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Distribution and relative abundance of demersal fishes from beam trawl surveys in the Irish Sea (ICES division VIIa) 1993-2001

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1. IRISH SEA FISHERIES

ICES division VIIa supports important fisheries for demersal and pelagic finfish and shellfish, and the main fisheries involve otter, beam and *Nephrops* trawlers.

Otter trawlers target cod, haddock, whiting and plaice, although important by-catch species include anglerfish, hake, sole and skates and rays. Since the early 1980s there has been a development of semi-pelagic gear, which again targets cod, whiting and haddock.

The beam trawl fishery in the Irish Sea involves vessels from Belgium, UK (England, Wales and Northern Ireland), Ireland, Holland and France. It commenced in the early 1960s to target sole and fishing effort peaked in the late 1980s, following a period of strong year classes of sole. The effort is currently about 60% of that peak value, and the fishery also lands plaice, rays, brill, turbot and anglerfish.

There is also an important *Nephrops* fishery on the muddy grounds in the north-western Irish Sea, and this is one of the most valuable fisheries in the area.

Other fisheries that operate in the Irish Sea deploy gillnets and tangle nets, often by inshore boats targeting cod, bass, grey mullet, sole, plaice and rays. Longline fisheries targeting spurdog expanded in the 1980s, although this fishery has subsequently declined. There are also important fisheries for shellfish, notably scallop fisheries off the Isle of Man and pot fisheries for edible crab and lobster. Pelagic fisheries in the Irish Sea target herring. The fisheries of the area were described by Pawson *et al*. (2002).

Table 1 shows the landings (all gears combined) of demersal finfish and shellfish by UK vessels landing into England and Wales. The data cover the period 1993 to 2001, and cover the most commercially important species for ICES division VIIa. Boon (1992) reviewed commercial landings from this area for earlier years.

2. HISTORY OF THE SURVEY

Fisheries science is dependent upon accurate fisheries and biological data to assess the status of fish stocks. In addition to landings information and biological data collected from commercial landings, it is also necessary to collect fishery-independent data describing the distribution and relative abundance of fishes, including juveniles, and further biological sampling of commercial species. This is achieved by conducting standardised scientific surveys of the relevant fish stocks and areas. CEFAS conducts surveys around the coast of England and Wales using a variety of fishing gears, to collect fisheries-independent indices of stock abundance. These data are integrated into the stock assessments carried out under the auspices of ICES (International Council for Exploration of the Seas) Assessment Working Groups. See www.ices.dk for more information.

The CEFAS near-west groundfish survey has taken place every autumn since 1988, and covers the Irish Sea (ICES division VIIa), Bristol Channel (VIIf) and parts of the Celtic Sea (VIIg). Equivalent spring surveys were also conducted between 1993 and 1998. The survey was initially designed to provide abundance indices for pre-recruit (1 and 2 year old) plaice (*Pleuronectes platessa*) and sole (*Solea solea*), while also providing abundance and length data for all species caught, and age and other biological data for commercially important species. *RV CORYSTES* has been used for all the near-west groundfish surveys used in this report. Due to minor inconsistencies in the sampling grid before 1993, this report uses data from 1993 onwards, during which time the position of sampling stations and tow length have been consistent.

3. CURRENT SURVEY OBJECTIVES

The primary objectives of the Irish Sea beam trawl survey are to (a) carry out a 4 m beam-trawl survey of groundfish to i) obtain fisheries independent data on the distribution and abundance of commercial flatfish species, and ii) derive age compositions of sole and plaice for use in the assessment of stock size; and (b) to collect biological data, including maturity and weight at age, for sole, plaice, lemon sole and other commercially important species. The epibenthic by-catch from these catches has been quantified since 1997 (Ellis *et al*., 2000), and these surveys are also used to collect biological samples in support of other CEFAS projects and training courses.

4. SURVEY METHODS

The standard gear used is a 4 m beam trawl with chain mat, flip up rope, and a 40 mm codend liner to retain small fish. The gear is towed at 4 knots (over the ground) for 30 minutes, averaging 2 nautical miles per tow. Fishing is only carried out in daylight, shooting after sunrise and hauling no later than sunset, as the vertical distribution of some species is known to vary diurnally. The gear described and illustrated by Kaiser and Spencer (1994).

Once on board the catch is sorted to species level, with the exception of small gobies and sandeels, which are identified to genus. Species were identified according to Wheeler (1969) and Whitehead *et al.* (1986). Plaice, sole, dab, and elasmobranchs are sorted by sex, all fish categories weighed, and total lengths are measured to the nearest full centimetre below. Area-stratified samples of selected species are sampled for weight, length, sex, maturity, and otoliths or scales removed for ageing. The extent of sampling carried out by species is detailed in Table 2.

Table 1. Demersal and shellfish landings from all gears, by UK vessels landing into England and Wales from 1993-2001

Year	1993			1994			1995		
Species	Weight (tonnes)	Value (£1000s)	Price per kg (£/kg)	Weight (tonnes)	Value (£1000s)	Price per kg (£/kg)	Weight (tonnes)	Value (£1000s)	Price per kg (£/kg)
Anglerfish	148	250	1.69	77	125	1.62	85	133	1.58
Brill	53	164	3.10	53	185	3.47	57	210	3.65
Bass	8	24	3.16	33	177	5.30	31	141	4.48
Cod	837	995	1.19	483	541	1.12	527	554	1.05
Conger eel	55	31	0.56	32	27	0.84	30	25	0.83
Dab	49	14	0.28	48	16	0.32	46	15	0.33
Spurdog	1105	984	0.89	504	430	0.85	400	299	0.75
Flounder	31	4	0.13	19	4	0.20	66	16	0.25
Haddock	42	46	1.09	27	24	0.86	63	52	0.83
Hake	140	498	3.56	58	190	3.25	41	139	3.39
John dory	3	12	3.61	4	13	3.27	4	16	4.13
Lemon sole	34	77	2.29	28	62	2.21	22	55	2.51
Ling	77	53	0.70	44	33	0.74	46	34	0.74
Megrim	48	115	2.40	18	51	2.80	17	44	2.49
Red mullet	1	7	5.09	1	6	5.99	1	4	5.28
Plaice	1006	928	0.92	867	884	1.02	905	945	1.04
Saithe	55	32	0.58	23	13	0.58	22	9	0.38
Pollock	79	83	1.05	26	28	1.05	45	46	1.04
Sole	294	1377	4.68	361	1597	4.42	383	1911	4.99
Sand sole	1	2	1.80	3	6	2.08	3	6	1.96
Turbot	64	342	5.36	31	167	5.37	26	145	5.53
Whiting	551	187	0.34	284	107	0.38	481	145	0.30
Witch	12	15	1.24	3	3	1.06	6	5	0.95
Mixed demersal	32	30	0.96	17	16	0.97	12	9	0.79
Mixed gurnards	115	42	0.36	73	24	0.33	68	26	0.38
Mixed mullets	1	2	1.20	3	3	1.21	3	3	1.11
Dogfish, hounds and sharks	242	70	0.29	194	88	0.45	123	54	0.43
Skates and rays	924	858	0.93	618	616	1.00	522	509	0.98
Total demersal landings	**6007**	**7239**		**3935**	**5437**		**4034**	**5550**	
Cockles	1905	457	0.24	156	31	0.20	75	22	0.29
Edible crab	30	24	0.81	9	7	0.75	80	45	0.57
Loster	37	335	8.95	32	285	8.88	26	244	9.38
Mussels	3983	692	0.17	2548	406	0.16	4309	1169	0.27
Nephrops	518	869	1.68	447	795	1.78	491	868	1.77
Queen scallops	1008	342	0.34	508	293	0.58	204	127	0.62
Scallops	121	183	1.51	342	494	1.44	280	418	1.49
Whelk	367	114	0.31	156	41	0.26	464	147	0.32
Total shellfish landings	**7969**	**3016**		**4198**	**2352**		**5929**	**3040**	

Table 1. continued: Demersal and shellfish landings from all gears, by UK vessels landing into England and Wales from 1993-2001

Year	1996			1997			1998		
Species	Weight (tonnes)	Value (£1000s)	Price per kg (£/kg)	Weight (tonnes)	Value (£1000s)	Price per kg (£/kg)	Weight (tonnes)	Value (£1000s)	Price per kg (£/kg)
Anglerfish	70	114	1.62	79	115	1.46	55	94	1.71
Brill	47	205	4.33	54	214	3.99	60	225	3.79
Bass	15	75	5.12	7	34	5.03	4	24	6.14
Cod	382	389	1.02	588	643	1.09	653	786	1.20
Conger eel	44	34	0.77	49	35	0.72	75	55	0.74
Dab	62	23	0.37	57	15	0.27	37	7	0.18
Spurdog	629	494	0.79	733	530	0.72	903	672	0.74
Flounder	71	13	0.19	63	11	0.18	52	8	0.16
Haddock	84	74	0.89	144	137	0.95	185	185	1.00
Hake	32	88	2.78	73	167	2.29	35	83	2.37
John dory	0	1	3.36	1	4	4.00	1	2	2.59
Lemon sole	13	26	1.94	24	42	1.76	19	43	2.26
Ling	29	20	0.71	24	16	0.69	30	24	0.81
Megrim	6	14	2.29	5	4	0.82	4	6	1.51
Red mullet	0	1	6.09	0	2	5.15	0	1	2.32
Plaice	627	752	1.20	601	667	1.11	545	545	1.00
Saithe	11	6	0.53	25	15	0.60	17	11	0.62
Pollock	22	18	0.79	29	28	0.98	41	41	1.00
Sole	171	1014	5.93	168	1069	6.36	139	901	6.48
Sand sole	1	1	2.24	1	1	2.35	1	2	2.70
Turbot	20	115	5.92	19	109	5.57	23	119	5.29
Whiting	420	154	0.37	398	128	0.32	398	124	0.31
Witch	3	2	0.58	6	2	0.42	4	1	0.39
Mixed demersal	5	6	1.13	11	8	0.75	15	9	0.62
Mixed gurnards	83	26	0.31	93	24	0.26	70	20	0.28
Mixed mullets	2	2	1.23	2	2	1.29	0	0	1.45
Dogfish, hounds and sharks	250	102	0.41	120	56	0.47	203	102	0.50
Skates and rays	658	714	1.08	764	710	0.93	880	897	1.02
Total demersal landings	**3758**	**4484**		**4136**	**4792**		**3364**	**3989**	
Cockles	154	88	0.57	732	432	0.59	606	764	1.26
Edible crab	11	11	1.03	100	101	1.01	82	96	1.17
Loster	12	131	11.08	52	436	8.44	60	504	8.39
Mussels	6480	2873	0.44	5631	2097	0.37	7723	2673	0.35
Nephrops	471	822	1.74	614	1123	1.83	378	698	1.85
Queen scallops	198	83	0.42	261	97	0.37	1073	396	0.37
Scallops	534	888	1.66	641	1125	1.75	1101	1748	1.59
Whelk	2563	1040	0.41	748	194	0.26	285	85	0.30
Total shellfish landings	**10423**	**5936**		**8779**	**5605**		**11308**	**6964**	

Table 1. continued: Demersal and shellfish landings from all gears, by UK vessels landing into England and Wales from 1993-2001

Year	1999			2000			2001		
Species	Weight (tonnes)	Value (£1000s)	Price per kg (£/kg)	Weight (tonnes)	Value (£1000s)	Price per kg (£/kg)	Weight (tonnes)	Value (£1000s)	Price per kg (£/kg)
Anglerfish	27	52	1.98	17	33	2.00	28	59	2.08
Brill	49	184	3.78	27	92	3.44	32	135	4.18
Bass	1	5	5.71	7	23	3.53	14	59	4.14
Cod	339	480	1.41	156	243	1.55	208	329	1.58
Conger eel	91	65	0.71	61	48	0.79	41	28	0.69
Dab	34	7	0.19	22	4	0.20	14	3	0.20
Spurdog	1139	858	0.75	730	747	1.02	777	856	1.10
Flounder	36	7	0.18	54	10	0.20	45	9	0.19
Haddock	152	198	1.30	90	112	1.25	205	295	1.44
Hake	37	82	2.22	58	92	1.59	25	58	2.36
John dory	1	3	3.15	1	2	2.14	1	3	2.86
Lemon sole	11	26	2.49	10	26	2.56	12	35	2.95
Ling	31	26	0.84	25	26	1.03	20	18	0.92
Megrim	3	5	1.63	1	2	2.82	1	1	1.79
Red mullet	0	1	4.40	3	3	1.30	1	1	2.30
Plaice	557	594	1.07	489	420	0.86	459	407	0.89
Saithe	18	16	0.90	8	5	0.62	12	7	0.57
Pollock	24	27	1.15	27	36	1.31	38	50	1.31
Sole	149	900	6.04	119	655	5.53	180	1082	6.02
Sand sole	0	1	2.67	0	1	2.74	1	3	2.87
Turbot	22	121	5.53	17	86	5.12	17	95	5.46
Whiting	247	82	0.33	116	42	0.36	90	40	0.44
Witch	4	2	0.49	2	1	0.50	3	2	0.51
Mixed demersal	27	26	0.94	3	2	0.81	2	1	0.79
Mixed gurnards	78	21	0.27	88	26	0.30	96	36	0.38
Mullets	1	2	1.29	1	1	1.12	3	4	1.31
Dogfish, hounds and sharks	244	119	0.49	211	170	0.81	117	67	0.58
Skates and rays	742	738	0.99	537	588	1.10	770	852	1.11
Total demersal landings	**3077**	**3789**		**2131**	**2741**		**2325**	**3615**	
Cockles	323	53	0.16	208	76	0.37	1268	367	0.29
Edible crab	76	79	1.04	102	131	1.29	141	198	1.40
Loster	27	252	9.31	67	675	10.05	57	603	10.52
Mussels	1929	477	0.25	2807	470	0.17	9714	3868	0.40
Nephrops	523	1208	2.31	464	738	1.59	514	1051	2.04
Queen scallops	476	203	0.43	1045	448	0.43	2729	1177	0.43
Scallops	1285	2407	1.87	1050	1711	1.63	955	1524	1.60
Whelk	66	17	0.25	1315	343	0.26	964	380	0.39
Total shellfish landings	**4705**	**4696**		**7058**	**4592**		**16342**	**9168**	

Table 2. Sampling protocols for commercial and non-commercial fish and shellfish

Higher taxa	Scientific name	Common name	Total catch				Biological sample				
			Number	Biomass	Length	Sex	Length	Weight	Sex	Maturity	Age
Gadiformes	*Gadus morhua*	Cod	✓	✓	✓	-	✓	✓	✓	✓	✓
	Melanogrammus aeglefinus	Haddock	✓	✓	✓	-	✓	✓	✓	✓	✓
	Merlangius merlangus	Whiting	✓	✓	✓	-	✓	✓	✓	✓	✓
	Merluccius merluccious	Hake	✓	✓	✓	-	✓	✓	✓	✓	✓
Lophiiformes	*Lophius piscatorius*	Monkfish	✓	✓	✓	-	✓	✓	✓	✓	✓
	Lophius budegassa	Black bellied angler	✓	✓	✓	-	✓	✓	✓	✓	✓
Perciformes	*Dicentrarchus labrax*	European sea bass	✓	✓	✓	-	✓	✓	✓	✓	✓
Pleuronectiformes	*Lepidorhombus whiffiagonis*	Megrim	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Scophthalmus maximus	Turbot	✓	✓	✓	-	✓	✓	✓	✓	✓
	Scophthalmus rhombus	Brill	✓	✓	✓	-	✓	✓	✓	✓	✓
	Glyptocephalus cynoglossus	Witch	✓	✓	✓	-	✓	-	-	-	-
	Limanda limanda[#]	Dab	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Microstomus kitt	Lemon sole	✓	✓	✓	-	✓	✓	✓	✓	✓
	Pleuronectes platessa	Plaice	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Solea solea	Sole	✓	✓	✓	✓	✓	✓	✓	✓	✓
Others	Sharks and dogfishes		✓	✓	✓	✓	-	-	-	-	-
	Skates and rays[+]		✓	✓	✓	✓	✓	✓	✓	✓	-
	Other fin fish		✓	✓	✓	-	-	-	-	-	-
Shellfish	*Homarus gammarus*	European Lobster	✓	✓	✓	✓	✓	-	-	-	-
	Nephrops norvegicus	Nephrops	✓	✓	✓	✓	✓	-	-	-	-
	Maia squinado	Spiny spider crab	✓	✓	-	✓	-	-	-	-	-
	Cancer pagurus	Edible crab	✓	✓	✓	✓	✓	-	-	-	-
	Pecten maximus	Scallop	✓	✓	-	-	-	-	-	-	-
	Sepiola spp. and *Rossia* spp.*	Cuttlefish	✓	✓	-	-	-	-	-	-	-
	Sepia spp.*	Cuttlefish	✓	✓	-	-	-	-	-	-	-
	Octopodidae*	Octopus	✓	✓	-	-	-	-	-	-	-
	Loliginidae*	Squid	✓	✓	-	-	-	-	-	-	-

[#] *Biological samples taken from 2000 onwards.*
[+] *Biological samples taken from 2001 onwards.*
***** *Identified to species level.*

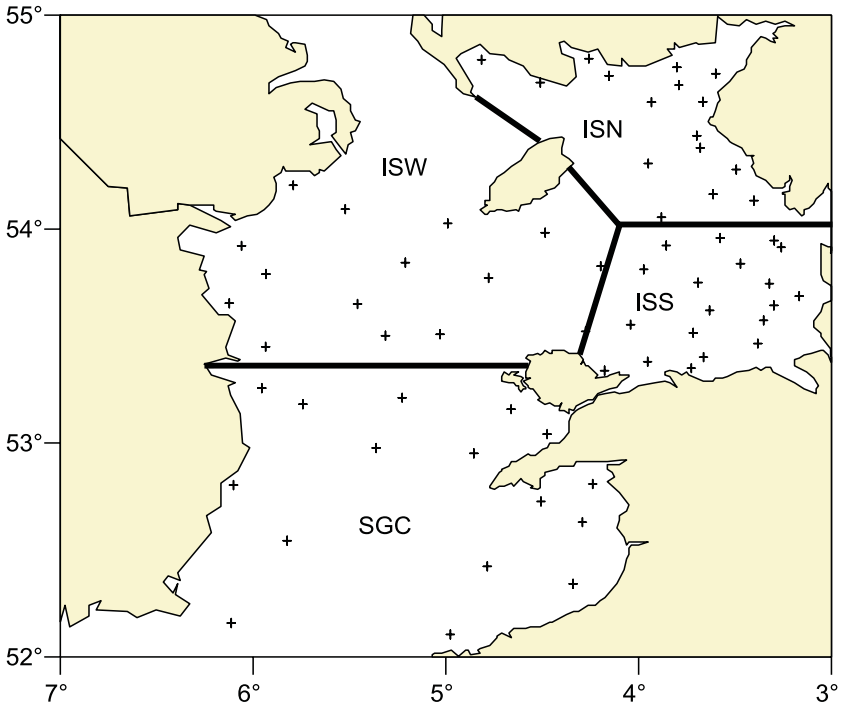

Figure 1. Irish Sea and St Georges's Channel, with sectors and fixed sampling stations indicated

To account for possible population differences within ICES division VIIa, biological samples are taken from 4 sectors (Figure 1). These are north-eastern Irish Sea (ISN), south-eastern Irish Sea (ISS), western Irish Sea (ISW) and St Georges Channel (SGC). Commercial species have length-stratified otolith targets for any combination of sector, sex and depth band.

In all, 66 stations were consistently fished in VIIa in the period 1993–2001 (Figure 1), although the presence of static fishing gear, etc., may have prevented the sampling of certain stations in some years. Additional stations were sampled prior to 1993, but as these stations are not currently fished, they are excluded from this report.

5. PHYSICAL CHARACTERISTICS OF THE AREA

5.1 Depth

The primary bathymetric feature in the Irish Sea is the channel running north to south in the western Irish Sea and St George's Channel (Figure 2). This channel, which is approximately 150 m at its deepest point, creates a 'divide' between the western Irish Sea, where there is a comparatively narrow shelf of shallow water, and the eastern Irish Sea, which has extensive shallow-water habitats. This divide may also play an important role for the demersal fish stocks in the area, and stocks

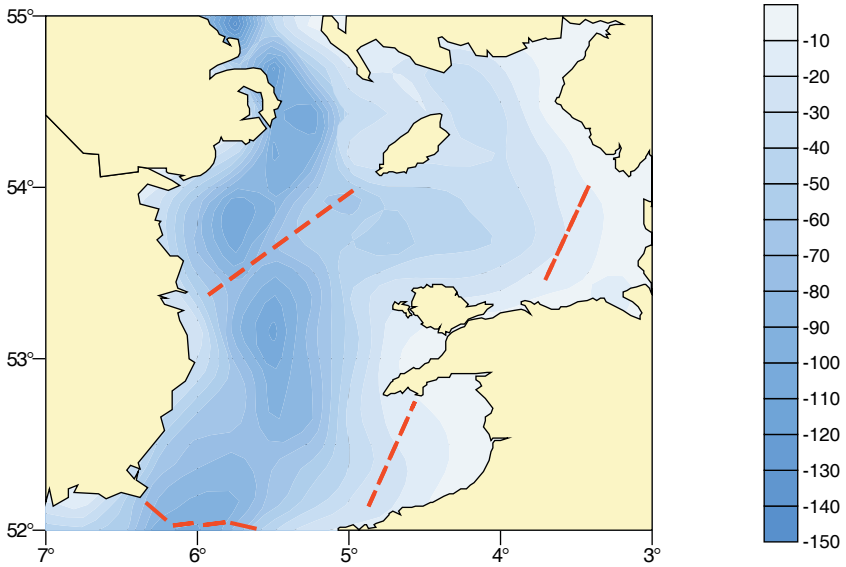

Figure 2. Bathymetry of the Irish Sea and St George's Channel including positions of fronts

in the eastern and western Irish Sea may have different biological characteristics (e.g. growth rates). The deep-water channel also permits several species that occur typically in the deeper waters of the Celtic Sea and off North-west Scotland to live in the Irish Sea (e.g. boarfish).

5.2 Circulation

The main water flow into and out of the Irish Sea is from the North Channel to the north, and St George's Channel to the south (Figure 3), and this leads to a general south-to-north flow to the west of the Isle of Man. In the eastern Irish Sea the flow is more complicated, with an anticlockwise gyre dominating off the North Wales coast. The average rate of travel within the Irish Sea is 2½ to 3 km per day, although locally this may vary considerably with tides, gales or seasonal circulation features.

5.3 Fronts

A front is the transitional zone between two different water masses and, within the Irish Sea, there are several seasonal frontal systems (Figure 2). The western Irish Sea front is pronounced in spring and separates the mixed waters to its south-east from the stratified waters to its north-west. Similarly, the Celtic Sea front separates the cooler, tidally mixed waters of St George's Channel from the warm surface waters of the Celtic Sea, which is stratified. Seasonal fronts may also occur in the eastern Irish Sea and Cardigan Bay. Frontal systems, and their associated eddies and upwellings, may result in either increased local productivity and/or concentrating of organisms, including fishes (Le Fèvre, 1986; Durazo *et al*., 1998).

5.4 Temperature

The main feature of the water temperature of the Irish Sea is the east-west alignment of the isotherms, with the warmest waters in the east in summer and in the west in winter (Figure 4). The shallowness of the eastern Irish Sea influences water temperature, which ranges from 16°C in summer to 6°C in winter (Figure 4). Western Irish Sea waters are kept relatively warm by the warm water masses entering the Irish Sea from the south-west, which derive from the continuation of the Gulf Stream driven by the North Atlantic Drift. This flow is stronger in winter, and there is thus much less variation in temperature, from 13.5°C in summer to 9.5°C in winter. Warm weather in summer warms the surface layers and there is a temperature gradient to the cooler bottom waters, while in winter there is virtually no difference in temperature between surface and bottom waters over most of the Irish Sea.

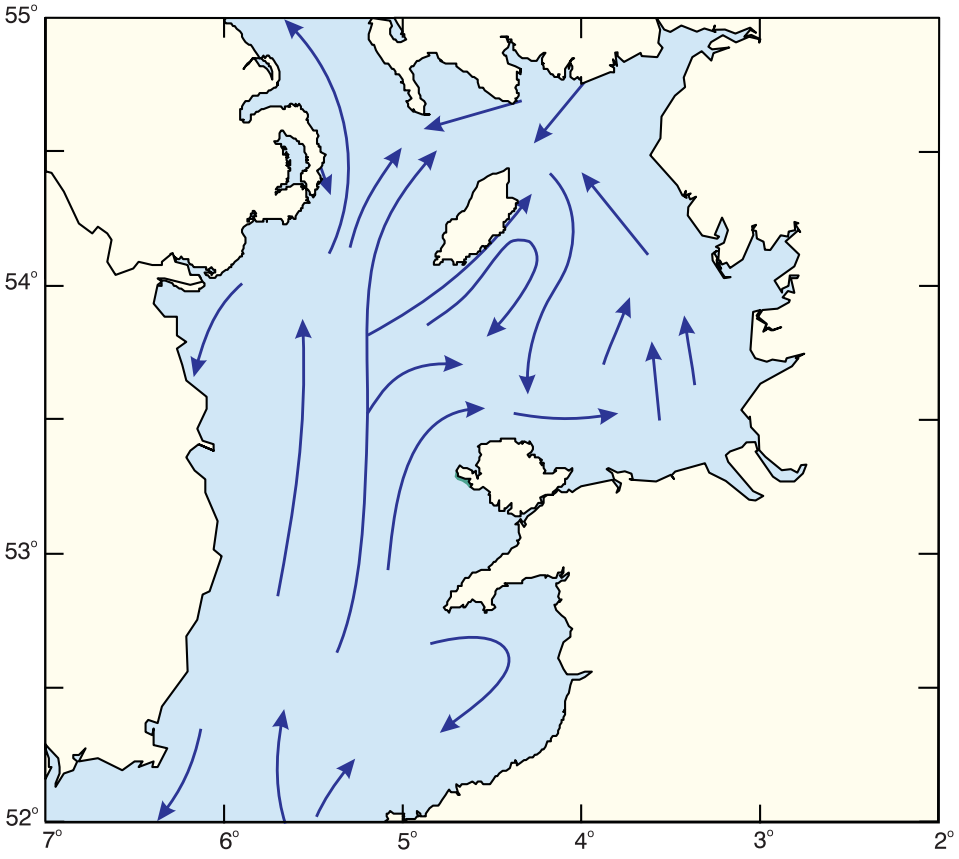

Figure 3. Near surface water circulation. Adapted from Lee and Ramster (1981)

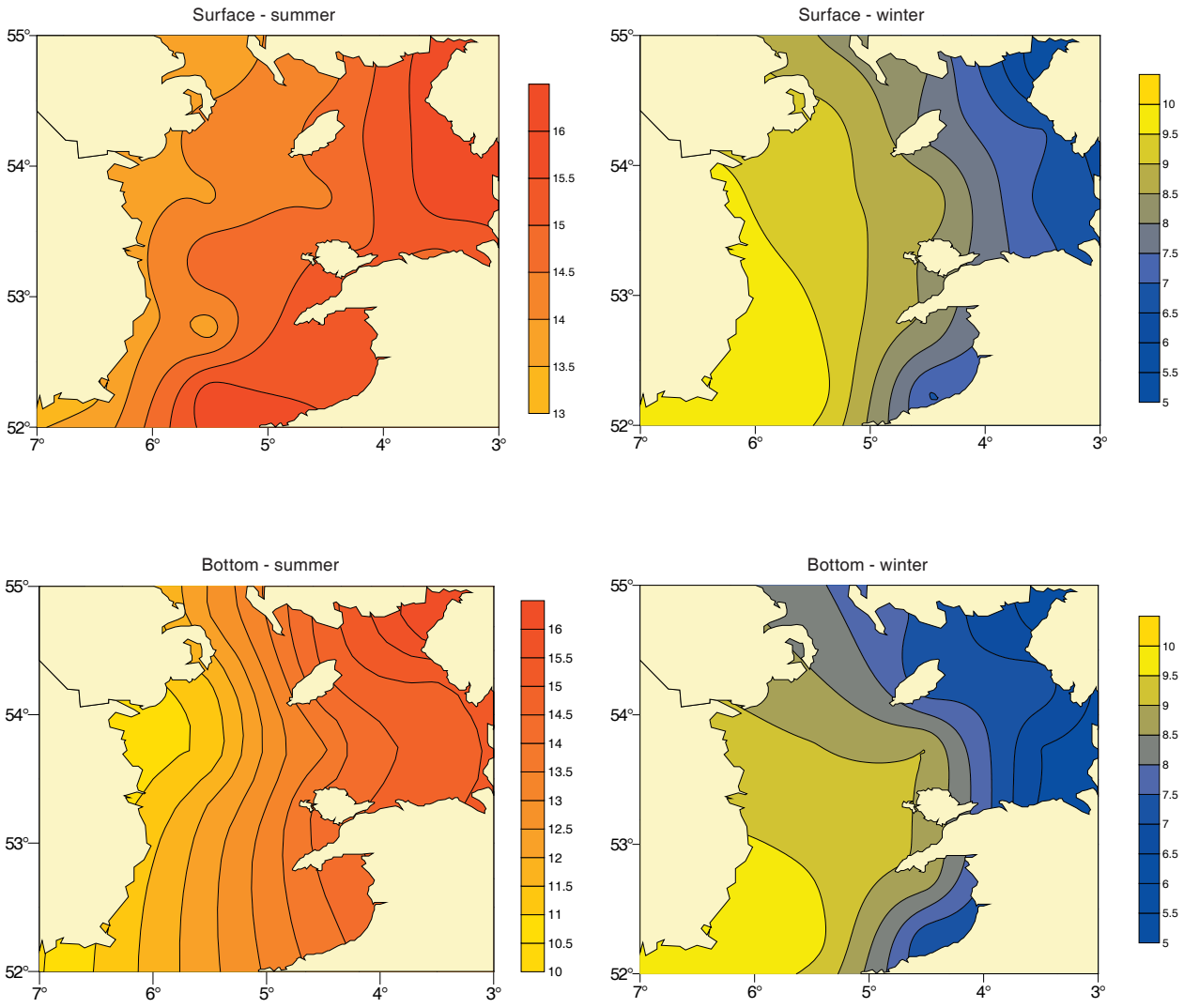

Figure 4. Average near bottom and near surface temperature (1993-2001) for summer (August) and winter (January). Data supplied by ICES

5.5 Salinity

Saline North Atlantic water pushing up through St George's Channel produces a south-to-north plume of higher salinity water in the western Irish Sea, while in the east, surface run-off from the Mersey, Solway Firth and other west coast estuaries maintains less saline surface waters (Figure 5). Surface waters are slightly more saline in summer owing to faster evaporation rates. Bottom waters are fairly homogeneous throughout the year, with slightly higher salinities in the south.

5.6 Sediment type

The distribution of many marine fishes is closely linked to both bathymetry and sediment type. Within the Irish Sea, there are two offshore mud grounds, one off Cumbria and a more extensive mud bank in the north-western Irish Sea (Figure 6). Such sediments are important fishing grounds for *Nephrops*. The inshore sediments in the Irish Sea are generally composed of sand, with coarser grounds in the deeper waters of the central Irish Sea and St George's Channel.

6. SPECIES RECORDED BY THE SURVEY

More than 100 species of marine fish were recorded during CEFAS beam trawl surveys of the Irish Sea (Table 3). More than 170 species of marine fish have been recorded from within the Irish Sea, and an annotated inventory of Irish Sea fishes is given in Ellis *et al*. (2002).

