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1. THE YOUNG FISH SURVEY (YFS)

Studies of the coastal waters of England and Wales in the early 1960s showed that the young stages of commercially important flatfish, particularly sole and plaice, could be found in inshore nursery grounds, but that there was no information on the size or extent of these populations. Preliminary surveys of the inshore waters of England between 1970 and 1972 revealed the general extent of these nursery grounds, and identified those areas of the coast which were particulary important for the survival and growth of young fish.

More thorough surveys of these small fish populations were undertaken throughout England and Wales in subsequent years (Riley, *et al*., 1986), and have continued to the present day . Annual indices of fish abundance derived from these surveys have been used during the assessment of the size of flatfish stocks, and information on the size and location of the most important nursery grounds has also been of value when considering potentially harmful developments in the coastal zone. In addition, data on the non-commercial species which are also caught in these surveys have been used to monitor the presence in UK waters of infrequent migratory species, and to assess the diversity of these coastal fish populations (Rogers and Millner, 1996).

2. SURVEY METHODS

Preliminary surveys of the east and south coast of England were undertaken in 1970 and 1971, and these were used as a basis for more thorough surveys in 1973 (east coast), 1974 (south coast), and 1979 (east coast). From 1981 to 1997, stations on both coasts were sampled annually, during September, and a consistent dataset was produced. The coast was divided into 15 sectors on the basis of major geographical features such as bays and estuaries (Figure 1) and, within these, fixed fishing station positions were distributed within each of four depth bands, 0-1.9 m, 2-5.9 m, 6-11.9 m, and 12-20 m. Stations were most frequent in depth bands where common flatfish species were caught in largest numbers. Between 1981 and 1997, a total of 6267 stations were fished on the east and south coast of England (Table 1).

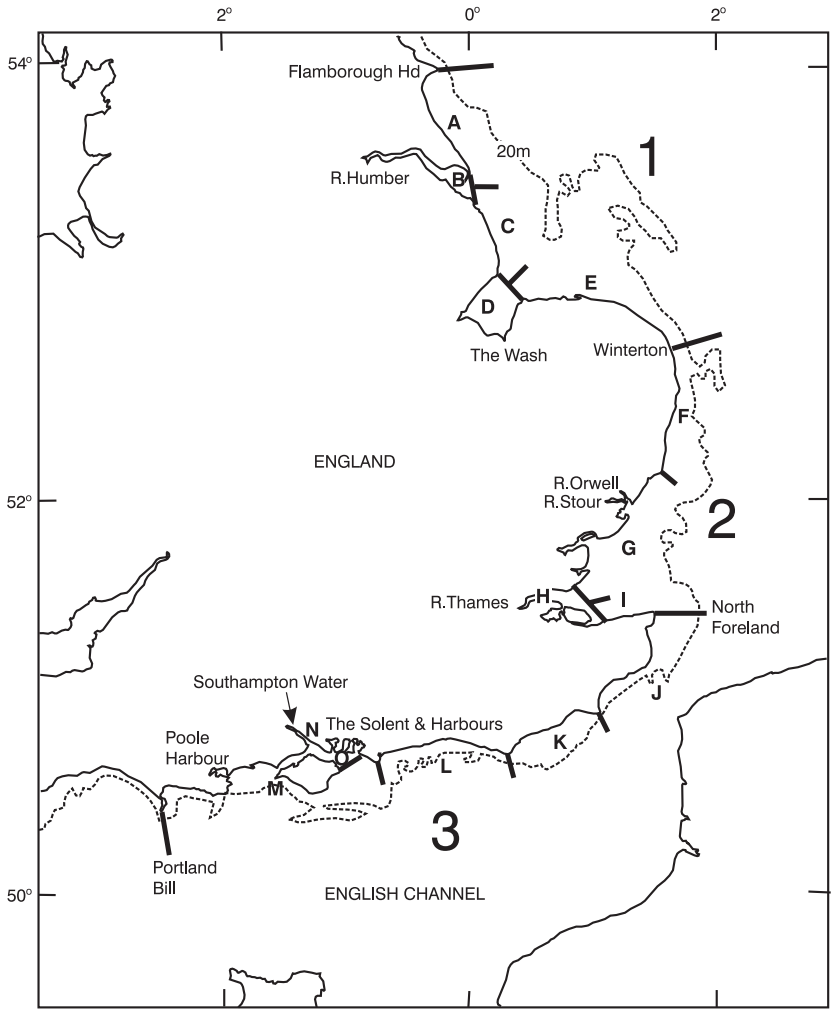


Figure 1. Map of the study area showing the three numbered regions delimited by long bold lines, 15 lettered sectors delimited by shorter lines, and place names referred to in the text. The 20 m depth contour is shown

Table 1. The area of each depth band (million m^2) in each survey region, with the total number of beam trawl and push net stations fished in each year 1981-97

Year	Region														
	1					2					3				
	Depthband					Depthband					Depthband				
	0-1.9 m	2-5.9 m	6-11.9 m	12-20m	**Total**	0-1.9 m	2-5.9 m	6-11.9 m	12-20m	**Total**	0-1.9 m	2-5.9 m	6-11.9 m	12-20m	**Total**
Area (million m^2)	166.52	478.89	1178.13	2423.79	**4247.33**	305.97	617.35	774.23	1050.20	**2747.75**	19.40	41.64	96.12	193.27	**350.43**
1981	28	27	25	4	**84**	17	34	34	20	**105**	65	42	30	17	**154**
1982	24	30	32	12	**98**	24	34	32	17	**107**	63	42	33	20	**158**
1983	26	28	33	10	**97**	20	30	36	12	**98**	29	21	22	8	**80**
1984	28	36	27	11	**102**	18	42	34	15	**109**	47	38	36	18	**139**
1985	10	22	17	9	**58**	28	34	46	24	**132**	45	29	25	22	**121**
1986	16	17	17	8	**58**	15	39	54	16	**124**	46	37	45	20	**148**
1987	13	20	19	6	**58**	19	51	31	24	**125**	45	42	38	18	**143**
1988	21	29	37	12	**99**	26	45	34	22	**127**	47	28	41	26	**142**
1989	23	30	33	11	**97**	16	33	44	21	**114**	35	47	44	28	**154**
1990	25	42	35	7	**109**	22	41	47	21	**131**	52	56	33	29	**170**
1991	26	43	34	8	**111**	33	51	37	18	**139**	40	58	38	32	**168**
1992	21	33	44	8	**106**	32	51	39	21	**143**	47	46	34	27	**154**
1993	20	48	36	6	**110**	35	53	39	18	**145**	59	50	43	21	**173**
1994	18	37	37	5	**97**	29	56	38	23	**146**	50	56	33	29	**168**
1995	7	32	43	13	**95**	8	41	58	23	**130**	9	63	48	38	**158**
1996	7	29	43	9	**88**	13	41	68	19	**141**	11	58	62	40	**171**
1997	8	19	47	7	**81**	10	40	70	22	**142**	6	62	50	42	**160**
Regional station totals	**321**	**522**	**559**	**146**	**1548**	**365**	**716**	**741**	**336**	**2158**	**696**	**775**	**655**	**435**	**2561** **6267**

The two fishing gears used during the surveys, the 2 m beam trawl and 1.5 m push net, have been widely used in Europe during surveys of juvenile fish populations in inshore waters up to the low tide mark. They were designed to have similar efficiency and selectivity so that the catches of fish per unit area from each gear could be directly compared. Both push net and beam trawl used a fine mesh net with a cod-end liner of 4 mm knotless mesh, a light chain footrope and three tickler chains stretched loosely between the shoes. The push net was operated at low water mark in water of 0-1 m depth, while the beam trawl was deployed from a small boat in water depths from approximately 1 m up to a maximum depth of 20 m. Both gears passed over the ground at a speed of approximately 1 knot, or 35 m per minute. The distance covered by the beam trawl was recorded by an odometer attached to its shoe, or by using the distance travelled determined by GPS. The distance fished by the push net was measured along the beach.

At each station, all fish caught were identified to species wherever possible and measured to the half centimetre below. The length frequency distributions of sole and plaice were used to estimate the age composition as 0-group, 1-group and 2+-group. The catch numbers of each species and age group were then converted to relative densities (numbers per 1000 m^2) based on the swept area of each gear. The fishing gears normally only catch small fish below a total body length of approximately 150 mm, although larger fish were occasionally caught. During September, the majority of newly metamorphosed fish occupy shallow nursery grounds in high abundance. Later in the year the high levels of predation experienced by these small fish, and the tendancy for developing fish to move into deeper water, result in lower catch rates. The efficiency of the gears for these small fish is not known, but it varies with both species and body size. It is greatest for the juvenile flatfish which are the target of the survey, and least for the more mobile and larger bodied roundfish.

3. THE SURVEY AREA

In this report, 15 coastal sectors have been grouped into three major coastal regions, 1 - the northeast coast of England between Flamborough Head and Winterton, including the estuary of the River Humber, 2 - The east coast including the estuarine areas of the Rivers Thames, Orwell and Stour between Winterton and North Foreland, and 3 - the south coast of England between North Foreland and Portland Bill, including the Solent and associated Harbours (Figure 1).

4. SPECIES RECORDED

Fish species from 39 families have been recorded since 1981 (Table 2). Those species which comprise the bottom-dwelling small fish community are shown. Occasional mid-water species which would not normally be considered as typical of this community, and for which catch efficiency is presumed to be low, are listed, but the distribution of these species is not described here. Catches have been combined for some genera for which there was a risk of incorrect species identification in the field, or where identification was incomplete. For example, the dragonets *Callionymus reticulatus* and *C. lyra* are combined into the Callionymidae, and the sand goby *Pomatoschistus minutus*, common goby *P. microps*, Norway goby *P. norvegicus* and the painted goby *P. pictus*, are combined into the *Pomatoschistus* spp.

The percentage occurrence of bottom-dwelling species and taxa caught since 1981 (Table 3) shows that relatively few species dominate the catches, while the majority occur in fewer than 40% of samples. Particularly infrequent species include those of southern origin such as the big-scale sand-smelt *Atherina boyeri* and the undulate ray *Raja undulata*, and boreal species such as the Norway haddock *Sebastes viviparus*. In Table 3, species are grouped in order to illustrate that the inshore fish community on the south coast of England (sector 3) includes a wider range of species than that of the north-east coast (sector 1).

The temperature and salinity of the surface water were recorded at each station, and the mean values for each region in each year are shown in Figure 2.

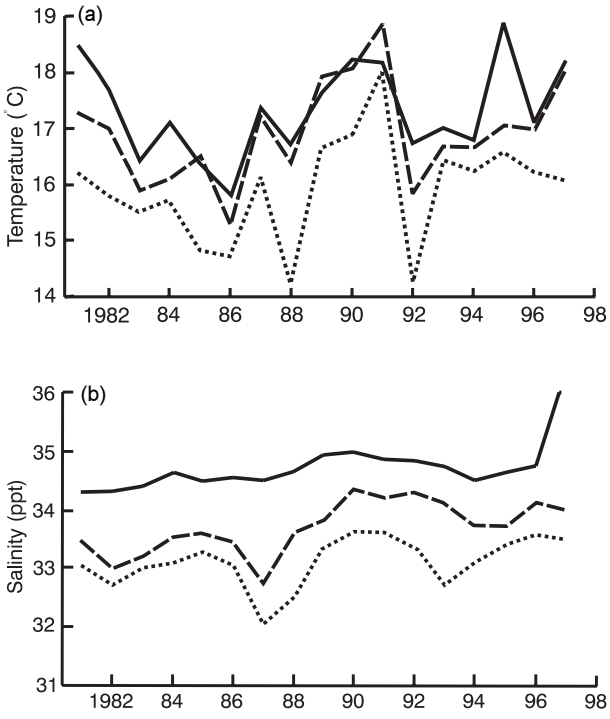


Figure 2. (a) Mean surface water temperature and (b) mean surface salinity from all fishing stations on the northeast coast (dashed line), east coast (long-dashed line), and south coast (continuous line)

Table 2. All fish species caught during the surveys, with their taxonomic hierarchy. Those species which are considered to be well sampled by the trawls, i.e. they have a generally bottom-dwelling habit (S) are marked by (*). Those species for which a figure has been provided (F) are marked by (*)

Order	Family	Common name	Latin name	S	F
Carcharhiniformes	SCYLIORHINIDAE	lesser spotted dogfish	*Scyliorhinus canicula*	*	*
Squaliformes	SQUALIDAE	spurdog	*Squalus acanthias*	*	
Rajiformes	RAJIDAE	blonde ray	*Raja brachyura*	*	
		thornback ray	*Raja clavata*	*	*
		small-eyed ray	*Raja microocellata*	*	
		spotted ray	*Raja montagui*	*	*
		undulate ray	*Raja undulata*	*	*
		starry ray	*Raja radiata*	*	*
	TRIAKIDAE	smooth hound	*Mustelus mustelus*	*	
		starry smooth hound	*Mustelus asterias*	*	
Anguilliformes	ANGUILLIDAE	eel	*Anguilla anguilla*	*	*
	CONGRIDAE	Conger eel	*Conger conger*	*	
Clupeiformes	CLUPEIDAE	herring	*Clupea clupea*		
		sprat	*Sprattus sprattus*		
	OSMERIDAE	smelt	*Osmerus eperlanus*		*
Gadiiformes	GADIDAE	cod	*Gadus morhua*	*	*
		whiting	*Merlangius merlangus*	*	*
		poor cod	*Trisopterus minutus*	*	*
		bib	*Trisopterus luscus*	*	*
		pollack	*Pollachius pollachius*	*	*
		saithe	*Pollachius virens*		
		five-bearded rockling	*Ciliata mustela*	*	*
		four-bearded rockling	*Enchelyopus cimbrius*	*	*
		three-bearded rockling	*Gaidropsarus vulgaris*	*	
Zeiformes	ZEIDAE	John dory	*Zeus faber*	*	
Gasterosteiformes	GASTEROSTEIDAE	stickleback	*Gasterosteus aculeatus*	*	*
		fifteen-spined stickleback	*Spinachia spinachia*	*	*
		nine-spined stickleback	*Pungitius pungitius*	*	
	SYNGNATHIDAE	greater pipefish	*Syngnathus acus*	*	*
		Nilsson's pipefish	*Syngnathus rostellatus*	*	*
		deep-snouted pipefish	*Syngnathus typhle*	*	*
		worm pipefish	*Nerophis lumbriciformis*	*	*
		straight-nosed pipefish	*Nerophis ophidion*	*	
		snake pipefish	*Entelurus aequoreus*	*	*
Perciformes	CARANGIDAE	horse mackerel	*Trachurus trachurus*		
	SPARIDAE	black sea-bream	*Spondyliosoma cantharus*	*	*
	MULLIDAE	red mullet	*Mullus surmuletus*	*	*
	PERCICHTHYIDAE	sea bass	*Dicentrarchus labrax*	*	*
	LABRIDAE	cuckoo wrasse	*Labrus mixtus*	*	*
		ballan wrasse	*Labrus bergylta*	*	*
		rock cook	*Centrolabrus exoletus*	*	
		goldsinny	*Ctenolabrus rupestris*	*	*
		corkwing wrasse	*Crenilabrus melops*	*	*
		rainbow wrasse	*Coris julis*	*	
	AMMODYTIDAE	sand eel	*Ammodytes sp*	*	*

Table 2. continued.

Order	Family	Common name	Latin name	S	F
Perciformes *(continued)*	TRACHINIDAE	lesser weever	*Echiichthys vipera*	*	*
	ZOARCIDAE	viviparous blenny	*Zoarces viviparus*	*	*
	PHOLIDAE	butterfish	*Pholis gunnellus*	*	*
	STICHAEIDAE	snake blenny	*Lumpenus lampretaeformis*	*	
	BLENNIIDAE	butterfly blenny	*Blennius ocellaris*	*	
		shanny	*Lipophrys pholis*	*	
	GOBIESOCIDAE	two-spotted clingfish	*Diplecogaster bimaculata*	*	*
		small-headed clingfish	*Apletodon microcephalus*	*	
	CALLIONYMIIDAE	dragonets	*Callionymus spp.*	*	*
	GOBIIDAE	rock goby	*Gobius paganellus*	*	*
		black goby	*Gobius niger*	*	*
		giant goby	*Gobius cobitis*	*	*
		sand gobies	*Pomatoschistus sp.*	*	*
		two-spotted goby	*Gobiusculus flavescens*	*	*
		crystal goby	*Crystallogobius linearis*		
		transparent goby	*Aphia minuta*		*
		leopard-spotted goby	*Thorogobius ephippiatus*	*	
Atheriniformes	ATHERINIDAE	sand smelt	*Atherina presbyter*		*
		big-scale sand smelt	*Atherina boyeri*		
Pleuronectiformes	SOLEIDAE	sole	*Solea solea*	*	*
		sand sole	*Pegusa lascaris*	*	*
		solenette	*Buglossidium luteum*	*	*
		thick back sole	*Microchirus variegatus*	*	
	PLEURONECTIDAE	plaice	*Pleuronectes platessa*	*	*
		flounder	*Platichthys flesus*	*	*
		dab	*Limanda limanda*	*	*
		lemon sole	*Microstomus kitt*	*	*
		long rough dab	*Hippoglossoides platessoides*	*	
	SCOPHTHALMIDAE	brill	*Scophthalmus rhombus*	*	*
		turbot	*Scophthalmus maximus*	*	*
	BOTHIDAE	scaldfish	*Arnoglossus laterna*	*	*
Scorpaeniformes	SCORPAENIDAE	Norway haddock	*Sebastes viviparus*	*	
	TRIGLIDAE	tub gurnard	*Trigla lucerna*	*	*
		red gurnard	*Aspitrigla cuculus*	*	
		grey gurnard	*Eutrigla gurnardus*	*	*
	COTTIDAE	bull-rout	*Myoxocephalus scorpius*	*	*
		sea scorpion	*Taurulus bubalis*	*	*
	AGONIDAE	pogge	*Agonus cataphractus*	*	*
	CYCLOPTERIDAE	lump sucker	*Cyclopterus lumpus*	*	
	LIPARIDAE	sea snail	*Liparis liparis*	*	*
		Montagu's sea-snail	*Liparis montagui*	*	
Mugiliformes	MUGILIDAE	thick lipped mullet	*Chelon labrosus*	*	
		golden grey mullet	*Liza aurata*	*	

Table 3. The distribution of demersal fish by sector within three coastal regions, shown by their percentage occurrence in each sector (number of stations in which the species occurred / total number of stations in the sector, 1981-97). ('+' = <9%, '1' = 10-39%, '2' = 40-59% and '3' = >60%)

		Region	1					2				3					
		Sector	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
viviparous blenny	*Zoarces viviparus*		+	+	+	1	+	+	+	+	+	.	.	.	.	.	.
lesser spotted dogfish	*Scyliorhinus canicula*		.	.	.	.	.	+	+	+	.	+	+	.	.	.	.
lemon sole	*Microstomus kitt*		.	.	+	+	+	+	+	+	+	+	+	.	.	.	.
cod	*Gadus morhua*		+	+	+	+	+	+	+	+	+	+	+	.	.	.	.
thick lipped mullet	*Chelon labrosus*		.	.	.	+	.	.	.	.	.	.	+	.	+	.	.
sea-snail	*Liparis liparis*		+	1	2	1	1	1	1	1	+	.	+	+	+	+	.
grey gurnard	*Eutrigla gurnardus*		1	+	1	1	1	+	+	+	+	+	+	+	+	+	.
poor cod	*Trisopterus minutus*		+	.	+	+	+	+	+	1	+	1	1	+	+	+	.
scaldfish	*Arnoglossus laterna*		1	+	+	+	+	+	.	.	.	+	1	1	+	+	.
spotted ray	*Raja montagui*		+	+	+	+	+	+	+	.	.	+	+	1	+	+	.
four-bearded rockling	*Enchelyopus cimbrius*		.	.	+	.	.	.	+	.	+	.	.	+	+	+	+
Montagu's sea-snail	*Liparis montagui*		+	.	+	.	.	.	.	.	.	.	.	+	.	+	+
turbot	*Scophthalmus maximus*		1	+	1	+	1	+	+	+	.	+	+	.	+	+	+
sand eel family	*Ammodytidae*		1	1	1	1	1	+	+	+	+	+	+	+	+	+	+
bull-rout	*Myoxocephalus scorpius*		+	+	+	+	+	+	+	+	+	+	.	+	.	+	+
sand goby family	*Pomatoschistus spp.*		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
dab	*Limanda limanda*		3	1	3	3	3	2	3	3	2	3	3	3	1	1	1
dragonet family	*Callionymidae*		2	+	2	1	1	1	1	2	1	3	3	2	2	3	2
Nilsson's pipefish	*Syngnathus rostellatus*		1	1	2	3	3	1	1	1	2	1	1	3	1	1	1
plaice (0-group)	*Pleuronectes platessa*	*0-grp*	3	2	2	3	2	1	2	2	3	3	2	1	1	1	2
plaice (1-group)		*1-grp*	2	1	2	2	2	1	1	2	1	1	1	1	1	1	1
plaice (2-group)		*2+-grp*	1	+	+	+	+	+	1	1	+	1	1	1	+	+	+
sole (0-group)	*Solea solea*	*0-grp*	+	1	2	2	2	3	3	3	2	3	2	1	1	1	2
sole (1-group)		*1-grp*	+	1	1	1	1	1	2	1	1	2	1	1	1	1	1
sole (2-group)		*2+-grp*	+	1	1	+	+	1	1	1	1	1	1	1	1	+	1
five-bearded rockling	*Ciliata mustela*		+	+	+	+	+	1	+	+	1	1	+	+	+	+	1
lesser weever	*Echiichthys vipera*		3	1	1	1	1	1	+	+	+	1	2	+	1	1	+
whiting	*Merlangius merlangus*		1	2	2	3	1	2	2	1	2	1	+	1	+	+	+
butterfish	*Pholis gunnellus*		+	+	1	1	1	+	+	+	+	+	+	+	+	+	+
pogge	*Agonus cataphractus*		1	1	2	2	1	2	1	2	1	2	1	+	+	1	+
thornback ray	*Raja clavata*		+	+	1	+	+	+	1	1	+	1	1	1	1	+	+
flounder	*Platichthys flesus*		+	1	+	+	+	+	+	+	1	+	+	1	+	+	1
greater pipefish	*Syngnathus acus*		+	.	+	+	+	+	1	+	+	1	1	+	1	1	2
sea scorpion	*Taurulus bubalis*		+	.	+	+	+	+	.	+	+	+	+	1	+	1	1
solenette	*Buglossidium luteum*		+	+	+	+	+	+	+	+	+	2	3	1	2	1	+
eel	*Anguilla anguilla*		.	+	+	+	+	+	+	+	1	+	+	3	+	+	+
bib	*Trisopterus luscus*		+	+	+	+	1	2	2	3	1	2	2	+	1	1	1
brill	*Scophthalmus rhombus*		+	+	+	+	1	+	+	+	+	+	+	1	1	1	+
stickleback	*Gasterosteus aculeatus*		.	+	+	+	+	+	+	+	+	+	+	+	+	.	.
tub gurnard	*Trigla lucerna*		.	.	+	+	+	+	+	+	+	+	1	.	+	+	+
corkwing wrasse	*Crenilabrus melops*		+	.	.	.	.	.	.	+	.	+	+	+	1	2	1
sand sole	*Pegusa lascaris*		+	.	.	.	.	.	.	.	.	+	+	1	+	+	.
red mullet	*Mullus surmuletus*		.	.	+	+	+	+	+	+	+	.	+	+	+	+	+
sea bass	*Dicentrarchus labrax*		+	.	.	+	+	.	+	+	+	+	+	+	+	+	+

Table 3. continued.

		Region	1					2				3					
		Sector	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
snake pipefish	*Entelurus aequoreus*		+	.	.	.	+	+	.	.	.	.	+	+	+	+	.
sand-smelt	*Atherina presbyter*		.	.	.	+	+	+	+	+	+	+	+	+	+	+	+
smelt	*Osmerus eperlanus*		.	+	.	+	.	+	+	+	1	.	+	+	+	+	+
snake blenny	*Lumpenus lampretaeformis*		.	.	.	.	.	+	.	.	.	.	.	+	.	.	.
smooth hound	*Mustelus mustelus*		.	.	.	+	.	.	+	+	.	.	.	.	.	.	.
small-headed clingfish	*Apletodon microcephalus*		.	.	.	.	.	.	.	.	.	.	+	.	+	.	.
three-bearded rockling	*Gaidropsarus vulgaris*		.	.	.	.	+	.	.	.	.	.	.	+	+	+	.
lump sucker	*Cyclopterus lumpus*		.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
black goby	*Gobius niger*		.	.	.	.	.	+	+	+	+	+	+	+	+	1	2
spurdog	*Squalus acanthias*		.	.	.	.	.	+	.	.	.	.	.	+	.	.	.
red gurnard	*Aspitrigla cuculus*		.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
starry ray	*Raja radiata*		.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
starry smooth hound	*Mustelus asterias*		.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
small-eyed ray	*Raja microocellata*		.	.	.	.	.	.	+	.	.	.	+	.	+	.	.
two-spotted goby	*Gobiusculus flavescens*		.	.	.	.	.	.	+	+	+	+	+	+	+	+	+
rock goby	*Gobius paganellus*		.	.	.	.	.	.	+	+	+	.	+	+	+	+	+
giant goby	*Gobius cobitis*		.	.	.	.	.	.	+	+	+	.	.	+	.	.	.
golden grey mullet	*Liza aurata*		.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
long rough dab	*Hippoglossoides platessoides*		.	.	.	.	.	.	+	.	+	.	.	+	.	.	.
Norway haddock	*Sebastes viviparus*		.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
deep-snouted pipefish	*Syngnathus typhle*		.	.	.	.	.	.	.	+	.	.	.	.	+	+	+
crystal goby	*Crystallogobius linearis*		.	.	.	.	.	.	+	.	.	+	.	.	.	+	.
goldsinny	*Ctenolabrus rupestris*		.	.	.	.	.	.	.	.	.	.	+	.	+	+	+
black sea-bream	*Spondyliosoma cantharus*		.	.	.	.	.	.	.	.	.	+	+	+	1	1	1
pollack	*Pollachius pollachius*		.	.	.	.	.	.	.	.	.	+	+	+	+	+	+
cuckoo wrasse	*Labrus mixtus*		.	.	.	.	.	.	.	.	.	.	+	.	+	+	+
fifteen-spined stickleback	*Spinachia spinachia*		.	.	.	.	.	.	.	.	.	+	+	+	+	1	1
conger	*Conger conger*		.	.	.	.	.	.	.	.	.	+	.	+	.	.	.
thickback sole	*Microchirus variegatus*		.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
nine-spined stickleback	*Pungitius pungitius*		.	.	.	.	.	.	.	.	.	+	+	.	.	.	.
transparent goby	*Aphia minuta*		.	.	.	.	.	.	.	.	.	+	+	.	+	.	+
two-spotted clingfish	*Diplecogaster bimaculata*		.	.	.	.	.	.	.	.	.	.	+	+	+	+	.
balan wrasse	*Labrus bergylta*		.	.	.	.	.	.	.	.	.	.	.	+	+	+	+
undulate ray	*Raja undulata*		.	.	.	.	.	.	.	.	.	.	.	+	+	.	+
big-scale sand-smelt	*Atherina boyeri*		.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
rock cook	*Centrolabrus exoletus*		.	.	.	.	.	.	.	.	.	.	.	+	+	.	.
straight-nosed pipefish	*Nerophis ophidion*		.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
rainbow wrasse	*Coris julis*		.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
butterfly blenny	*Blennius ocellaris*		.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
blonde ray	*Raja brachyura*		.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
John dory	*Zeus faber*		.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
shanny	*Lipophris pholis*		.	.	.	.	.	.	.	.	.	.	.	+	+	.	.
leopard-spotted goby	*Thorogobius ephippiatus*		.	.	.	.	.	.	.	.	.	.	.	.	.	.	+

5. SPECIES CATCH DATA (*Figures 3 to 59)*

The relative abundance of 57 of the most common species are shown in Figures 3 to 59. For the entire coastline surveyed, the mean catch rates (numbers/1000 m^2) at individual station positions sampled from 1981 to 1997 inclusive is shown (each figure part (a)). On the facing page, for each of the three sectors, northeast, east and south coasts (Figure 1), the depth distribution of catches, and the mean catch rates for the same period are shown (Figure part (b), (c) and (d)).

