name	Data category	Analyses presented for: Age	Distribution by number	Distribution by incidence	Trend by number	Trend by incidence	Length distribution	Exclude data for years, applicable to analysis by: Incidence	Abundance	Length	Comment
Anglerfish	B		✔		✔	✔	✔				
Small-headed clingfish	D			✔							
Two-spotted clingfish	D			✔							
Sand smelt	n/a										
Saury pike	n/a										
Garfish	n/a										
John Dory	B		✔		✔	✔	✔				
Three-spined stickleback	D			✔							
Snake pipefish	n/a										
Greater pipefish	C			✔		✔					
Nilsson's pipefish	D			✔							
Sea-horse	D			✔							
Red gurnard	B		✔		✔	✔	✔		91, 92, 98, 01	91, 92, 98, 01, 03	
Tub gurnard	B		✔		✔	✔	✔			03	
Long-finned gurnard	B		✔		✔	✔	✔				
Grey gurnard	B		✔		✔	✔	✔		92, 98, 01	91, 92, 01, 03	
Streaked gurnard	B		✔		✔	✔	✔		98, 06	92, 98, 06	
Pogge	C			✔		✔					
Common sea-snail	D			✔							
European sea-bass	B		✔		✔	✔	✔				
Horse mackerel	n/a										
Gilthead sea-bream	D			✔							
Black sea-bream	B		✔		✔	✔	✔		93, 95, 98	92, 93, 95	
Red mullet	B		✔		✔	✔	✔				
Red bandfish	C			✔		✔					
Goldsinny wrasse	C			✔		✔					
Cuckoo wrasse	D			✔							
Corkwing wrasse	D			✔							
Wrasses	D			✔							
Butterfish	D			✔							
Sandeels	C			✔		✔					
Lesser weever fish	C			✔		✔					
Greater weever fish	D			✔							
Butterfly blenny	C			✔		✔					
Common dragonet	C			✔		✔					

Table 6: continued.

Common name	Data category	Analyses presented for: Age	Distribution by number	Distribution by incidence	Trend by number	Trend by incidence	Length distribution	Exclude data for years, applicable to analysis by: Incidence	Abundance	Length	Comment
Spotted dragonet	C			✔		✔					
Reticulated dragonet	C			✔		✔					
Jeffrey's goby	D			✔							
Black goby	D			✔							
Rock goby	D			✔							
Gobies	D			✔							
Fries's goby	D			✔							Questionable record
Sand gobies	C			✔		✔		<2001			Data inconsistent prior to 2001
Mackerel	n/a										
Boarfish	C			✔		✔					
Megrim	B		✔		*	*	*				
Norwegian topknot	C			✔		✔					
Turbot	B		✔		✔	✔	✔			03	
Brill	B		✔		✔	✔	✔				
Ekström's topknot	D			✔							
Common topknot	D			✔							
Imperial scaldfish	C			✔		✔		<1995, 2003			Questionable species separation of *A. imperialis* & *A. laterna*
Scaldfish	C			✔		✔		<1995, 2003			
Dab	B		✔		✔	✔	✔		92, 93, 98, 03	92, 93, 98, 03	
Lemon sole	B		✔		✔	✔	✔				
Flounder	B		✔		✔	✔	✔				
European plaice	A	✔	✔		✔	✔	✔				
Solenette	C			✔		✔					
Thickback sole	C			✔		✔					
Sand sole	B		✔		✔	✔	✔				
Sole	A	✔	✔		✔	✔	✔				
European lobster	B		✔		*	*	*				
Spiny spider crab	B		✔		✔	✔		03, 05	90, 91, 03, 05	All	Not recorded in 03, 05
Edible crab	B		✔		✔	✔	✔				
Great scallop	B		✔		✔	✔	✔		94, 01	93, 96-99, 01-04	
Common cuttlefish	B		✔		✔	✔			89, 91, 97, 98	All	
Squids	B		✔		✔	✔			91, 95, 98, 01, 06, 08, 10	All	

(c) Length frequency distributions, shown as the total numbers of fish caught by 1 cm length groups, with numbers caught at each station standardised per 30 min tow and corrected to the deployment of two beam trawls at a station.

Data category C (species inconsistently quantified)

This category (19 non-commercial species) were those observed on a significant number of occasions (>10% of the time). The analyses were based on their occurrence only, so showing the

(a) Spatial distribution, shown as the average frequency of occurrence (% of occasions that a species was recorded) by prime station.
(b) Occurrence trends, shown as the frequency of occurrence (%) at stations per year.

Data category D (incidental species)

For the remaining 28 non-commercial species observed over the survey period, analyses were restricted to showing their spatial distributions only, which are shown as the average frequency of occurrence at prime stations (% of occasions that a species was recorded).

9. Species distributions

This section of the report presents and discusses the main features of the species distributions. Plaice and sole are shown first, because they are the main species targeted, and a time-series of catch-at-age data is available for each. Following this, the distributions and other information for the other species considered are presented in taxonomic order.

European plaice (*Pleuronectes platessa*)

The distributions of female and male plaice were similar (Figure 11a and b). The 0-groups were restricted to stations off Teignmouth, although their abundance was variable from year to year. 1-group fish were also primarily encountered inshore, especially off Teignmouth and Dawlish, as well as in Start Bay. From the age of 2 years, fish were dispersed widely over the survey area, with low catches of 2- and 3-year-old fish south of Start Point.

Plaice were caught over a broad length range (7–68 cm), and two noticeable peaks in length frequency distributions were observed (7–13 cm and 27–40 cm) (Figure 11c). The maximum recorded length for a male was 44 cm, and above 31 cm the majority of fish caught were female; below 32 cm males were proportionally more abundant. Over the course of the survey time-series, the overall ratio of females to males was 1.3:1, but varied between 0.9:1 and 2.2:1 for individual years. Female plaice clearly grew faster than males (e.g. the average length of a 4-year old female was 38 cm, whereas that for a male was 33 cm) (Figure 11c). The maximum ages of males and females were 16 and 22 years, respectively.

On average, plaice were caught at 83% of the stations sampled each year, and this was relatively stable over the study period (70–93%). There were peaks in relative abundance in 1989, 1997, 2001, and more recently in 2010 and 2011 (Figure 11c). The two last years were particularly high, being more than twice the time-series average. Plaice aged 2 and 3 years were the dominant age groups, accounting for 53% of the total plaice catch.

The survey data were used to track recruitment pulses (Figure 11d), and the relationships between the abundance of age groups and older age groups in subsequent year(s) were examined. There was generally a good relationship between the abundance of 2- and 3-group fish with the abundance of fish caught in the following year(s). In some cases there were also positive relationships between the abundance of 1-group and older age-groups, but these relationships were generally less well correlated. Hence, it was concluded that the survey was not appropriate for sampling 0-group plaice, because they were only encountered at a small number of stations, although 1-groups were sampled relatively effectively.

Sole (*Solea solea*)

Similar to plaice, sole were also more abundant inshore (Figure 12a). 0-group fish were only caught in very low numbers and on the occasions that they were encountered, it was at the two inshore stations off Teignmouth. 1-group sole were also restricted to inshore stations and again were primarily encountered at stations close to the Teign and Exe estuaries. From an age of 2 years, sole, although most abundant inshore, were distributed across the whole survey area, with catches lower on the most offshore grounds.

Most sole were within the length range 22–39 cm, with an observed overall length range of 11–53 cm. Females were, on average, larger than the males at age (Figure 12b). Similar maximum ages were recorded for female and male sole (24 and 23 years, respectively).

Like plaice, sole were also frequently caught during the survey, being taken on average at 89% of the stations sampled each year (Figure 12b). Other than in 2004 (67% occurrence), sole were generally recorded at 79–97% of stations. The relative abundance of sole was quite variable, with peaks in relative abundance in 1991/92, 1997–2001 and 2007–2011 (Figure 12b).

On average, the sole catch was mostly of 2- and 3-year-old fish, 35% and 30% of the catch, respectively. On occasion it was possible to track high abundances of year groups from one year to the next, although this was not always the case (Figure 12c). For example, a peak in the 1-year-olds in 1990 was readily tracked through to peaks in the abundance of 2-, 3- and 4-year-olds in 1991–1993; in contrast, the relative abundance of 2-year-old sole in 2003, which corresponded to a peak in the 3-year-olds in the next year did not correspond to a peak in 1-year-olds in 2002 (which was even below the long-term average). The relationships between catch rates of 2- and 3-year-old fish corresponded well with older age classes in subsequent years. However, the abundance of 1-year-old sole did not appear to correlate well with older age classes and, as stated earlier, 0-year-olds were not sampled effectively. Overall, the survey was most effective for sampling sole 2–4 years old.

Sharks and dogfish (Squalidae, Scyliorhinidae and Triakidae)

Four species of dogfish were recorded during the time-series, the most numerous being the lesser-spotted dogfish *Scyliorhinus canicula*. Spurdog *Squalus acanthias*, greater-spotted dogfish *Scyliorhinus stellaris* and starry smooth-hound *Mustelus asterias* were also caught, but in much fewer numbers. There has been much confusion about the identification of *M. asterias* and common

smooth-hound *M. mustelus* (Farrell *et al*., 2009), so for the purposes of the present study, we have combined records for the two species (Appendix I).

Spurdog were only caught occasionally (Figure 13) because beam trawls do not catch them effectively. Although spurdog have traditionally been commercially important, other dogfish are of more limited commercial value.

Lesser-spotted dogfish were very abundant in every year of the survey and, on average, were caught at 73% of the stations fished. The relative abundance and frequency of occurrence increased slightly over time. They were generally more abundant farther offshore (Figure 14). Lesser-spotted dogfish were caught over a broad length range (5–74 cm), although catches of smaller fish (<30 cm) were low. There was no obvious difference in the length distributions of males and females. The larger greater-spotted dogfish was caught primarily on the grounds off Start Point and to the east of the survey grid (Figure 15).

Starry smooth-hound were also quite common and encountered in most years. The species was caught predominantly in the northeast part of the survey grid (Figure 16), and most of the specimens caught were juveniles.

For further information on the elasmobranch species listed above, see Ellis *et al*. (2005a, b). There were no records of angel shark *Squatina squatina* during the survey, although angel sharks were historically present in the study area (Garstang, 1903; Rogers and Ellis, 2000).

Electric rays (Torpedinidae)

Two species of electric ray occur in British waters: common electric ray *Torpedo nobiliana* and marbled electric ray *T. marmorata*. Both species were recorded rarely on this survey (Figure 17).

Skates (Rajidae)

Skates are an important group of commercial fish, and six species were reported during the survey. Just over half the skates caught were thornback ray (roker) *Raja clavata*, with spotted ray *Raja montagui* also common, accounting for a further 30% of the total skate catch. The remaining four species; cuckoo ray *Leucoraja naevus*, blonde ray *Raja brachyura*, small-eyed ray *Raja microocellata* and undulate ray *Raja undulata* were caught much less frequently, and each constituted between 1 and 5% of the overall skate species catch annually.

Blonde rays were generally encountered on the grounds in the southwest of the survey grid (Figure 18), and thornbacks (Figure 19) almost exclusively inshore in Lyme Bay, in particular at stations between Teignmouth and Exmouth. Small-eyed rays were encountered only inshore inside Lyme Bay (Figure 20). Spotted rays (Figure 21) were infrequent catches on the grounds where *R. clavata* was most abundant, but were widely distributed on grounds farther offshore, being taken at 81% of the stations (cf. 55% for thornback ray). Undulate rays were taken in the east of the survey grid (Figure 22) and cuckoo rays generally on grounds in the southwest of the survey grid (Figures 23).

The length distributions of thornback and spotted ray were similar, with most fish 20–50 cm long. Smaller (newly hatched) skates and larger fish were captured only rarely, a result that might reflect the lesser gear selectivity for such size classes.

The relative abundance of thornback rays was relatively stable over the time-series, but catches of spotted ray declined over the time-series. The lowest reported catches of the latter species were between 2004 and 2007, although catches have increased slightly very recently. There were no records of white skates *Rostroraja alba* being taken, although the species was historically caught in the area (Le Danois, 1913). For further information on the skates of the area, the reader is referred to Ellis *et al*. (2005a, b, 2011, 2012).

Stingrays (Dasyatidae)

The common stingray *Dasyatis pastinaca* was only reported once, when two fish were caught at the same station in 2001 (Figure 23).

Eels (Anguillidae and Congridae)

Two species of eel were recorded in the survey: the European eel *Anguilla anguilla* and the European conger eel *Conger conger*. Both species were caught in very low numbers (<10 in total for each species). European eels were recorded at two inshore stations just off the Teign Estuary (Figure 24a), with no reported incidences offshore, and conger eels in small numbers across the study area (Figure 24b). Both species are commercially important, with conger eel a species of interest for southwestern fleets.

Cod-like fish (Gadidae)

Fish of this family are mostly found in cool temperate waters, in both coastal and offshore regions, and although some species are of economic importance, their relative value to the VIIe fishery is more limited (Table 1).

Cod *Gadus morhua* (Figure 25) were caught mainly offshore, albeit in small numbers, and were encountered quite frequently (in 60% of the years). Most of the cod caught were 40–70 cm long. Haddock *Melanogrammus aeglefinus* were absent for most of the time-series but became more abundant from 2006, mainly off Start Point (Figure 26). Whiting *Merlangius merlangus* were caught every year, generally at about one-third of the stations (Figure 27). Whiting catches were greatest inshore in Lyme Bay, and catches were dominated by small fish (10–20 cm long).

Blue whiting *Micromesistius poutassou* (Figure 28a) were taken sporadically, mainly east of Start Point, and pollack *Pollachius pollachius* (Figure 28b) were caught mainly at offshore locations and in small numbers. Bib *Trisopterus luscus* were taken each year, throughout the survey area but only at about one-third of the stations in any one year (Figure 29).

Of the eight gadoid species caught during the survey, poor cod *Trisopterus minutus* was the most common (Figure 30). It was caught every year and, on average, at about 70% of the stations sampled. Both poor cod and bib

were widely distributed across the survey area. Norway pout *Trisopterus esmarki* were only caught sporadically (Figure 31; Southward and Mattacola, 1980), although the species is much more abundant farther west (Tidd and Warnes, 2006).

Rocklings and ling (Lotidae)

Within this family, three species of rockling, three-bearded rockling *Gaidropsarus vulgaris*, four-bearded rockling *Enchelyopus cimbrius* and five-bearded rockling *Ciliata mustela* (Figure 32), and common ling *Molva molva* (Figure 33) were recorded in the survey area. All were infrequent catches. It is unclear as to whether there was any confusion between *C. mustela* and the related northern rockling *Ciliata septentrionalis*.

Five-bearded rockling were encountered most often, mainly inshore, as were four-bearded rockling, whereas the larger three-bearded rockling was caught farther offshore. Common ling, which is commercially important on the fishing grounds in the west of the survey area, was only caught occasionally, usually in deeper water in the southwest of the survey grid.

Forkbeard (Phycidae)

Another cod-like species, the greater forkbeard *Phycis blennoides,* was rarely encountered during the survey, with just six individuals being caught at one station in 2002 (Figure 33). Although they are occasionally found in shallow water, they are usually found at depths of 100–350 m (Wheeler, 1978), where they can be encountered occasionally in large numbers. Greater forkbeard are edible but are not particularly important for the fisheries of southwest England.

Hakes (Merlucciidae)

Hakes are also cod-like fish, and a single species, European hake *Merluccius merluccius,* is found in shelf seas around the British Isles. They can attain a length of >120 cm, and are valued as a food fish. During winter and spring, hake live in deeper water (165–550 m), but they then migrate to shallower water where they are caught generally during summer (Wheeler, 1978). Hake were encountered routinely in the survey, in about half the years. When they were caught, however, they were in relatively low numbers (survey total, n = 64) and were mostly small (29–44 cm). Although sparsely distributed across the survey area, their overall average abundance was greatest at stations in the west of the survey grid (Figure 34). Hake are much more abundant farther west (Tidd and Warnes, 2006).

Anglerfish (Lophiidae)

Anglerfish (or monkfish) are a very important component of the VIIe fishery (Table 1), and two species were caught during the survey; anglerfish *Lophius piscatorius* and black-bellied anglerfish *L. budegassa*. The former species was the more common (Figure 35), whereas the latter was only rarely recorded (Figure 36), because it generally inhabits deeper water farther offshore (Wheeler, 1978).

Although a broad length range of anglerfish was observed (12–110 cm), most of the specimens were 15–60 cm long. Smaller fish (<30 cm) were caught throughout the study area, including the more inshore stations, whereas larger anglerfish (≥30 cm) were primarily on the deeper grounds in the southwest of the study area. On average, anglerfish were encountered at ~30% of the stations fished each year, and their abundance as well as their occurrence has increased in recent years, part of which may be attributed to there being a large cohort of smaller anglerfish in some of these years.

Clingfish (Gobiesocidae)

Clingfish are small-bodied and generally live close to shore. They are cryptic species with a strong ventral sucker (associated with modified pelvic fins), so they are often found clinging onto, for example, empty bivalve shells and rocks. Hence, they are not sampled effectively by larger trawls and are easily overlooked while sorting trawl catches. There are four species in British waters, of which two were recorded in this survey. Two-spotted clingfish *Diplecogaster bimaculata* were most frequently encountered, but were still only observed in four years, two of which were when all species were sorted when the survey was conducted on RV *Corystes*. They were caught mainly to the east of Lyme Bay (Figure 37). Two specimens of the small-headed clingfish *Apletodon microcephalus* were also caught, at the same inshore location in 2002, one of the years during which RV *Corystes* conducted the survey.

John Dory (Zeidae)

John Dory *Zeus faber* is a predatory species with protrusible jaws that can be found inshore in small groups (Wheeler, 1978). It was caught every year of the survey and was distributed throughout the area, but was most abundant inshore in Lyme Bay (Figure 38). They were caught in low but variable numbers each year, on average at 26% of the stations fished. Several peaks in the length frequency distribution were noted: 2–12 cm, 16–30 cm and 33–37 cm. The John Dory is an excellent food fish and usually commands a good market price.

Stickleback (Gasterosteidae)

Of the three species of stickleback in British waters (Wheeler, 1978), three-spined stickleback *Gasterosteus aculeatus* was the only species reported during the survey. Although it is essentially a freshwater species, it can tolerate saltwater conditions to a limited extent, and was observed once (2001) at a station east of Lyme Bay (Figure 39).

Pipefish and sea-horses (Syngnathidae)

The most commonly encountered pipefish species in the survey was greater pipefish *Syngnathus acus*, which like most other species of pipefish, is usually found inshore. Greater pipefish were reported in each year of the survey, and were more frequently encountered inshore close to Teignmouth and Sidmouth (Figure 39), where they may associate with algae and hydroids. Farther offshore the species was either sparse or absent. There were occasional reports of Nilsson's pipefish *Syngnathus rostellatus* and

sea horse *Hippocampus* spp. (Figure 40), and these were also at inshore stations. There was one observation of snake pipefish *Entelurus aequoreus* (in 2007, Table 4), and this pelagic/oceanic species has recently increased in abundance around the UK (Harris *et al.,* 2007).

Gurnards (Triglidae)

Five species of gurnard were encountered in the survey, all are of some commercial value, and large specimens are often landed. The largest species of gurnard, the tub gurnard *Chelidonichthys lucerna*, was caught throughout the survey area, although its abundance was greatest inshore (Figure 41). Tub gurnards were caught mainly in the length range 25–38 cm and have shown a steady increase in relative abundance over the period of the survey.

Both red *Chelidonichthys cuculus* and grey gurnard *Eutrigla gurnardus* were caught in large numbers, with red gurnard the more abundant and widely distributed. There was a clear difference in the distribution of the two species; red gurnard being caught predominantly offshore (Figure 42) and grey gurnard mainly inshore (Figure 43). The abundance and incidence of both species remained relatively consistent over the time-series. There were, however, two notable peaks in length frequency for both red (8–15 cm and 18–30 cm) and grey gurnard (8–15 cm and 17–25 cm).

The streaked gurnard *Trigloporus lastoviza* was caught rarely, and when they were, catches were mainly inshore near Sidmouth and Lyme Regis (Figure 44). Distinguished by its elongate second dorsal fin spine, the long-finned gurnard *Chelidonichthys obscurus* was caught in 2005 and 2008–2011, albeit in low numbers, and at just four stations relatively close to each other (J4, M1, M5, P2; Figure 45). This species is considered to be rare in UK waters, at the northern limit of its distribution (Wheeler, 1978). All specimens of long-finned gurnard were ≥19 cm.

Pogge (Agonidae)

The pogge *Agonus cataphractus* is a small demersal species covered in scutes that is very common inshore, particularly farther north. Pogge were caught at most stations (86%), but were less frequently taken farther offshore (Figure 46) and totally absent from stations in deep water. On average, pogge were caught at 40% of the stations sampled each year.

Sea-snails (Liparidae)

Sea-snails are small species of fish that live inshore, but are more abundant farther north (Wheeler, 1978). Of the two species known from UK coastal waters, the common sea-snail *Liparis liparis* was observed in just one year (2004, Table 4) at two stations southeast of Lyme Bay (Figure 47). As do clingfish, sea-snails can adhere to shells and rocks, and these small cryptic species can easily be overlooked when processing trawl catches.

Sea-bass (Moronidae)

The European sea-bass *Dicentrarchus labrax* is a high-value food fish and a very important component of the VIIe fishery (Table 1). In 2011, about half of the VIIe total bass catch, by value, was caught by pair trawl and rod and line, followed by gillnet and otter trawl. The species is not captured effectively by beam trawl, so the total number of fish caught in this survey was low (Figure 48), generally inshore, especially just off the Teign Estuary.

Sea-breams (Sparidae)

Two species of sea-bream were caught during the survey; black *Spondyliosoma cantharus* and gilthead *Sparus auratus*. Black sea-bream were encountered more regularly, although in relatively small numbers. They were caught in most years, on average at 6% of the stations, mainly east of Lyme Bay and virtually none elsewhere. They were caught in two cohorts (4–10 cm and 14–19 cm, Figure 49). Only one gilthead sea-bream was caught, in Start Bay in 1999 (Figure 50). All large sea-breams are commercially valuable, and they are most often landed in gillnet fisheries.

Red mullets (Mullidae)

The red mullet *Mullus surmuletus* is also a valued food fish, and it was encountered frequently during the survey. They were caught every year, on average at 37% of the stations. The numbers of red mullet caught were relatively stable too, although there were notable peaks in abundance for some of the years between 1999 and 2006. Two distinct size categories were apparent (5–15 cm and >18 cm). Red mullet were caught at every station during the survey, but were more abundant inshore (Figure 51).

Red bandfish (Cepolidae)

The little-studied red bandfish *Cepola rubescens* has a wide biogeographic range in European waters, but is often locally abundant in certain areas, perhaps because it requires specific habitats (Atkinson *et al.,* 1977). Although it was only encountered occasionally (on average at 5% of the stations each year), it was recorded in all years except 2004. Within the survey area, the distribution of red bandfish was very localised, and all catches were made in northwestern Lyme Bay (Figure 52).

Wrasse (Labridae)

Wrasses are a large group of inshore fish, and there are eight species in northern Europe (Wheeler, 1978). Three species were recorded during the survey, but they are of little economic value to the VIIe fishery. The most commonly encountered species was goldsinny wrasse *Ctenolabrus rupestris* (which was caught in about 75% of years). On average, they were caught at ~3% of stations, mainly offshore south of Start Point (Figure 53).

Cuckoo wrasse *Labrus mixtus* and corkwing wrasse *Symphodus melops* were also encountered, but only rarely (Figure 54). In 2005, however, there were two occasions that wrasse were caught but not identified to species. There were no records of Baillions wrasse *Symphodus bailloni*, although the species has been reported increasingly in the eastern English Channel (Dunn and Brown, 2003).

Butterfish (Pholidae)

The butterfish *Pholis gunnellus* is a relatively small species of fish which usually inhabits rocky seabed close to shore.

It is relatively common around the coast of the British Isles but less so to the south, so it is probably at the southern limit of its distribution in the survey area (Wheeler, 1978). Butterfish were observed on two occasions inshore in Lyme Bay (Figure 55).

Sandeels (Ammodytidae)

The identification of sandeels is often problematic, so all records for sandeels were combined for this study. They were caught in nearly every year of the survey, on average at 9% of the stations sampled, generally south of Start Point (Figure 56). In VIIe sandeels are of no direct economic importance for fisheries, although they are caught as bait for longline fisheries and for angling.

Weeverfish (Trachinidae)

Two species of weeverfish were recorded. They are mainly found in areas of sand, in which they bury themselves, with just their eyes exposed above the surface, and are ambush predators.

The lesser weever *Echiichthys vipera* was the more common of the two species and was encountered at just over one-third of the stations sampled each year. It was observed mostly on grounds east and west of Start Point (Figure 57). The reason for the apparent increase in occurrence of lesser weever observed at the start of the time-series is unknown, but it is possible that they were under-reported in the first five years of the survey.

The greater weever *Trachinus draco* was recorded only occasionally (Figure 58), and its distribution was more restricted to offshore grounds in the south of the study area.

Blennies (Blennidae)

Blennies in UK waters are a small family of mainly small, coastal fish (Wheeler, 1978). Of the four species found around the coast of the British Isles, the butterfly blenny *Blennius ocellaris* was the only one encountered during this survey. It was caught in all but one of the years of the survey and, on average, was taken at 12% of the stations sampled annually. Butterfly blennies were found mainly inshore in Lyme Bay (Figure 59), with few reported at deeper, offshore locations.

Dragonets (Callionymidae)

All three species of British dragonet were encountered in the survey. The common dragonet *Callionymus lyra* was the most frequently recorded species. When it was consistently measured at every station (for the years that the survey was conducted by the RV *Corystes*), it was the second most abundant fish species after solenette *Buglossidium luteum*. It was found across the entire survey area, and encountered at nearly every station each year (Figure 60).

The spotted *Callionymus maculatus* (Figure 61) and the reticulated dragonet *Callionymus reticulatus* (Figure 62) were encountered much less frequently and were recorded, on average, at 4% and 2%, respectively, of the stations sampled each year. For both species, incidence increased in the years when full species sampling was conducted on the RV *Corystes* (2002 and 2004). It should also be noted that there can be confusion in the identification of dragonets, especially between spotted and reticulated dragonet, and between juveniles of all three species.

Gobies (Gobiidae)

The Gobiidae is a family of small-bodied inshore fish. Many species can be difficult to identify to species level, so for most years, identification was not to species level, but to family or genus. In recent years, there has been greater emphasis on identifying the larger gobies, with all sand gobies recorded to genus (*Pomatoschistus* spp.).

On the few occasions that gobies were identified to species level, four species were reported: Jeffrey's goby *Buenia jeffreysii* (surveys on RV *Corystes*), black goby *Gobius niger* (2000–2002, 2008–2009), rock goby *Gobius paganellus* (2004 only) and Fries's goby *Lesueurigobius friesii* (2004 only), although the records for *L. friesii* are questionable (Table 4). On average, *Pomatoschistus* spp. were encountered at 30% of the stations each year, most of which were inshore, as were black goby and rock goby (Figures 63 and 64). Observations of *Pomatoschistus* and other gobies prior to 2001 are not considered reliable, so were omitted from the analysis.

Steven's goby *Gobius gasteveni* also inhabits offshore grounds of the western English Channel (Ellis, pers. obs.), but it was not recorded in this survey.

Boarfish (Caproidae)

The boarfish *Capros aper* is usually found in deeper water (between about 100 and 400 m) on the outer continental shelf, and can be found in extremely large shoals in midwater (Wheeler, 1978). They are often reported in the western English Channel. The fish is of no saleable value for the southwest fleet (although industrial fisheries have expanded off southwest Ireland in recent years). Boarfish were caught in small numbers on just 28 occasions during about half the years that the survey has been undertaken (Table 4). They were mainly offshore and absent inshore (Figure 65).

Left-eyed flatfish (Scophthalmidae)

Six species of scophthalmid were caught during the survey. The most commercially important species are brill *Scophthalmus rhombus* and turbot *Scophthalmus maximus*, both of which, compared with other commercial flatfish species, were caught in small numbers. Although the megrim *Lepidorhombus whiffiagonis* is commercially important for Celtic Sea fisheries, it was taken rarely during this survey, unsurprising considering that they prefer deeper water (50–300 m) (Wheeler, 1978; Tidd and Warnes, 2006). On the few occasions that they were observed, they were generally captured at deeper stations south of Start Point (Figure 66).

Brill were more abundant and frequently encountered than turbot in the survey, although both species were well dispersed across the area (Figures 67 and 68). Most of the brill captured were 30–60 cm, with a few individuals of 17–23 cm also caught. Similarly, the turbot caught were mostly 40–65 cm, and there were no records of turbot <20 cm. Further studies to understand the distribution

of the younger size classes of these species in the area better are clearly required. The relative abundance of both species increased during the 1990s and, after low catches over the period 2005–2007, have continued to increase in recent years, with the best overall catch rates for both species in 2010.

Three species of topknot were caught occasionally. The Norwegian topknot *Phrynorhombus norvegius* was the more frequently observed species, on average being taken at 14% of the stations each year, and was distributed over much of the survey area (Figure 69). The common topknot *Zeugopterus punctatus* and Ekström's topknot *Phrynorhombus regius* were only caught sporadically (Figure 70).

Scaldfish (Bothidae)

The data in Table 4 suggest that there has probably been some misidentification problems associated with the separation of the two species of scaldfish. In 2003 all scaldfish were identified as *A. imperialis* and prior to 1995 all (or virtually all in 1994) were reported as *A. laterna*. Such issues were addressed in the analyses of occurrence presented here, with data presented only for the years 1995–2002 and 2004–2011).

The Imperial scaldfish *Arnoglossus imperialis* were taken at 55% of the stations sampled, almost entirely at the deeper offshore stations but absent inshore (Figure 71). In contrast, the scaldfish *Arnoglossus laterna* was caught at every station at least once and, on average, was caught at 70% of the stations fished each year. Scaldfish were most abundant in relatively shallow water (Figure 72), so for the survey overall, their incidence was recorded as greatest inshore.

Right-eyed flatfish (Pleuronectidae)

In addition to plaice (see above), another three pleuronectids were caught during the survey. Although of limited commercial value, the dab *Limanda limanda* was one of the most commonly encountered flatfish that, on average, was observed at about half the stations each year (Figure 73). They were in greatest numbers inshore west of Lyme Bay, but were absent from many of the offshore stations. Two distinct size groups of dab were found (4–10 cm and >10 cm).

Of greater economic value, the lemon sole *Microstomus kitt* was caught in fewer numbers, and was most common at stations south of Start Point (Figure 74). On average they were taken at 30% of the stations fished each year, most within the length range 23–40 cm. The distribution and habitats of smaller lemon sole are poorly known. However, the relative abundance of lemon sole has increased over the past four years to the levels observed at the start of the time-series.

The flounder *Platichthys flesus* is a coastal and estuarine species, and was the least frequent of the pleuronectids encountered. It was caught in about half of the years sampled, but was only found inshore, particularly close to the Teign Estuary (Figure 75). All of the flounder captured were ≥23 cm, with smaller individuals likely inhabiting more-estuarine waters.

Soles (Soleidae)

In addition to sole (see above), three other species of sole were observed in the survey. The sand sole *Pegusa lascaris* was the least frequent soleid encountered, and was caught in relatively small numbers and, on average, at 12% of the stations each year. Although it was recorded every year except 1993 (Figure 76), it appears to have become more abundant in the five most recent years. It was most abundant offshore, including at stations south of Start Point. Most of the sand sole were ≥18 cm and, again, further studies to identify the grounds of smaller fish are required.

The solenette *Buglossidium luteum* is the smallest European soldeid and was the most abundant species of fish caught in the three years when the survey was conducted by RV *Corystes* and constituted, by number, nearly 40% of the total fish caught. It was a consistent catch at nearly half the stations each year (Figure 77) and its distribution was primarily restricted to inshore locations.

Another small and abundant soleid, the thickback sole *Microchirus variegatus*, was captured at 83% of the stations each year (Figure 78). It was distributed across much of the survey area, although was less frequent or absent at the inshore stations close to Teignmouth and Exmouth.

Commercial crustaceans

The lobster *Homarus gammarus* was rarely encountered (it prefers rockier grounds than those sampled here), but the few individuals recorded were distributed across much of the survey area (Figure 79).

Of increasing economic importance, the spiny spider crab *Maja brachydactyla* was observed in greater numbers, and it was most abundant in Lyme Bay, particularly off Sidmouth and Lyme Regis (Figure 80). Catch rates were much lower in the southwest of the survey area. Peaks in spider crab abundance were noted in 2001 and 2004 (although numbers were not recorded in 2003 and 2005).

The edible crab *Cancer pagurus* was the most abundant, commercially important crustacean caught during the survey. On average, edible crabs were caught at about half the stations occupied each year, and they were common over much of the survey area, albeit less abundant in the northeast (Figure 81). Both the occurrence and the relative abundance of *C. pagurus* were variable.

Scallops (Bivalvia)

The great scallop *Pecten maximus* was distributed over nearly all the survey area, and on average was taken at one-third of the stations each year (Figure 82). In the past few years there has been an overall increase in its prevalence and relative abundance, however. Although there was a slight decrease in 2011, catches that year were still above the time-series average. Data for other scallops, such as the queen scallop *Aequipecten opercularis*, were not collected routinely.

Commercial cuttlefish and squid (Cephalopoda)

The common cuttlefish *Sepia officinalis* was one of the most abundant commercially important species captured

during the survey and, on average, was taken at nearly 80% of stations each year. The species is distributed over most of the survey area but is slightly more abundant offshore and on the grounds east of Lyme Bay (Figure 83). Although abundance data were not available for all years, abundance was variable, with a peak in relative abundance in 2004. Data for other cuttlefish (e.g. *Sepia elegans* and *Sepiola atlantica*), which are not commercially fished, were not collected during the survey.

Although two species of squid were recorded during the survey (*Loligo forbesi* and *L. vulgaris,* Appendix I), squids are not always identified to species level, and smaller animals may be overlooked in catch processing; hence any analysis of these data should be undertaken at an aggregated level. Over the time-series, larger squid were encountered at most stations, but were less abundant at the inshore stations in Lyme Bay (Figure 84). Compared with cuttlefish, large squid were much less numerous, and on average were caught at just 28% of the stations every year.

Pleuronectes platessa – European plaice

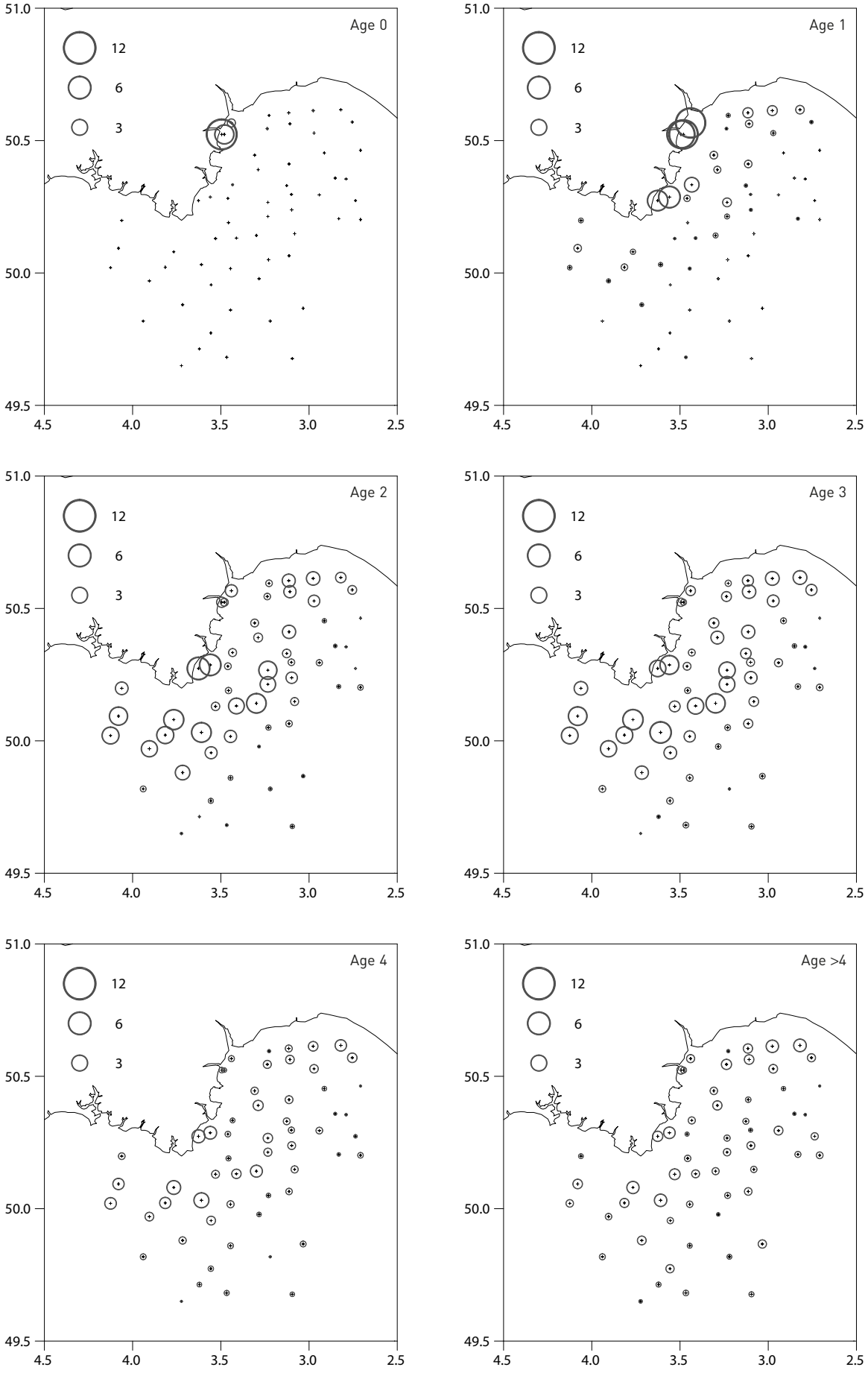


Figure 11a: Female European plaice *Pleuronectes platessa*: Spatial distribution by age, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+).

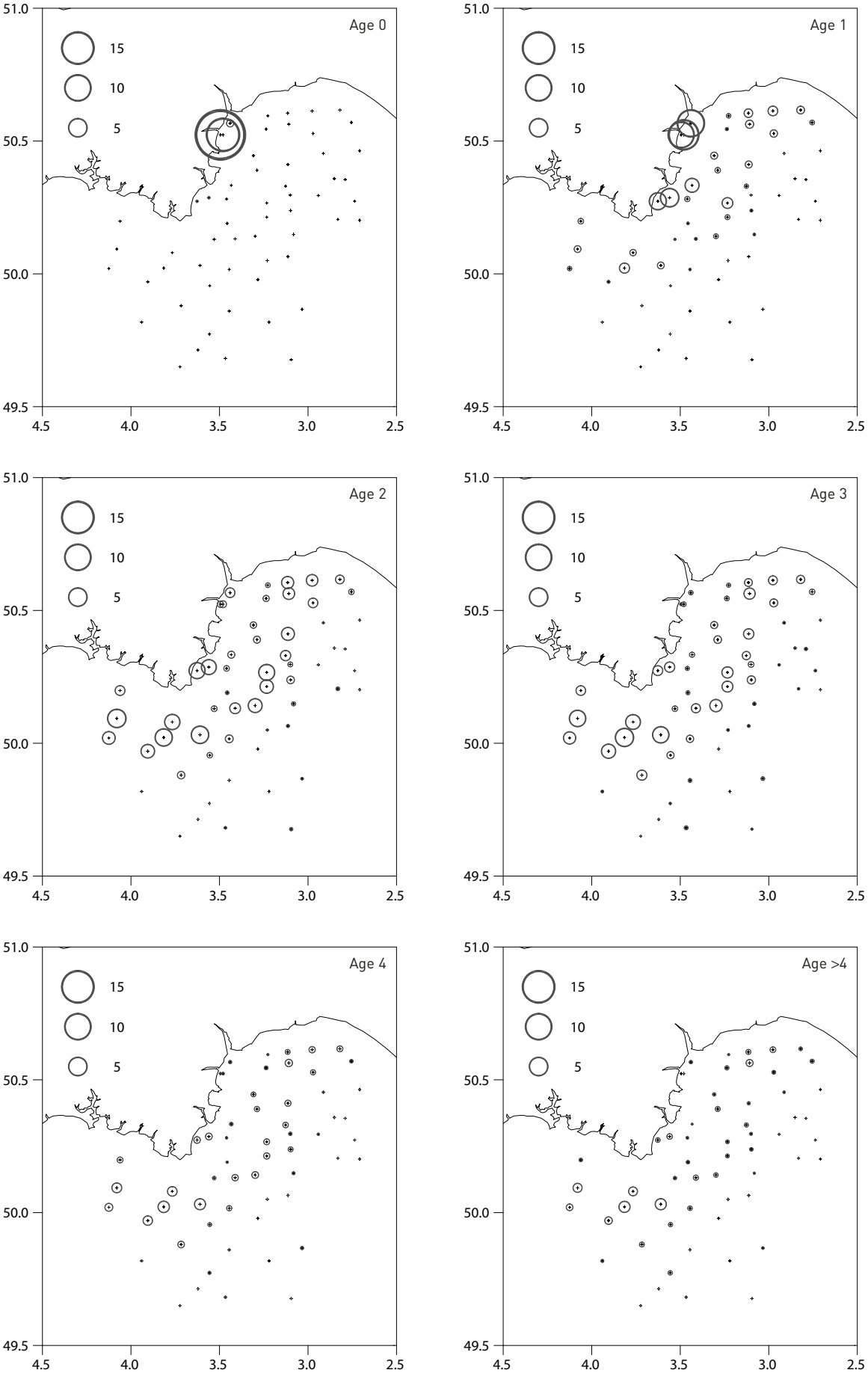


Figure 11b: Male European plaice *Pleuronectes platessa*: Spatial distribution by age, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+).