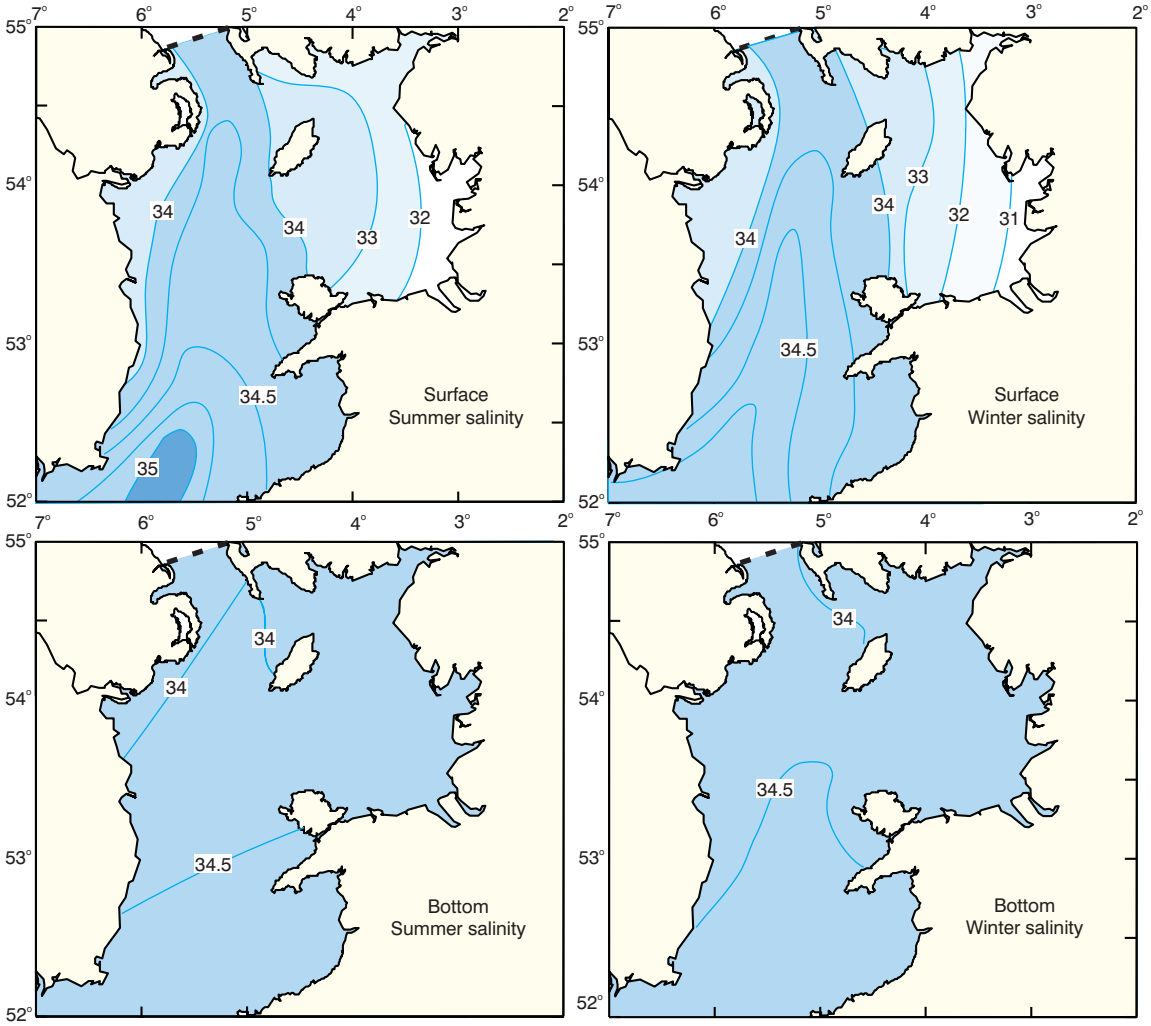

Figure 5. Average near bottom and near surface salinity for summer and winter. Adapted from Lee and Ramster (1981)

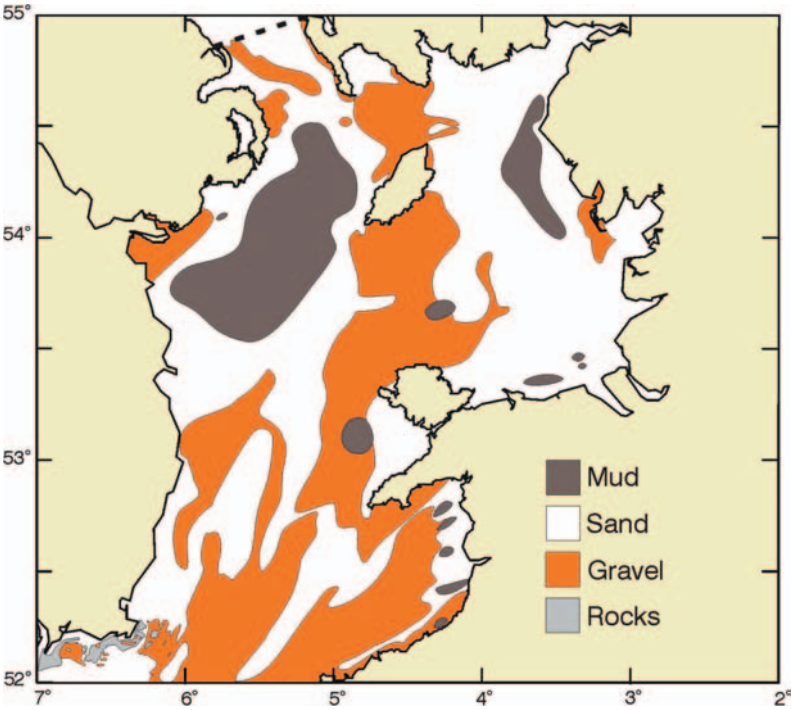

Figure 6. Distribution of major sediment types in the Irish Sea and St George's Channel. Adapted from Mackie (1990)

Table 3. Species recorded by the surveys

Latin name	Common name	Number	% abundance	Weight in kg	% of total weight
Limanda limanda	Dab	80171	28.04	3118.879	17.40
Pleuronectes platessa	European plaice	47544	16.63	4381.712	24.44
Buglossidium luteum	Solenette	33420	11.69	401.795	2.24
Callionymus lyra	Common dragonet	21757	7.61	869.725	4.85
Trisopterus minutus	Poor cod	19889	6.96	436.320	2.43
Merlangius merlangus	Whiting	12697	4.44	604.746	3.37
Solea solea	Sole	12298	4.30	1546.257	8.62
Eutrigla gurnardus	Grey gurnard	8646	3.02	348.032	1.94
Arnoglossus laterna	Scaldfish	8297	2.90	117.313	0.65
Agonus cataphractus	Pogge	6359	2.22	67.624	0.38
Echiichthys vipera	Lesser weever fish	5030	1.76	110.812	0.62
Gobiidae	Gobies	4571	1.60	8.513	0.05
Scyliorhinus canicula	Lesser spotted dogfish	4039	1.41	2569.125	14.33
Microchirus variegatus	Thickback sole	3950	1.38	111.764	0.62
Gadus morhua	Cod	1499	0.52	208.354	1.16
Microstomus kitt	Lemon sole	1440	0.50	173.433	0.97
Trisopterus luscus	Bib	1416	0.50	81.821	0.46
Trigla lucerna	Tub gurnard	1375	0.48	306.700	1.71
Trisopterus esmarki	Norway pout	1214	0.42	18.418	0.10
Aspitrigla cuculus	Red gurnard	1139	0.40	156.524	0.87
Raja clavata	Thornback ray	946	0.33	568.279	3.17
Glyptocephalus cynoglossus	Witch	913	0.32	96.703	0.54
Melanogrammus aeglefinus	Haddock	820	0.29	59.897	0.33
Raja montagui	Spotted ray	815	0.29	249.490	1.39
Hippoglossoides platessoides	Long-rough dab	588	0.21	15.715	0.09
Ammodytidae	Sandeels	565	0.20	3.411	0.02
Leucoraja naevus	Cuckoo ray	513	0.18	243.396	1.36
Syngnathus acus	Greater pipefish	394	0.14	6.559	0.04
Myoxocephalus scorpius	Bullrout	351	0.12	36.750	0.21
Lophius piscatorius	Anglerfish	350	0.12	376.019	2.10
Callionymus maculatus	Spotted dragonet	265	0.09	1.988	0.01
Platichthys flesus	Flounder	229	0.08	73.084	0.41
Phrynorhombus norvegius	Norwegian topknot	208	0.07	2.479	0.01
Scophthalmus rhombus	Brill	191	0.07	93.124	0.52
Sprattus sprattus	Sprat	156	0.05	0.144	+
Raja brachyura	Blonde ray	154	0.05	136.825	0.76
Callionymus reticulatus	Reticulate dragonet	152	0.05	0.937	0.01
Blennius ocellaris	Butterfly blenny	151	0.05	3.334	0.02
Hyperoplus lanceeolatus	Great sandeel	117	0.04	0.174	+
Ctenolabrus rupestris	Goldsinny wrasse	87	0.03	2.846	0.02
Pholis gunnellus	Butter fish	83	0.03	0.749	+
Syngnathidae	Pipe fishes	80	0.03	0.113	+
Merluccius merluccius	European hake	78	0.03	24.775	0.14
Zeus faber	John dory	77	0.03	15.553	0.09
Scyliorhinus stellaris	Greater spotted dogfish	72	0.03	122.040	0.68
Taurulus bubalis	Sea scorpion	66	0.02	4.936	0.03
Mustelus asterias	Starry smooth hound	62	0.02	19.145	0.11
Syngnathus rostellatus	Nilssons pipefish	58	0.02	0.054	+
Crenilabrus melops	Corkwing wrasse	54	0.02	1.091	0.01
Trachinus draco	Greater weever fish	54	0.02	7.510	0.04
Solea lascaris	Sand sole	38	0.01	5.150	0.03

Table 3. continued: Species recorded by the surveys

Latin name	Common name	Number	% abundance	Weight in kg	% of total weight
Scophthalmus maximus	Turbot	30	0.01	33.450	0.19
Mullus surmuletus	Red mullet	24	0.01	1.593	0.01
Gaidropsarus vulgaris	Three bearded rockling	23	0.01	4.735	0.03
Enchelyopus cimbrius	Four bearded rockling	22	0.01	0.517	+
Ciliata mustela	Five bearded rockling	22	0.01	0.304	+
Trachurus trachurus	Horse mackerel	20	0.01	3.253	0.02
Ciliata septentrionalis	Northern rockling	20	0.01	0.092	+
Zeugopterus punctatus	Topknot	20	0.01	1.284	0.01
Spondyliosoma cantharus	Black seabream	17	0.01	1.058	0.01
Gobius niger	Black goby	17	0.01	0.258	+
Liparis liparis	Sea snail	17	0.01	0.068	+
Molva molva	Common ling	15	0.01	7.638	0.04
Argentinidae	Argentines	14	+	0.380	+
Conger conger	European conger eel	14	+	28.890	0.16
Belone belone	Garfish	13	+	1.900	0.01
Buenia jeffreysii	Jeffreys goby	13	+	0.025	+
Diplecogaster bimaculata	Two spotted clingfish	12	+	0.012	+
Lesueurigobius friesii	Fries goby	11	+	0.031	+
Cepola rubescens	Red bandfish	11	+	0.790	+
Centrolabrus exoletus	Small mouthed wrasse	11	+	0.225	+
Cyclopterus lumpus	Lumpsucker	10	+	0.187	+
Labrus bergylta	Ballan wrasse	9	+	2.010	0.01
Clupeidae	Herrings	9	+	0.007	+
Liparis spp	Sea snails	8	+	0.013	+
Phrynorhombus regius	Ekstroms topknot	7	+	0.212	+
Gobiesocidae	Clingfishes	6	+	0.008	+
Trigloporus lastoviza	Streaked gurnard	6	+	1.225	0.01
Squalus acanthias	Spurdog	4	+	8.330	0.05
Clupea harengus	Herring	4	+	0.084	+
Lepidorhombus whiffiagonis	Megrim	4	+	1.493	0.01
Gasterosteus aculeatus	Three spined stickleback	4	+	0.006	+
Labrus mixtus	Cuckoo wrasse	3	+	0.435	+
Argentina sphyraena	Lsr silver smelt	3	+	0.080	+
Raja microocellata	Painted ray	3	+	4.290	0.02
Ammodytes tobianus	Sandeel	3	+	0.042	+
Chirolophis ascanii	Yarrells blenny	3	+	0.052	+
Galeorhinus galeus	Tope shark	2	+	1.180	0.01
Pollachius pollachius	Pollack	2	+	6.860	0.04
Gobius paganellus	Rock goby	2	+	0.010	+
Mustelus mustelus	Smooth hound	2	+	0.270	+
Spinachia spinachia	Sea stickleback	2	+	0.009	+
Balistes carolinensis	Trigger fish	2	+	1.460	0.01
Labridae	Wrasses	2	+	0.050	+
Cottidae (indet)		1	+	0.035	+
Anguilla anguilla	European eel	1	+	0.270	+
Abramis spp	Breams	1	+	0.029	+
Scomber scombrus	(European) mackerel	1	+	0.115	+
Entelurus aequoreus	Snake pipefish	1	+	0.001	+
Gaidropsarus mediterraneus	Shore rockling	1	+	0.002	+
Micromesistius poutassou	Blue whiting	1	+	0.225	+

7. SPECIES DISTRIBUTIONS

This report presents the data describing catches of the major fish and selected commercial shellfish species from ICES Division VIIa. Data cover the period 1993 to 2001, during which time the position of sampling stations and tow length have been consistent.

More detailed analyses are presented for sole and plaice, owing to their commercial importance in the Irish Sea. Data for the eastern and western Irish Sea are treated separately for plaice and sole. This division (illustrated in Figure 1) is necessary as differences in growth rate and other life history parameters are known to occur (Nash *et al*., 2000).

Analyses for these plaice and sole provide:
(a) The mean numbers of fish (by age) caught per 30 min tow at core stations.
(b) The mean number of fish (all ages) caught per 30 min tow at core stations.
(c) The mean number of fish caught (by age) per year, from a 30 min tow.
(d) The mean catch weight of fish from a 30 min tow.
(e) Length-frequency (by age) for (i) eastern and (ii) western Irish Sea.
(f) Mean length at age for i) eastern and ii) western Irish Sea.
(g) Mean weight at length for i) eastern, and ii) western Irish Sea.
(h) Proportion of male and female fish mature at length for i) eastern and ii) western Irish Sea.

Information for other species is restricted to:
(a) The mean number of fish caught per 30 min tow at core stations.
(b) The mean catch weight of fish from a 30 min tow.
(c) Length frequency distributions.

8. SUMMARY

CEFAS have conducted beam trawl surveys in ICES division VIIa since 1988, providing indices of abundance for commercially important demersal stocks. During the course of these surveys, in excess of 100 fish species have been recorded, and data on the length distributions and relative abundance have been collected. This report summarises the results for 1993-2001.

9. ACKNOWLEDGEMENTS

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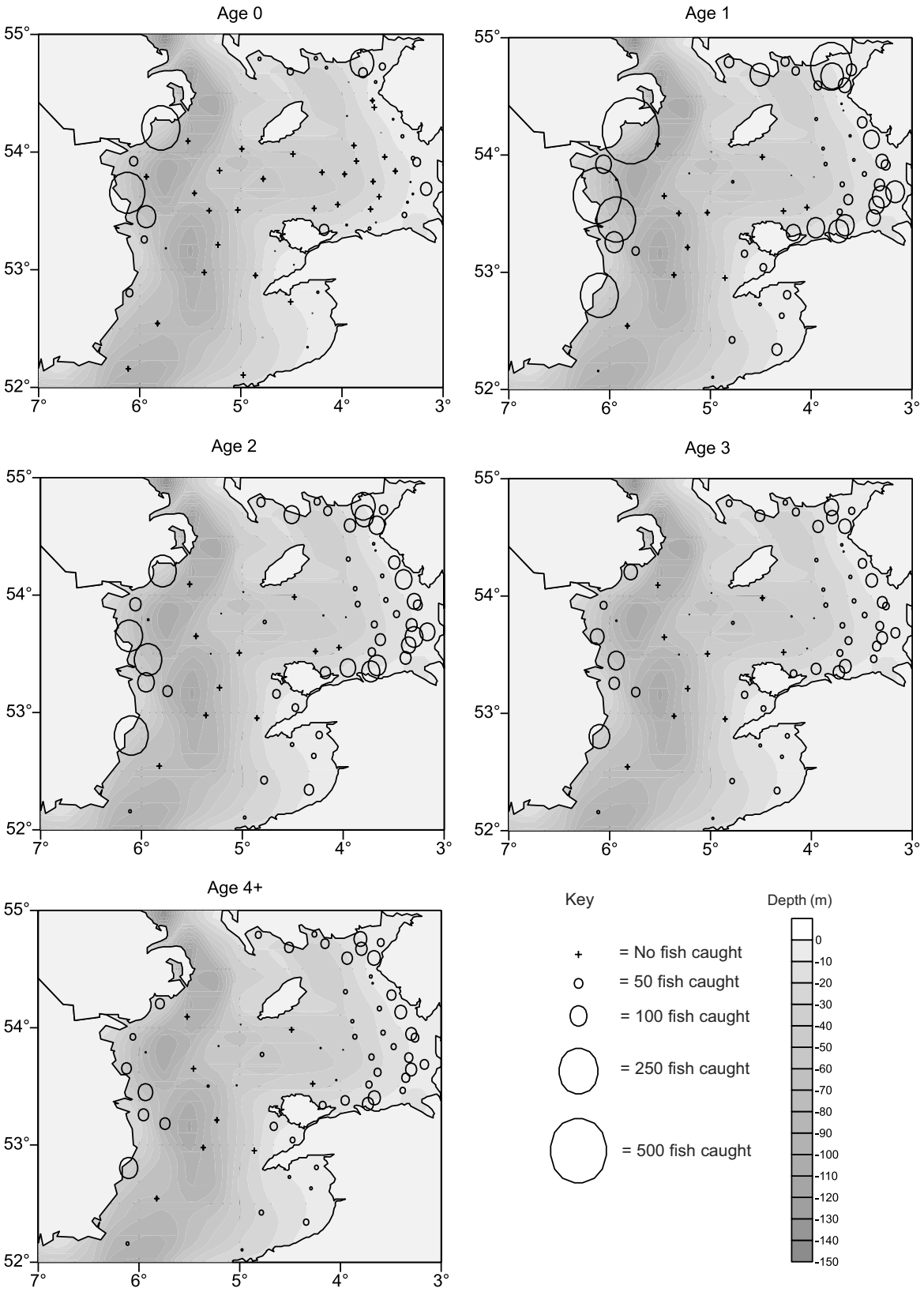
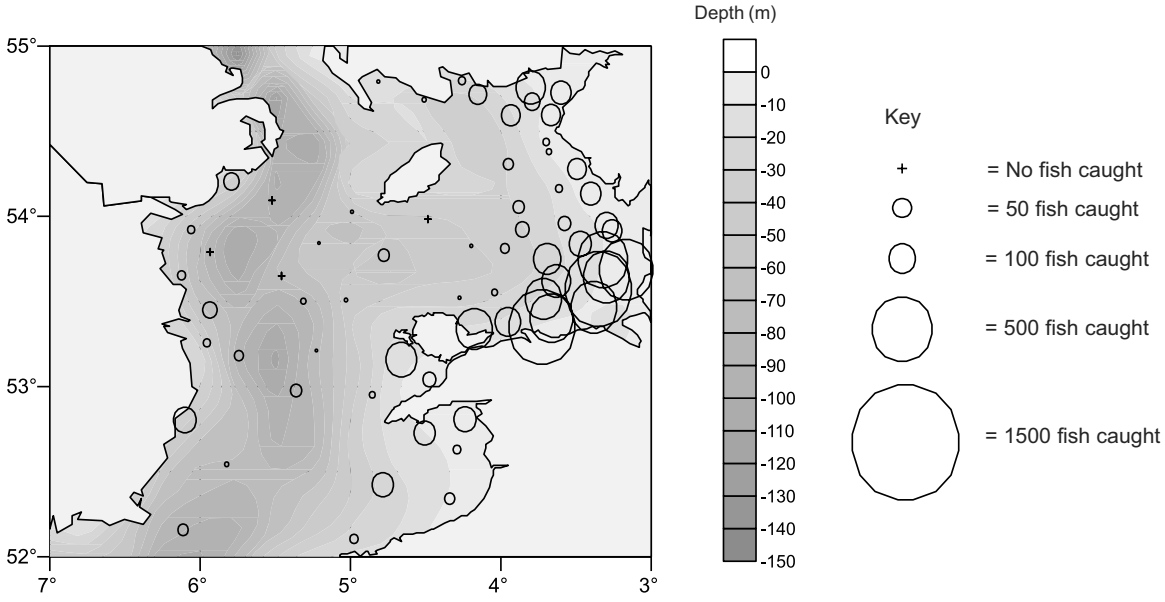
Flatfish

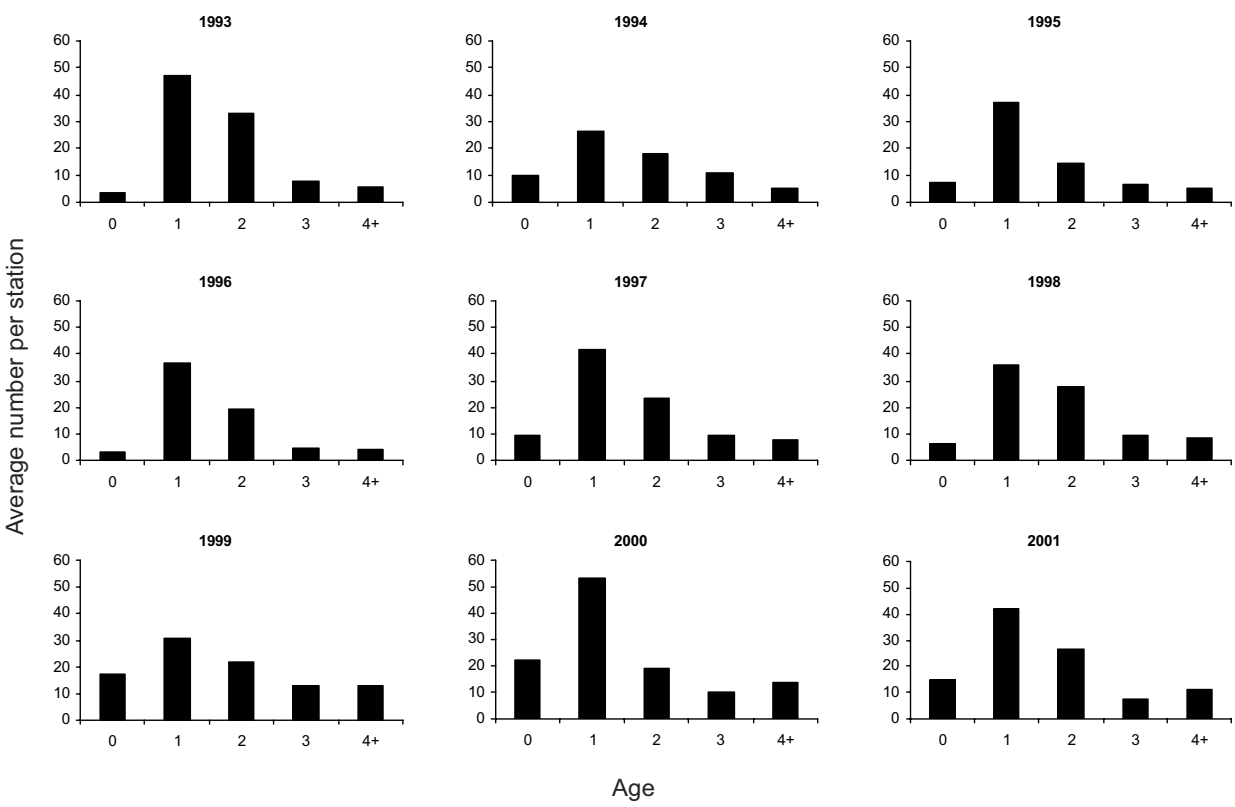
(a)


Age 0
Age 1
Age 2
Age 3
Age 4+
55°
54°
53°
52°
7°
6°
5°
4°
3°
Key
= No fish caught
= 50 fish caught
= 100 fish caught
= 250 fish caught
= 500 fish caught
Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150

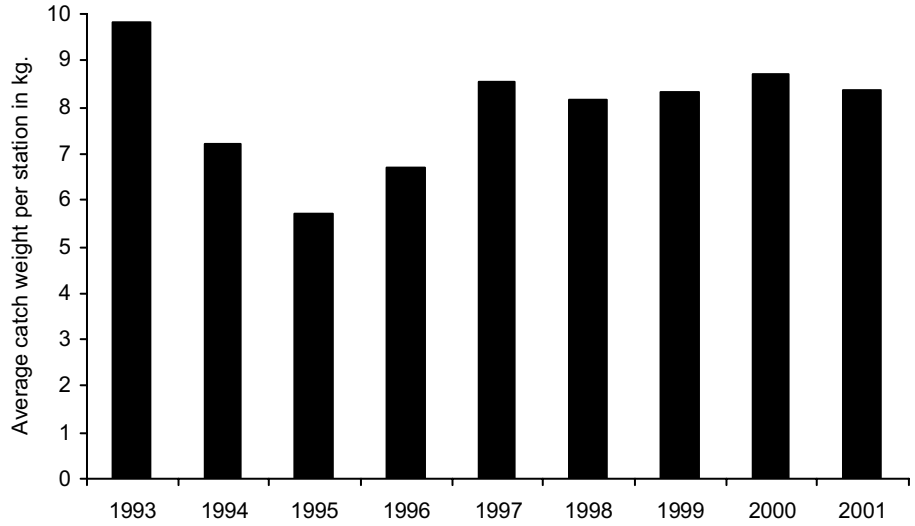
(b)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
Key
+ = No fish caught
= 50 fish caught
= 100 fish caught
= 500 fish caught
= 1500 fish caught
55°
54°
53°
52°
7°
6°
5°
4°
3°

(c)

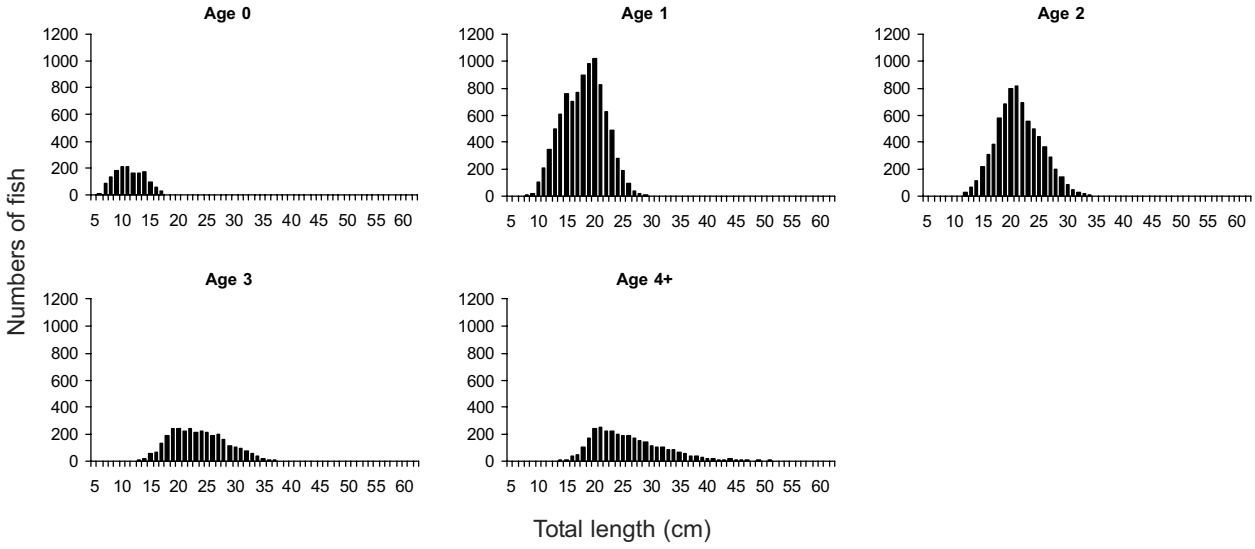

1993
1994
1995
1996
1997
1998
1999
2000
2001
Average number per station
Age
0
1
2
3
4+
10
20
30
40
50
60

(d)

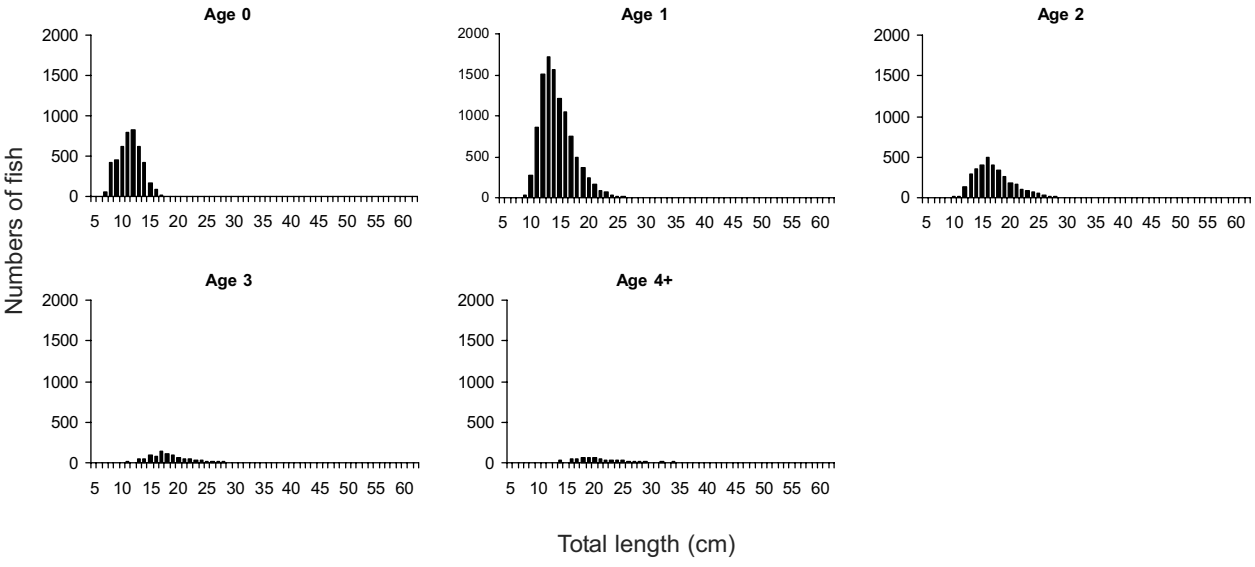

Average catch weight per station in kg.
0
1
2
3
4
5
6
7
8
9
10
1993
1994
1995
1996
1997
1998
1999
2000
2001

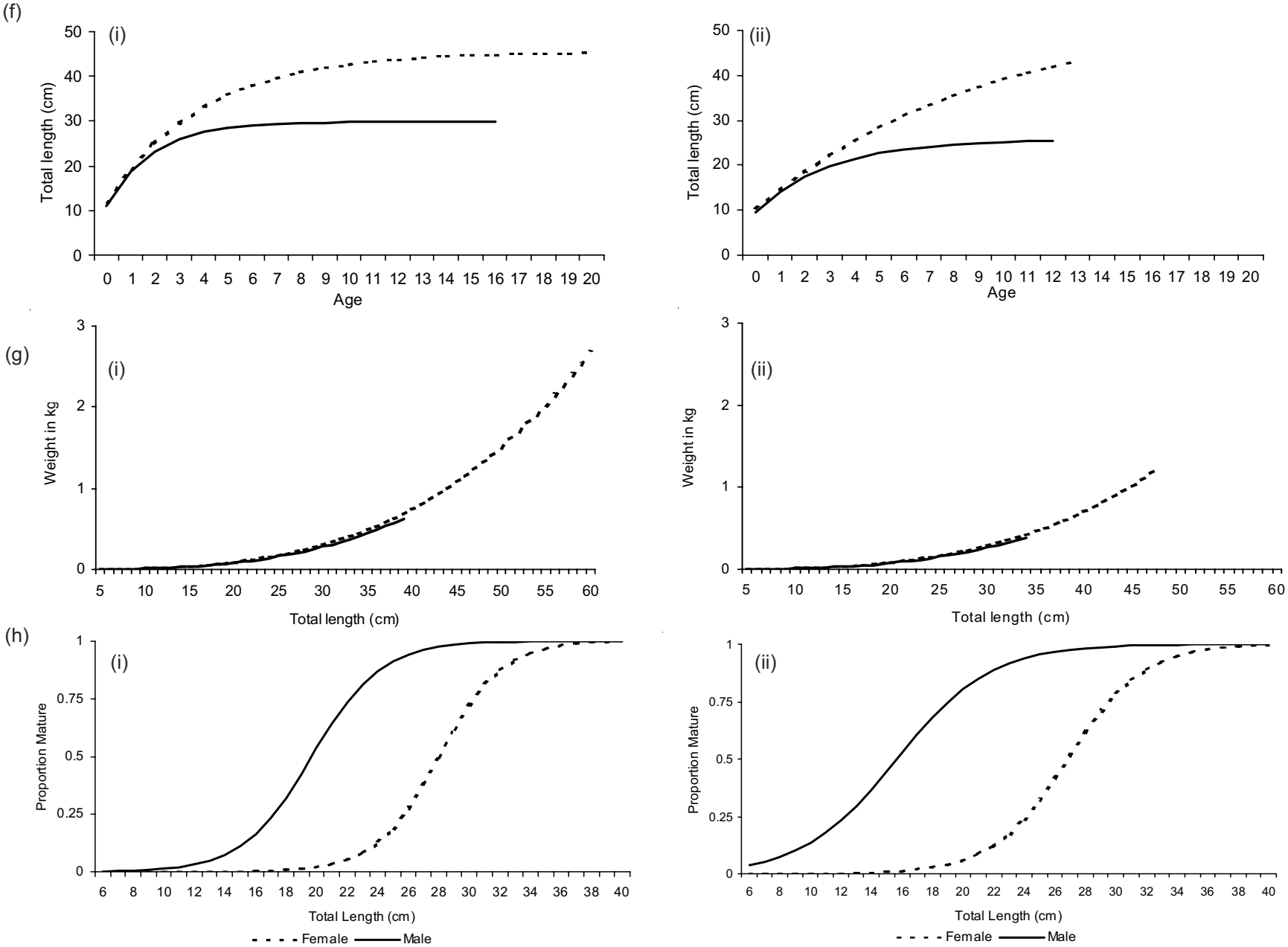
(e)

(i)

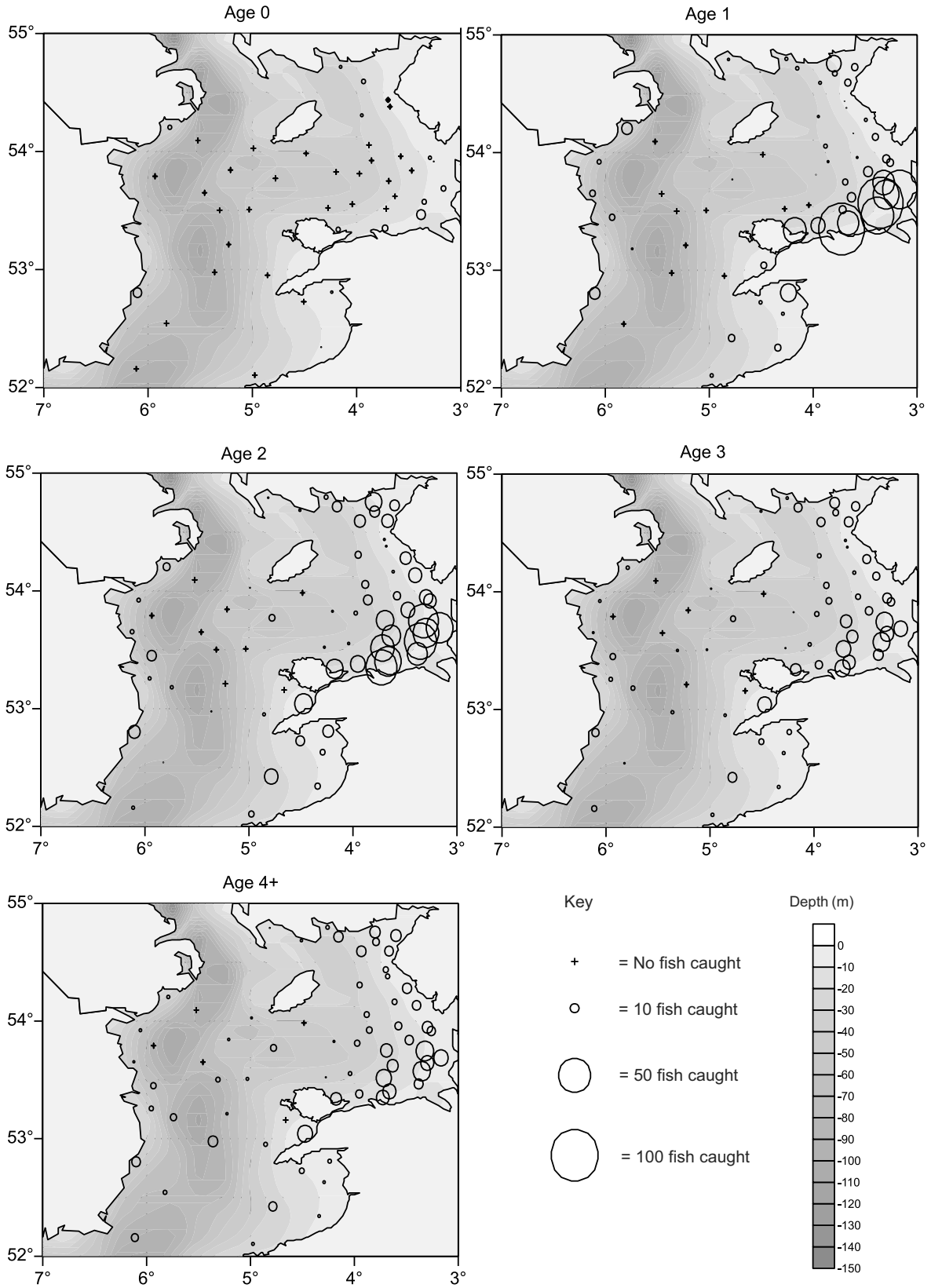

Age 0
Age 1
Age 2
Age 3
Age 4+
Numbers of fish
Total length (cm)

(ii)

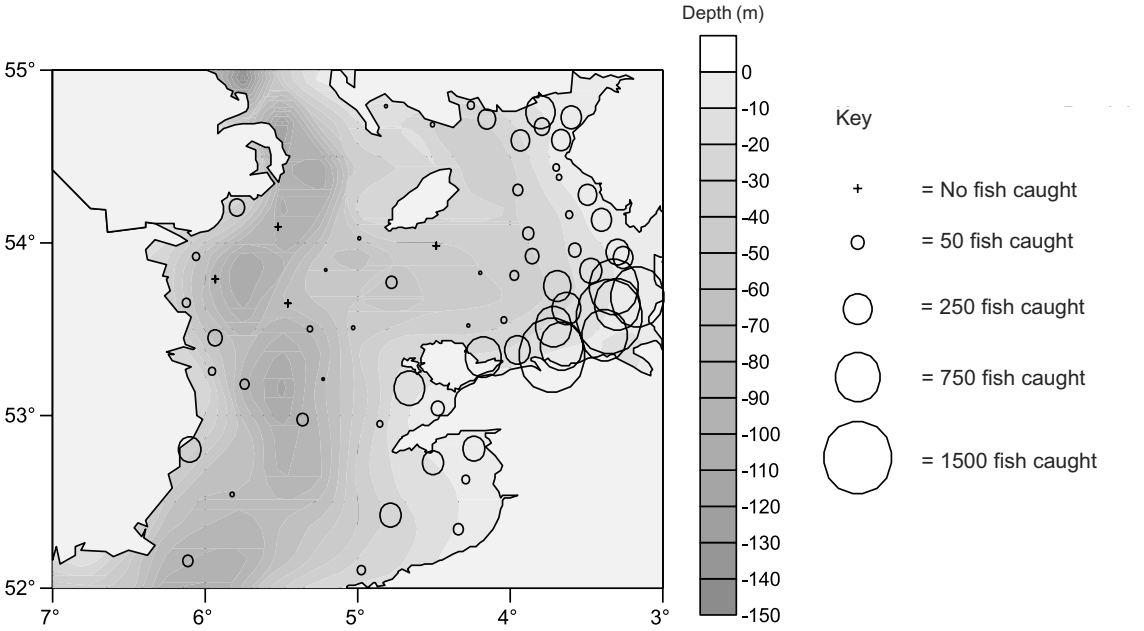

Age 0
Age 1
Age 2
Age 3
Age 4+
Numbers of fish
Total length (cm)


(f)
(i)
Total length (cm)
Age
(ii)
Total length (cm)
Age
(g)
(i)
Weight in kg
Total length (cm)
(ii)
Weight in kg
Total length (cm)
(h)
(i)
Proportion Mature
Total Length (cm)
Female
Male
(ii)
Proportion Mature
Total Length (cm)
Female
Male

(a)


Age 0
Age 1
Age 2
Age 3
Age 4+
55°
54°
53°
52°
7°
6°
5°
4°
3°
Key
+ = No fish caught
o = 10 fish caught
= 50 fish caught
= 100 fish caught
Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150

(b)