6. FISH DISTRIBUTION AND RELATIVE ABUNDANCE - KEY FEATURES

The following section summarises the major features of the distribution and relative abundance of small fish by order and by family (Table 2).

Carcharhiniformes, Scyliorhinidae.
The dogfishes belong to one of the largest families of shark, of which there are three common European species. The lesser spotted dogfish *Scyliorhinus canicula*, the only species sampled by the YFS, occupies sand and gravel seabed up to 100 m deep, but the young can be found in coastal areas. This species is generally rare in this survey (Figure 3).

Rajiformes. Rajidae
All members of the ray family are large, flattened cartilagenous fish with broad pectoral fins and an elongated tail. Most species depend on their sense of smell or taste for finding food, and their diet is composed mainly of small benthic invertebrates. The most frequently occuring ray is the thornback ray *Raja clavata* (Figure 4), which is found throughout the survey area but is most abundant on the south coast of England. Both spotted ray *Raja montagui* (Figure 5) and undulate ray *Raja undulata* (Figure 6) have a predominantly southern distribution and juveniles are infrequent in catches. The starry ray *Raja radiata* (Figure 7) has only been caught recently in relatively deep water on the east coast.

Anguilliformes, Anguillidae
Eels have a distinctive elongated body and long dorsal and anal fins. The commonest representative of the family in northern European waters, the eel *Anguilla anguilla*, breeds in mid-Atlantic and larvae are transported to coastal waters by oceanic currents. The juvenile stages are closely associated with freshwater, and hence eels are found in greatest abundance near estuaries (Figure 8).

Clupeiformes, Osmeridae
The smelt species found in our waters are related to salmon and trout and are small bodied, marine coastal fish which enter rivers to breed in winter. Smelt *Osmerus eperlanus* (Figure 9) are relatively common in this survey, particularly in depths of 5-10 m on the east coast and near brackish water. They are generally considered to live close to the seabed for much of their lives.

Gadiiformes, Gadidae.
Most members of the Gadidae are found in cooler temperate waters and are widely distributed in coastal and offshore regions. While larger adults generally feed and spawn offshore, juveniles can be found in coastal waters where they consume a wide range of mainly invertebrate prey items and possibly find shelter from larger predators. Adult cod *Gadus morhua* are relatively abundant in the North Sea and juveniles (Figure 10) are particularly common in the Wash and estuary of the River Humber. The 1996 year-class was particularly abundant in catches on the north east coast, but in all years cod were virtually absent from the south coast. Whiting *Merlangius merlangus* are common in inshore waters and the juveniles are found throughout the coastal waters of eastern England (Figure 11). Both poor cod *Trisopterus minutus*, and bib *Trisopterus luscus* (Figures 12 and 13) are small-bodied fish which are common on the east and south coasts of England. Adult pollack *Pollachius pollachius* are generally found close to rocks or on rough ground and, though juveniles (Figure 14) can be found in shallow sandy areas and estuaries, they tend to be less frequent in catches than other gadidiae and are absent from the east coast.

Three species of rockling have been caught during the survey, two of which, the five-bearded rockling *Ciliata mustela* and four-bearded rockling *Enchelyopus cimbrius*, were sufficiently abundant to provide distribution and abundance data (Figures 15 and 16). These are small, slender, round-bodied fish which prey on crustaceans and other fish in a range of inshore seabed habitats. The four-bearded rockling is uncommon, and has been caught on only a few occasions in relatively shallow water.

Gasterosteiformes, Gasterosteidae.
Sticklebacks are well known members of coastal fish communities and most can survive in marine or fresh water. Most species are small cigar shaped, scale-less fish with sharp dorsal spines and a spine on each pelvic fin. Of the three species caught on the survey, the three-spined stickleback *Gasterosteus aculeatus* (Figure 17) is most closely associated with freshwater, although it can be found among marine algae near the shore. The fifteen-spined stickleback *Spinachia spinachia* (Figure 18) has a characteristically long, slender body with 15 spines along the back, and is found in only fully saline coastal waters. It is relatively abundant in shallow waters of the south coast, where most individuals were found in water less than 5 m deep. The nine-spined stickleback *Pungitius pungitius*, which is also a small

coastal dwelling fish, has only been found on two occasions in shallow water off southern Kent (Table 3).

Gasterosteiformes, Syngnathidae.
This family, which also includes the seahorses, is well known in shallow coastal waters. The pipefish have a long, slender, segmented and armoured body with most fins reduced in size, except for the dorsal fin which is used for swimming. They are relatively small and are captured both as juveniles and adults. Males incubate eggs in a groove on the underside of the body. The greater pipefish *Syngnathus acus* and Nilssons pipefish *Syngnathus rostellatus* are abundant in coastal waters of England at depths of less than 10 m (Figures 19 and 20). The deep-snouted pipefish *Syngnathus typhle* (Figure 21) and worm pipefish *Nerophis lumbriciformis* (Figure 22) are occasionally found in close association with marine algae in shallow water, while the snake pipefish *Entelurus aequoreus* (Figure 23) is thought to be most abundant in offshore waters.

Perciformes, Sparidae/Mullidae/Percichthyidae.
These three families of bottom-dwelling roundfish are represented by black sea-bream *Spondyliosoma cantharus*, red mullet *Mullus surmuletus* and sea bass *Dicentrarchus labrax* (Figures 24 to 26), species generally of southern distribution which are found in abundance in this survey only on the south coast of England and into the southern part of the North Sea. Juveniles of all three species occur in sheltered inshore waters, where they feed on a range of prey, from small inshore fish (sea bass) to invertebrates living within soft sandy or muddy bottoms (red mullet). Local climatic effects will tend to influence the abundance and distribution of these species, and the higher sea water temperatures that were prevalent since 1989 (Figure 2) may have been responsible for relatively high catch rates of red mullet and bass observed in the YFS during those years.

Perciformes, Labridae.
The wrasses are an abundant and widespread group of fish with a largely southern distribution, and all have pharyngeal bones with flattened teeth which are used to crush prey items such as molluscs and crustaceans. Of the six species caught during the YFS, the rock cook *Centrolabrus exoletus* and rainbow wrasse *Coris julis* are rare (Table 3), whilst the four more abundant species; cuckoo wrasse *Labrus mixtus,* ballan wrasse *Labrus bergylta,* goldsinny *Ctenolabrus rupestris* and corkwing wrasse *Crenilabrus melops*, are present in limited numbers on the south coast of England (Figures 27 to 30).

Perciformes, Ammodytidae.
Sandeels are slender-bodied, streamlined fish with a number of superficially similar species which are difficult to identify in the field. They burrow in clean sand and shelly substrates, but also swim in mid-water in huge shoals which in some areas are commercially exploited. Sandeels are an important part of the inshore marine ecosystem as they form an important food supply for birds and piscivorous fish. Because of their preference for coarse sediments, sandeels are most common in the Wash, the estuary of the River Humber and on the coast of East Anglia. During this survey, they are less common in the Thames area and on the south coast (Figure 31).

Perciformes, Trachinidae.
This small family of temperate and tropical species is represented in English coastal waters by the lesser weever *Echiichthys vipera* (Figure 32). This relatively small-bodied species occupies shallow sandy and intertidal areas where it remains buried in the sediment with only the eyes exposed. The dorsal fin and gill cover spines contain venom which deters predators. On both east and south coasts, lesser weever were most abundant in shallow waters less than 5 m depth.

Perciformes, Zoarcidae.
The viviparous blenny, or eelpout (*Zoarces viviparus*), develops its eggs within the body cavity of the female, which later gives birth to several fully formed young. This family has a northerly distribution, extending to the southern North Sea, and is locally common on shallow rocky coasts and in estuaries. They have not been caught on the south coast, and on the east coast are most abundant from 3-14 m depth (Figure 33).

Perciformes, Pholidae.
Like the viviparous blenny, the butterfish *Pholis gunnellus* is also a small, northern species which can be found on the seashore amongst weed and stones where is finds food and shelter. During the survey, butterfish were most frequently caught in water greater than 10 m deep (Figure 34). On the northeast coast, this species appears to have declined in abundance since the late 1970s.

Perciformes, Gobiesocidae.
The clingfish are characterised by a powerful sucking disc formed by the pelvic fins on the underside of the body, which is used to grip onto the underside of rocks or shells. For this reason they are seldom caught, even though they may be relatively abundant. However, a few specimens of the two-spotted clingfish *Diplecogaster bimaculata* are caught each year on the south coast near Poole Harbour, at approximately 15 m depth (Figure 35).

Perciformes, Callionymidae.
This family of small-bodied marine species have a flattened appearance and a gill opening near the top of the head, to assist with breathing while they remain partly buried in the sand. Males are brightly coloured during the spawning season and both sexes undergo elaborate courtship displays. The dragonet *Callionymus lyra* is widespread and one of the commonest members of the coastal fish fauna. Outside the spawning season,

it can be confused with the reticulated dragonet *Callionymus reticulatus* and the spotted dragonet *C. maculatus*, and all three species are included in Figure 36.

Perciformes, Gobiidae.
This family of small inshore fish contains many species of which the commonest gobies are important members of the community, both as predators and prey. Three relatively large (<25 cm) members of the genus *Gobius*, the rock goby *G. paganellus*, black goby *G. niger* and giant goby *G. cobitis* (Figures 37 to 39) are caught in small numbers on the south coast and in the Thames estuary. They occupy rocky inshore waters and the male fish broods eggs in a nest constructed from sand and shells. The black goby and giant goby have become more abundant in catches since the mid-1980s, perhaps as a result of recent increases in water temperature (cf. red mullet and sea bass). Small sand gobies, *Pomatoschistus* species, are the most abundant fish in the survey, often being caught in their thousands in a single haul, and are evenly distributed at all depths sampled. There are several species of which the commonest, *P. minutus*, is rarely absent from beam trawl and pushnet catches (Figure 40). Two species of slender-bodied gobies which swim off the seabed in shallow water, the two-spotted goby *Gobiusculus flavescens* and transparent goby *Aphia minuta*, are well represented in catches (Figure 41 and 42). Little is known of their life history, although these short-lived species undergo substantial changes in abundance from year to year.

Atheriniformes, Atherinidae.
Sand smelts are common inshore and estuarine fish of southern origin which shoal in shallow waters. Although they lay eggs onto marine algae, they have a largely mid-water existence, and so they are not frequently caught in bottom trawls (Figure 43).

Pleuronectiformes, Soleidae.
The soles are a widespread family of flatfish in temperate European waters. The common sole *Solea solea* is an important commercial species and is heavily exploited in all areas where it is abundant. Juveniles occupy shallow inshore waters on the south and east coasts of England, where 0-groups (fish in their first year of life) are relatively abundant at all depths sampled (Figure 44). The youngest age groups are particularly abundant on the coast of East Anglia, in the estuary of the River Thames, and in the bays on the southeast coast. The sand sole *Pegusa lascaris* can be easily confused with the common sole, but is a lighter colour and has a roseate nostril on the underside. It is a southern species and juveniles are uncommon in English inshore waters (Figure 45). The solenette *Buglossidium luteum* can be distinguished from juvenile sole by occasional black dorsal and anal fin rays. It is not commercially exploited and grows only to a maximum length of c.13 cm. It is also a southern species which is becoming increasingly abundant on the south coast of England, but is uncommon elsewhere (Figure 46).

Pleuronectiformes, Pleuronectidae.
This family of right-eyed flatfish comprise large-bodied species of which several are commercially exploited. Juvenile pleuronectids dominate the catch in all regions of the survey. The best known Pleuronectid, the plaice *Pleuronectes platessa*, is common thoroughout the inshore waters of England and juveniles occupy sandy and muddy nursery areas in all coastal regions. During September, 0-group plaice are most abundant in the intertidal zone and over 25% of fish are found in water less than 1 m deep (Figure 47). The flounder *Platichthys flesus*, although superficially similar to the plaice and able to interbreed with it, is of limited commercial value. It is most abundant in and close to estuaries and is often found in fresh water, though it breeds in the sea (Figure 48). Juvenile dab *Limanda limanda* are numerous in sandy coastal waters and are often associated with juvenile plaice (Figure 49). The lemon sole *Microstomus kitt* (Figure 50) is a valuable commercial species and one of the most specialised feeders in this family, taking mainly polychaete worms. During the YFS, limited numbers of juveniles have been caught in the Outer Thames estuary and in the Wash but were rare elsewhere.

Pleuronectiformes, Scophthalmidae.
This family of left-eyed flatfish is best known for two commercially important species, brill *Scophthalmus rhombus* and turbot *S. maximus*, which are both caught during the survey (Figure 51 and 52). Both species are close to the northern limits of their distribution in the North Sea, but are still relatively common on the coast of eastern England, preying heavily on small fish such as sandeels, whiting and sprat. While the juveniles of both species are most common in inshore waters, juvenile turbot occupy especially shallow water and are found almost exclusively in the surf zone in depths of less than 1 m (Figure 52).

Pleuronectiformes, Bothidae.
The bothids, a family of left-eyed flatfish, are represented in catches during this survey by the scaldfish *Arnoglossus laterna*, so-called because damage to the skin caused during capture resembles that of a burn (Figure 53). It is a small, slender-bodied flatfish which is of no commercial importance. The scaldfish is a species of southern origin which has increased in survey catches since the mid-1980s.

Scorpaeniformes, Triglidae.
The gurnards are stout-bodied fish which consume crustaceans and other bottom-living invertebrates which they locate in the sediment using modified pectoral fin rays. The tub gurnard *Trigla lucerna*, (Figure 54) and grey gurnard *Eutrigla gurnardus* (Figure 55) generally have a southerly distribution and are not abundant in survey catches, but may be influenced by the

prevalence of warmer water conditions. On the northeast coast, the grey gurnard was most abundant during the late 1980s when water temperatures were generally higher than average.

Scorpaeniformes, Cottidae.
This family of fish is similar in appearance to the gurnards, but has a series of stout spines on the preoperculum and gill cover. Both the bull rout *Myoxocephalus scorpius* and sea scorpion *Taurulus bubalis* are small, active predators of fish and crustaceans. During the survey, bull rout (Figure 56) were locally abundant in the Thames estuary and the northeast coast, while sea scorpion were found on both south and northeast coasts (Figure 57). The catch rate of sea scorpion has recently declined on the south coast and was particularly high in 1996 on the northeast coast.

Scorpaeniformes, Agonidae.
The pogge or hooknose *Agonus cataphractus* is a small fish with head and body encased in hard body plates. It is a relatively abundant northern species that, on the east coast of England, appears to have declined in abundance during the period of the survey, possibly in response to increased water temperature (Figure 58). It is seldom found in water shallower than 5 m depth and is most abundant between 10 and 20 m.

Scorpaeniformes, Liparidae.
Another species of northern origin, the sea snail *Liparis liparis* is a small, tadpole-shaped fish which is normally found on mud and muddy sand where it preys upon a wide range of bottom-dwelling invertebrates and fish. It has occurred regularly in survey catches on the east coast, particularly in colder years, but is almost absent from the south coast (Figure 59).

Figures 3 to 59. The relative density distribution, occurrence by depth and catch rate from 1981 to 1997 for each of the 57 most common species caught in the survey. For the entire survey area, the mean annual catch (numbers/1000 m²) at individual station positions is shown (Figure part (a)). The size of the shaded bubble at each station position where fish were caught represents the mean relative density which is shown on the key provided. On the facing page the percentage occurrence of a species in 1 m depth bands is shown for the northeast, east and south coasts, in parts (b), (c) and (d) respectively, together with the corresponding mean catch rates for the same sectors, for those years when data were available. Data for the northeast coast (sector 1 in Figure 1) are therefore shown at the top of the right hand page, while data for the south coast (sector 3 in Figure 1) are shown at the bottom. Note that the scales differ between the species

Figure 3. ***Scyliorhinus canicula*** **- lesser spotted dogfish**

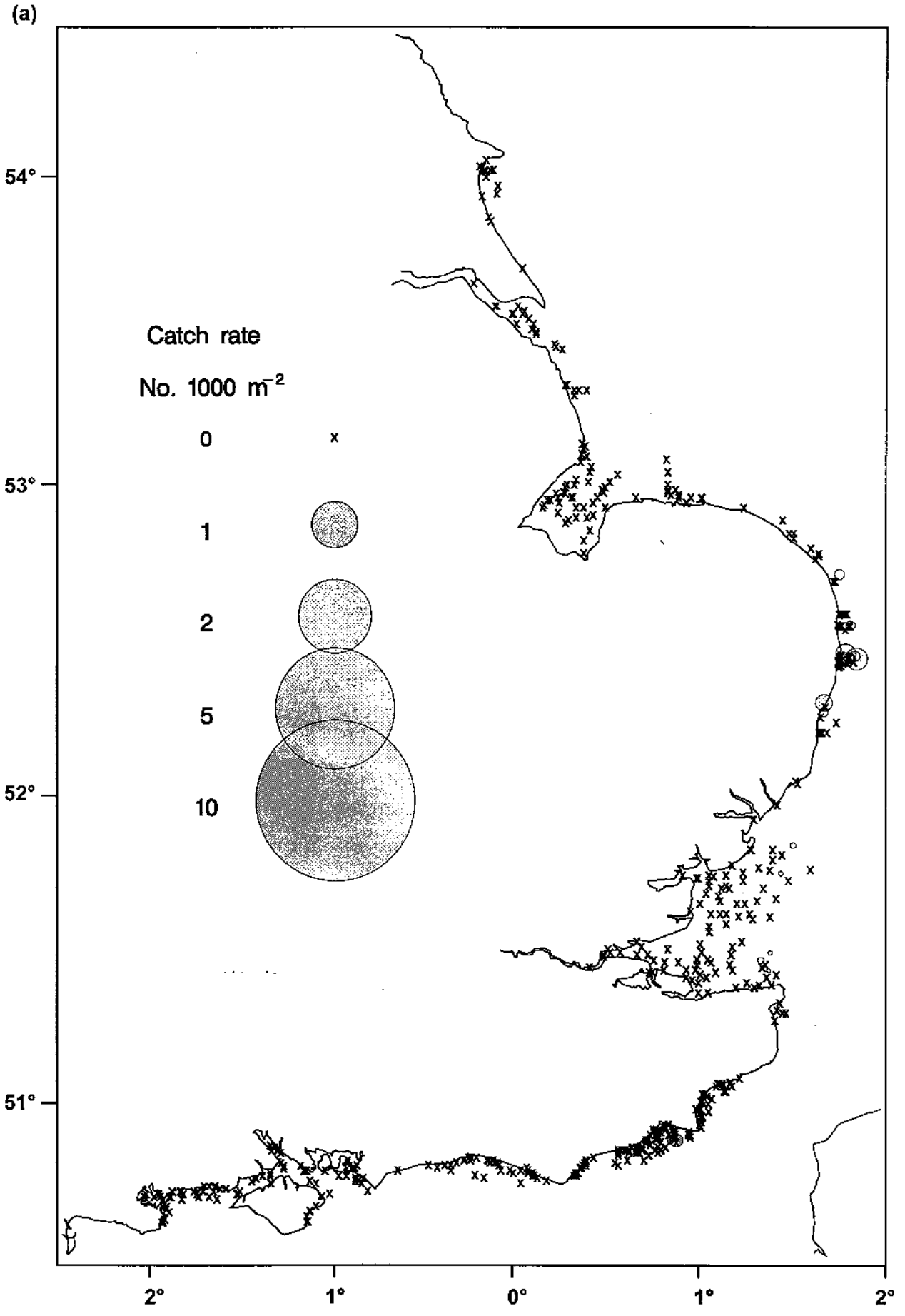


Figure 3. ***Scyliorhinus canicula*** **- lesser spotted dogfish**

(b)