Pleuronectes platessa - European plaice

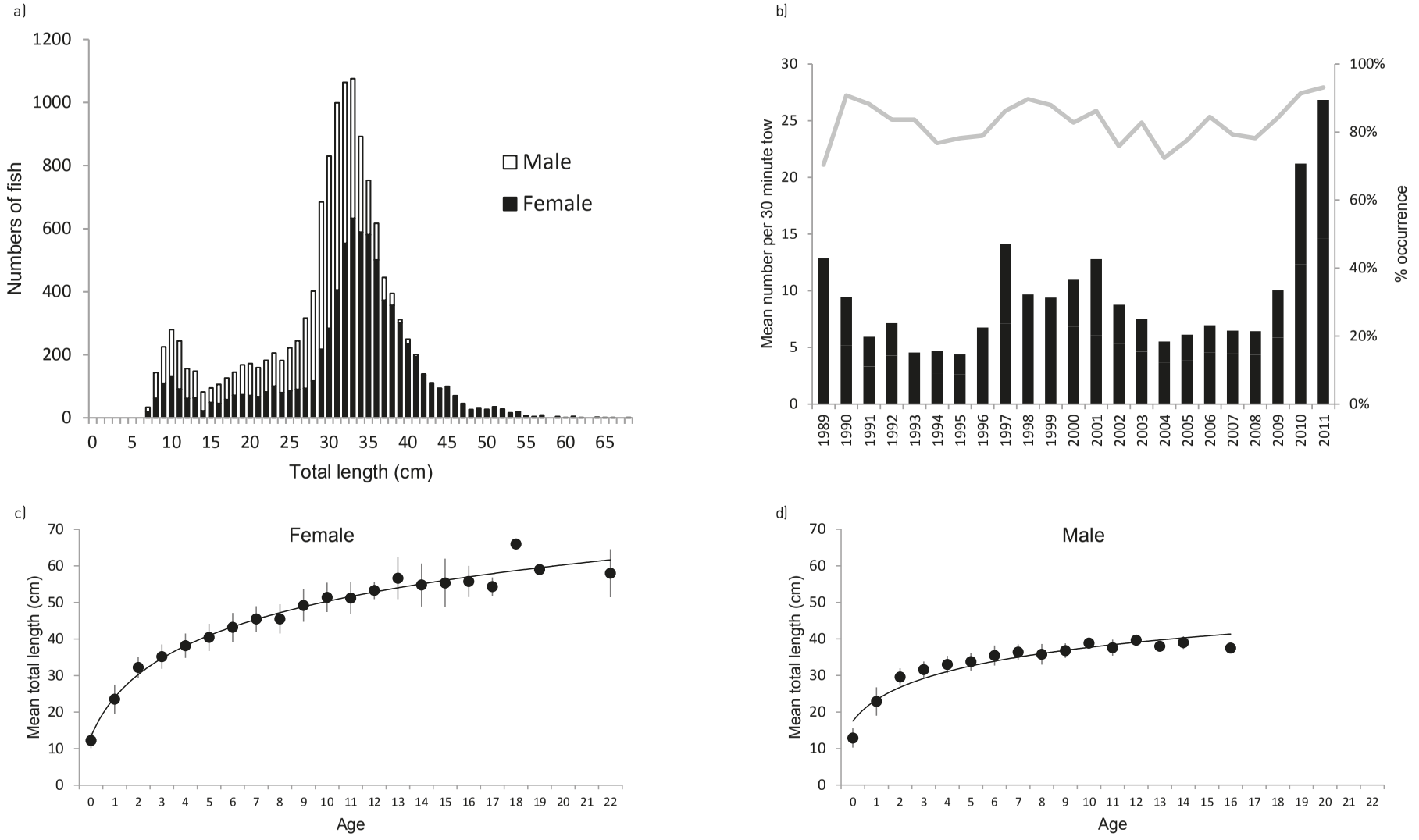


Figure 11c: European plaice *Pleuronectes platessa*: (a) Length frequency distribution by sex. (b) Temporal trends (1989–2011) in relative abundance (sexes combined), shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c-d) Mean length at age by sex. Vertical bars represent ±1SD.

Pleuronectes platessa - European plaice

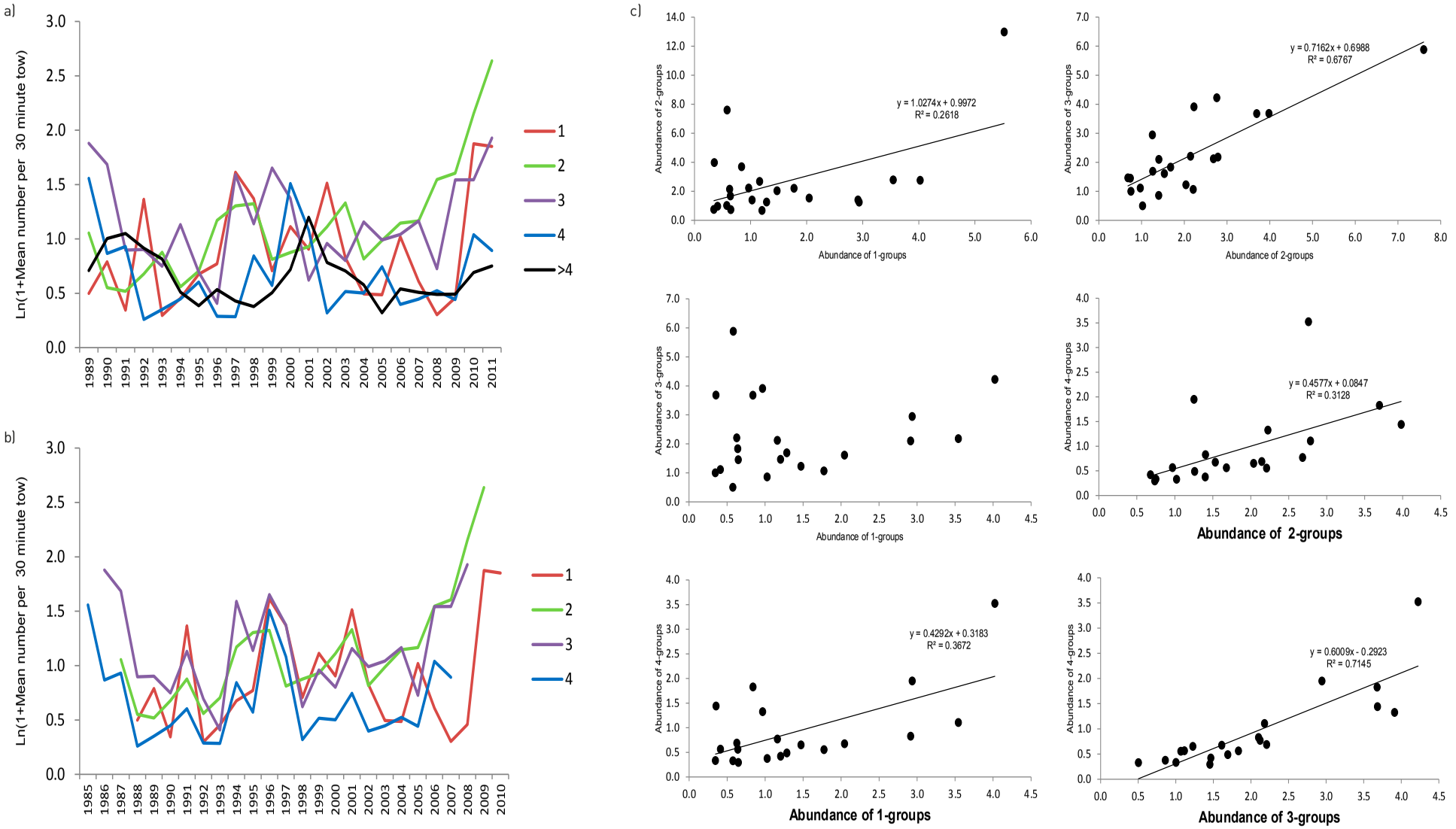


Figure 11d: European plaice *Pleuronectes platessa*: (a) Temporal trends (1989–2011) in the relative abundance (sexes combined) by age-group, shown as the natural log of the mean number of fish caught per 30 minute tow, and (b) the relative abundance aligned as a cohort to the year that a fish was recruited. (c) The relationship between relative abundance (mean number of fish caught per 30 minute tow) of 1-, 2- and 3-groups with older age-groups in the following year(s). The solid lines show significant correlations ($p<0.05$).

Solea solea - Sole

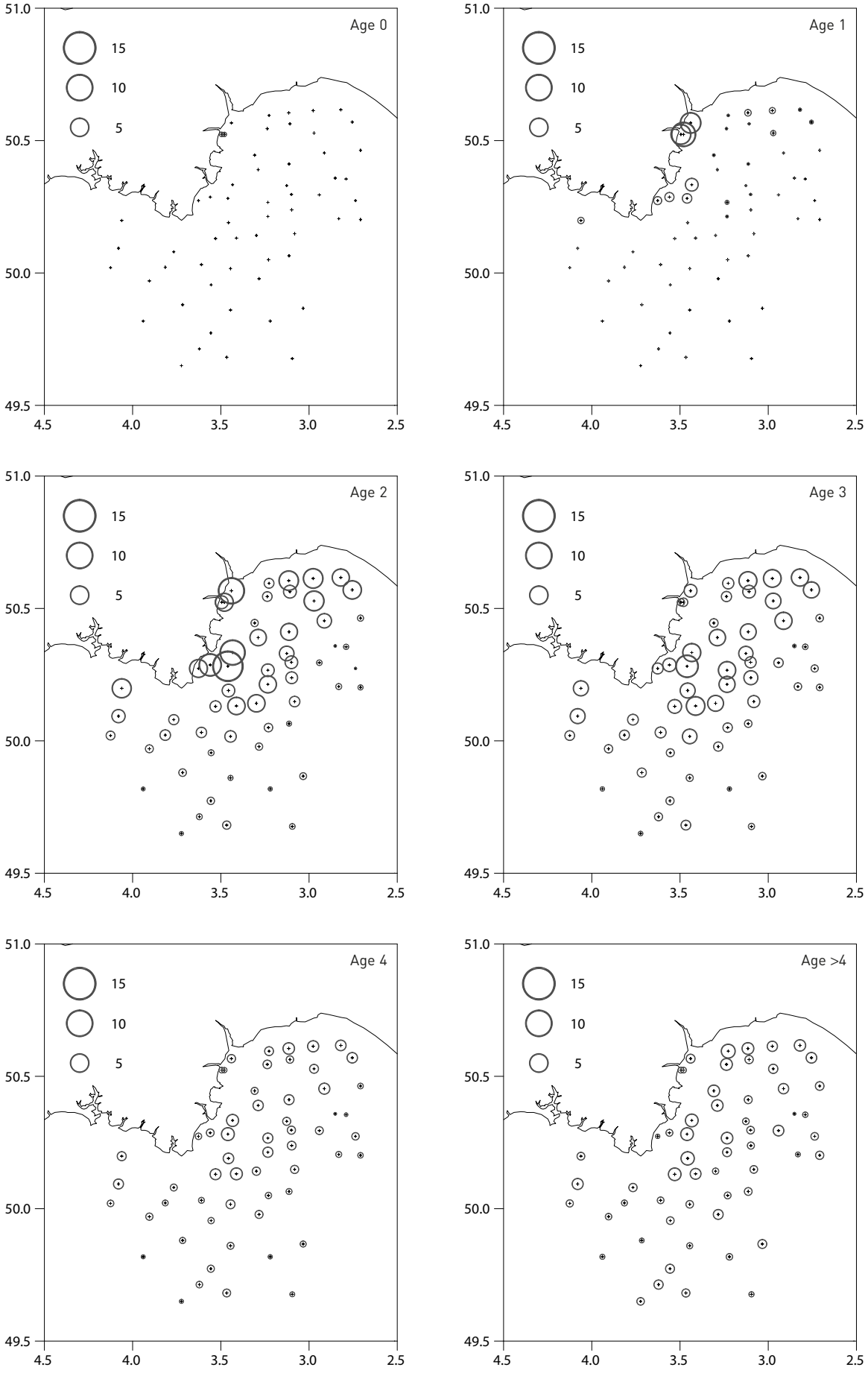


Figure 12a: Sole *Solea solea*: Spatial distribution by age, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+).

Solea solea - Sole

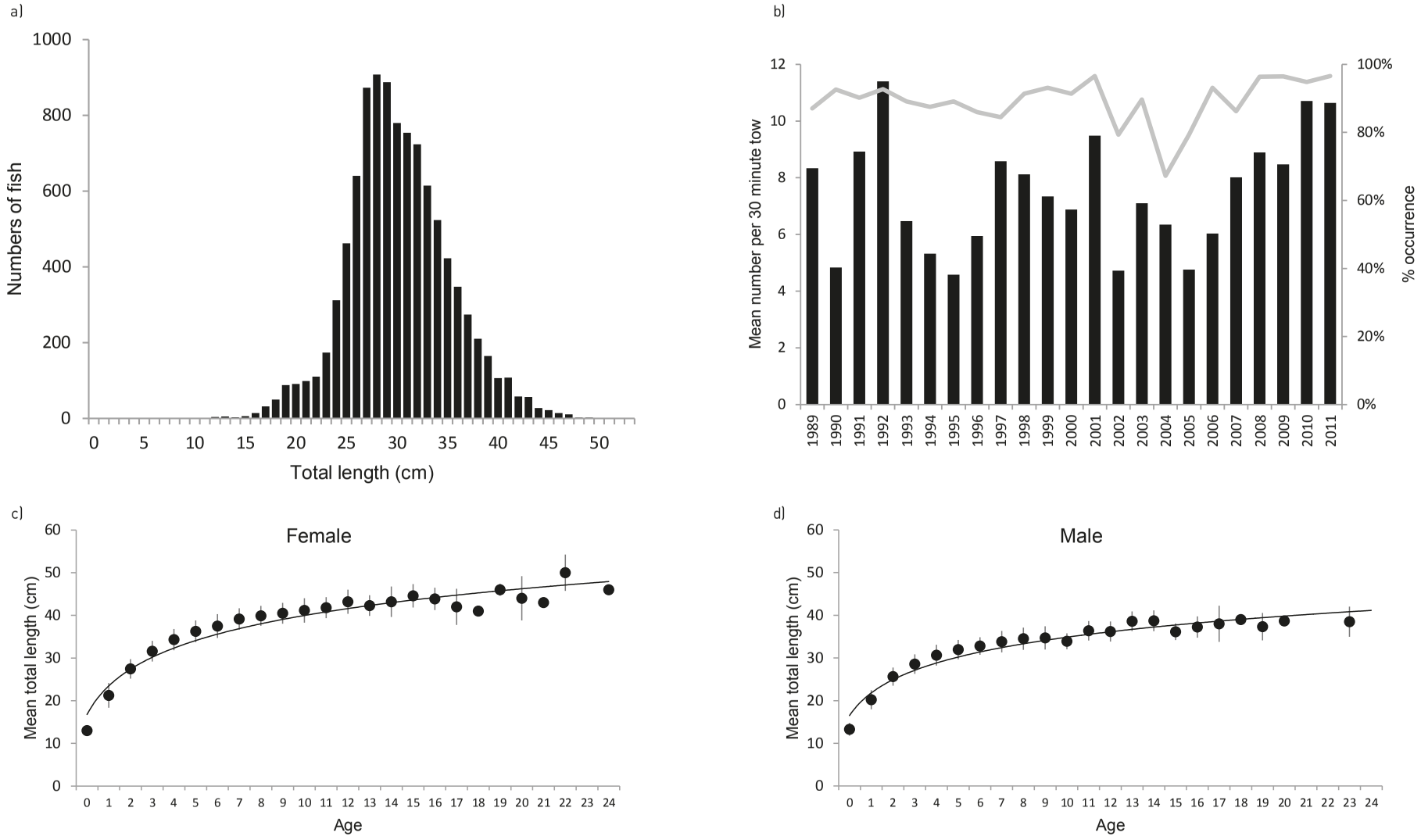


Figure 12b: Sole *Solea solea*: (a) Length frequency distribution. (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c–d) Mean length at age by sex. Vertical bars represent ±1SD.

Solea solea - Sole

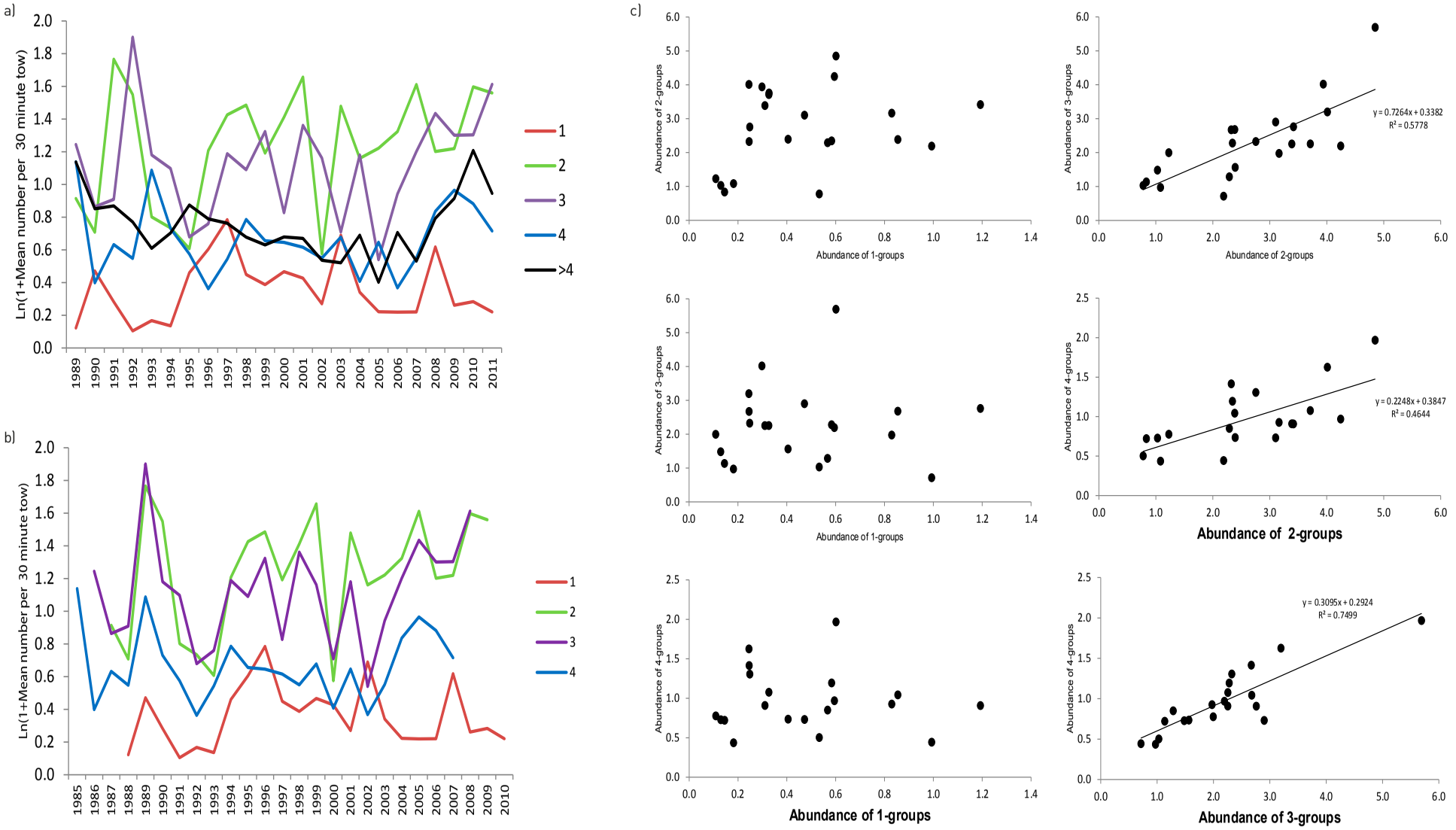
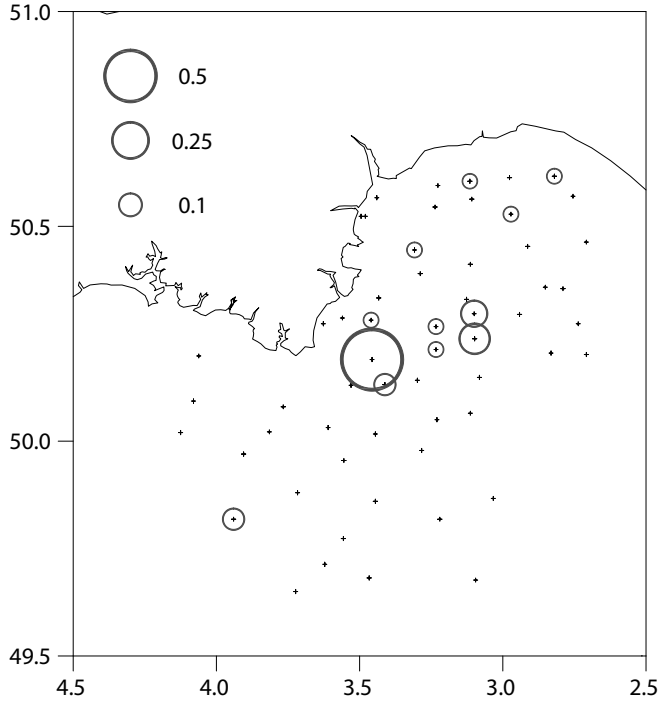
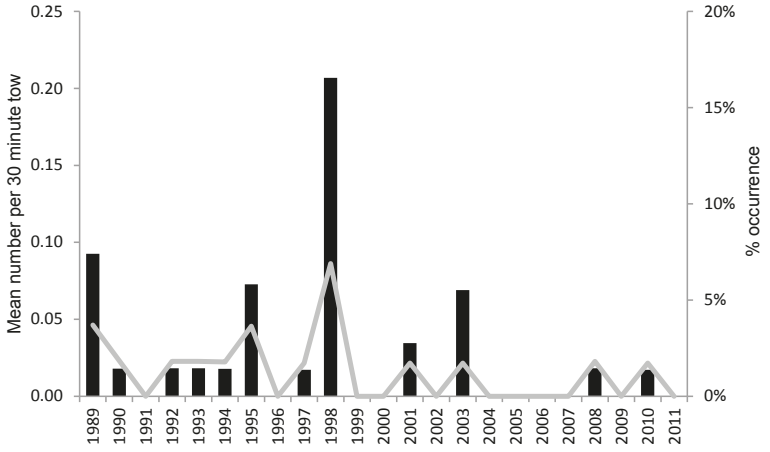


Figure 12c: Sole *Solea solea*: (a) Temporal trends (1989–2011) in the relative abundance by age-group, shown as the natural log of mean number of fish caught per 30 minute tow, and (b) the relative abundance aligned as a cohort to the year that a fish was recruited. (c) The relationship between relative abundance (mean number of fish caught per 30 minute tow) of 1-, 2- and 3-groups with older age-groups in the following year(s). The solid lines show significant correlations ($p<0.05$).

a)



b)



c)

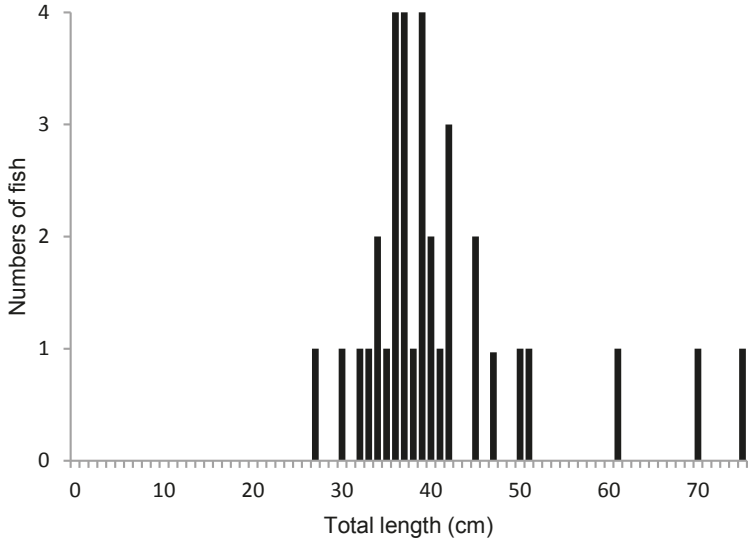


Figure 13: Spurdog *Squalus acanthias*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

Sharks and dogfish (Squalidae, Scyliorhinidae and Triakidae)

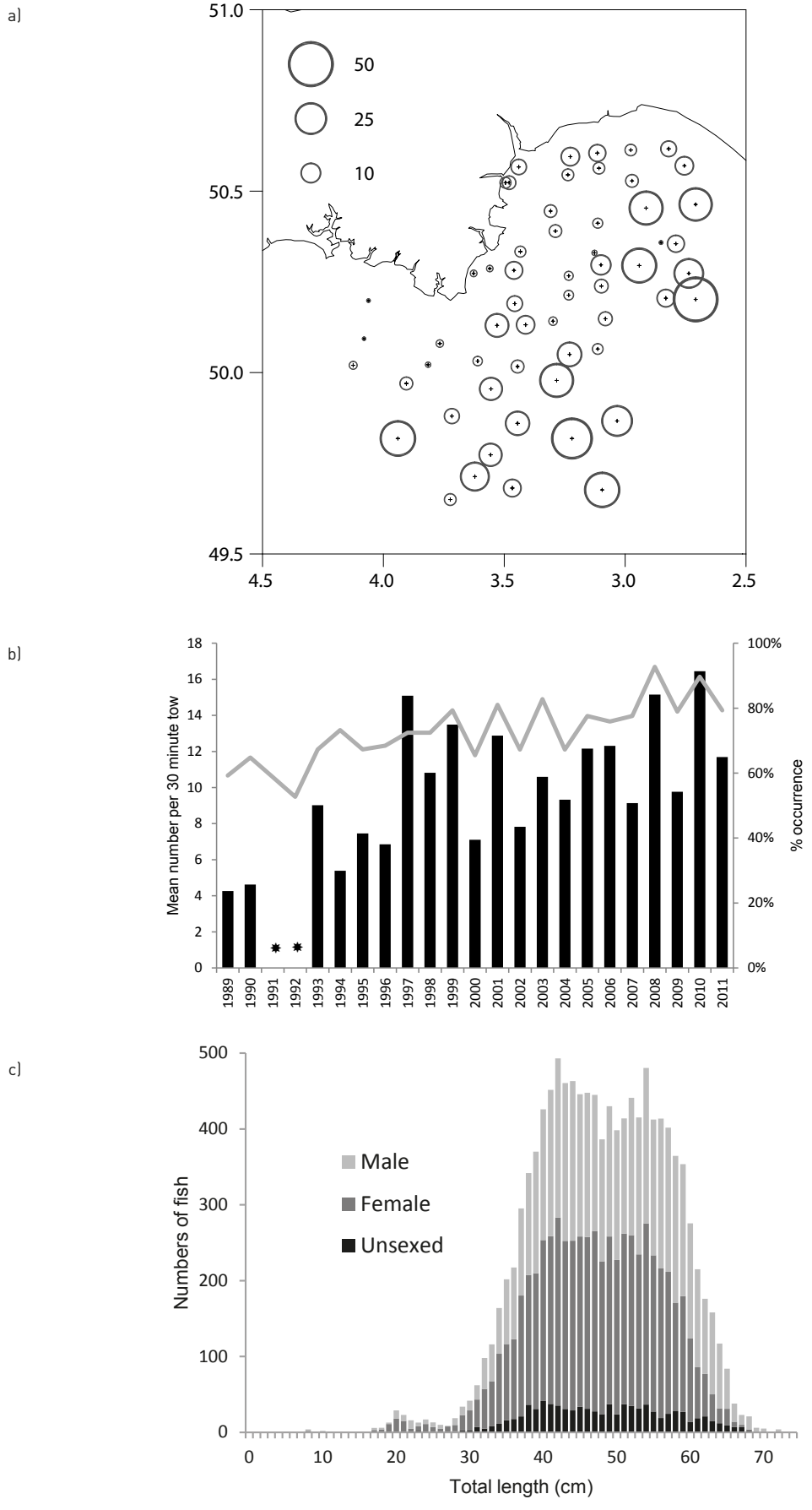


Figure 14: Lesser-spotted dogfish *Scyliorhinus canicula*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution by sex. *Denotes that abundance data are not suitable to use. Data category B (refer to Table 6).

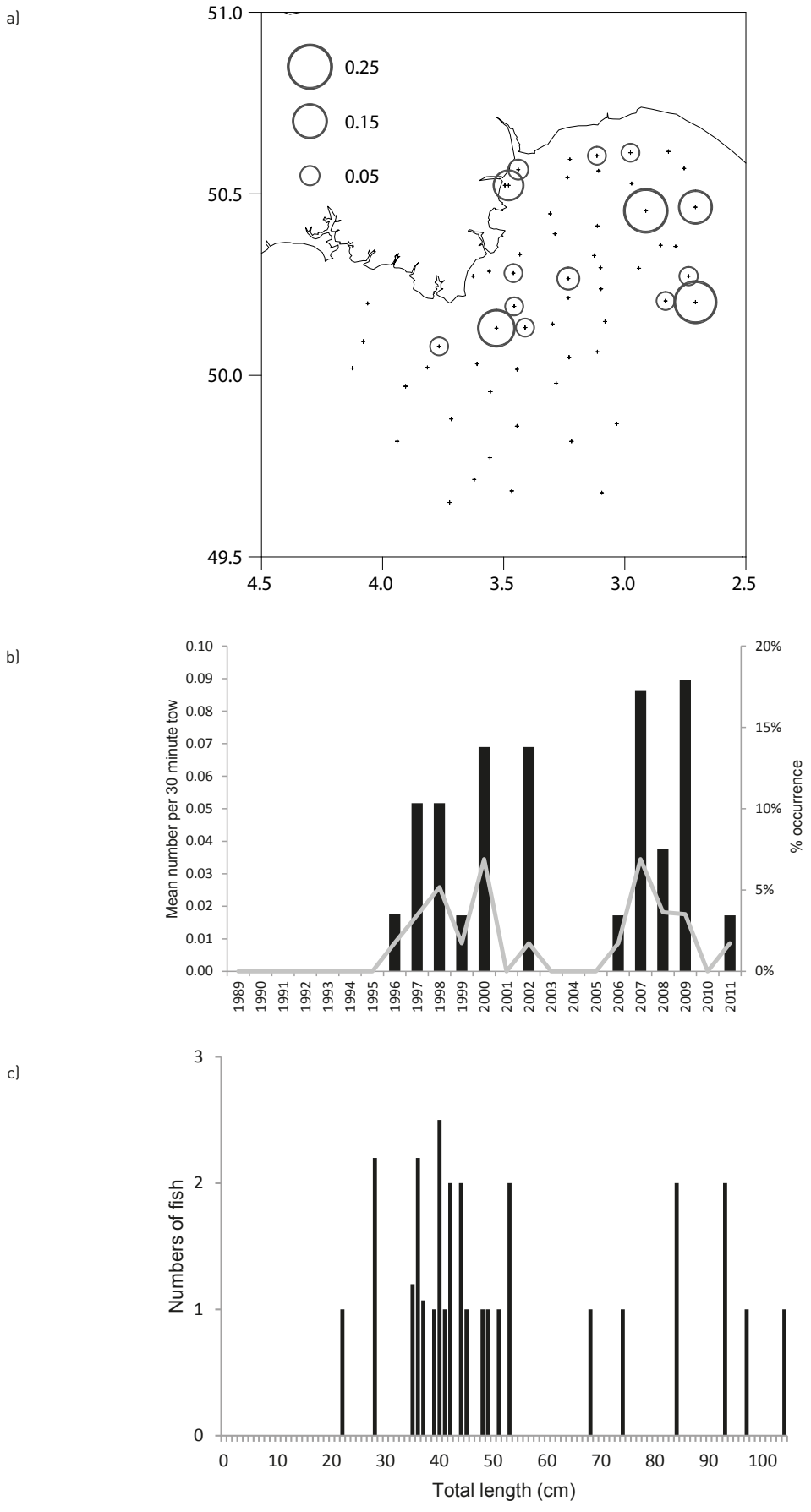


Figure 15: Greater-spotted dogfish *Scyliorhinus stellaris*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

Sharks and dogfish (Squalidae, Scyliorhinidae and Triakidae)

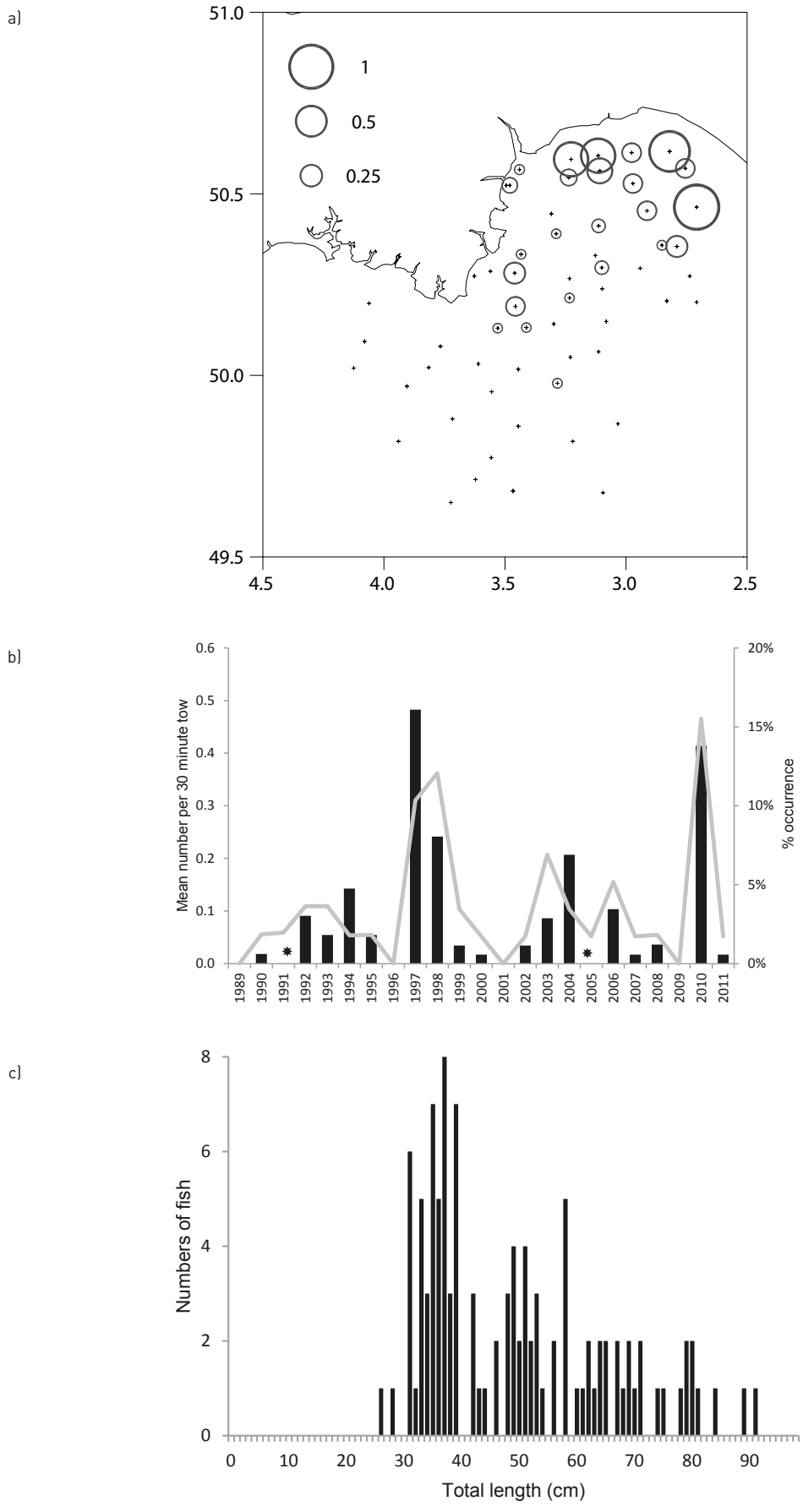


Figure 16: Starry smooth-hound *Mustelus asterias*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. *Denotes that abundance data are not suitable to use. Data category B (refer to Table 6).

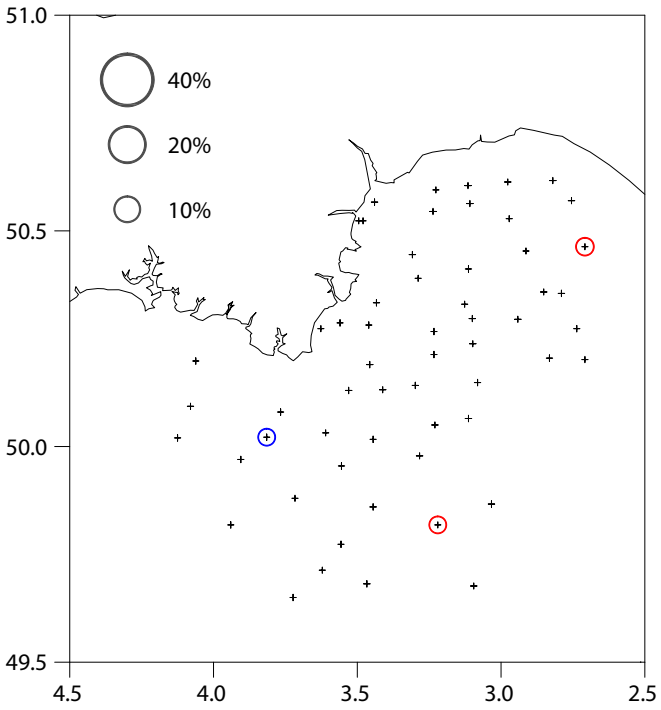


Figure 17: Spatial distribution of marbled electric ray *Torpedo marmorata* (red) and common electric ray *T. nobiliana* (blue), shown as the average relative frequency of occurrence at prime stations (+). Data category D (refer to Table 6).