Depth (m)
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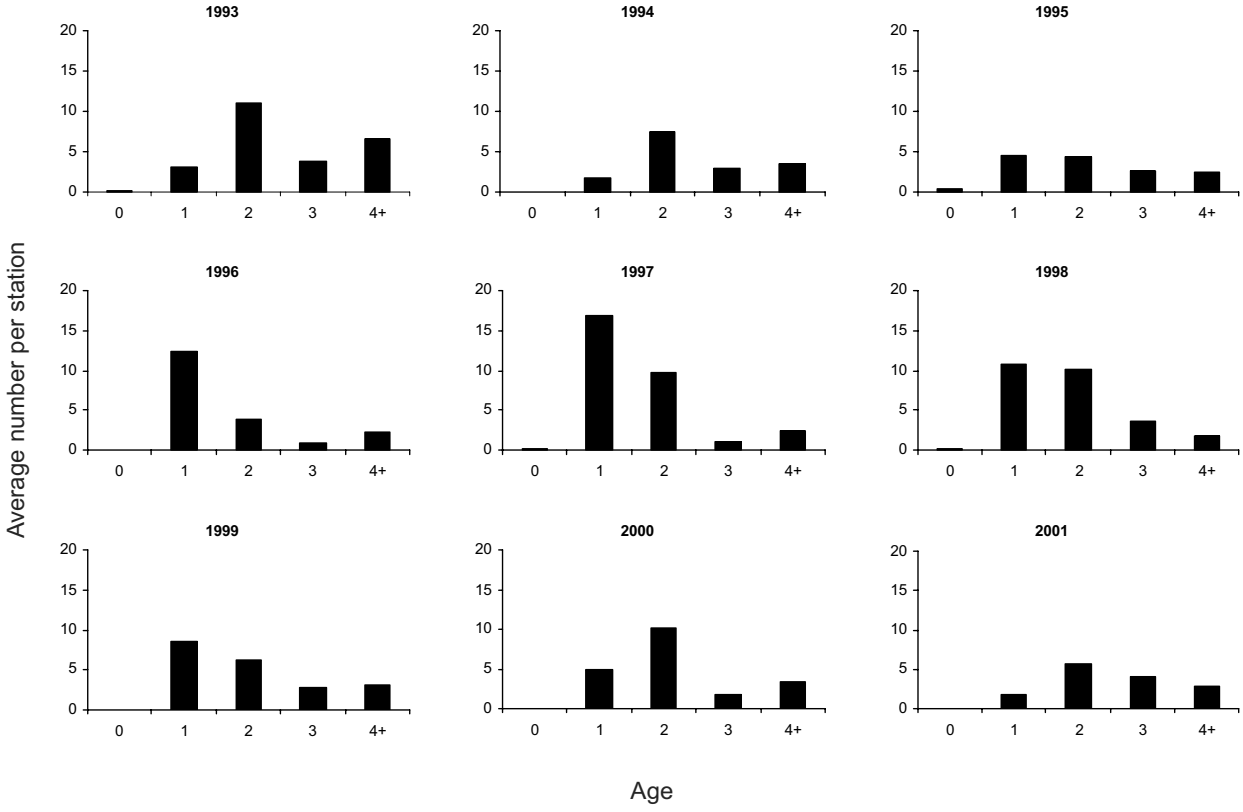
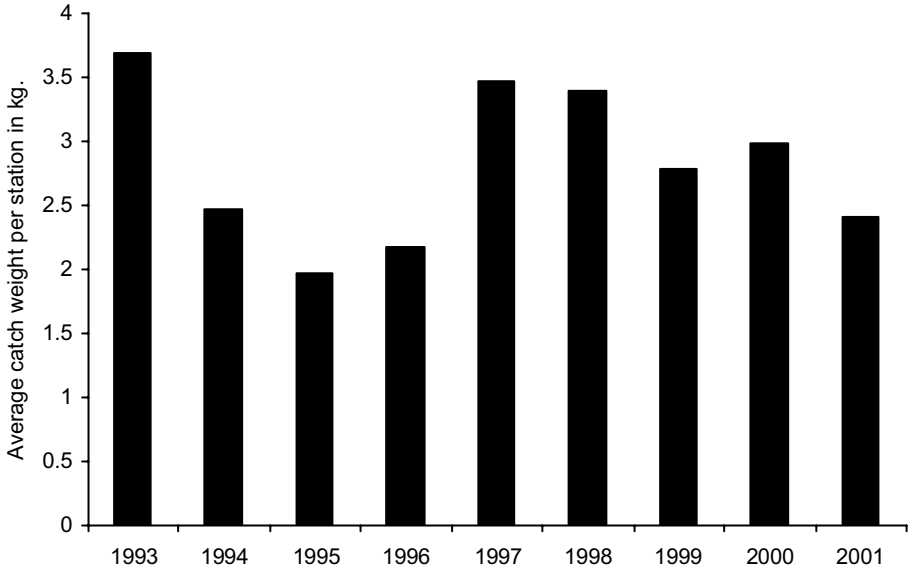
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
Key
+ = No fish caught
= 50 fish caught
= 250 fish caught
= 750 fish caught
= 1500 fish caught

(c)

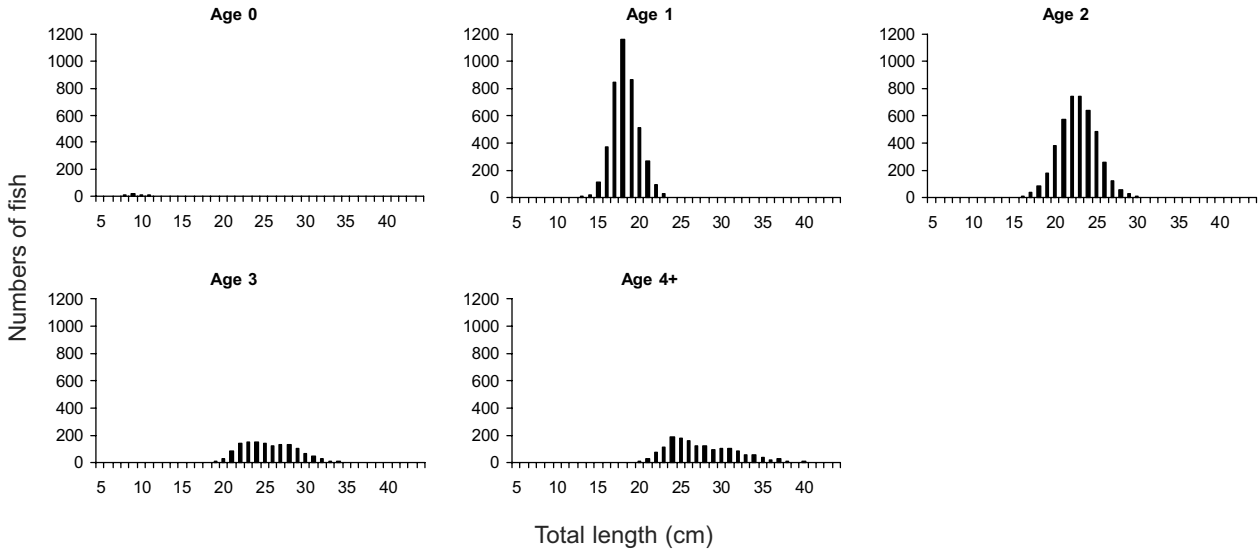

1993
1994
1995
1996
1997
1998
1999
2000
2001
Average number per station
Age
0
1
2
3
4+
0
5
10
15
20

(d)

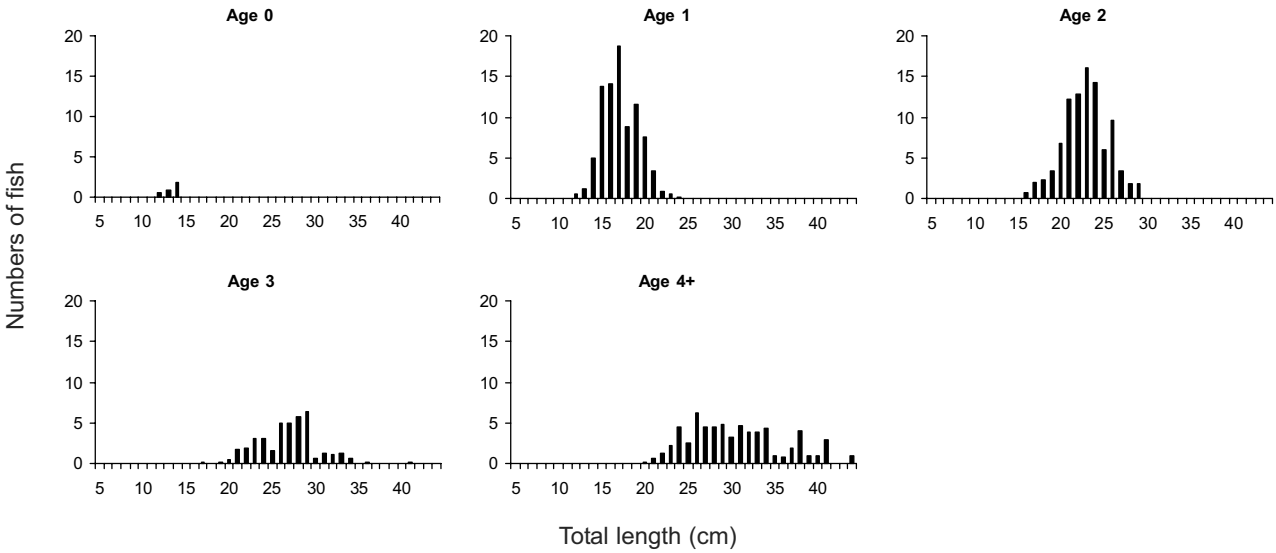

Average catch weight per station in kg.
0
0.5
1
1.5
2
2.5
3
3.5
4
1993
1994
1995
1996
1997
1998
1999
2000
2001

(e)

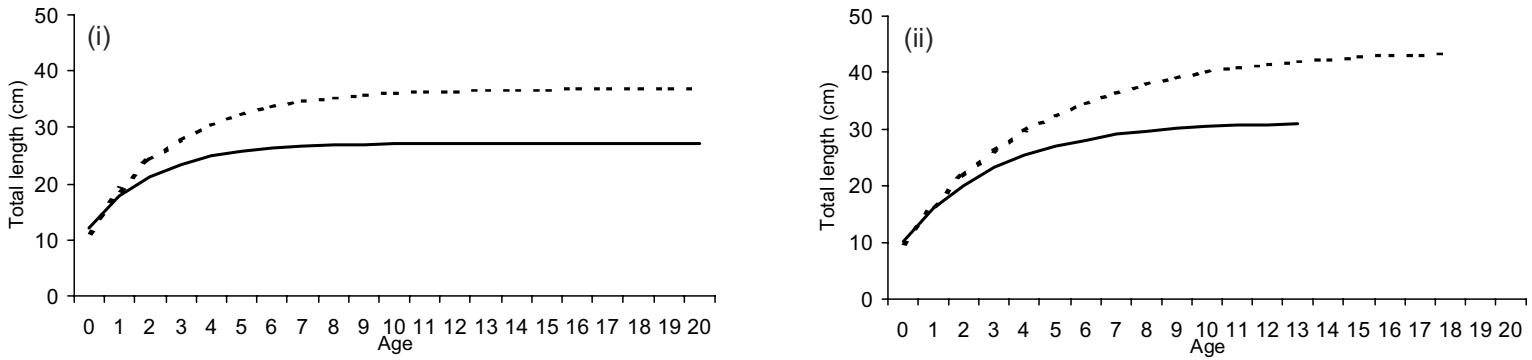
(i)


Age 0
Age 1
Age 2
Age 3
Age 4+
Numbers of fish
Total length (cm)

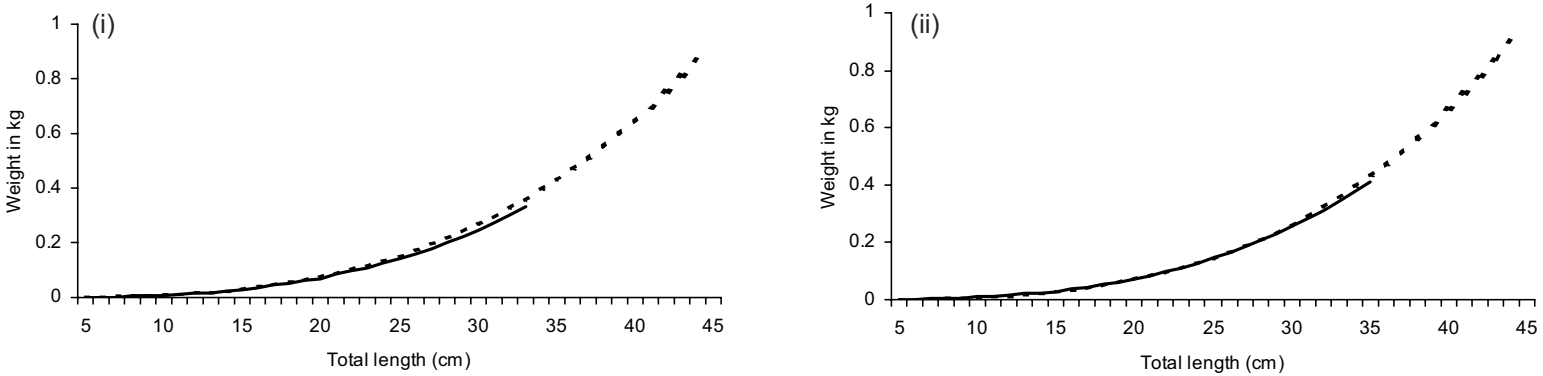
(ii)


Age 0
Age 1
Age 2
Age 3
Age 4+
Numbers of fish
Total length (cm)

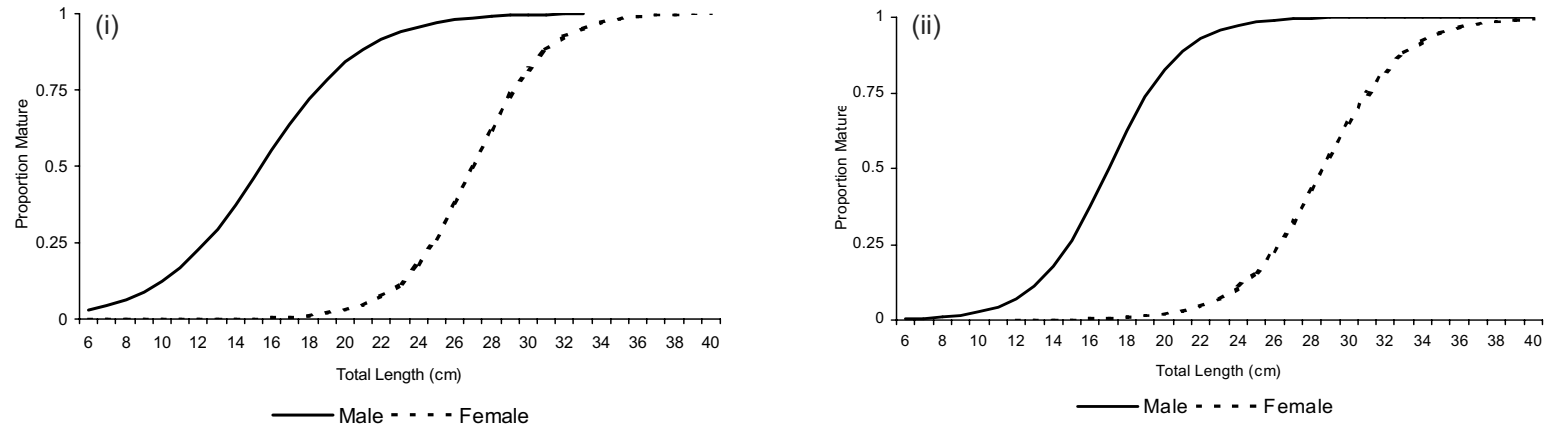
(f)


(i)
Total length (cm)
0 10 20 30 40 50
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Age
(ii)
Total length (cm)
0 10 20 30 40 50
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Age

(g)

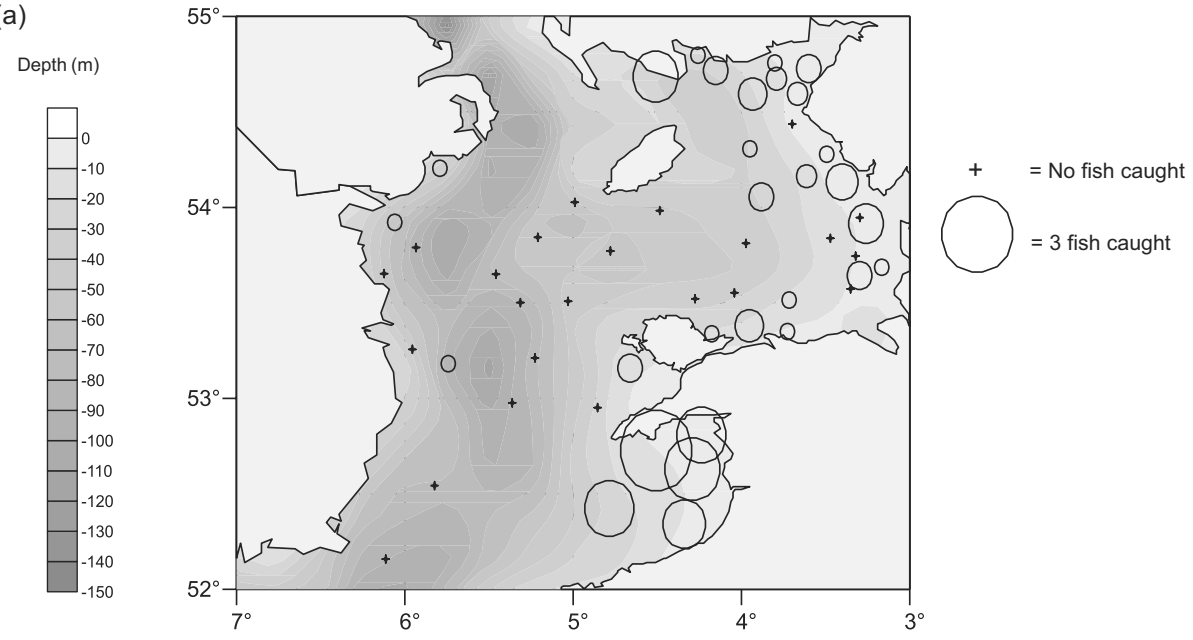

(i)
Weight in kg
0 0.2 0.4 0.6 0.8 1
5 10 15 20 25 30 35 40 45
Total length (cm)
(ii)
Weight in kg
0 0.2 0.4 0.6 0.8 1
5 10 15 20 25 30 35 40 45
Total length (cm)

(h)

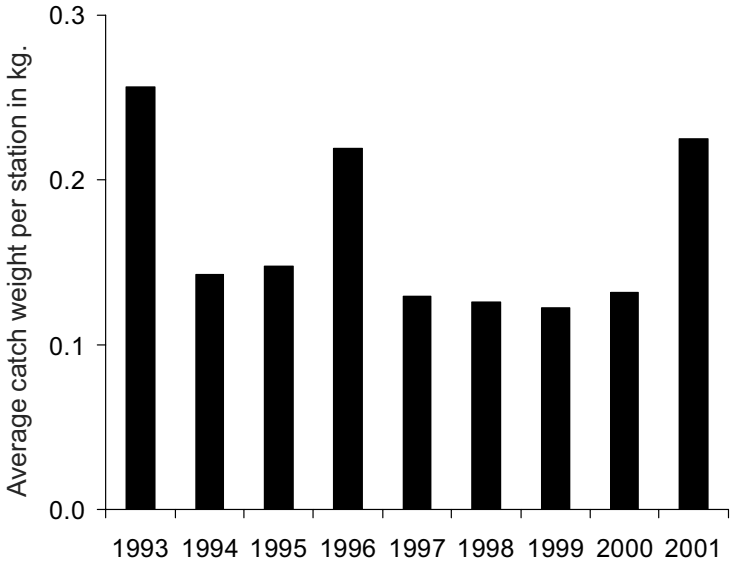

(i)
Proportion Mature
0 0.25 0.5 0.75 1
6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40
Total Length (cm)
Male
Female
(ii)
Proportion Mature
0 0.25 0.5 0.75 1
6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40
Total Length (cm)
Male
Female

Brill - *Scophthalmus rhombus*

(a)



(b)



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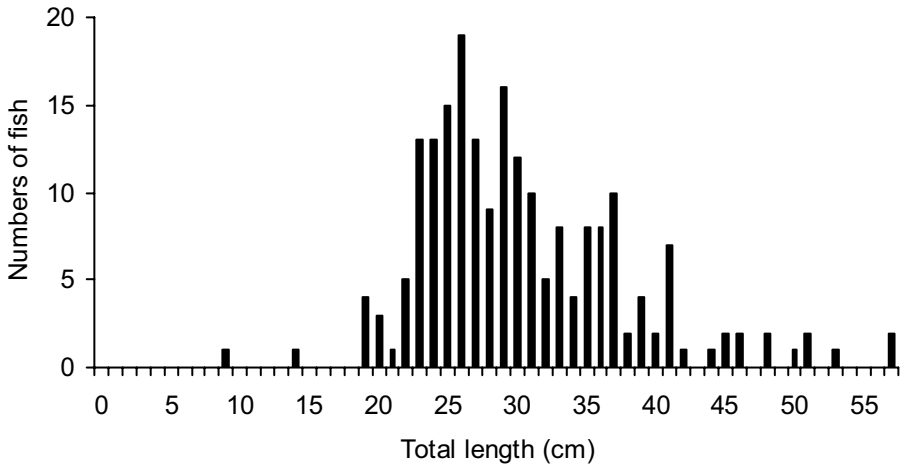
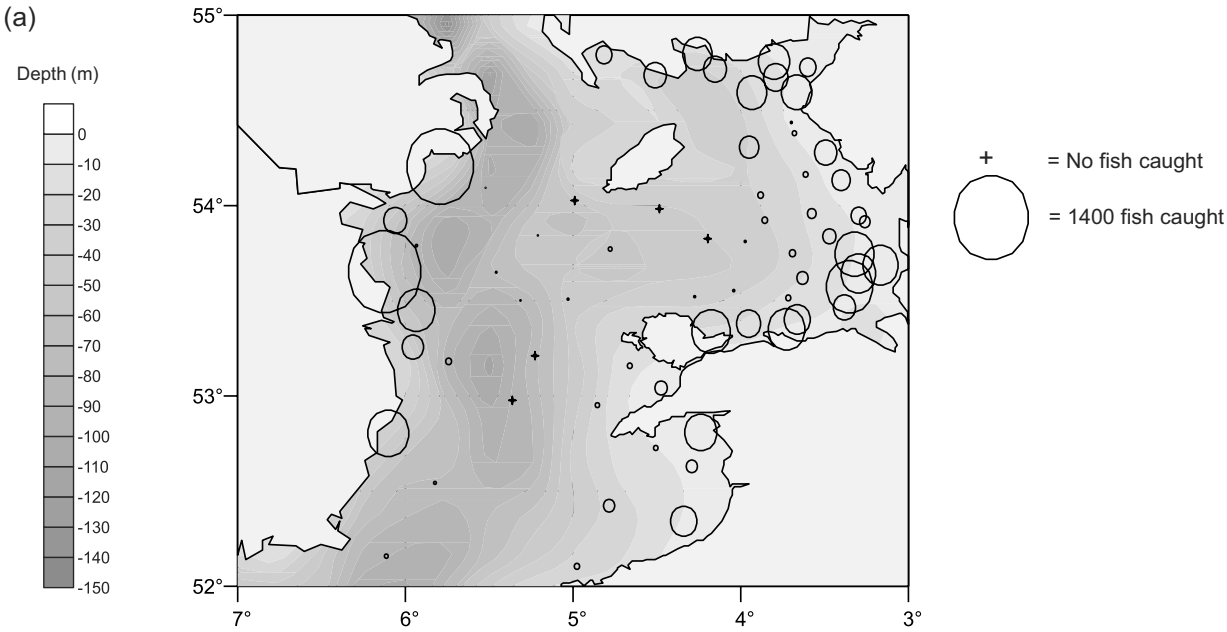
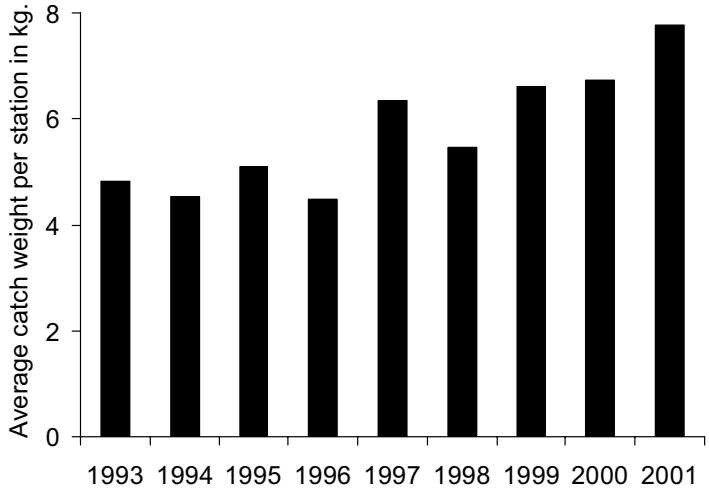


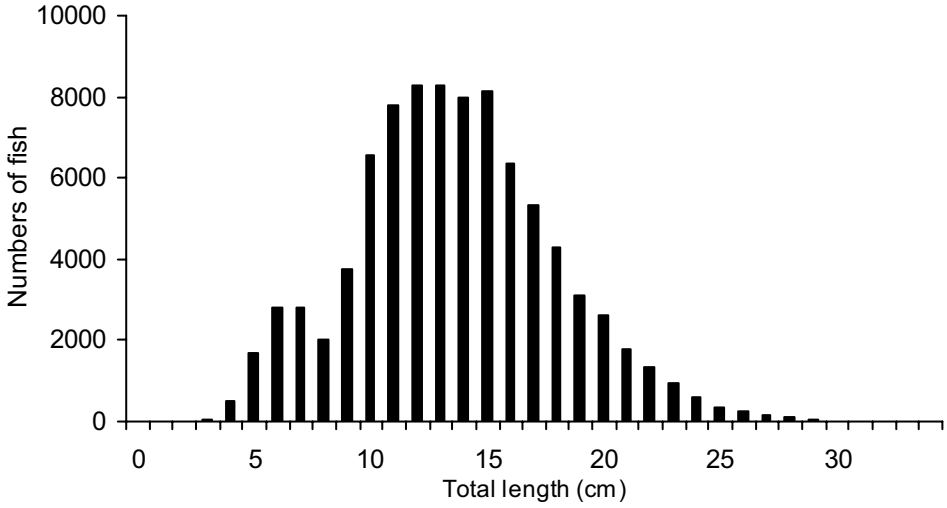
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 1400 fish caught

(b)

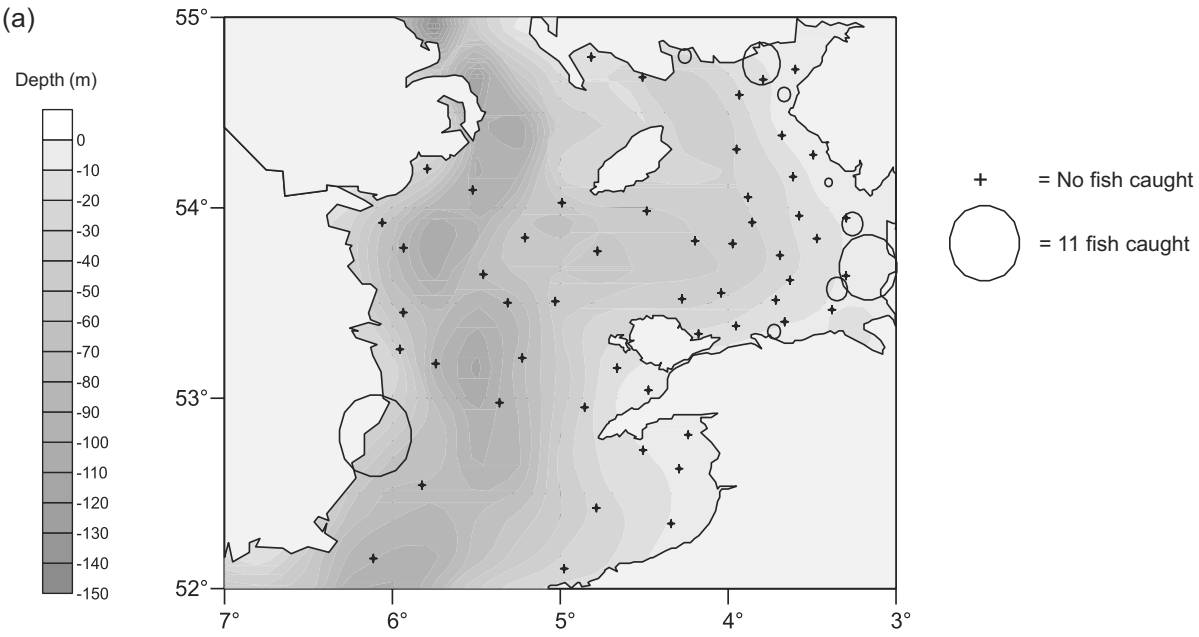

Average catch weight per station in kg.
0
2
4
6
8
1993 1994 1995 1996 1997 1998 1999 2000 2001

(c)

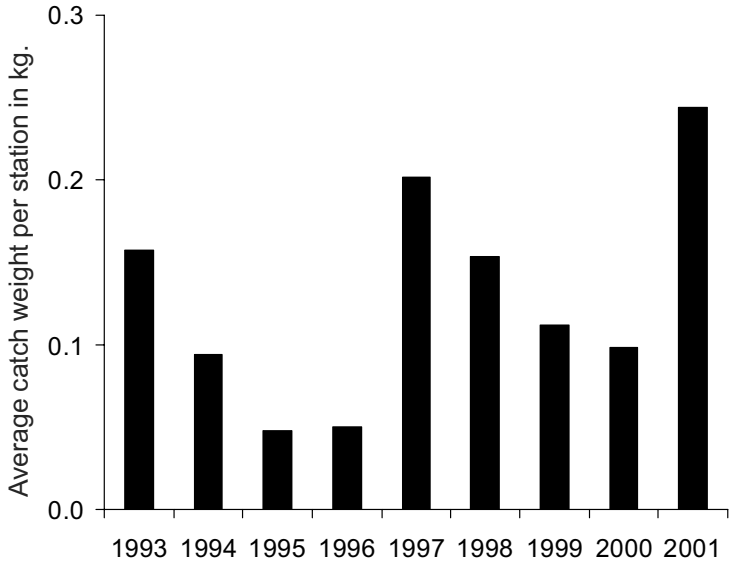

Numbers of fish
0
2000
4000
6000
8000
10000
0 5 10 15 20 25 30
Total length (cm)

Flounder - *Platichthys flesus*

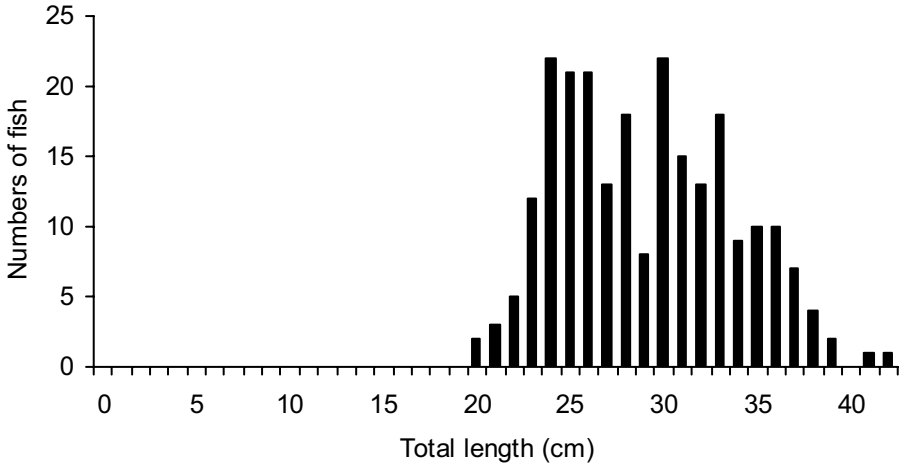
(a)



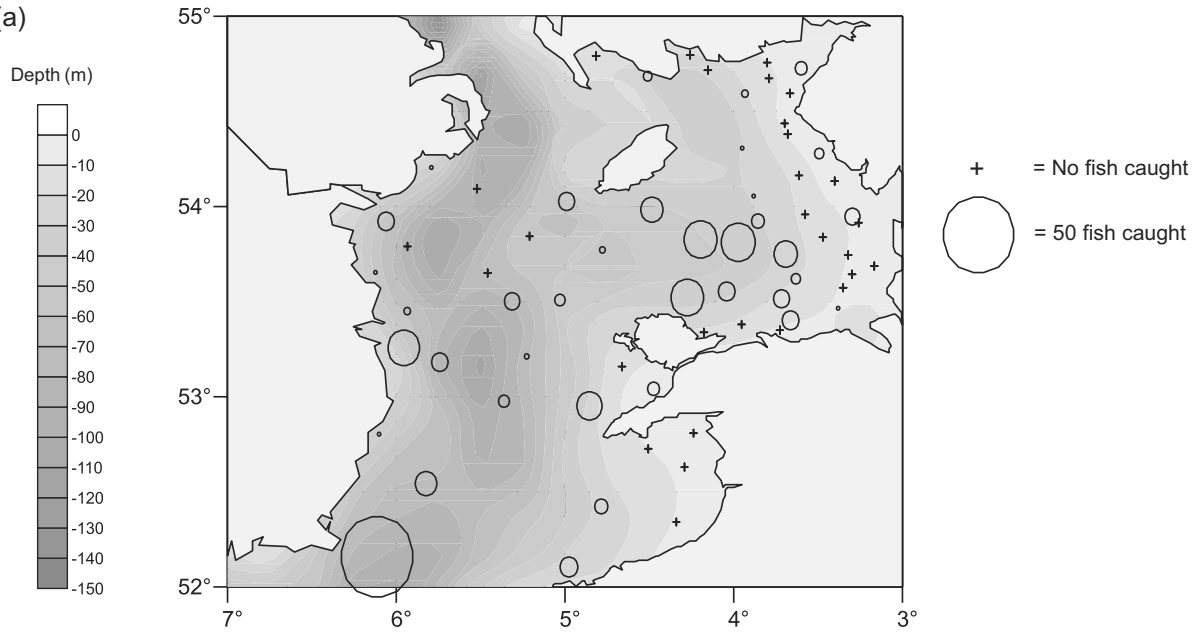
(b)



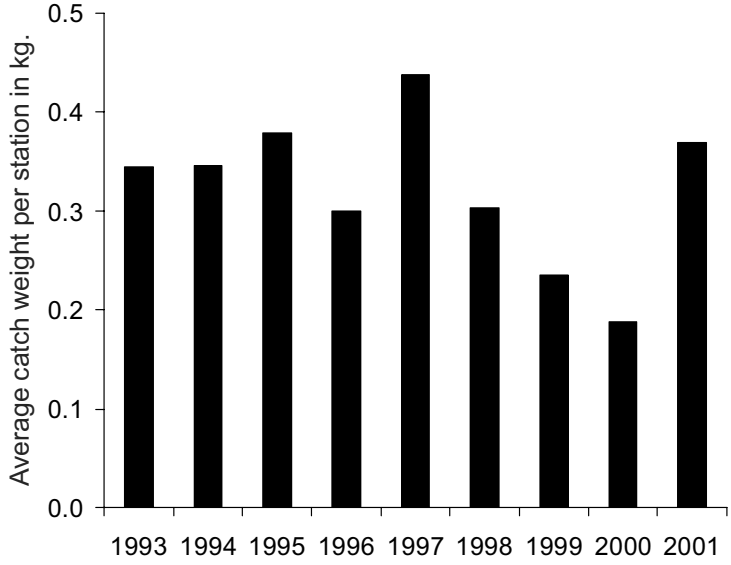
(c)



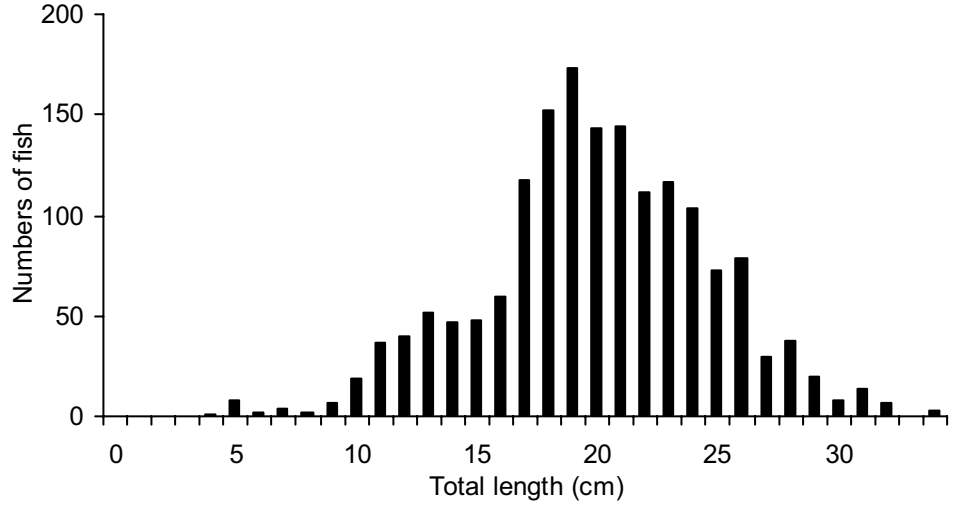
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 50 fish caught

(b)