No data

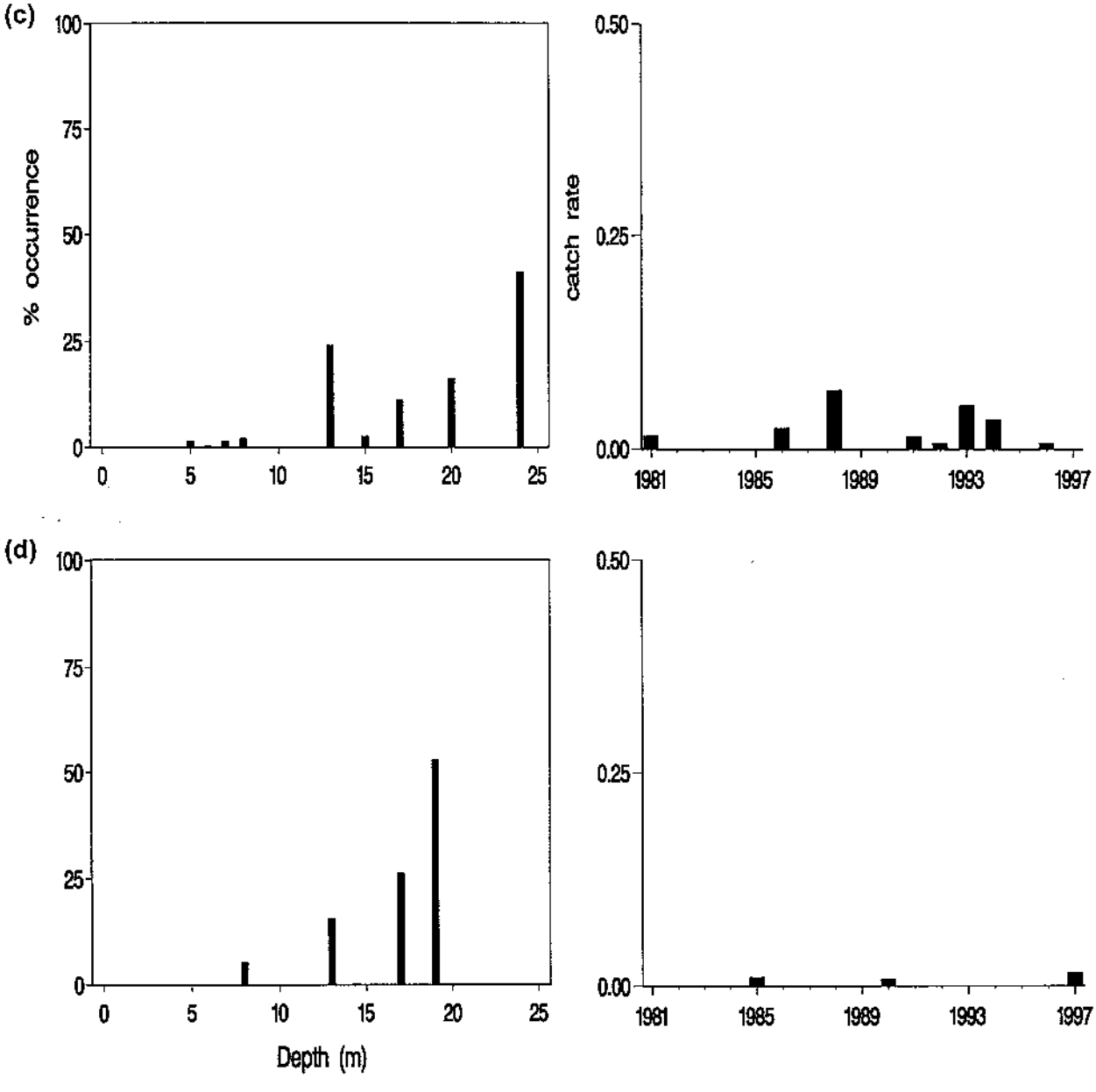


Figure 4. ***Raja clavata*** **- thornback ray**

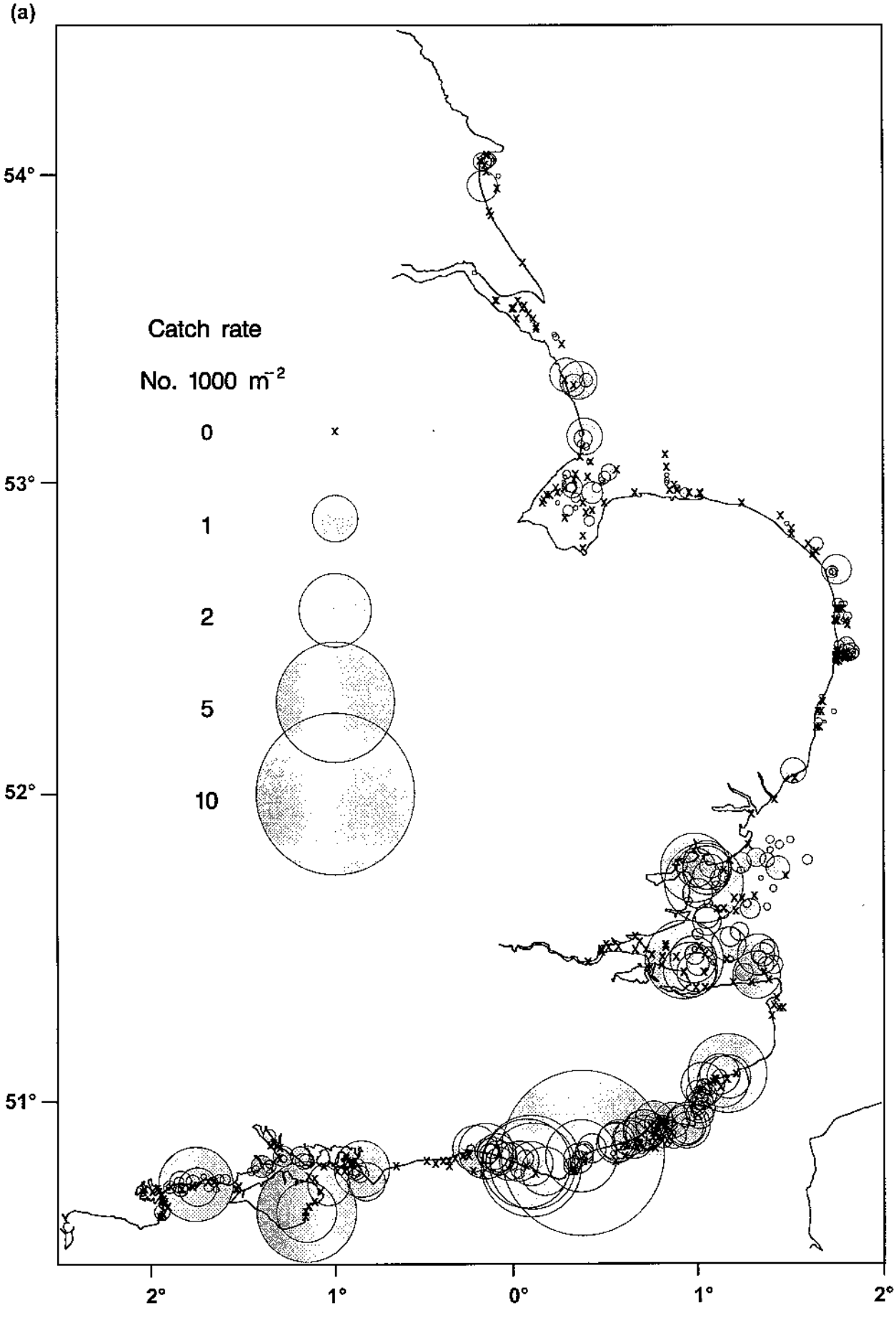


Figure 4. ***Raja clavata*** **- thornback ray**

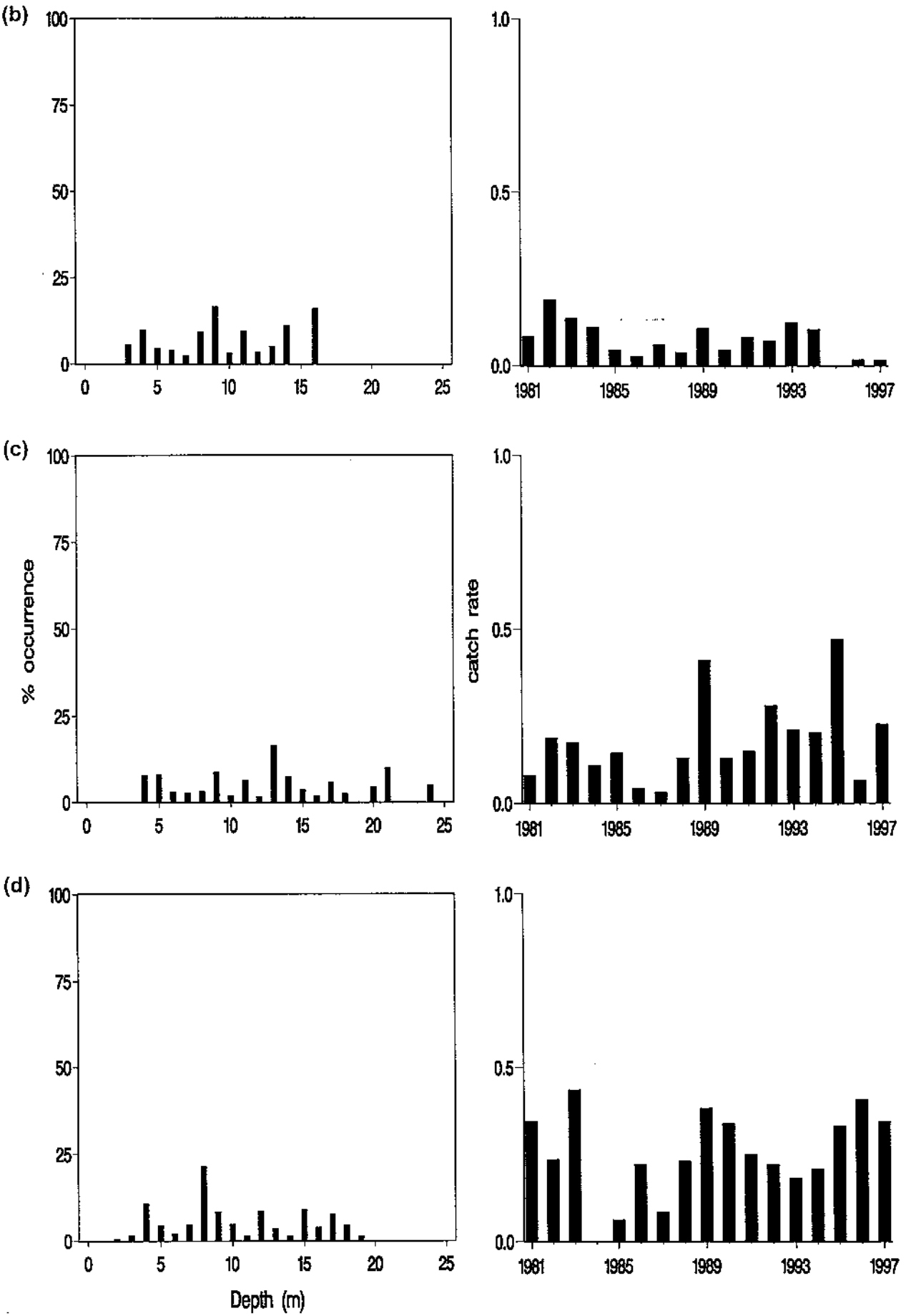


Figure 5. ***Raja montagui*** **- spotted ray**

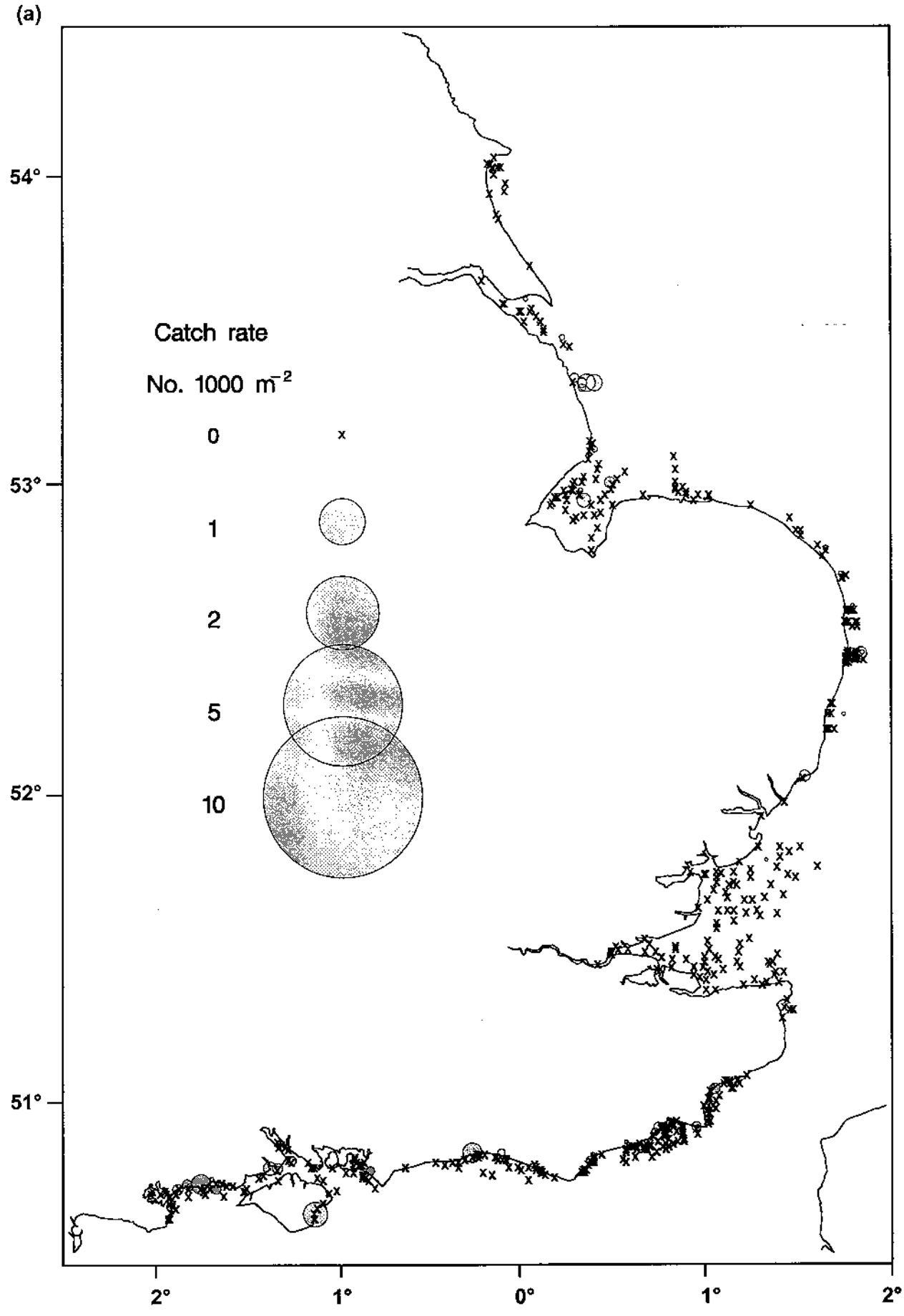


Figure 5. ***Raja montagui*** **- spotted ray**

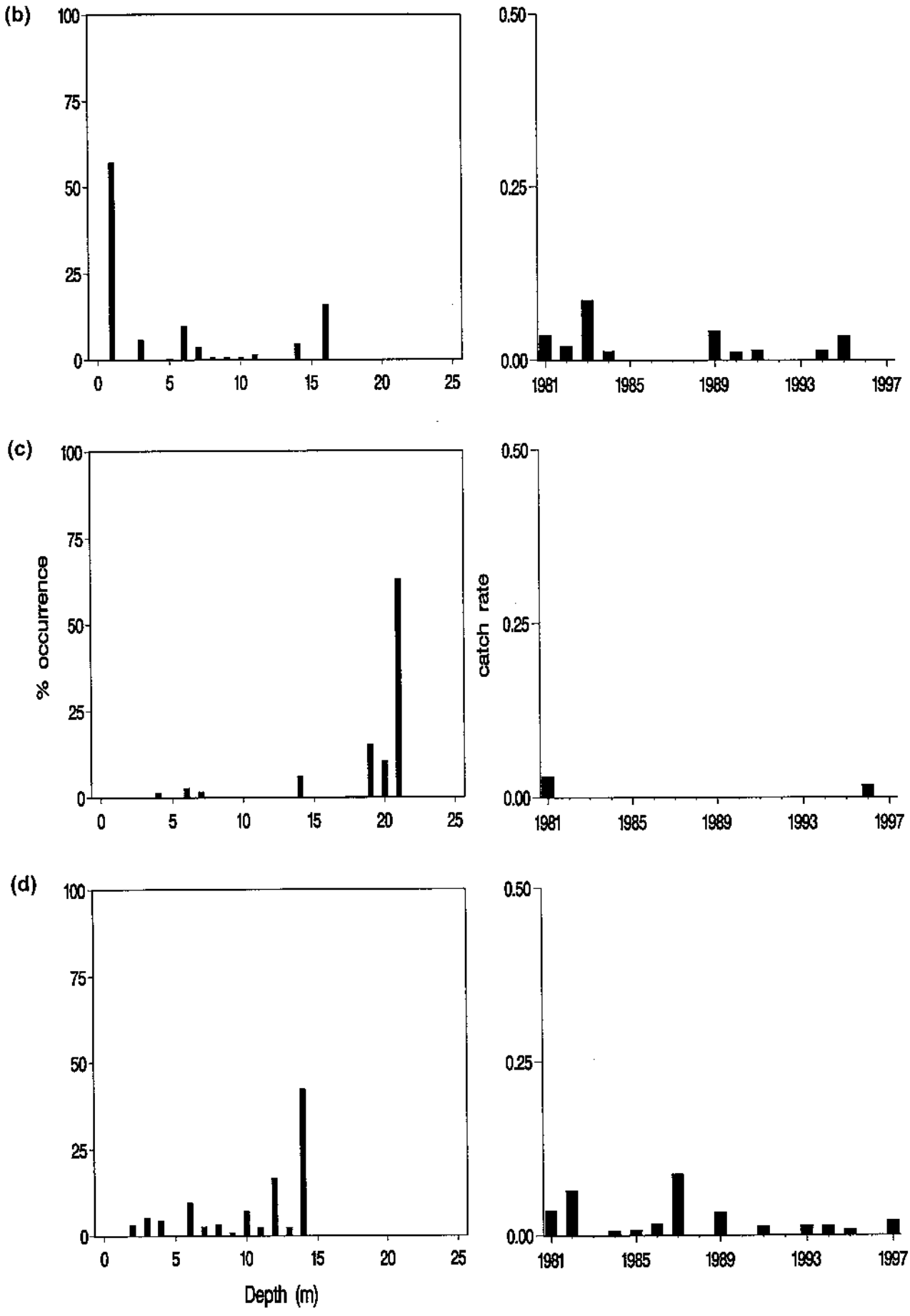


Figure 6. ***Raja undulata*** **- undulate ray**

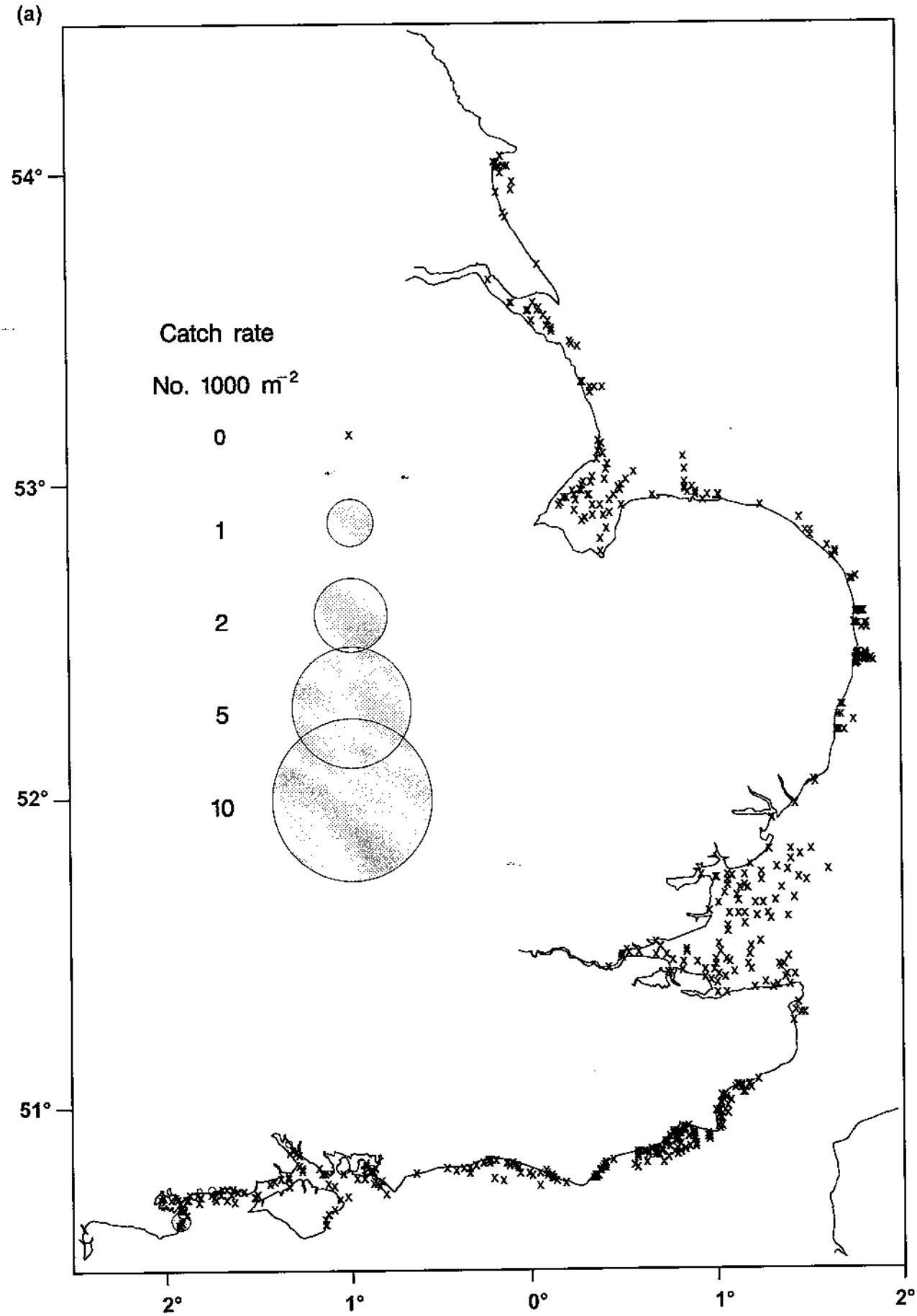


Figure 6. ***Raja undulata*** **- undulate ray**

(b)

No data

(c)

No data

(d)

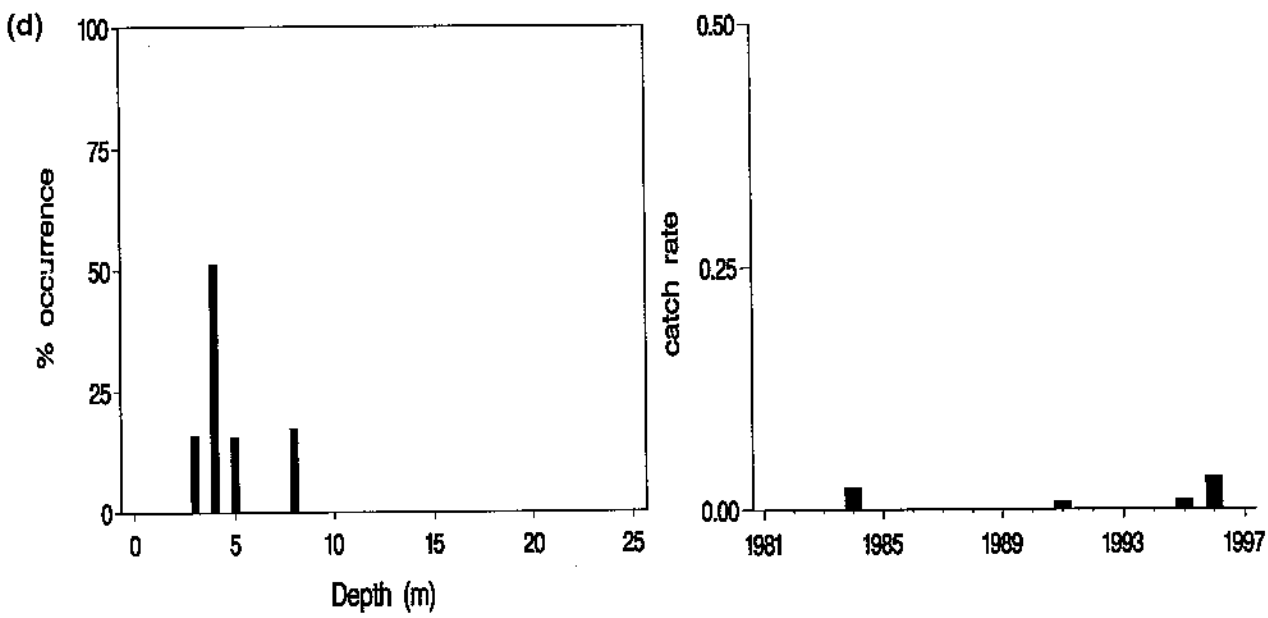


Figure 7. ***Raja radiata*** **- starry ray**

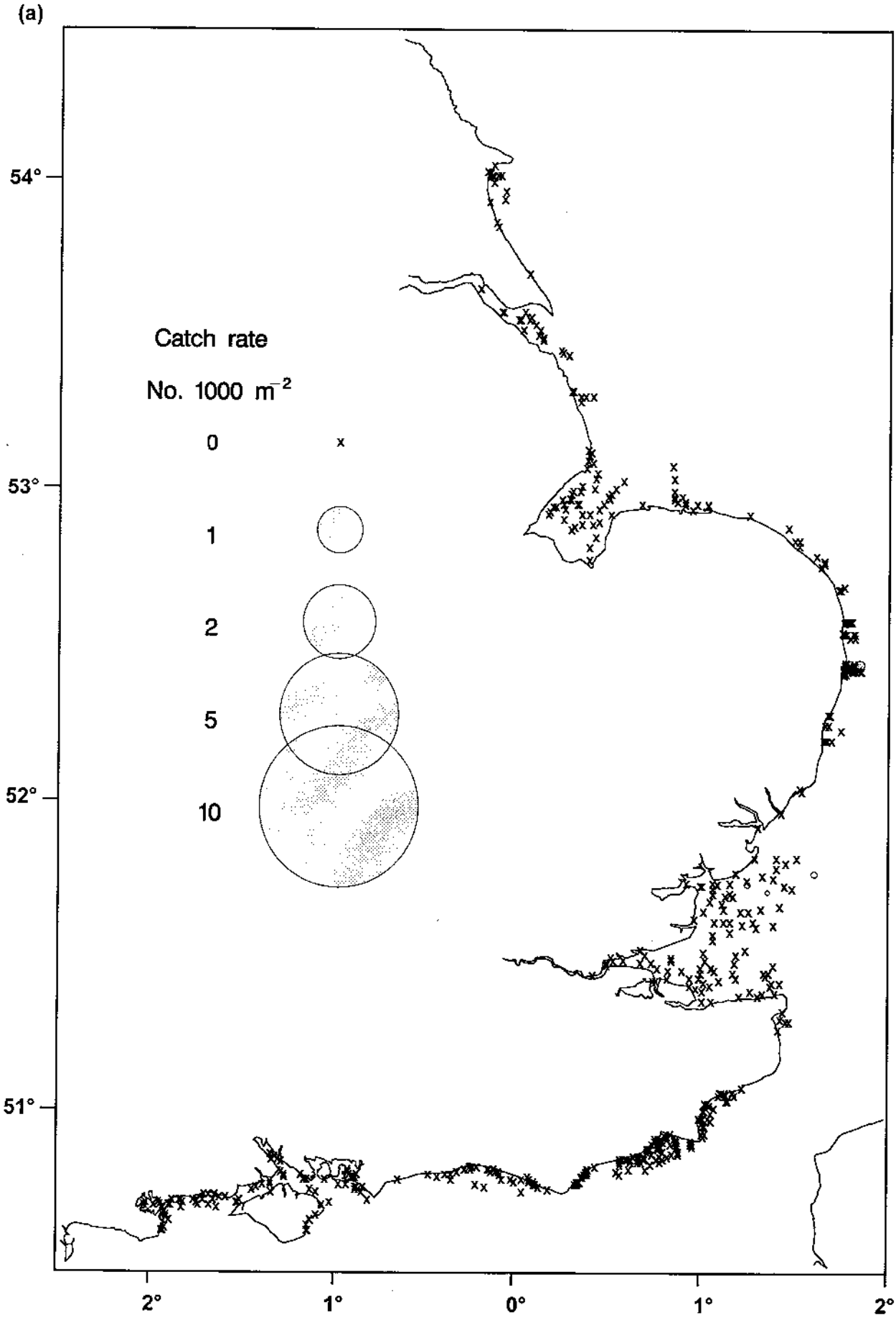
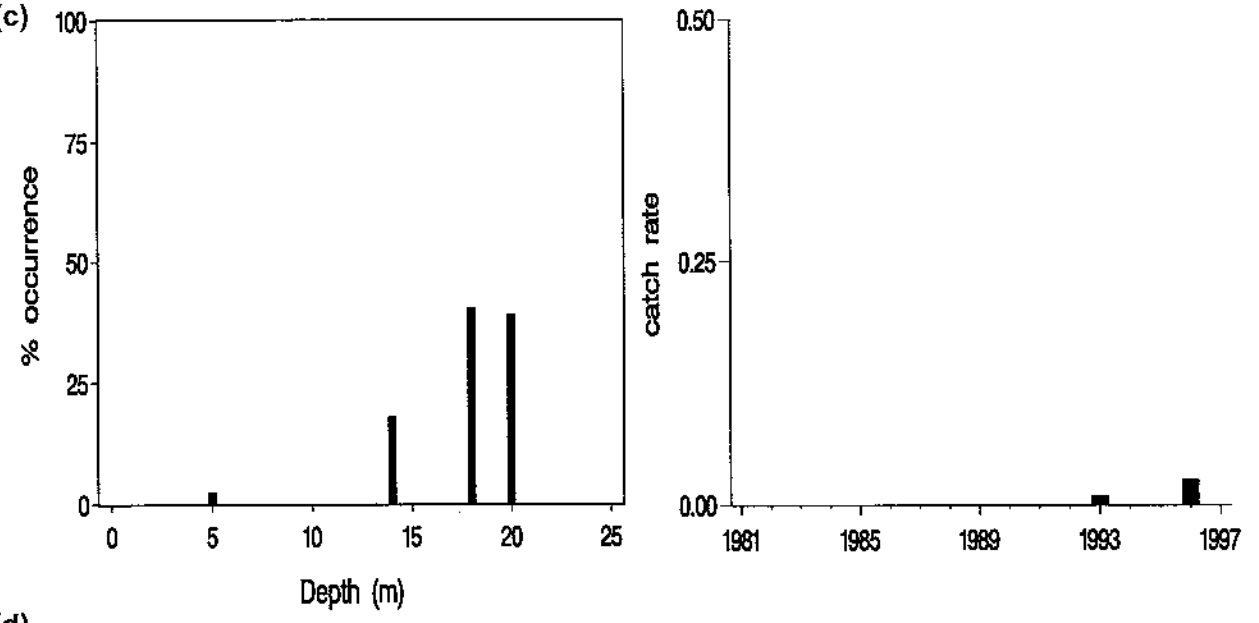