Skates (Rajidae)

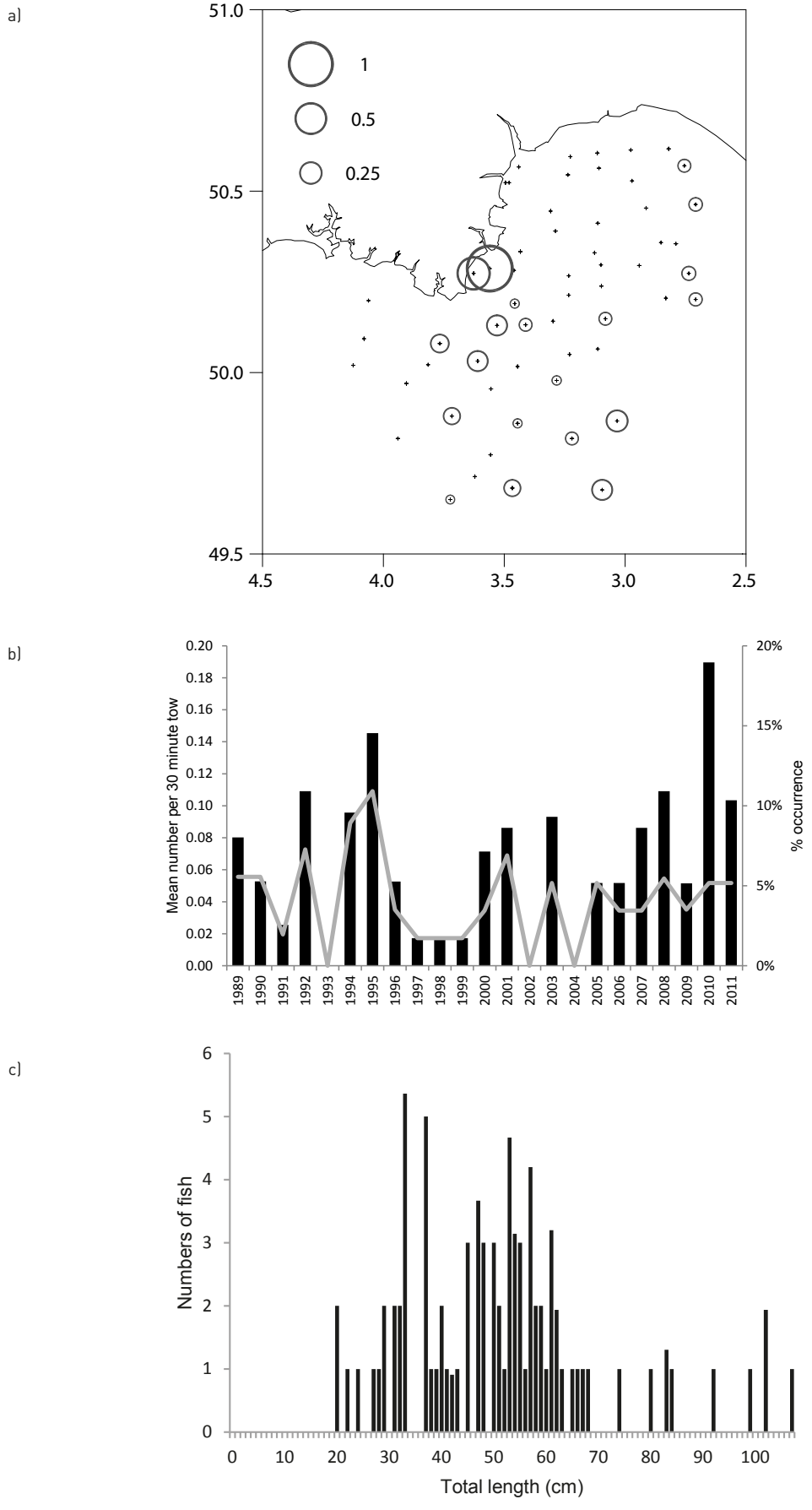
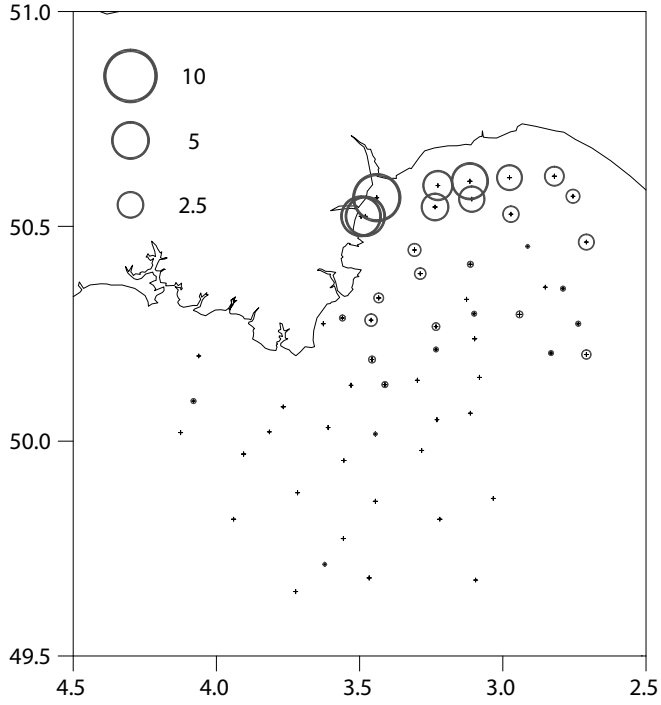


Figure 18: Blonde ray *Raja brachyura*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

a)



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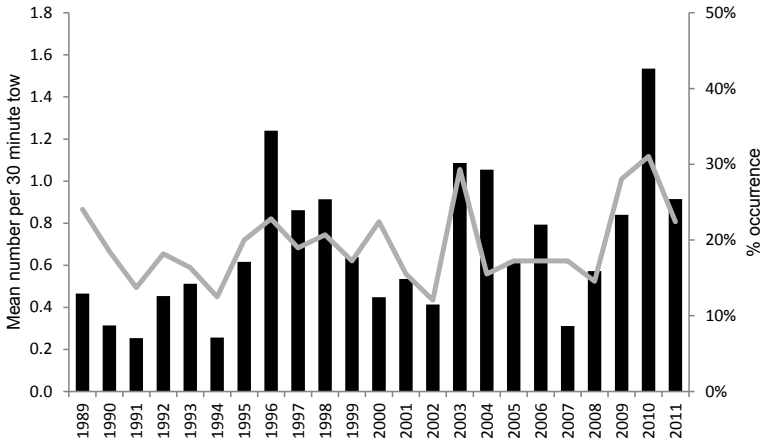


c)

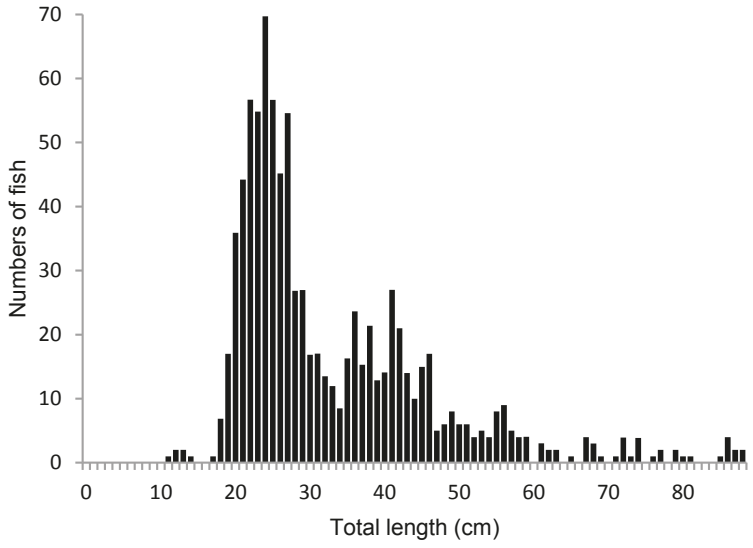


Figure 19: Thornback ray *Raja clavata*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

Skates (Rajidae)

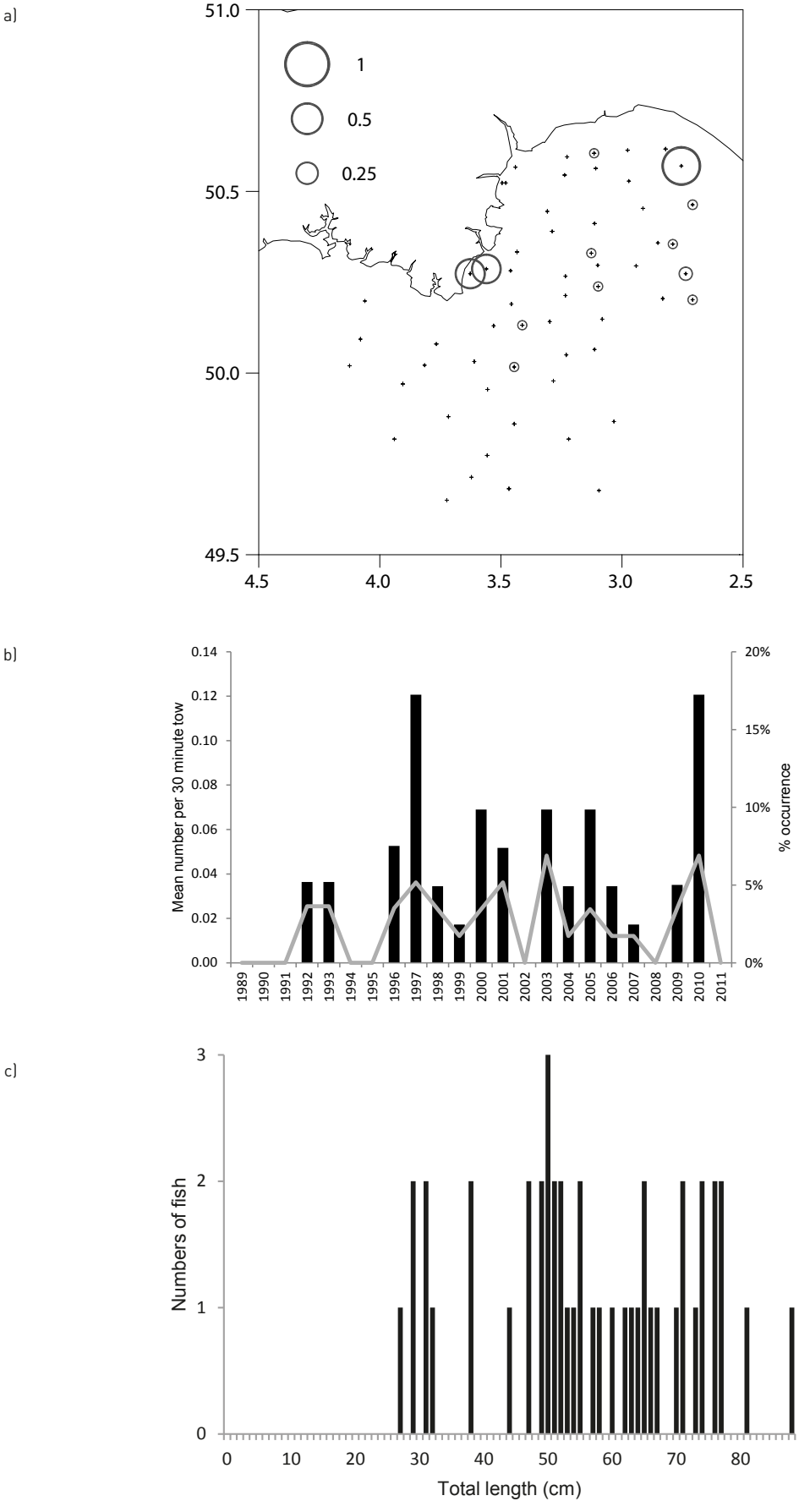


Figure 20: Small-eyed ray *Raja microocellata*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

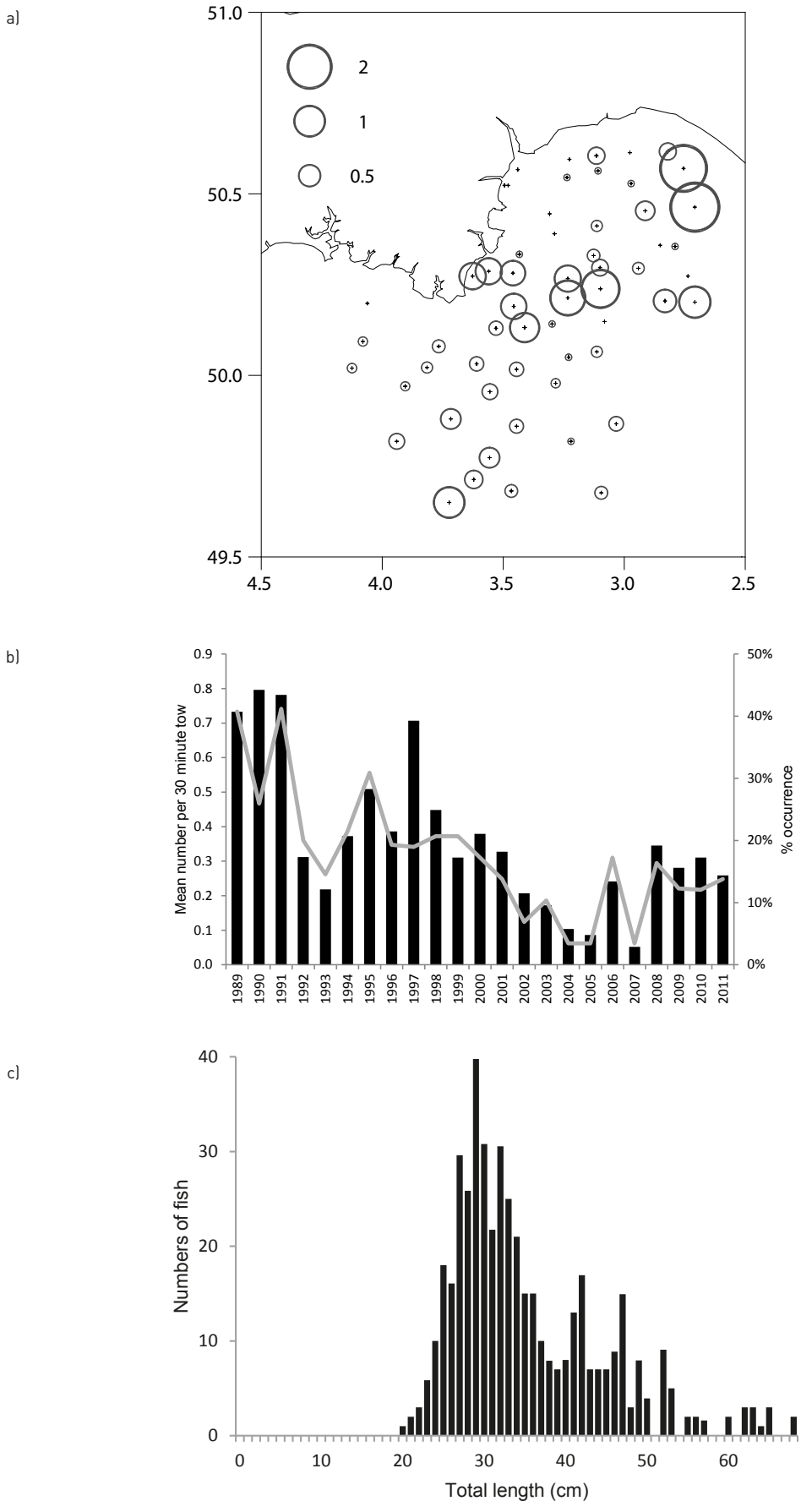
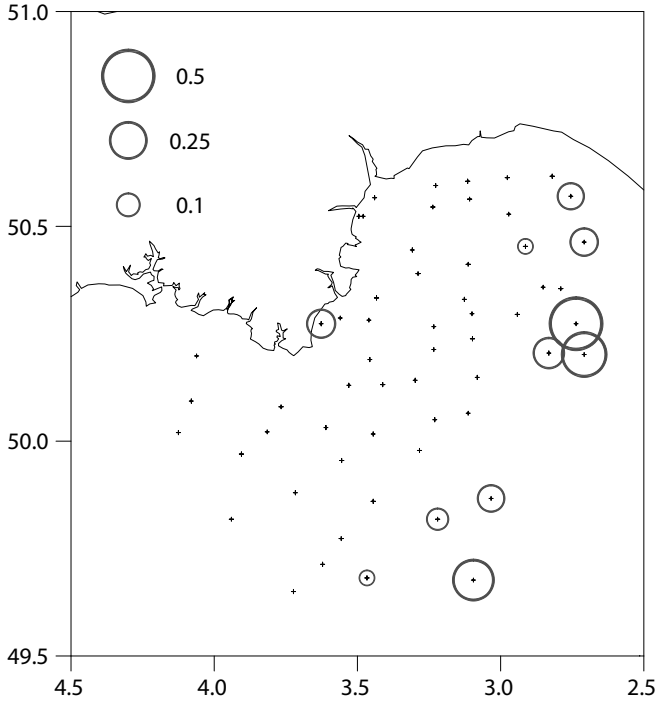


Figure 21: Spotted ray *Raja montagui*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

Skates (Rajidae)

a)



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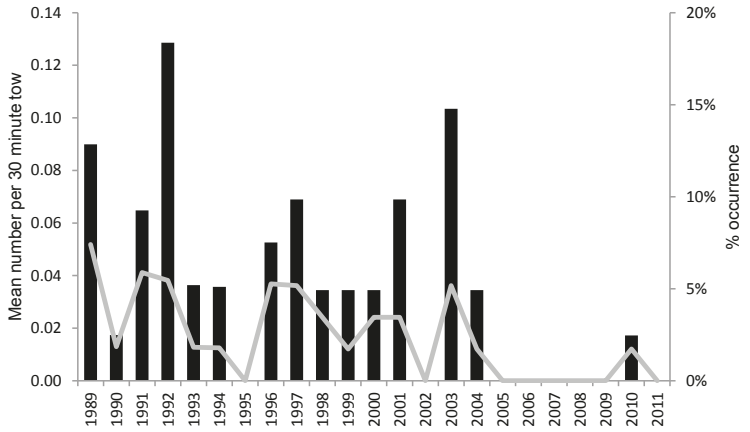

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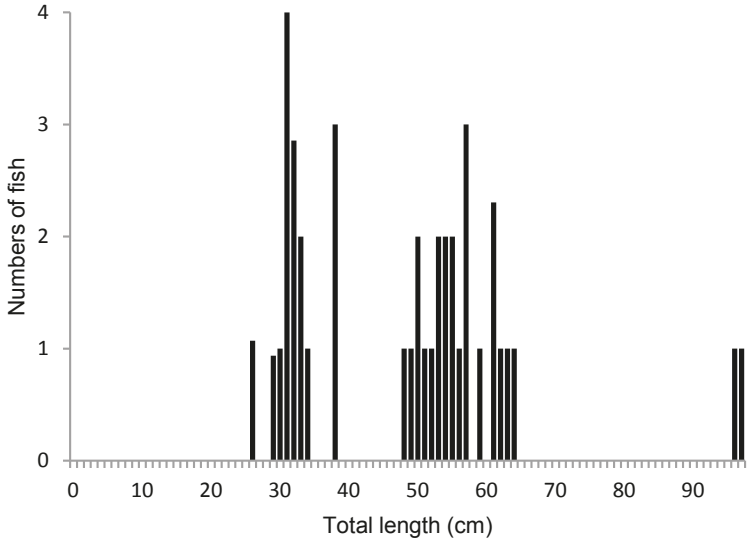


Figure 22: Undulate ray *Raja undulata*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

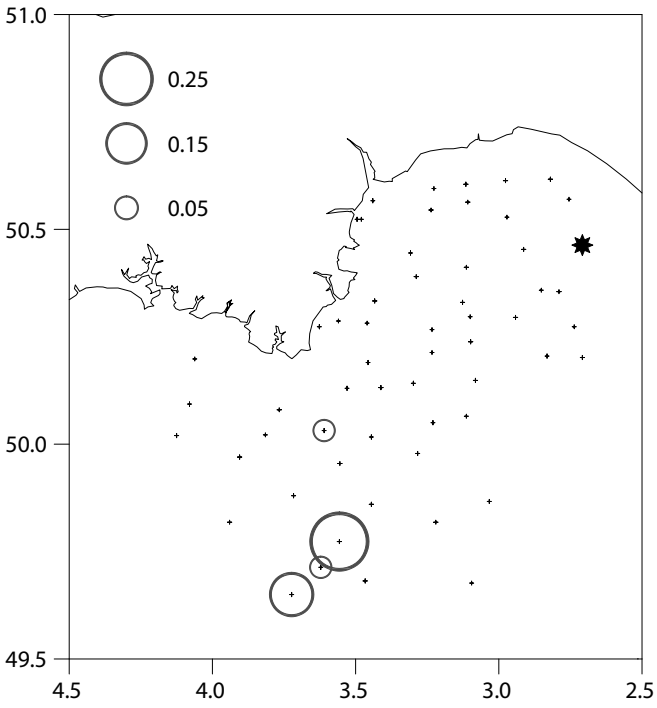


Figure 23: Spatial distribution of cuckoo ray *Leucoraja naevus*, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). Data category B (refer to Table 6). Occurrence of stingray *Dasyatis pastinaca*, (data category D) shown as *.

Eels (Anguillidae and Congridae)

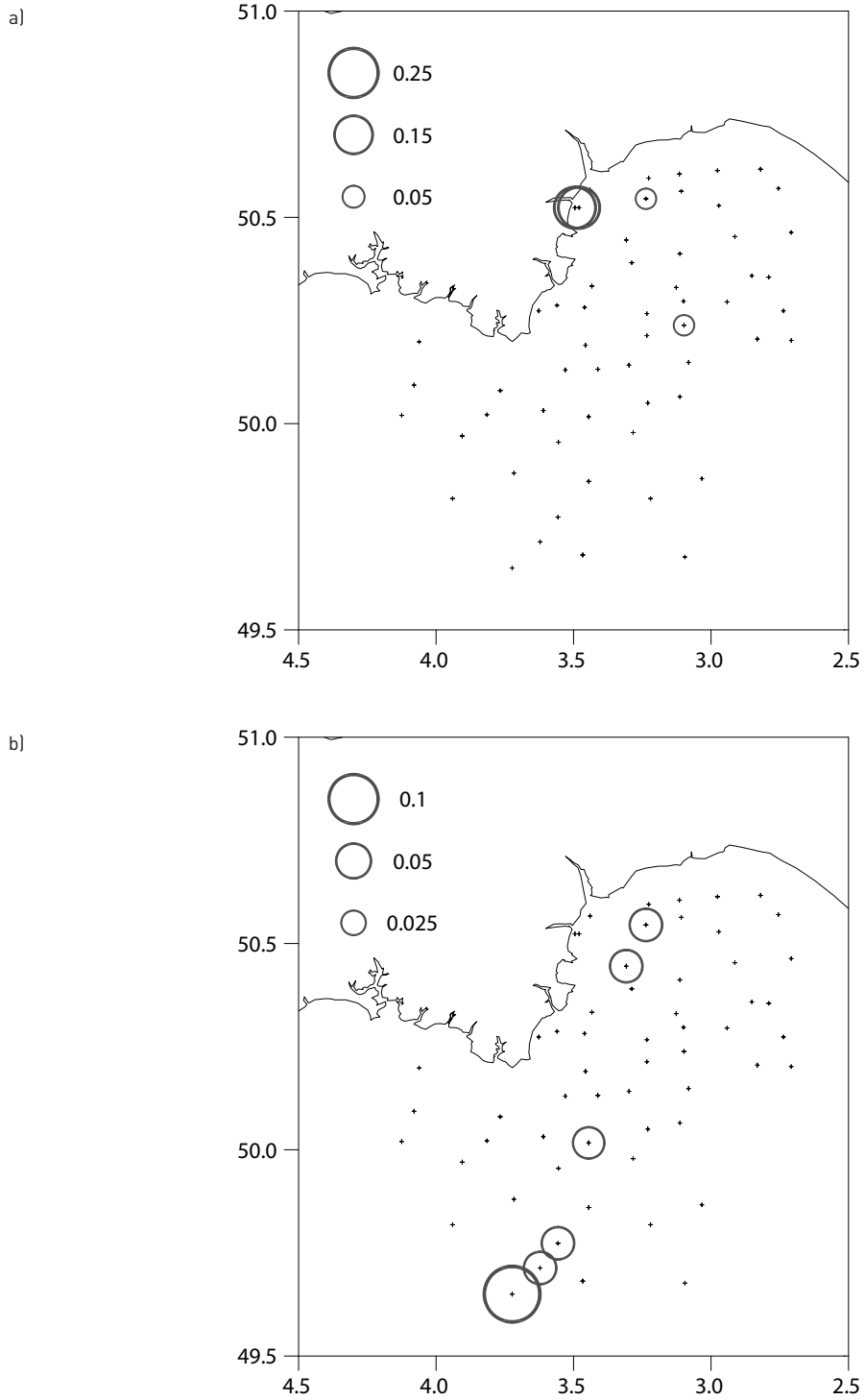


Figure 24: Spatial distribution of (a) European eel *Anguilla anguilla*, and (b) European conger eel *Conger conger*, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). Data category B (refer to Table 6).

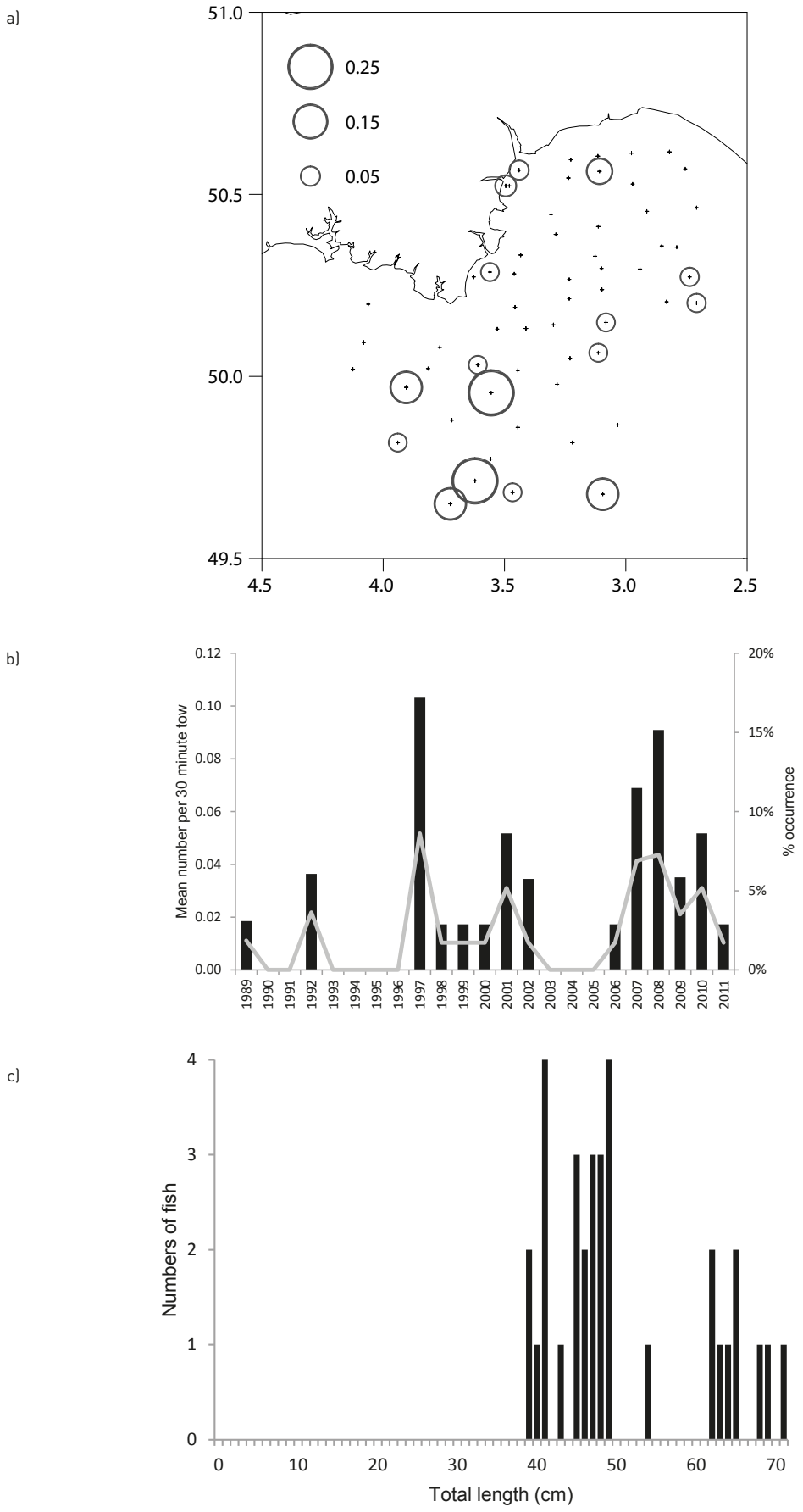


Figure 25: Cod *Gadus morhua*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

Cod-like fishes (Gadidae)

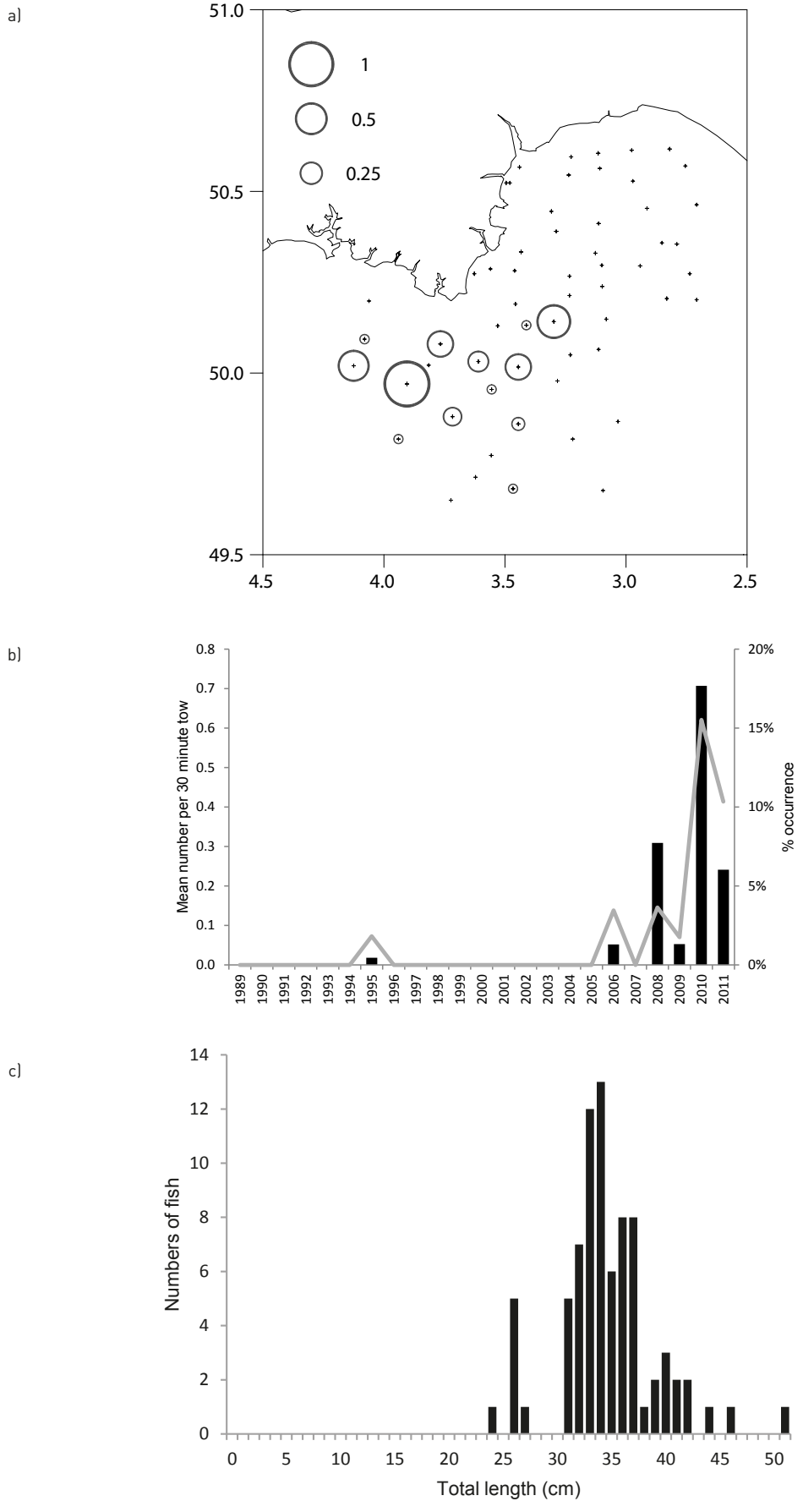
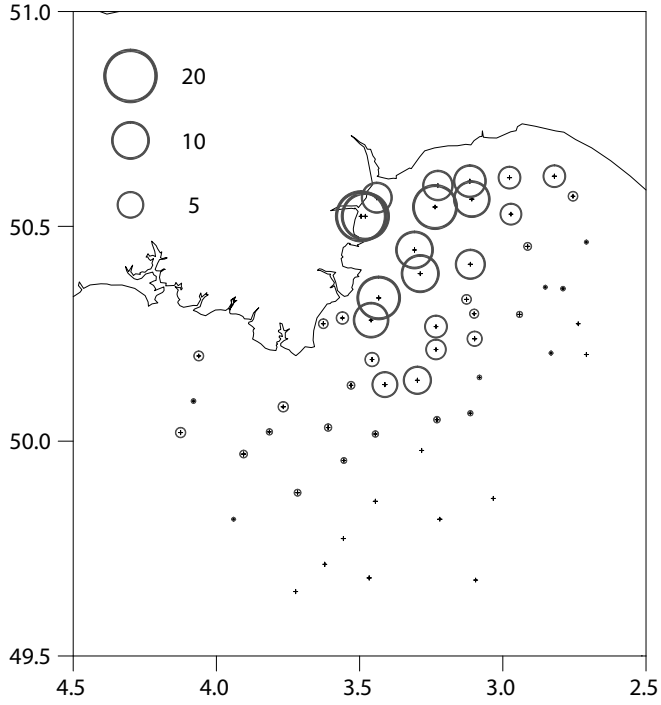
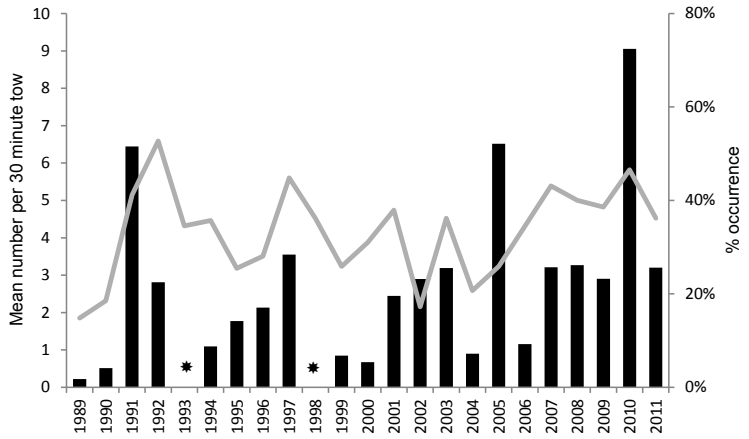


Figure 26: Haddock *Melanogrammus aeglefinus*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

a)



b)



c)

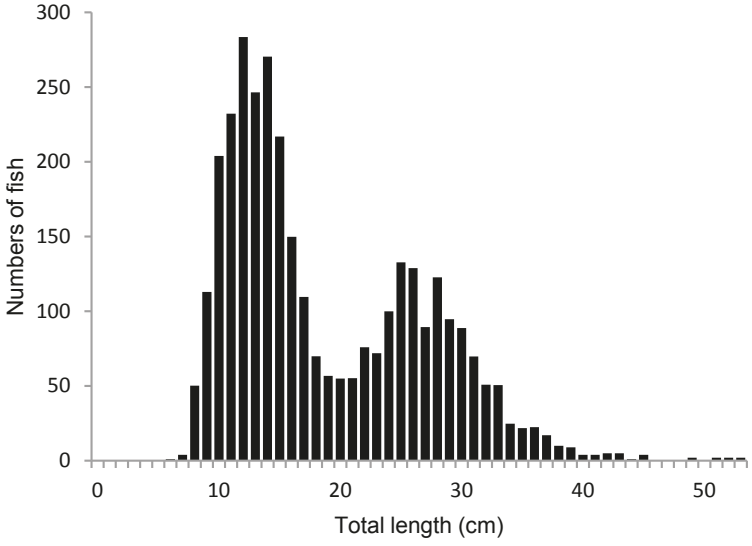


Figure 27: Whiting *Merlangius merlangus*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. *Denotes that abundance data are not suitable to use. Data category B (refer to Table 6).

Cod-like fishes (Gadidae)

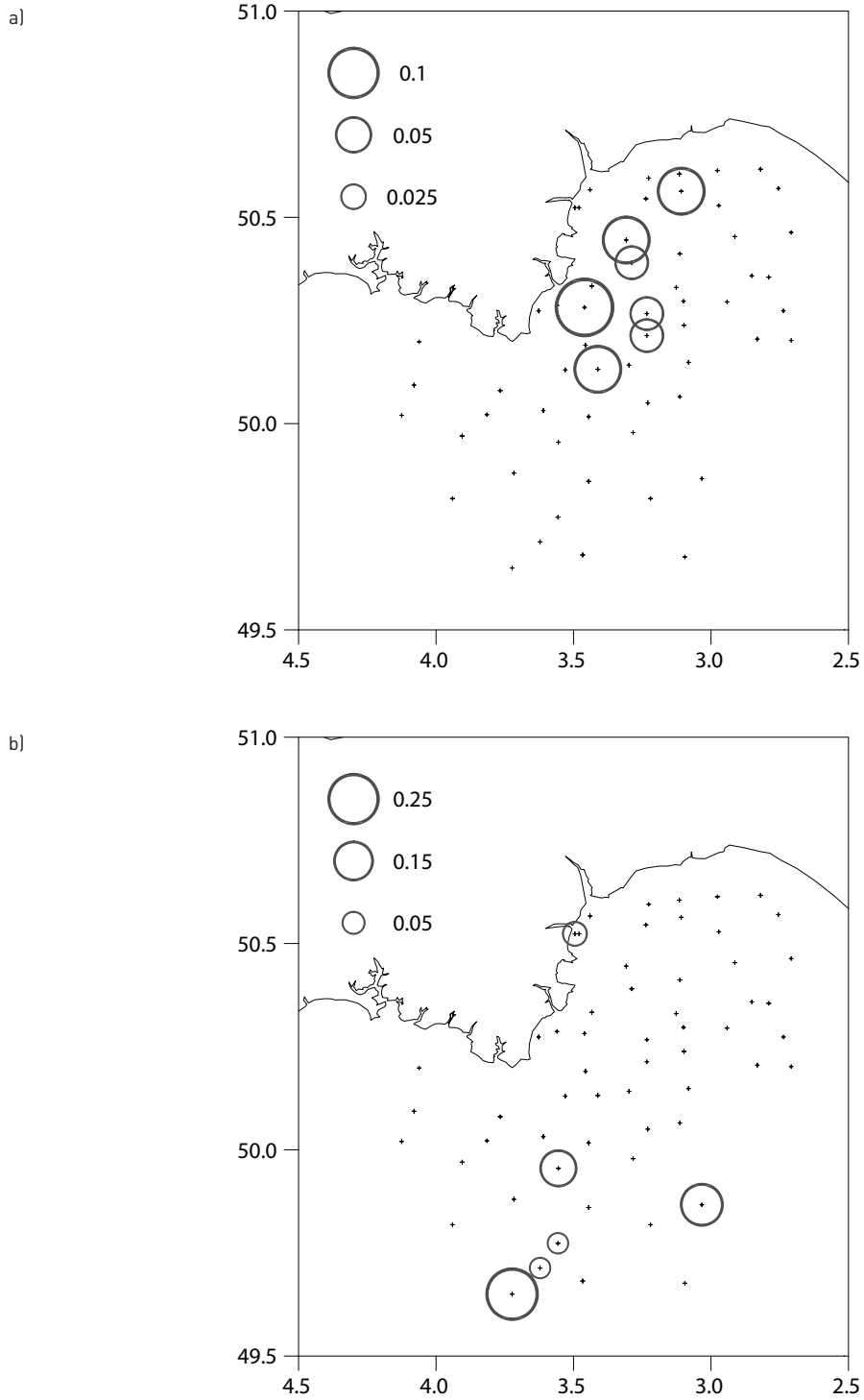
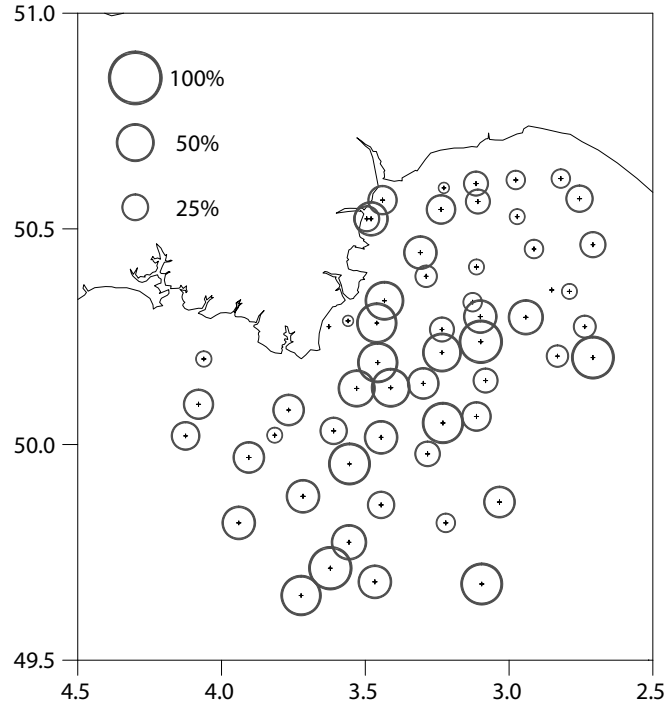


Figure 28: Spatial distribution of (a) blue whiting *Micromesistius poutassou*, and (b) pollack *Pollachius pollachius*, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). Data category B (refer to Table 6).

a)



b)

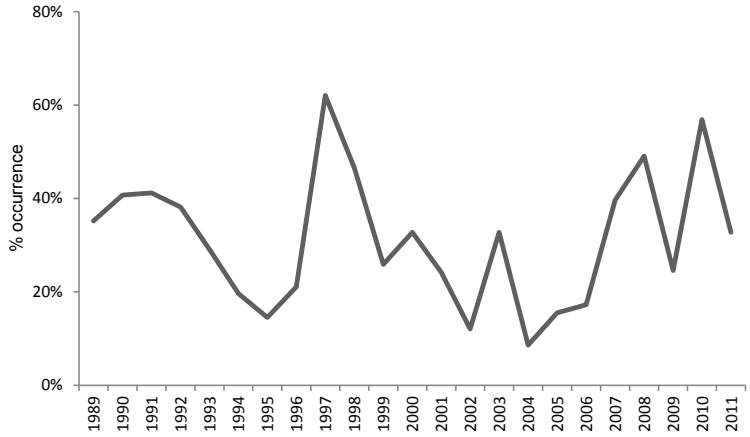
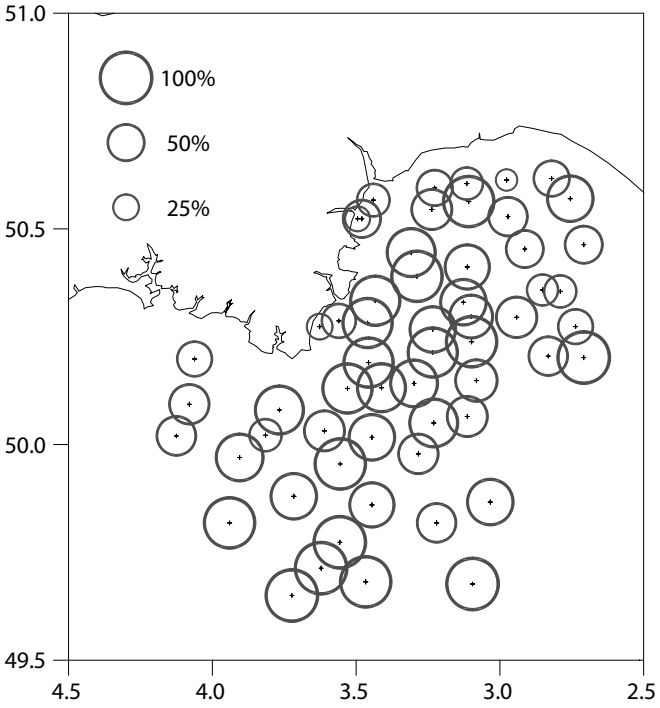


Figure 29: Bib *Trisopterus luscus*: (a) Spatial distribution, shown as the average frequency of occurrence at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the frequency of occurrence per year. Data category C (refer to Table 6).