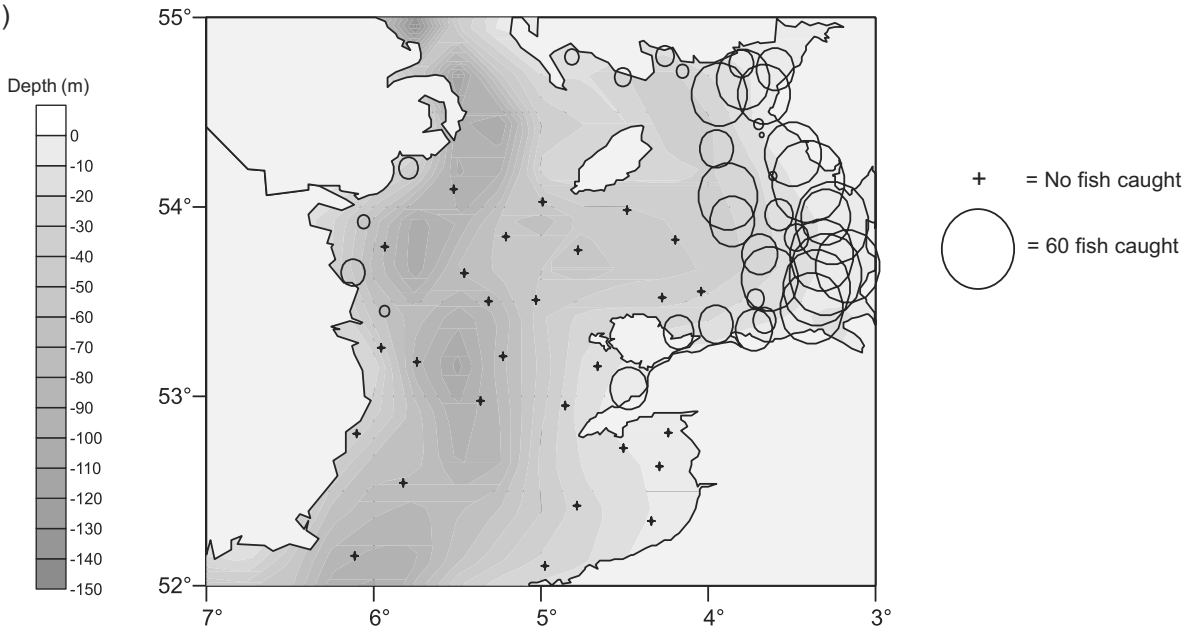

Average catch weight per station in kg.
0.0
0.1
0.2
0.3
0.4
0.5
1993 1994 1995 1996 1997 1998 1999 2000 2001

(c)

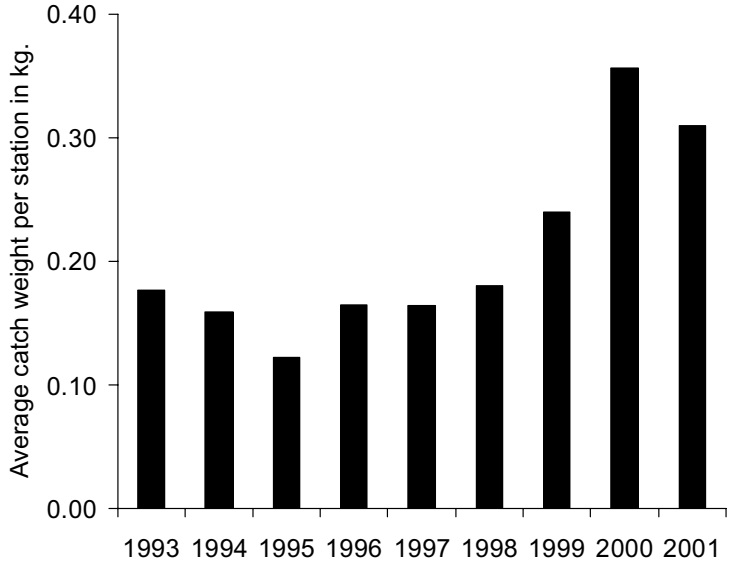

Numbers of fish
0
50
100
150
200
0 5 10 15 20 25 30
Total length (cm)

Scaldfish - *Arnoglossus laterna*

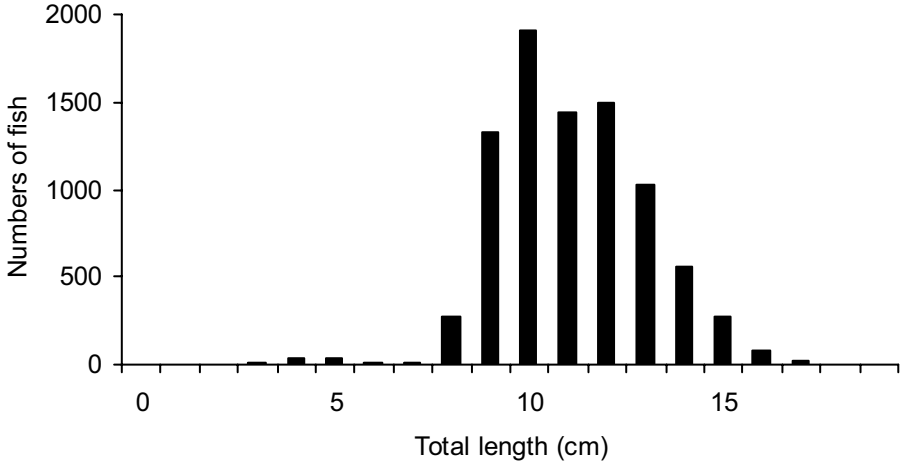
(a)



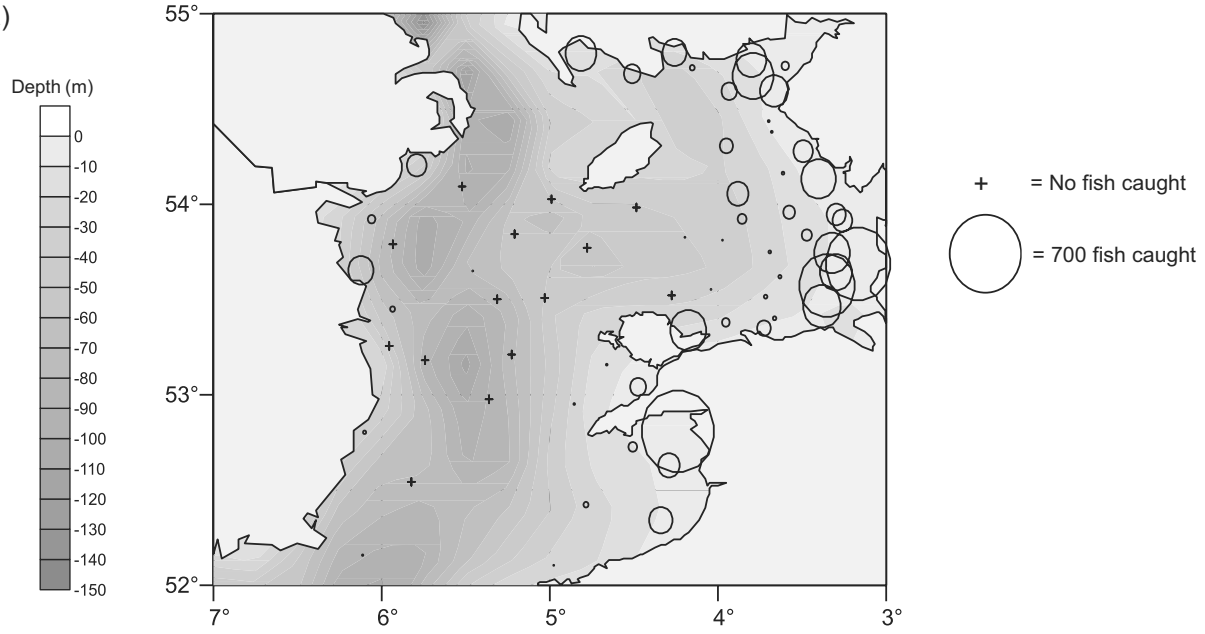
(b)



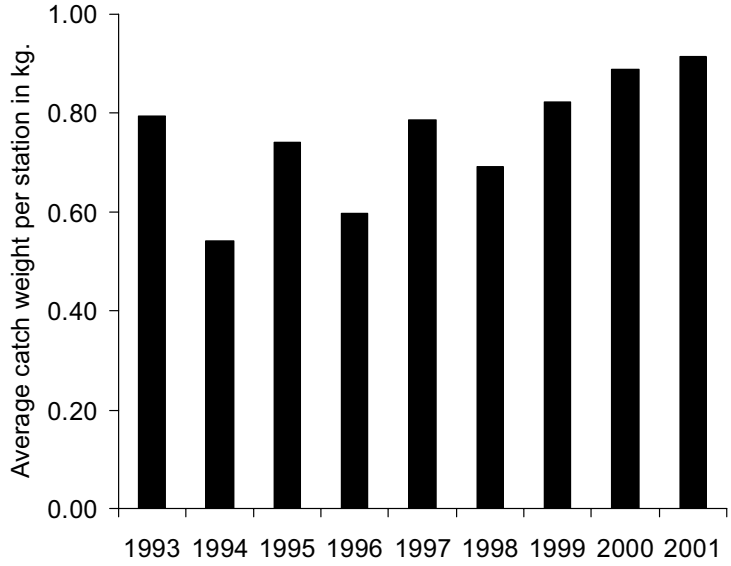
(c)



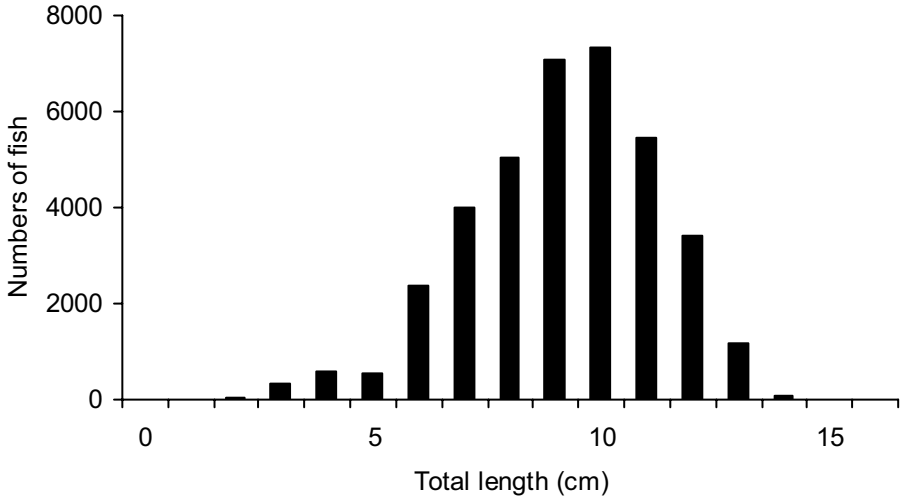
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 700 fish caught

(b)

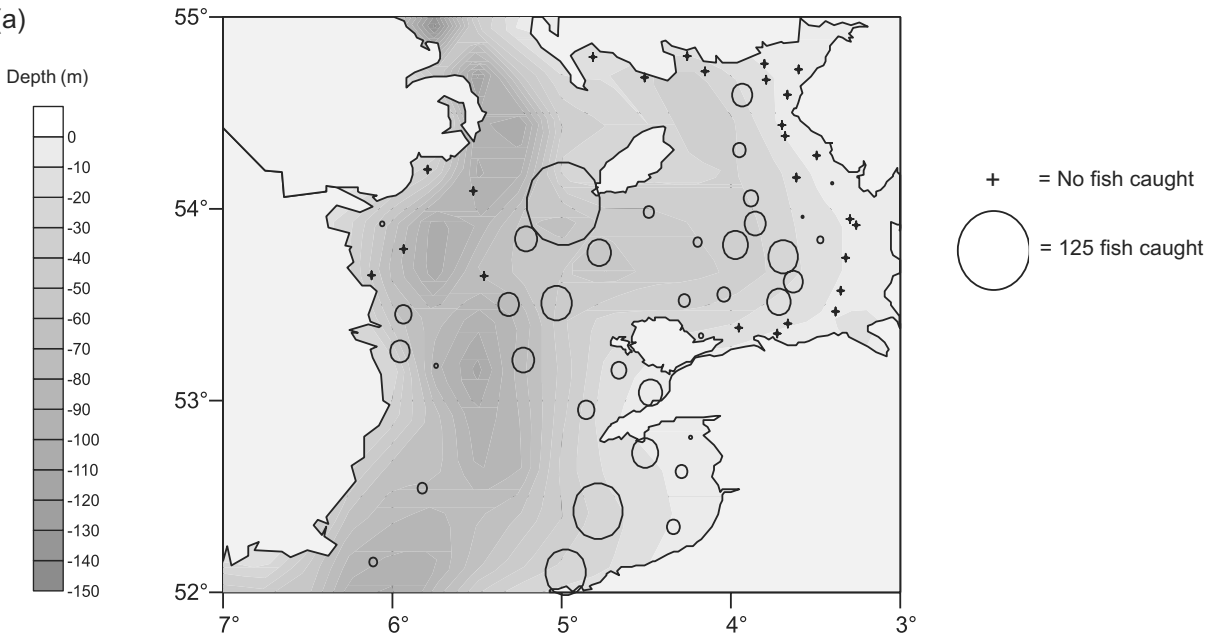

Average catch weight per station in kg.
1.00
0.80
0.60
0.40
0.20
0.00
1993 1994 1995 1996 1997 1998 1999 2000 2001

(c)

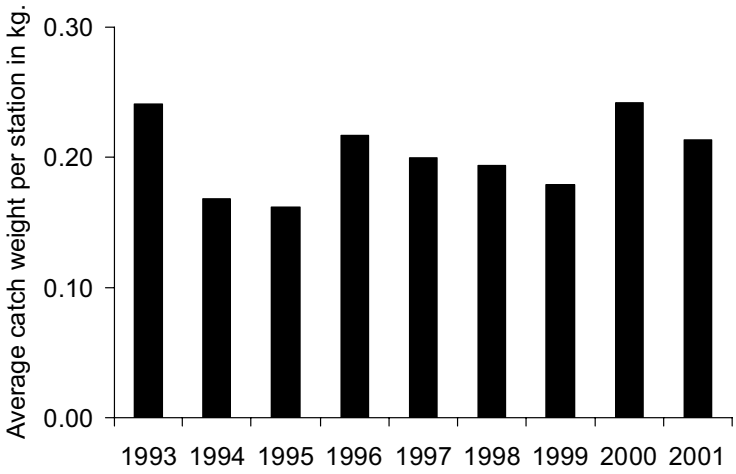

Numbers of fish
8000
6000
4000
2000
0
0
5
10
15
Total length (cm)

Thickback sole - *Microchirus variegatus*

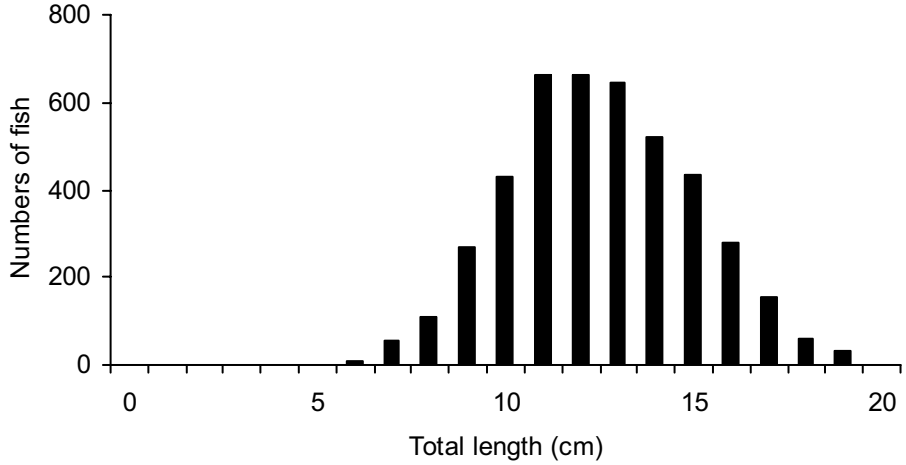
(a)



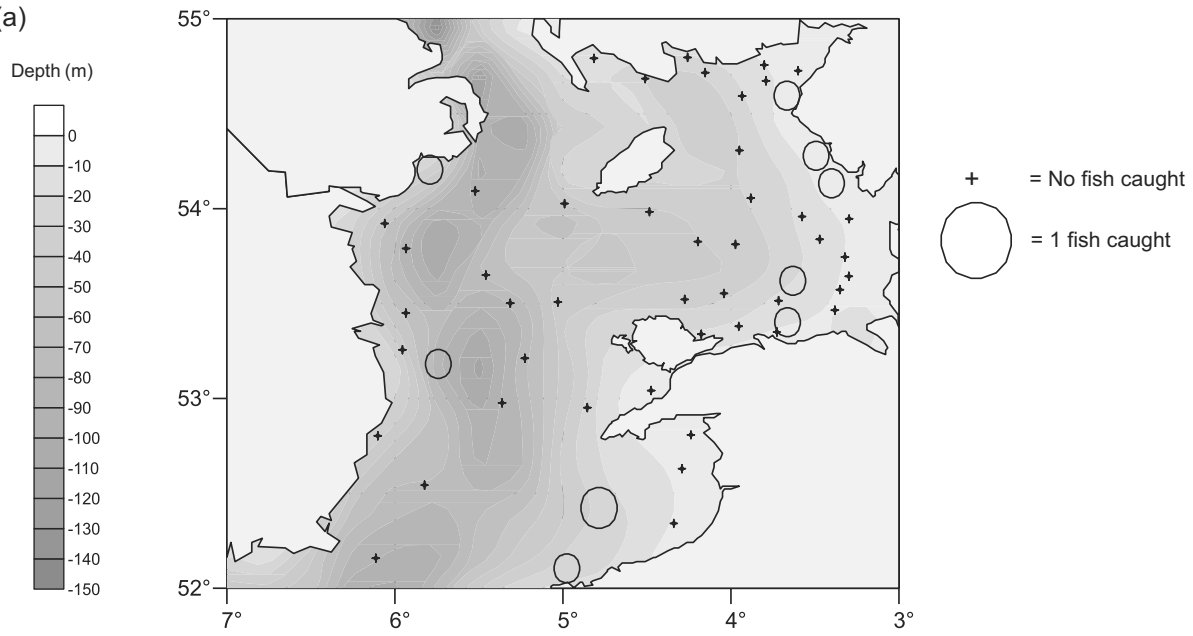
(b)



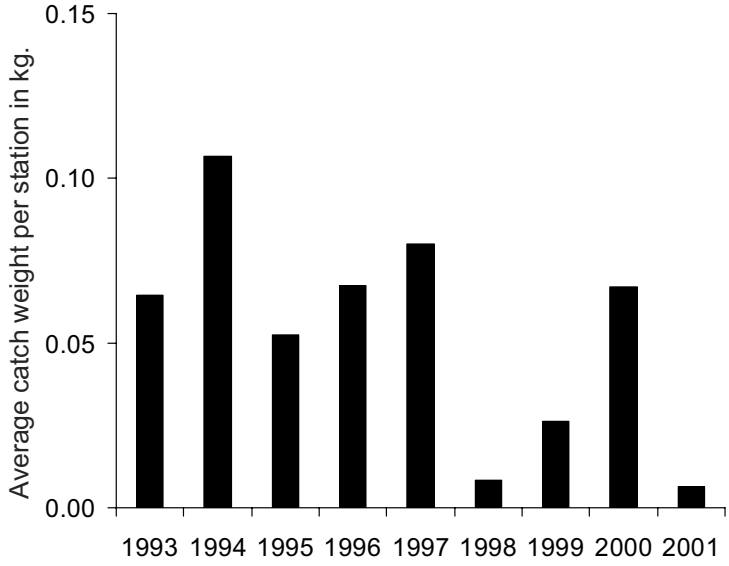
(c)



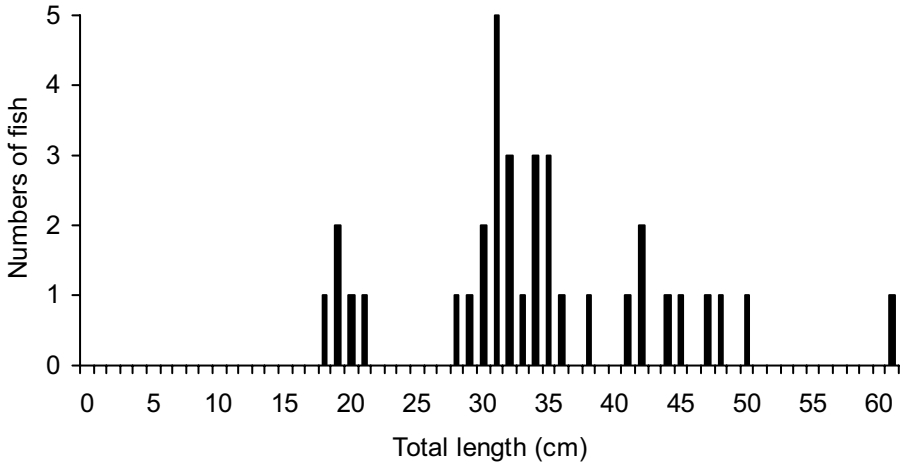
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 1 fish caught

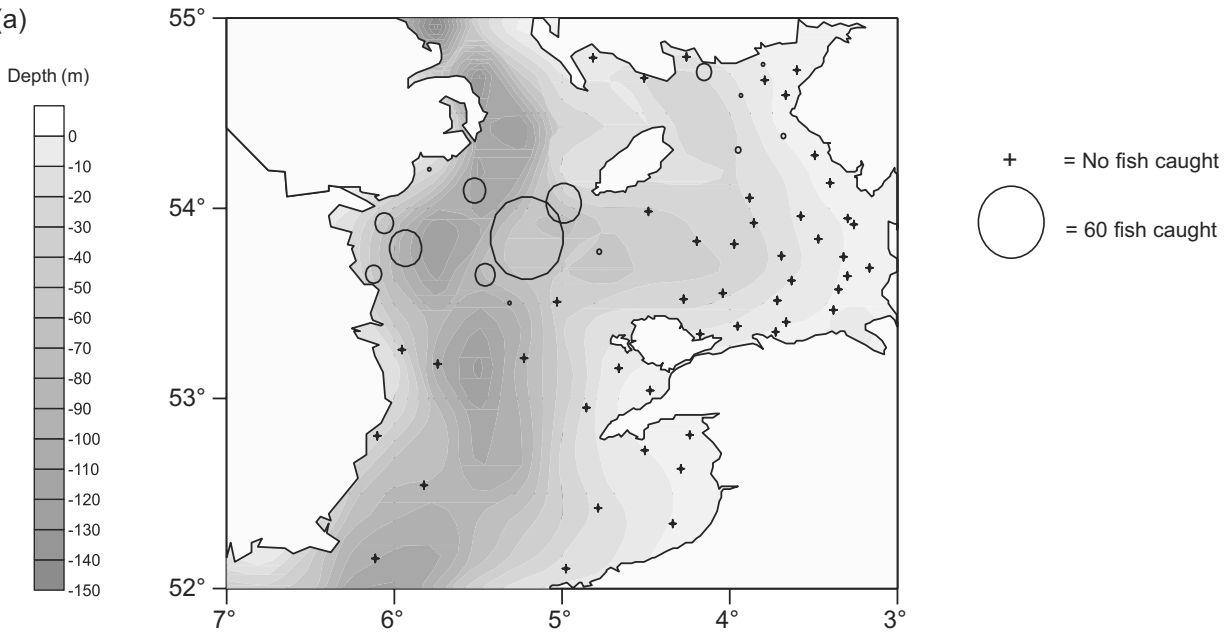
(b)


Average catch weight per station in kg.
0.15
0.10
0.05
0.00
1993 1994 1995 1996 1997 1998 1999 2000 2001

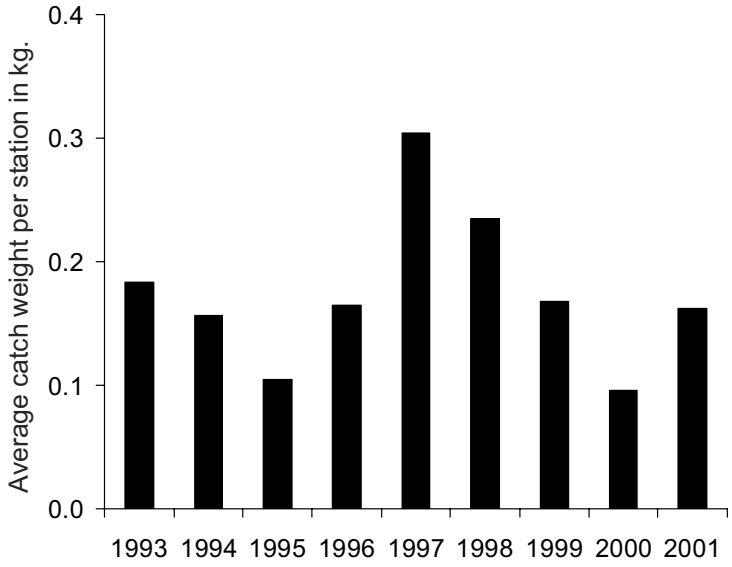
(c)


Numbers of fish
5
4
3
2
1
0
0 5 10 15 20 25 30 35 40 45 50 55 60
Total length (cm)

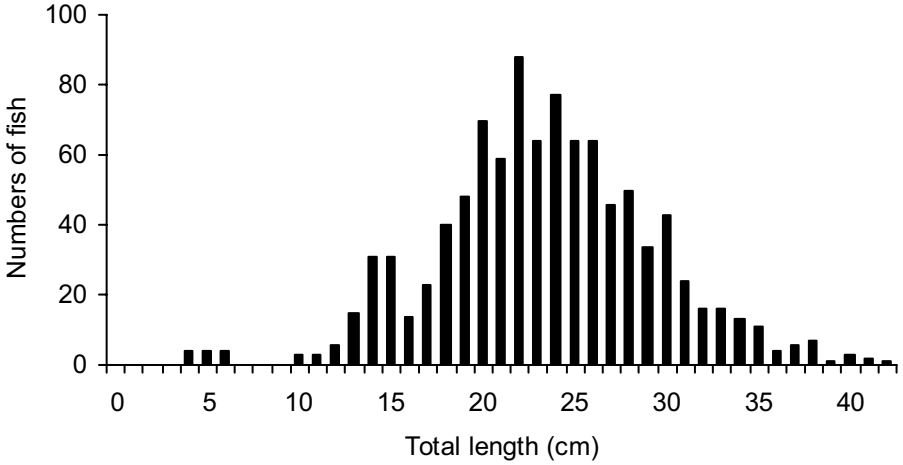
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 60 fish caught

(b)

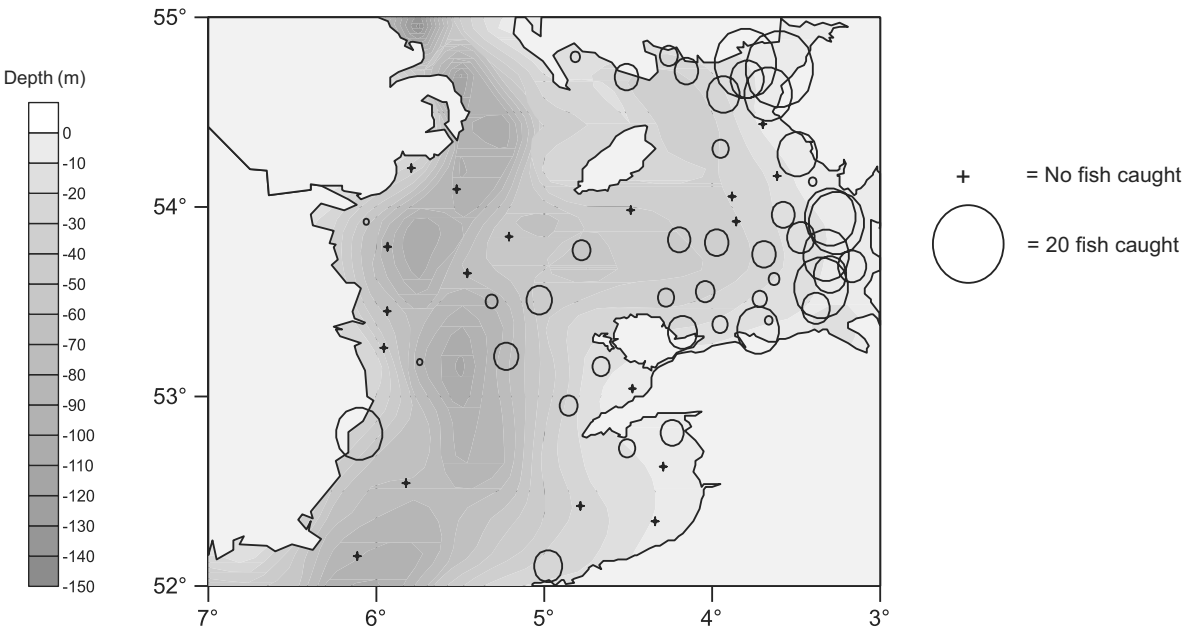

Average catch weight per station in kg.
0.4
0.3
0.2
0.1
0.0
1993 1994 1995 1996 1997 1998 1999 2000 2001

(c)

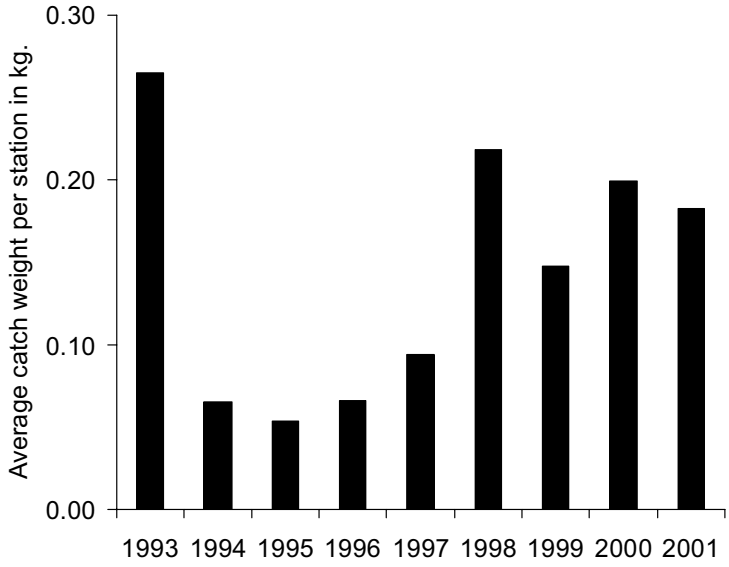

Numbers of fish
100
80
60
40
20
0
0 5 10 15 20 25 30 35 40
Total length (cm)

Gadoids

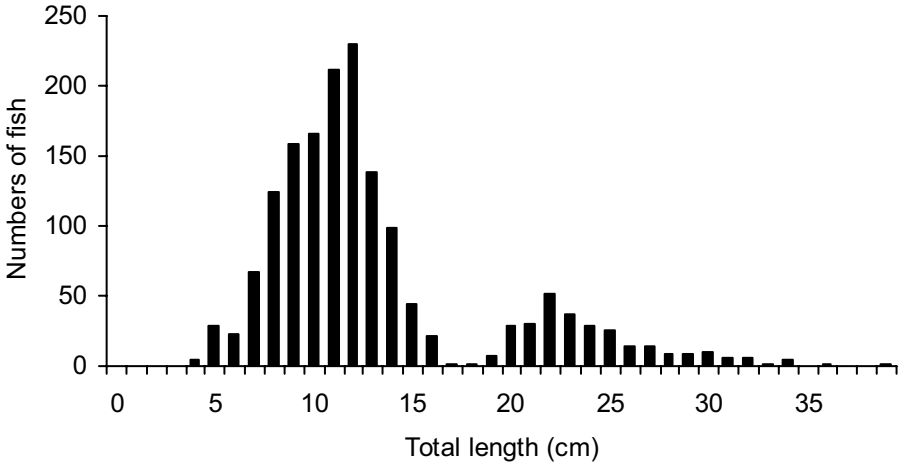
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 20 fish caught

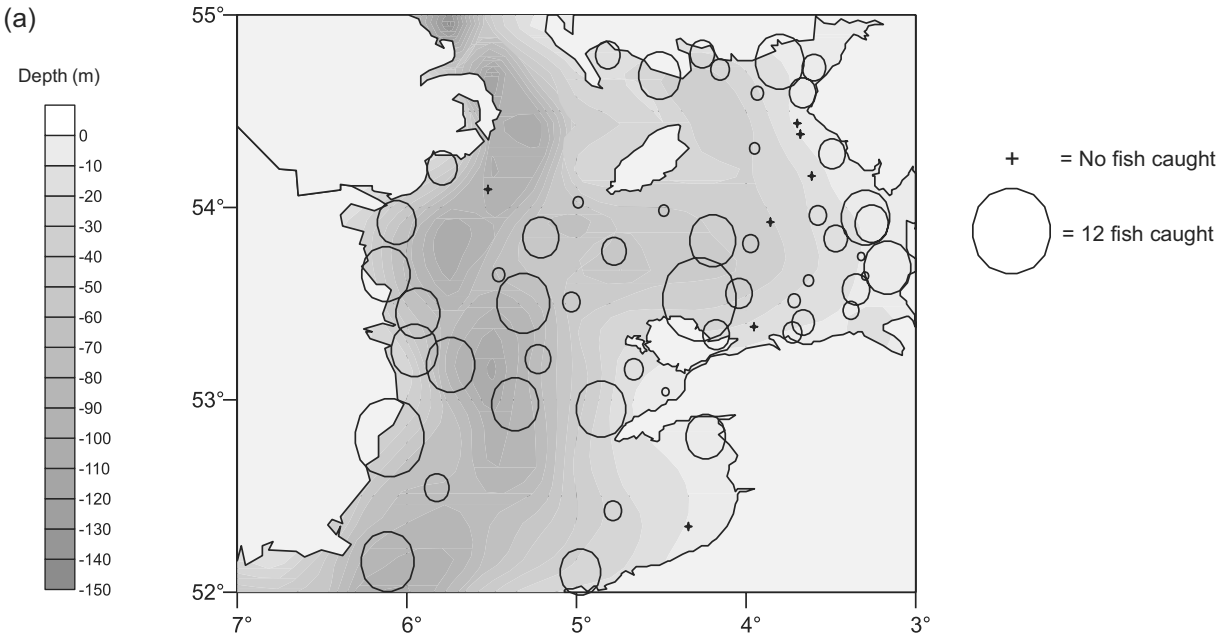
(b)


Average catch weight per station in kg.
0.30
0.20
0.10
0.00
1993 1994 1995 1996 1997 1998 1999 2000 2001

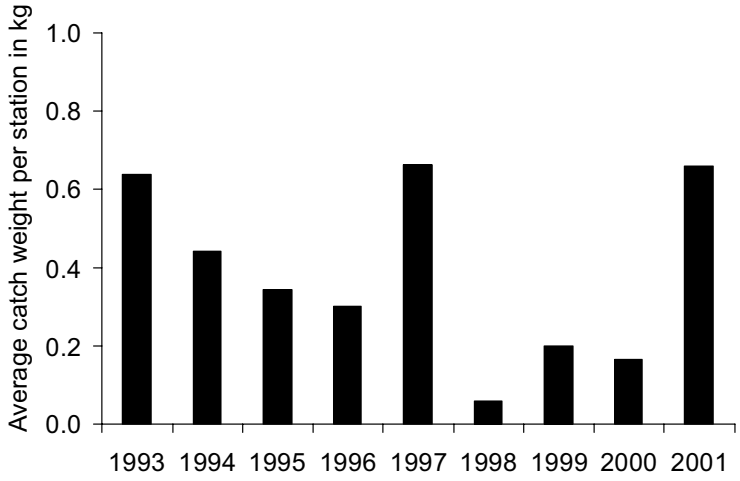
(c)


Numbers of fish
250
200
150
100
50
0
0 5 10 15 20 25 30 35
Total length (cm)

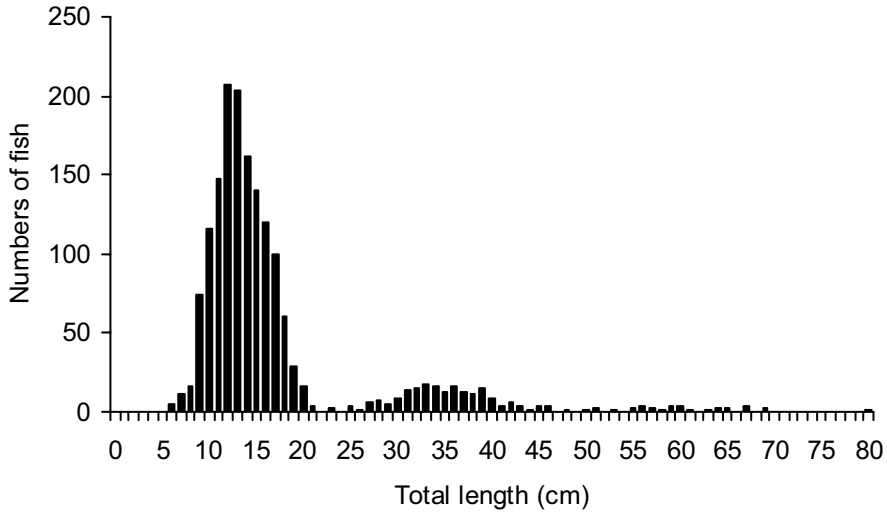
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 12 fish caught