Figure 7. ***Raja radiata*** **- starry ray**

(b)

No data

(c)



(d)

No data

Figure 8. ***Anguilla anguilla*** - eel

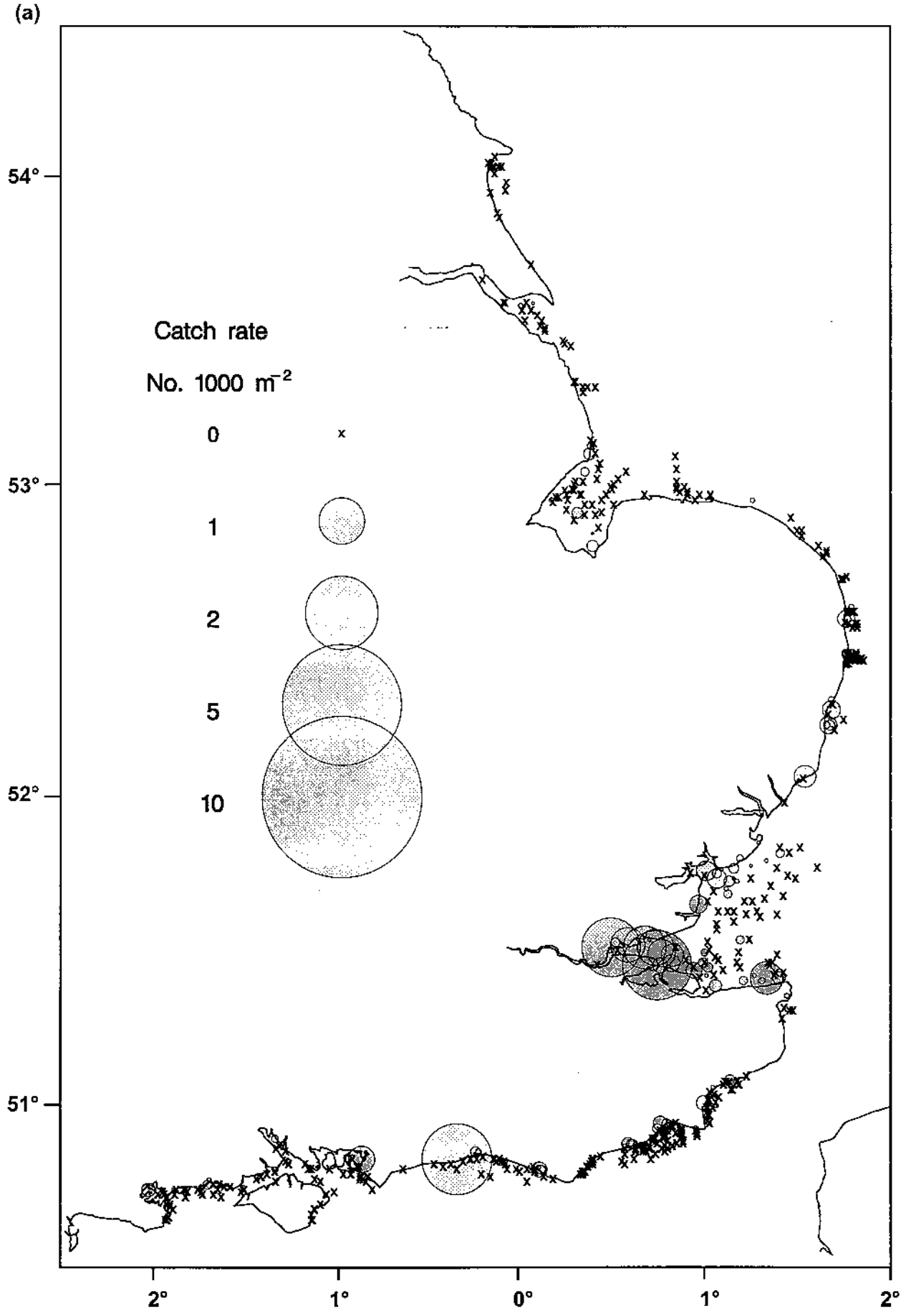


Figure 8. ***Anguilla anguilla*** **- eel**

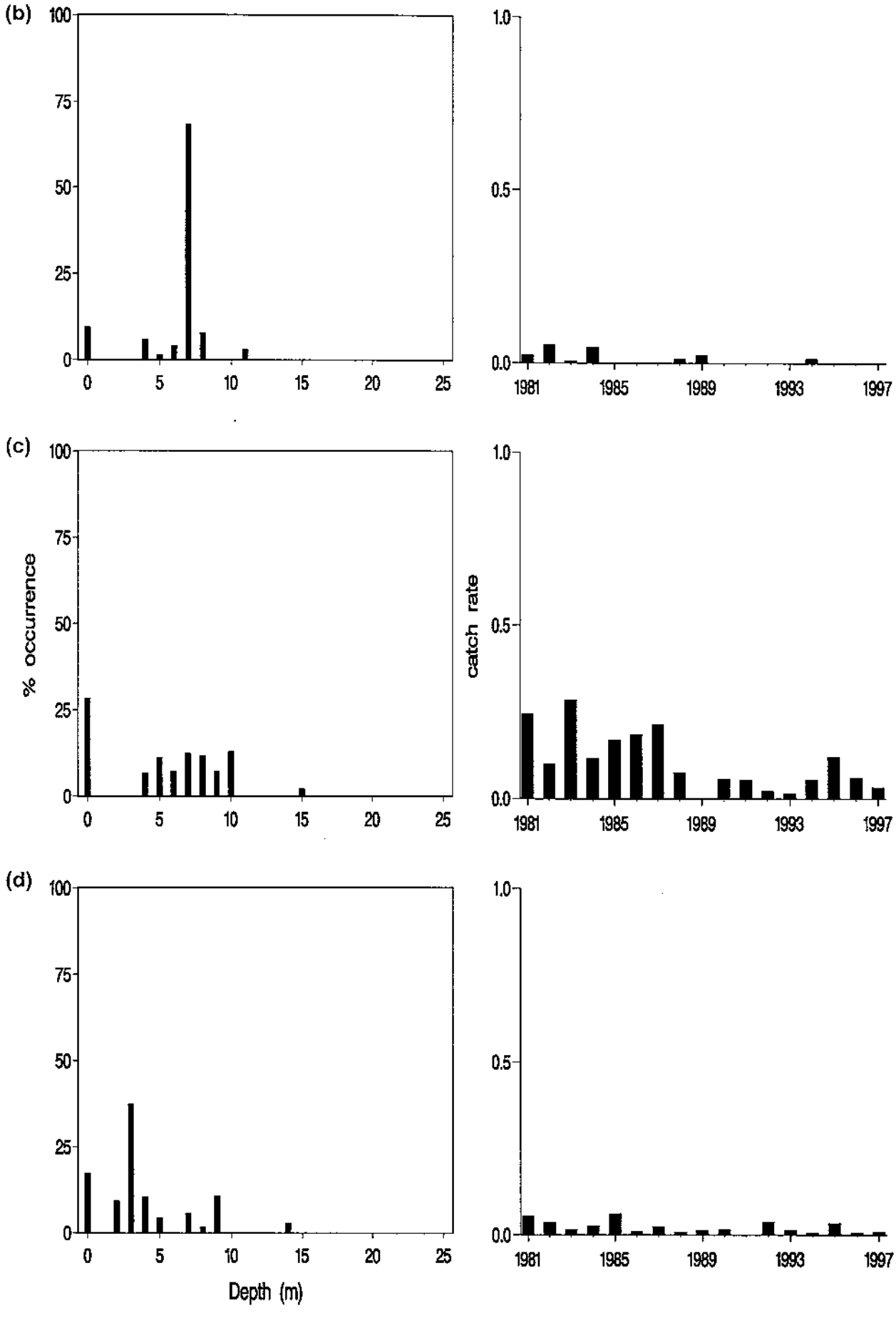


Figure 9. ***Osmerus eperlanus*** **- smelt**

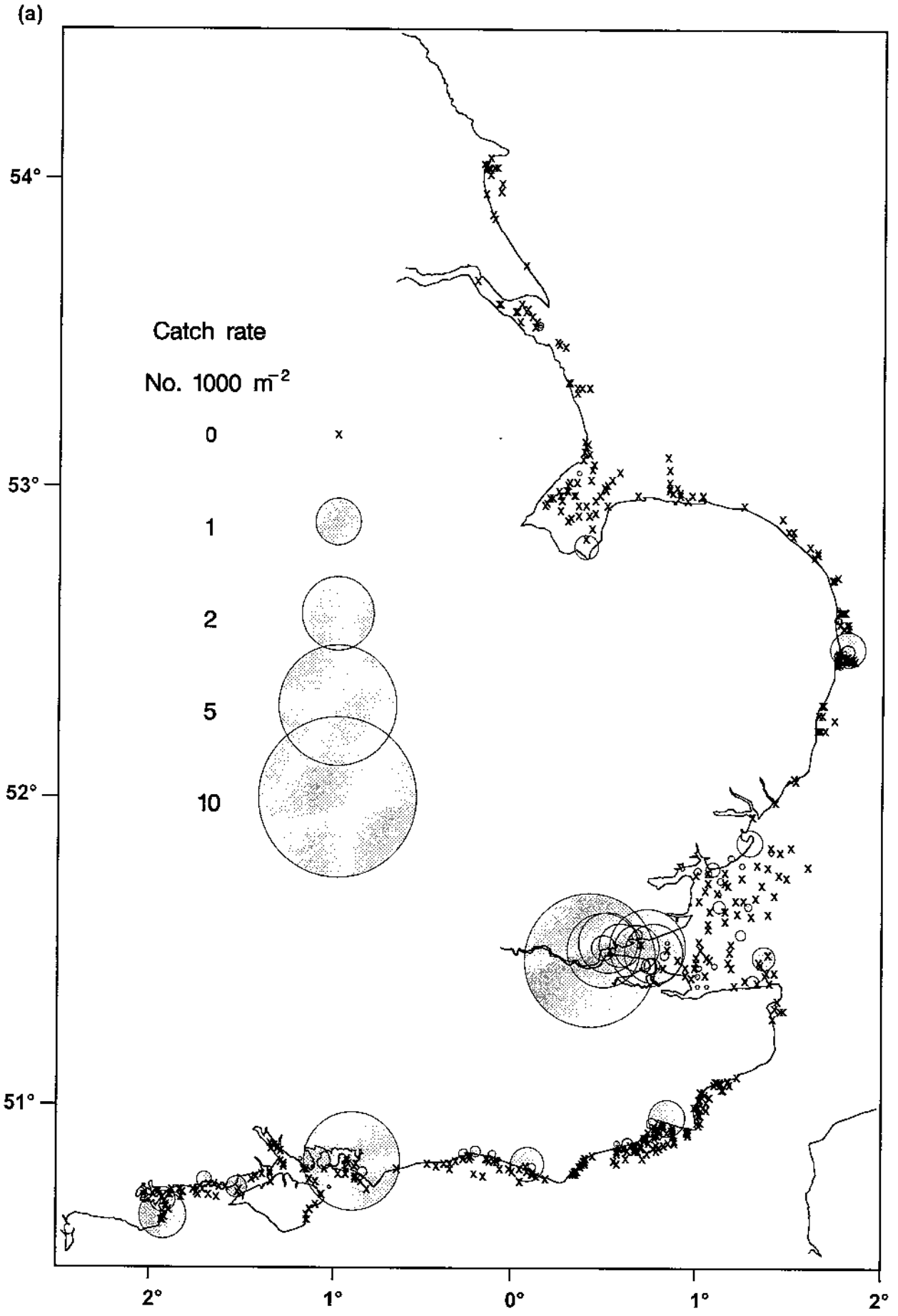


Figure 9. ***Osmerus eperlanus*** **- smelt**

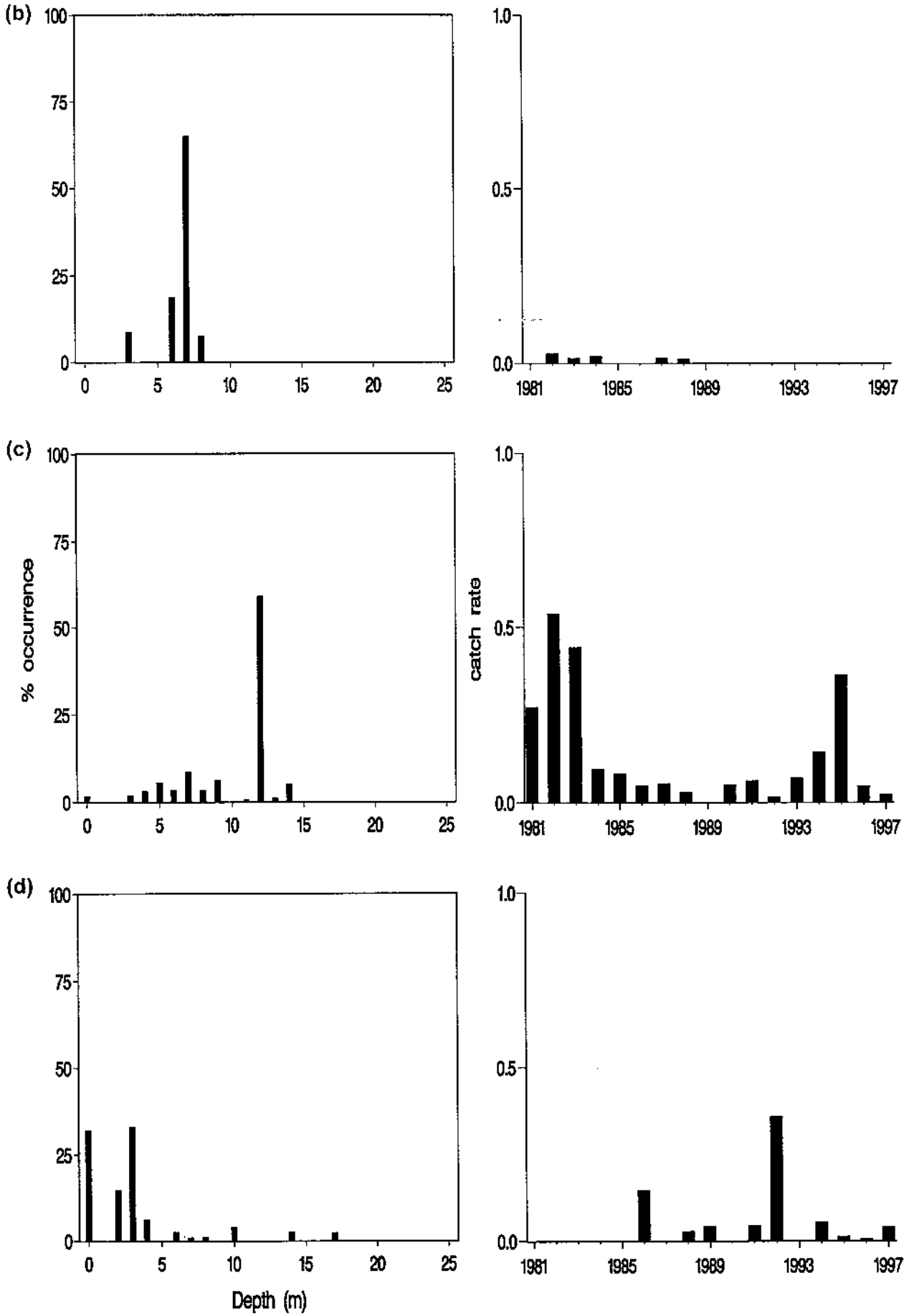


Figure 10. ***Gadus morhua*** - cod

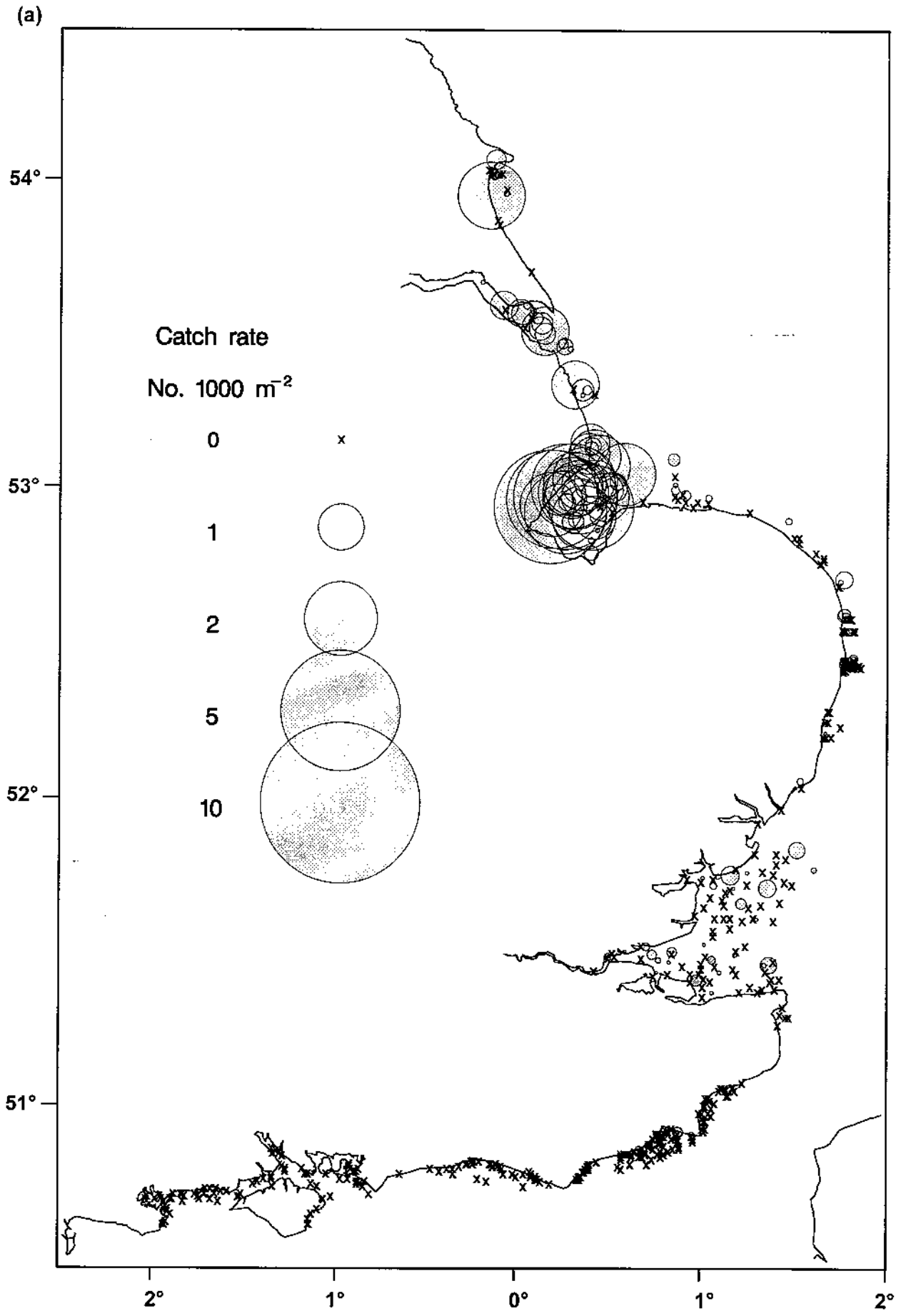


Figure 10. ***Gadus morhua*** **- cod**

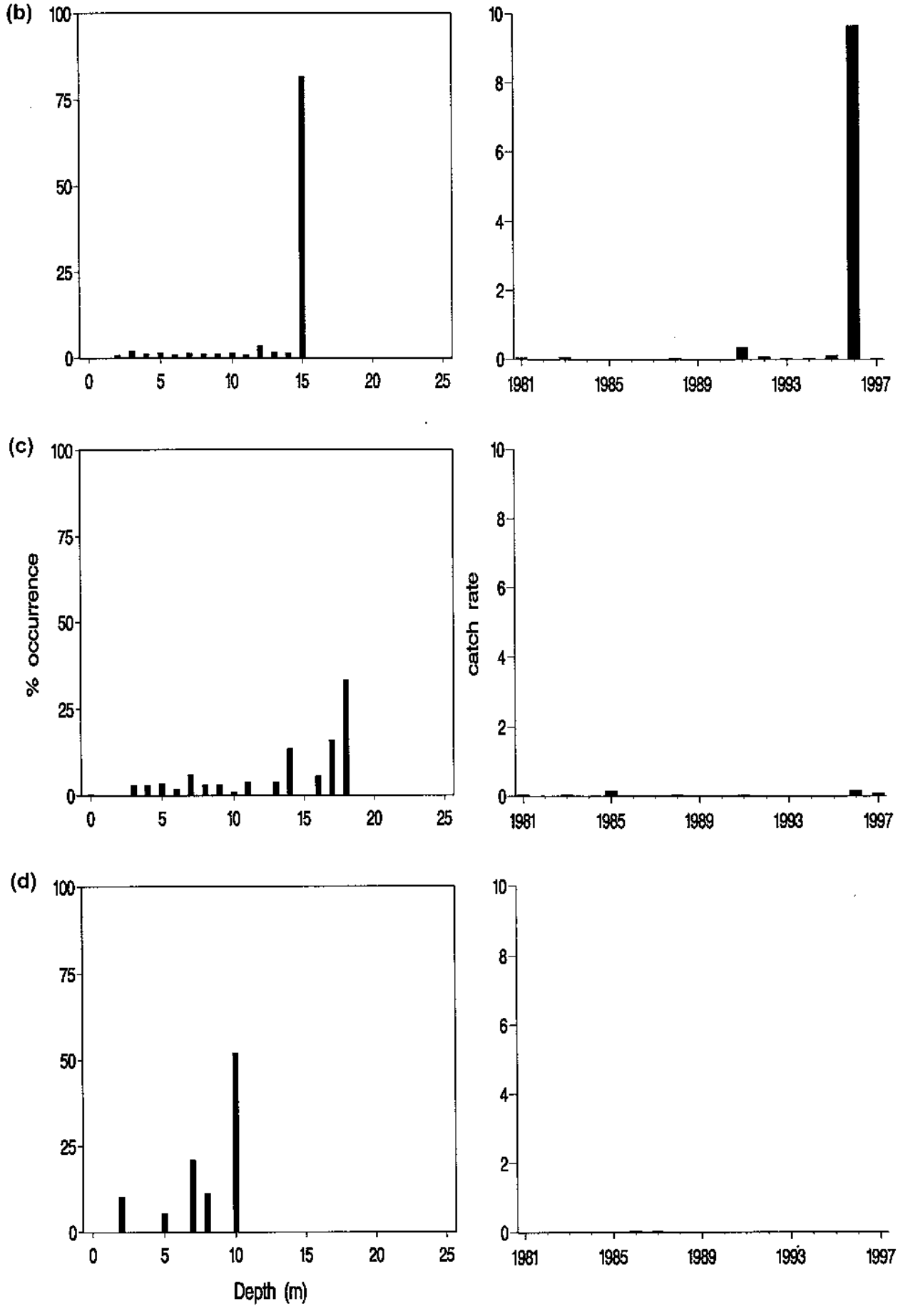


Figure 11. ***Merlangius merlangus*** - whiting

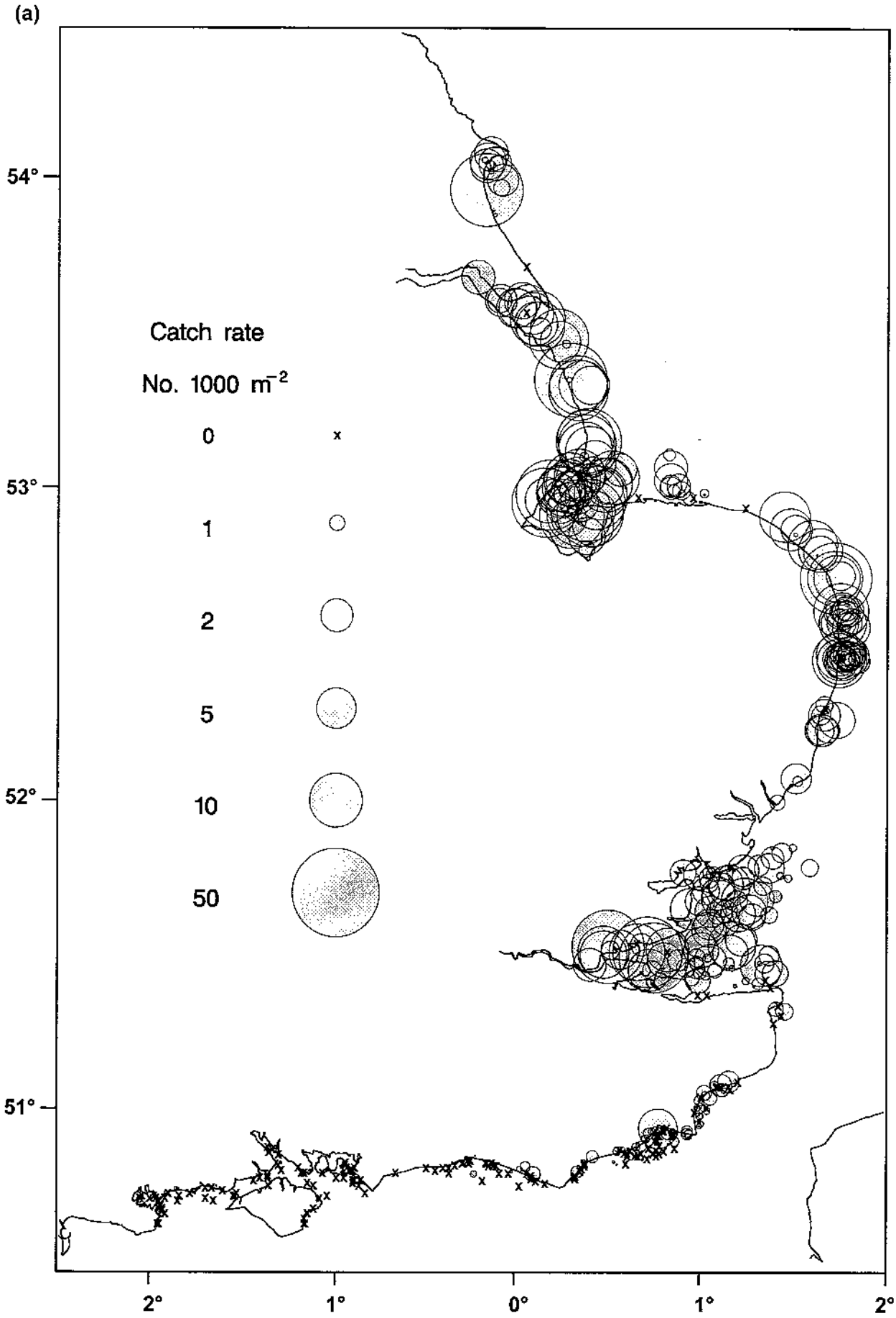