Cod-like fishes (Gadidae)

a)



b)

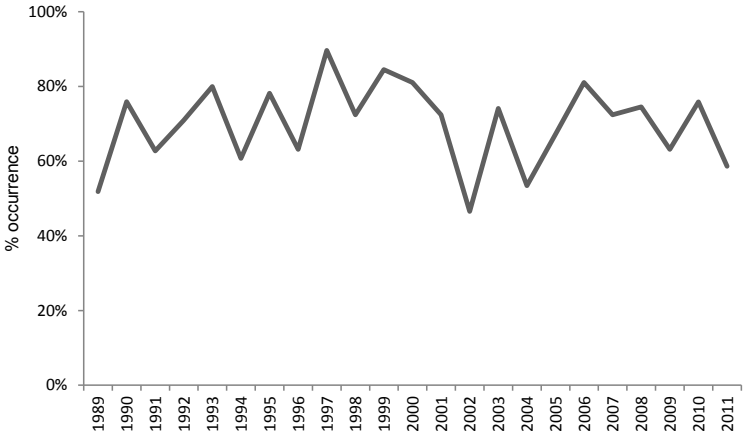


Figure 30: Poor cod *Trisopterus minutus*: (a) Spatial distribution, shown as the average frequency of occurrence at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the frequency of occurrence per year. Data category C (refer to Table 6).

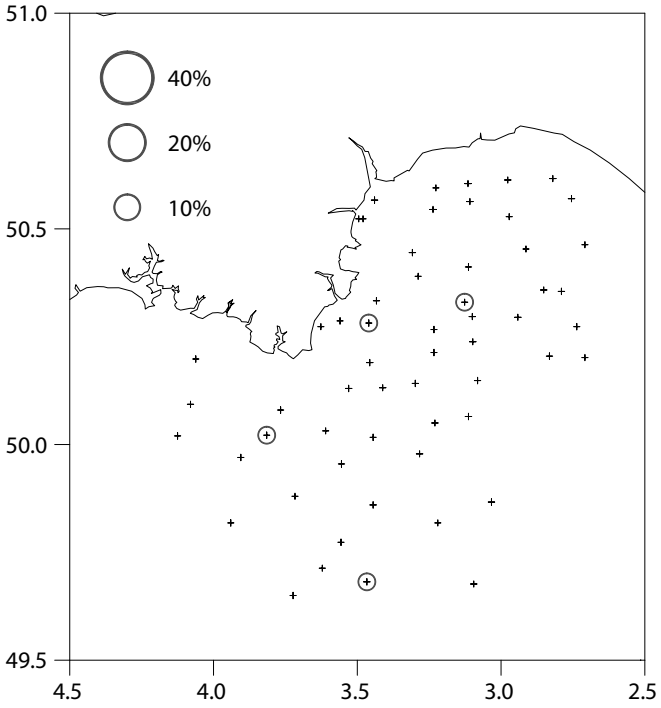


Figure 31: Spatial distribution of Norway pout *Trisopterus esmarki*, shown as the average frequency of occurrence at prime stations (+). Data category D (refer to Table 6).

Rocklings and ling (Lotidae)

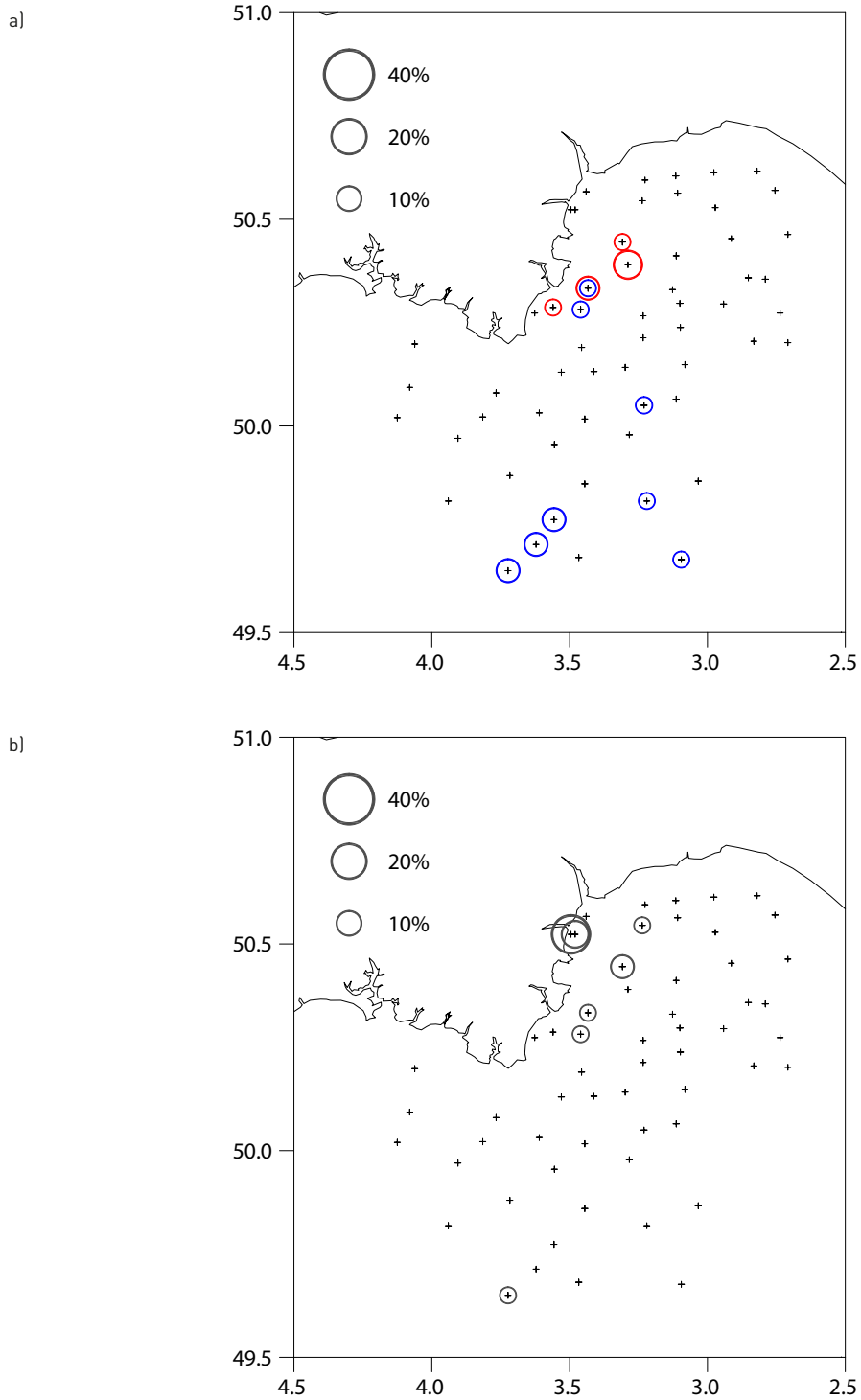


Figure 32: Spatial distribution of (a) three-bearded *Gaidropsarus vulgaris* (blue), four-bearded *Enchelyopus cimbrius* (red), and (b) five-bearded rockling *Ciliata mustela*, shown as the average frequency of occurrence at prime stations (+). Data category D (refer to Table 6).

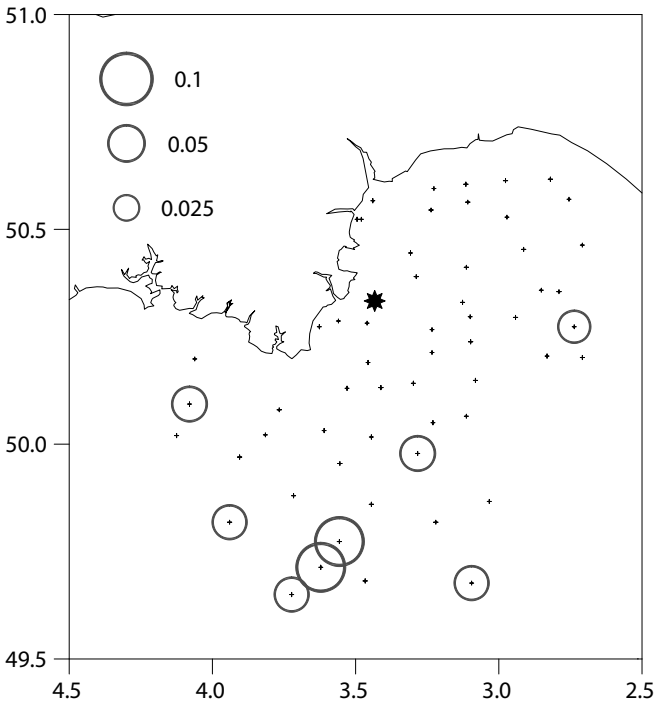


Figure 33: Spatial distribution of common ling *Molva molva*, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). Data category B (refer to Table 6). Occurrence of greater forkbeard *Phycis blennoides* (data category D) shown as *.

Hakes (Merluccidae)

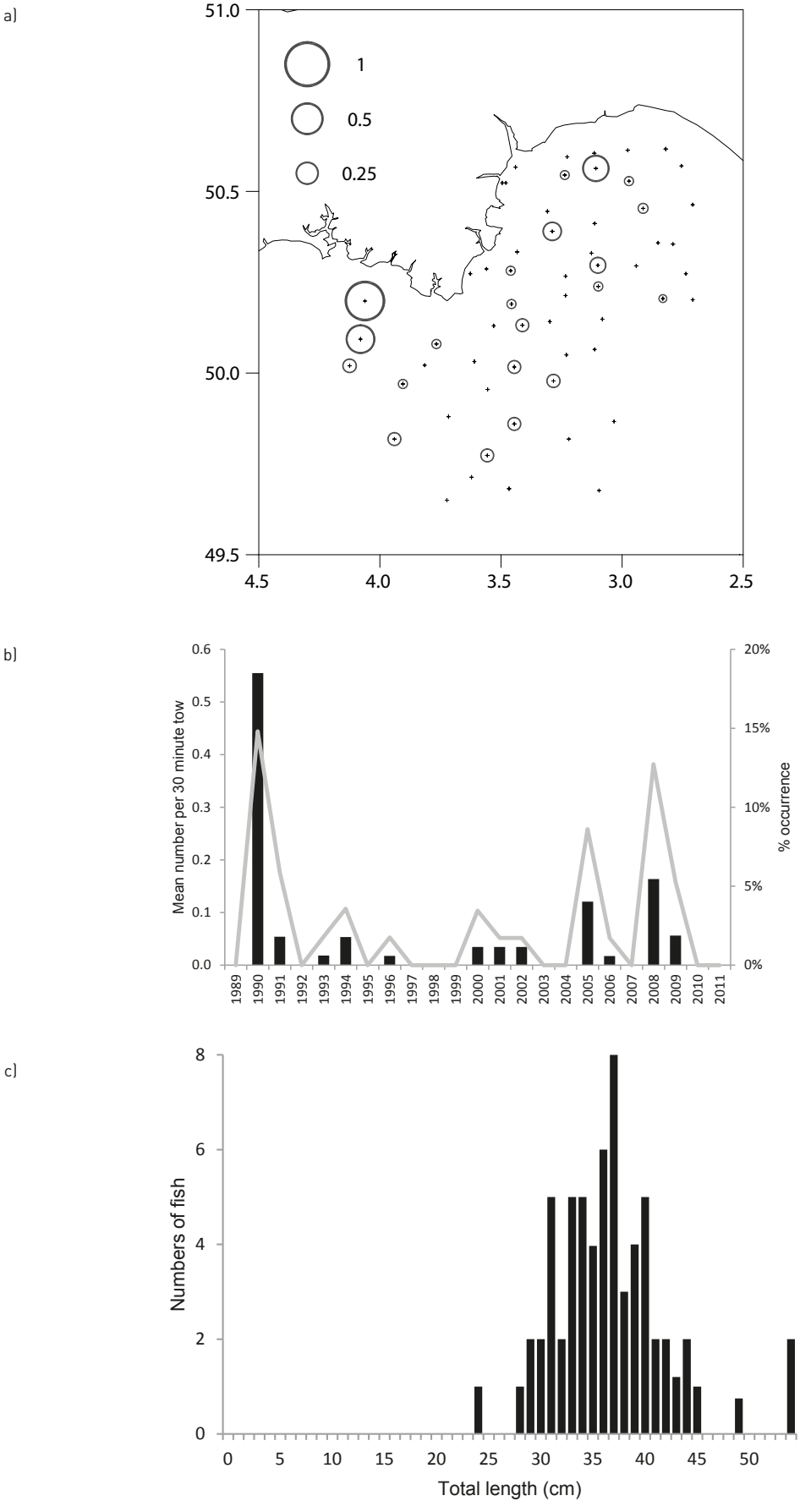
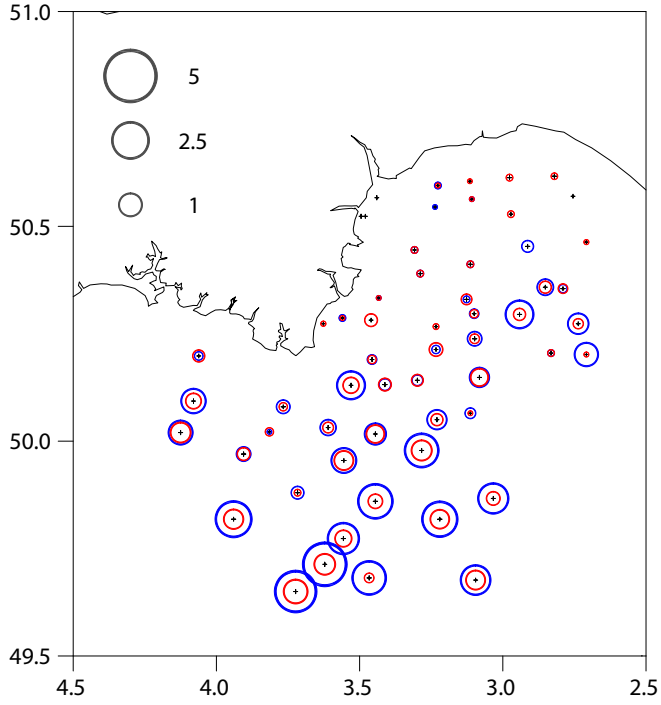
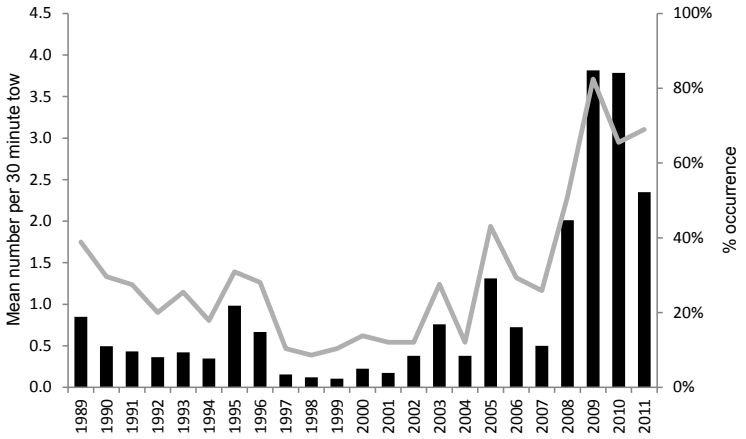


Figure 34: European hake *Merluccius merluccius*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

a)



b)



c)

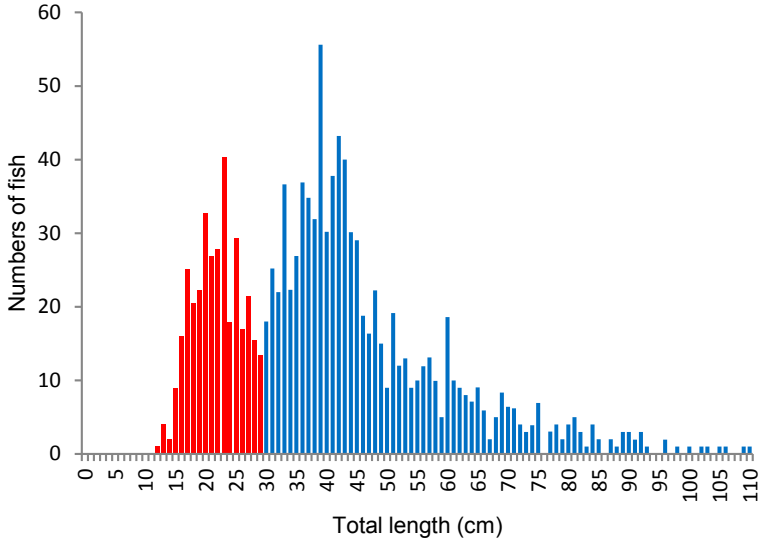


Figure 35: Anglerfish *Lophius piscatorius*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+) for fish <30 cm (red) and fish ≥30 cm (blue). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

Anglerfish (Lophiidae)

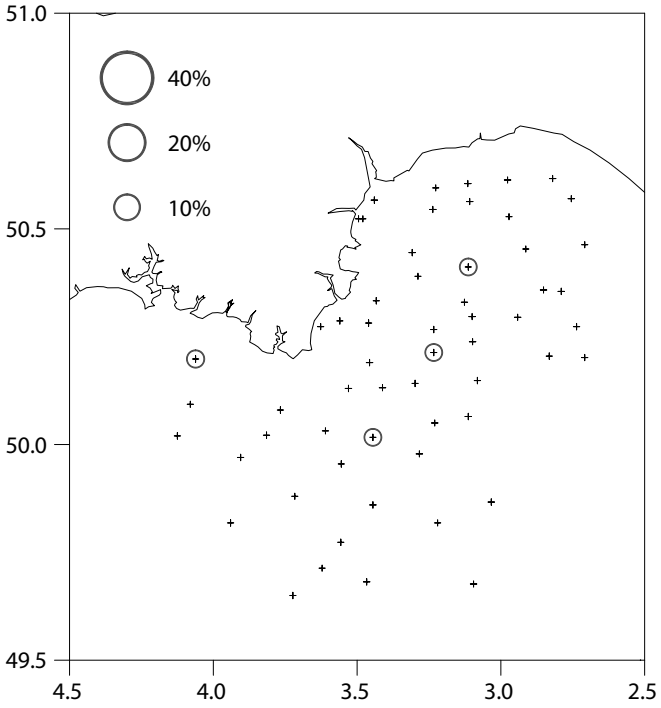


Figure 36: Spatial distribution of black-bellied anglerfish *Lophius budegassa*, shown as the average frequency of occurrence at prime stations (+). Data category D (refer to Table 6).

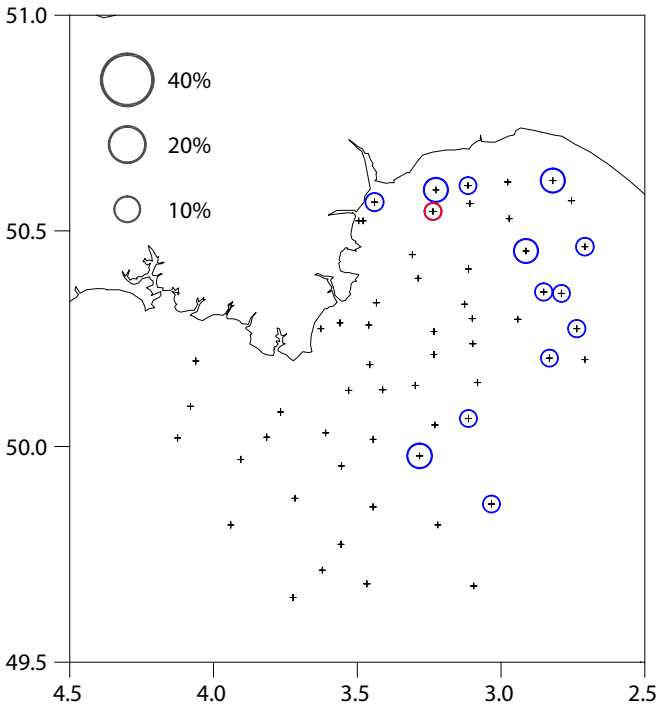


Figure 37: Spatial distribution of small-headed clingfish *Apletodon microcephalus* (red) and two-spotted clingfish *Diplecogaster bimaculata* (blue), shown as the average frequency of occurrence at prime stations (+). Data category D (refer to Table 6).

John Dory (Zeidae)

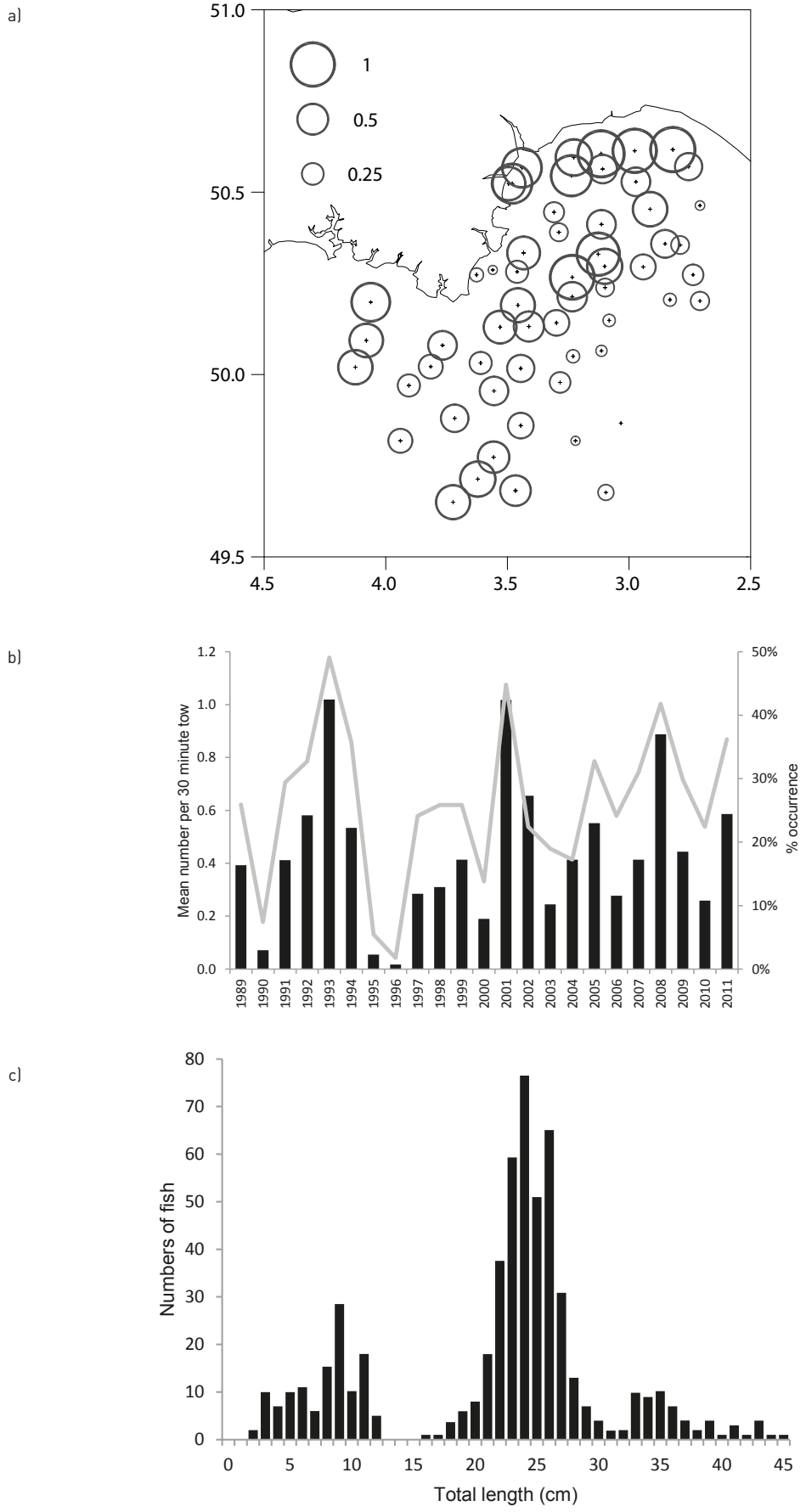
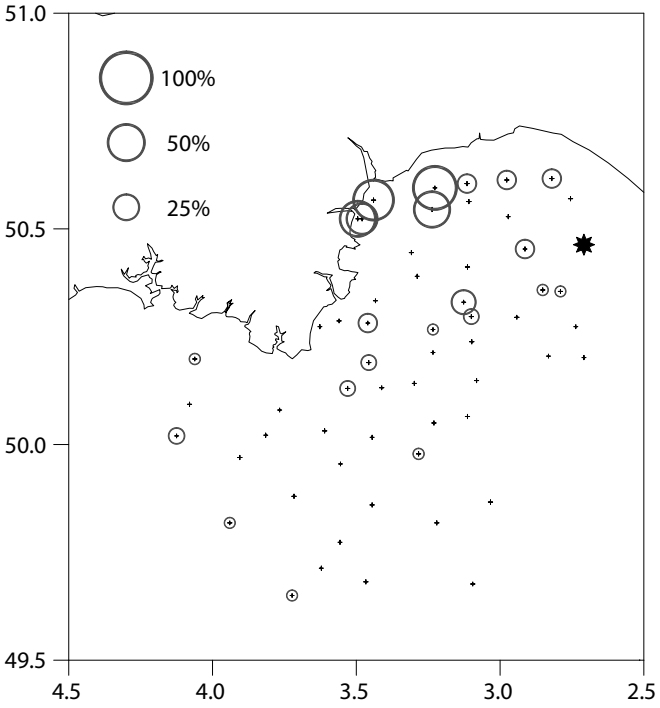


Figure 38: John Dory *Zeus faber*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

a)



b)

Figure 39: Greater pipefish *Syngnathus acus*: (a) Spatial distribution, shown as the average frequency of occurrence at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the frequency of occurrence per year. Data category C (refer to Table 6). Occurrence of three-spined stickleback *Gasterosteus aculeatus* (data category D) shown as *.

Pipefishes and sea-horses (Syngnathidae)

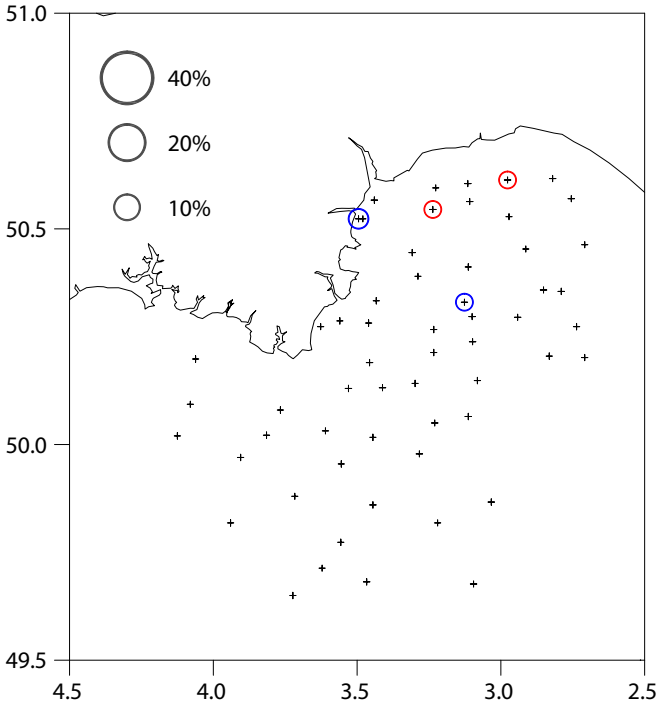
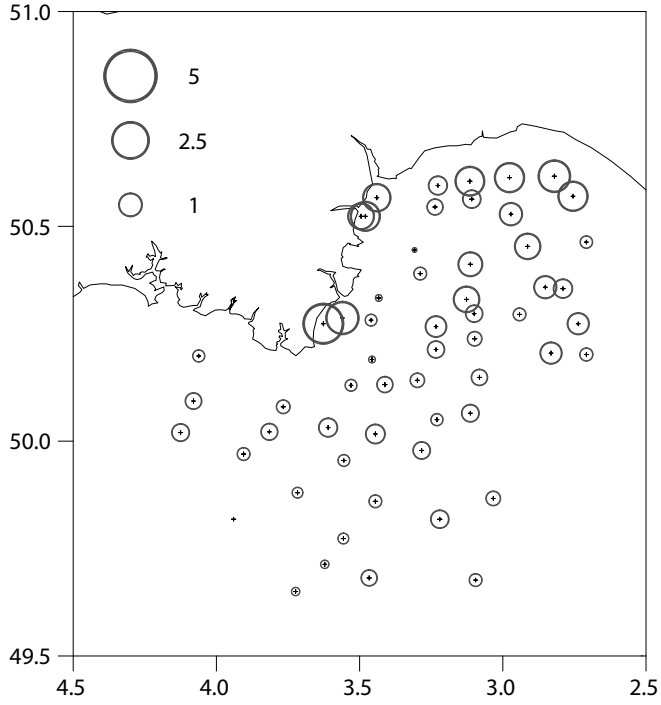
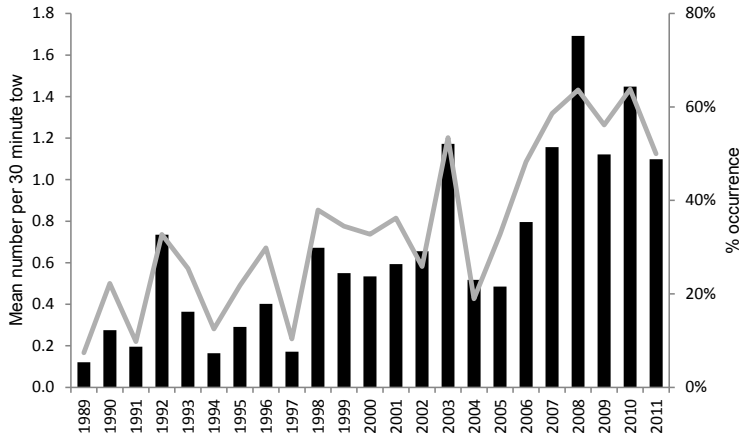


Figure 40: Spatial distribution of Nilsson's pipefish *Syngnathus rostellatus* (blue) and sea-horse *Hippocampus* spp. (red), shown as the average frequency of occurrence at prime stations (+). Data category D (refer to Table 6).

a)



b)



c)

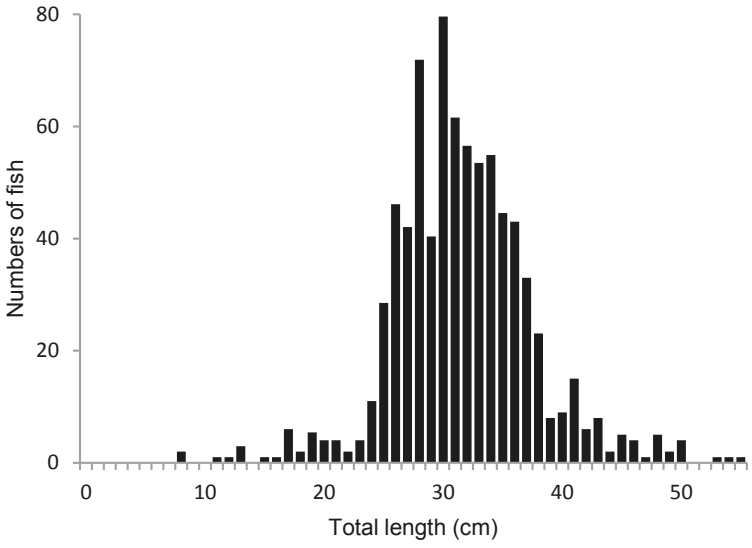
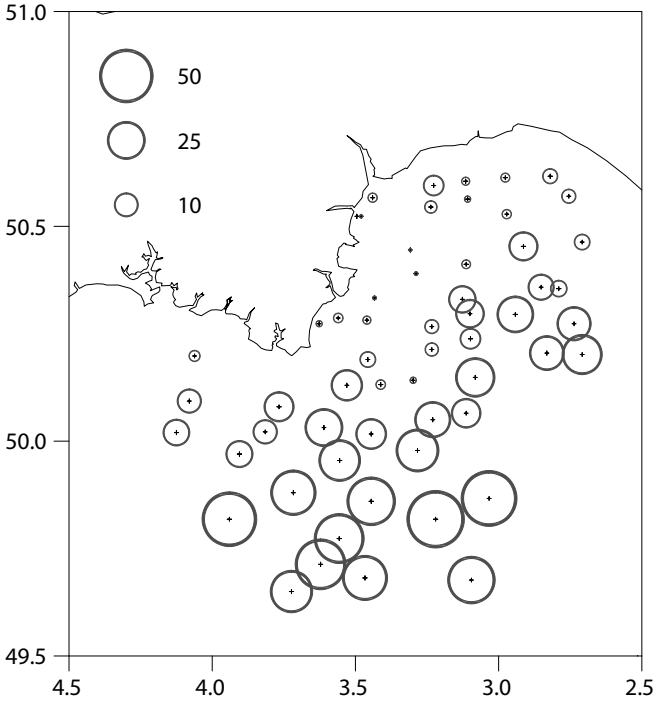


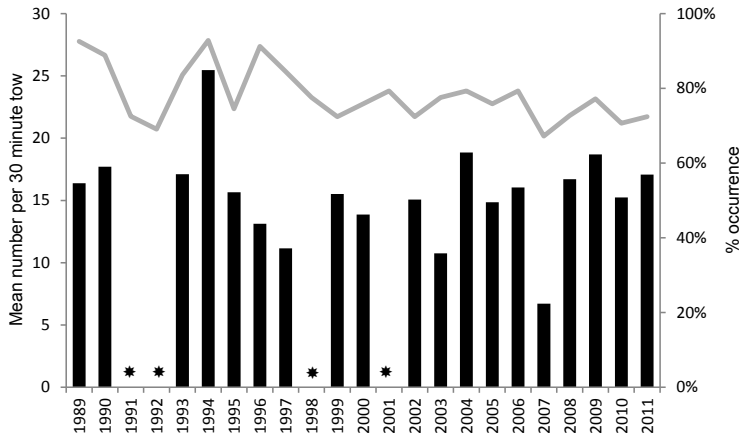
Figure 41: Tub gurnard *Chelidonichthys lucerna*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

Gurnards (Triglidae)

a)



b)



c)

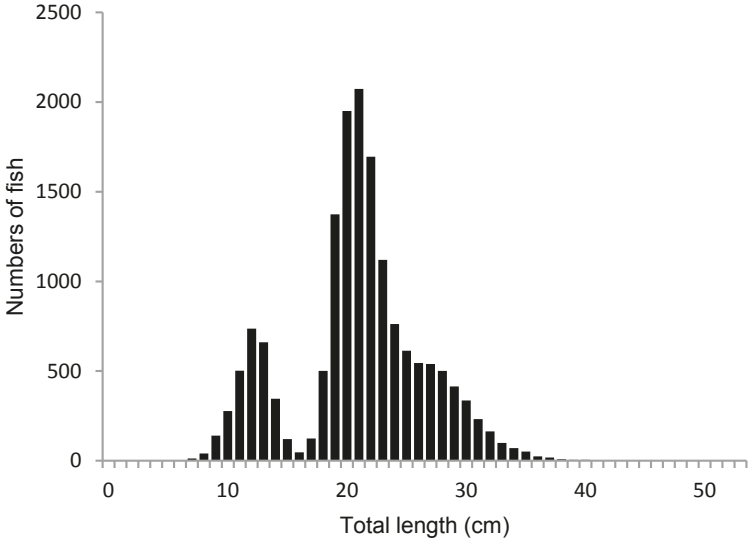


Figure 42: Red gurnard *Chelidonichthys cuculus*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. *Denotes that abundance data are not suitable to use. Data category B (refer to Table 6).

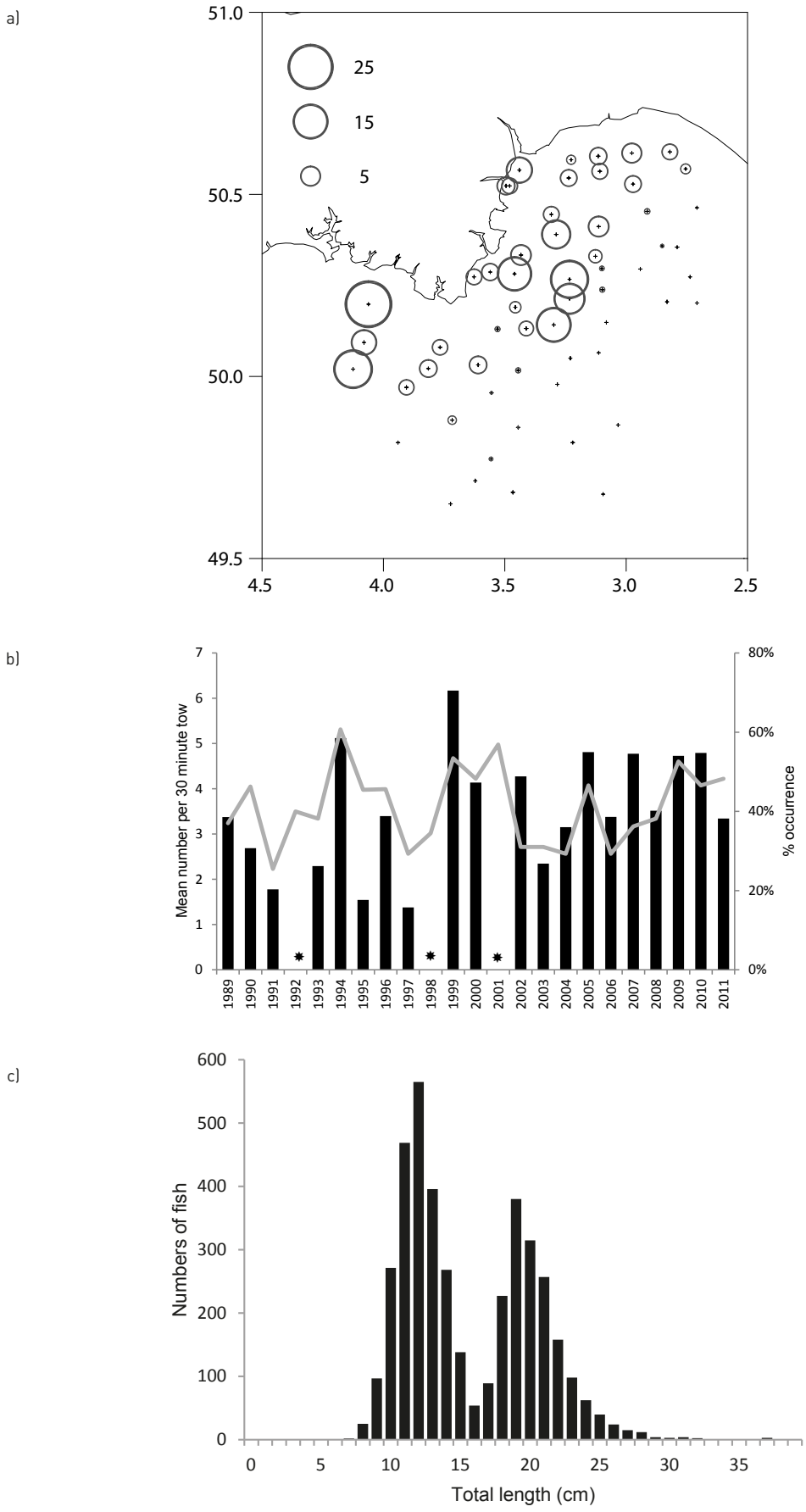


Figure 43: Grey gurnard *Eutrigla gurnardus*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. *Denotes that abundance data are not suitable to use. Data category B (refer to Table 6).