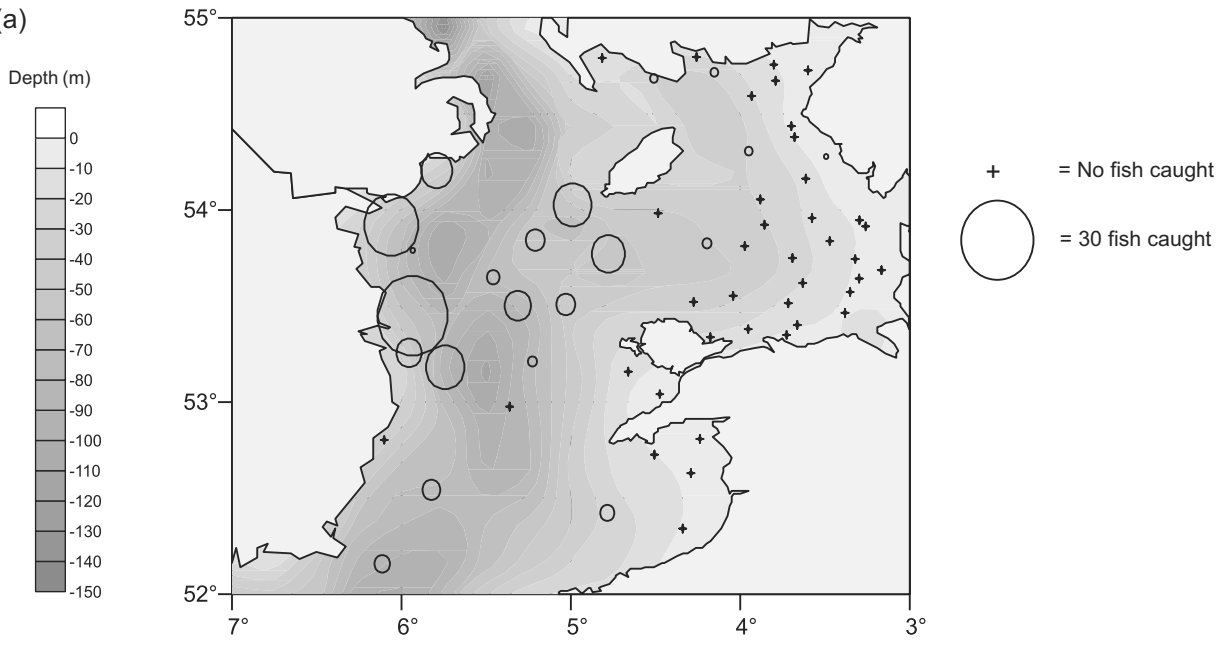
(b)


Average catch weight per station in kg
1.0
0.8
0.6
0.4
0.2
0.0
1993 1994 1995 1996 1997 1998 1999 2000 2001

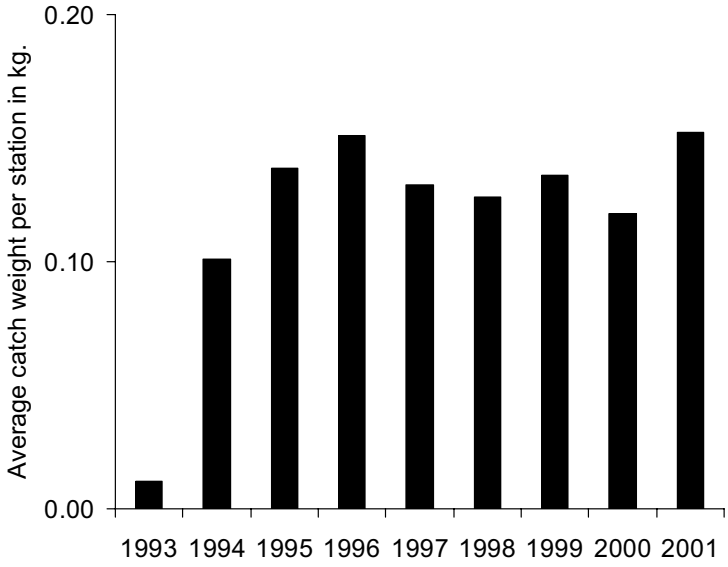
(c)


Numbers of fish
250
200
150
100
50
0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80
Total length (cm)

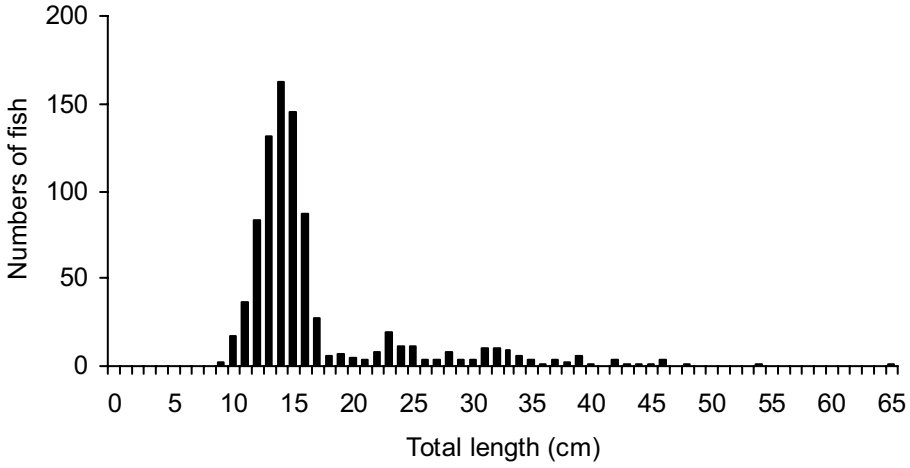
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 30 fish caught

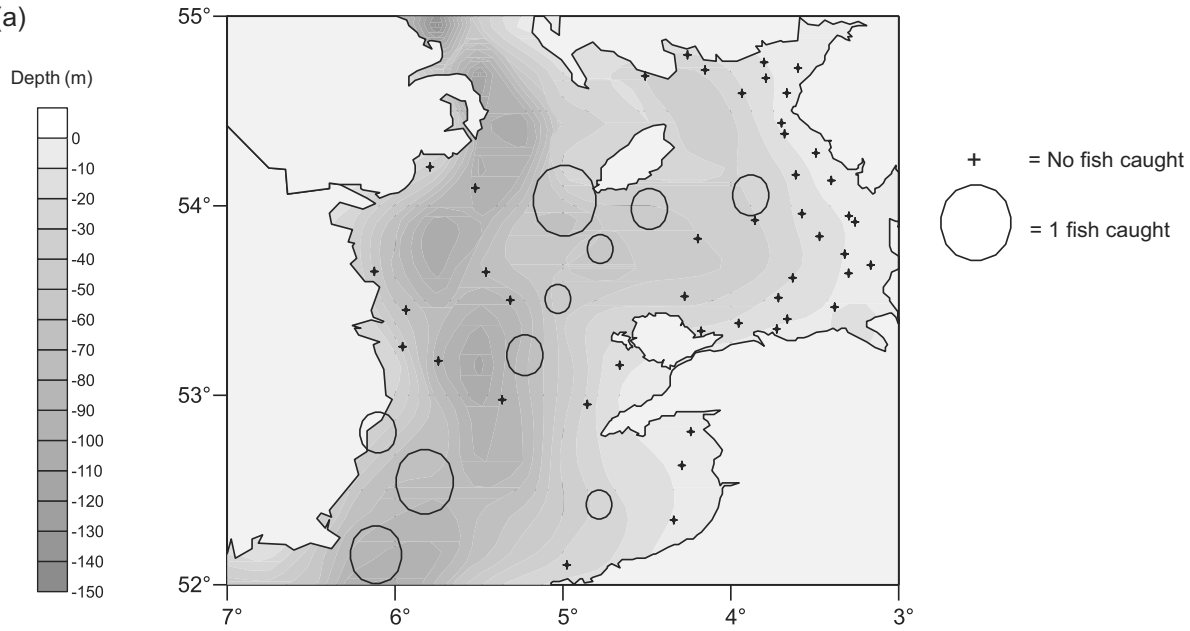
(b)


Average catch weight per station in kg.
0.20
0.10
0.00
1993 1994 1995 1996 1997 1998 1999 2000 2001

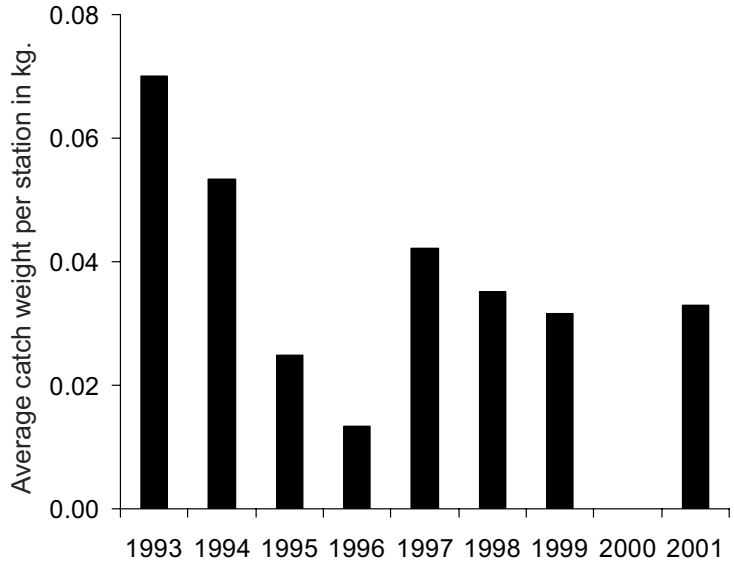
(c)


Numbers of fish
200
150
100
50
0
0 5 10 15 20 25 30 35 40 45 50 55 60 65
Total length (cm)

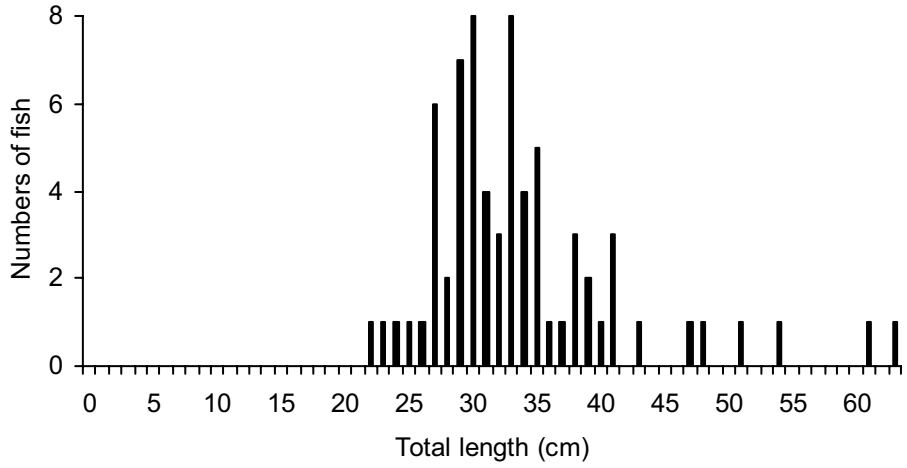
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 1 fish caught

(b)

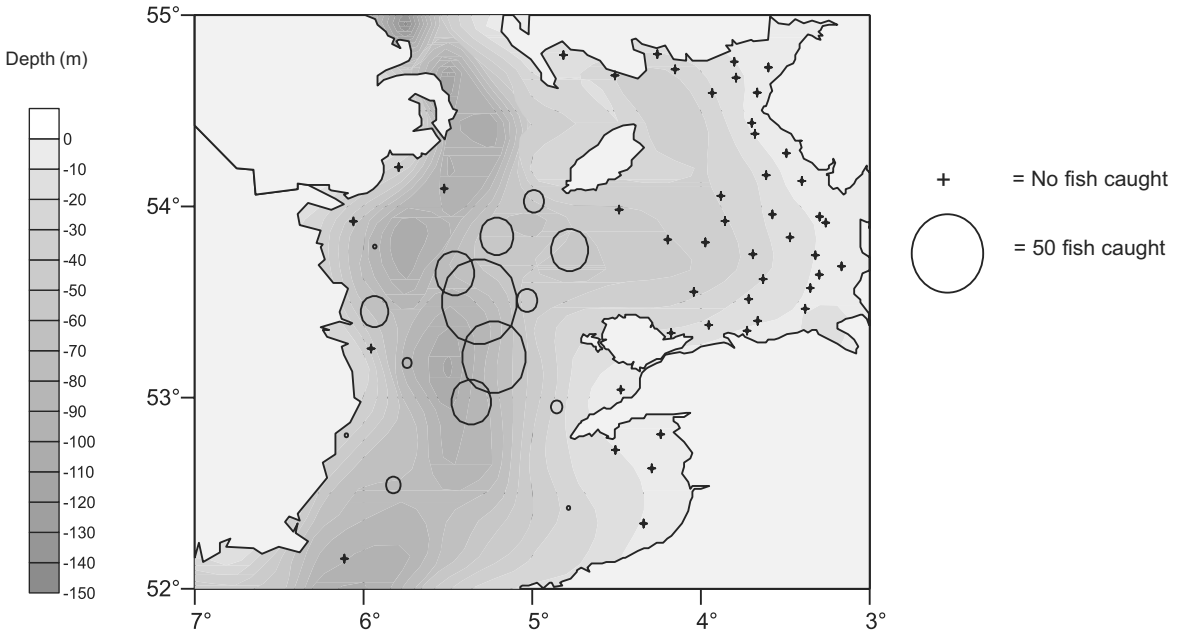

Average catch weight per station in kg.
0.08
0.06
0.04
0.02
0.00
1993 1994 1995 1996 1997 1998 1999 2000 2001

(c)

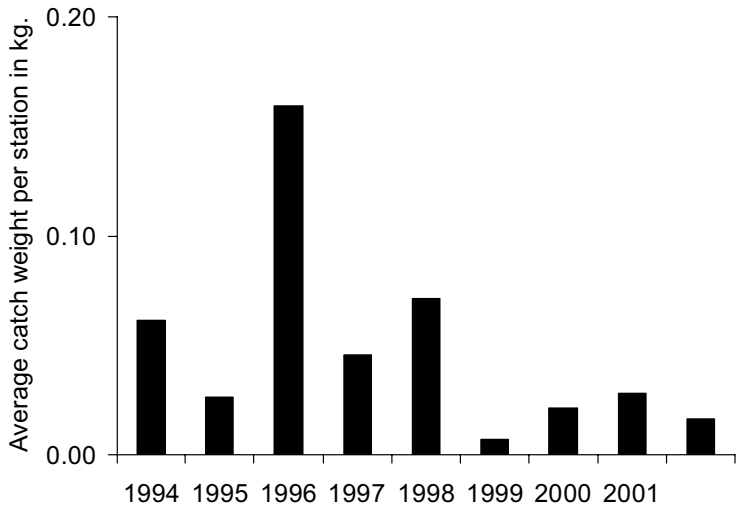

Numbers of fish
8
6
4
2
0
0 5 10 15 20 25 30 35 40 45 50 55 60
Total length (cm)

Norway pout - *Trisopterus esmarki*

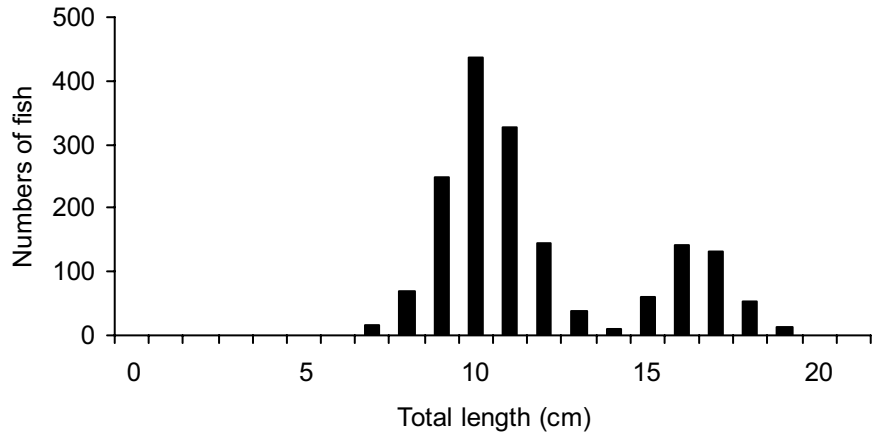
(a)



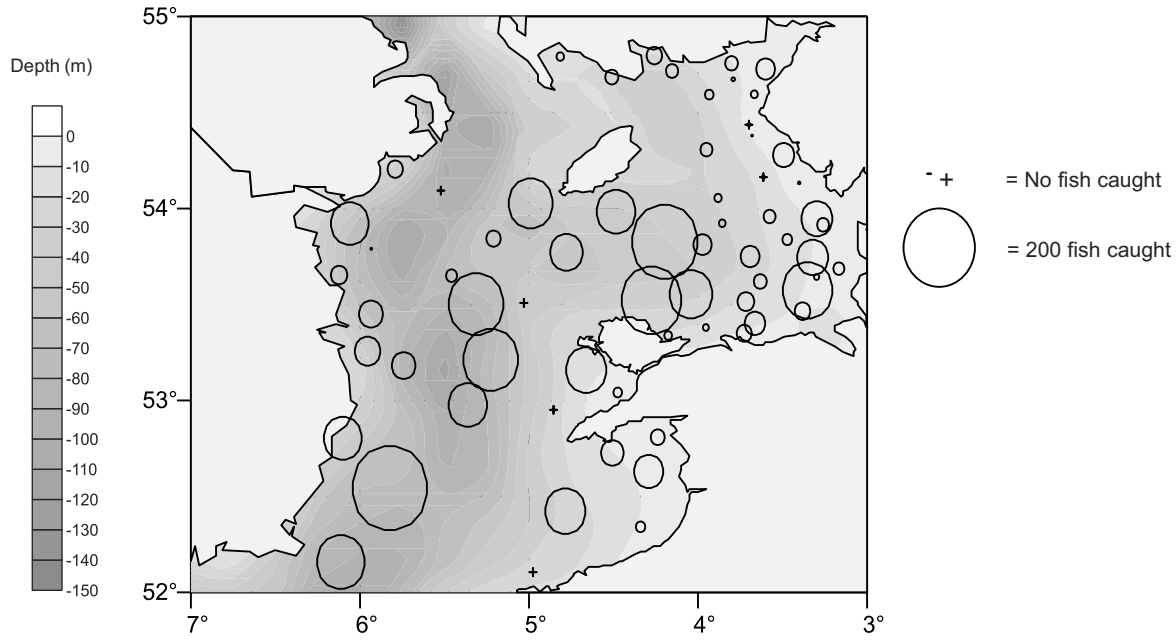
(b)



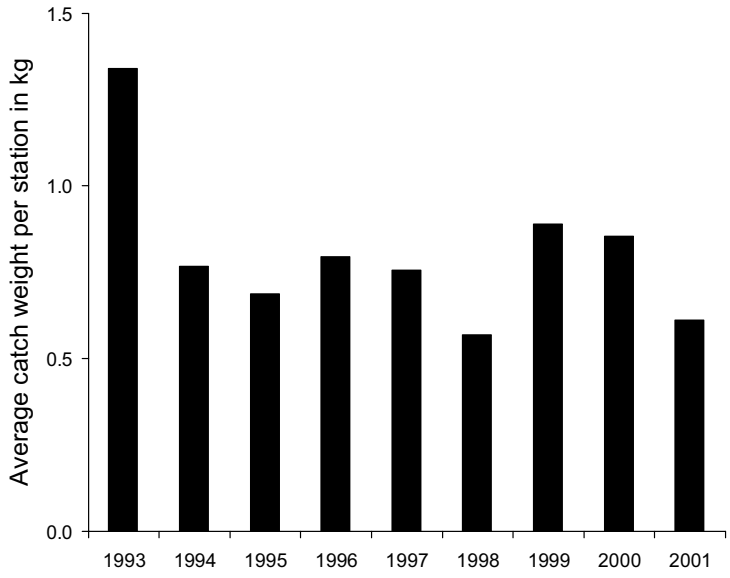
(c)



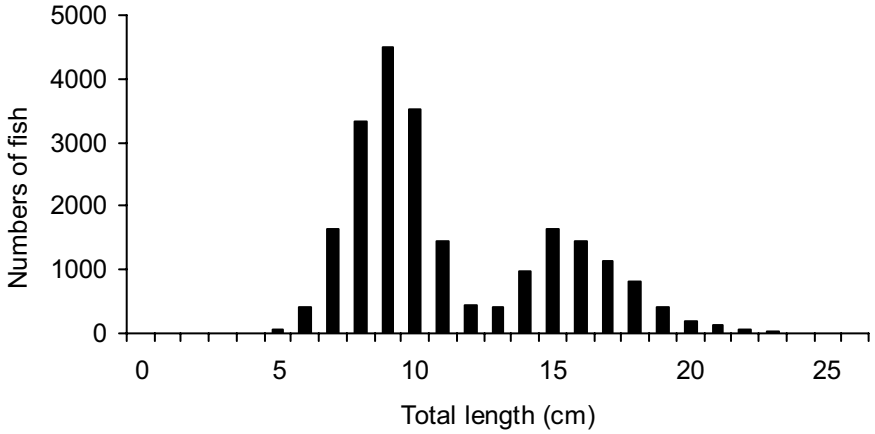
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
= No fish caught
= 200 fish caught

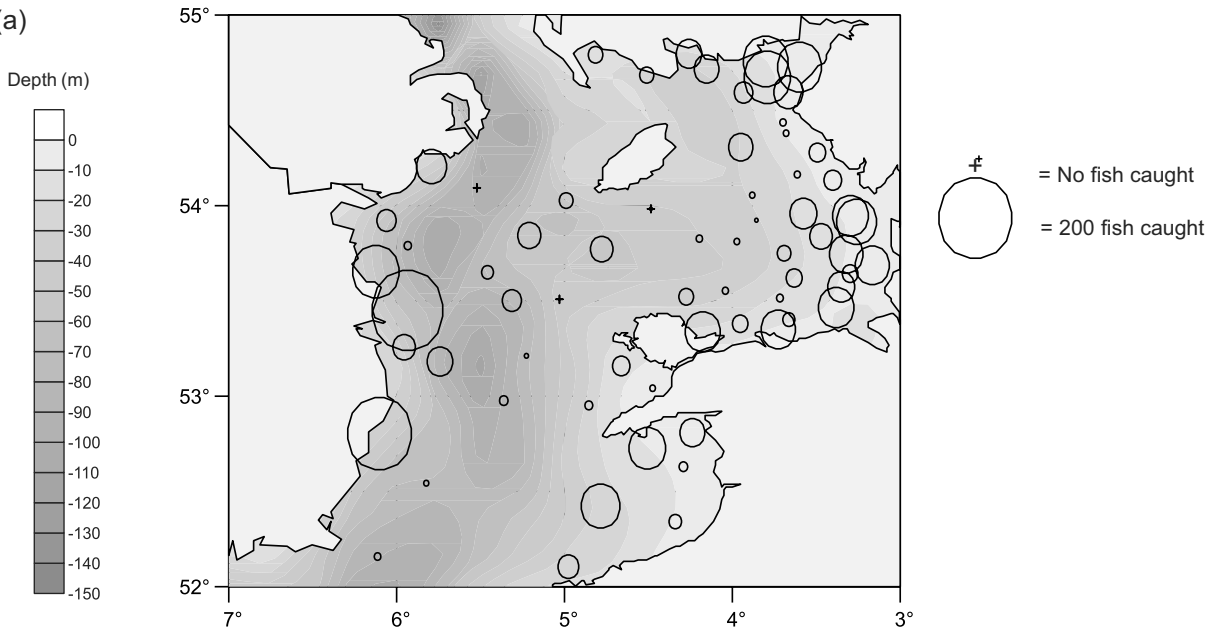
(b)


Average catch weight per station in kg
1.5
1.0
0.5
0.0
1993
1994
1995
1996
1997
1998
1999
2000
2001

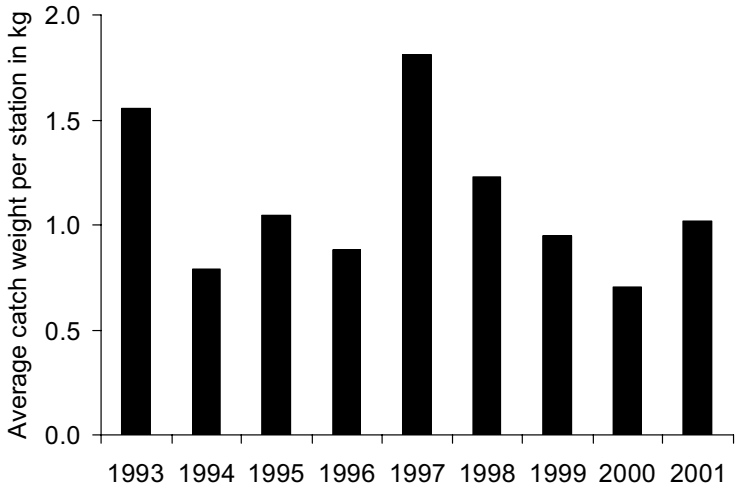
(c)


Numbers of fish
5000
4000
3000
2000
1000
0
0
5
10
15
20
25
Total length (cm)

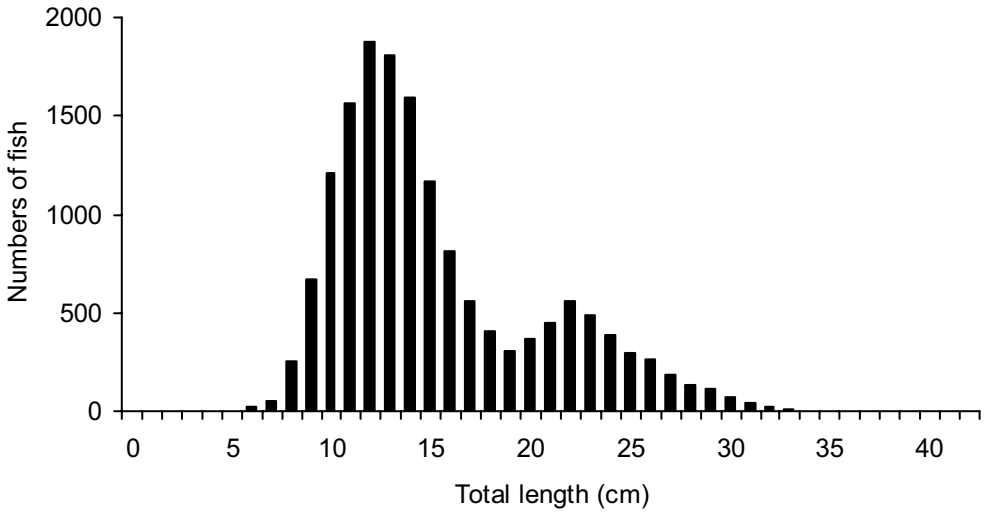
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
= No fish caught
= 200 fish caught

(b)


Average catch weight per station in kg
2.0
1.5
1.0
0.5
0.0
1993 1994 1995 1996 1997 1998 1999 2000 2001

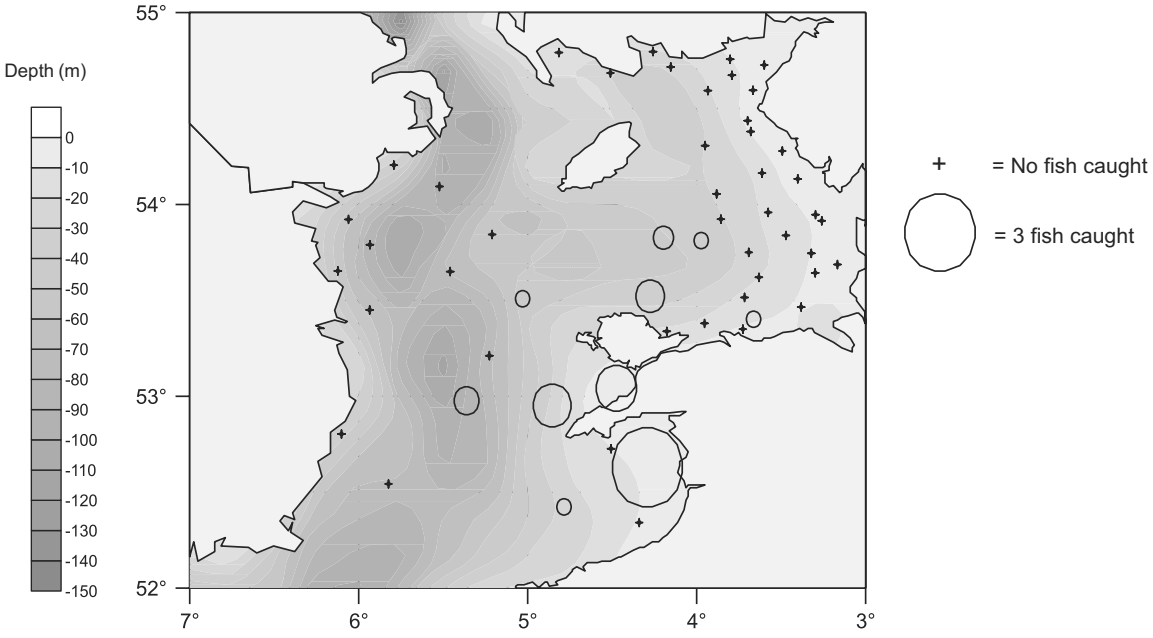
(c)


Numbers of fish
2000
1500
1000
500
0
0 5 10 15 20 25 30 35 40
Total length (cm)

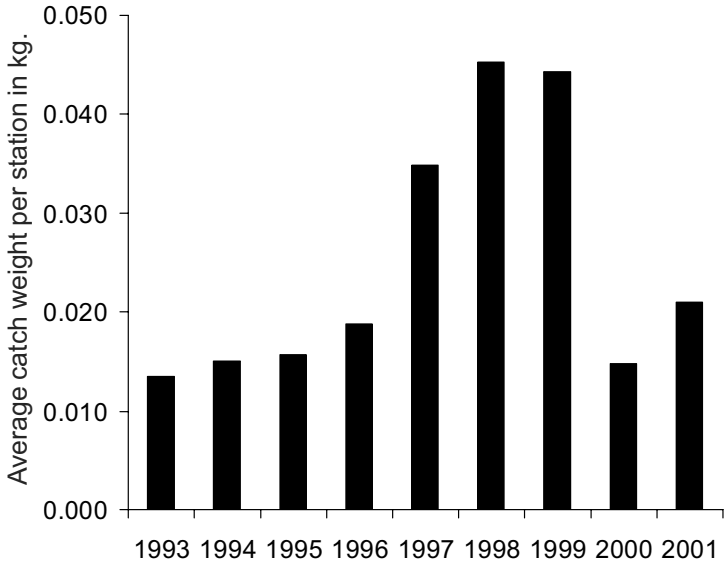
Elasmobranchs

Greater spotted dogfish - *Scyliorhinus stellaris*

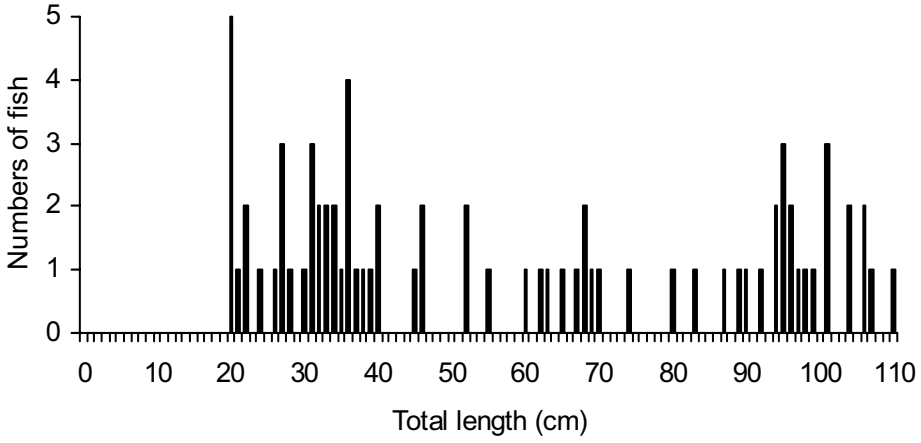
(a)



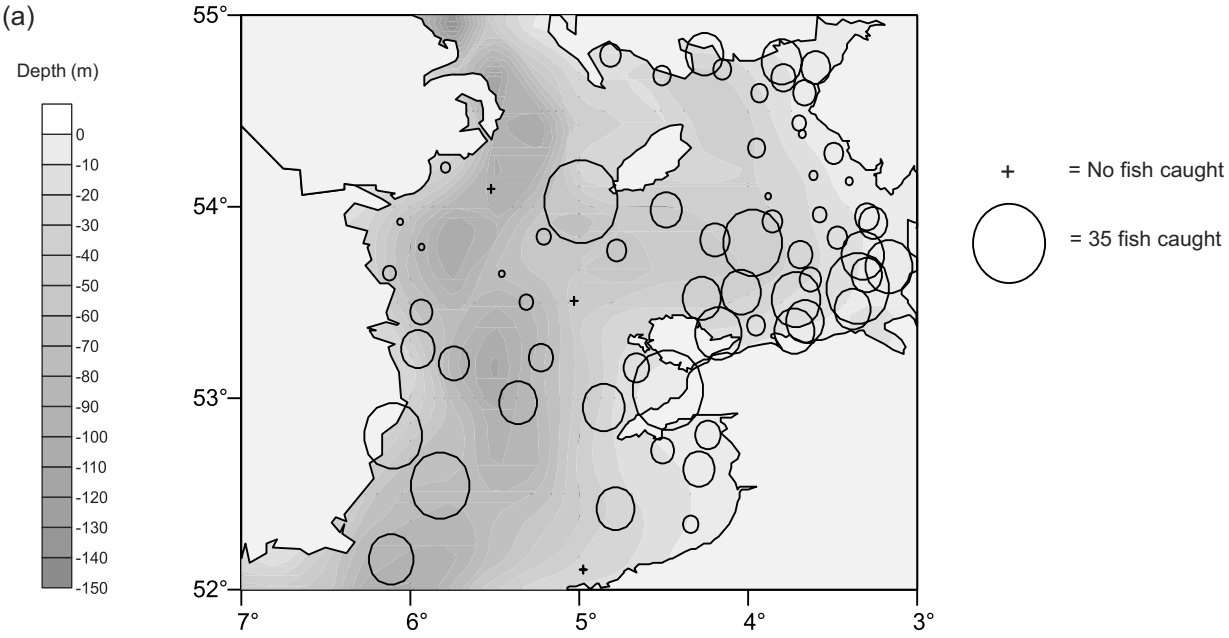
(b)



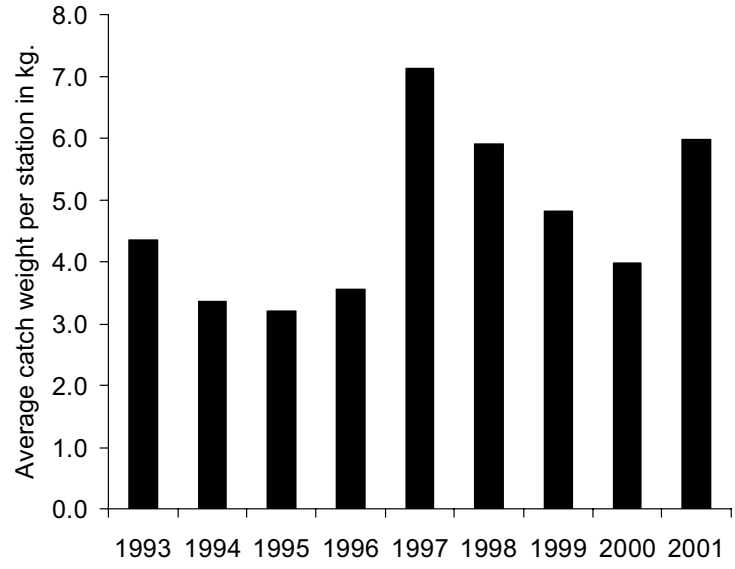
(c)



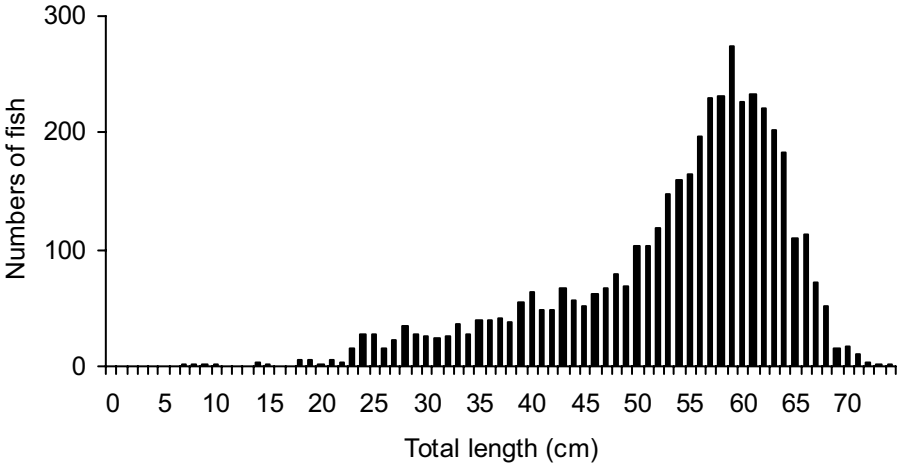
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 35 fish caught