Figure 11. ***Merlangius merlangus*** **- whiting**

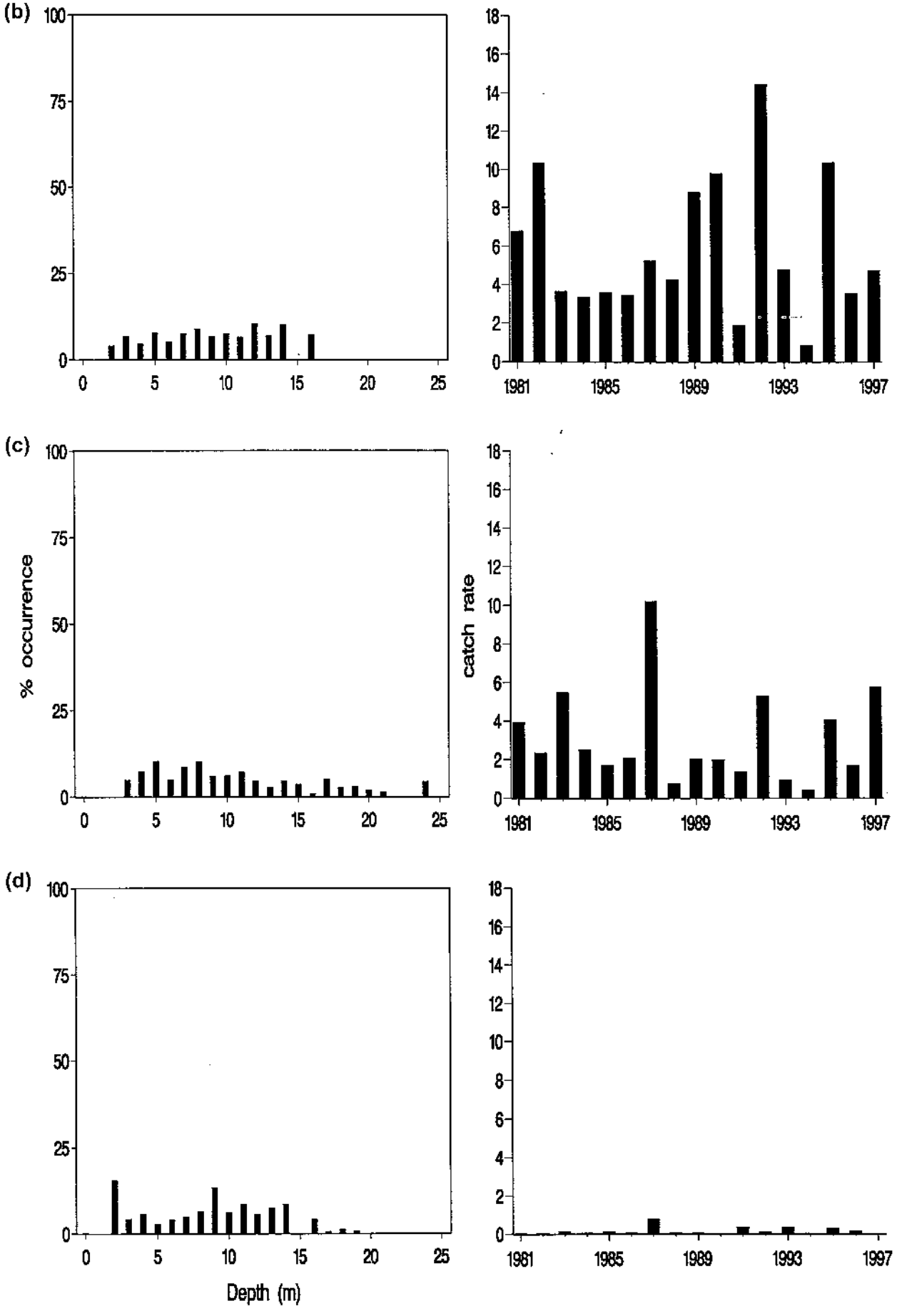


Figure 12. ***Trisopterus minutus*** **- poor cod**

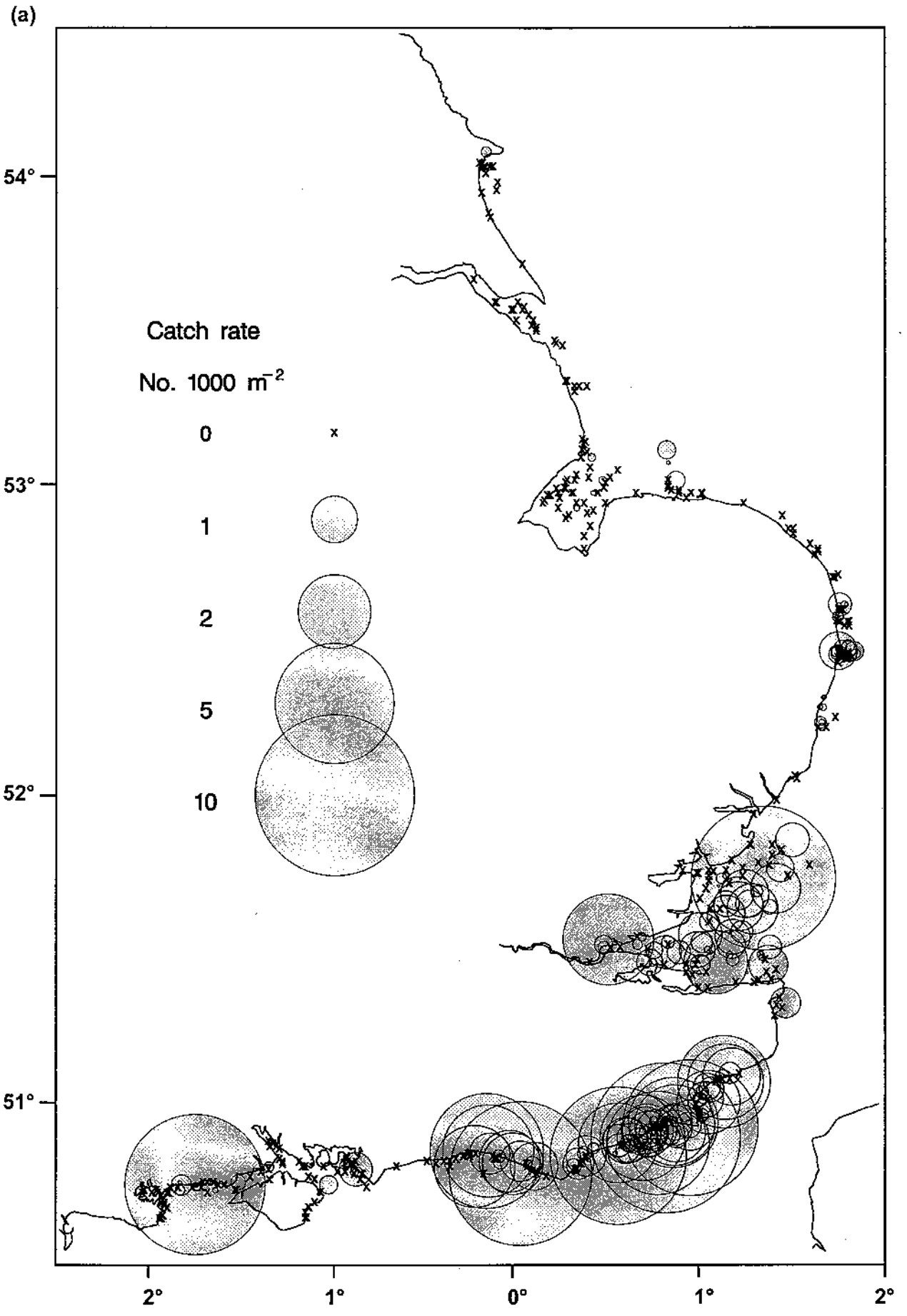


Figure 12. ***Trisopterus minutus*** **- poor cod**

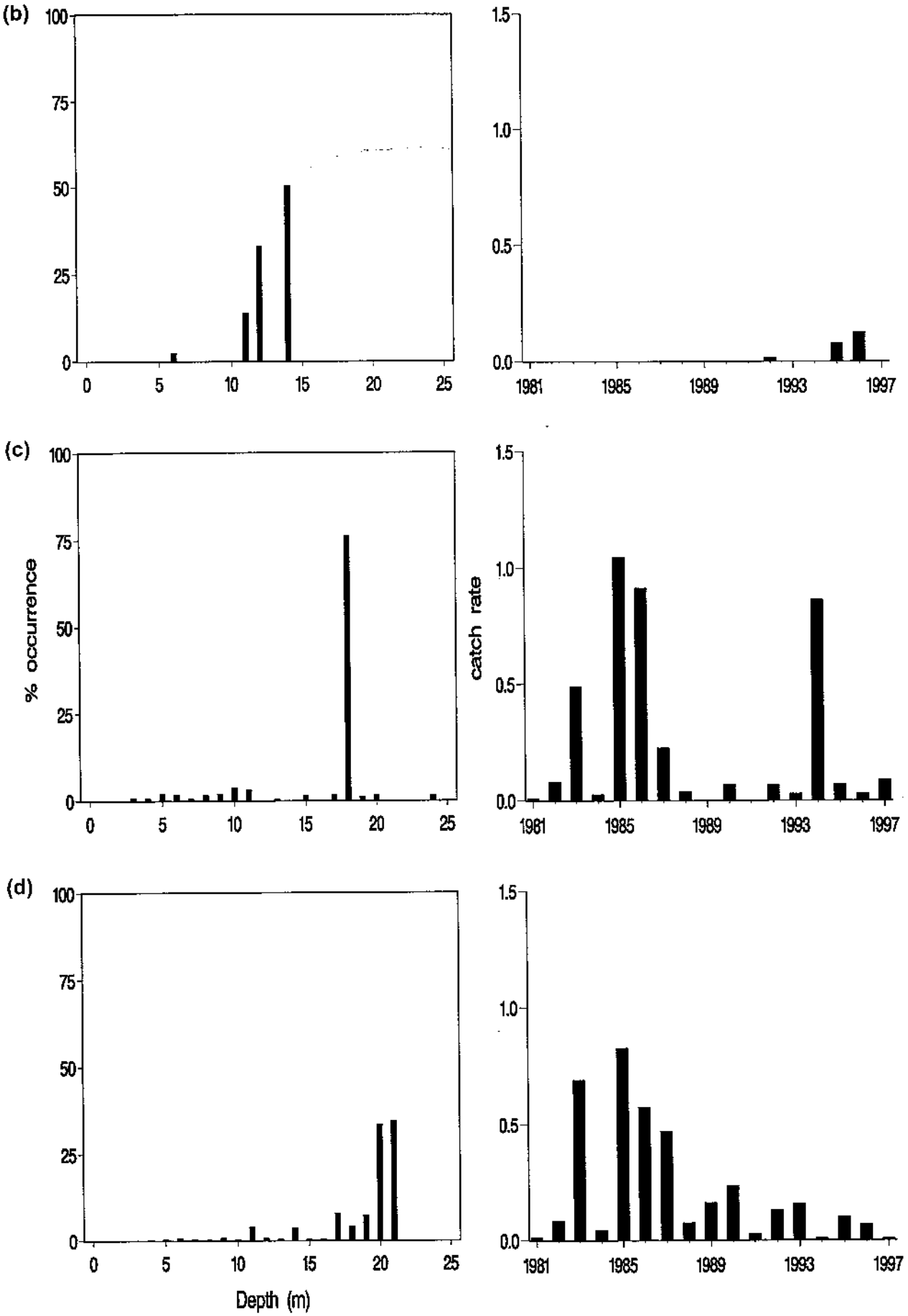


Figure 13. ***Trisopterus luscus*** **- bib**

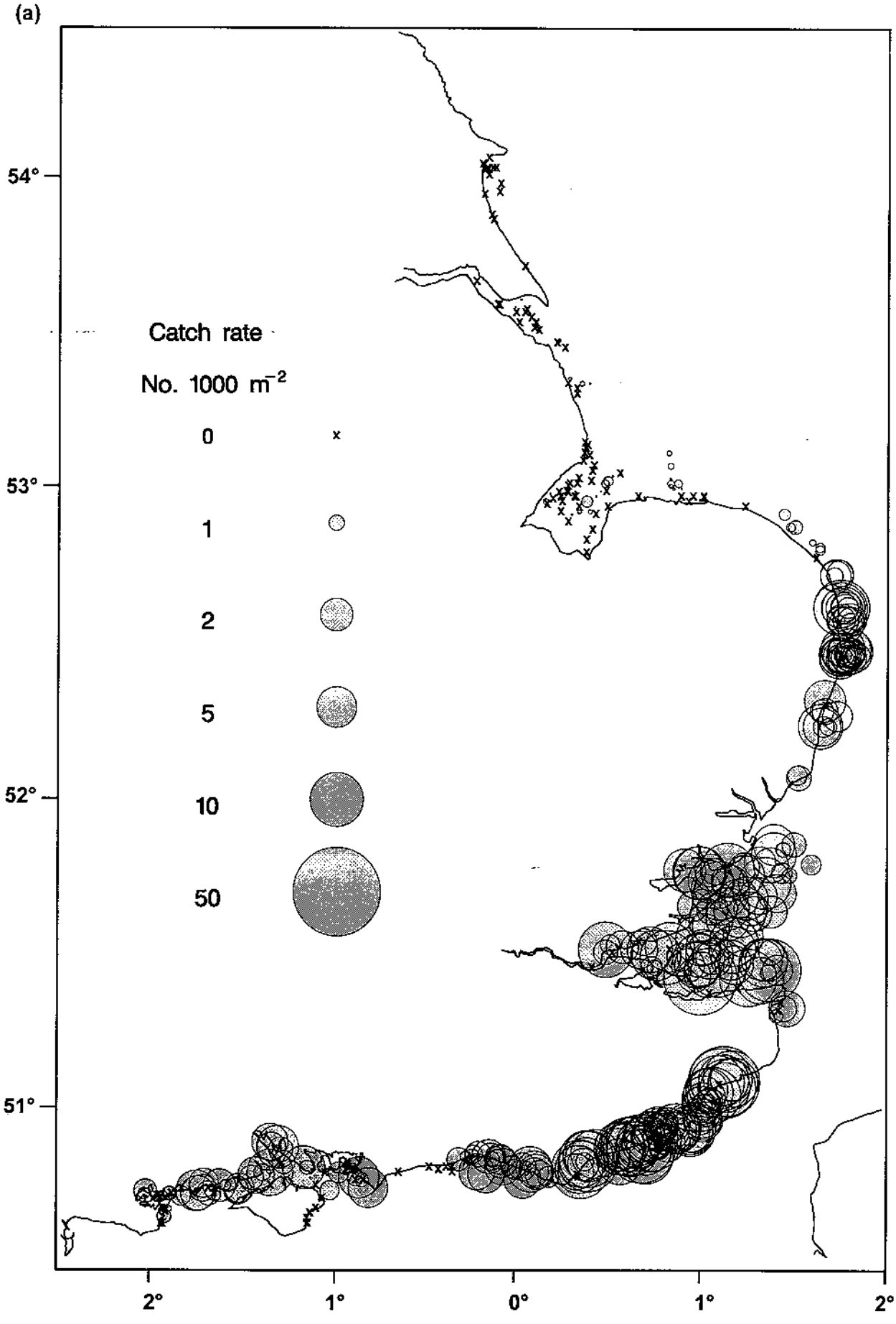


Figure 13. ***Trisopterus luscus*** **- bib**

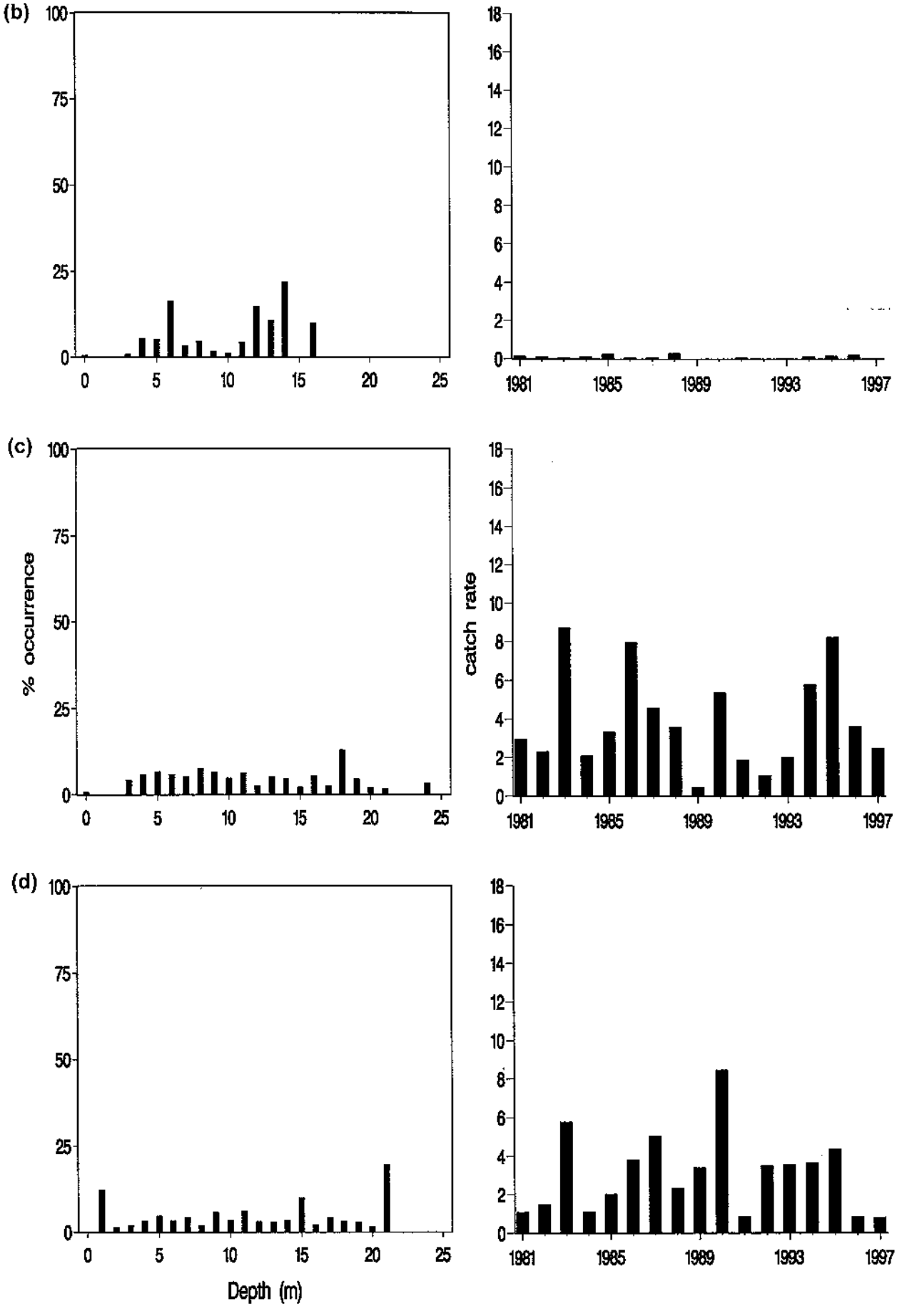


Figure 14. ***Pollachius pollachius*** **- pollack**

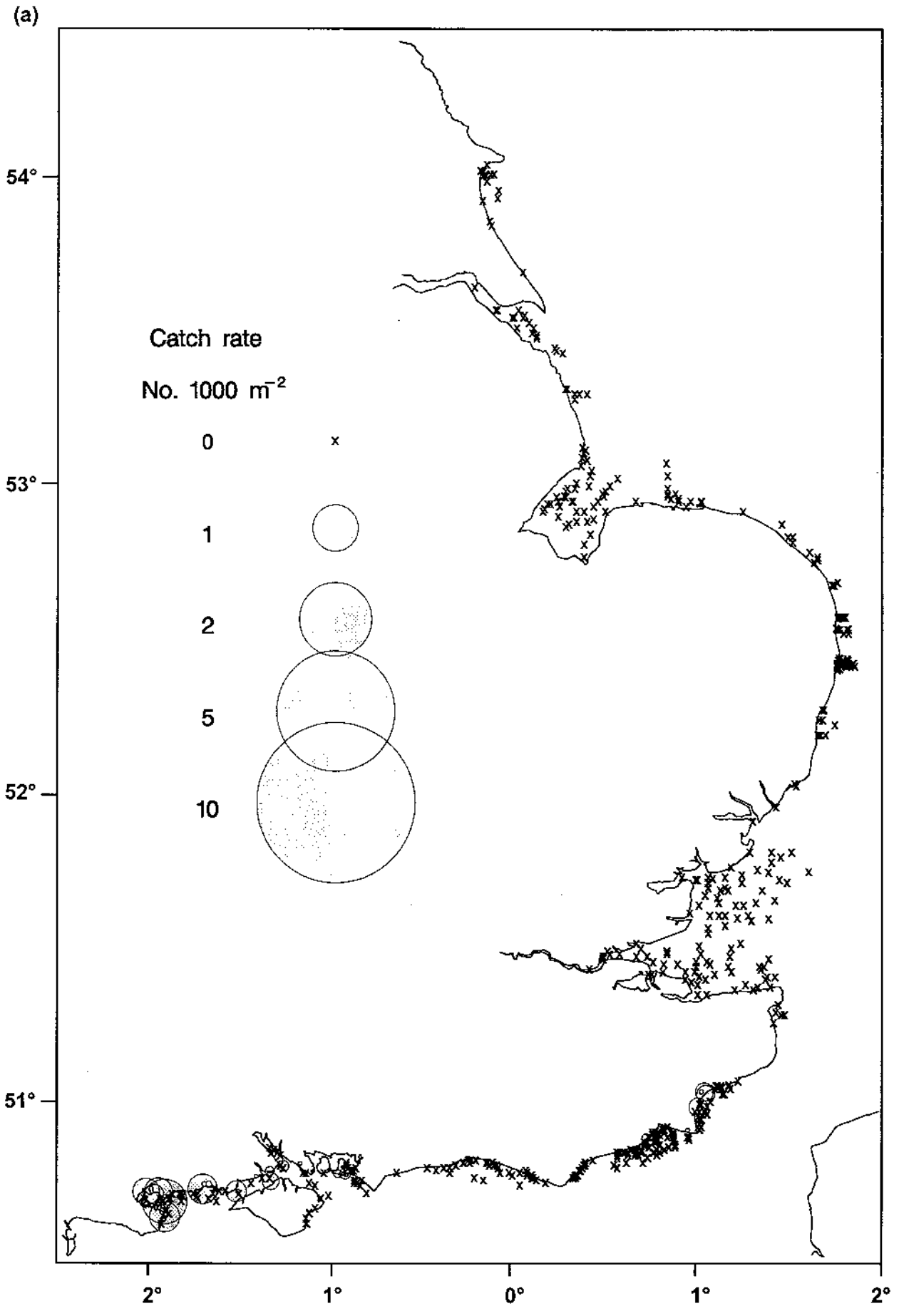


Figure 14. ***Pollachius pollachius*** **- pollack**

(b)

No data

(c)

No data

(d)