Gurnards (Triglidae)

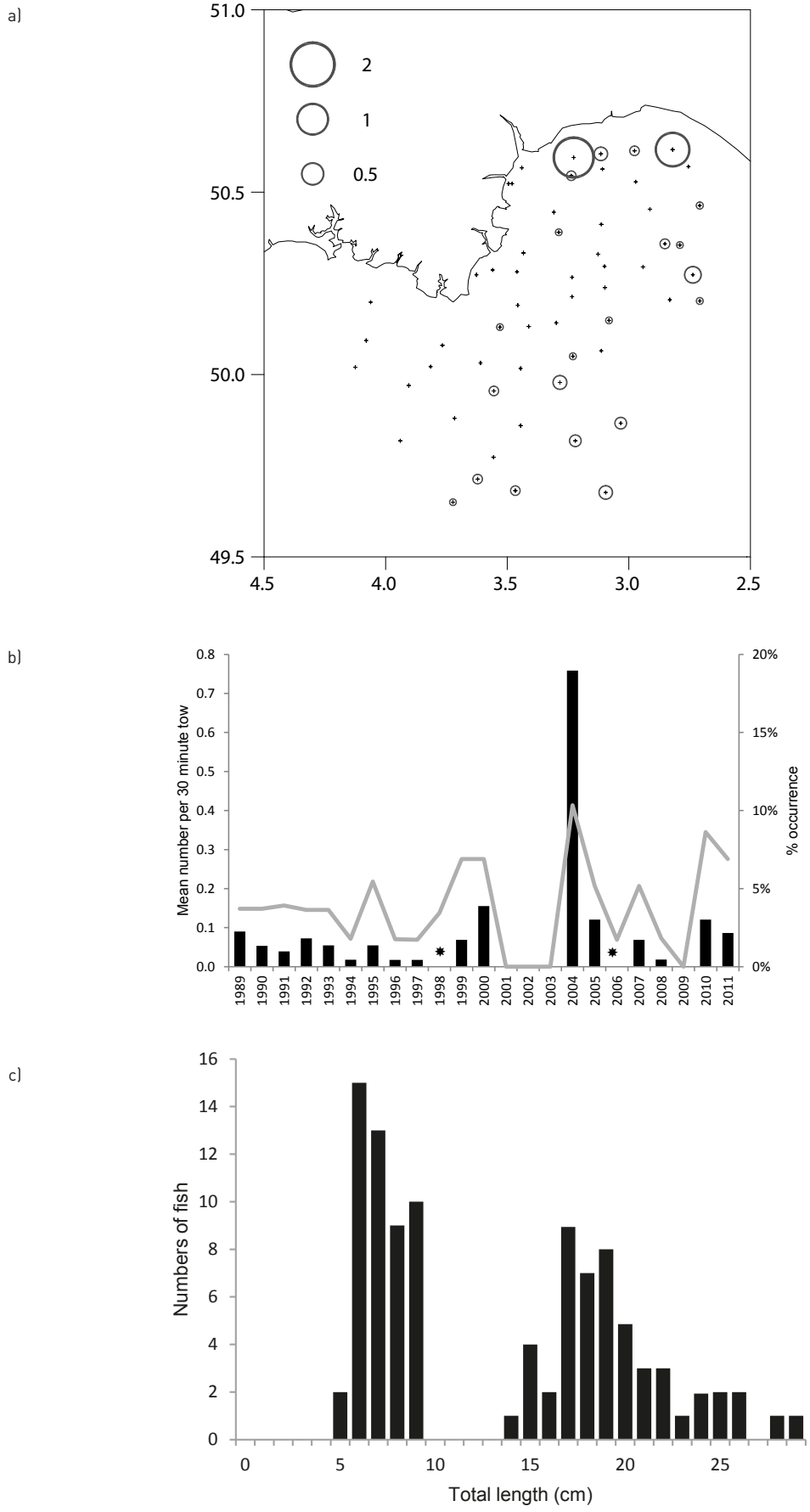


Figure 44: Streaked gurnard *Trigloporus lastoviza*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. *Denotes that abundance data are not suitable to use. Data category B (refer to Table 6).

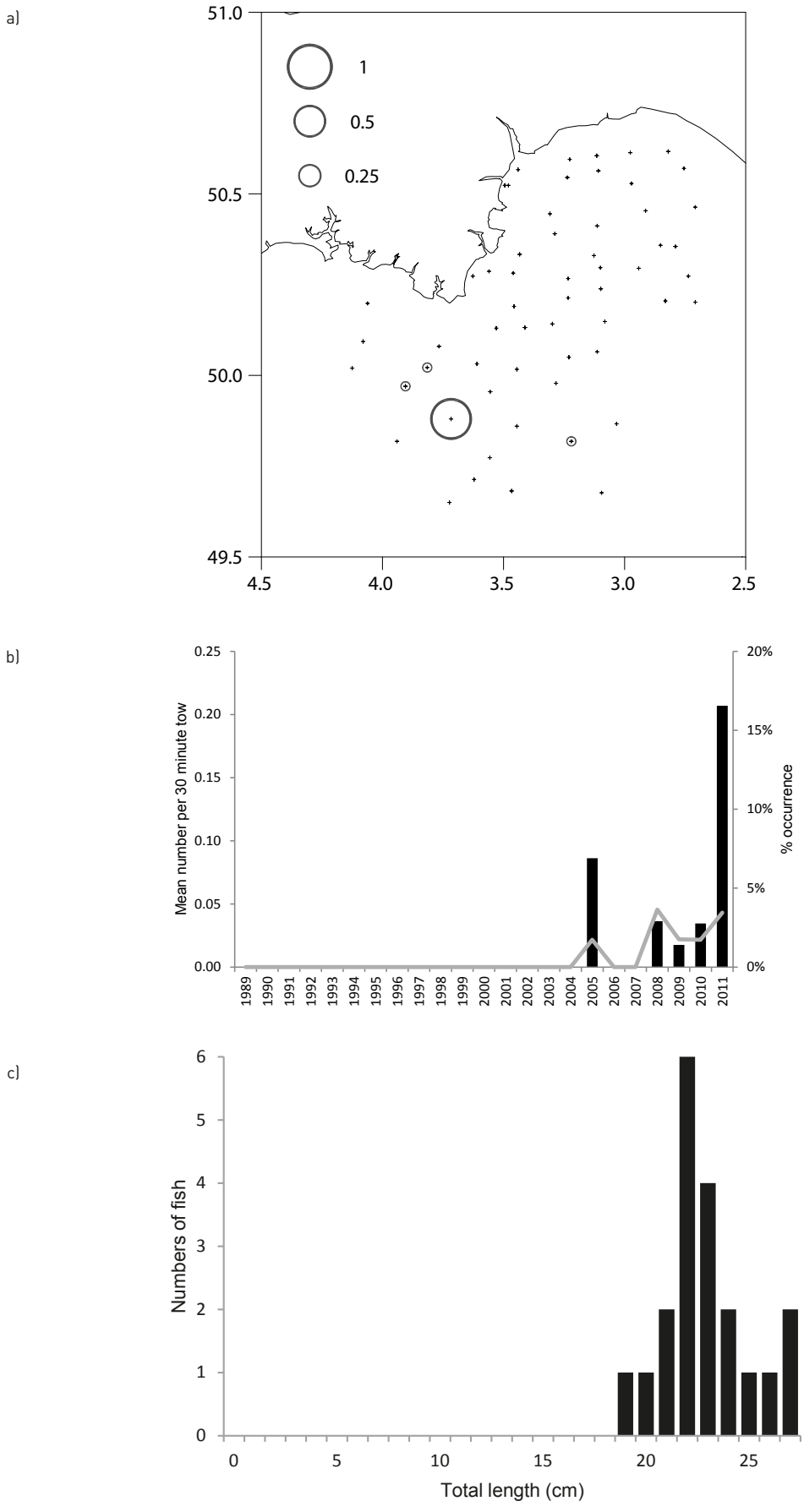
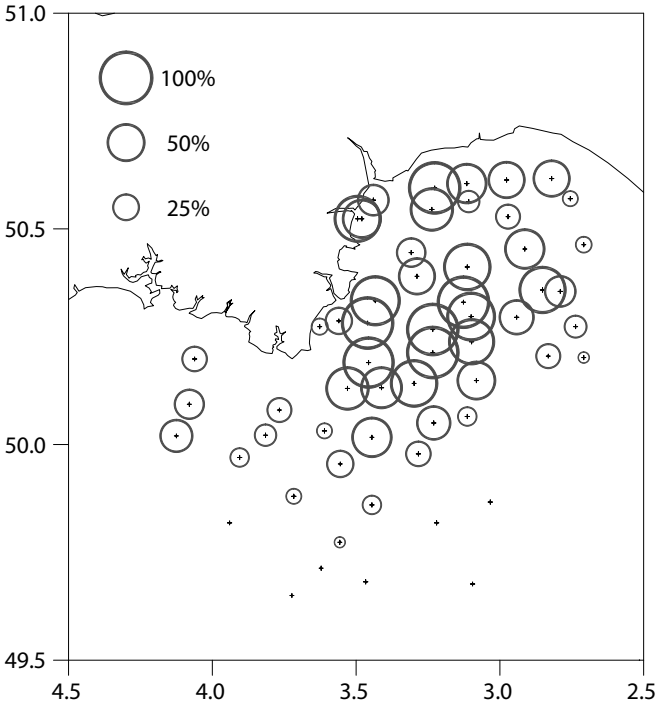


Figure 45: Long-finned gurnard *Chelidonichthys obscurus*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

Pogge (Agonidae)

a)



b)

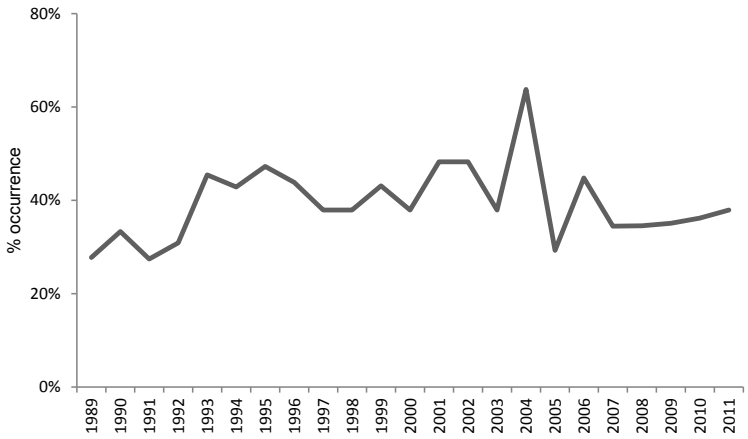


Figure 46: Pogge *Agonus cataphractus*: (a) Spatial distribution, shown as the average frequency of occurrence at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the frequency of occurrence per year. Data category C (refer to Table 6).

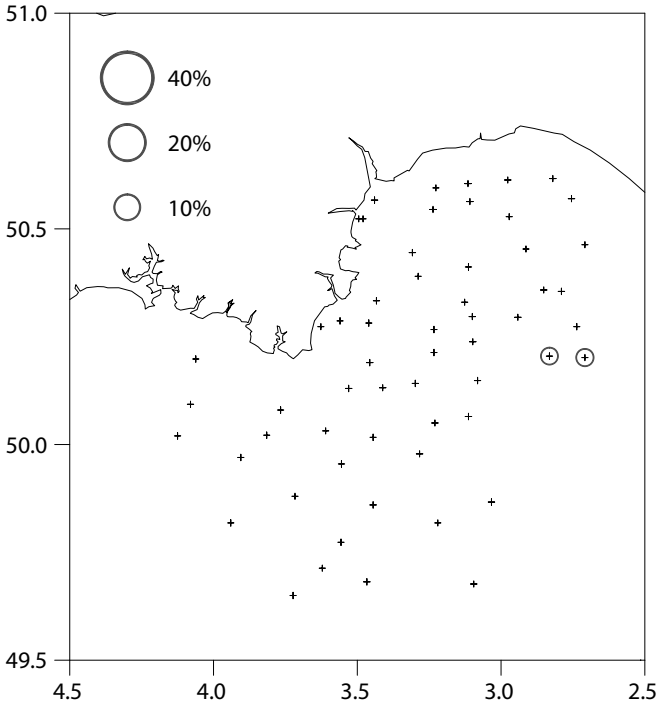


Figure 47: Spatial distribution of common sea-snail *Liparis liparis*, shown as the average frequency of occurrence at prime stations (+). Data category D (refer to Table 6).

Sea-bass (Moronidae)

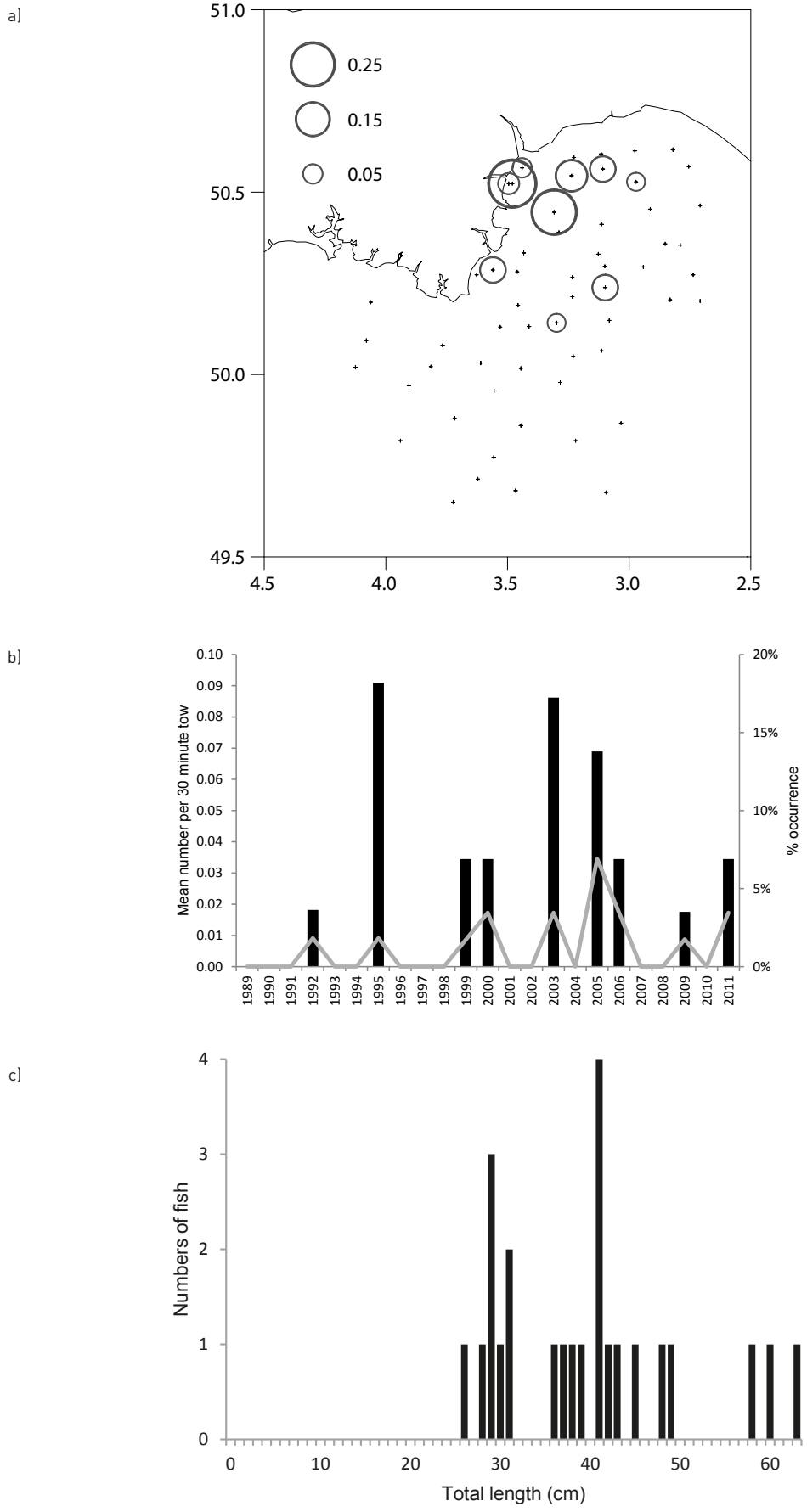


Figure 48: European sea-bass *Dicentrarchus labrax*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

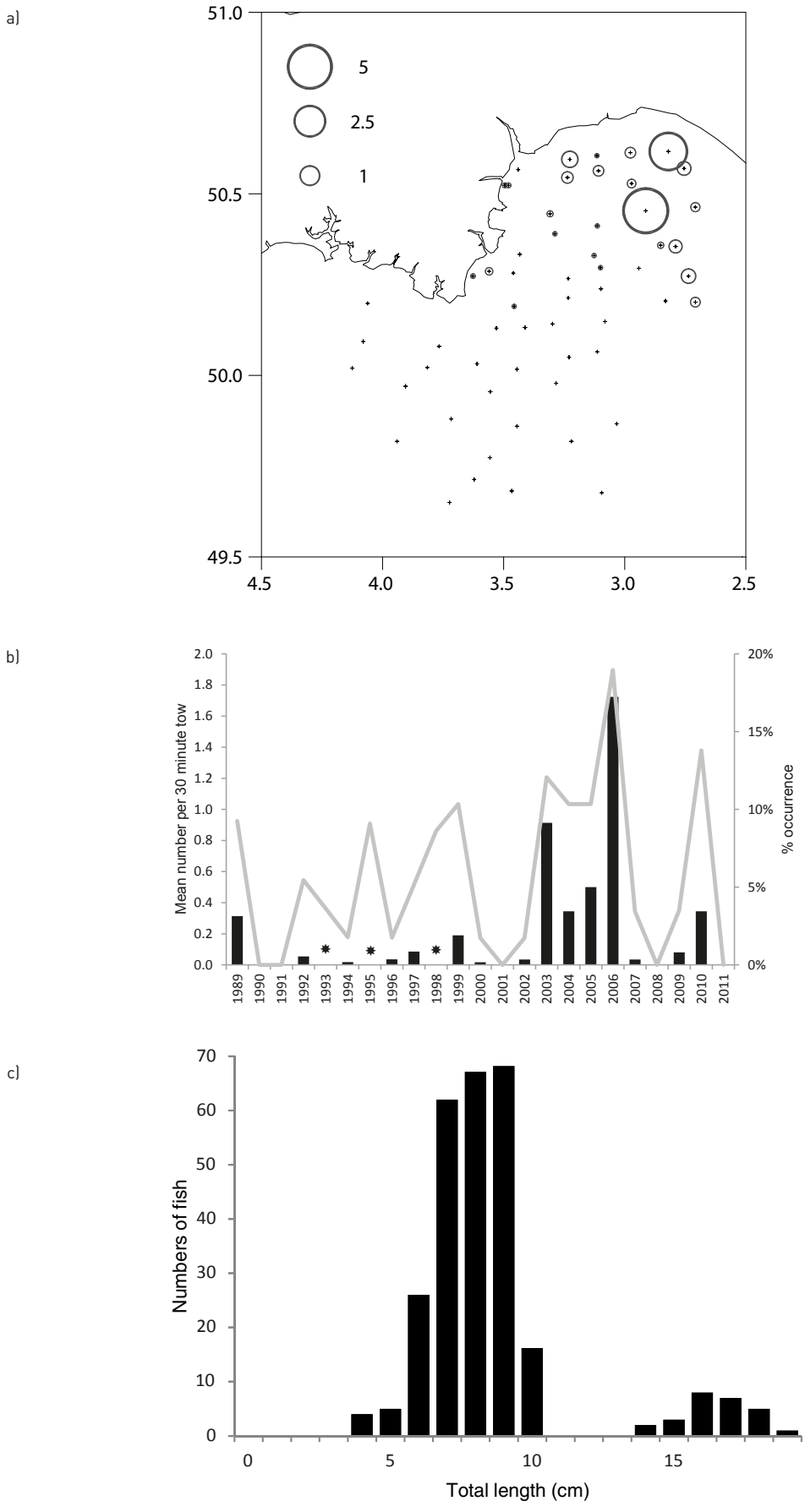


Figure 49: Black sea-bream *Spondyliosoma cantharus*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. *Denotes that abundance data are not suitable to use. Data category B (refer to Table 6).

Sea-breams (Sparidae)

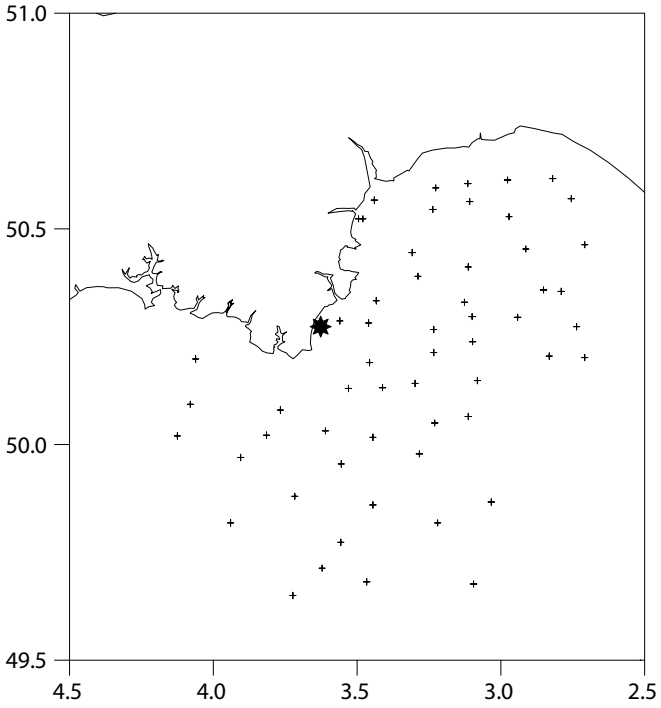


Figure 50: Occurrence of gilthead sea-bream *Sparus auratus*, shown as * at prime stations (+). Data category D (refer to Table 6).

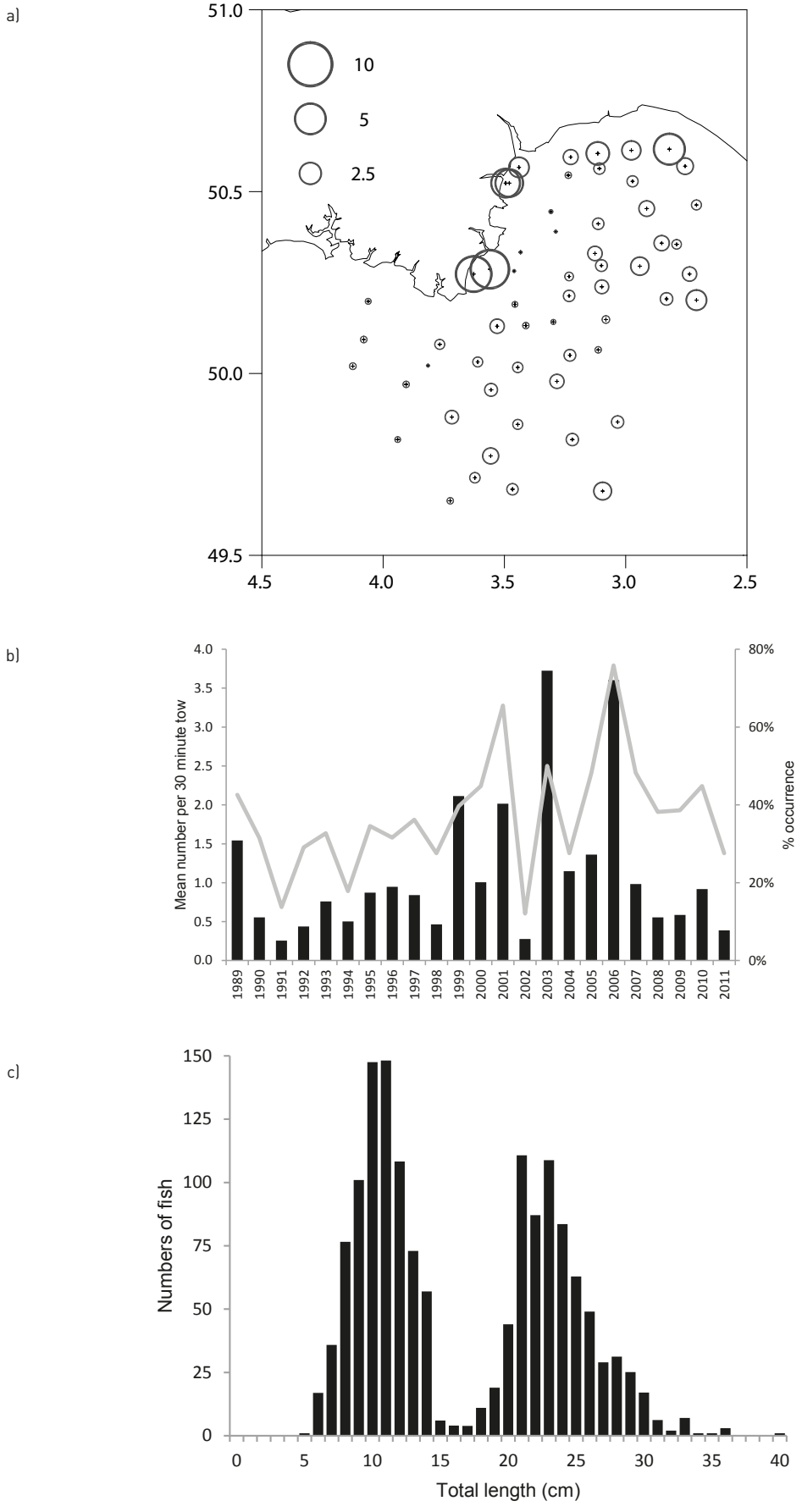
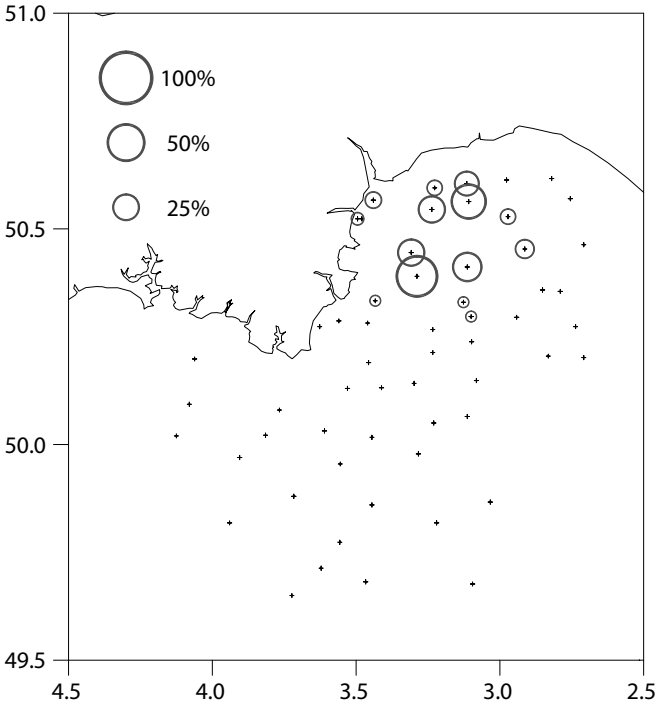


Figure 51: Red mullet *Mullus surmuletus*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

Red bandfish (Cepolidae)

a)



b)

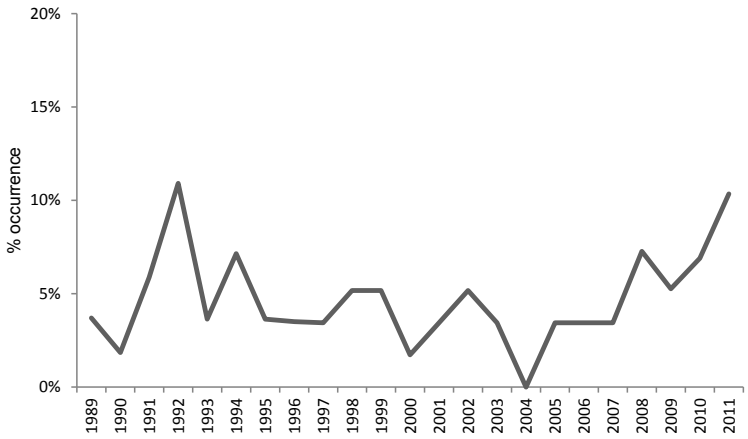
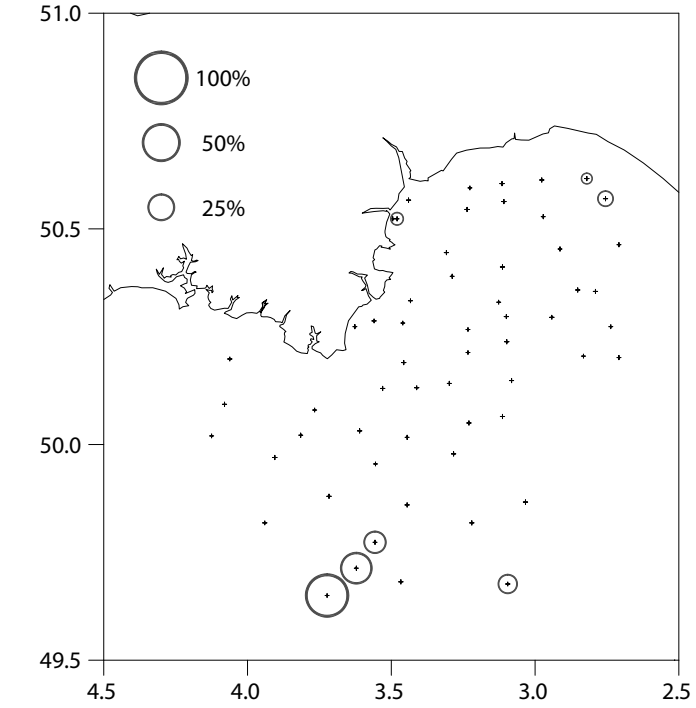


Figure 52: Red bandfish *Cepola rubescens*: (a) Spatial distribution, shown as the average frequency of occurrence at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the frequency of occurrence per year. Data category C (refer to Table 6).

a)



b)

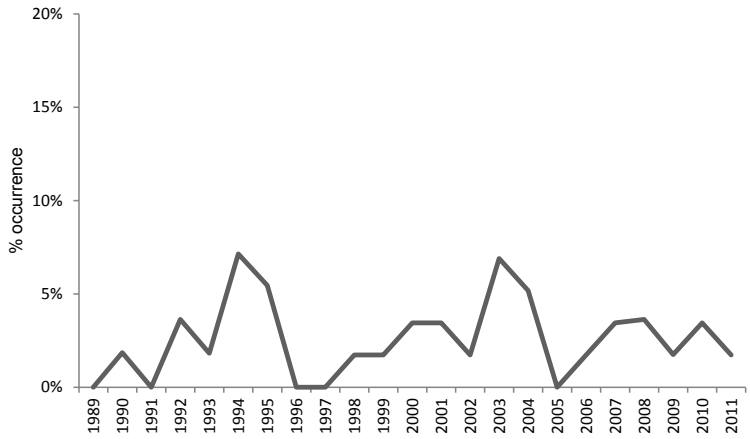
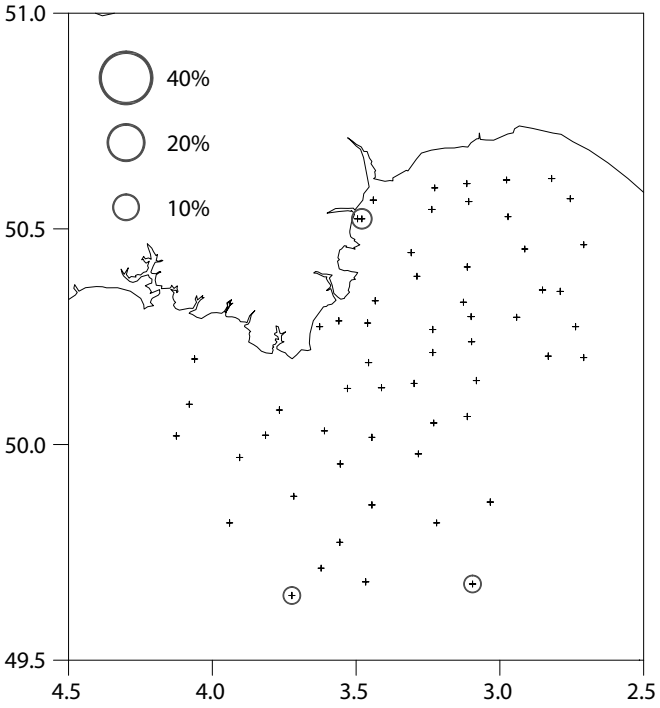


Figure 53: Goldsinny wrasse *Ctenolabrus rupestris*: (a) Spatial distribution, shown as the average frequency of occurrence at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the frequency of occurrence per year. Data category C (refer to Table 6).

Wrasse (Labridae)

a)



b)

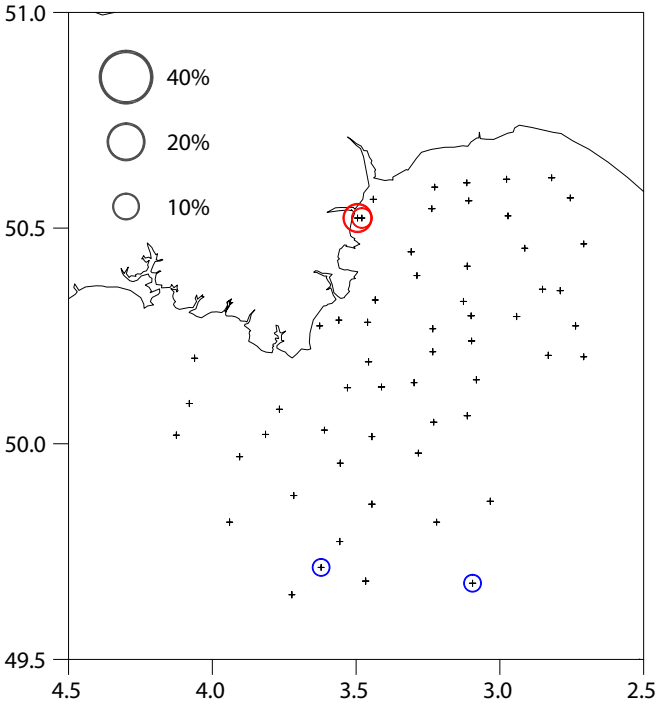


Figure 54: Spatial distribution of (a) cuckoo wrasse *Labrus mixtus*, and (b) corkwing wrasse *Symphodus melops* (red) and wrasses Labridae (indet.) (blue), shown as the average frequency of occurrence at prime stations (+). Data category D (refer to Table 6).

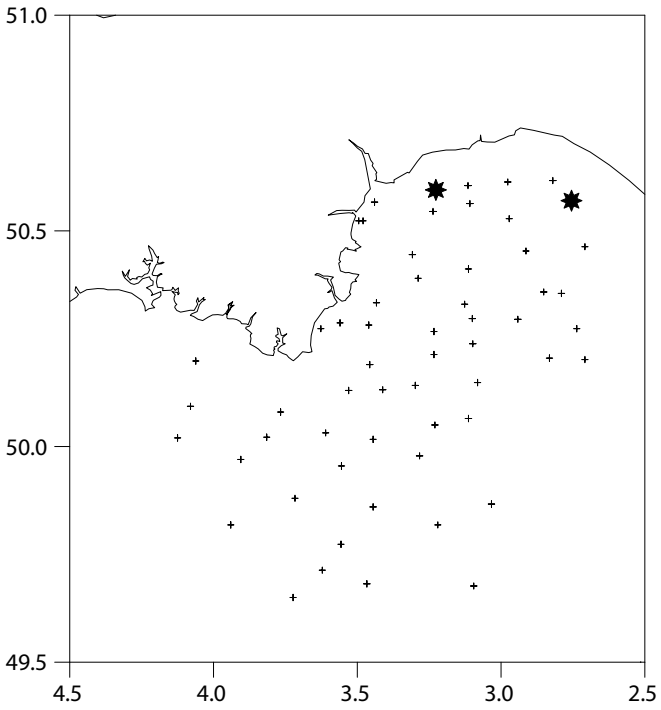
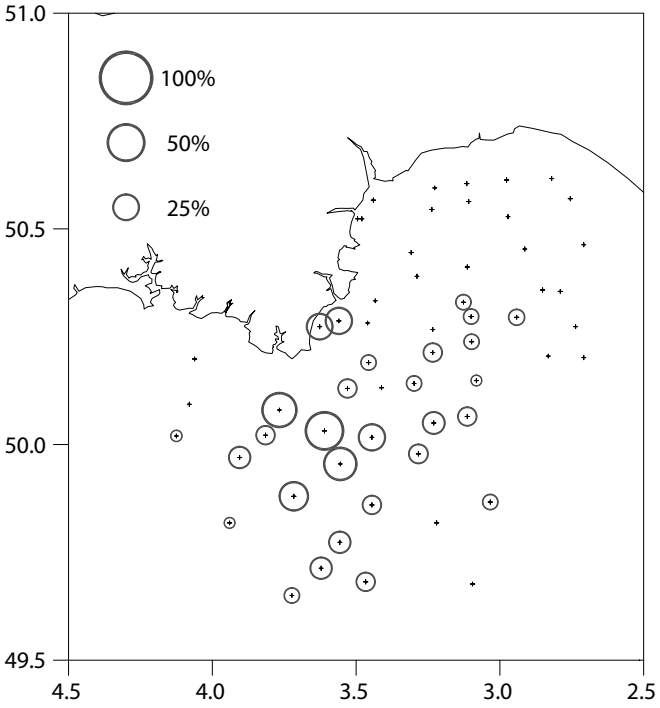


Figure 55: Occurrence of butterfish *Pholis gunnellus*, shown as * at prime stations (+). Data category D (refer to Table 6).

Sandeels (Ammodytidae)

a)



b)

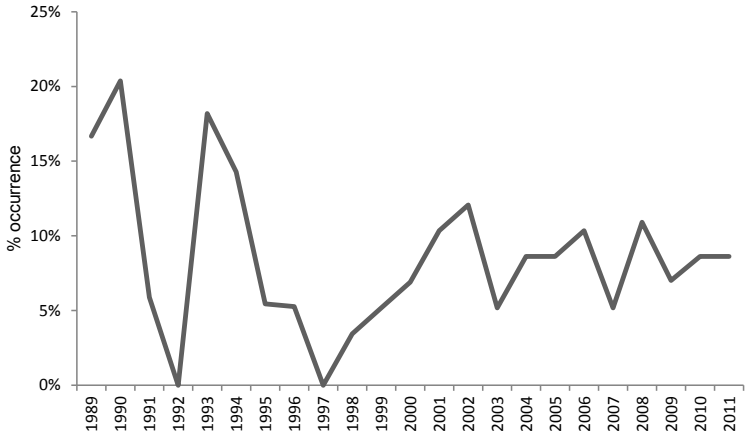
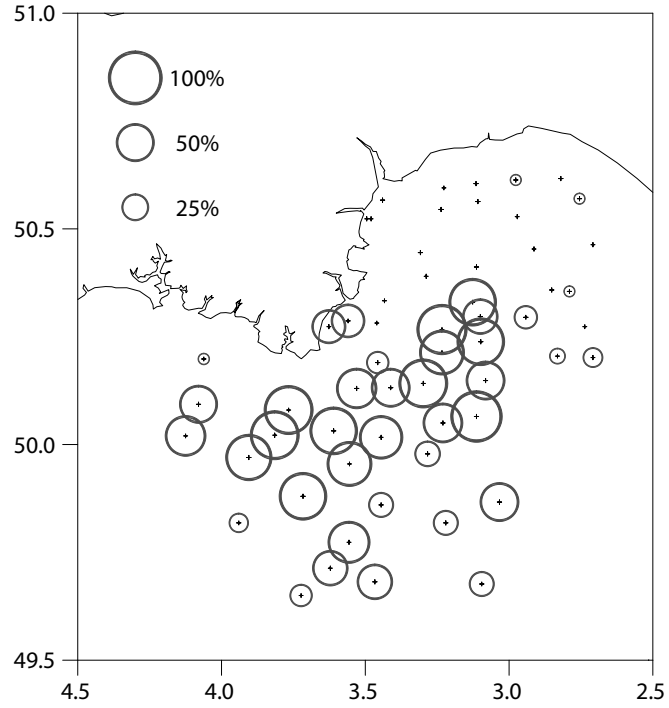


Figure 56: Sandeels Ammodytidae: (a) Spatial distribution, shown as the average frequency of occurrence at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the frequency of occurrence per year. Data category C (refer to Table 6).

a)



b)

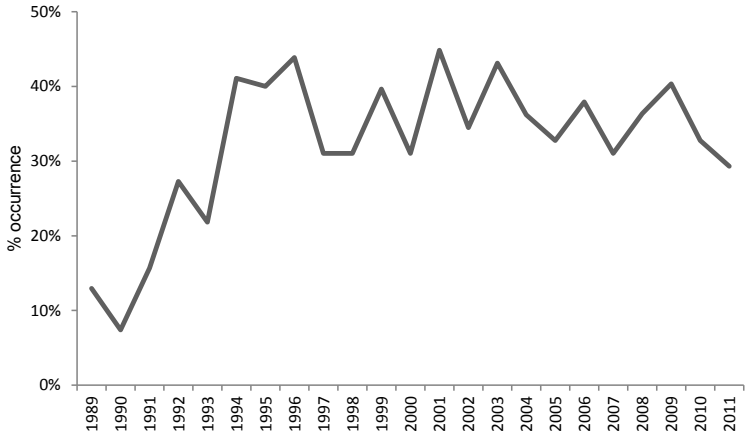


Figure 57: Lesser weever fish *Echiichthys vipera*: (a) Spatial distribution, shown as the average frequency of occurrence at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the frequency of occurrence per year. Data category C (refer to Table 6).