(b)

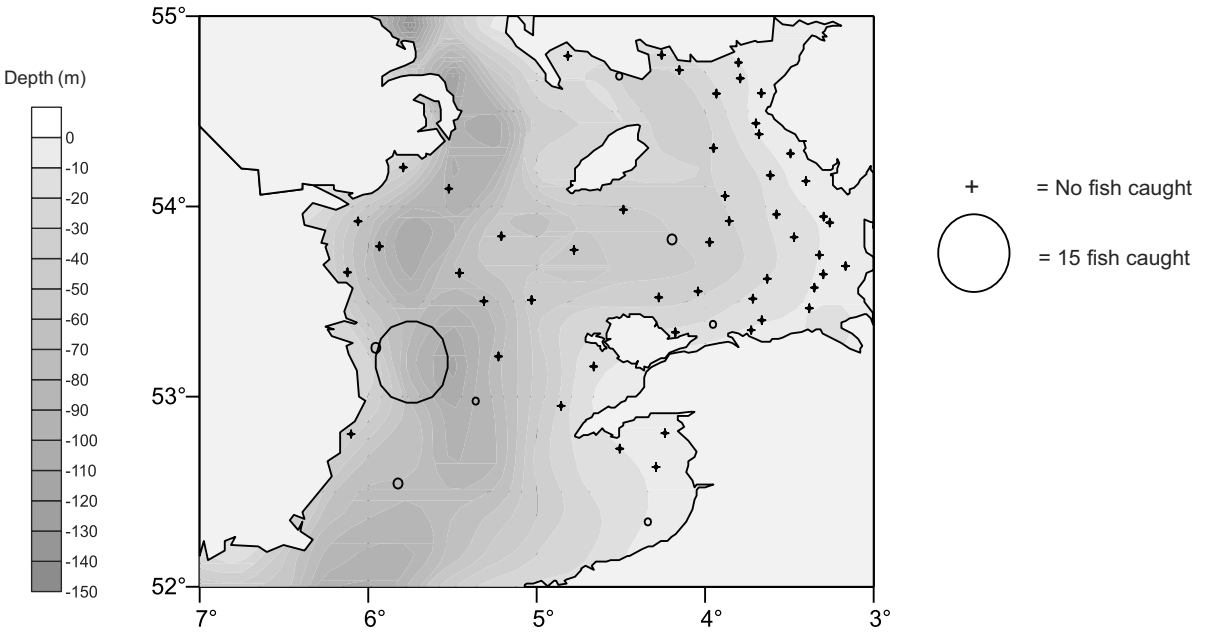

Average catch weight per station in kg.
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1993 1994 1995 1996 1997 1998 1999 2000 2001

(c)

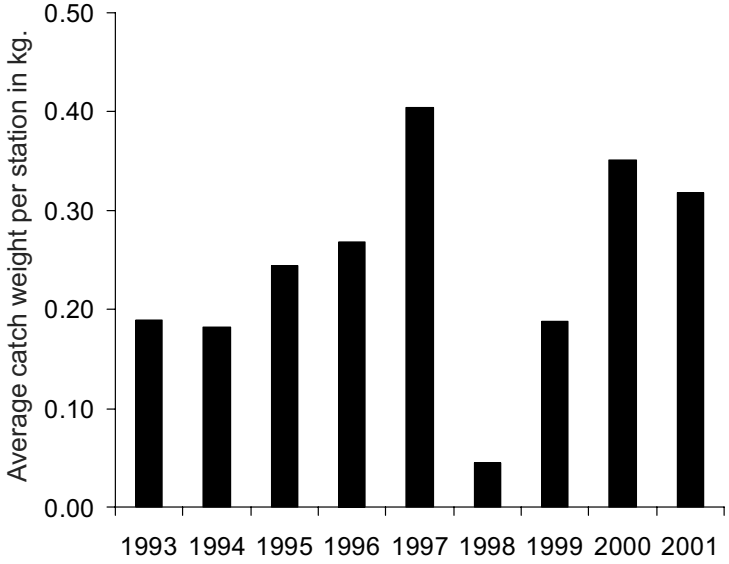

Numbers of fish
300
200
100
0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70
Total length (cm)

Ray, blonde - *Raja brachyura*

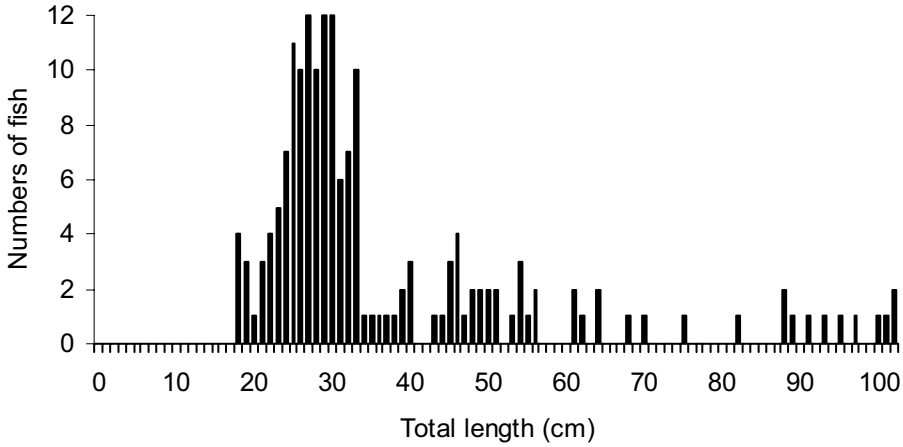
(a)



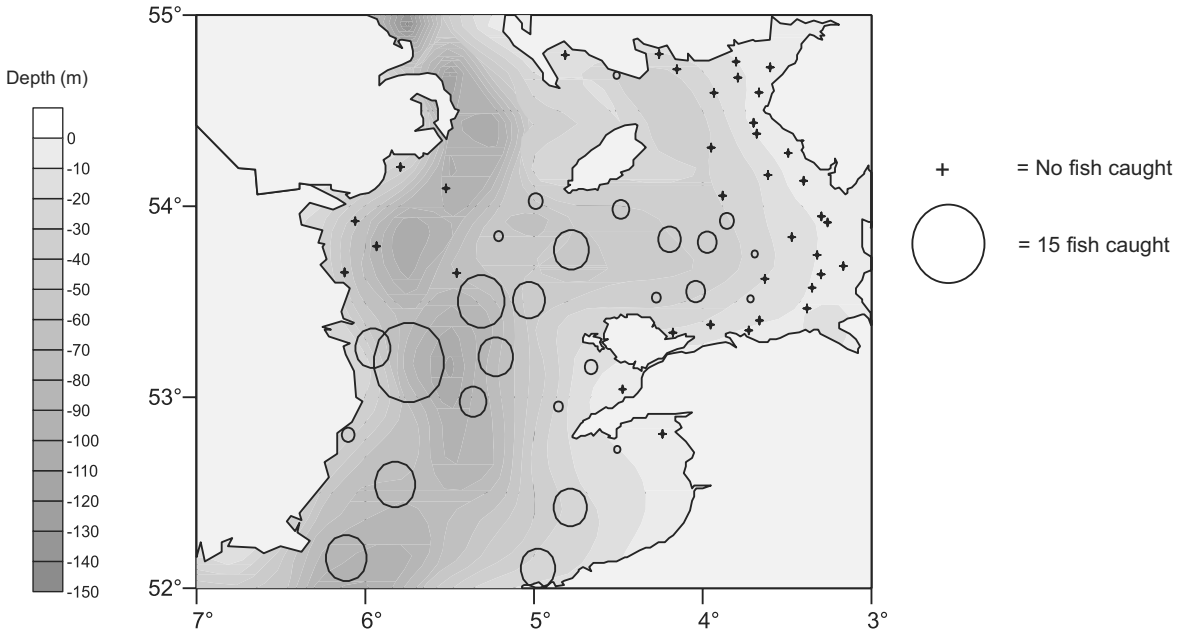
(b)



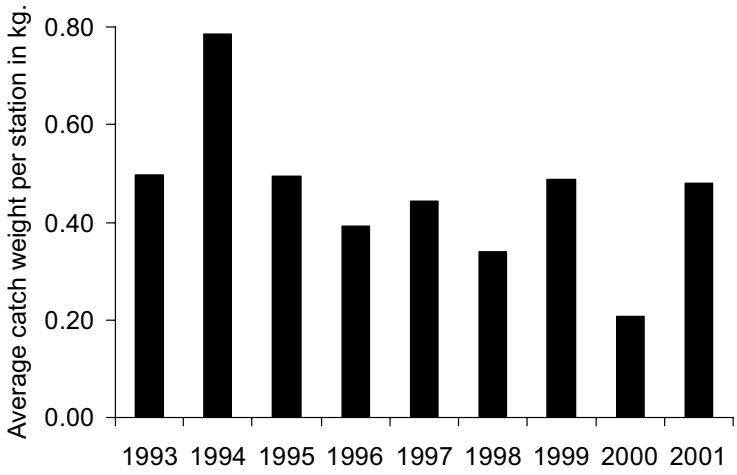
(c)



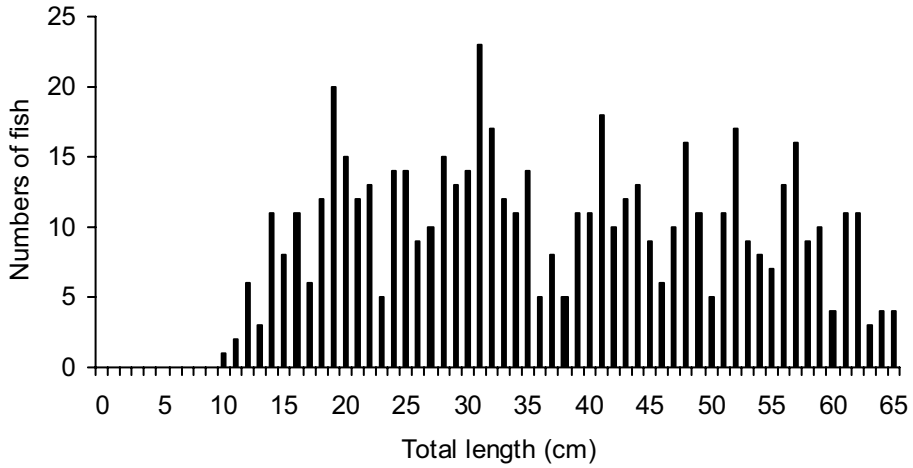
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 15 fish caught

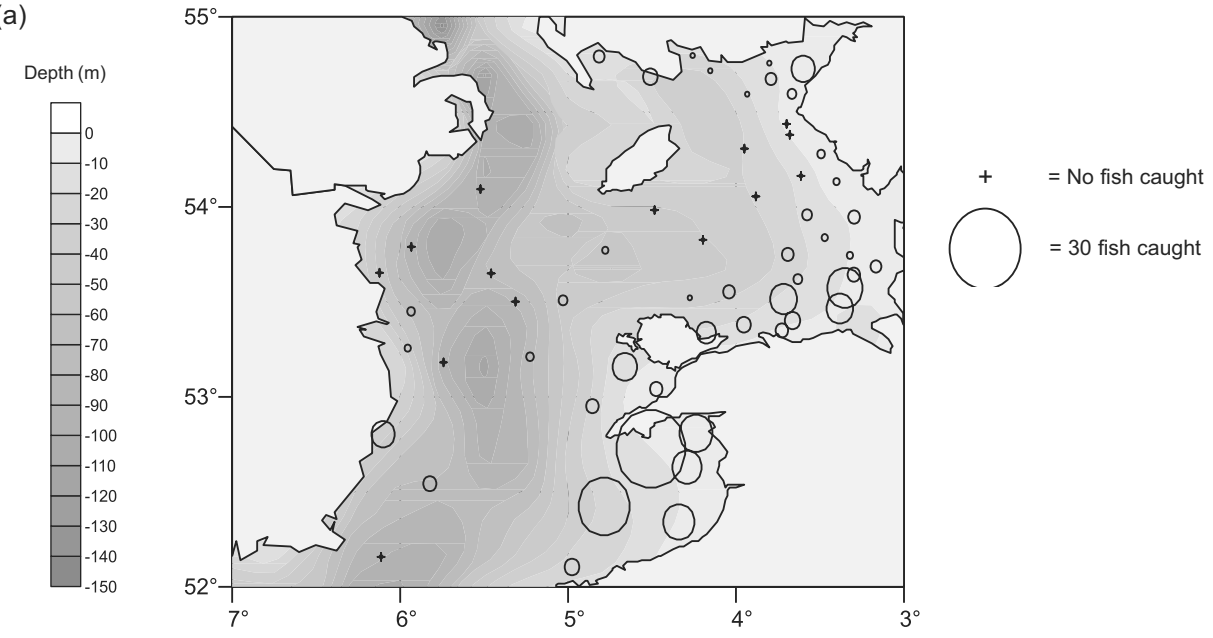
(b)


Average catch weight per station in kg.
0.80
0.60
0.40
0.20
0.00
1993 1994 1995 1996 1997 1998 1999 2000 2001

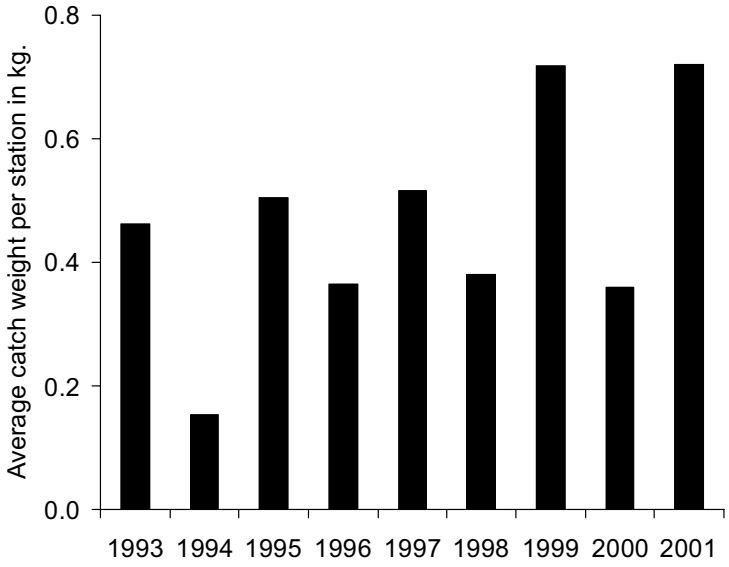
(c)


Numbers of fish
25
20
15
10
5
0
0 5 10 15 20 25 30 35 40 45 50 55 60 65
Total length (cm)

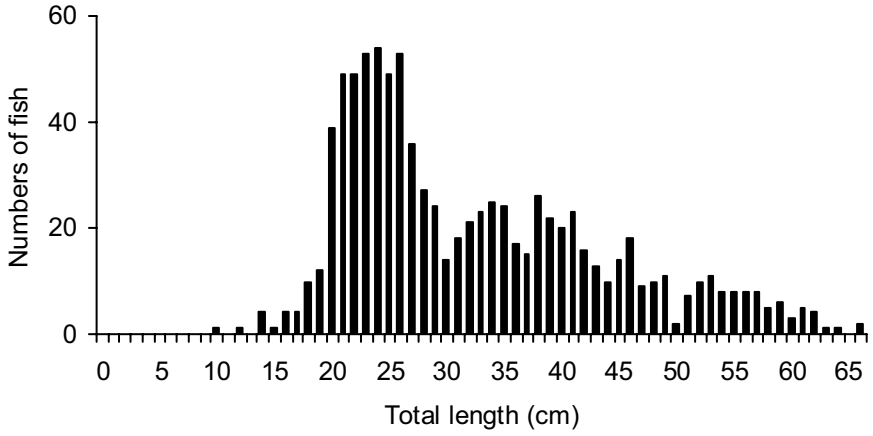
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 30 fish caught

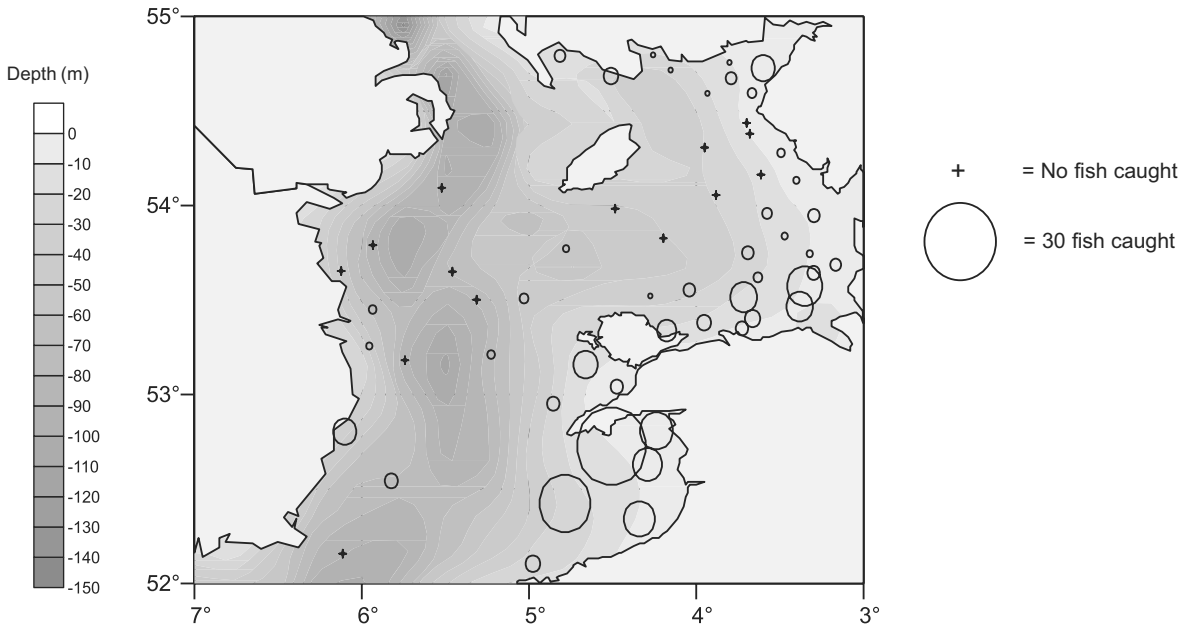
(b)


Average catch weight per station in kg.
0.0
0.2
0.4
0.6
0.8
1993 1994 1995 1996 1997 1998 1999 2000 2001

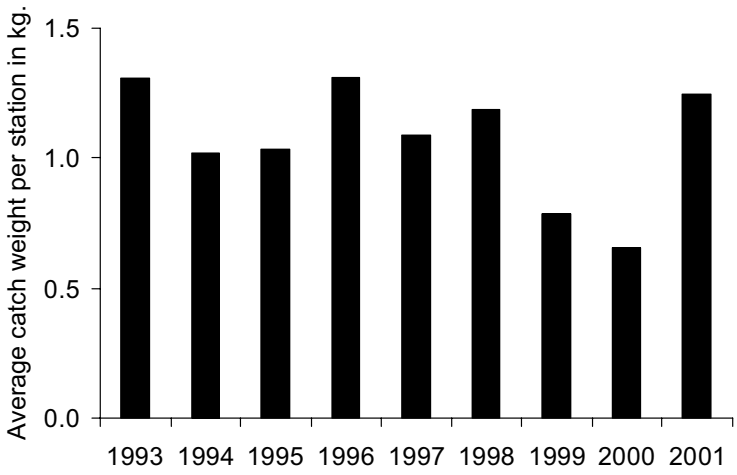
(c)


Numbers of fish
0
20
40
60
0 5 10 15 20 25 30 35 40 45 50 55 60 65
Total length (cm)

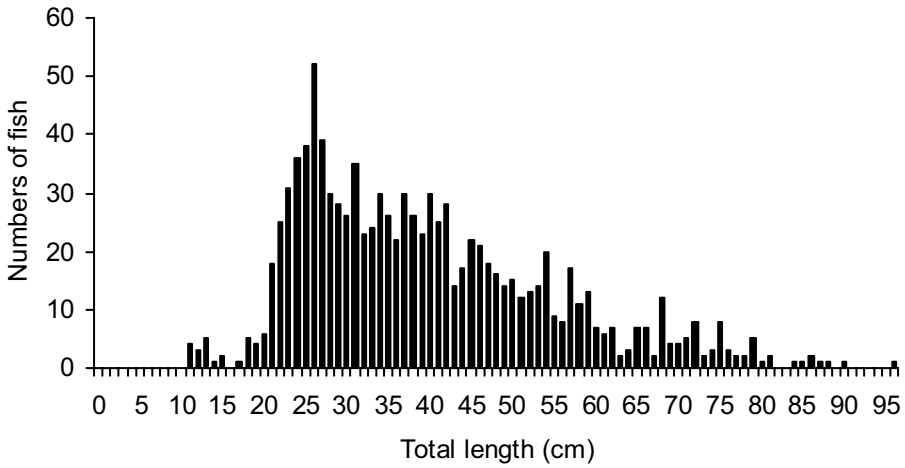
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 30 fish caught

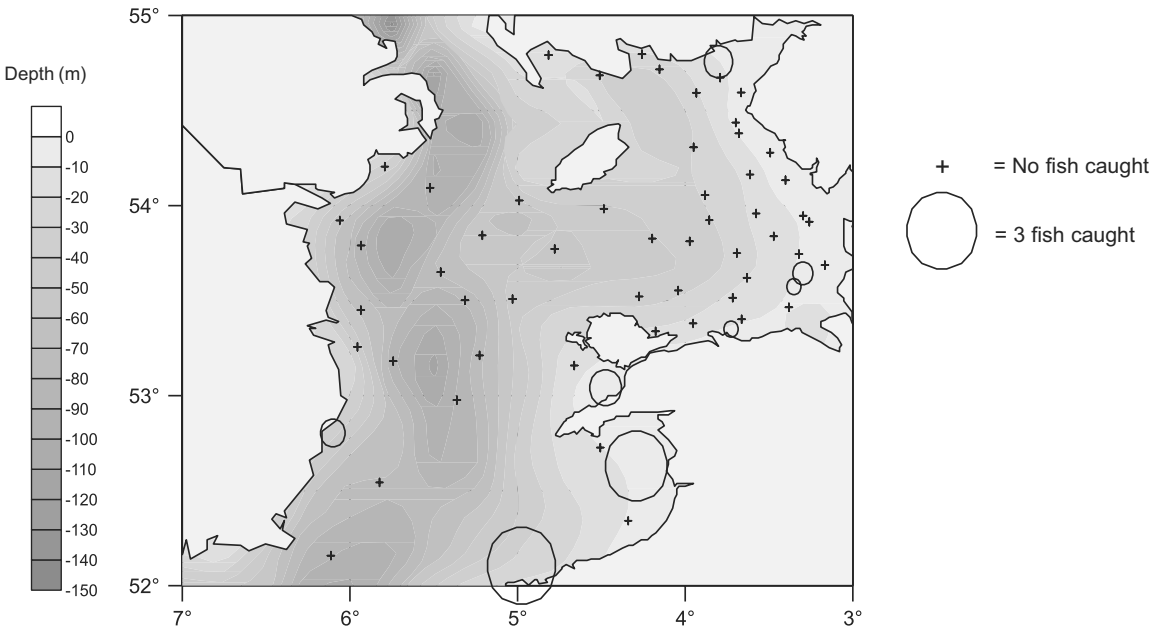
(b)


Average catch weight per station in kg.
1.5
1.0
0.5
0.0
1993 1994 1995 1996 1997 1998 1999 2000 2001

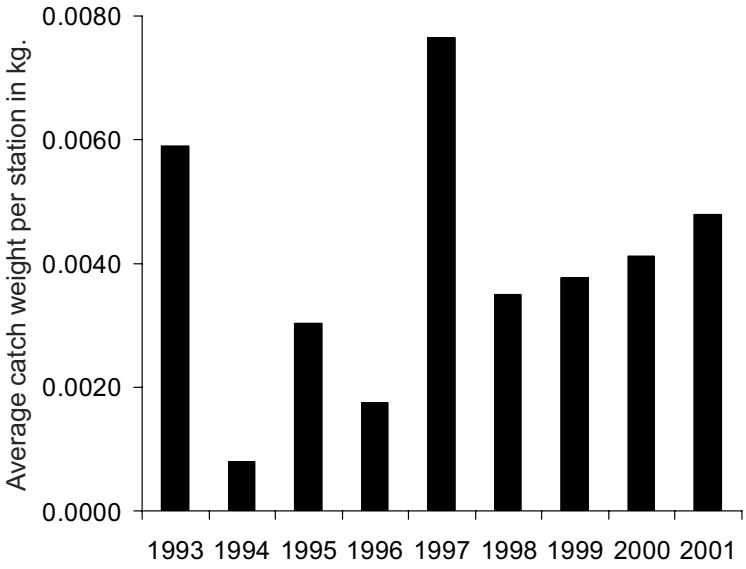
(c)


Numbers of fish
60
50
40
30
20
10
0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95
Total length (cm)

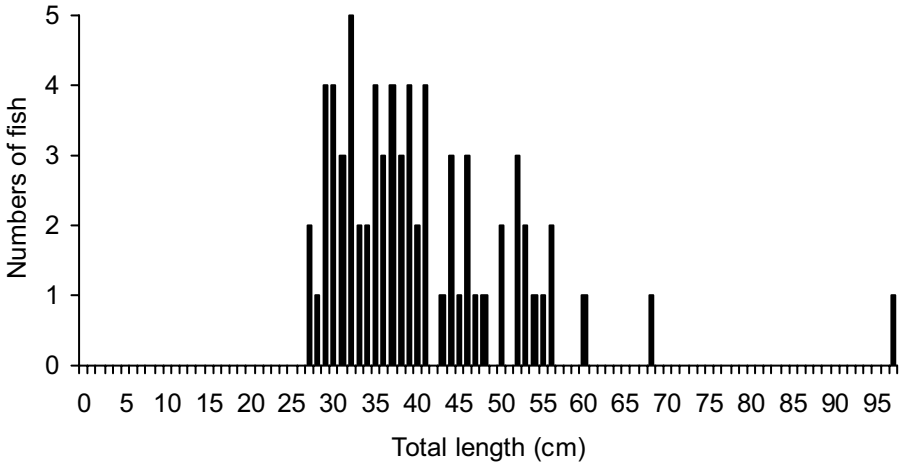
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 3 fish caught

(b)

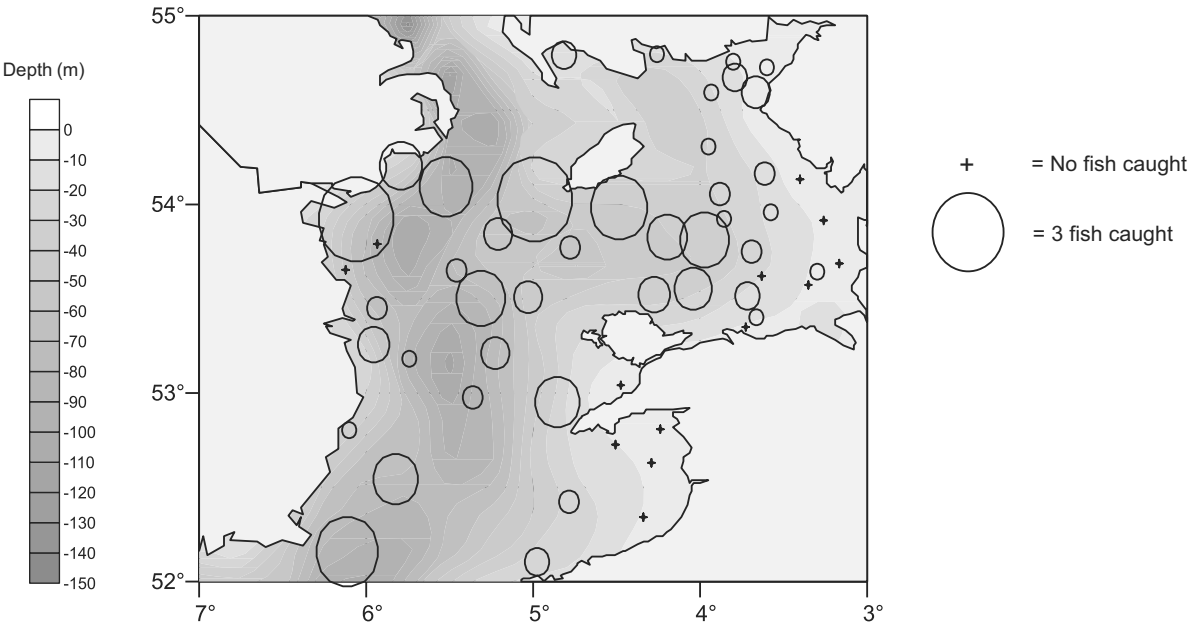

Average catch weight per station in kg.
0.0080
0.0060
0.0040
0.0020
0.0000
1993 1994 1995 1996 1997 1998 1999 2000 2001

(c)

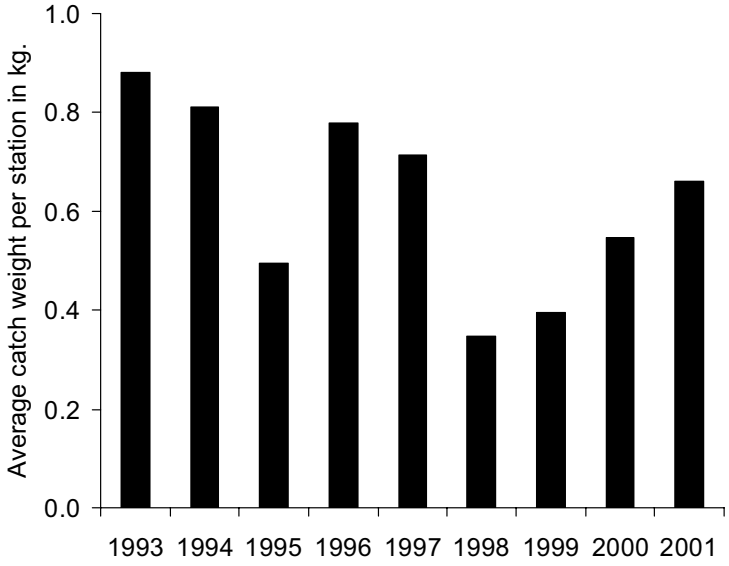

Numbers of fish
5
4
3
2
1
0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95
Total length (cm)

Other fish species

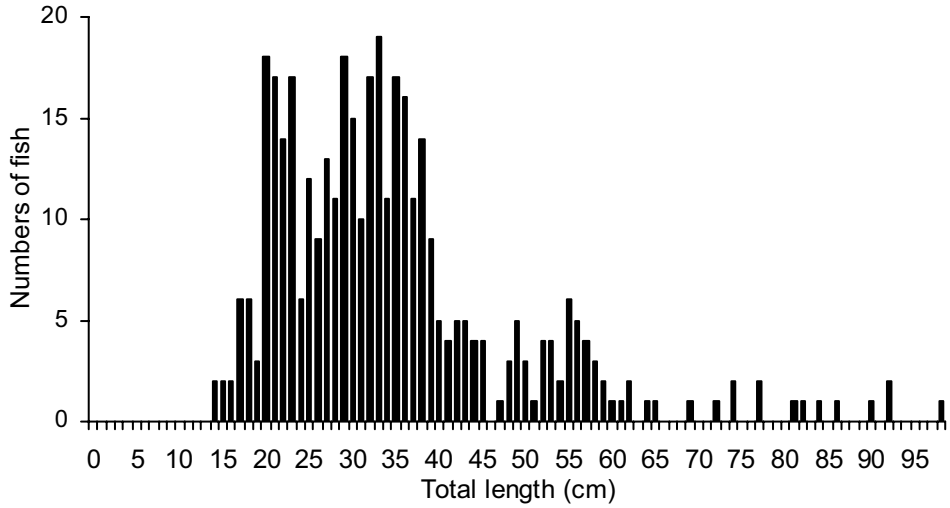
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 3 fish caught

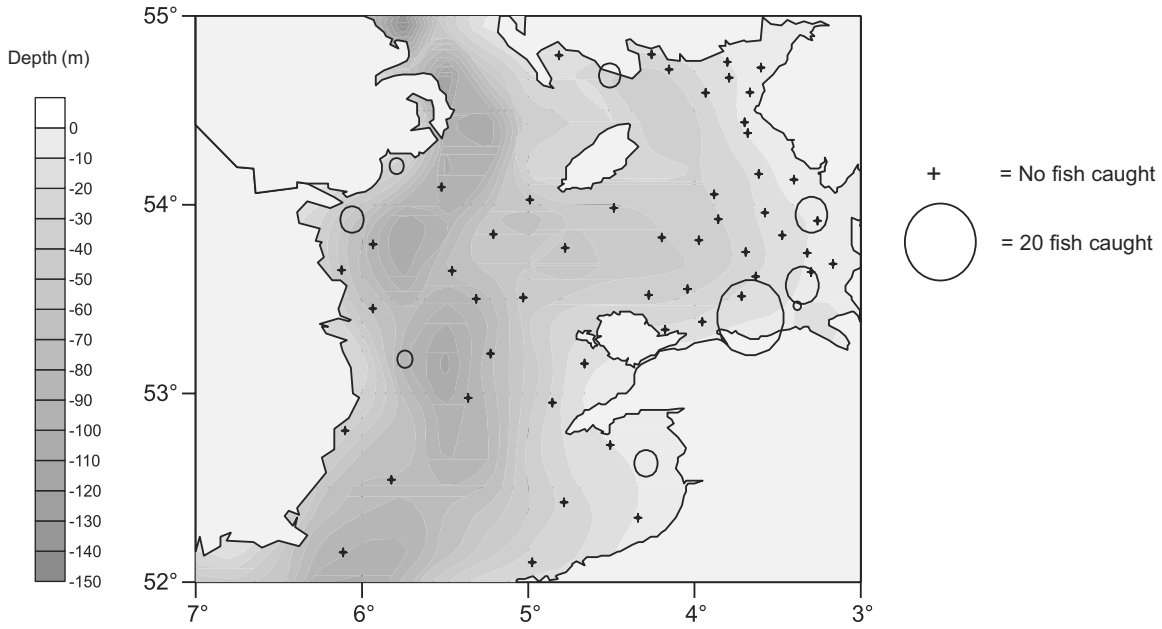
(b)


Average catch weight per station in kg.
1.0
0.8
0.6
0.4
0.2
0.0
1993 1994 1995 1996 1997 1998 1999 2000 2001

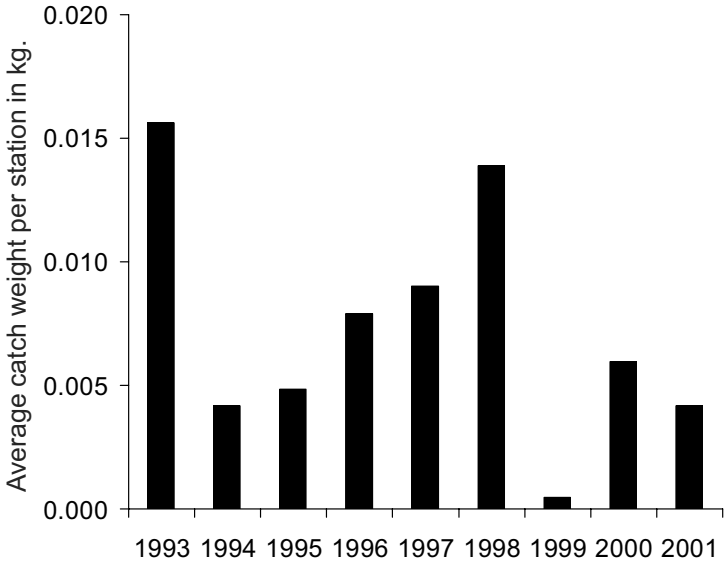
(c)


Numbers of fish
20
15
10
5
0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95
Total length (cm)

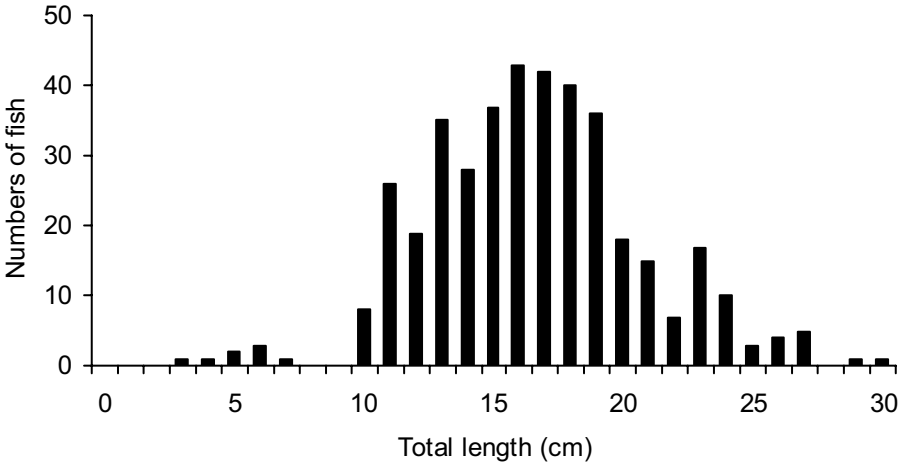
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 20 fish caught