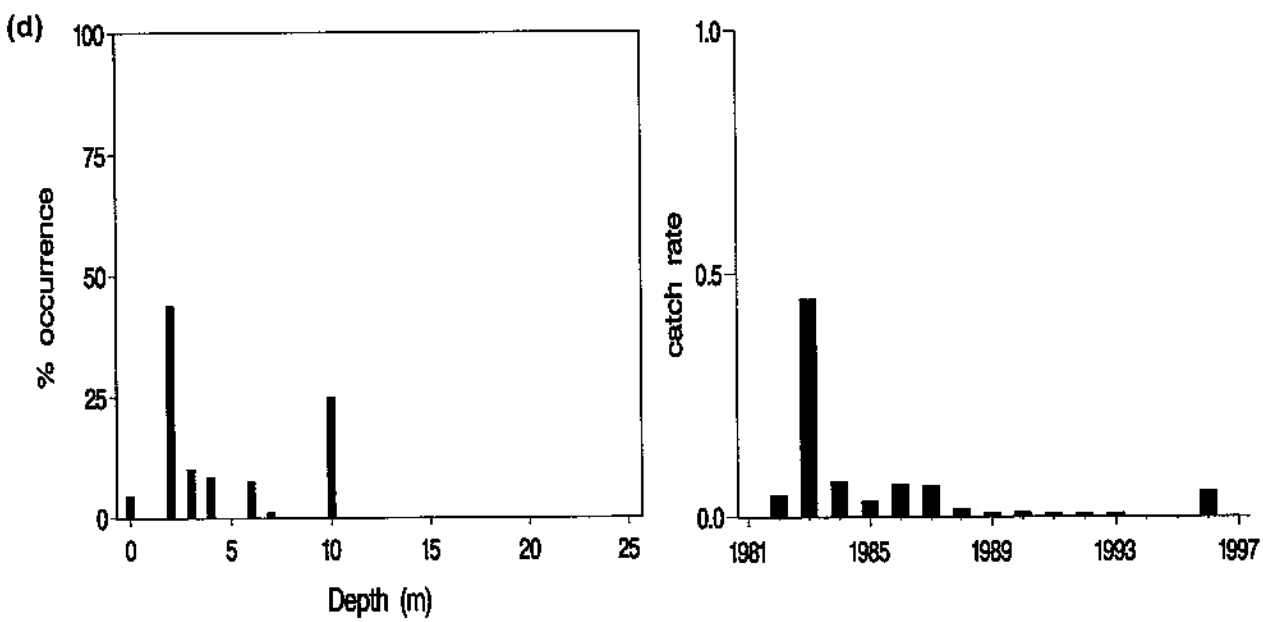


Figure 15. ***Ciliata mustela*** **- five-bearded rockling**

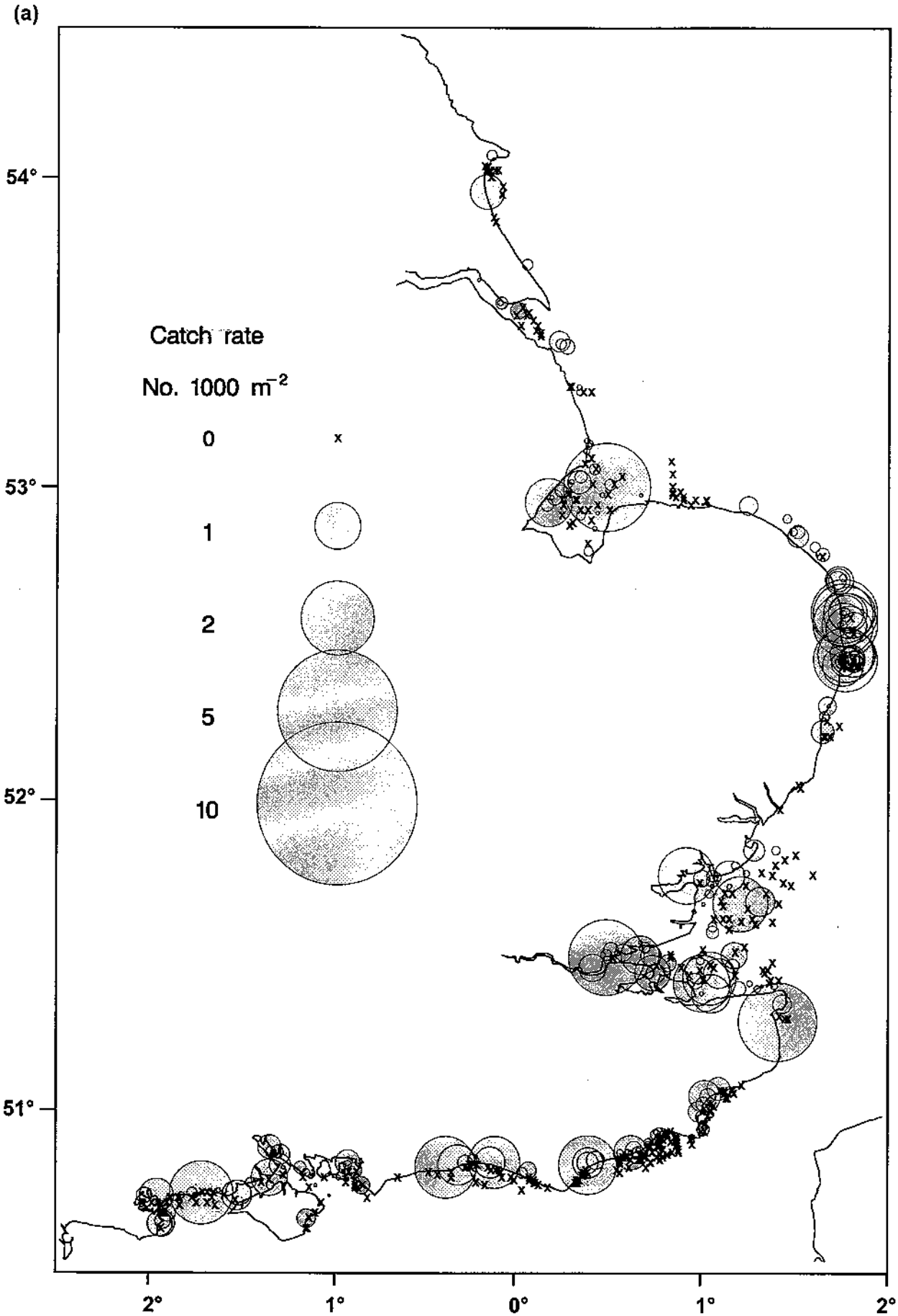


Figure 15. ***Ciliata mustela*** **- five-bearded rockling**

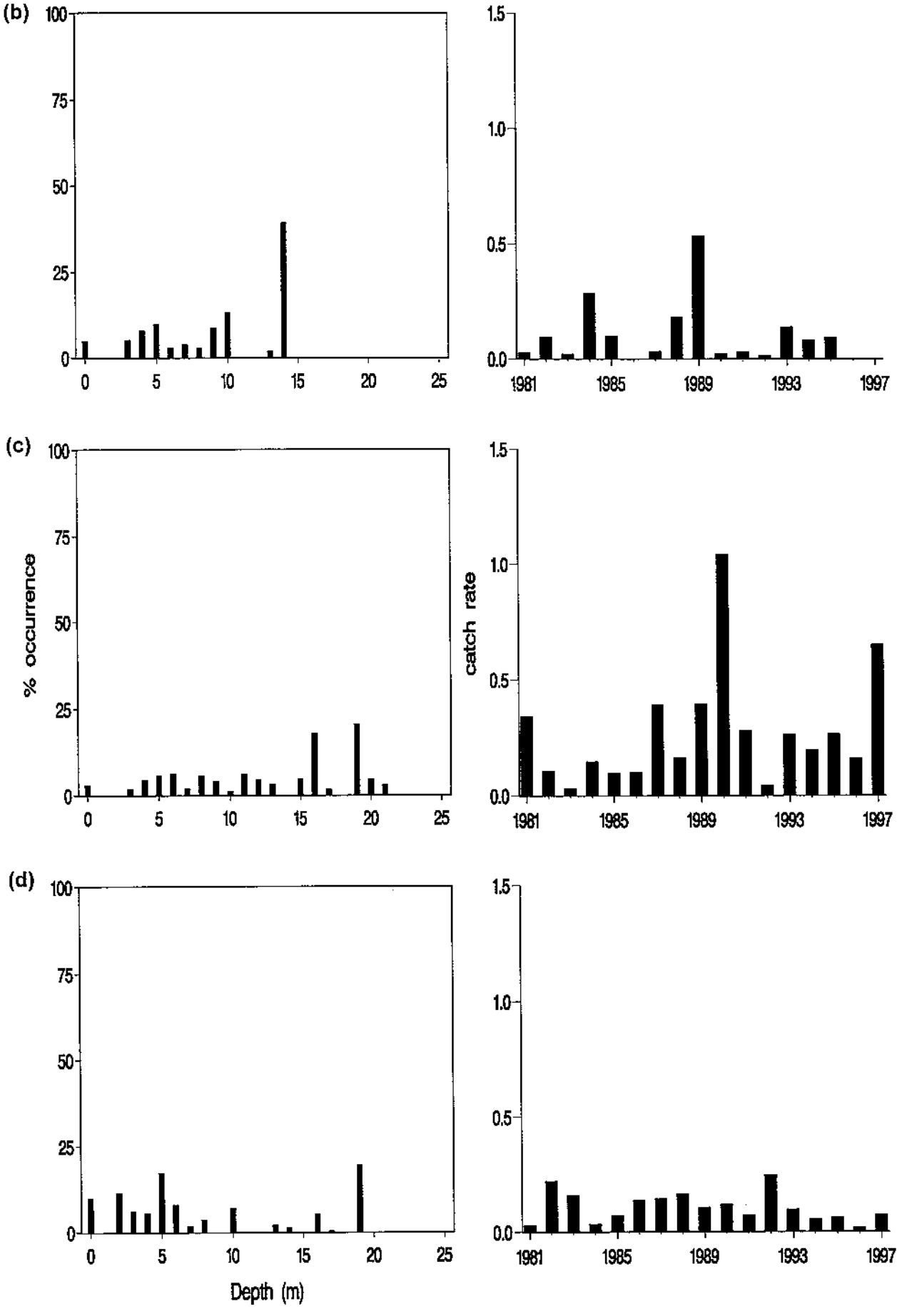


Figure 16. ***Enchelyopus cimbrius*** **- four-bearded rockling**

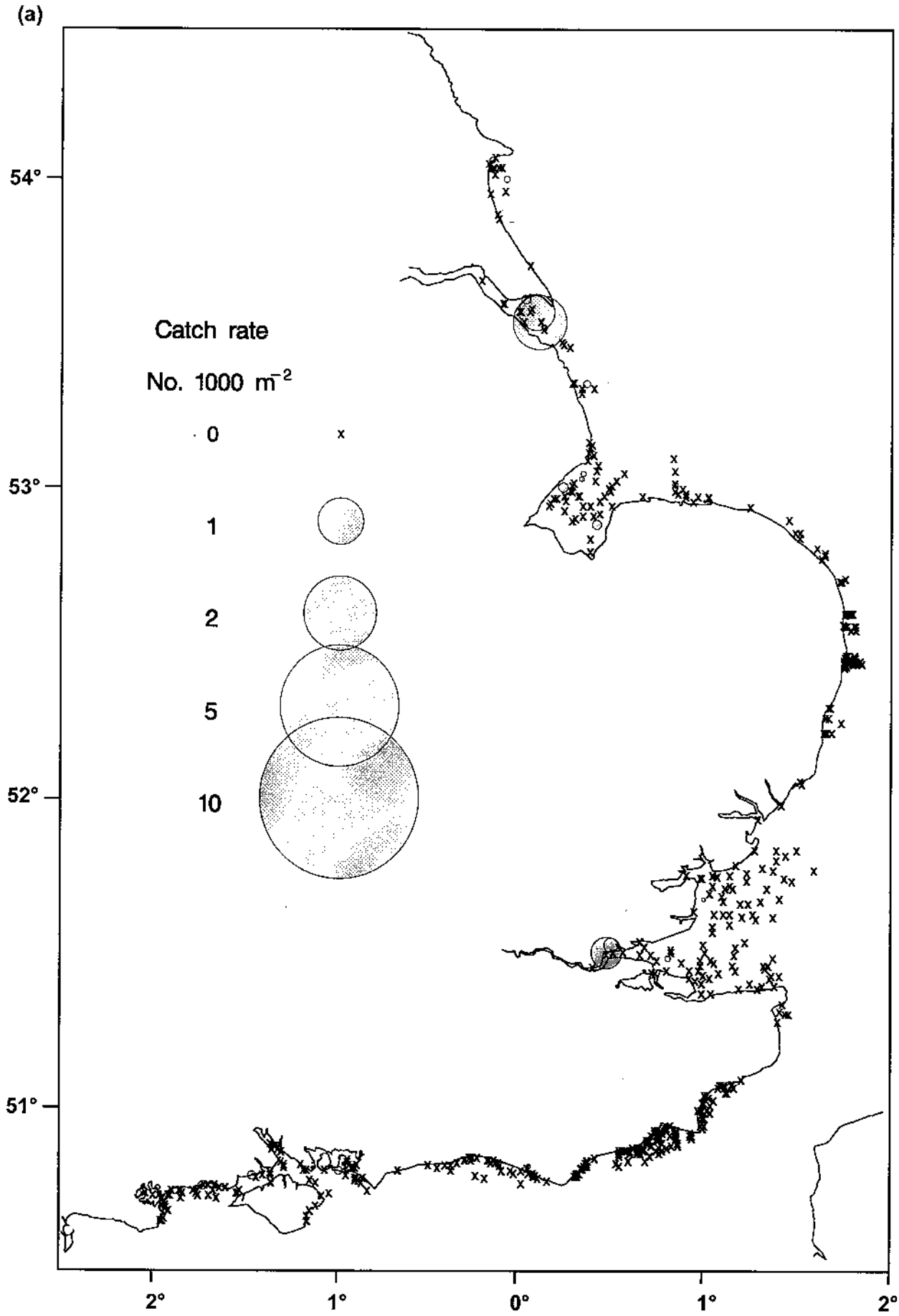


Figure 16. ***Enchelyopus cimbrius*** **- four-bearded rockling**

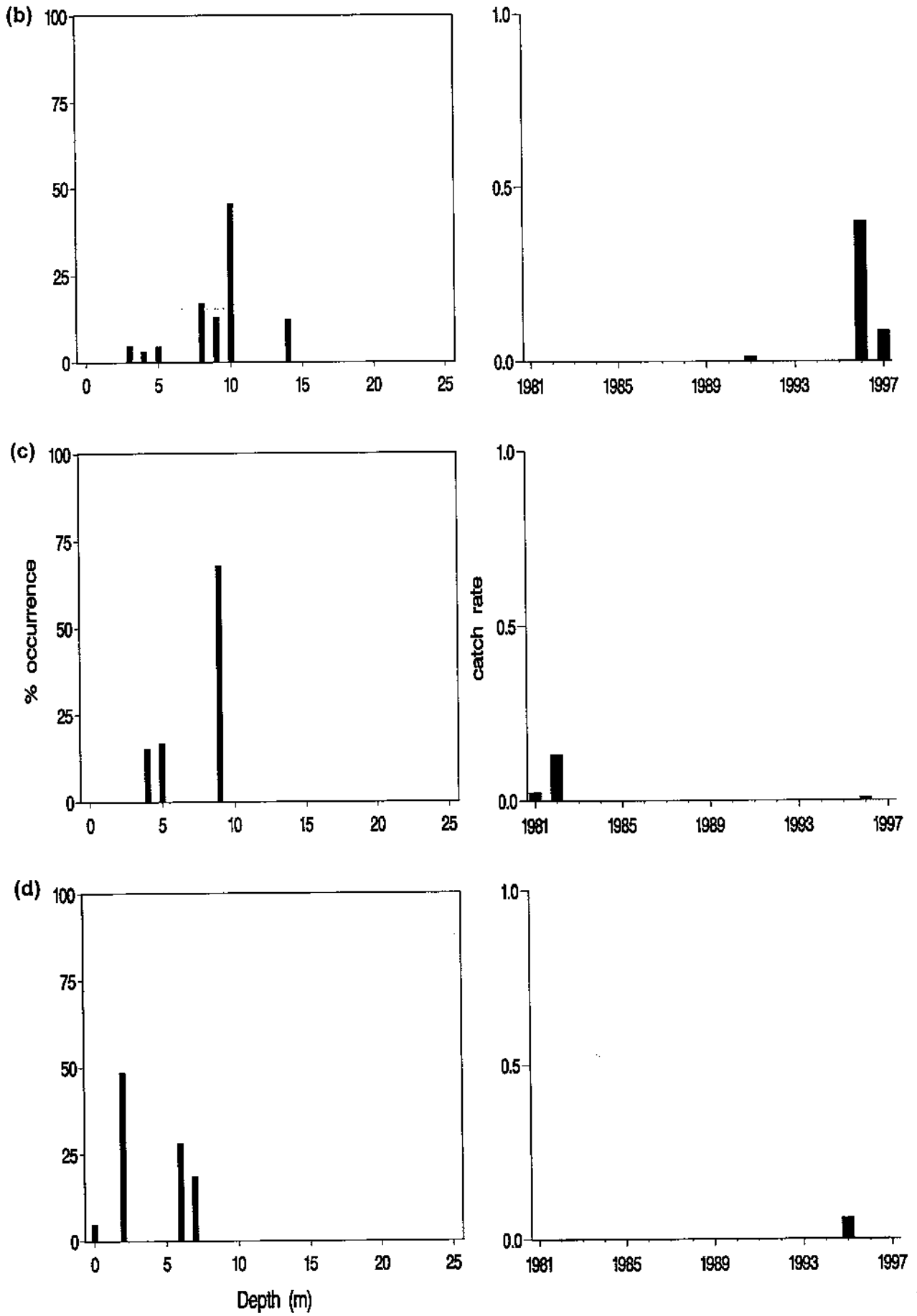


Figure 17. ***Gasterosteus aculeatus*** **- stickleback**

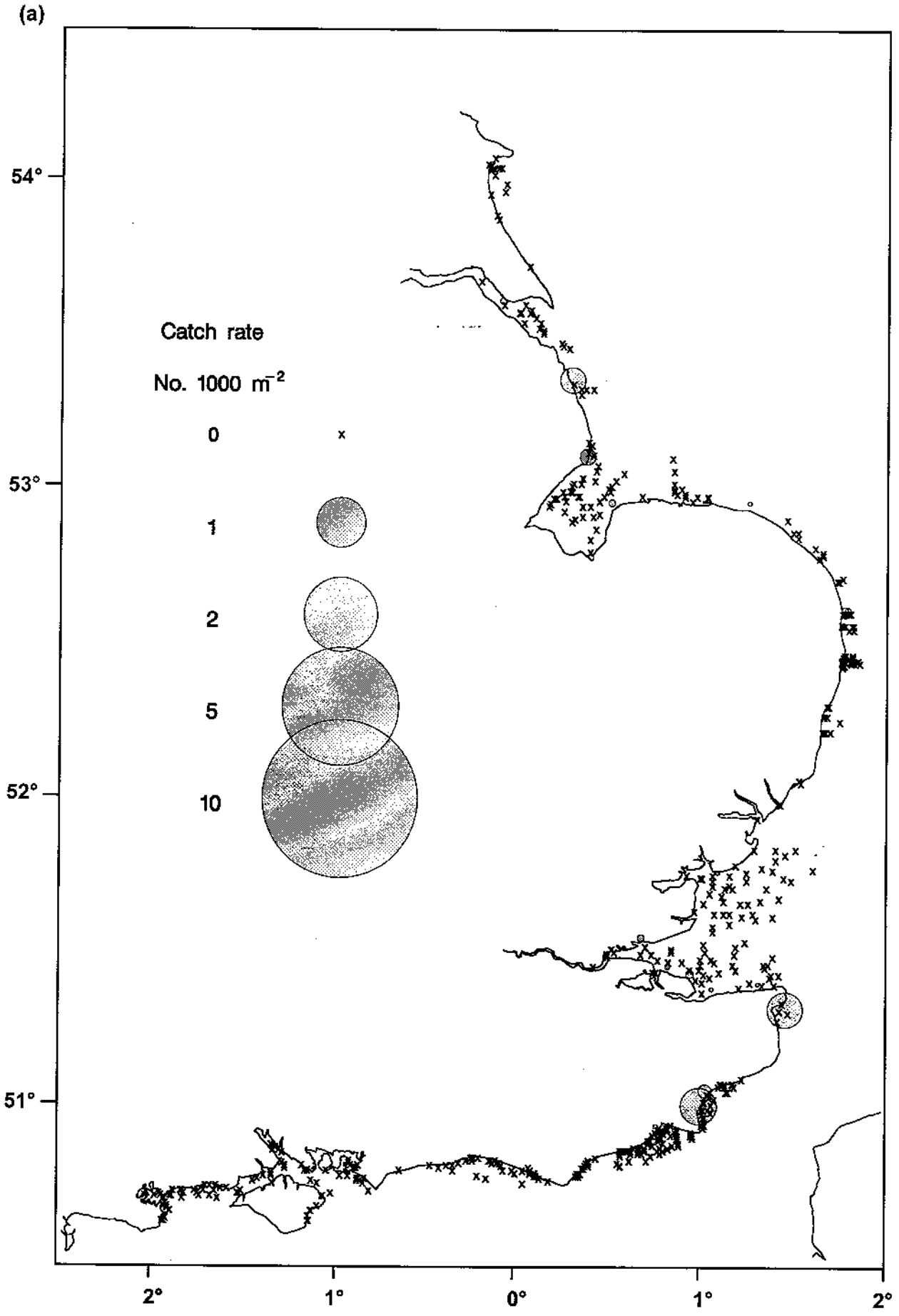


Figure 17. ***Gasterosteus aculeatus*** **- stickleback**

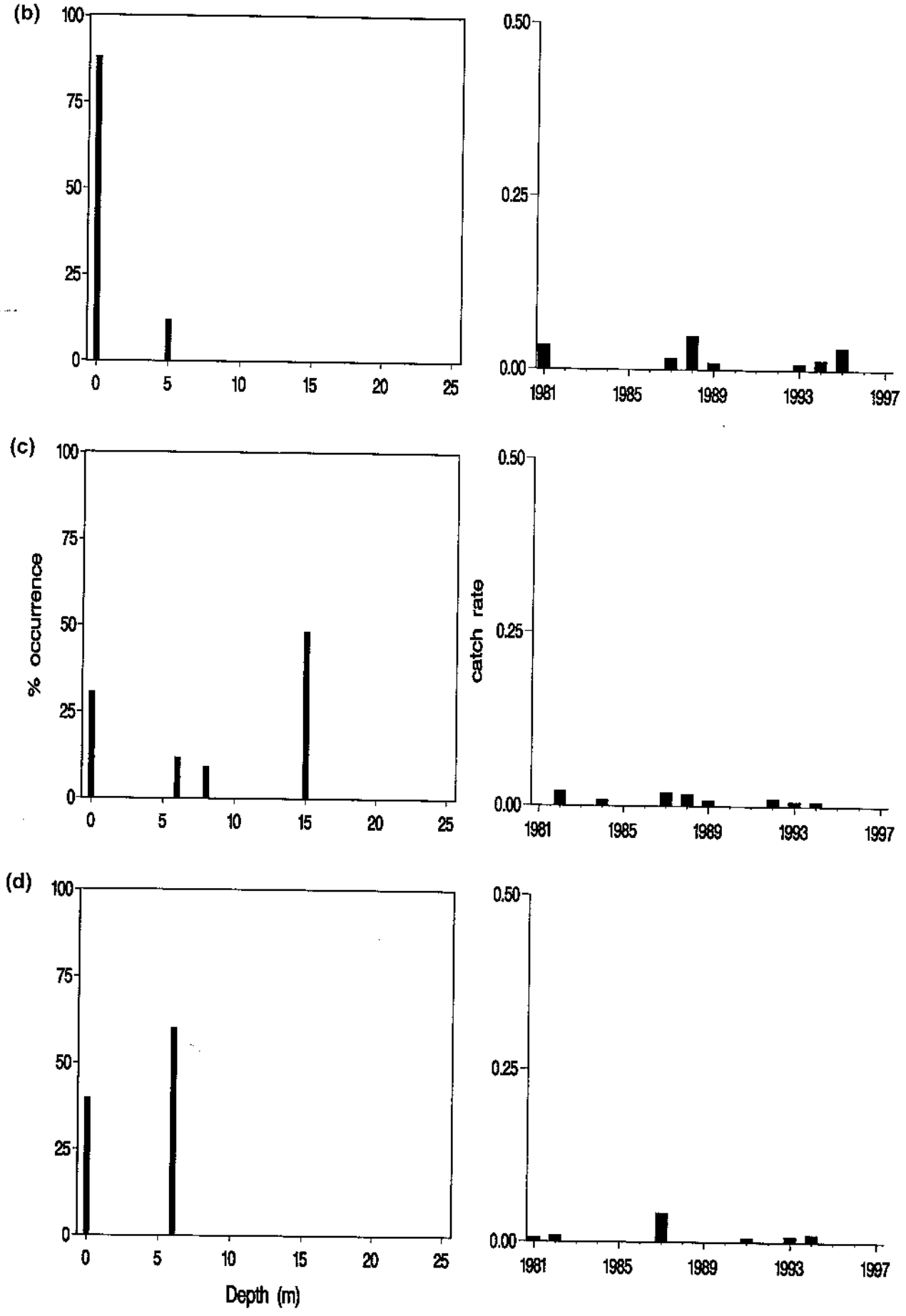


Figure 18. ***Spinachia spinachia*** **- fifteen-spined stickleback**

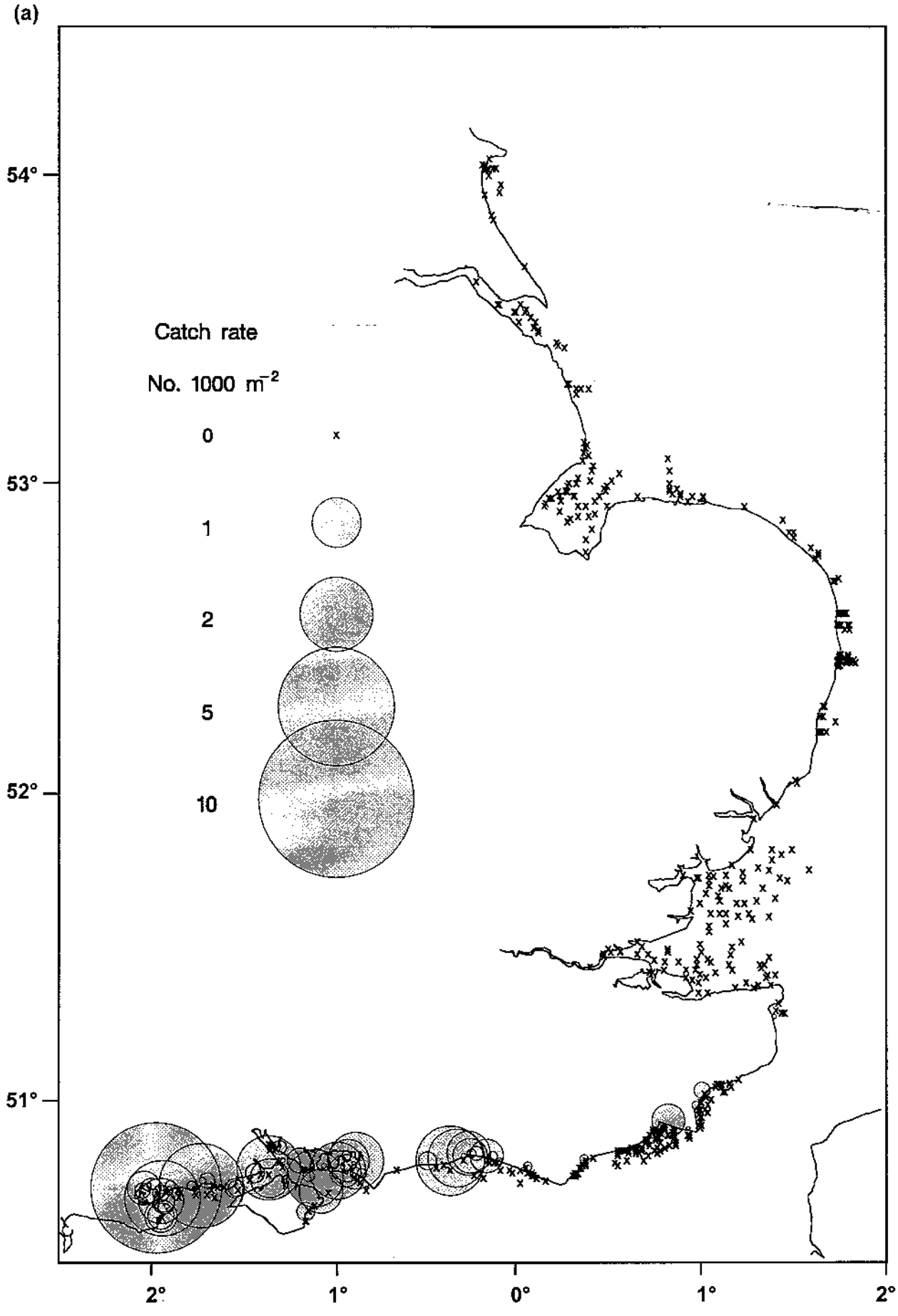


Figure 18. ***Spinachia spinachia*** **- fifteen-spined stickleback**

(b)

No data

(c)

No data

(d)