Weeverfish (Trachinidae)

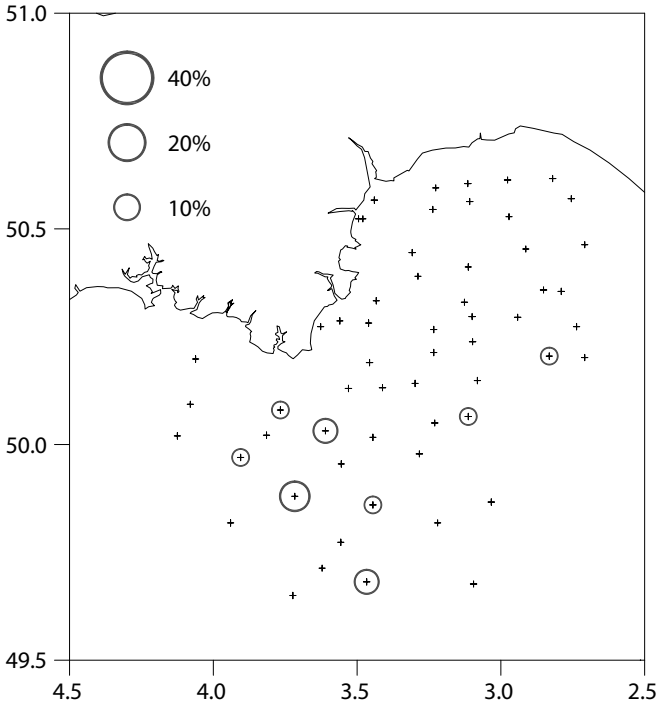
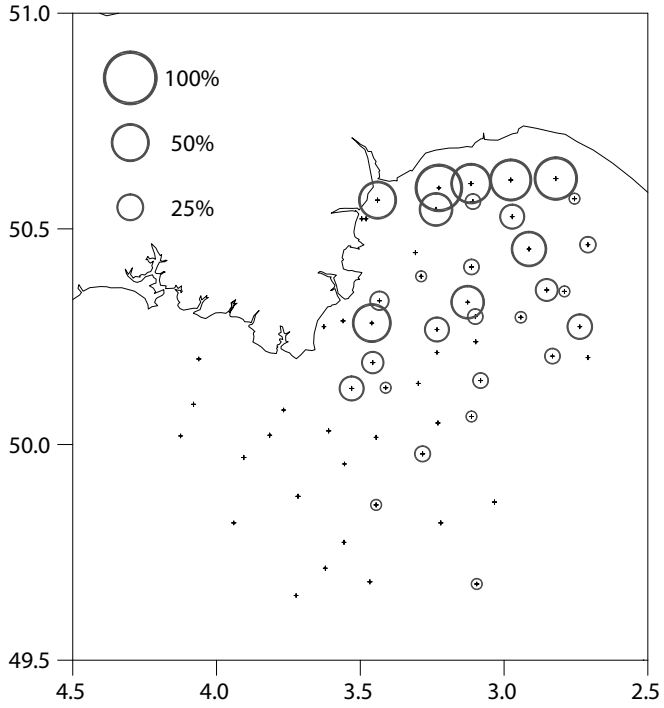


Figure 58: Spatial distribution of greater weever fish *Trachinus draco*, shown as the average frequency of occurrence at prime stations (+). Data category D (refer to Table 6).

a)

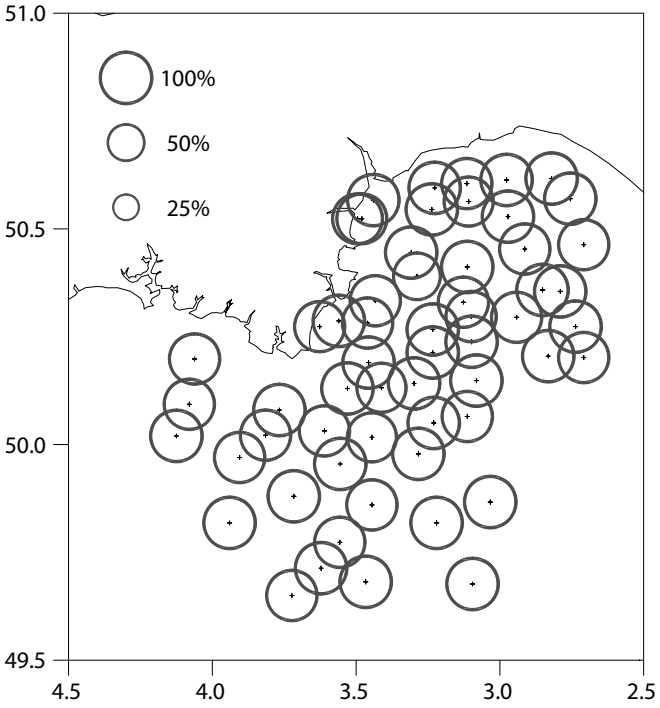


b)

Figure 59: Butterfly blenny *Blennius ocellaris*: (a) Spatial distribution, shown as the average frequency of occurrence at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the frequency of occurrence per year. Data category C (refer to Table 6).

Dragonets (Callionymidae)

a)



b)

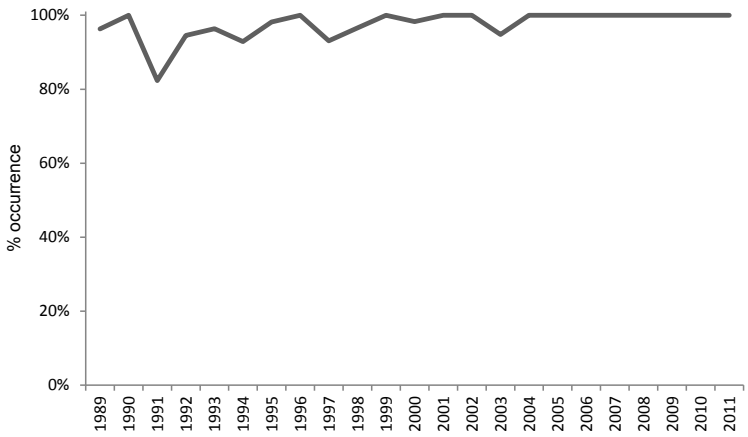
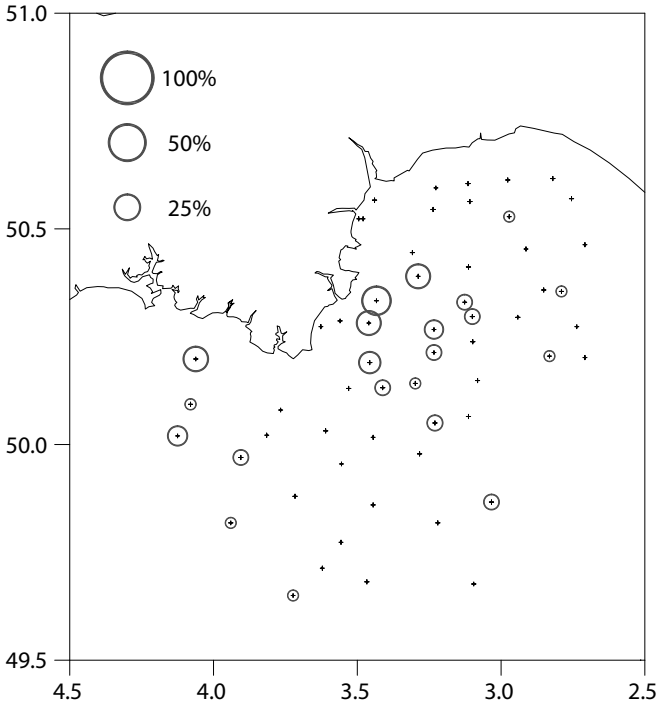


Figure 60: Common dragonet *Callionymus lyra*: (a) Spatial distribution, shown as the average frequency of occurrence at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the frequency of occurrence per year. Data category C (refer to Table 6).

a)



b)

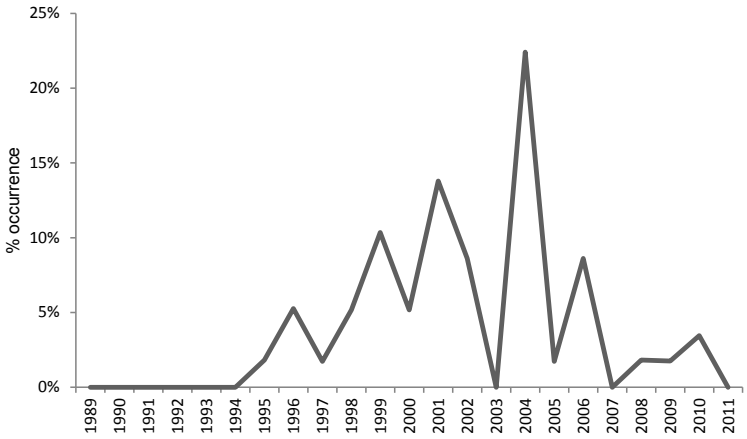
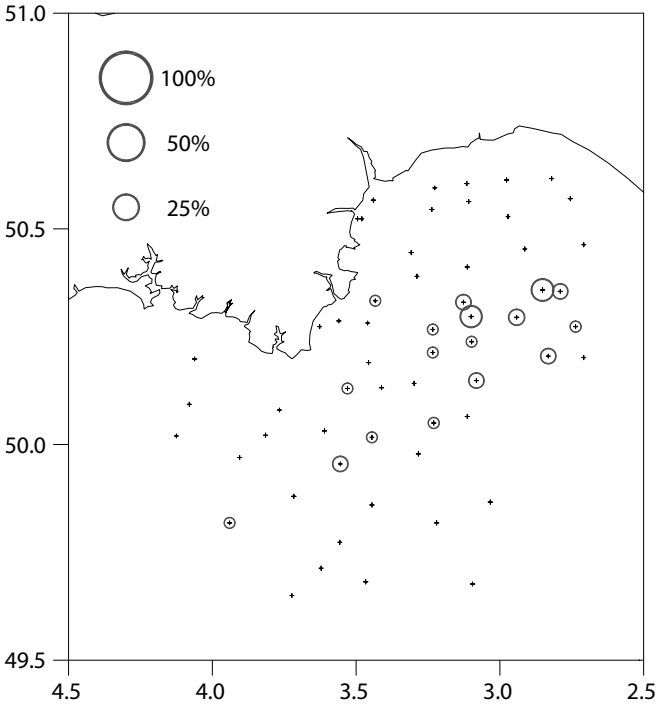


Figure 61: Spotted dragonet *Callionymus maculatus*: (a) Spatial distribution, shown as the average frequency of occurrence at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the frequency of occurrence per year. Data category C (refer to Table 6).

Dragonets (Callionymidae)

a)



b)

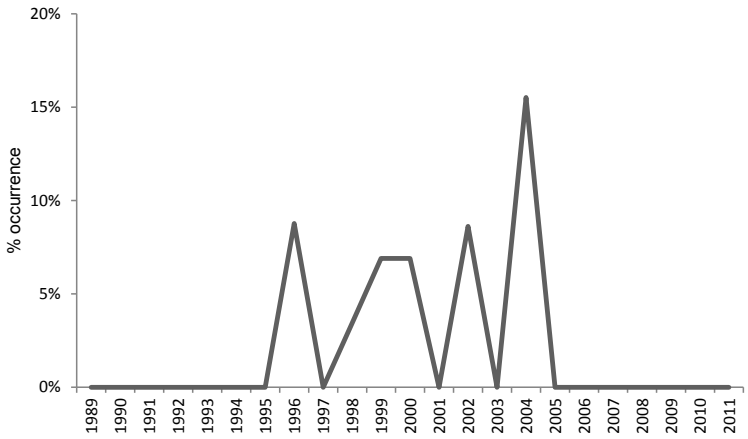
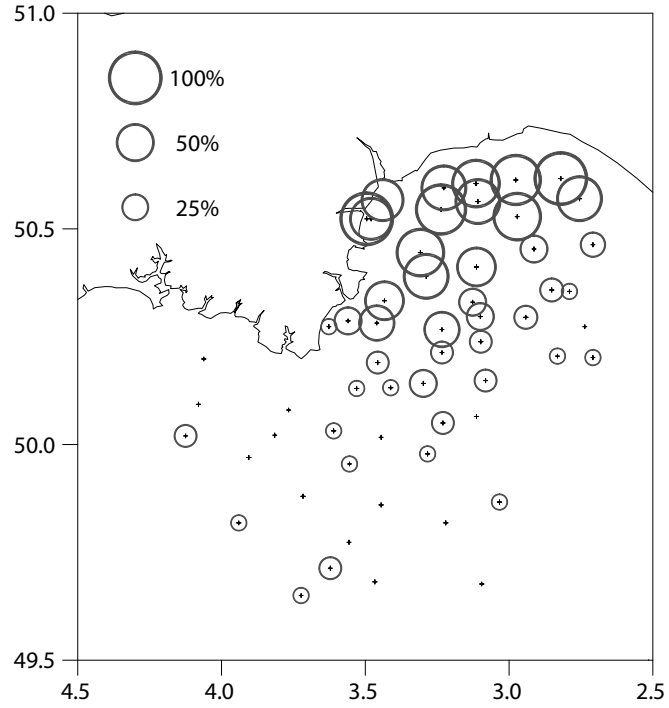


Figure 62: Reticulated dragonet *Callionymus reticulatus*: (a) Spatial distribution, shown as the average frequency of occurrence at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the frequency of occurrence per year. Data category C (refer to Table 6).

a)



b)

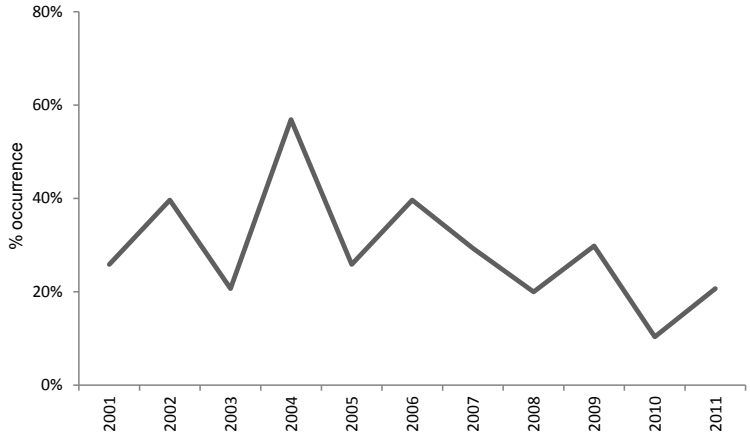


Figure 63: Sand gobies *Pomatoschistus* spp.: (a) Spatial distribution, shown as the average frequency of occurrence at prime stations (+). (b) Temporal trends (2001–2011) in relative abundance, shown as the frequency of occurrence per year. Data category C (refer to Table 6).

Gobies (Gobiidae)

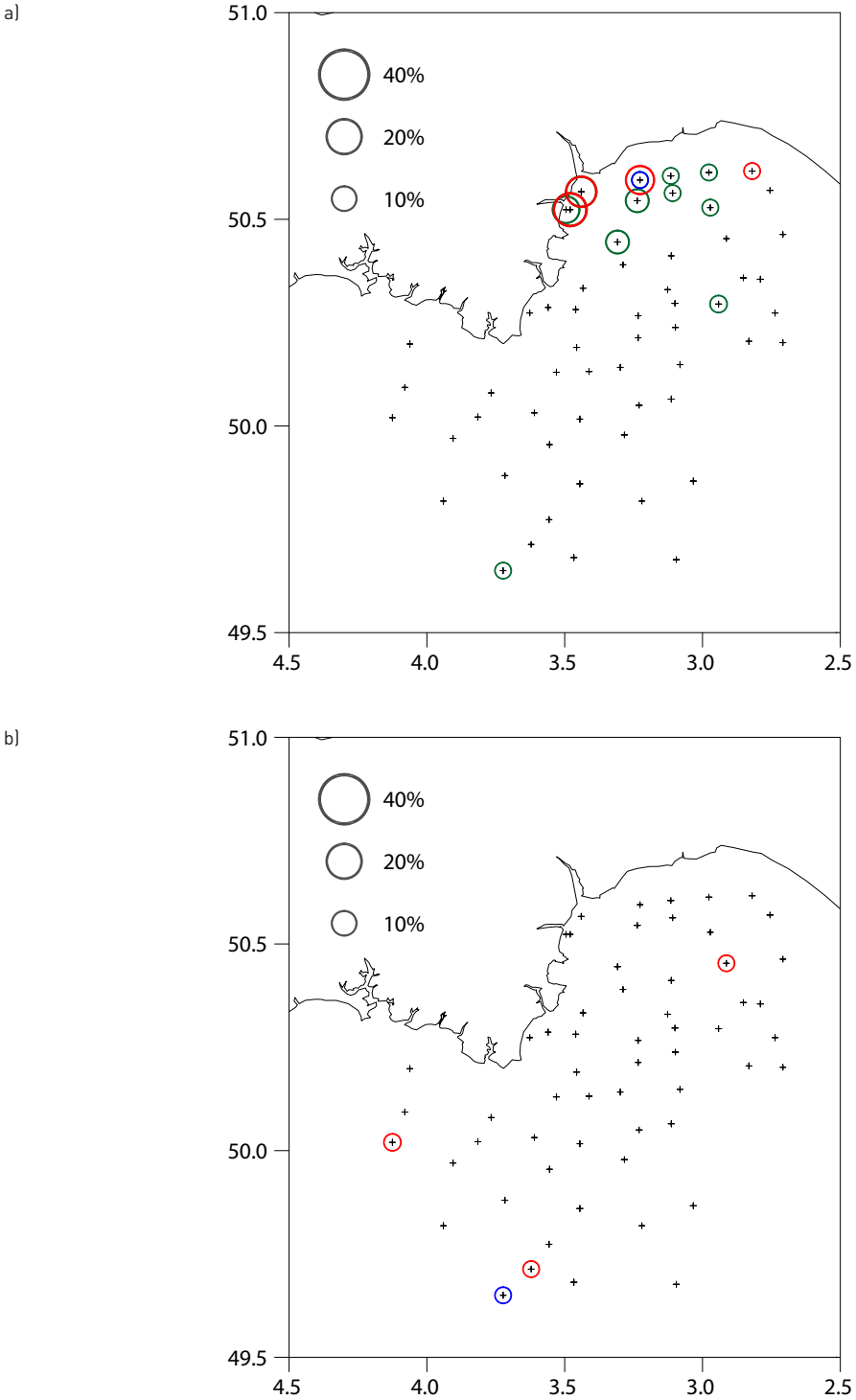
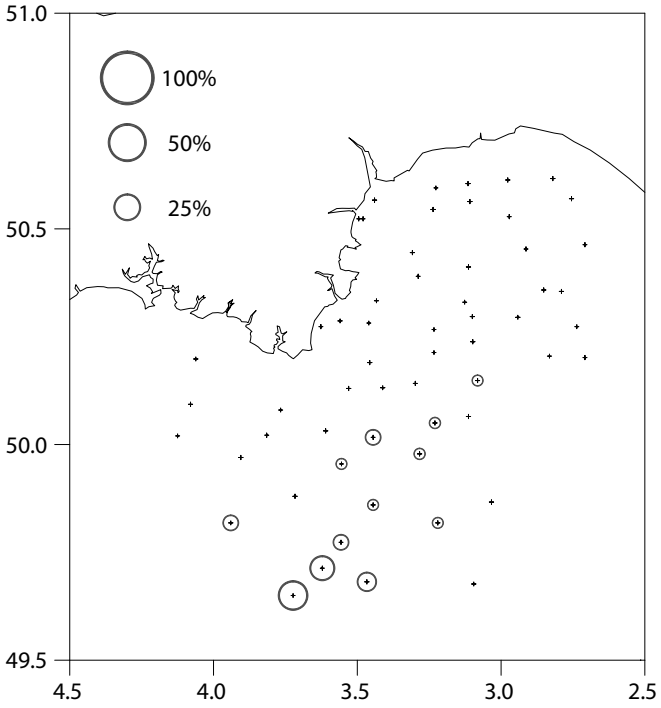


Figure 64: Spatial distribution of (a) black goby *Gobius niger* (red) rock goby *Gobius paganellus* (blue) and gobies *Gobius* spp. (green), and (b) Jeffrey's goby *Buenia jeffreysii* (red) and Fries's goby *Lesueurigobius friesii* (blue), shown as the average frequency of occurrence at prime stations (+). Data category D (refer to Table 6).

a)



b)

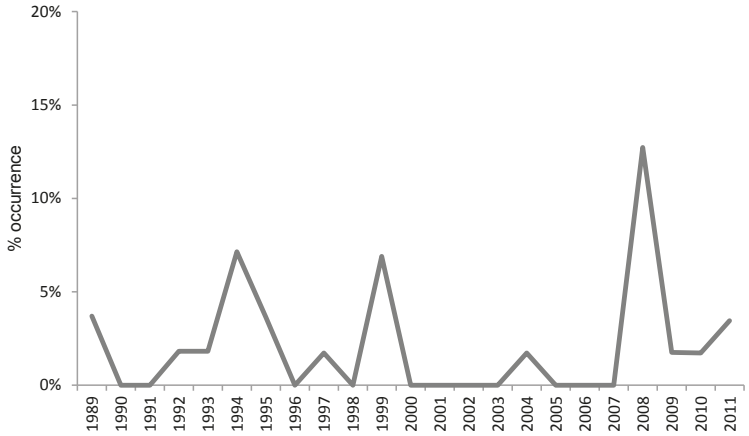


Figure 65: Boarfish *Capros aper*: (a) Spatial distribution, shown as the average frequency of occurrence at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the frequency of occurrence per year. Data category C (refer to Table 6).

Left-eyed flatfish (Scophthalmidae)

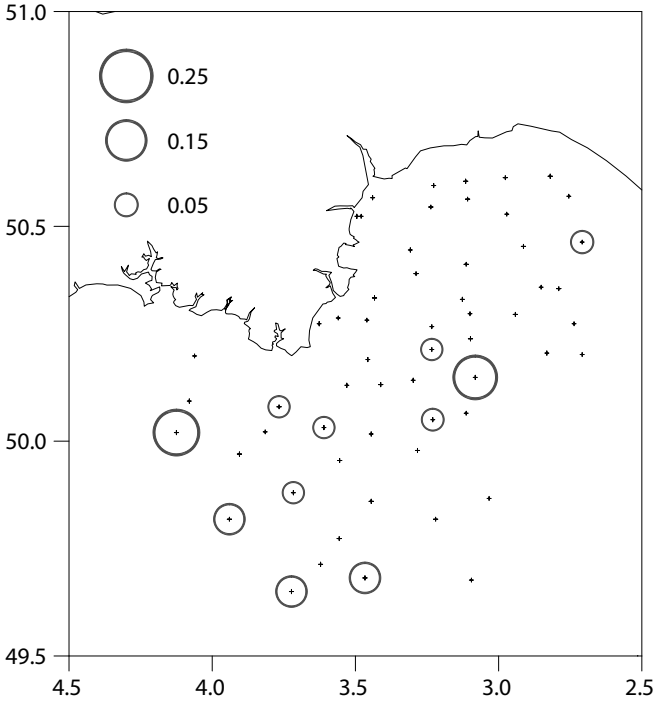
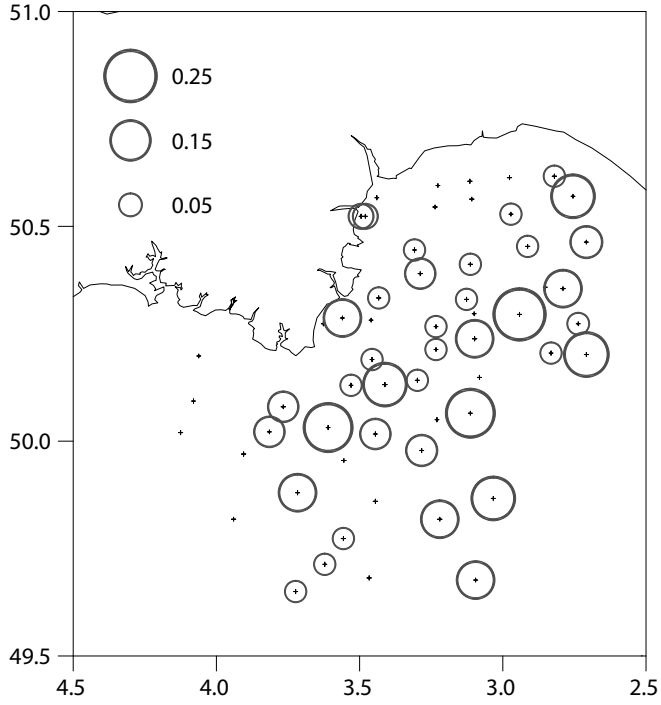
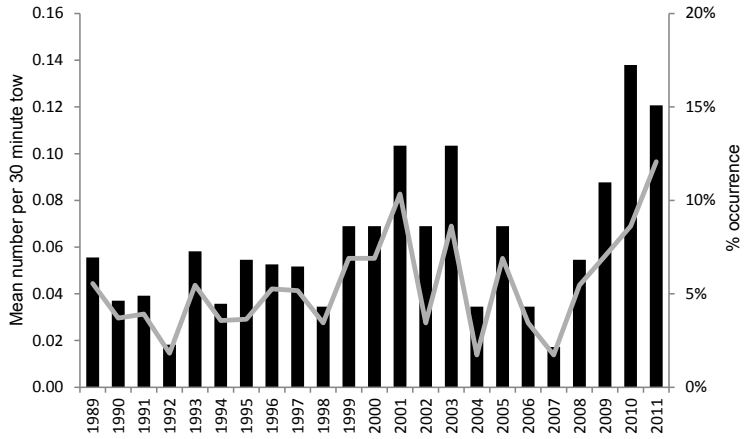


Figure 66: Spatial distribution of Megrim *Lepidorhombus whiffiagonis*, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). Data category B (refer to Table 6).

a)



b)



c)

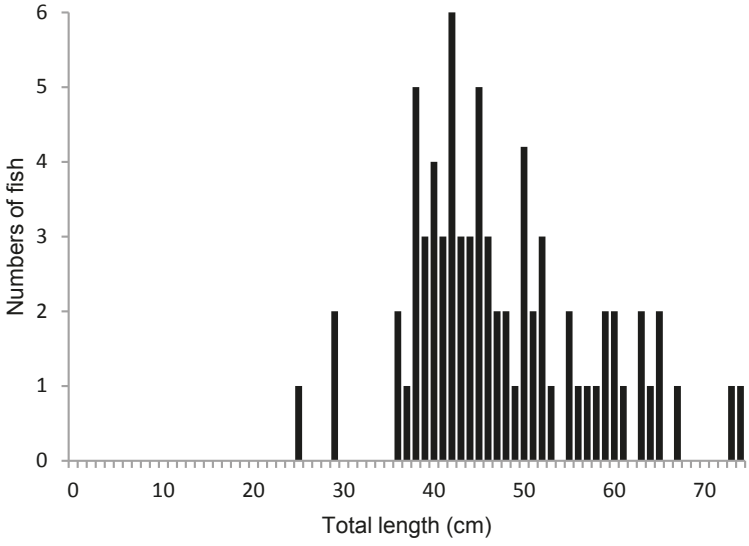


Figure 67: Turbot *Scophthalmus maximus*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

Left-eyed flatfish (Scophthalmidae)

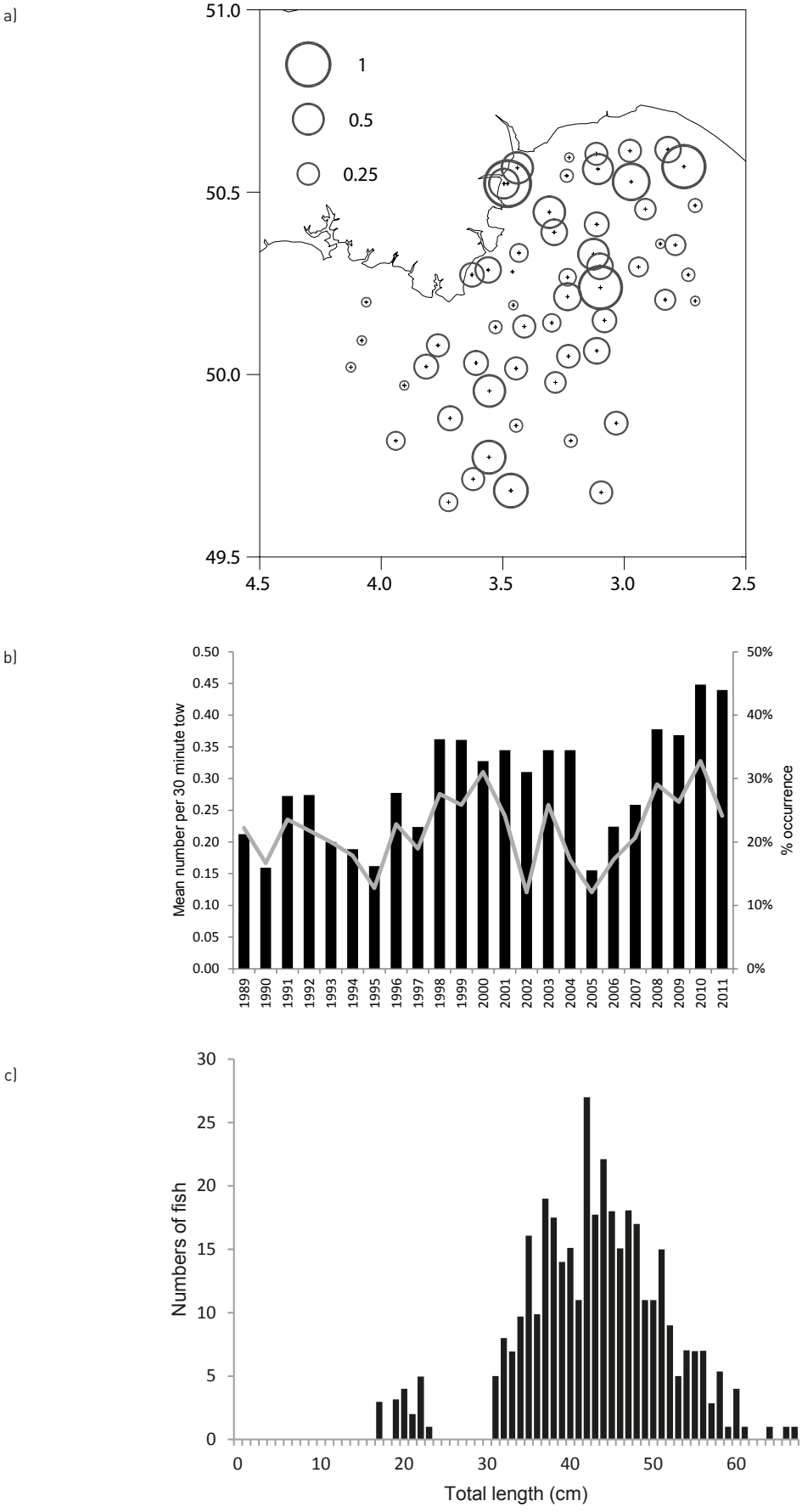
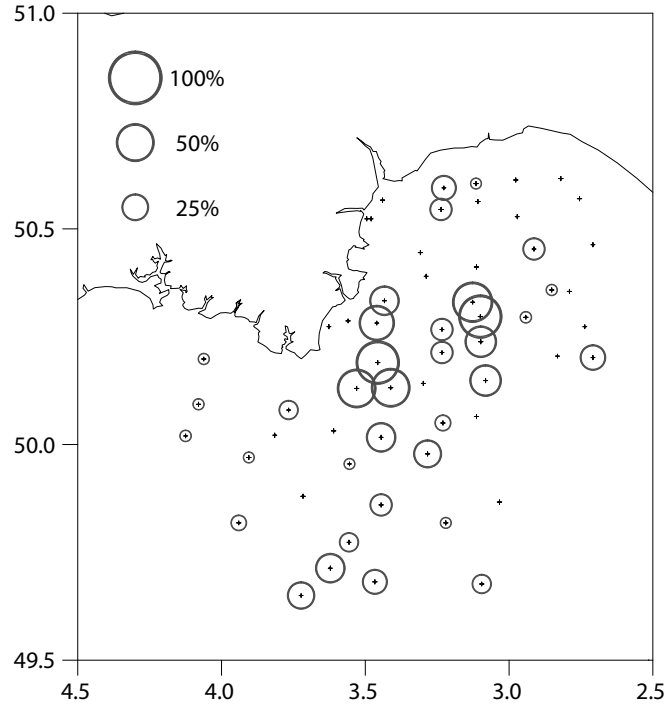


Figure 68: Brill *Scophthalmus rhombus*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

a)



b)

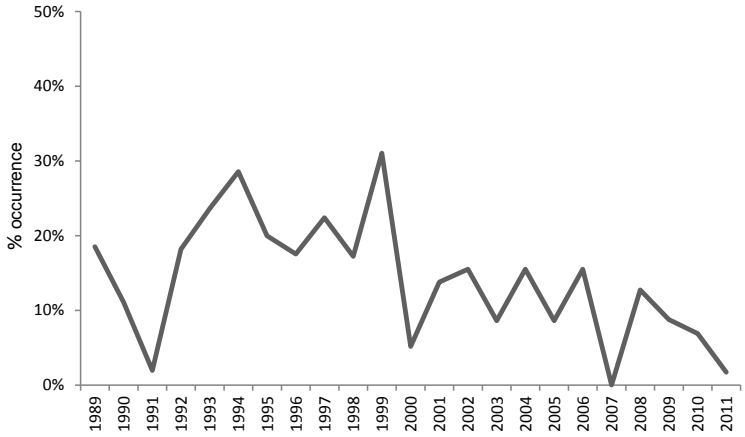


Figure 69: Norwegian topknot *Phrynorhombus norvegius*: (a) Spatial distribution, shown as the average frequency of occurrence at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the frequency of occurrence per year. Data category C (refer to Table 6).

Left-eyed flatfish (Scophthalmidae)

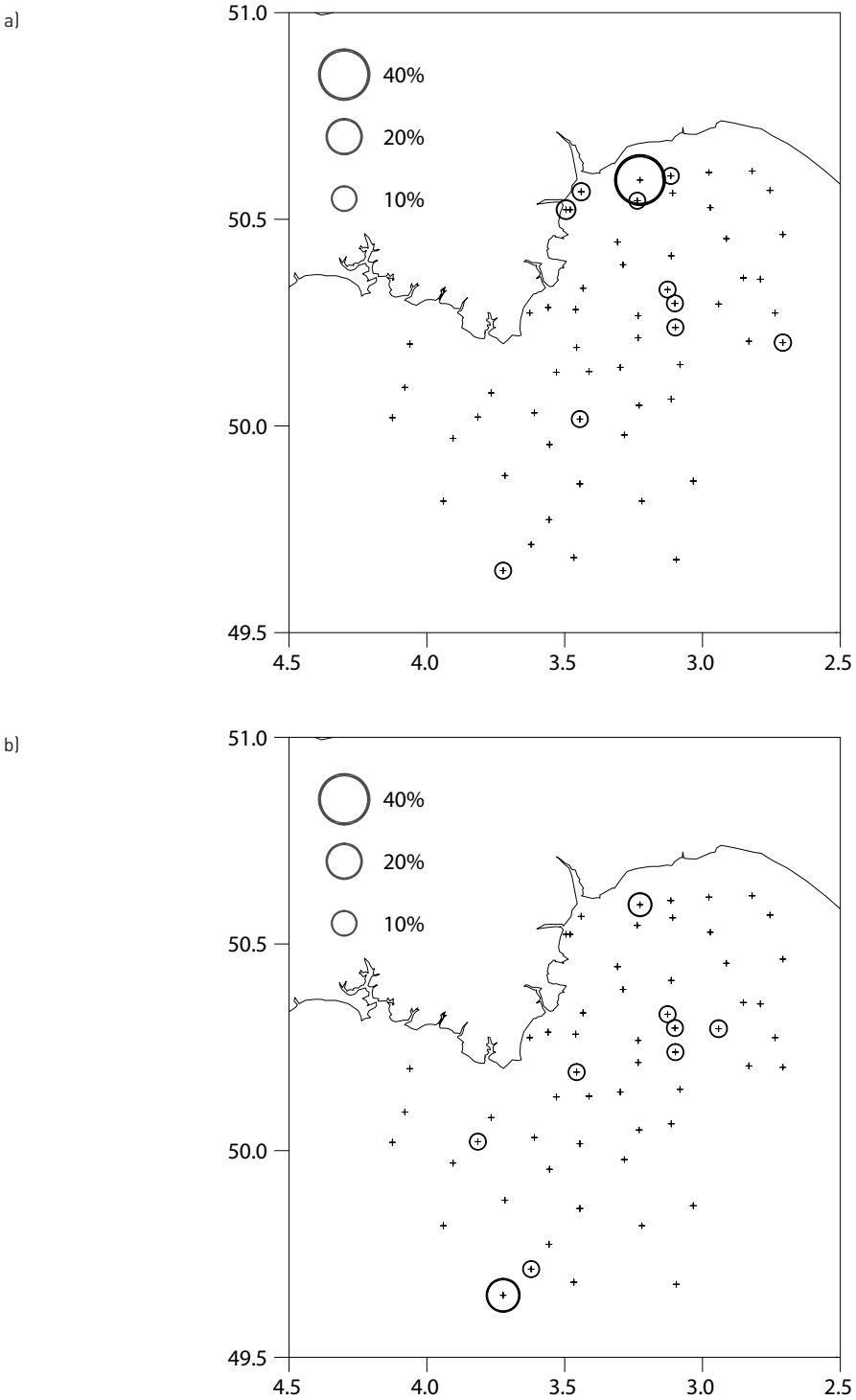
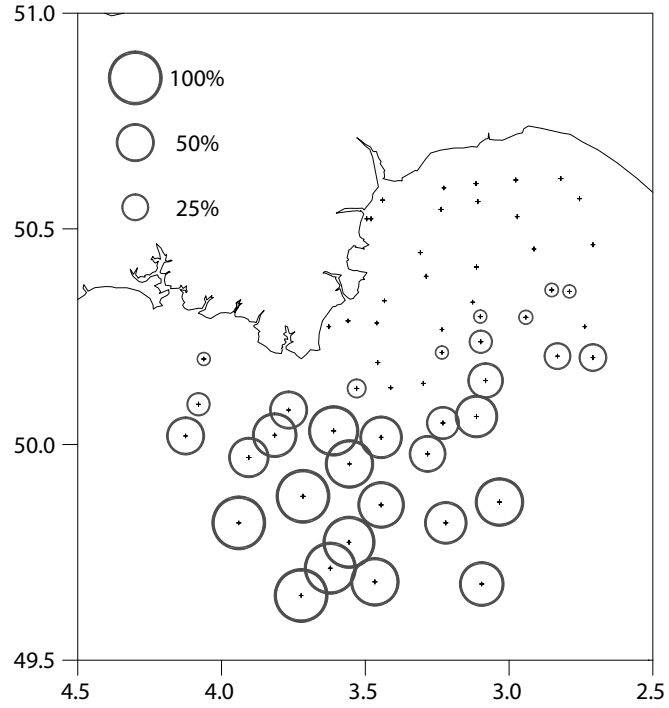


Figure 70: Spatial distribution of (a) Ekström's topknot *Phrynorhombus regius* and (b) common topknot *Zeugopterus punctatus*, shown as the average frequency of occurrence at prime stations (+). Data category D (refer to Table 6).

a)



b)

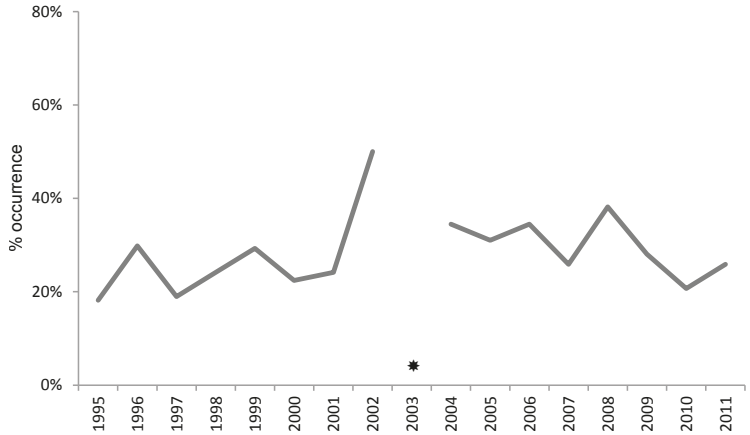
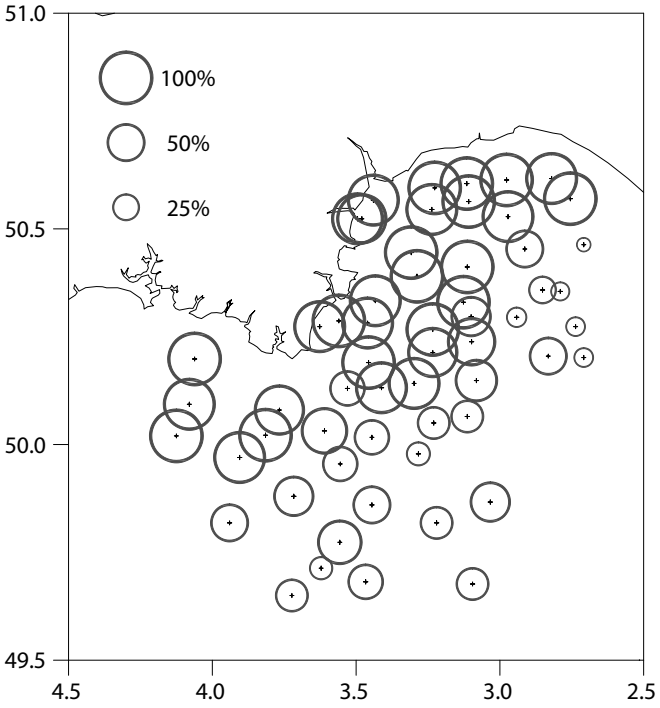


Figure 71: Imperial scaldfish *Arnoglossus imperialis*: (a) Spatial distribution, shown as the average frequency of occurrence at prime stations (+). (b) Temporal trends (1995–2011) in relative abundance, shown as the frequency of occurrence per year. *Denotes that data are not suitable to use. Data category C (refer to Table 6).