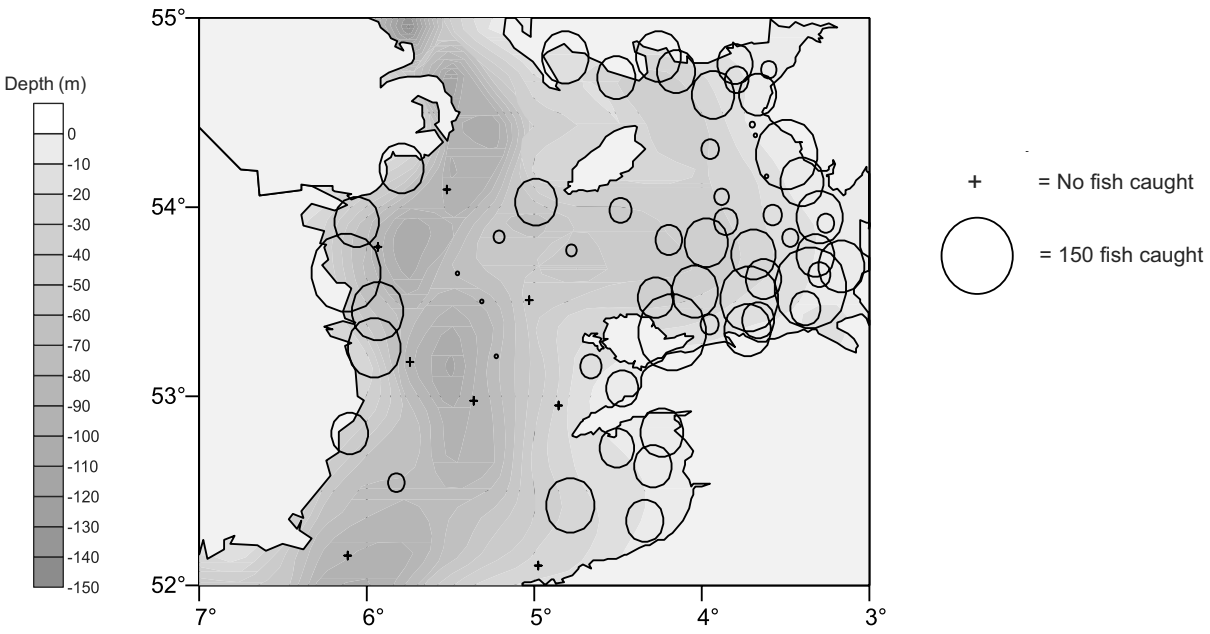
(b)


Average catch weight per station in kg.
0.020
0.015
0.010
0.005
0.000
1993 1994 1995 1996 1997 1998 1999 2000 2001

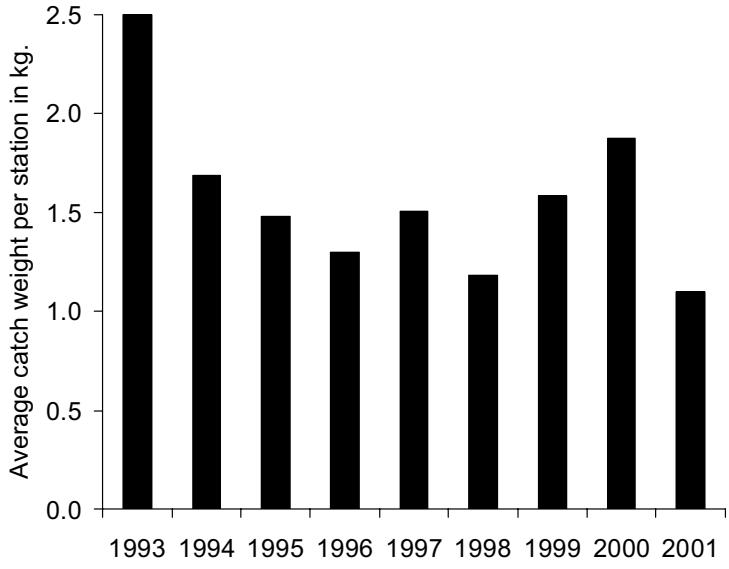
(c)


Numbers of fish
50
40
30
20
10
0
0 5 10 15 20 25 30
Total length (cm)

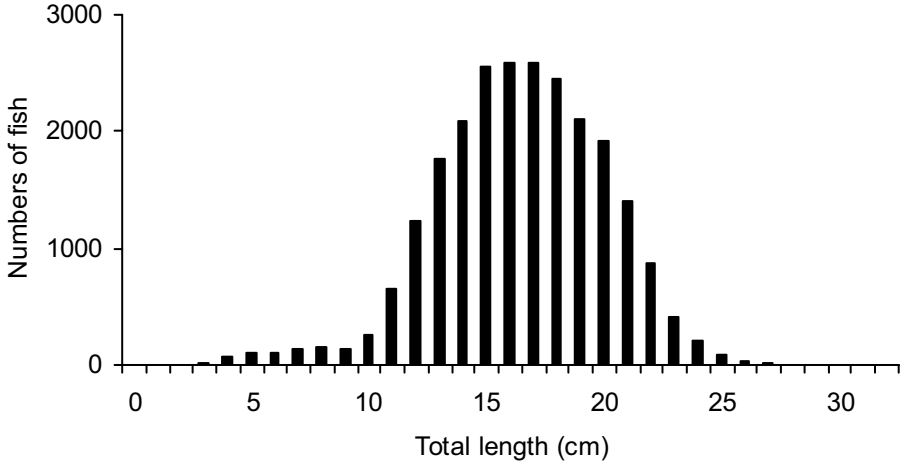
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 150 fish caught

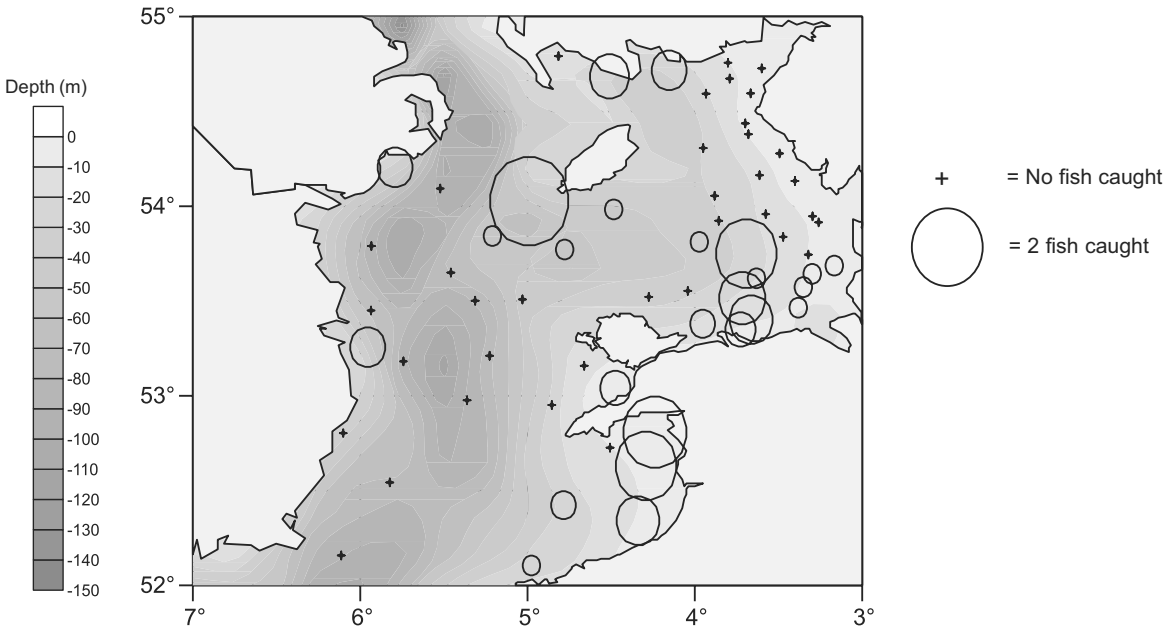
(b)


Average catch weight per station in kg.
2.5
2.0
1.5
1.0
0.5
0.0
1993 1994 1995 1996 1997 1998 1999 2000 2001

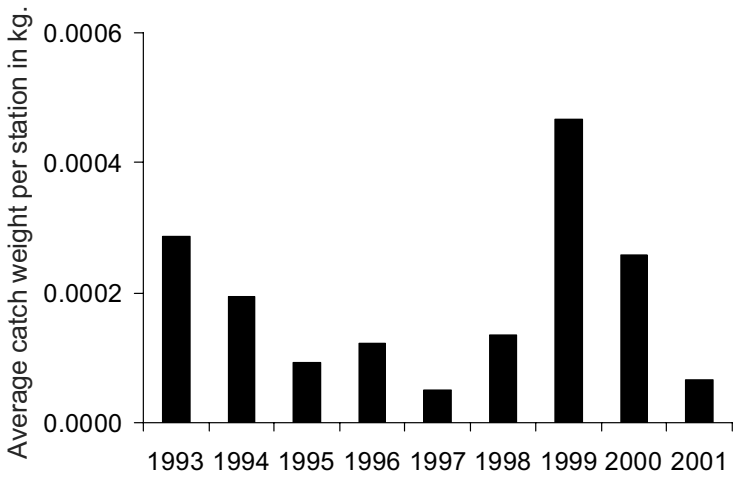
(c)


Numbers of fish
3000
2000
1000
0
0 5 10 15 20 25 30
Total length (cm)

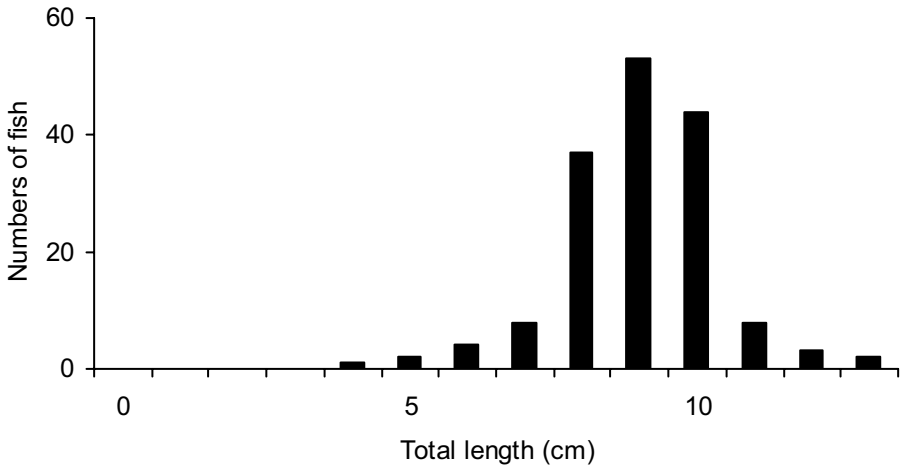
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 2 fish caught

(b)

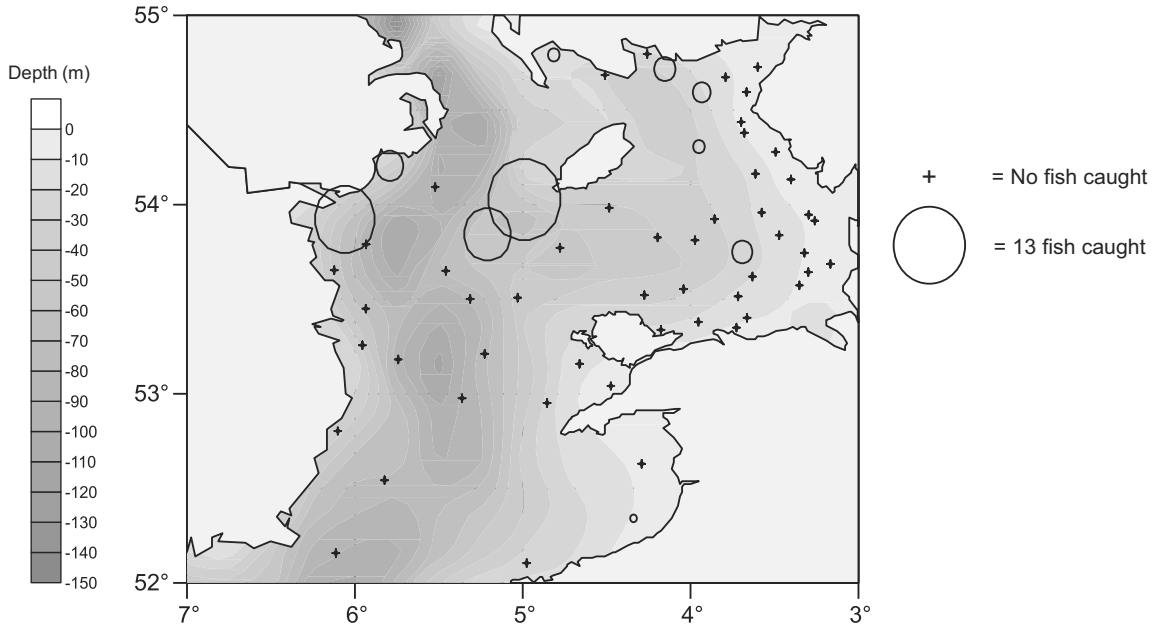

Average catch weight per station in kg.
0.0006
0.0004
0.0002
0.0000
1993 1994 1995 1996 1997 1998 1999 2000 2001

(c)

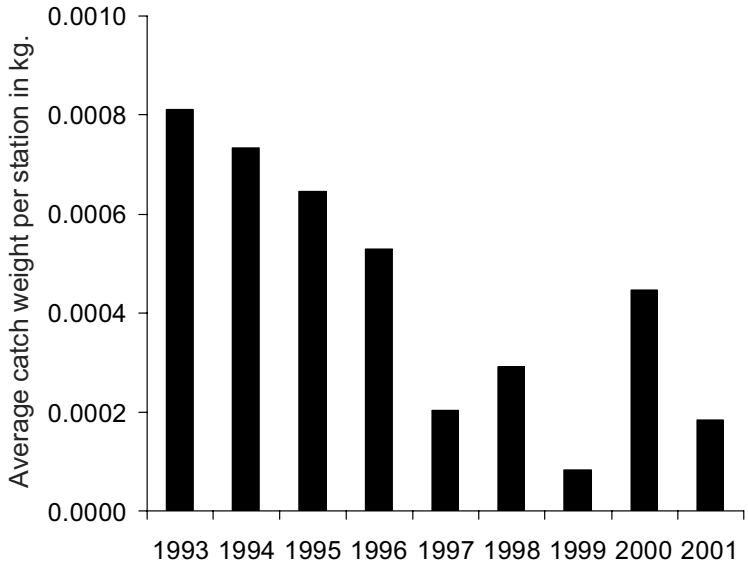

Numbers of fish
60
40
20
0
0
5
10
Total length (cm)

Dragonet, spotted - *Callionymus maculatus*

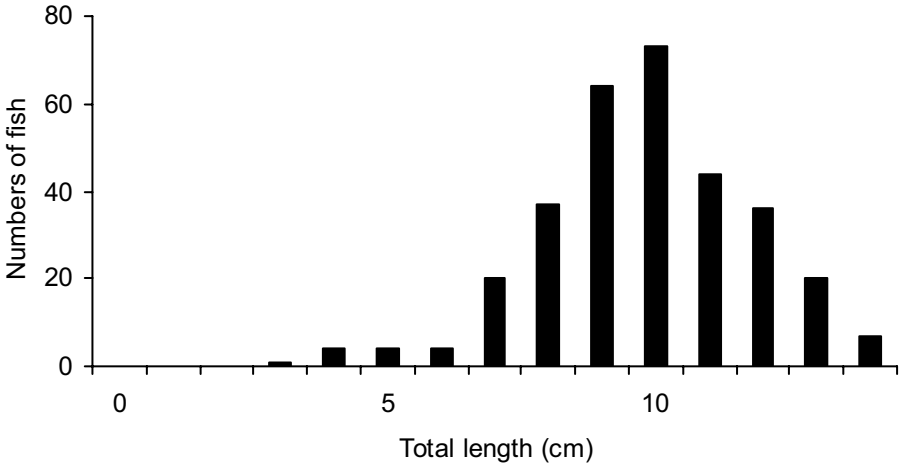
(a)



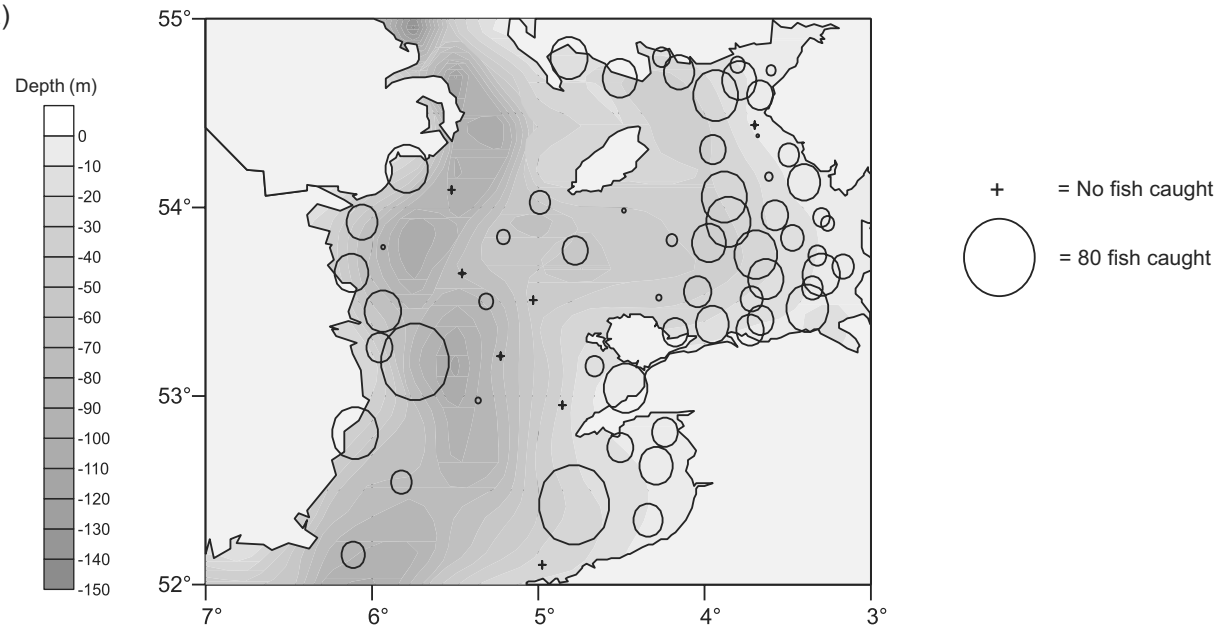
(b)



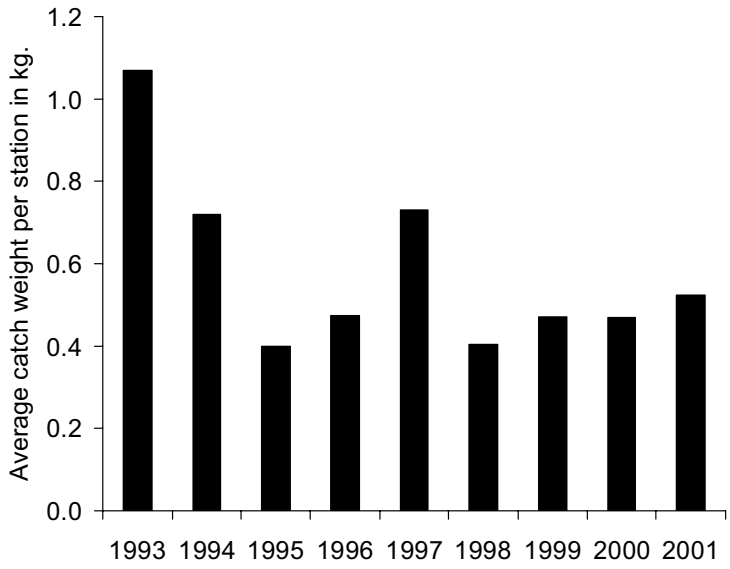
(c)



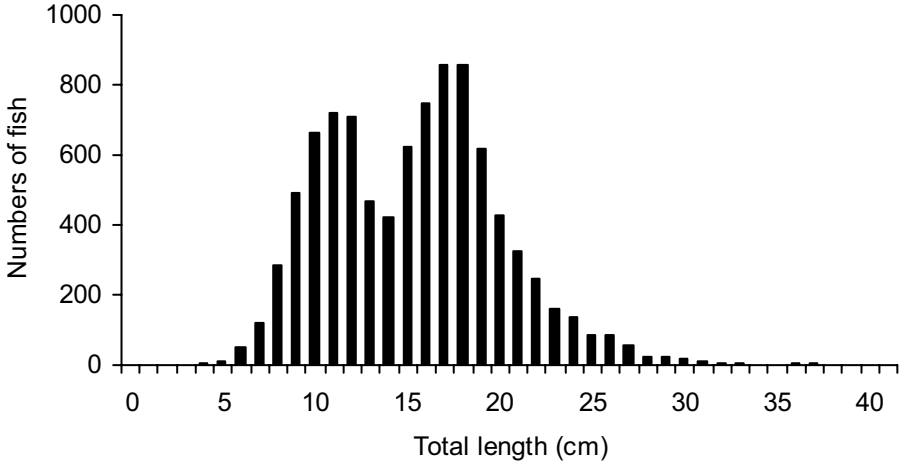
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 80 fish caught

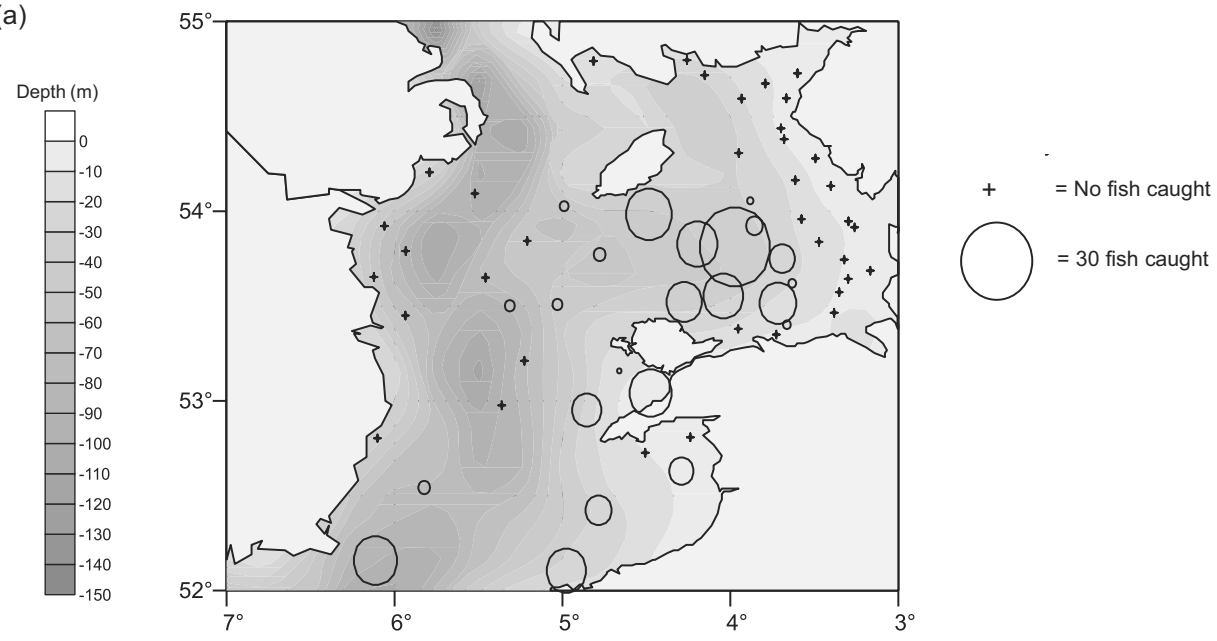
(b)


Average catch weight per station in kg.
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1993 1994 1995 1996 1997 1998 1999 2000 2001

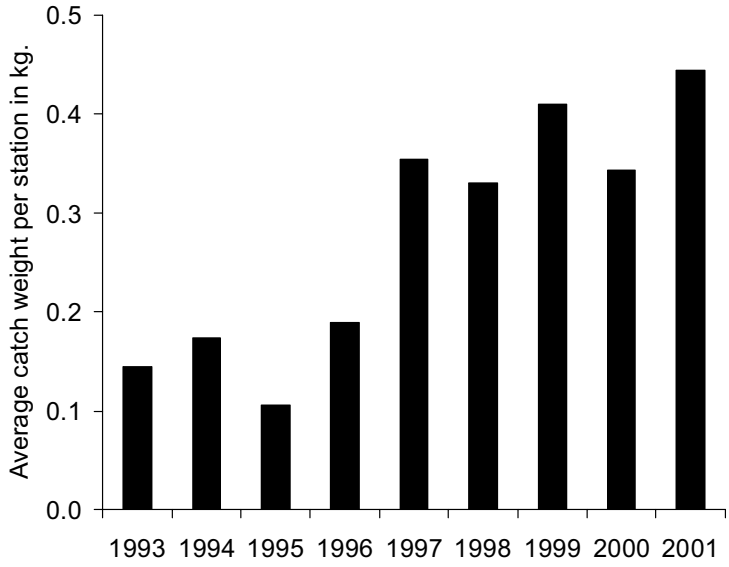
(c)


Numbers of fish
1000
800
600
400
200
0
0 5 10 15 20 25 30 35 40
Total length (cm)

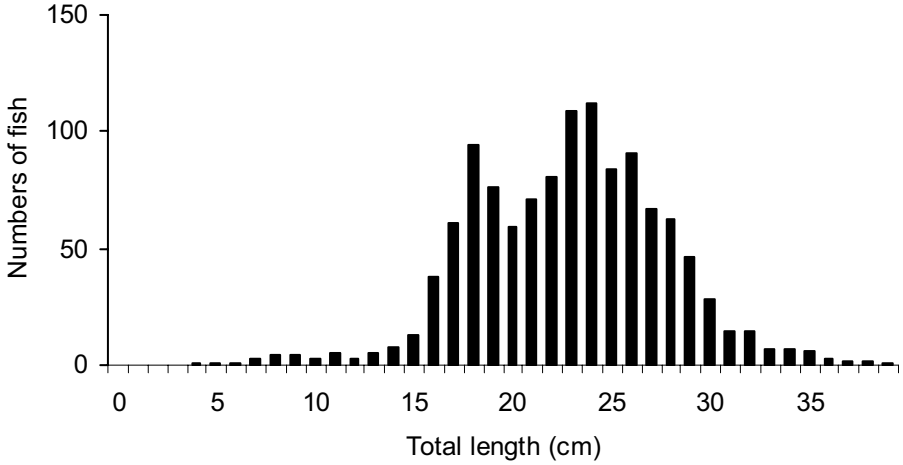
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 30 fish caught

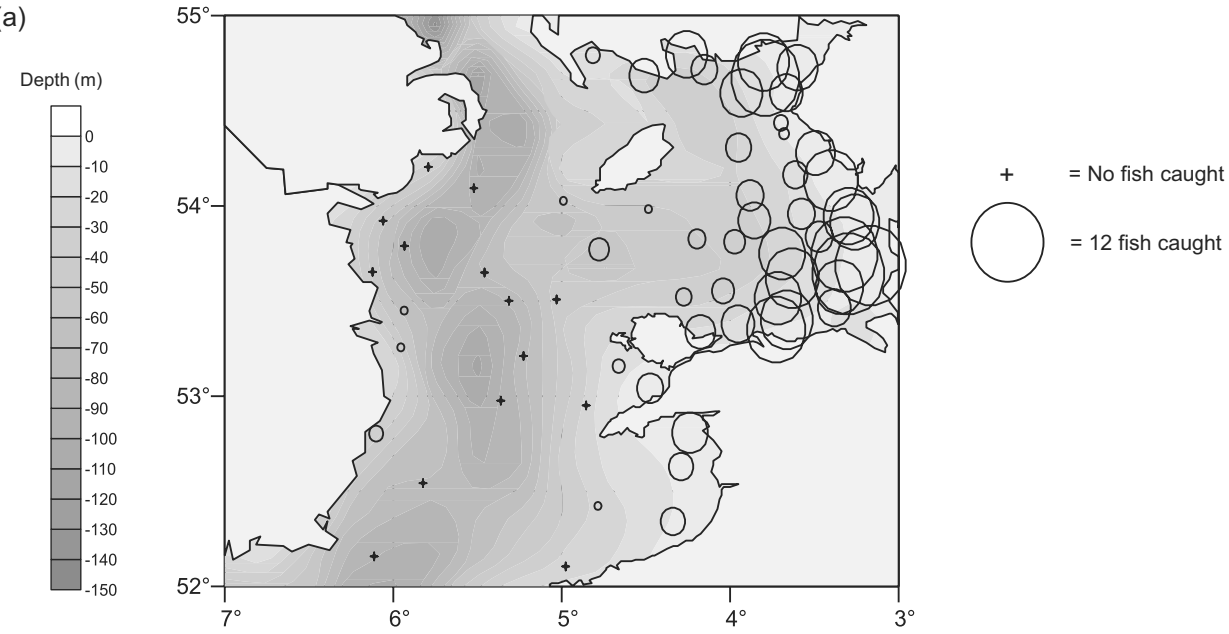
(b)


Average catch weight per station in kg.
0.5
0.4
0.3
0.2
0.1
0.0
1993 1994 1995 1996 1997 1998 1999 2000 2001

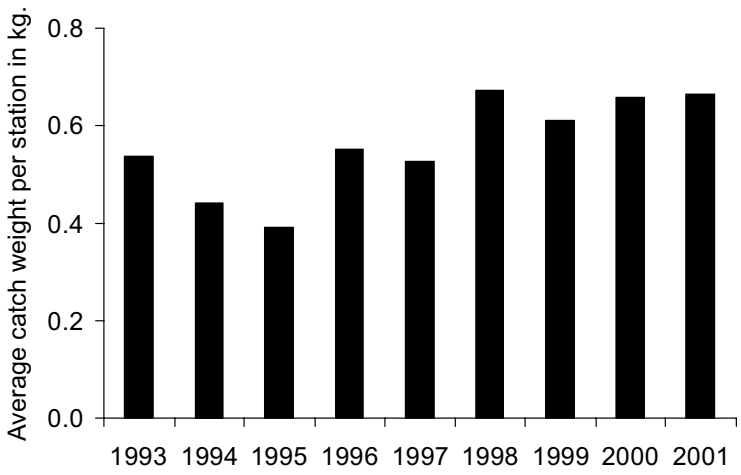
(c)


Numbers of fish
150
100
50
0
0 5 10 15 20 25 30 35
Total length (cm)

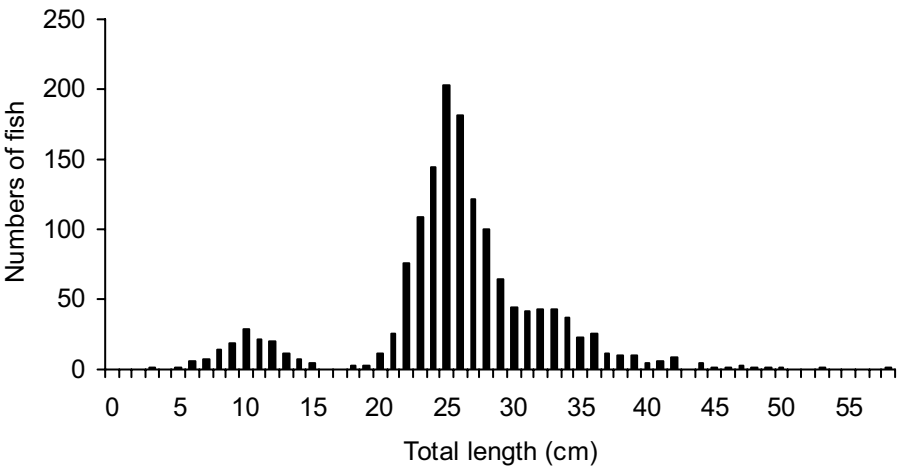
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 12 fish caught

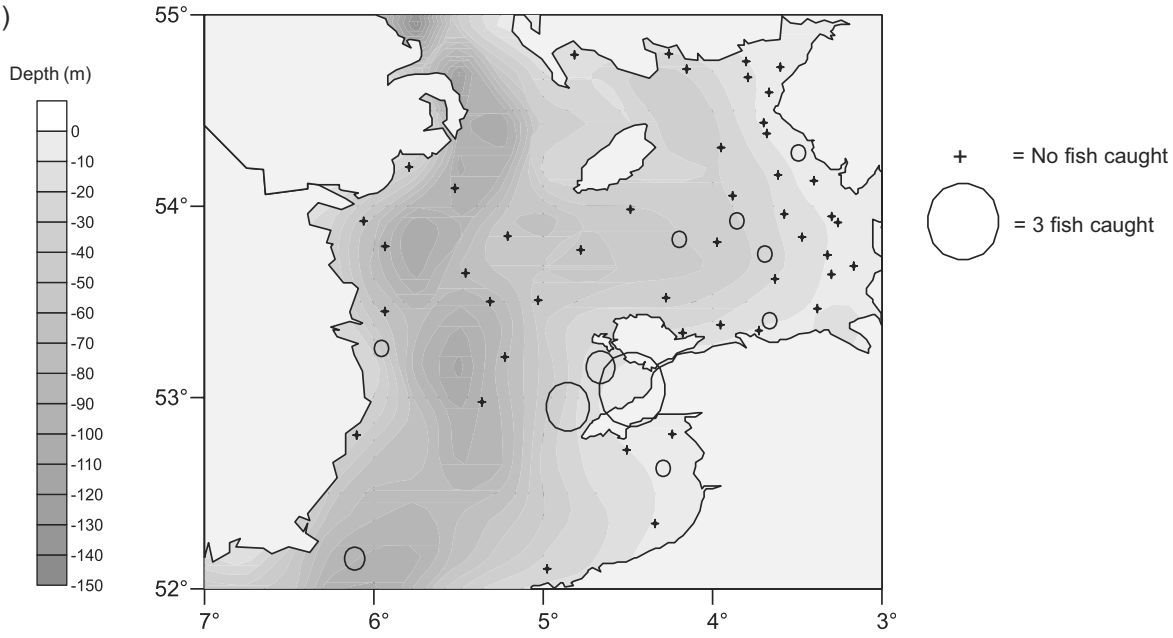
(b)


Average catch weight per station in kg.
0.0
0.2
0.4
0.6
0.8
1993 1994 1995 1996 1997 1998 1999 2000 2001

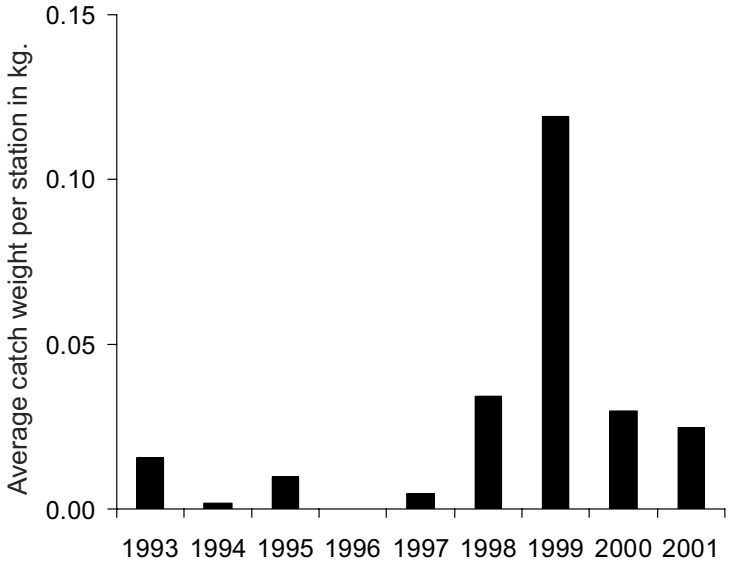
(c)


Numbers of fish
0
50
100
150
200
250
0 5 10 15 20 25 30 35 40 45 50 55
Total length (cm)