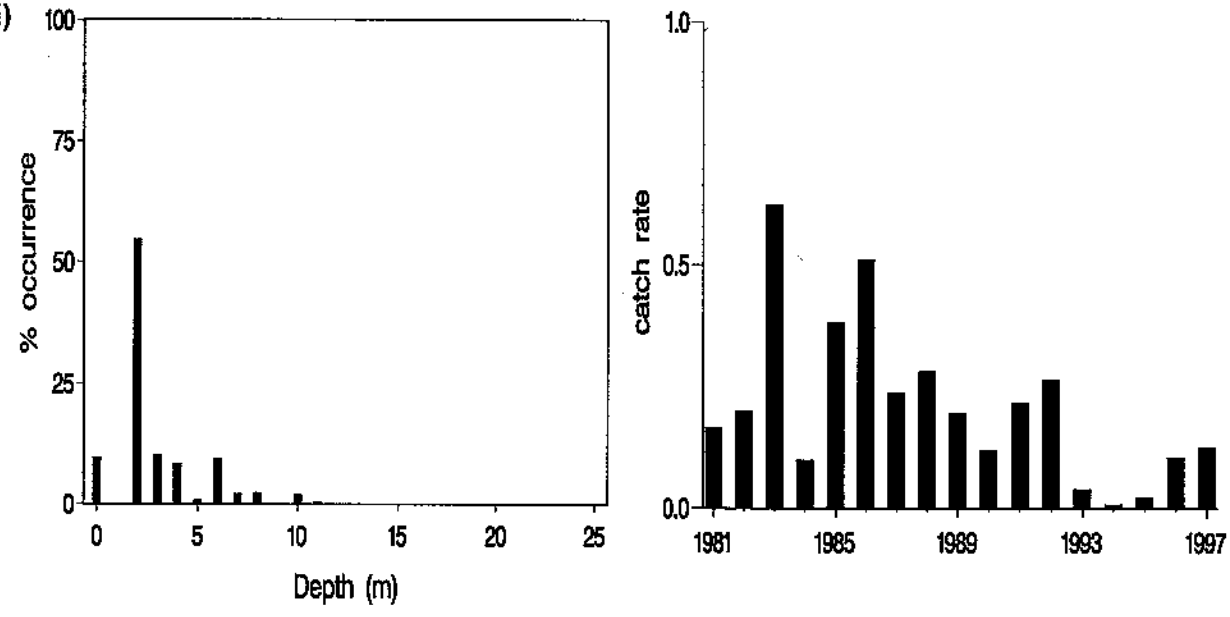


Figure 19. ***Syngnathus acus*** **- greater pipefish**

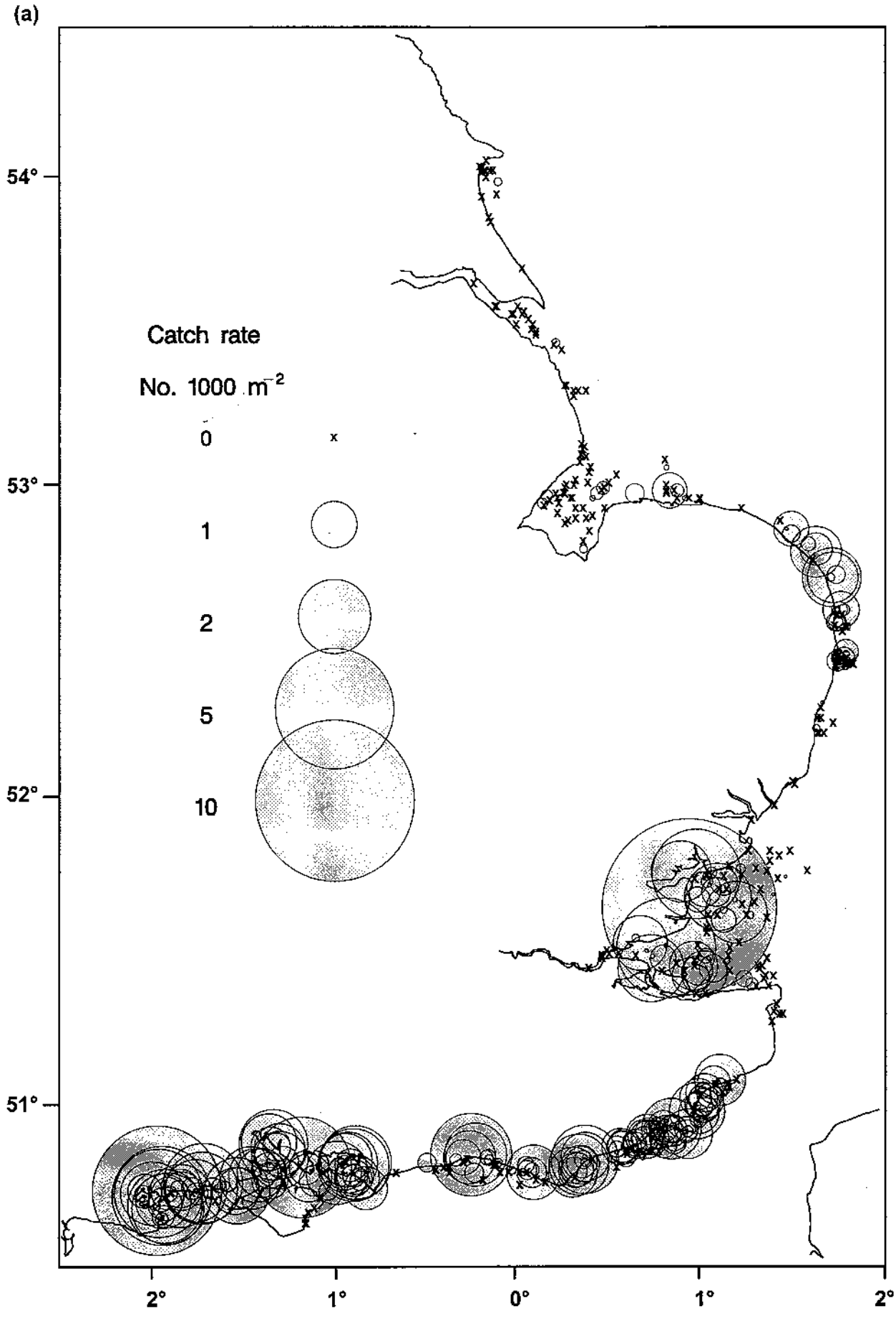


Figure 19. ***Syngnathus acus*** **- greater pipefish**

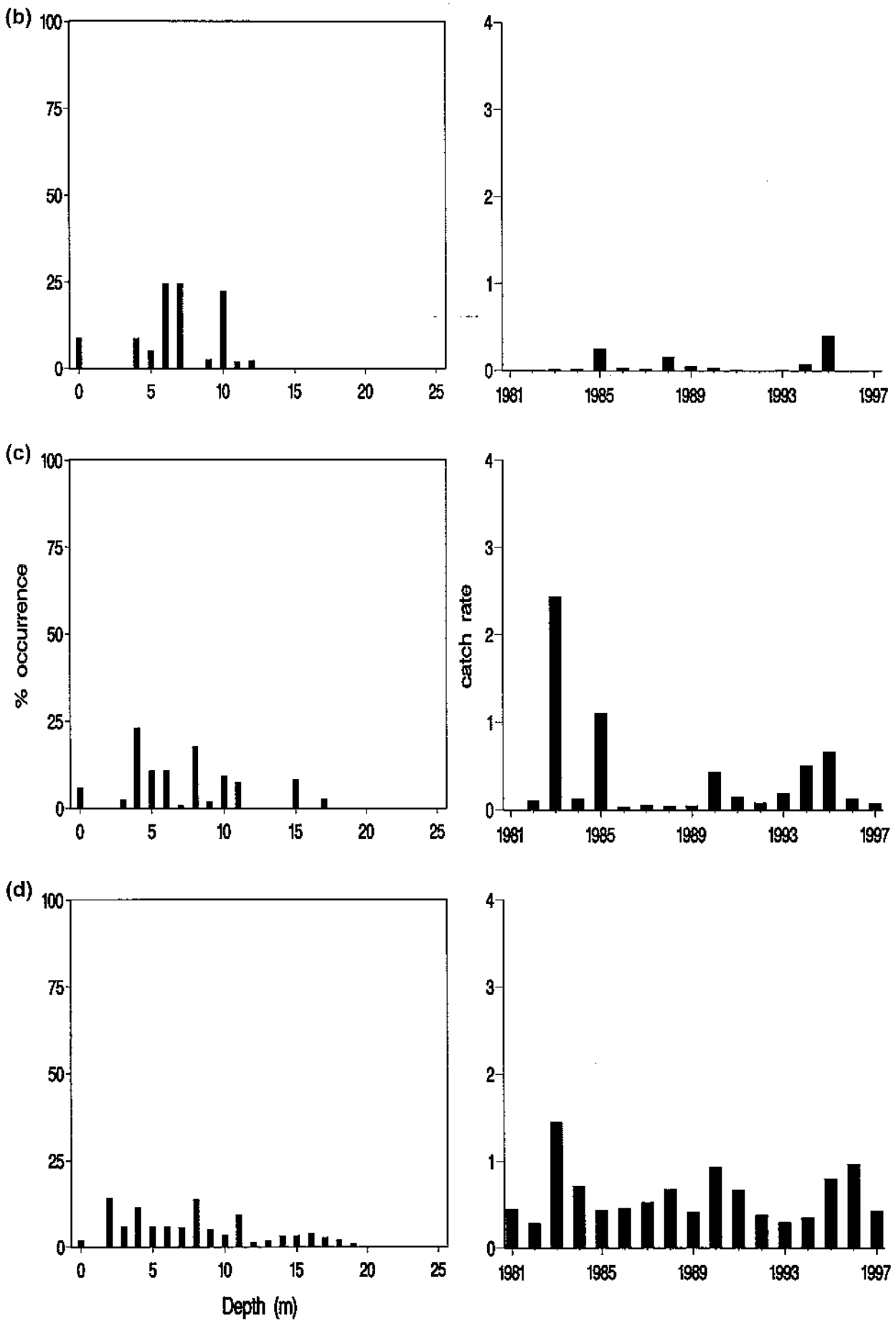


Figure 20. ***Syngnathus rostellatus*** **- Nilssons pipefish**

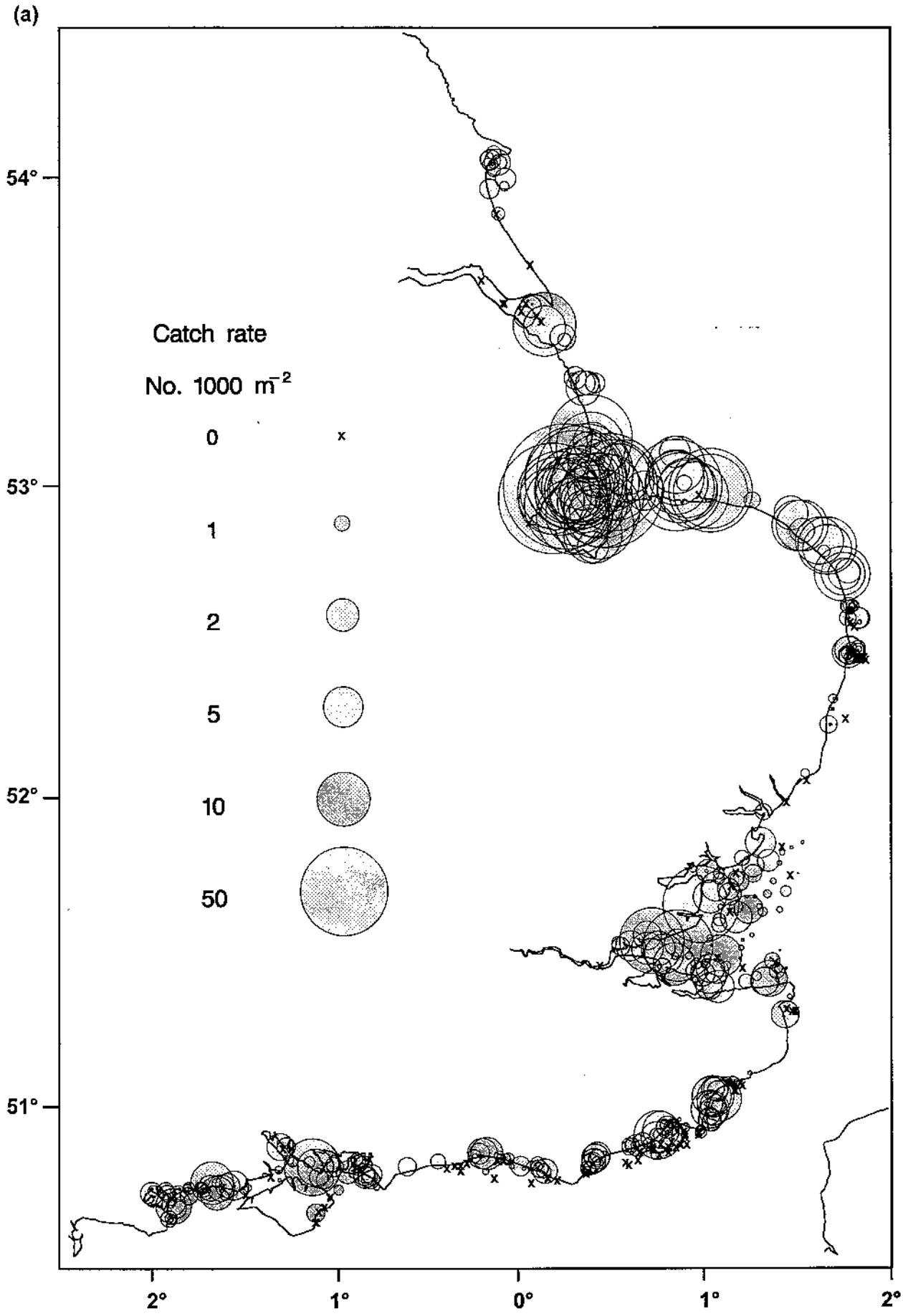


Figure 20. ***Syngnathus rostellatus*** **- Nilssons pipefish**

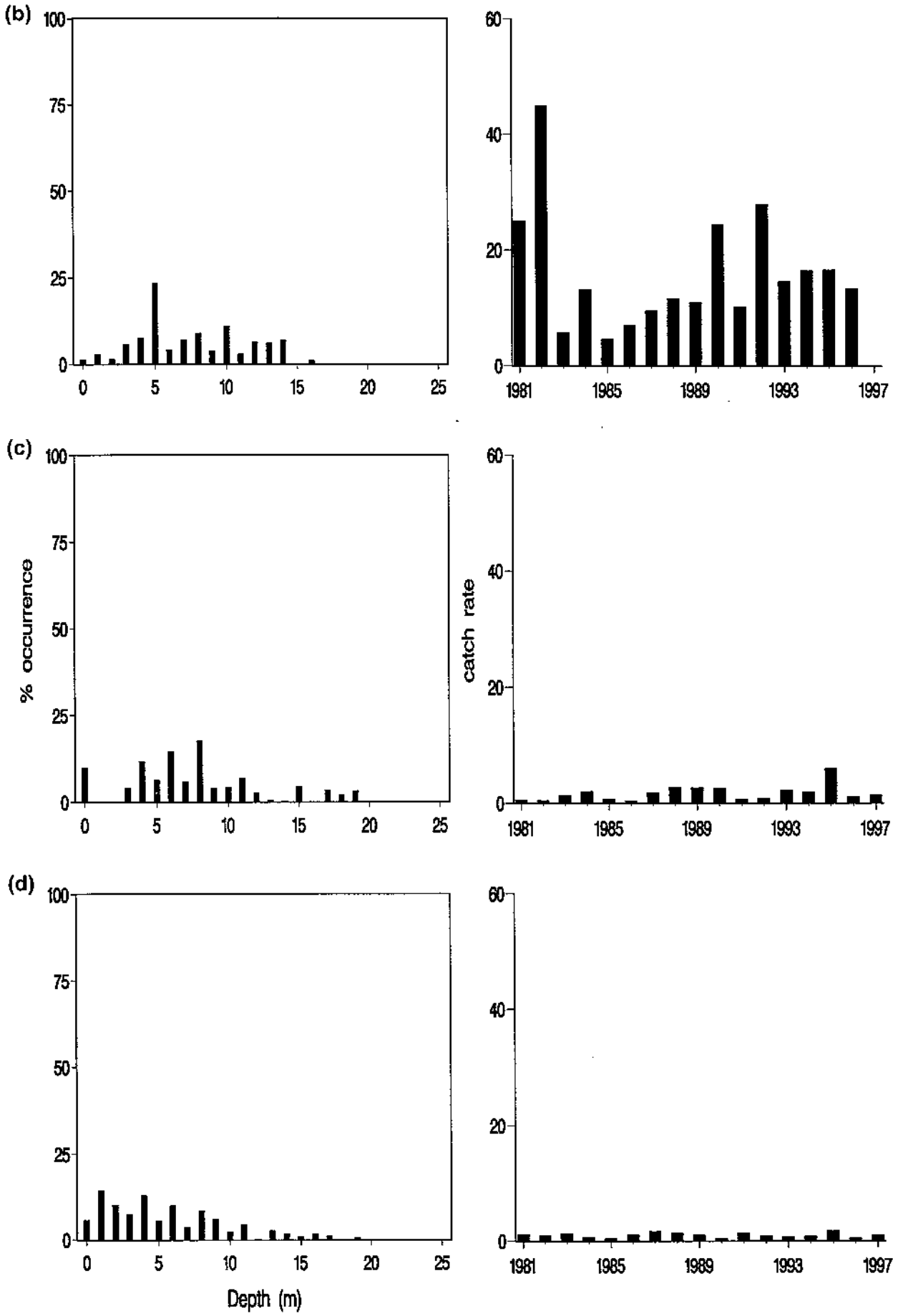


Figure 21. ***Syngnathus typhle*** **- deep-snouted pipefish**

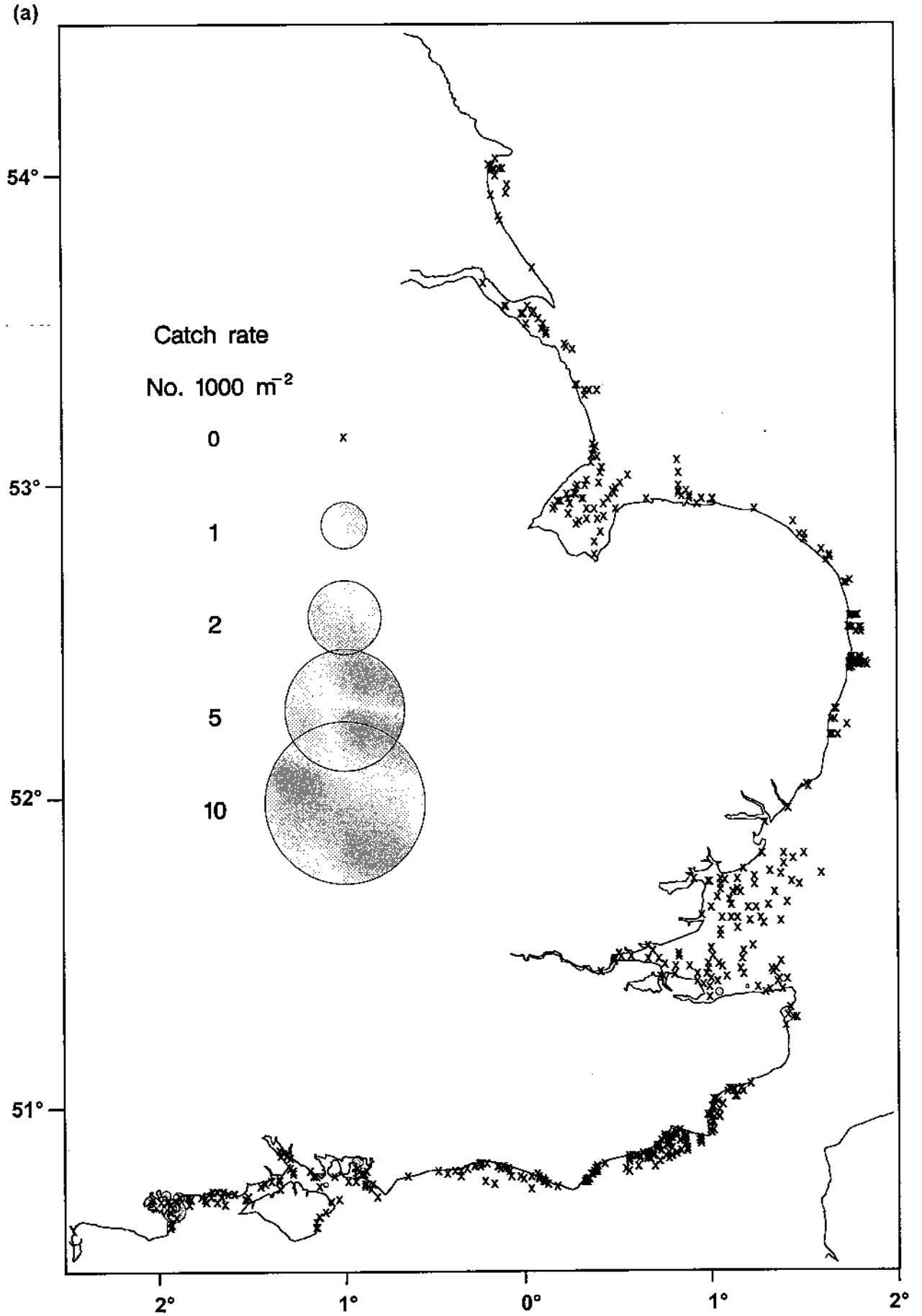


Figure 21. ***Syngnathus typhle*** **- deep-snouted pipefish**

(b)

No data

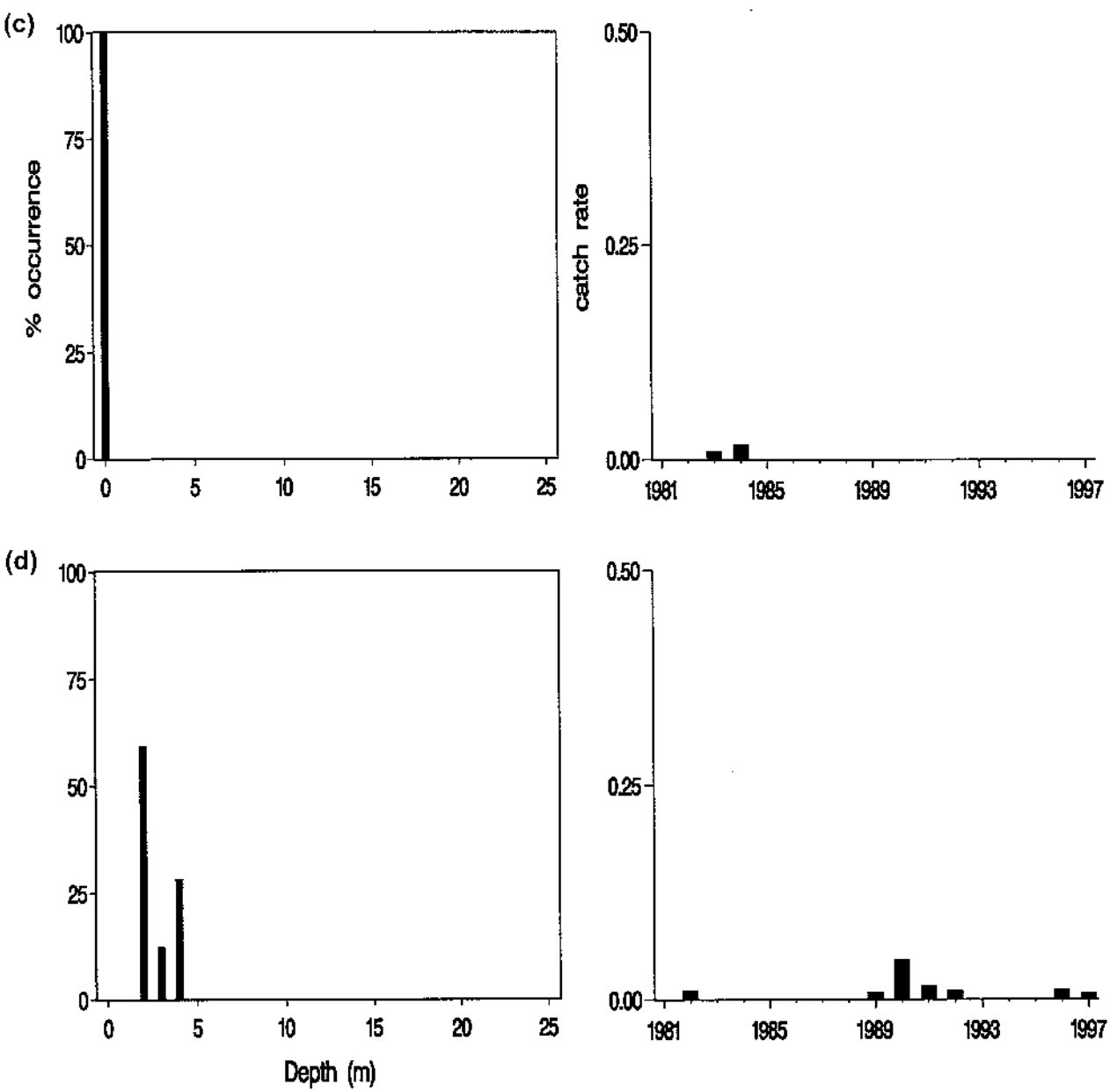


Figure 22. ***Nerophis lumbriciformis*** **- worm pipefish**

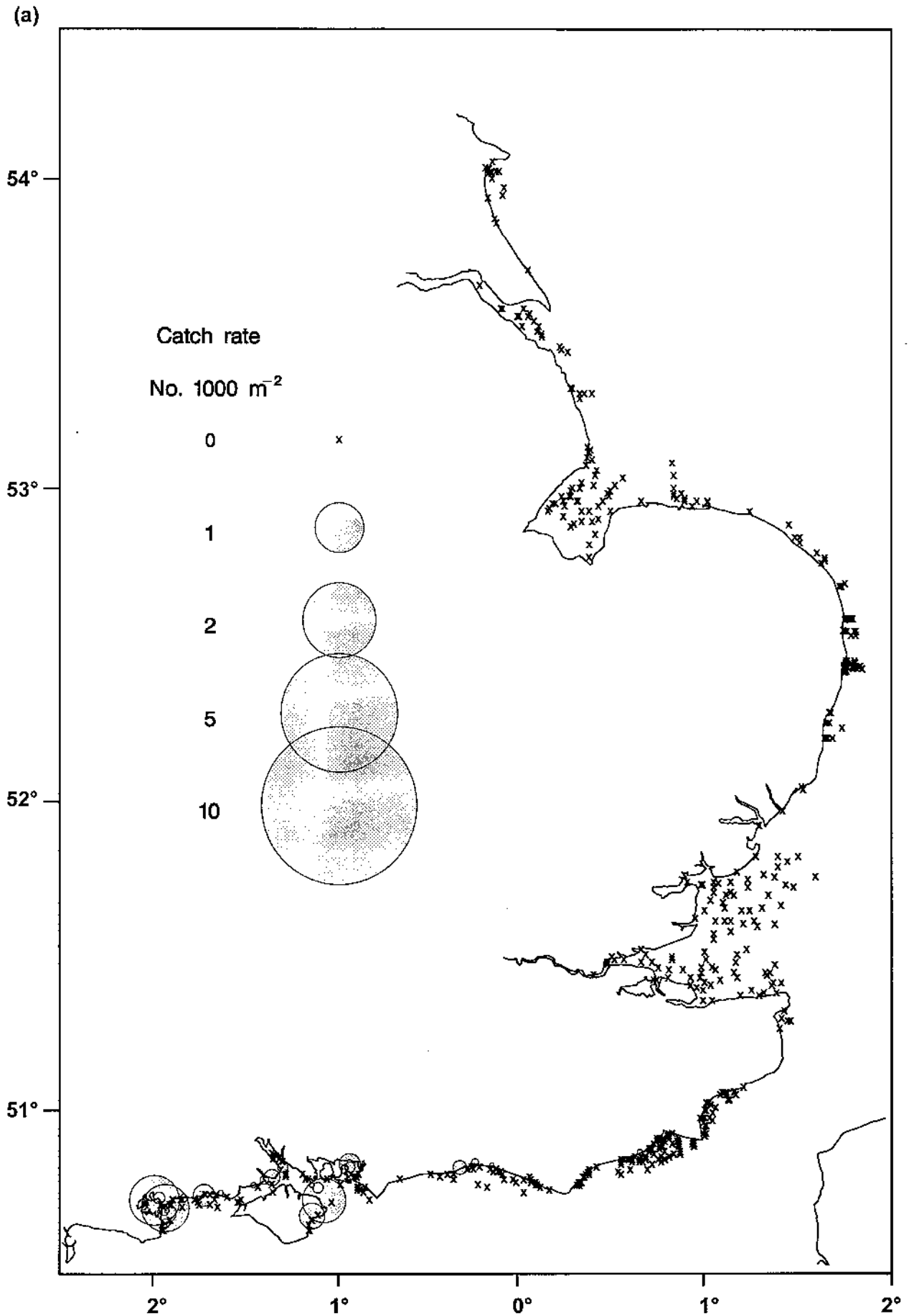


Figure 22. ***Nerophis lumbriciformis*** **- worm pipefish**

(b)