Scaldfish (Bothidae)

a)



b)

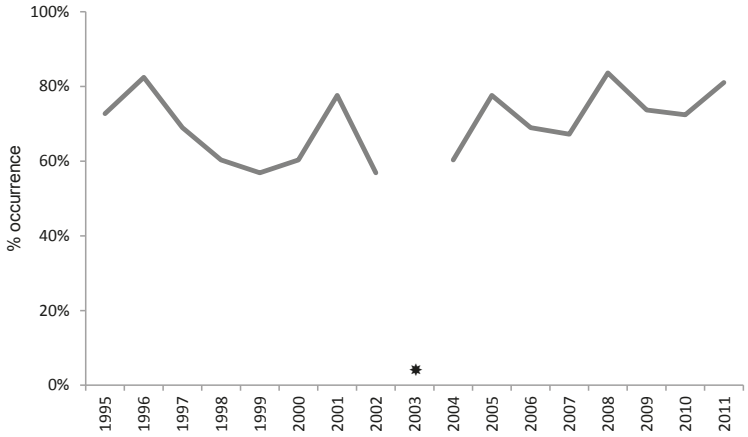
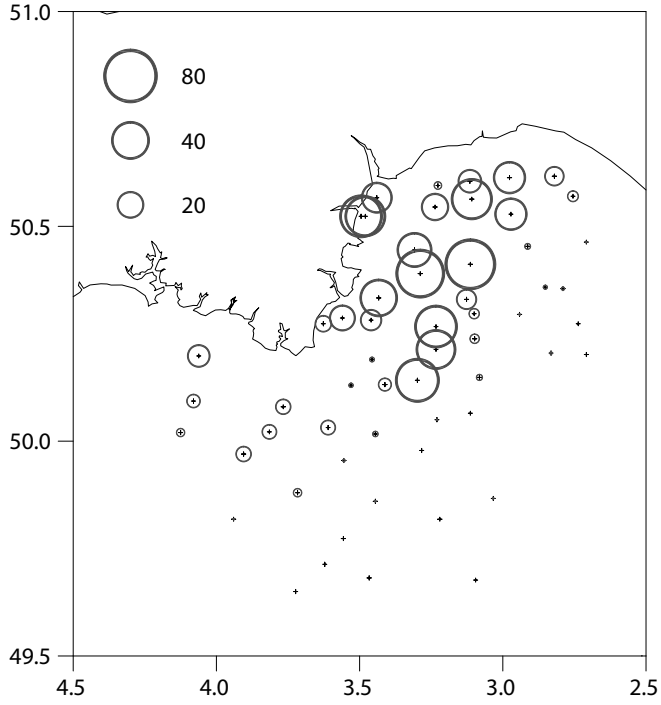
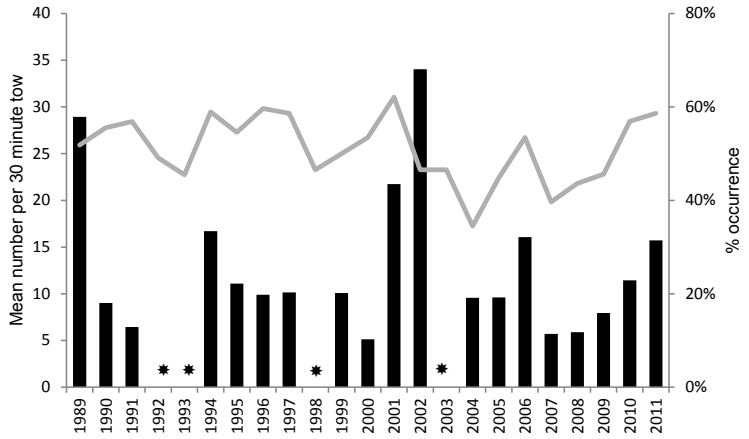


Figure 72: Scaldfish *Arnoglossus laterna*: (a) Spatial distribution, shown as the average frequency of occurrence at prime stations (+). (b) Temporal trends (1995–2011) in relative abundance, shown as the frequency of occurrence per year. *Denotes that data are not suitable to use. Data category C (refer to Table 6).

a)



b)



c)

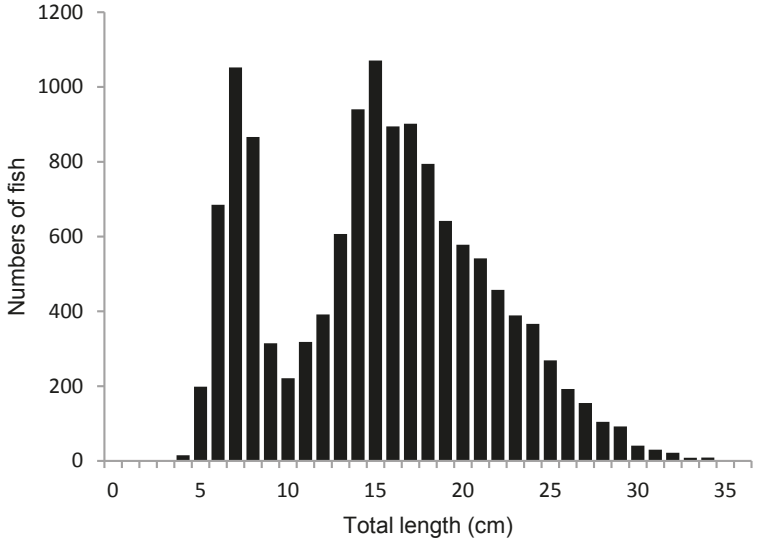


Figure 73: Dab *Limanda limanda*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. *Denotes that abundance data are not suitable to use. Data category B (refer to Table 6).

Right-eyed flatfishes (Pleuronectidae)

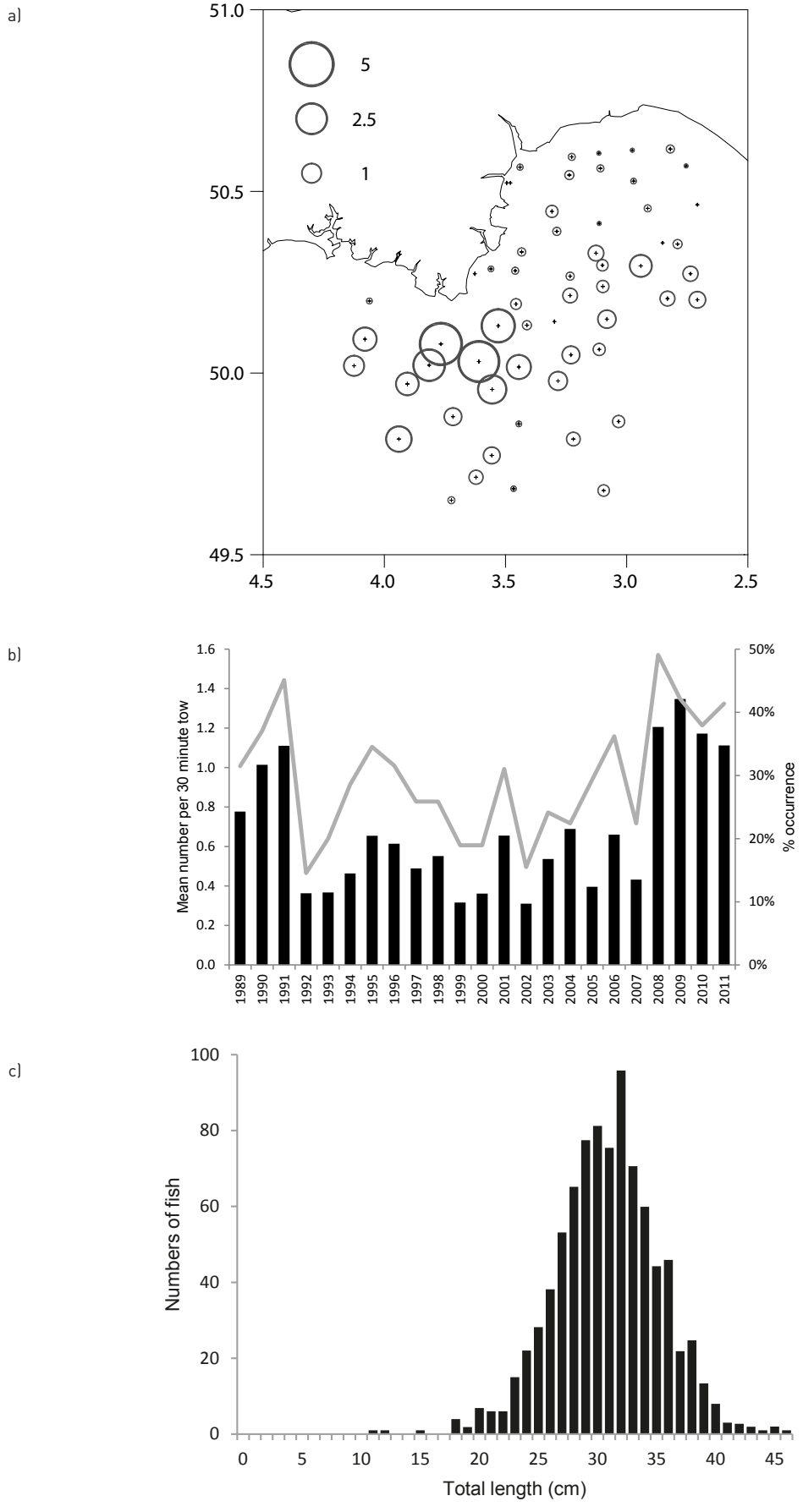
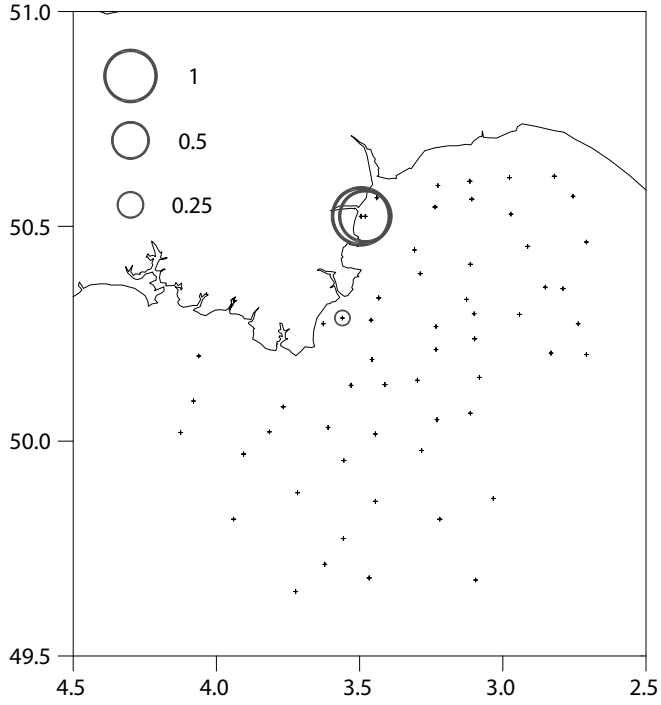
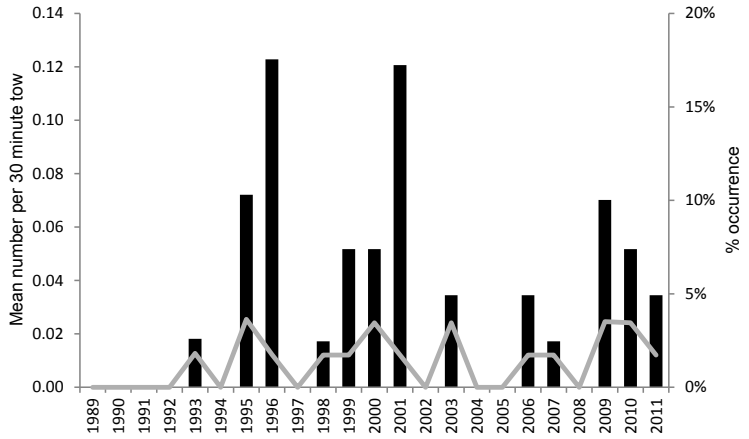


Figure 74: Lemon sole *Microstomus kitt*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

a)



b)



c)

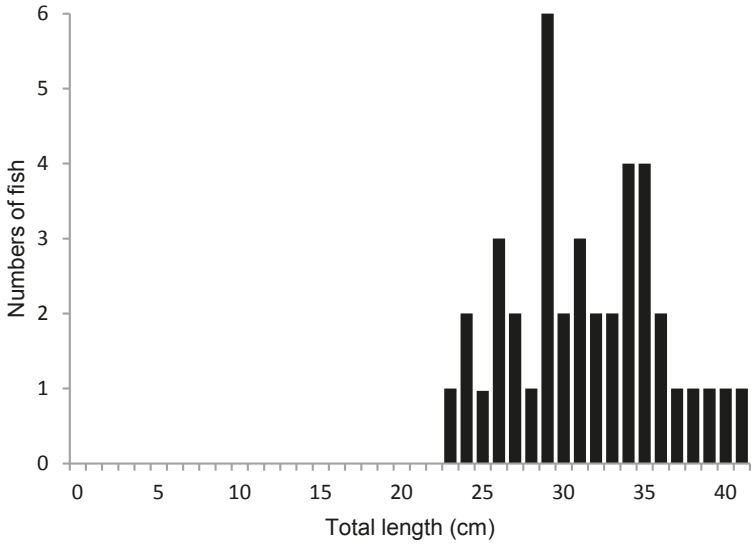
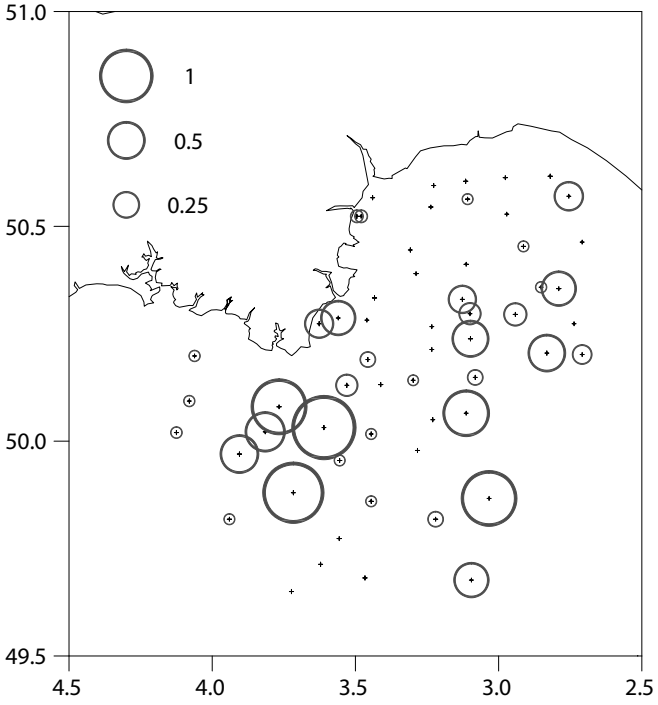


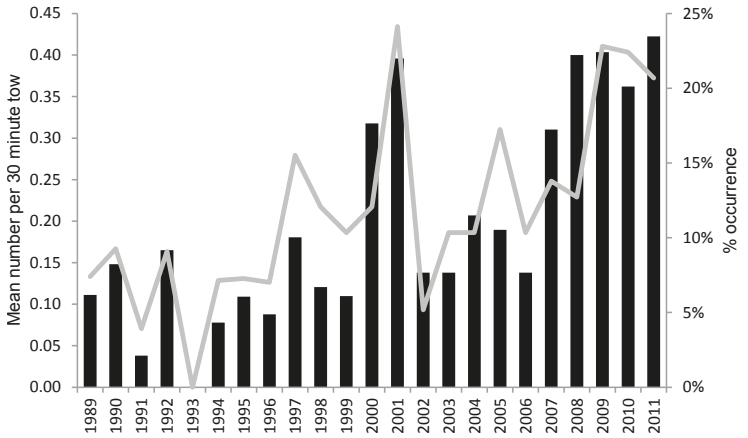
Figure 75: Flounder *Platichthys flesus*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

Soles (Soleidae)

a)



b)



c)

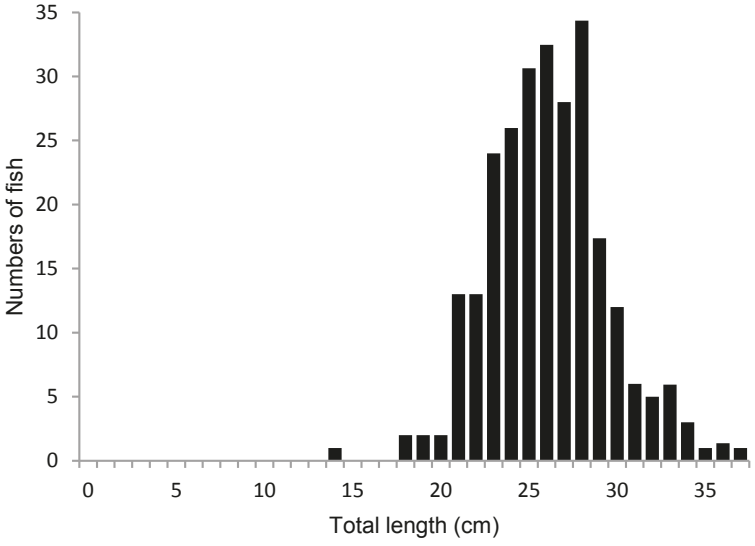
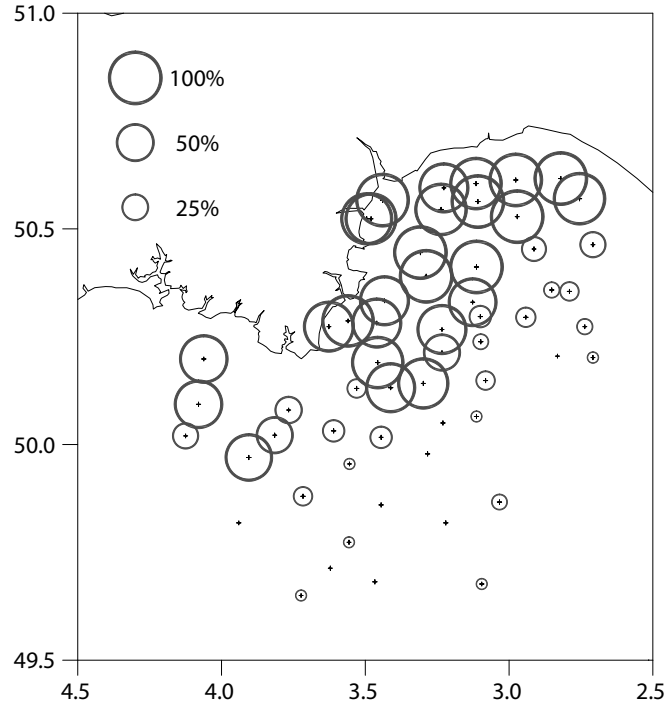


Figure 76: Sand sole *Pegusa lascaris*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Length frequency distribution. Data category B (refer to Table 6).

a)



b)

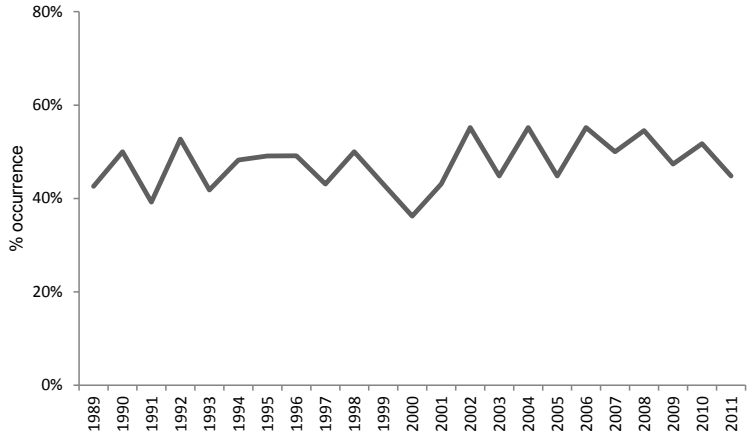
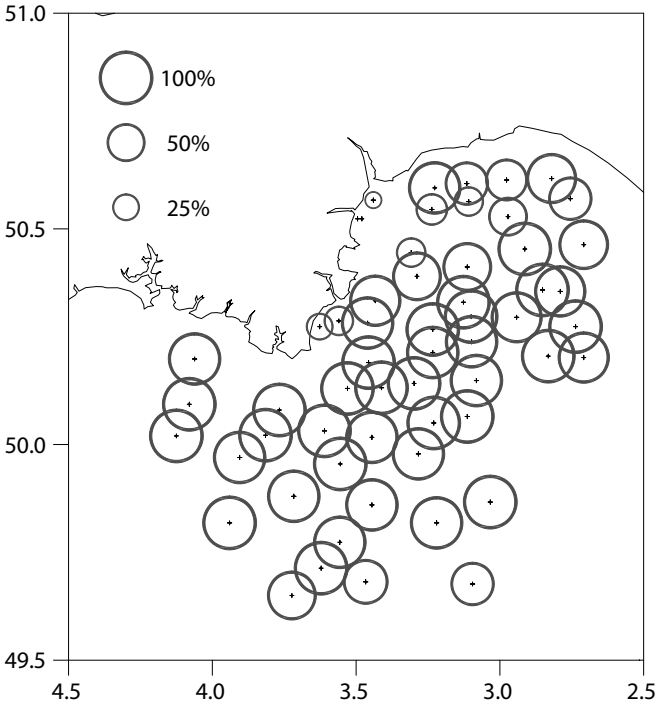


Figure 77: Solenette *Buglossidium luteum*: (a) Spatial distribution, shown as the average frequency of occurrence at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the frequency of occurrence per year. Data category C (refer to Table 6).

Soles (Soleidae)

a)



b)

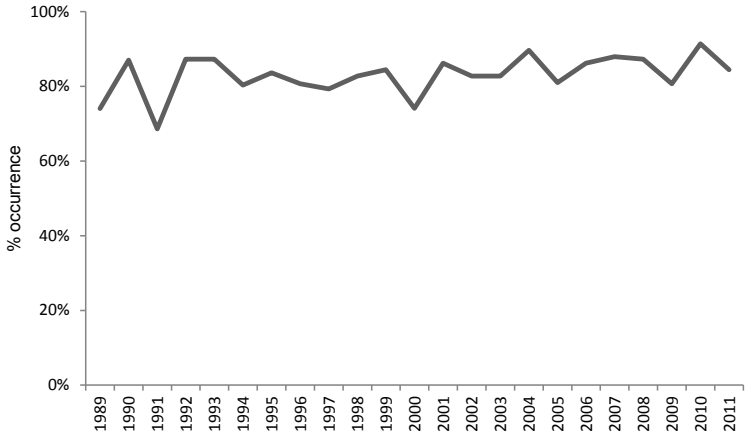


Figure 78: Thickback sole *Microchirus variegatus*: (a) Spatial distribution, shown as the average frequency of occurrence at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the frequency of occurrence per year. Data category C (refer to Table 6).

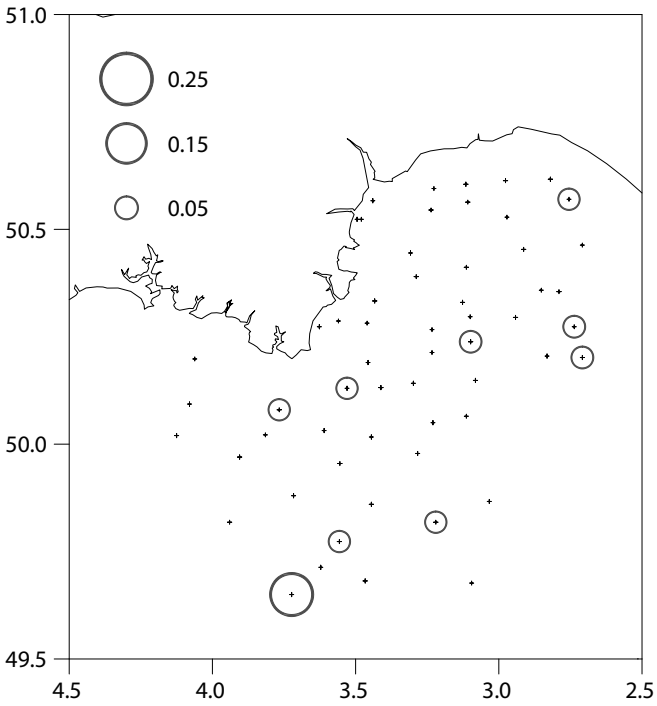
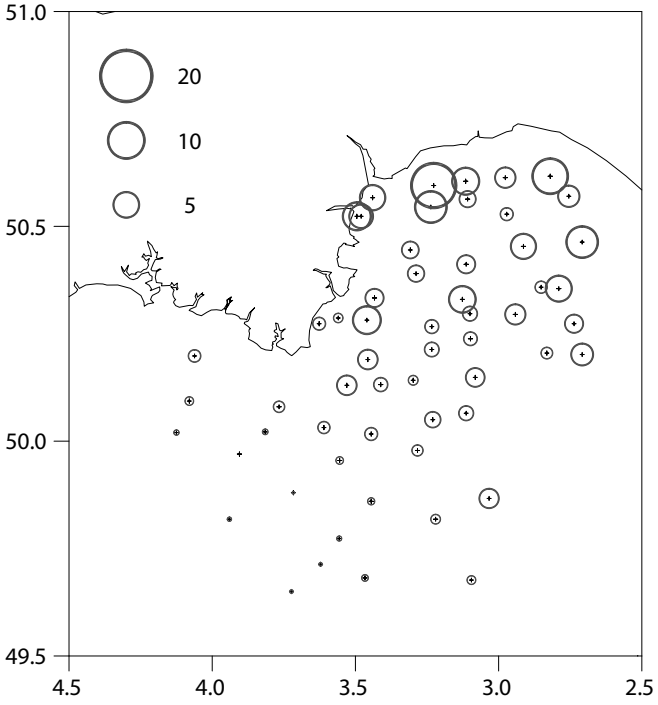


Figure 79: Spatial distribution of European lobster *Homarus gammarus*, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). Data category B (refer to Table 6).

Commercial crustaceans

a)



b)

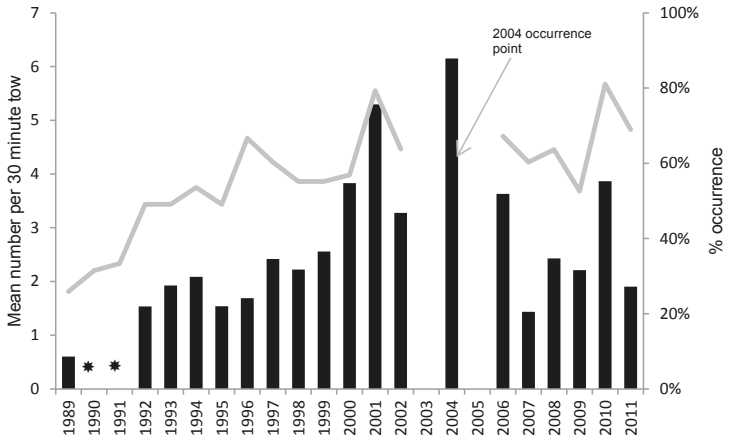
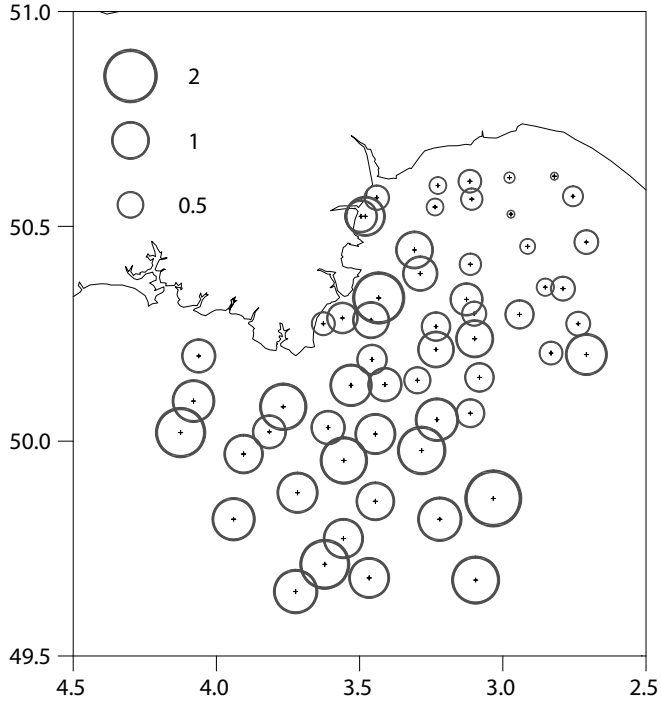
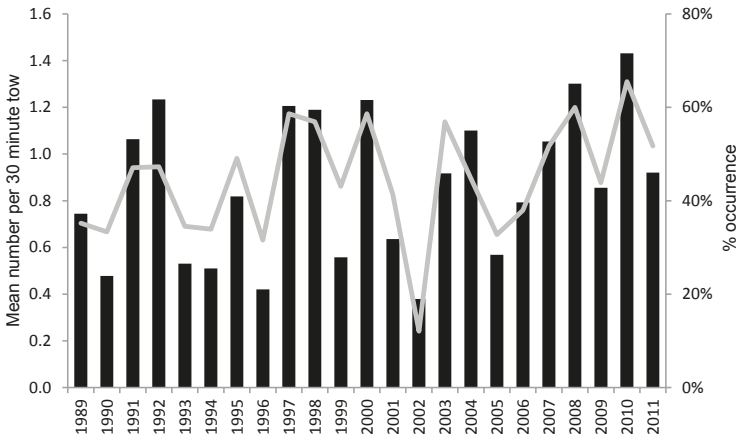


Figure 80: Spiny spider crab *Maja brachydactyla*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. Species not recorded in 2003 and 2005. *Denotes that abundance data are not suitable to use. Data category B (refer to Table 6).

a)



b)



c)

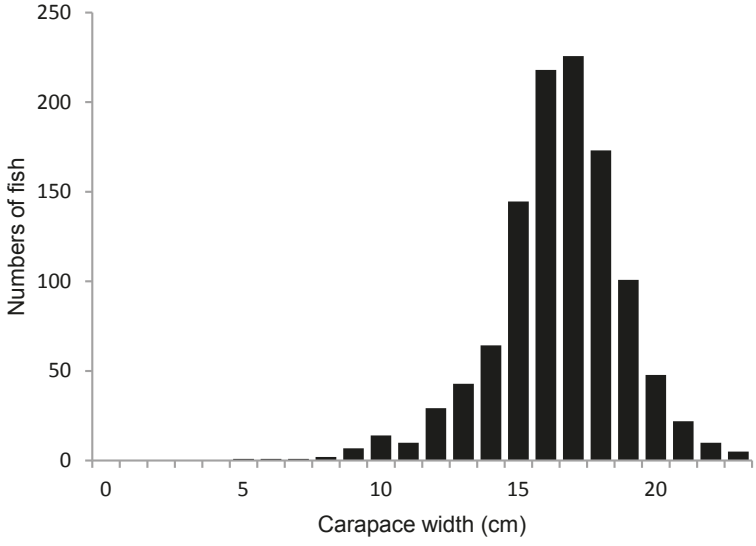
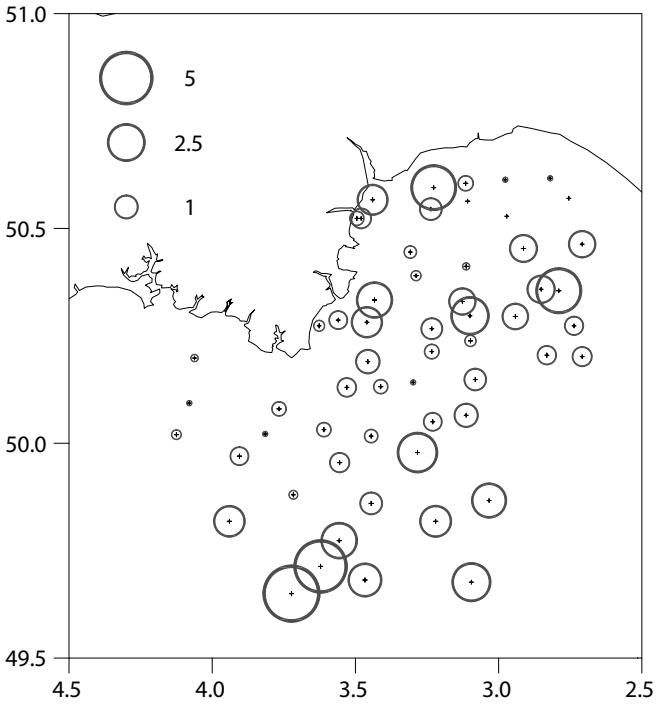


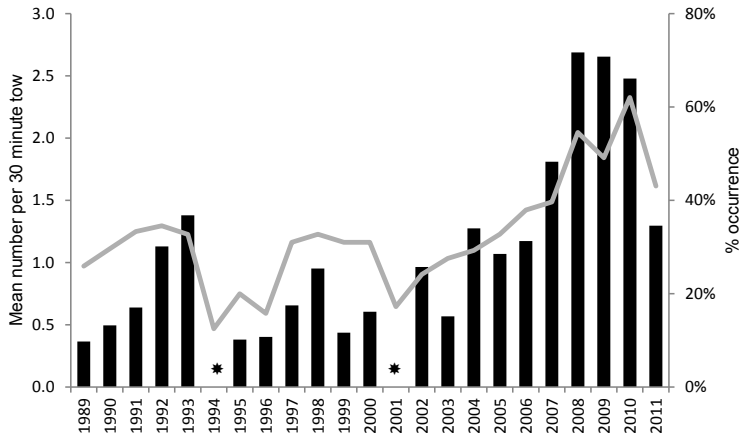
Figure 81: Edible crab *Cancer pagurus*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Carapace width frequency distribution. Data category B (refer to Table 6).

Scallops (Bivalvia)

a)



b)



c)

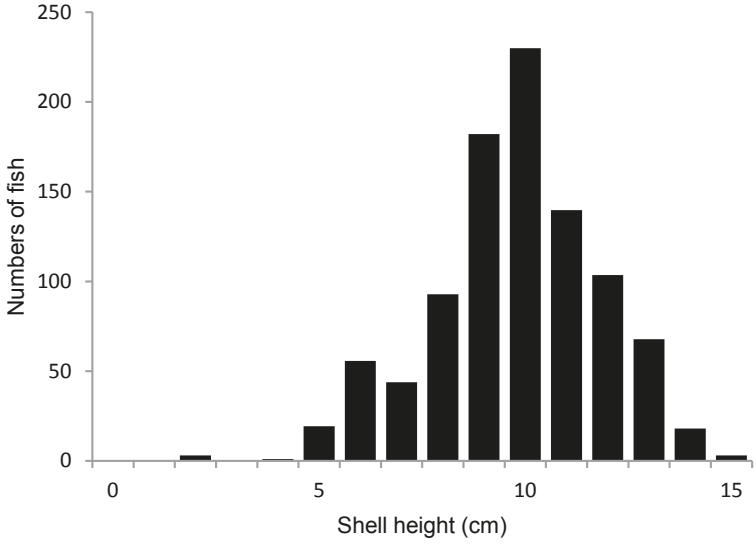
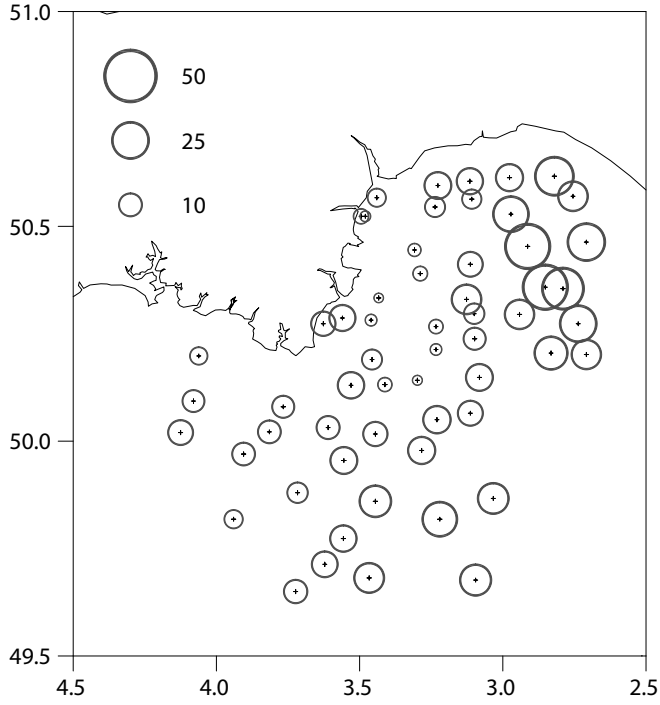


Figure 82: Great scallop *Pecten maximus*; (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. (c) Shell height frequency distribution. *Denotes that abundance data are not suitable to use. Data category B (refer to Table 6).

a)



b)

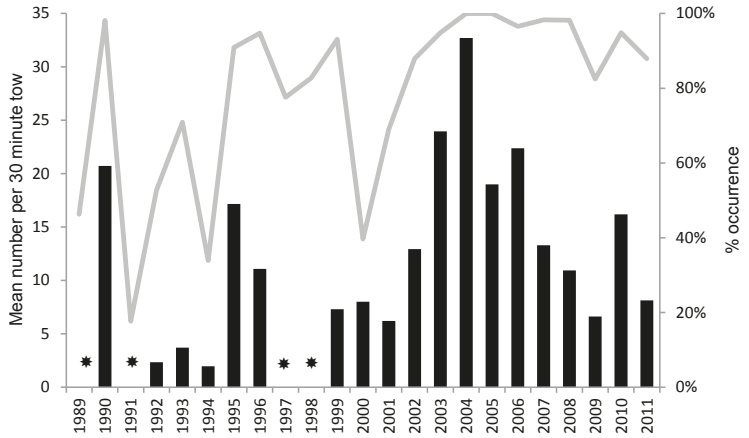
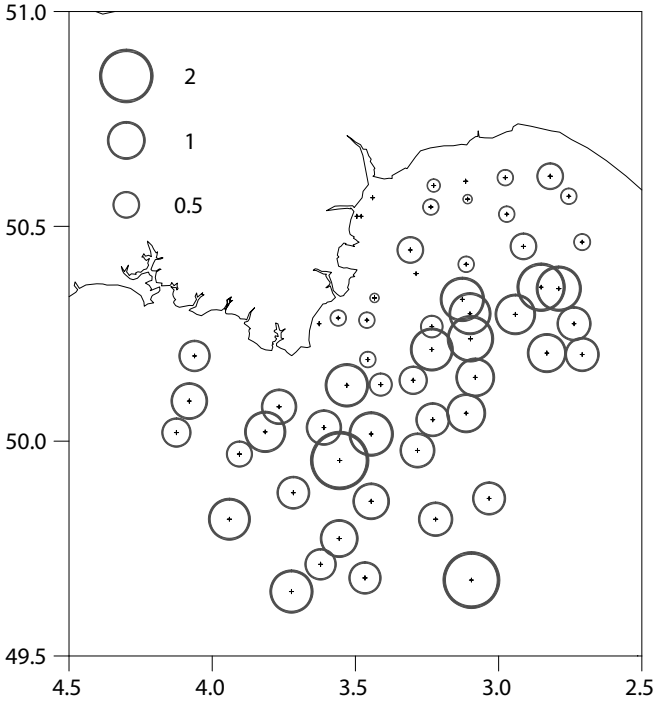


Figure 83: Common cuttlefish *Sepia officinalis*: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. *Denotes that abundance data are not suitable to use. Data category B (refer to Table 6).

Commercial cuttlefish and squid (Cephpoda)

a)



b)

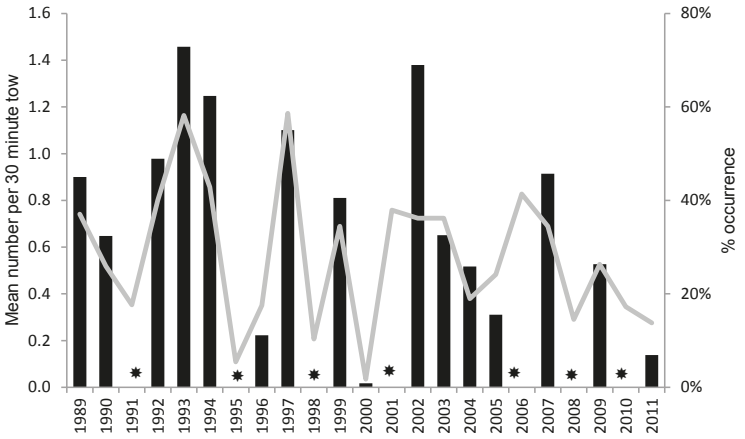


Figure 84: Squids Loliginidae: (a) Spatial distribution, shown as the average relative abundance (mean number caught per 30 minute tow) at prime stations (+). (b) Temporal trends (1989–2011) in relative abundance, shown as the mean number of fish caught per 30 minute tow (solid bars, left axis) and the frequency of occurrence (grey line, right axis), per year. *Denotes that abundance data are not suitable to use. Data category B (refer to Table 6).