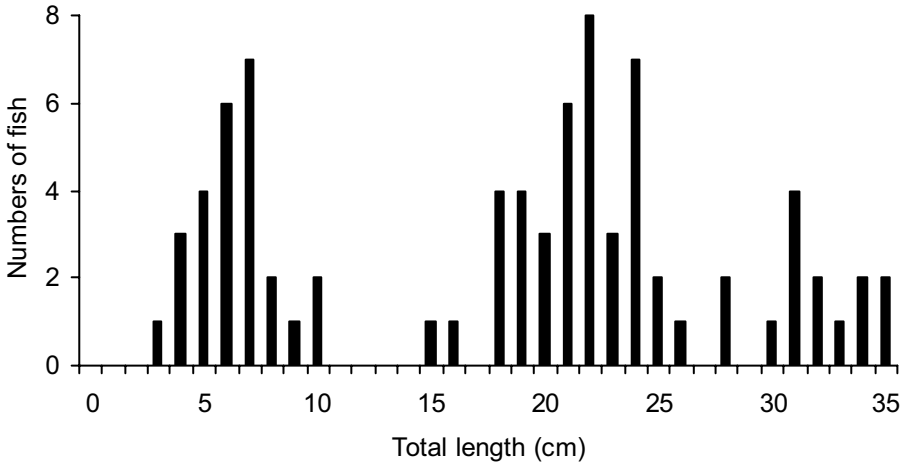
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 3 fish caught

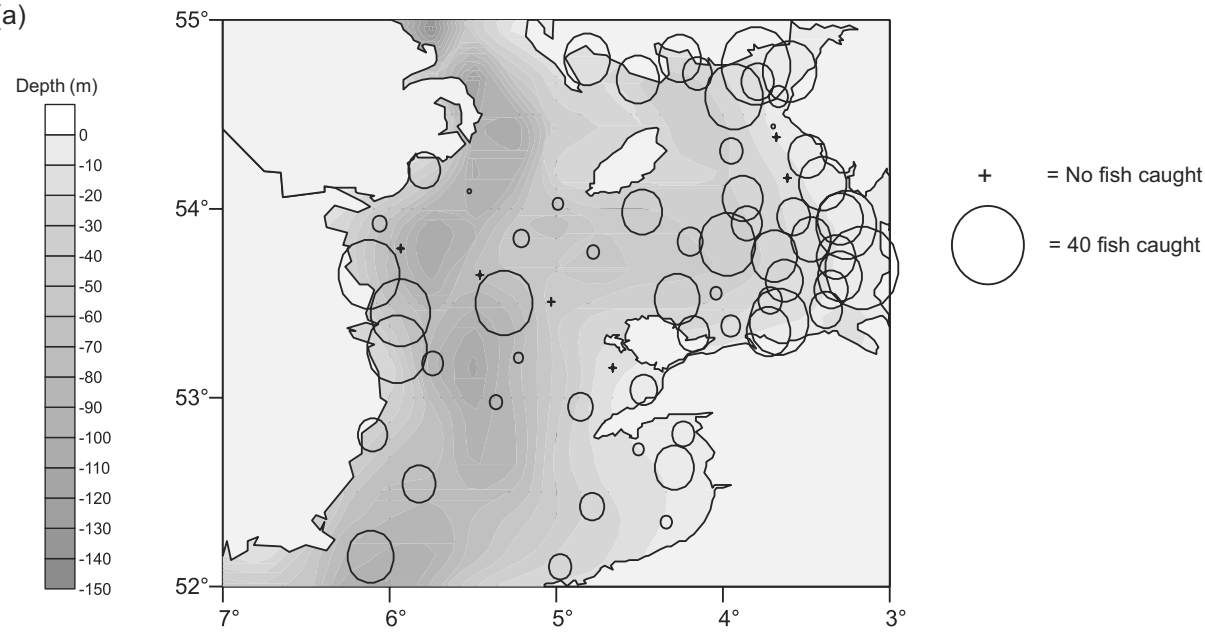
(b)


Average catch weight per station in kg.
0.15
0.10
0.05
0.00
1993 1994 1995 1996 1997 1998 1999 2000 2001

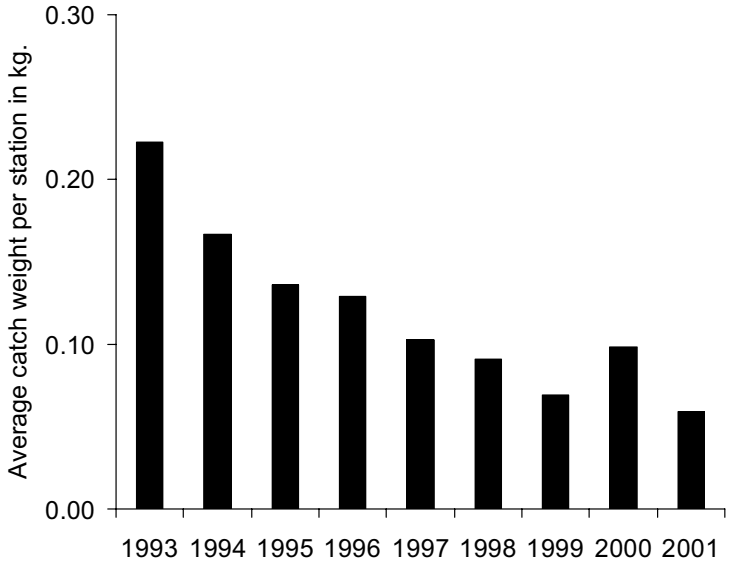
(c)


Numbers of fish
8
6
4
2
0
0 5 10 15 20 25 30 35
Total length (cm)

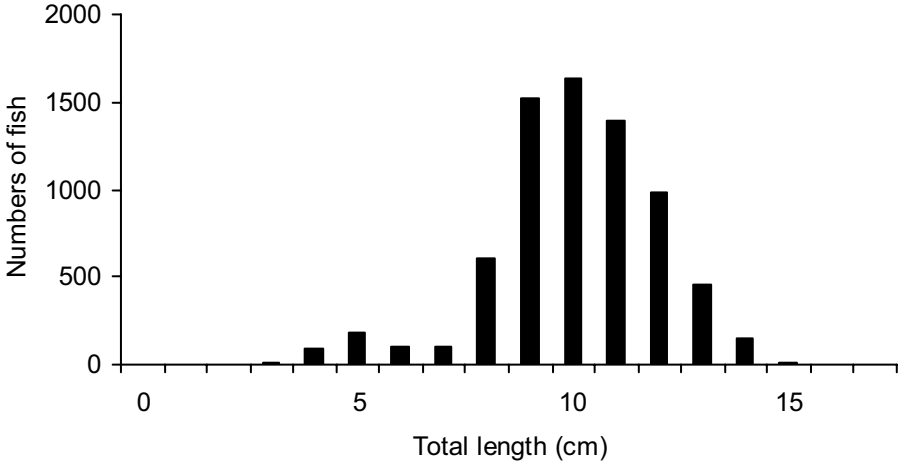
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 40 fish caught

(b)

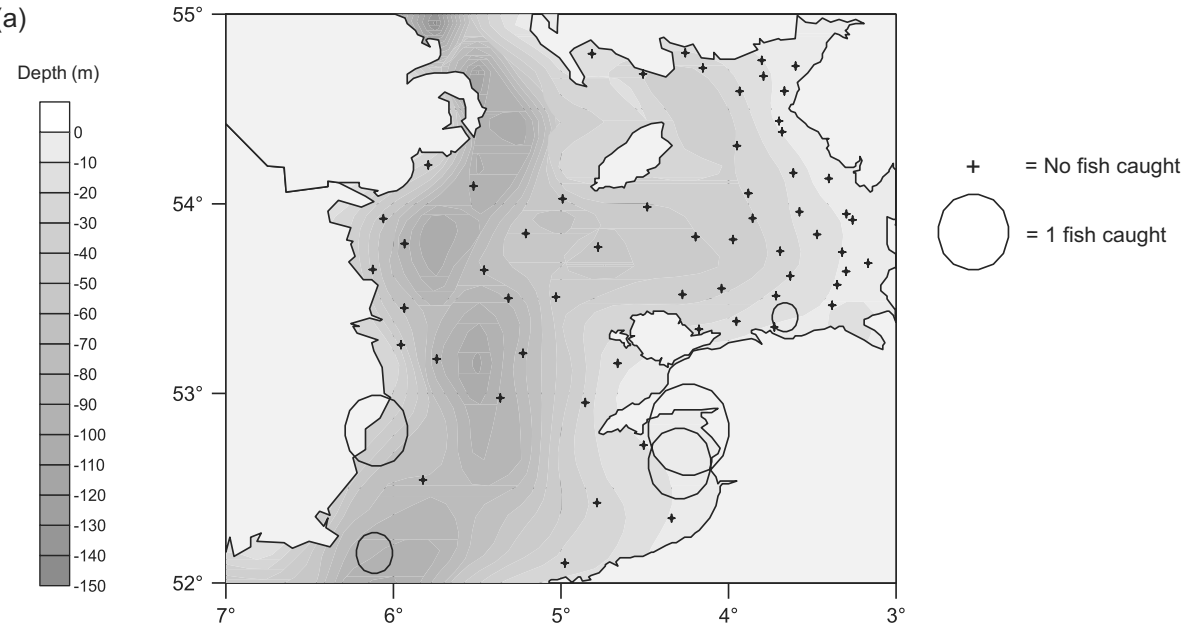

Average catch weight per station in kg.
0.30
0.20
0.10
0.00
1993 1994 1995 1996 1997 1998 1999 2000 2001

(c)

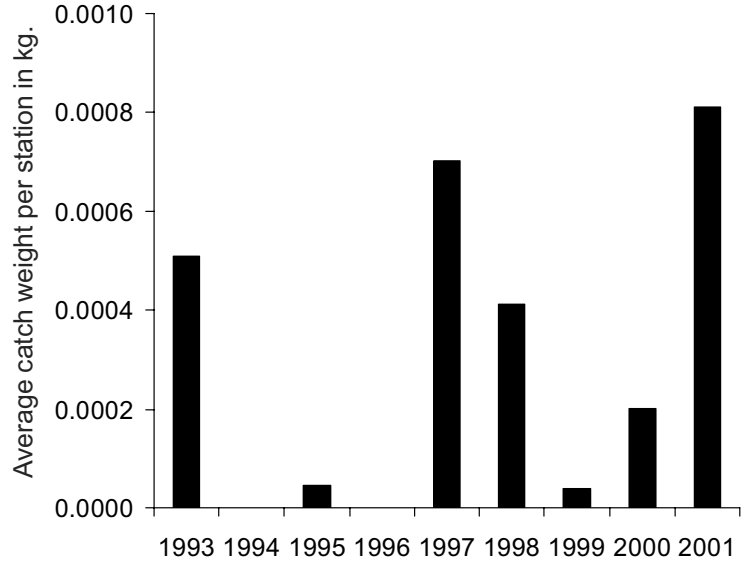

Numbers of fish
2000
1500
1000
500
0
0
5
10
15
Total length (cm)

Red mullet - *Mullus surmuletus*

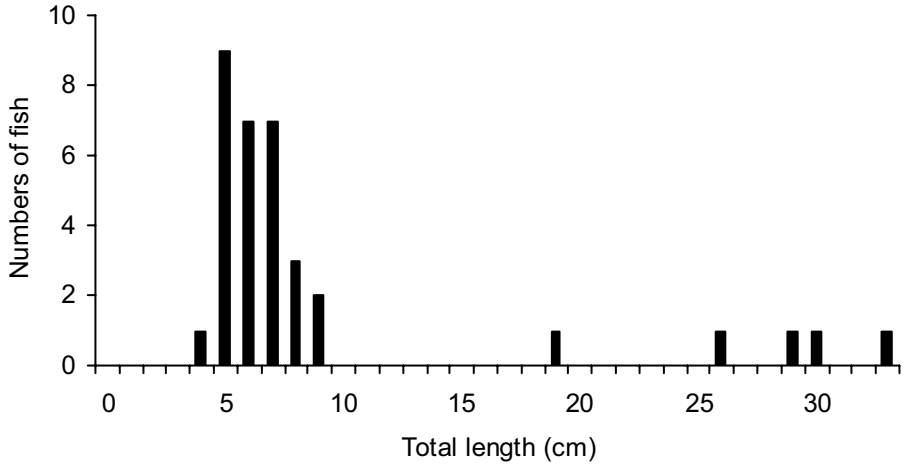
(a)



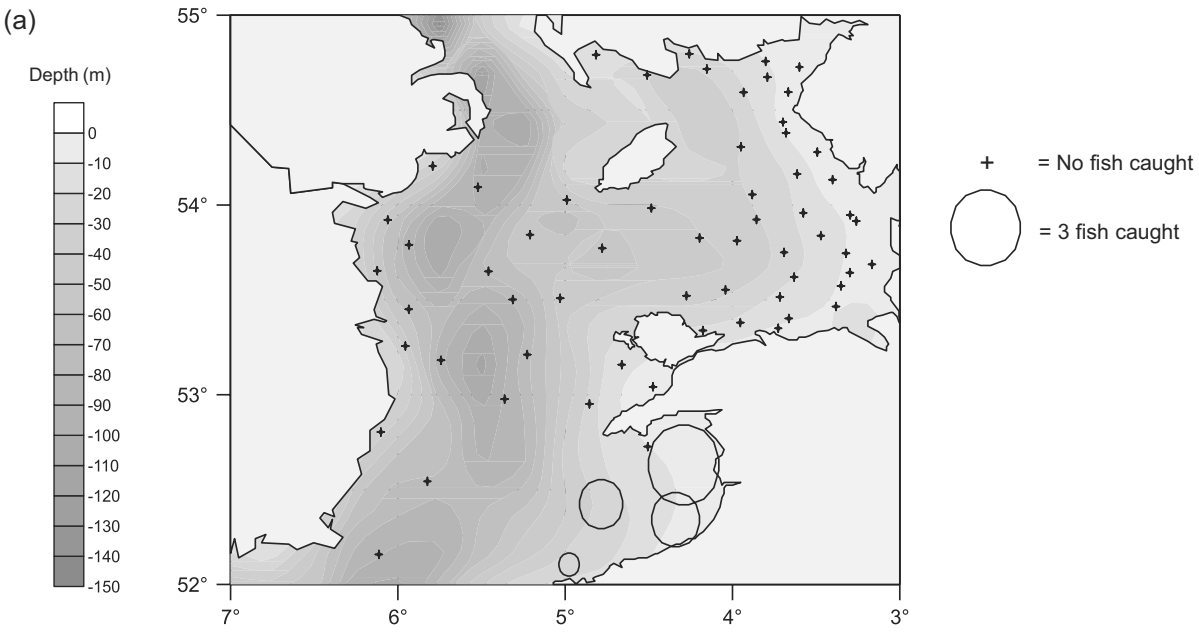
(b)



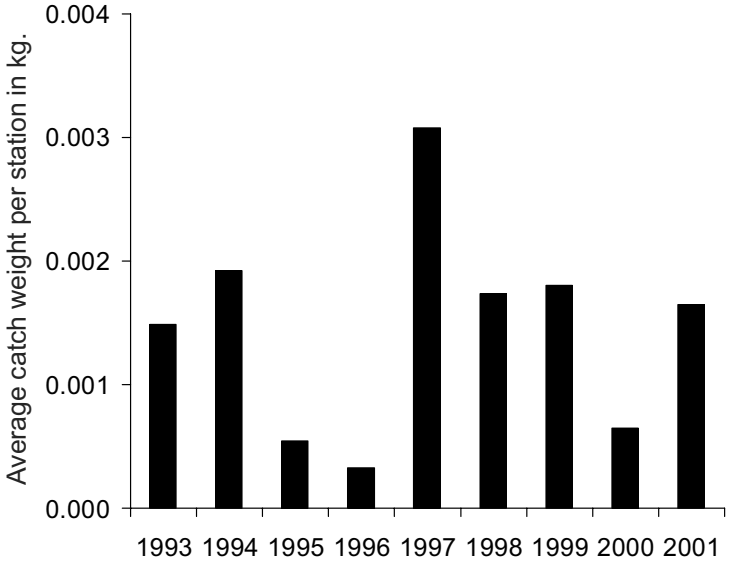
(c)



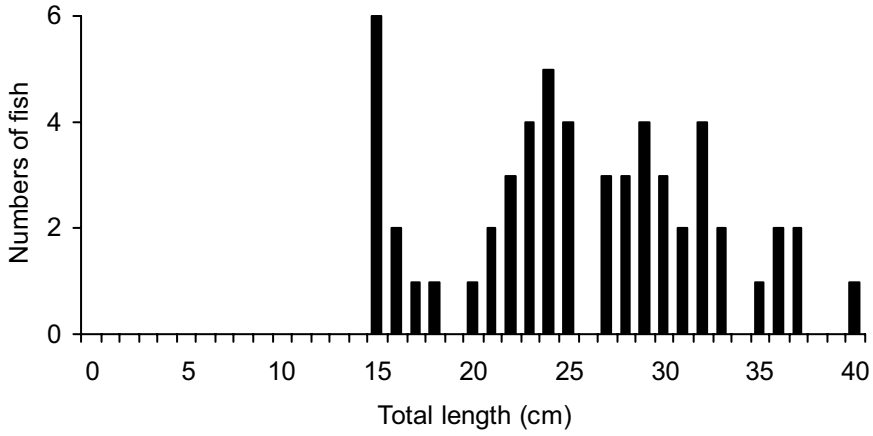
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 3 fish caught

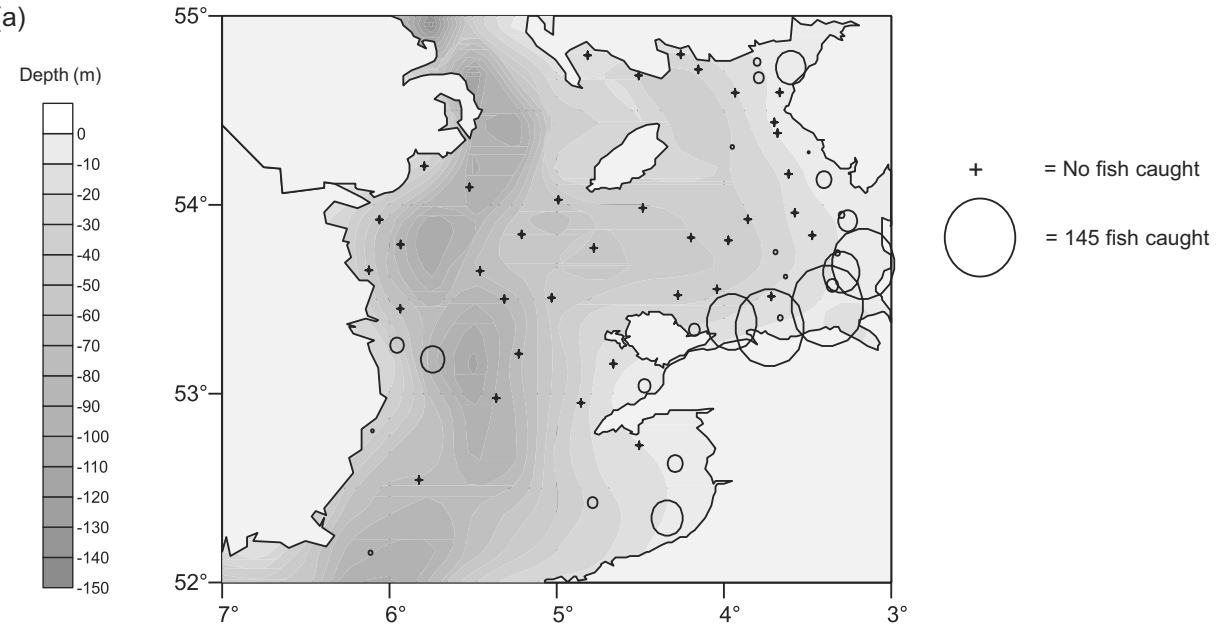
(b)


Average catch weight per station in kg.
0.004
0.003
0.002
0.001
0.000
1993 1994 1995 1996 1997 1998 1999 2000 2001

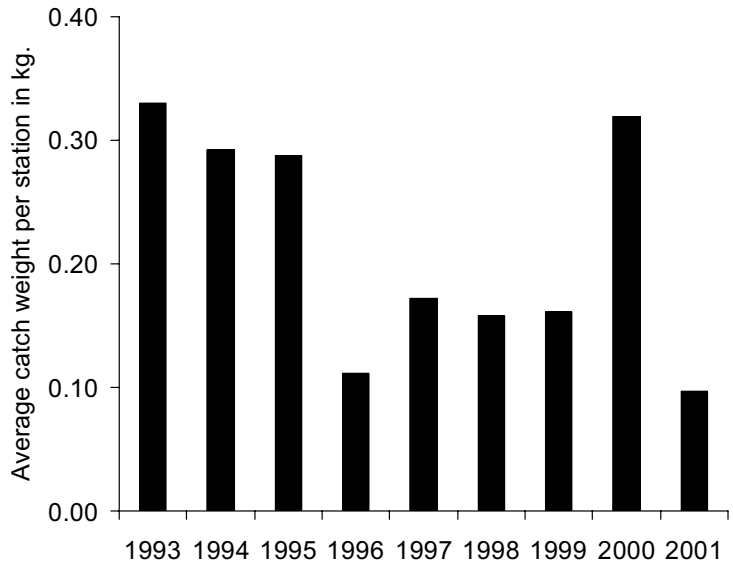
(c)


Numbers of fish
6
4
2
0
0 5 10 15 20 25 30 35 40
Total length (cm)

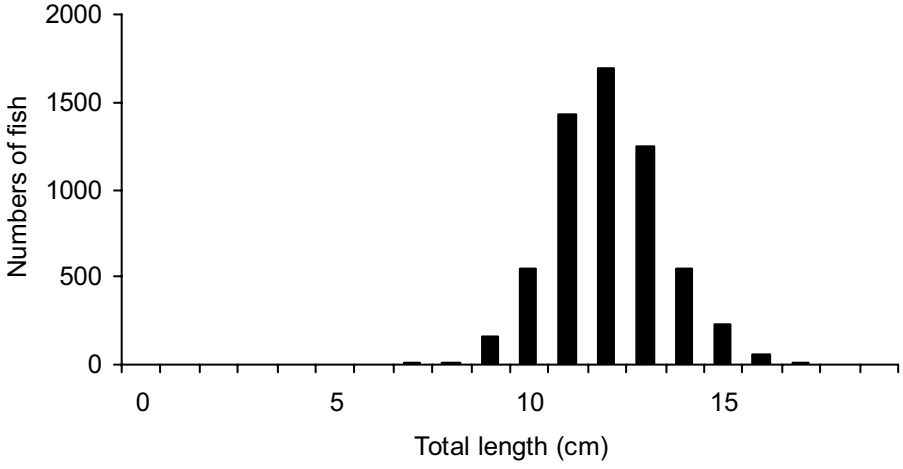
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = No fish caught
= 145 fish caught

(b)


Average catch weight per station in kg.
0.40
0.30
0.20
0.10
0.00
1993 1994 1995 1996 1997 1998 1999 2000 2001

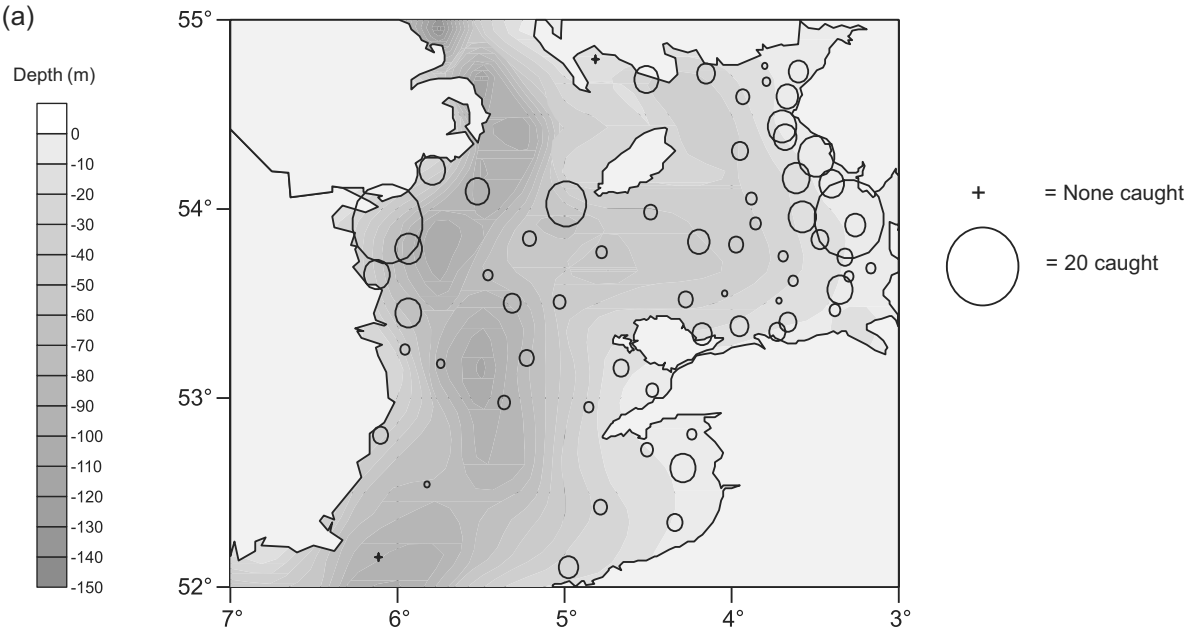
(c)


Numbers of fish
2000
1500
1000
500
0
0
5
10
15
Total length (cm)

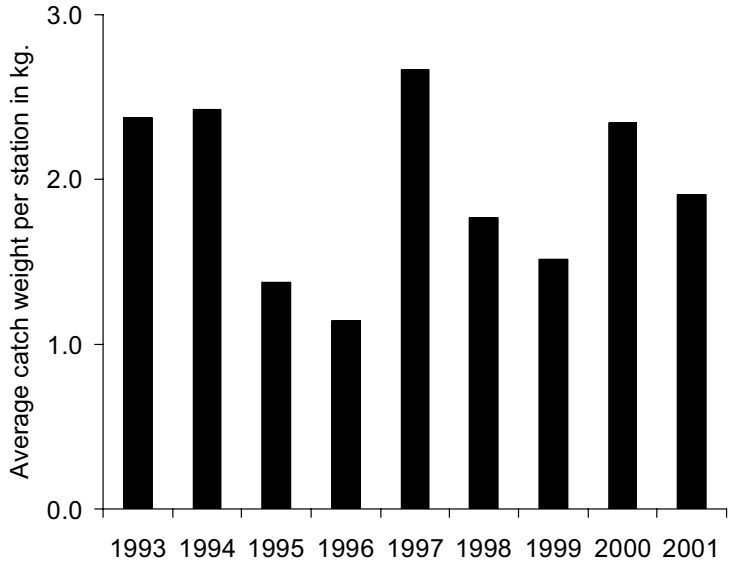
Invertebrate species

Edible crab - *Cancer pagurus*

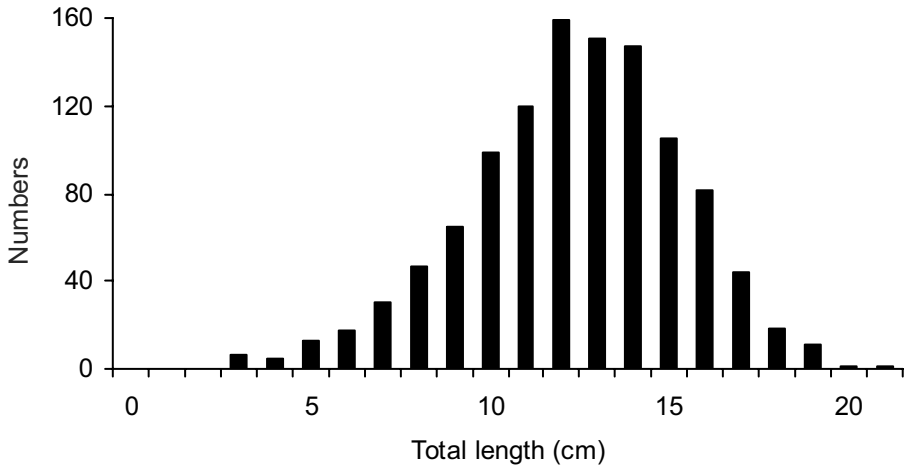
(a)



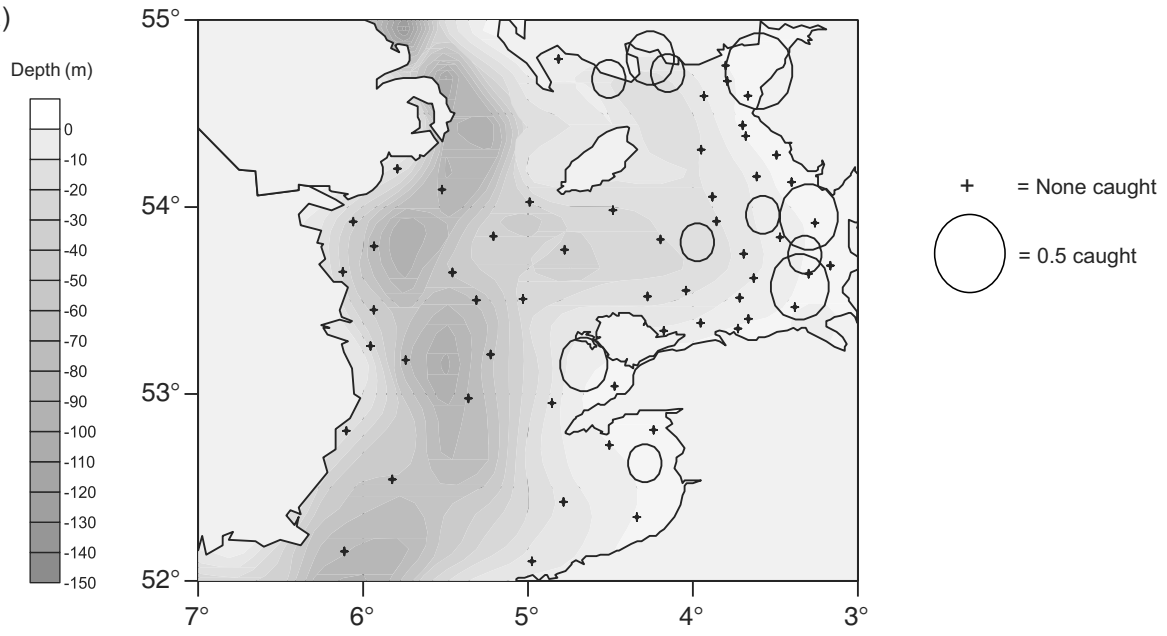
(b)



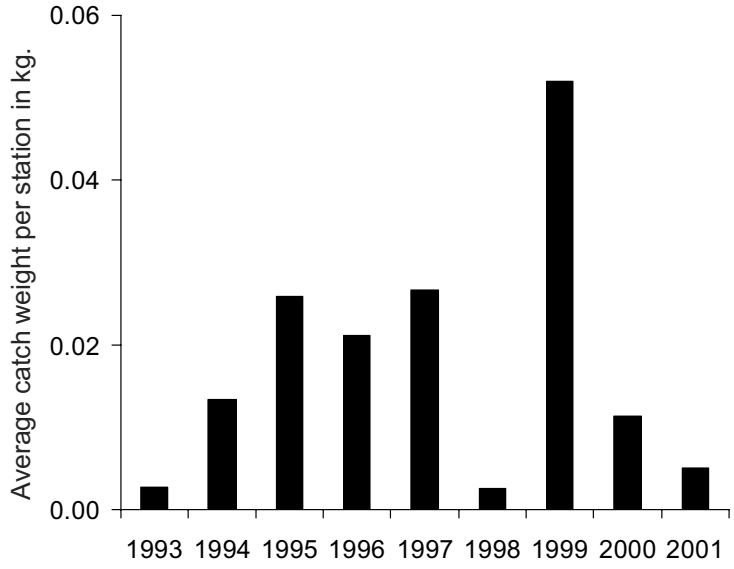
(c)



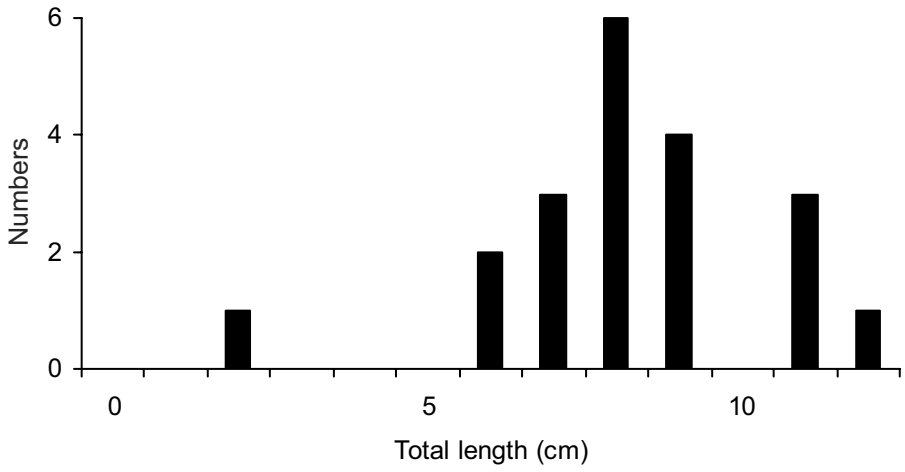
(a)


Depth (m)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
55°
54°
53°
52°
7°
6°
5°
4°
3°
+ = None caught
= 0.5 caught

(b)

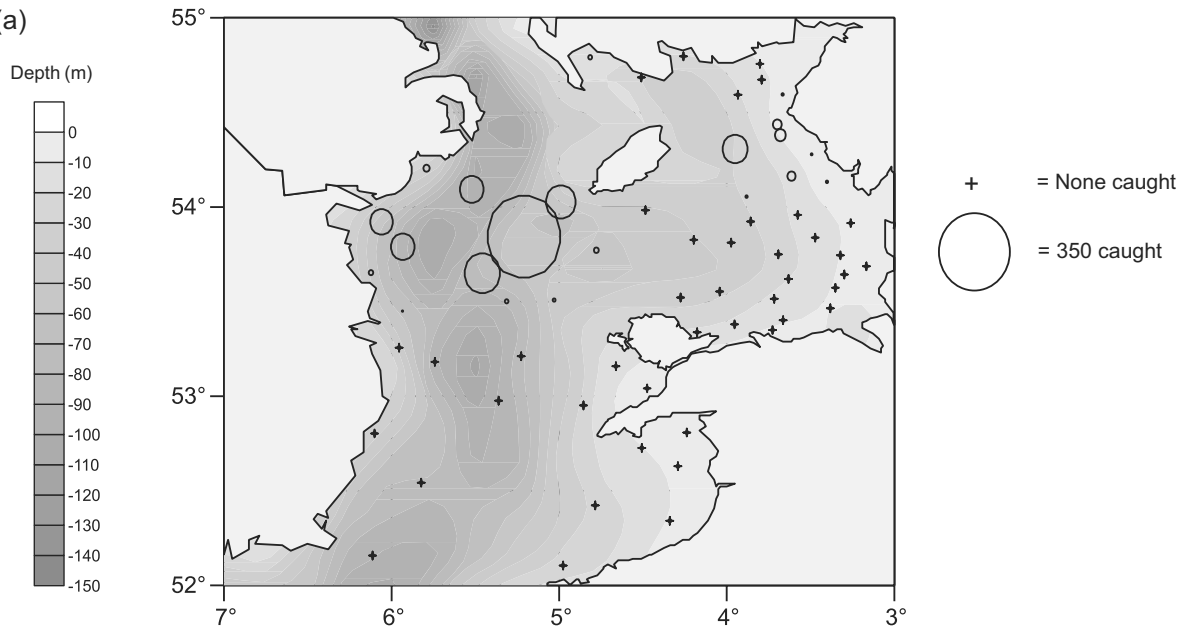

Average catch weight per station in kg.
0.06
0.04
0.02
0.00
1993 1994 1995 1996 1997 1998 1999 2000 2001

(c)

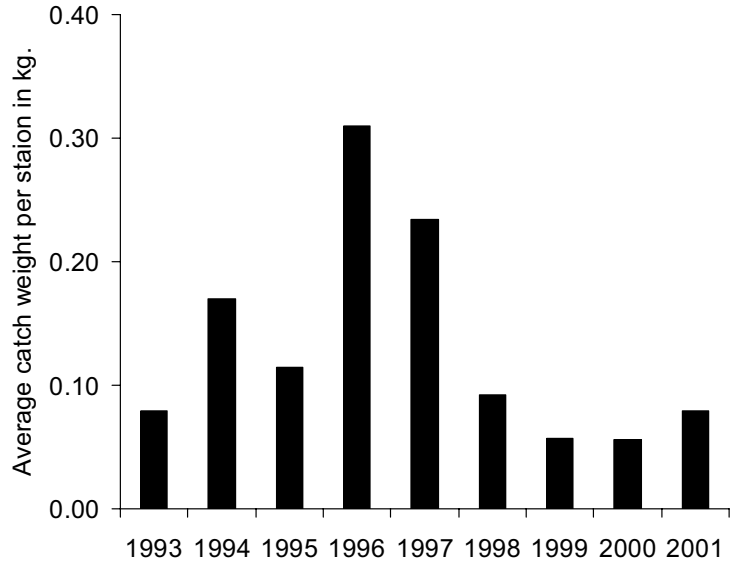

Numbers
6
4
2
0
0
5
10
Total length (cm)

Norway lobster - *Nephrops norvegicus*

(a)



(b)



(c)