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Appendix I
Species / taxa groupings as used to process the recorded catch data from the survey

Species / genera as recorded		Other species / genera included	
Common Name	**Scientific name**	**Common name**	**Scientific name**
Spurdog	*Squalus acanthias*		
Lesser-spotted dogfish	*Scyliorhinus canicula*		
Greater-spotted dogfish	*Scyliorhinus stellaris*		
Starry smooth-hound	*Mustelus asterias*	Smooth-hound	*Mustelus mustelus*
Marbled electric ray	*Torpedo marmorata*		
Common electric ray	*Torpedo nobiliana*		
Cuckoo ray	*Leucoraja naevus*		
Blonde ray	*Raja brachyura*		
Thornback ray	*Raja clavata*		
Small-eyed ray	*Raja microocellata*		
Spotted ray	*Raja montagui*		
Undulate ray	*Raja undulata*		
Stingray	*Dasyatis pastinaca*		
European eel	*Anguilla anguilla*	Eels	Anguillidae
European conger eel	*Conger conger*		
Pilchard	*Sardina pilchardus*		
Sprat	*Sprattus sprattus*		
European anchovy	*Engraulis encrasicolus*		
Atlantic cod	*Gadus morhua*		
Haddock	*Melanogrammus aeglefinus*		
Whiting	*Merlangius merlangus*		
Blue whiting	*Micromesistius poutassou*		
Pollack	*Pollachius pollachius*		
Norway pout	*Trisopterus esmarki*		
Bib	*Trisopterus luscus*		
Poor cod	*Trisopterus minutus*		
Five-bearded rockling	*Ciliata mustela*		
Four-bearded rockling	*Enchelyopus cimbrius*		
Three-bearded rockling	*Gaidropsarus vulgaris*		
Common ling	*Molva molva*		
Greater forkbeard	*Phycis blennoides*		
European hake	*Merluccius merluccius*		

Species / genera as recorded		Other species / genera included	
Common Name	**Scientific name**	**Common name**	**Scientific name**
Black-bellied anglerfish	*Lophius budegassa*		
Anglerfish	*Lophius piscatorius*		
Small-headed clingfish	*Apletodon microcephalus*		
Two-spotted clingfish	*Diplecogaster bimaculata*		
Sand smelt	*Atherina presbyter*		
Saury pike	*Scomberesox saurus*		
Garfish	*Belone belone*		
John Dory	*Zeus faber*		
Three-spined stickleback	*Gasterosteus aculeatus*		
Snake pipefish	*Entelurus aequoreus*		
Greater pipefish	*Syngnathus acus*		
Nilsson's pipefish	*Syngnathus rostellatus*		
Sea-horse	*Hippocampus* spp.		
Red gurnard	*Chelidonichthys cuculus*		
Tub gurnard	*Chelidonichthys lucerna*		
Long-finned gurnard	*Chelidonichthys obscurus*		
Grey gurnard	*Eutrigla gurnardus*		
Streaked gurnard	*Trigloporus lastoviza*		
Pogge	*Agonus cataphractus*		
Common sea-snail	*Liparis liparis*		
European sea-bass	*Dicentrarchus labrax*	Basses	*Dicentrarchus* spp.
Horse mackerel	*Trachurus trachurus*		
Gilthead sea-bream	*Sparus auratus*		
Black sea-bream	*Spondyliosoma cantharus*		
Red mullet	*Mullus surmuletus*		
Red bandfish	*Cepola rubescens*		
Goldsinny wrasse	*Ctenolabrus rupestris*		
Cuckoo wrasse	*Labrus mixtus*		
Corkwing wrasse	*Symphodus melops*		
Wrasses	Labridae (indet.)		
Butterfish	*Pholis gunnellus*		
Sandeels	Ammodytidae (indet.)	Great sandeel	*Hyperoplus lanceolatus*
		Raitt's sandeel	*Ammodytes marinus*
		Sandeel	*Ammodytes tobianus*
		Sandeels	*Ammodytes* spp.
Lesser weever fish	*Echiichthys vipera*		
Greater weever fish	*Trachinus draco*		
Butterfly blenny	*Blennius ocellaris*		

Species / genera as recorded		Other species / genera included	
Common Name	**Scientific name**	**Common name**	**Scientific name**
Common dragonet	*Callionymus lyra*		
Spotted dragonet	*Callionymus maculatus*		
Reticulated dragonet	*Callionymus reticulatus*		
Jeffrey's goby	*Buenia jeffreysii*		
Black goby	*Gobius niger*		
Rock goby	*Gobius paganellus*		
Gobies	*Gobius* spp.		
Fries's goby	*Lesueurigobius friesii*		
Sand gobies	*Pomatoschistus* spp.	Common goby	*Pomatoschistus microps*
		Gobies	Gobiidae
Mackerel	*Scomber scombrus*		
Boarfish	*Capros aper*		
Megrim	*Lepidorhombus whiffiagonis*		
Norwegian topknot	*Phrynorhombus norvegius*		
Turbot	*Scophthalmus maximus*		
Brill	*Scophthalmus rhombus*		
Ekström's topknot	*Phrynorhombus regius*		
Common topknot	*Zeugopterus punctatus*		
Imperial scaldfish	*Arnoglossus imperialis*		
Scaldfish	*Arnoglossus laterna*		
Dab	*Limanda limanda*		
Lemon sole	*Microstomus kitt*		
Flounder	*Platichthys flesus*		
European plaice	*Pleuronectes platessa*		
Solenette	*Buglossidium luteum*		
Thickback sole	*Microchirus variegatus*		
Sand sole	*Pegusa lascaris*		
Sole	*Solea solea*		
European lobster	*Homarus gammarus*		
Spiny spider crab	*Maja brachydactyla*		
Edible crab	*Cancer pagurus*		
Great scallop	*Pecten maximus*	Scallops	Pectinidae
Common cuttlefish	*Sepia officinalis*	Cuttle-fishes	Cephalopoda-Sepiida
Squids	Loliginidae	Northern squid	*Loligo forbesi*
		Squid	*Loligo vulgaris*
		Common squids	*Loligo* spp.

Appendix II
How taxa were sampled over the time-series

Total numbers of taxa measured (M), counted (C), and occasions observed (shown in bold) (O), by year. The number of occasions that a catch component was recorded are expressed as a percentage of the total number of occasions a species are recorded (shown in brackets). Where only the one gear is deployed at a station, the numbers of fish caught are corrected for the deployment of two gears.

Common name	Catch component	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Spurdog	M	5 (100)	1 (100)		1 (100)	1 (100)	1 (100)	4 (100)		1 (100)	12 (100)	
	C											
	O											
Lesser-spotted dogfish	M	235 (97)	251 (100)			405 (95)	298 (100)	410 (100)	385 (100)	872 (95)	593 (91)	778 (100)
	C	2 (3)		226 (43)	375 (90)	75 (5)					34 (2)	
	O			**17** (57)	**3** (10)					**2** (5)	**3** (7)	
Greater-spotted dogfish	M								1 (100)	3 (100)	3 (100)	1 (100)
	C											
	O											
Starry smooth-hound	M		1 (100)			3 (100)	8 (100)	3 (100)		28 (100)	14 (100)	2 (100)
	C				5 (100)							
	O			**1** (100)								
Marbled electric ray	M							1 (100)		1 (100)		
	C											
	O											
Common electric ray	M											
	C											
	O											
Cuckoo ray	M	2 (100)		1 (100)								
	C											
	O											
Blonde ray	M	5 (100)	3 (100)	1 (100)	6 (100)		5 (100)	8 (100)	3 (100)	1 (100)	1 (100)	1 (100)
	C											
	O											
Thornback ray	M	26 (100)	17 (100)	13 (100)	24 (100)	28 (100)	14 (100)	34 (100)	68 (100)	50 (100)	53 (100)	37 (100)
	C											
	O											
Small-eyed ray	M				2 (100)	2 (100)			3 (100)	7 (100)	2 (100)	1 (100)
	C											
	O											
Spotted ray	M	41 (100)	43 (100)	41 (100)	17 (100)	12 (100)	21 (100)	28 (100)	22 (100)	41 (100)	26 (100)	18 (100)
	C											
	O											
Undulate ray	M	5 (100)	1 (100)	3 (100)	7 (100)	2 (100)	2 (100)		3 (100)	4 (100)	2 (100)	2 (100)
	C											
	O											
Stingray	M											
	C											
	O											
European eel	M								1 (100)			
	C											
	O											
European conger eel	M	1 (100)						2 (100)			2 (100)	
	C											
	O											

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Common name
	2 (100)		4 (100)					1 (100)		1 (100)		Spurdog
373 (95) 39 (3) **1** (3)	691 (100)	454 (100)	471 (81) 143 (19)	492 (100)	704 (100)	714 (100)	529 (100)	826 (100)	552 (100)	896 (100)	666 (100)	Lesser-spotted dogfish
4 (100)		4 (100)				1 (100)	5 (100)	2 (100)	4 (100)		1 (100)	Greater-spotted dogfish
1 (100)		2 (100)	2 (50) 3 (50)	12 (100)	**1** (100)	6 (100)	1 (100)	2 (100)		24 (100)	1 (100)	Starry smooth-hound
												Marbled electric ray
							1 (100)					Common electric ray
	2 (100)						8 (100)					Cuckoo ray
3 (100)	5 (100)		5 (100)		3 (100)	3 (100)	5 (100)	6 (100)	3 (100)	11 (100)	6 (100)	Blonde ray
26 (100)	30 (100)	24 (100)	63 (100)	52 (100)	36 (100)	46 (100)	18 (100)	31 (100)	48 (100)	89 (100)	49 (100)	Thornback ray
4 (100)	3 (100)		4 (100)	2 (100)	4 (100)	2 (100)	1 (100)		2 (100)	7 (100)		Small-eyed ray
22 (100)	19 (100)	12 (100)	10 (100)	6 (100)	5 (100)	14 (100)	3 (100)	19 (100)	16 (100)	18 (100)	12 (100)	Spotted ray
2 (100)	4 (100)		5 (75) 1 (25)	2 (100)						1 (100)		Undulate ray
	2 (100)											Stingray
	2 (100)	2 (100)	1 (100)		1 (100)		1 (100)					European eel
									1 (100)		2 (100)	European conger eel

Common name	Catch component	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Pilchard	M											
	C								1 (100)		1 (100)	
	O											
Sprat	M		4 (100)									
	C					2 (100)				1 (100)		
	O										**1** (100)	
European anchovy	M											
	C						1 (100)					
	O											
Atlantic cod	M	1 (100)			2 (100)					6 (100)	1 (100)	1 (100)
	C											
	O											
Haddock	M							1 (100)				
	C											
	O											
Whiting	M	12 (100)	28 (100)	331 (100)	154 (100)	311 (65)	61 (100)	99 (100)	122 (100)	206 (96)	106 (71)	49 (100)
	C					33 (10)					8 (4)	
	O					**5** (25)				**1** (4)	**6** (25)	
Blue whiting	M			1 (100)							1 (100)	
	C											1 (100)
	O											
Pollack	M		2 (100)	4 (100)	1 (100)			2 (100)	3 (100)			
	C											
	O											
Norway pout	M											
	C											
	O	**2** (100)										
Bib	M	182 (95)	363 (91)	127 (48)	313 (95)	210 (100)	113 (100)	22 (25)	154 (85)	412 (92)	220 (71)	61 (38)
	C	1 (5)		106 (10)	2 (5)			30 (25)	3 (8)		17 (11)	16 (13)
	O		**2** (9)	**9** (43)				**4** (50)	**1** (8)	**3** (8)	**5** (18)	**8** (50)
Poor cod	M		275 (10)									228 (2)
	C		1717 (43)	324 (6)	3214 (56)	1223 (33)	2951 (54)	1262 (42)	3051 (71)	1092 (35)	2674 (48)	977 (26)
	O	**28** (100)	**20** (48)	**30** (94)	**17** (44)	**31** (67)	**18** (46)	**30** (58)	**13** (29)	**46** (65)	**36** (52)	**39** (72)
Five-bearded rockling	M		1 (100)									
	C									7 (50)		
	O									**2** (50)		
Four-bearded rockling	M										3 (100)	
	C				1 (100)		1 (100)	1 (100)				
	O											**1** (100)
Three-bearded rockling	M		1 (100)									
	C											
	O											
Common ling	M	2 (100)	1 (100)		1 (100)		1 (100)				1 (100)	
	C											
	O											
Greater forkbeard	M											
	C											
	O											
European hake	M		30 (100)	3 (100)		1 (100)	3 (100)		1 (100)			
	C											
	O											
Black-bellied anglerfish	M	1 (100)										
	C											
	O											
Anglerfish	M	47 (100)	27 (100)	22 (100)	17 (100)	22 (100)	19 (100)	54 (100)	38 (100)	9 (100)	7 (100)	6 (100)
	C											
	O											

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Common name
												Pilchard
			1 (100)				2 (100)		1 (100)	3 (100)	1 (100)	Sprat
						1 (100)						
												European anchovy
1 (100)	3 (100)	2 (100)				1 (100)	4 (100)	5 (100)	2 (100)	3 (100)	1 (100)	Atlantic cod
						3 (100)		17 (100)	3 (100)	41 (100)	14 (100)	Haddock
39 (100)	139 (100)	168 (100)	185 (100)	52 (100)	378 (100)	67 (100)	186 (100)	177 (100)	167 (100)	525 (100)	184 (100)	Whiting
			1 (100)	2 (100)		1 (100)	1 (100)	1 (100)		3 (100)		Blue whiting
	1 (100)					1 (100)	2 (100)					Pollack
				4 (100)								Norway pout
										1 (100)		
25 (16)	1 (7)	166 (100)	255 (79)	110 (100)	84 (100)	162 (100)	100 (91)	303 (100)	193 (100)	371 (100)	155 (100)	Bib
			27 (21)									
16 (84)	**13** (93)						**2** (9)					
148 (11)	183 (10)	1614 (100)	92 (2)	1945 (100)	774 (10)	226 (9)	132 (10)	336 (10)	164 (14)			Poor cod
10 (2)			380 (14)			26 (2)						
41 (87)	**38** (90)		**36** (84)		**35** (90)	**42** (89)	**38** (90)	**37** (90)	**31** (86)	**44** (100)	**34** (100)	
		4 (100)										Five-bearded rockling
			3 (100)		**1** (100)		**1** (100)		**1** (100)	**1** (100)		
	2 (100)											Four-bearded rockling
2 (100)	1 (50)			2 (100)								Three-bearded rockling
	1 (50)									**1** (100)	**4** (100)	
					1 (100)		2 (100)					Common ling
		6 (100)										Greater forkbeard
2 (100)	2 (100)	2 (100)			7 (100)	1 (100)		9 (100)	3 (100)			European hake
							1 (100)	2 (100)				Black-bellied anglerfish
13 (100)	10 (100)	22 (100)	44 (100)	22 (100)	76 (100)	42 (100)	29 (100)	111 (100)	203 (100)	206 (100)	135 (100)	Anglerfish

Common name	Catch component	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Small-headed clingfish	M											
	C											
	O											
Two-spotted clingfish	M											
	C										1 (50)	
	O										**1** (50)	
Sand smelt	M											
	C											
	O											
Saury pike	M		3 (100)									
	C											
	O											
Garfish	M		2 (50)	1 (100)			2 (50)					
	C	5 (100)	2 (50)				1 (50)	2 (33)			1 (50)	1 (50)
	O							**2** (67)			**1** (50)	**1** (50)
John Dory	M	22 (100)	4 (100)	21 (100)	30 (100)	55 (96)	30 (100)	3 (100)	1 (100)	16 (100)	17 (93)	24 (100)
	C					1 (4)					1 (7)	
	O											
Three-spined stickleback	M											
	C											
	O											
Snake pipefish	M											
	C											
	O											
Greater pipefish	M											
	C	1 (33)	1 (100)	1 (50)	1 (33)	4 (40)	5 (60)	4 (40)	9 (43)		10 (43)	7 (18)
	O	**2** (67)		**1** (50)	**2** (67)	**3** (60)	**2** (40)	**6** (60)	**4** (57)	**2** (100)	**4** (57)	**9** (82)
Nilsson's pipefish	M											
	C											
	O											
Sea-horse	M											
	C											
	O											
Red gurnard	M	913 (96)	926 (94)	209 (57)	626 (58)	933 (100)	1402 (100)	861 (100)	741 (100)	641 (100)	599 (71)	884 (100)
	C	7 (4)	42 (4)	62 (8)	187 (32)						26 (8)	
	O		**1** (2)	**13** (35)	**4** (11)						**10** (20)	
Tub gurnard	M	7 (100)	15 (100)	9 (80)	39 (94)	20 (100)	9 (100)	16 (100)	23 (100)	10 (100)	39 (96)	32 (100)
	C			1 (20)	1 (6)							
	O										**1** (4)	
Long-finned gurnard	M											
	C											
	O											
Grey gurnard	M	188 (100)	146 (100)	73 (79)	74 (41)	112 (90)	287 (100)	85 (100)	194 (93)	80 (94)	184 (83)	358 (100)
	C			18 (14)	31 (32)	14 (10)			2 (4)		28 (4)	
	O			**1** (7)	**6** (27)				**1** (4)	**1** (6)	**3** (13)	
Streaked gurnard	M	5 (100)	3 (100)	2 (100)	3 (50)	3 (100)	1 (100)	3 (100)	1 (100)	1 (100)	1 (50)	4 (100)
	C				1 (50)							
	O										**1** (50)	
Pogge	M		1 (6)									
	C	37 (40)	367 (72)	17 (14)	132 (53)	87 (36)	208 (53)	114 (40)	192 (51)	150 (36)	254 (48)	17 (29)
	O	**9** (60)	**4** (22)	**12** (86)	**8** (47)	**18** (64)	**14** (47)	**21** (60)	**17** (49)	**21** (64)	**21** (53)	**20** (71)
Common sea-snail	M											
	C											
	O											
European sea-bass	M				1 (100)			5 (100)				2 (100)
	C											
	O											

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Common name
		2 (100)										Small-headed clingfish
2 (100)		34 (100)		38 (100)								Two-spotted clingfish
												Sand smelt
			1 (100)									
												Saury pike
									2 (100)			
2 (100)	1 (100)			4 (100)						1 (50)		Garfish
			1 (100)			**5** (100)	**1** (100)	**2** (100)	**2** (100)	**1** (50)		
11 (100)	59 (100)	38 (100)	14 (100)	24 (100)	32 (100)	16 (100)	24 (100)	47 (100)	22 (100)	15 (100)	33 (100)	John Dory
	1 (100)											Three-spined stickleback
												Snake pipefish
							1 (100)					
14 (100)		56 (100)		2 (100)								Greater pipefish
	4 (100)		**4** (100)		**2** (100)	**2** (100)	**3** (100)	**2** (100)	**5** (100)	**2** (100)	**4** (100)	
												Nilsson's pipefish
										2 (100)		
												Sea-horse
								1 (100)	**1** (100)			
788 (98)	284 (13)	874 (100)	81 (7)	1062 (100)	861 (100)	930 (100)	389 (100)	916 (100)	993 (100)	847 (100)	983 (100)	Red gurnard
			540 (93)									
1 (2)	**40** (87)											
31 (100)	34 (100)	38 (100)	5 (13)	30 (100)	28 (100)	46 (100)	67 (100)	92 (100)	60 (100)	83 (100)	62 (100)	Tub gurnard
			63 (87)									
					5 (100)			2 (100)	1 (100)	2 (100)	12 (100)	Long-finned gurnard
240 (100)	31 (15)	248 (100)		182 (100)	279 (100)	196 (100)	277 (100)	184 (100)	234 (100)	278 (100)	191 (100)	Grey gurnard
			136 (100)									
	28 (85)											
9 (100)				36 (100)	7 (100)		4 (100)	1 (100)		7 (100)	5 (100)	Streaked gurnard
						1 (100)						
2 (5)	6 (7)	510 (100)		546 (100)	70 (12)	10 (15)	13 (10)		20 (15)			Pogge
			22 (5)			1 (4)						
21 (95)	**26** (93)		**21** (95)		**15** (88)	**21** (81)	**18** (90)	**19** (100)	**17** (85)	**21** (100)	**22** (100)	
				4 (100)								Common sea-snail
2 (100)			5 (100)		4 (100)	2 (100)			1 (100)		2 (100)	European sea-bass

Common name	Catch component	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Horse mackerel	M	2 (100)								1 (33)	2 (13)	1 (17)
	C					17 (60)	8 (86)	4 (33)		1 (33)	16 (44)	3 (50)
	O					**6** (40)	**1** (14)	**2** (67)		**1** (33)	**7** (44)	**2** (33)
Gilthead sea-bream	M											1 (100)
	C											
	O											
Black sea-bream	M	17 (100)			1 (33)		1 (100)	1 (17)	2 (100)	5 (100)	8 (80)	10 (83)
	C				2 (67)	7 (50)		2 (33)				1 (17)
	O					**1** (50)		**3** (50)			**1** (20)	
Red mullet	M	86 (100)	30 (100)	13 (100)	24 (100)	40 (100)	28 (100)	48 (100)	54 (100)	49 (100)	27 (100)	123 (100)
	C											
	O											
Red bandfish	M		4 (100)						1 (50)		2 (67)	3 (100)
	C	3 (50)		3 (50)	6 (50)	3 (33)	14 (75)	3 (100)	2 (50)	2 (100)	4 (33)	
	O	**1** (50)		**2** (50)	**3** (50)	**2** (67)	**1** (25)					
Goldsinny wrasse	M		1 (100)									
	C				8 (100)		7 (75)	13 (67)				1 (100)
	O					**1** (100)	**1** (25)	**1** (33)			**1** (100)	
Cuckoo wrasse	M				1 (100)							
	C										1 (100)	
	O											
Corkwing wrasse	M										1 (100)	
	C											
	O											
Wrasses	M											
	C											
	O											
Butterfish	M											
	C											
	O											
Sandeels	M		8 (73)	10 (67)		2 (10)					1 (33)	
	C	12 (100)	3 (27)			18 (70)	22 (100)	3 (67)	3 (100)		1 (33)	1 (25)
	O			**1** (33)		**2** (20)		**1** (33)			**1** (33)	**3** (75)
Lesser weever fish	M											1 (4)
	C	16 (71)	3 (50)		1 (7)	3 (15)	160 (50)	52 (56)	145 (92)	63 (41)	97 (52)	70 (36)
	O	**2** (29)	**2** (50)	**8** (100)	**14** (93)	**11** (85)	**13** (50)	**11** (44)	**2** (8)	**13** (59)	**13** (48)	**15** (60)
Greater weever fish	M						2 (100)					
	C				1 (100)	1 (100)						
	O											
Butterfly blenny	M										1 (10)	
	C		3 (100)		3 (60)	12 (33)	7 (50)	3 (50)	6 (57)	11 (27)	6 (30)	3 (13)
	O	**1** (100)			**2** (40)	**6** (67)	**3** (50)	**3** (50)	**3** (43)	**8** (73)	**6** (60)	**7** (88)
Common dragonet	M	39 (6)	366 (17)									42 (2)
	C	703 (30)	748 (35)	210 (12)	2075 (50)	981 (30)	2495 (52)	1670 (41)	3536 (67)	1135 (35)	2087 (48)	1125 (29)
	O	**34** (64)	**26** (48)	**37** (88)	**26** (50)	**39** (70)	**29** (48)	**39** (59)	**24** (33)	**48** (65)	**47** (52)	**45** (69)
Spotted dragonet	M											
	C							1 (100)	5 (75)	2 (50)	3 (60)	4 (50)
	O								**1** (25)	**1** (50)	**2** (40)	**3** (50)
Reticulated dragonet	M											
	C								10 (83)		2 (100)	10 (75)
	O								**1** (17)			**1** (25)
Jeffrey's goby	M											
	C											
	O											
Black goby	M											
	C											
	O											

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Common name
	7 (100)	10 (100)	13 (71)	24 (100)	1 (100)	3 (18)	8 (100)		2 (67)	11 (100)	4 (100)	Horse mackerel
			1 (7)									
4 (100)			**3** (21)			**9** (82)		**9** (100)	**1** (33)			
												Gilthead sea-bream
1 (100)		2 (100)	53 (100)	20 (100)	29 (100)	100 (100)	2 (100)		4 (100)	20 (100)		Black sea-bream
56 (100)	114 (100)	16 (100)	216 (100)	62 (100)	79 (100)	209 (100)	57 (100)	30 (100)	32 (100)	51 (100)	22 (100)	Red mullet
1 (100)	2 (100)	6 (100)										Red bandfish
			2 (100)		**2** (100)	**2** (100)	**2** (100)	**4** (100)	**3** (100)	**4** (100)	**6** (100)	
2 (100)		2 (100)	1 (25)	8 (100)								Goldsinny wrasse
	2 (100)		**3** (75)			**1** (100)	**2** (100)	**2** (100)	**1** (100)	**2** (100)	**1** (100)	
												Cuckoo wrasse
						1 (100)						
		2 (100)										Corkwing wrasse
										1 (100)		
					7 (50)							Wrasses
					1 (50)							
				2 (100)								Butterfish
									1 (100)			
1 (25)	4 (50)	16 (100)		14 (100)	3 (60)	3 (33)	3 (100)	1 (17)	3 (75)	8 (100)	6 (100)	Sandeels
			1 (33)									
3 (75)	**3** (50)		**2** (67)		**2** (40)	**4** (67)		**5** (83)	**1** (25)			
11 (17)	19 (15)	160 (100)	1 (4)	162 (100)	26 (16)	35 (18)	18 (17)	34 (20)	36 (17)			Lesser weever fish
1 (6)			22 (8)			1 (5)						
14 (78)	**22** (85)		**22** (88)		**16** (84)	**17** (77)	**15** (83)	**16** (80)	**19** (83)	**19** (100)	**17** (100)	
		2 (100)							1 (50)			Greater weever fish
	3 (100)					**1** (100)			**1** (50)		**1** (100)	
23 (100)		132 (100)		96 (100)	1 (14)	2 (7)		2 (13)				Butterfly blenny
			5 (15)									
	10 (100)		**11** (85)		**6** (86)	**13** (93)	**7** (100)	**7** (88)	**7** (100)	**8** (100)	**3** (100)	
57 (9)	447 (10)	4568 (100)	21 (2)	5194 (100)	270 (12)	315 (9)	110 (10)	240 (9)	163 (9)	134 (2)		Common dragonet
41 (2)			355 (11)			47 (2)						
51 (89)	**52** (90)		**48** (87)		**51** (88)	**52** (90)	**52** (90)	**50** (91)	**52** (91)	**57** (98)	**58** (100)	
3 (67)		22 (100)		106 (100)	1 (100)							Spotted dragonet
1 (33)	**8** (100)					**5** (100)		**1** (100)	**1** (100)	**2** (100)		
		22 (100)		98 (100)								Reticulated dragonet
1 (25)												
3 (75)												
		10 (100)		2 (100)								Jeffrey's goby
	2 (100)	10 (100)										Black goby
1 (100)								**2** (100)	**3** (100)			

Common name	Catch component	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Rock goby	M											
	C											
	O											
Gobies	M											
	C											
	O											
Fries's goby	M											
	C											
	O											
Sand gobies	M											2 (4)
	C								49 (36)		9 (25)	55 (17)
	O				**4** (100)		**1** (100)	**3** (100)	**9** (64)		**9** (75)	**18** (78)
Mackerel	M											1 (50)
	C											1 (50)
	O											
Boarfish	M											5 (20)
	C	2 (100)			1 (100)	1 (100)	11 (75)	4 (100)		1 (100)		4 (60)
	O						**1** (25)					**1** (20)
Megrim	M	1 (100)	1 (100)				1 (100)		1 (100)			1 (100)
	C											
	O											
Norwegian	M		2 (17)									1 (5)
topknot	C	27 (80)	19 (83)		38 (80)	15 (36)	77 (50)	23 (44)	38 (47)	25 (41)	28 (50)	11 (35)
	O	**2** (20)		**1** (100)	**2** (20)	**9** (64)	**11** (50)	**9** (56)	**8** (53)	**13** (59)	**9** (50)	**12** (60)
Turbot	M	3 (100)	2 (100)	2 (100)	1 (100)	3 (100)	2 (100)	3 (100)	3 (100)	3 (100)	2 (100)	4 (100)
	C											
	O											
Brill	M	12 (100)	9 (100)	14 (100)	14 (100)	11 (100)	10 (100)	9 (100)	16 (100)	13 (100)	21 (100)	21 (100)
	C											
	O											
Ekström's	M											
topknot	C							1 (33)				1 (33)
	O							**2** (67)		**1** (100)	**1** (100)	**2** (67)
Common	M											1 (50)
topknot	C											1 (50)
	O				**1** (100)							
Imperial	M											1 (5)
scaldfish	C						1 (100)	41 (70)	162 (100)	129 (50)	69 (61)	105 (42)
	O							**3** (30)		**7** (50)	**7** (39)	**10** (53)
Scaldfish	M	92 (53)	55 (26)									
	C	14 (16)	113 (45)	63 (17)	367 (56)	250 (34)	633 (48)	427 (41)	732 (65)	276 (34)	572 (47)	256 (21)
	O	**10** (31)	**9** (29)	**19** (83)	**19** (44)	**27** (66)	**29** (52)	**30** (59)	**21** (35)	**37** (66)	**31** (53)	**30** (79)
Dab	M	853 (82)	488 (100)	329 (97)	250 (22)	271 (72)	933 (94)	611 (100)	571 (100)	589 (91)	468 (73)	584 (100)
	C	746 (14)		4 (3)	142 (22)	78 (16)					2 (6)	
	O	**1** (4)			**15** (56)	**3** (12)	**2** (6)			**3** (9)	**7** (21)	
Lemon sole	M	43 (100)	55 (100)	58 (100)	20 (100)	20 (100)	26 (100)	36 (100)	35 (100)	28 (100)	32 (100)	18 (100)
	C											
	O											
Flounder	M					1 (100)		4 (100)	7 (100)		1 (100)	3 (100)
	C											
	O											
European plaice	M	699 (100)	511 (100)	310 (100)	411 (100)	267 (100)	269 (100)	255 (100)	447 (100)	998 (100)	571 (100)	617 (100)
	C											
	O											
Solenette	M	153 (17)	9 (7)									3 (3)
	C	55 (26)	331 (41)	22 (10)	1358 (31)	1199 (32)	3322 (45)	2063 (38)	2637 (50)	1117 (30)	3975 (44)	837 (23)
	O	**13** (57)	**14** (52)	**18** (90)	**20** (69)	**17** (68)	**18** (55)	**23** (62)	**20** (50)	**23** (70)	**28** (56)	**23** (74)

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Common name
				4 (100)								Rock goby
							5 (25)					Gobies
10 (100)						**1** (100)	**3** (75)			**4** (100)		
				16 (100)								Fries's goby
1 (100)	98 (7)	910 (100)		1104 (100)	1 (7)		3 (6)	2 (9)	5 (12)			Sand gobies
			8 (25)									
	14 (93)		**9** (75)		**14** (93)	**23** (100)	**16** (94)	**10** (91)	**15** (88)	**6** (100)	**12** (100)	
				6 (100)						2 (100)	1 (100)	Mackerel
								2 (100)				
				2 (100)				2 (14)				Boarfish
								6 (86)	**1** (100)	**1** (100)	**2** (100)	
						1 (100)				2 (100)	12 (100)	Megrim
8 (100)		58 (100)		52 (100)	6 (20)	1 (11)		1 (14)				Norwegian topknot
			1 (20)									
	8 (100)		**4** (80)		**4** (80)	**8** (89)		**6** (86)	**5** (100)	**4** (100)	**1** (100)	
4 (100)	6 (100)	4 (100)	4 (67)	2 (100)	4 (100)	2 (100)	1 (100)	3 (100)	5 (100)	8 (100)	7 (100)	Turbot
			2 (33)									
19 (100)	20 (100)	18 (100)	17 (88)	20 (100)	9 (100)	13 (100)	15 (100)	20 (100)	21 (100)	26 (100)	25 (100)	Brill
			3 (13)									
1 (100)	1 (50)			4 (100)								Ekström's topknot
	1 (50)		**1** (100)					**1** (100)	**1** (100)		**4** (100)	
												Common topknot
			1 (100)			**2** (100)	**5** (100)	**1** (100)	**2** (100)			
9 (8)	9 (14)	474 (100)	8 (2)	202 (100)	21 (17)	34 (15)	26 (20)	54 (19)	20 (13)			Imperial scaldfish
			177 (12)									
12 (92)	**12** (86)		**42** (86)		**15** (83)	**17** (85)	**12** (80)	**17** (81)	**14** (88)	**12** (100)	**15** (100)	
17 (11)	173 (13)	2363 (100)		2430 (100)	125 (11)	14 (5)	160 (15)	134 (11)	178 (10)	1 (2)		Scaldfish
						35 (3)						
31 (89)	**39** (87)				**40** (89)	**37** (93)	**33** (85)	**41** (89)	**38** (90)	**41** (98)	**47** (100)	
297 (100)	1255 (100)	1974 (100)		552 (100)	557 (100)	932 (100)	331 (100)	316 (100)	451 (100)	664 (100)	898 (100)	Dab
			224 (15)									
			23 (85)									
21 (100)	38 (100)	18 (100)	31 (100)	40 (100)	23 (100)	38 (100)	25 (100)	66 (100)	75 (100)	66 (100)	64 (100)	Lemon sole
3 (100)	7 (100)		2 (100)			2 (100)	1 (100)		4 (100)	3 (100)	2 (100)	Flounder
641 (100)	758 (100)	514 (100)	445 (98)	358 (100)	368 (100)	420 (100)	388 (100)	378 (100)	747 (100)	1294 (100)	1595 (100)	European plaice
			1 (2)									
34 (5)	588 (12)	12029 (100)		12754 (100)	231 (8)	3 (6)	272 (7)	259 (10)	411 (11)	2 (3)		Solenette
			1246 (19)			19 (3)						
20 (95)	**22** (88)		**21** (81)		**24** (92)	**29** (91)	**27** (93)	**27** (90)	**24** (89)	**29** (97)	**26** (100)	

Common name	Catch component	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Thickback sole	M	309 (44)	136 (19)	39 (3)								18 (2)
	C	293 (17)	784 (40)	120 (6)	1705 (54)	627 (29)	1218 (48)	703 (41)	1718 (73)	884 (35)	2853 (51)	830 (31)
	O	**16** (39)	**19** (40)	**32** (91)	**22** (46)	**36** (71)	**27** (52)	**32** (59)	**15** (27)	**42** (65)	**39** (49)	**36** (67)
Sand sole	M	6 (100)	8 (100)	2 (100)	9 (100)		4 (100)	6 (100)	5 (100)	10 (100)	7 (100)	6 (100)
	C											
	O											
Sole	M	452 (100)	263 (100)	461 (100)	631 (100)	365 (100)	299 (100)	258 (100)	344 (100)	531 (100)	472 (100)	432 (100)
	C											
	O											
European lobster	M		1 (100)		1 (100)				1 (100)	1 (100)		1 (100)
	C										1 (100)	
	O											
Spiny spider crab	M	31 (93)					115 (100)					
	C	1 (7)	28 (88)	30 (82)	81 (100)	102 (100)		85 (100)	96 (100)	140 (100)	129 (100)	148 (100)
	O		**2** (12)	**3** (18)								
Edible crab	M	41 (100)	26 (100)	53 (96)	63 (96)	24 (89)	27 (95)	45 (100)	24 (100)	69 (100)	69 (100)	32 (100)
	C			2 (4)	1 (4)	4 (11)	1 (5)					
	O											
Great scallop	M	21 (100)	27 (100)	32 (94)	54 (95)	57 (78)	11 (86)	20 (91)				
	C			1 (6)		8 (22)		1 (9)	23 (100)	36 (100)	55 (90)	25 (100)
	O				**1** (5)		**1** (14)				**2** (10)	
Common cuttlefish	M											
	C	48 (37)	1133 (98)	9 (44)	121 (90)	198 (95)	109 (95)	944 (94)	627 (100)	403 (89)	486 (86)	414 (91)
	O	**17** (63)	**1** (2)	**5** (56)	**3** (10)	**2** (5)	**1** (5)	**3** (6)		**5** (11)	**7** (14)	**5** (9)
Squids	M		13 (80)									
	C	50 (95)	22 (20)	17 (78)	52 (100)	79 (100)	69 (96)	9 (75)	13 (91)	64 (100)	26 (75)	47 (100)
	O	**1** (5)		**2** (22)			**1** (4)	**1** (25)	**1** (9)		**2** (25)	

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Common name
81 (9) 59 (2) **38** (88)	110 (10) **45** (90)	3365 (100)	1 (2) 180 (10) **42** (88)	2904 (100)	233 (15) **40** (85)	241 (10) 33 (2) **44** (88)	58 (10) **46** (90)	263 (10) **43** (90)	63 (9) **42** (91)	38 (2) **52** (98)	 **49** (100)	Thickback sole
15 (100)	23 (100)	8 (100)	8 (100)	12 (100)	11 (100)	8 (100)	18 (100)	22 (100)	23 (100)	21 (100)	24 (100)	Sand sole
399 (100)	557 (100)	298 (100)	416 (98) 1 (2)	380 (100)	282 (100)	355 (100)	466 (100)	493 (100)	488 (100)	629 (100)	627 (100)	Sole
					1 (100)			2 (100)	3 (100)	1 (100)		European lobster
213 (100)	289 (100)	190 (97) **1** (3)		336 (100)		210 (100)	83 (100)	131 (100)	116 (100)	223 (100)	105 (100)	Spiny spider crab
68 (100)	37 (100)	22 (100)	51 (97) 2 (3)	58 (96) **1** (4)	33 (100)	46 (100)	61 (100)	71 (100)	47 (100)	78 (100)	51 (100)	Edible crab
34 (100)	3 (30) **7** (70)	56 (100)	33 (100)	68 (100)	62 (100)	68 (100)	105 (100)	146 (100)	142 (100)	136 (100)	68 (100)	Great scallop
443 (91) **2** (9)	317 (100)	750 (100)	1392 (100)	1856 (100)	1094 (97) **2** (3)	1297 (100)	770 (100)	591 (100)	356 (100)	921 (100)	461 (100)	Common cuttlefish
1 (100)	4 (9) **21** (91)	80 (100)	38 (100)	30 (100)	18 (100)	67 (88) **3** (12)	53 (100)	7 (88) **1** (13)	28 (100)	12 (80) **2** (20)	8 (100)	Squids

Appendix III
Number of biological samples collected during the survey

Where a = the number of biological samples collected, b = the total number of fish aged, including the number of samples that were unable to age (shown in brackets), c = the number of fish measured at valid stations (not corrected for number of gears deployed).

Common name / Vessel		1989 Chmr	1990 Chmr	1991 Chmr	1992 Chmr	1993 Chmr	1994 Chmr	1995 Chmr	1996 Chmr	1997 Chmr	1998 Chmr	1999 Chmr	2000 Chmr
Atlantic cod	a									5			
	b									0			
	c	1			2					6	1	1	1
Whiting	a												
	b												
	c	12	28	331	154	311	61	99	122	190	106	49	39
European hake	a												
	b												
	c		30	3		1	3		1				2
Black-bellied anglerfish	a												
	b												
	c	1											
Anglerfish	a					22	19	54	40	9	7	6	13
	b					0	19 (1)	54	40	9	0	0	0
	c	47	27	22	17	22	19	54	38	9	7	6	13
Red gurnard	a						41						
	b						0						
	c	913	926	209	626	933	1402	861	741	634	599	884	788
Turbot	a						1	3	3	3			
	b						0	0	0	0			
	c	3	2	2	1	3	2	3	3	3	2	4	4
Brill	a						9	9	15	12			
	b						0	0	0	0			
	c	12	9	14	14	11	10	9	16	13	21	21	19
Dab	a							128	108				
	b							0	0				
	c	853	488	329	250	271	933	611	571	560	468	584	297
Lemon sole	a					19	26	36	35	28	32	18	21
	b					0	0	0	0	0	0	0	0
	c	43	55	58	20	20	26	36	35	28	32	18	21
European plaice (Female)	a	82	77	138	147	131	153	151	143	272	274	240	238
	b	82	77	138	147	131	153	151 (1)	143	272 (1)	274	240	238
	c	328	282	174	247	167	158	154	213	540	335	345	399
European plaice (Male)	a	57	50	69	79	76	103	88	96	172	169	162	169
	b	57	50	69	79	76	103	88	96	172	169	162	169
	c	371	229	136	164	100	111	101	234	447	236	272	242
Sole	a	169	148	323	334	328	309	258	330	388	402	388	296
	b	169 (2)	148 (1)	323	334 (3)	328 (2)	309	258	330	388 (2)	402(1)	388 (2)	296
	c	452	263	461	631	365	299	258	344	527	472	432	399

2001 Chmr	2002 Cory	2003 Chmr	2004 Cory	2005 Chmr	2006 Chmr	2007 Chmr	2008 Chmr	2009 Chmr	2010 Chmr	2011 Chmr	Total	Common name / Vessel
3	1				1	4	5	2	2		23	Atlantic cod
0	1				1	0	5	2	2		11	
3	1				1	4	5	2	3	1	32	
	60		26								86	Whiting
	60		26								86	
139	84	185	26	378	67	186	177	166	525	183	3618	
	1										1	European hake
	0										0	
2	1			7	1		9	3			63	
						1	1				2	Black-bellied
						1	1				2	anglerfish
						1	2				4	
10	11		11		31	29	83	156	115		616	Anglerfish
0	0		11		31 (2)	29 (1)	83 (1)	156	115 (2)		547 (7)	
10	11	44	11	74	42	29	111	203	206	132	1154	
											41	Red gurnard
											0	
284	437	81	531	850	930	389	916	992	847	978	16751	
6	2	4									22	Turbot
0	2	0									2	
6	2	4	1	4	2	1	3	5	8	7	75	
20	9	17									91	Brill
0	0	0									0	
20	9	17	10	9	13	15	20	21	26	25	354	
	162										398	Dab
	0										0	
1255	987		276	557	932	331	316	451	664	898	12882	
38	9	31			21	16	46	68	16	50	510	Lemon sole
0	0	1			0	0	0	68	16	50	135	
38	9	31	20	23	38	25	66	75	66	64	847	
208	145	218	119	197	164	188	152	196	259	238	4130	European plaice
208	145 (1)	218	119	197 (6)	164	188	152 (1)	196	259	238	4130 (10)	(Female)
356	156	274	118	235	270	265	253	409	779	861	7318	
140	99	130	61	108	94	94	88	144	181	214	2643	European plaice
140	99 (2)	130	61	108 (1)	94	94 (1)	88	144	181	214	2643 (4)	(Male)
402	101	171	61	133	150	123	125	338	515	729	5491	
336	148	306	190	250	271	300	294	336	354	258	6716	Sole
336 (2)	148 (2)	306 (1)	190 (1)	250 (1)	271 (3)	300 (3)	294 (1)	336 (1)	354 (2)	258 (1)	6716 (31)	
557	149	416	190	281	355	466	493	485	629	615	9539	

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