No data

(c)

No data

(d)

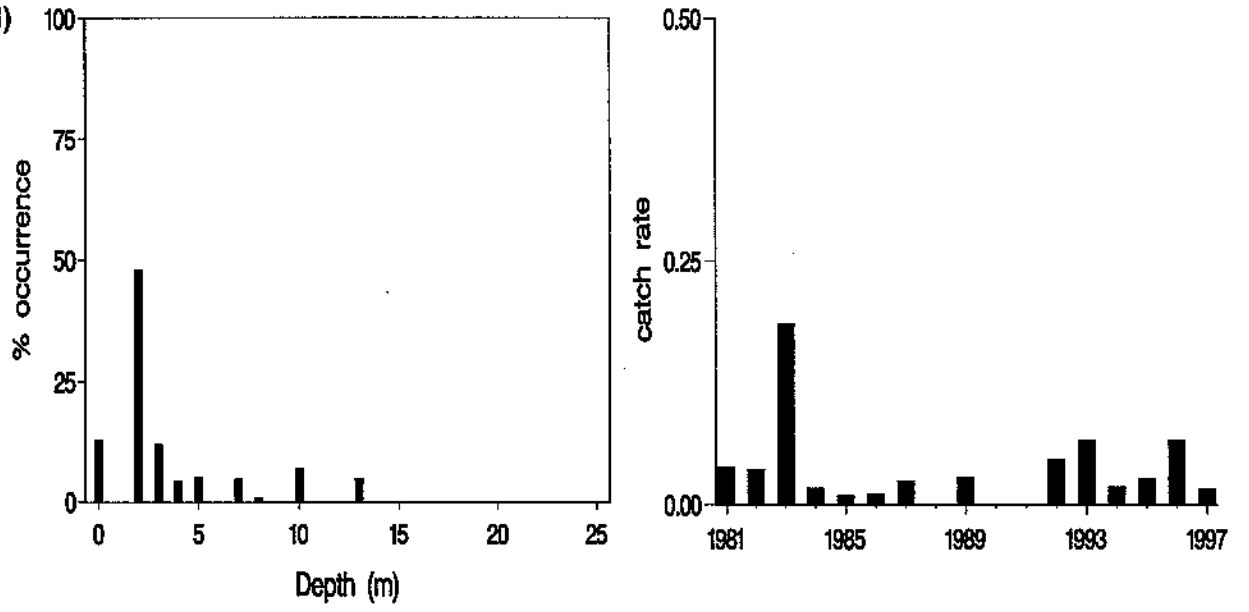


Figure 23. ***Entelurus aequoreus*** **- snake pipefish**

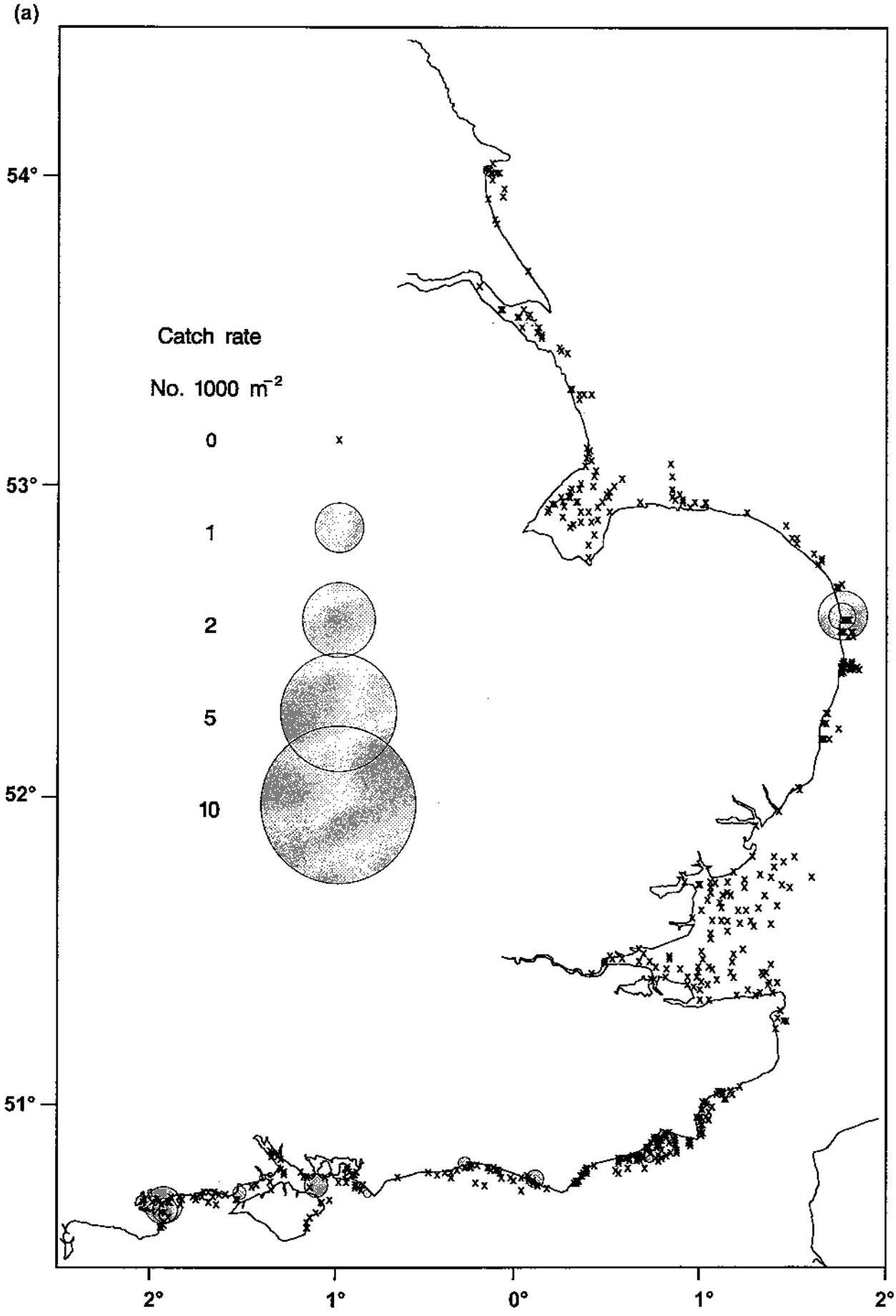


Figure 23. ***Entelurus aequoreus*** **- snake pipefish**

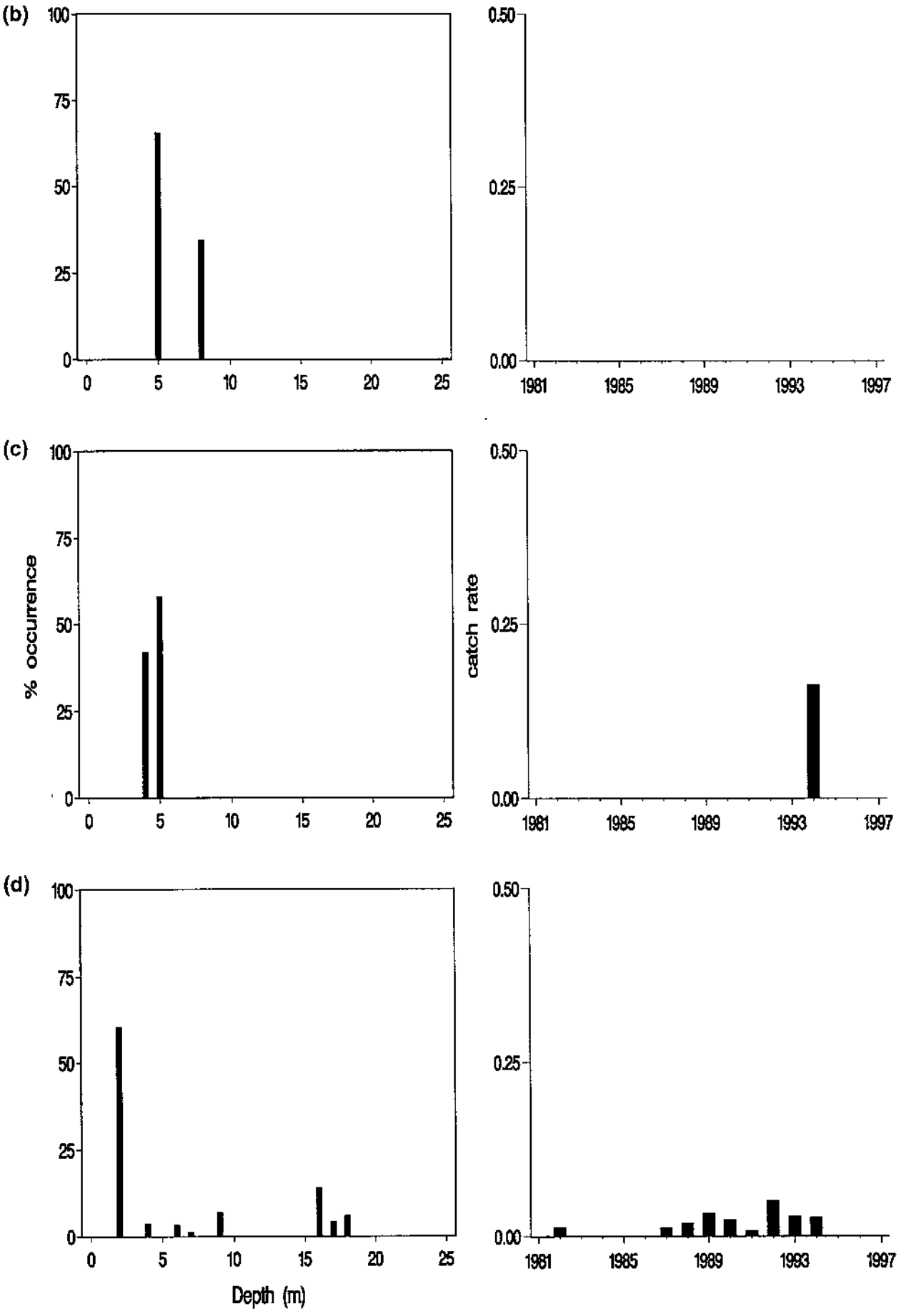


Figure 24. ***Spondyliosoma cantharus*** **- black sea-bream**

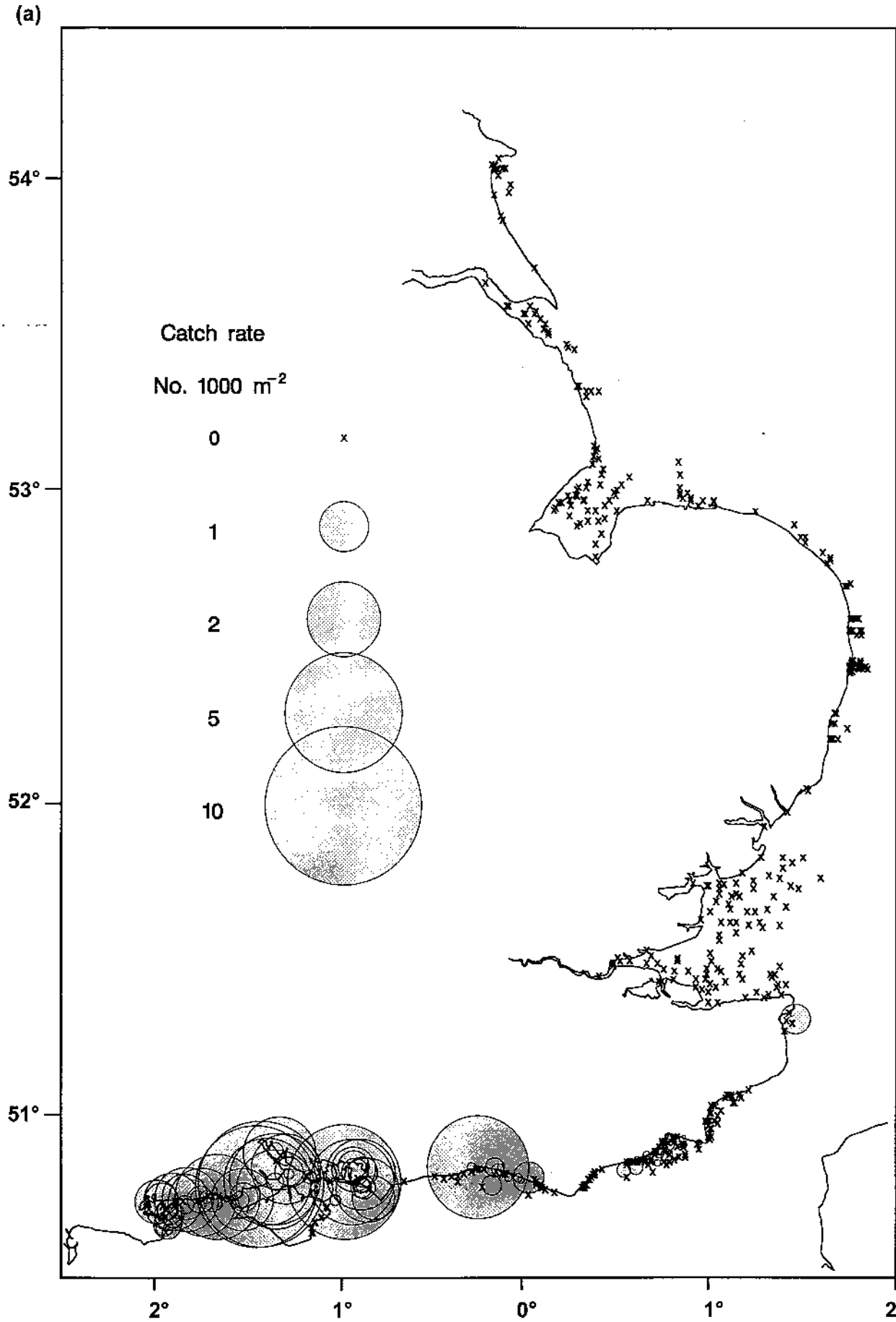


Figure 24. ***Spondyliosoma cantharus*** **- black sea-bream**

(b)

No data

(c)

No data

(d)

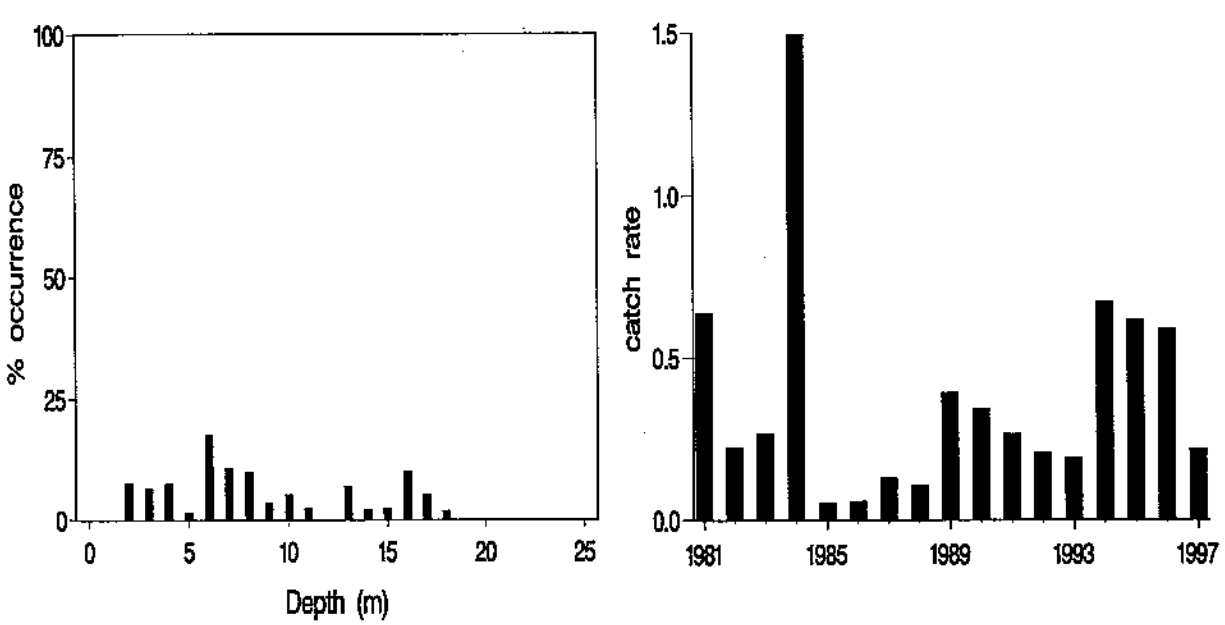


Figure 25. ***Mullus surmuletus*** **- red mullet**

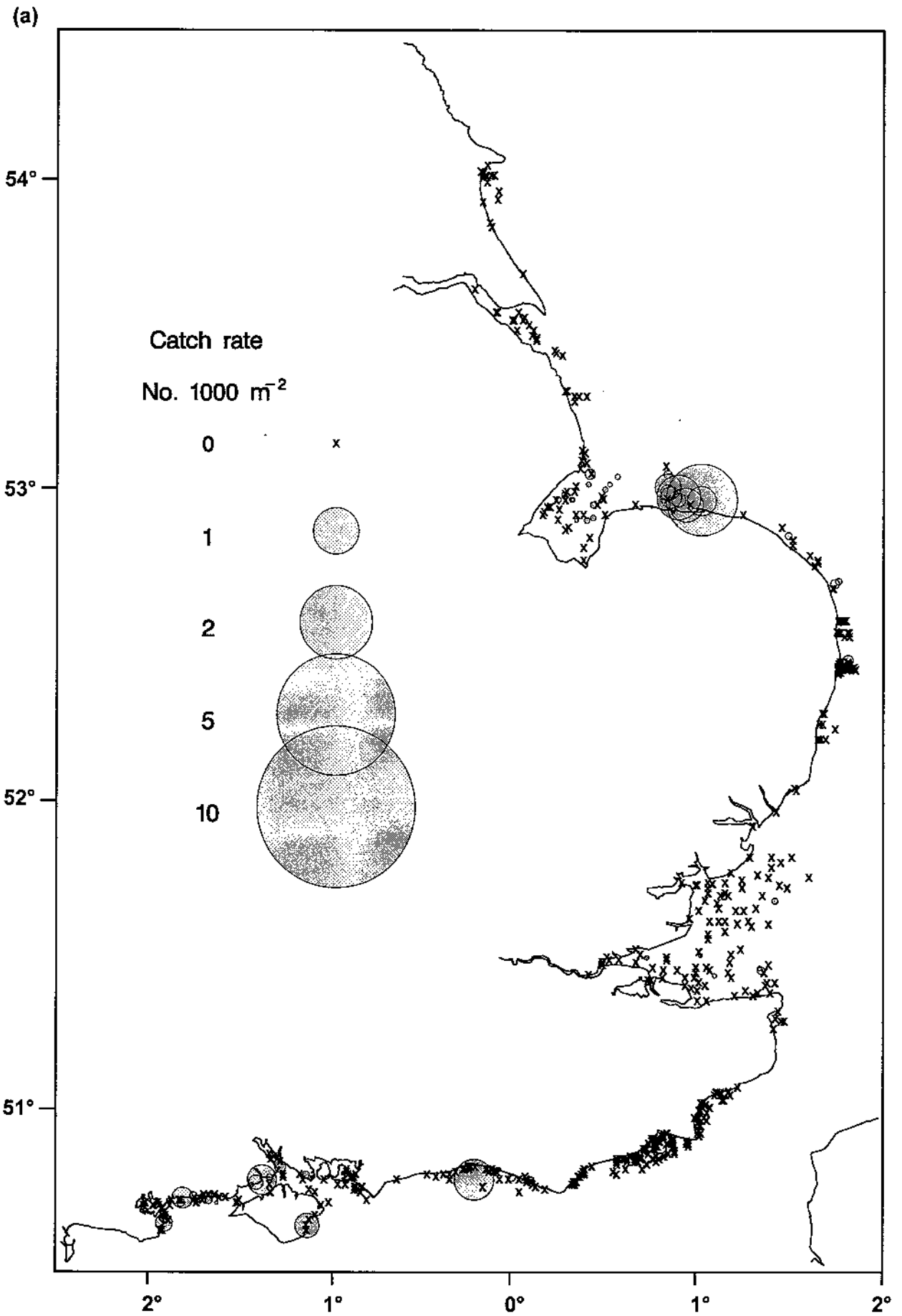


Figure 25. ***Mullus surmuletus*** **- red mullet**

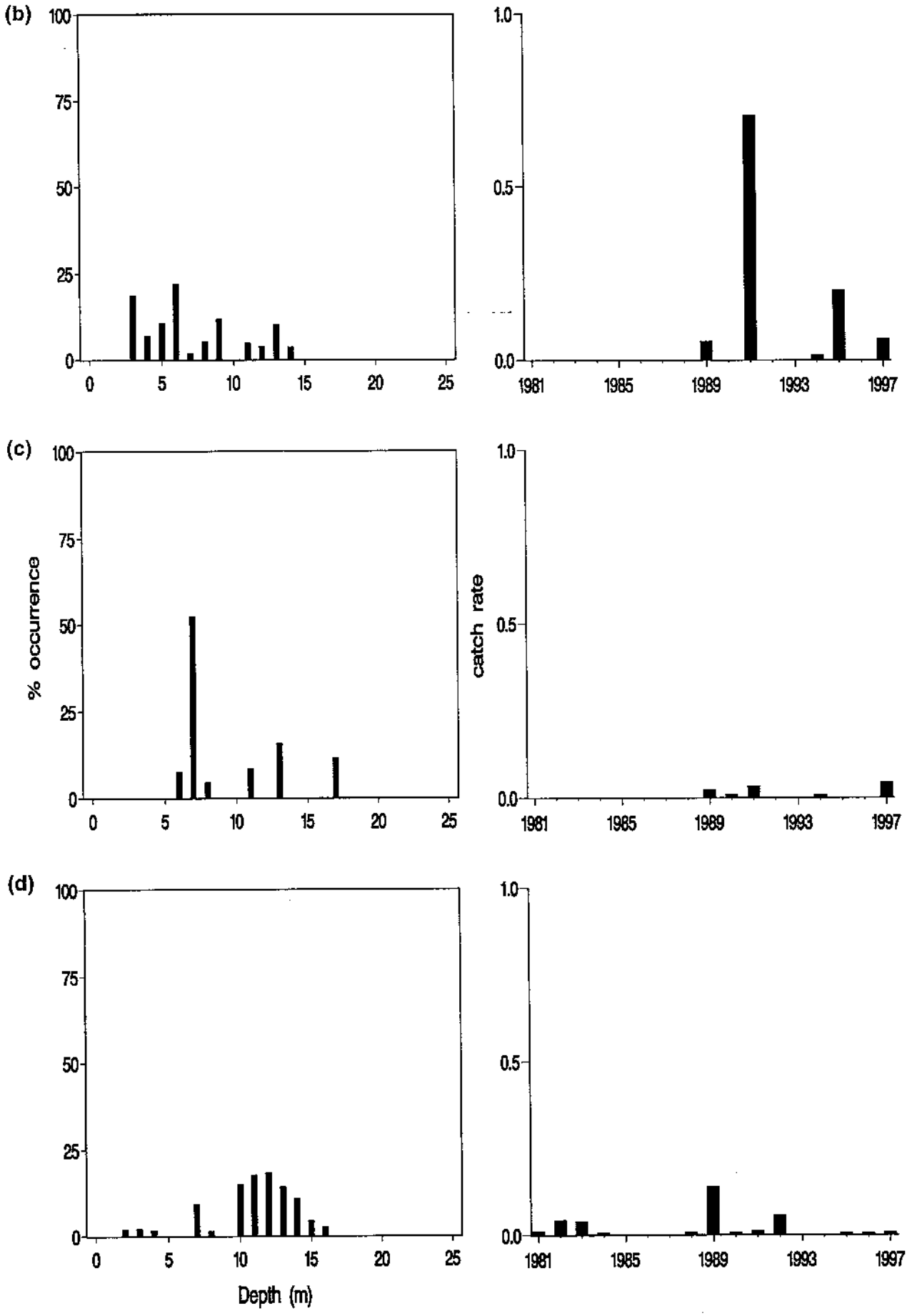


Figure 26. ***Dicentrarchus labrax*** **- sea bass**

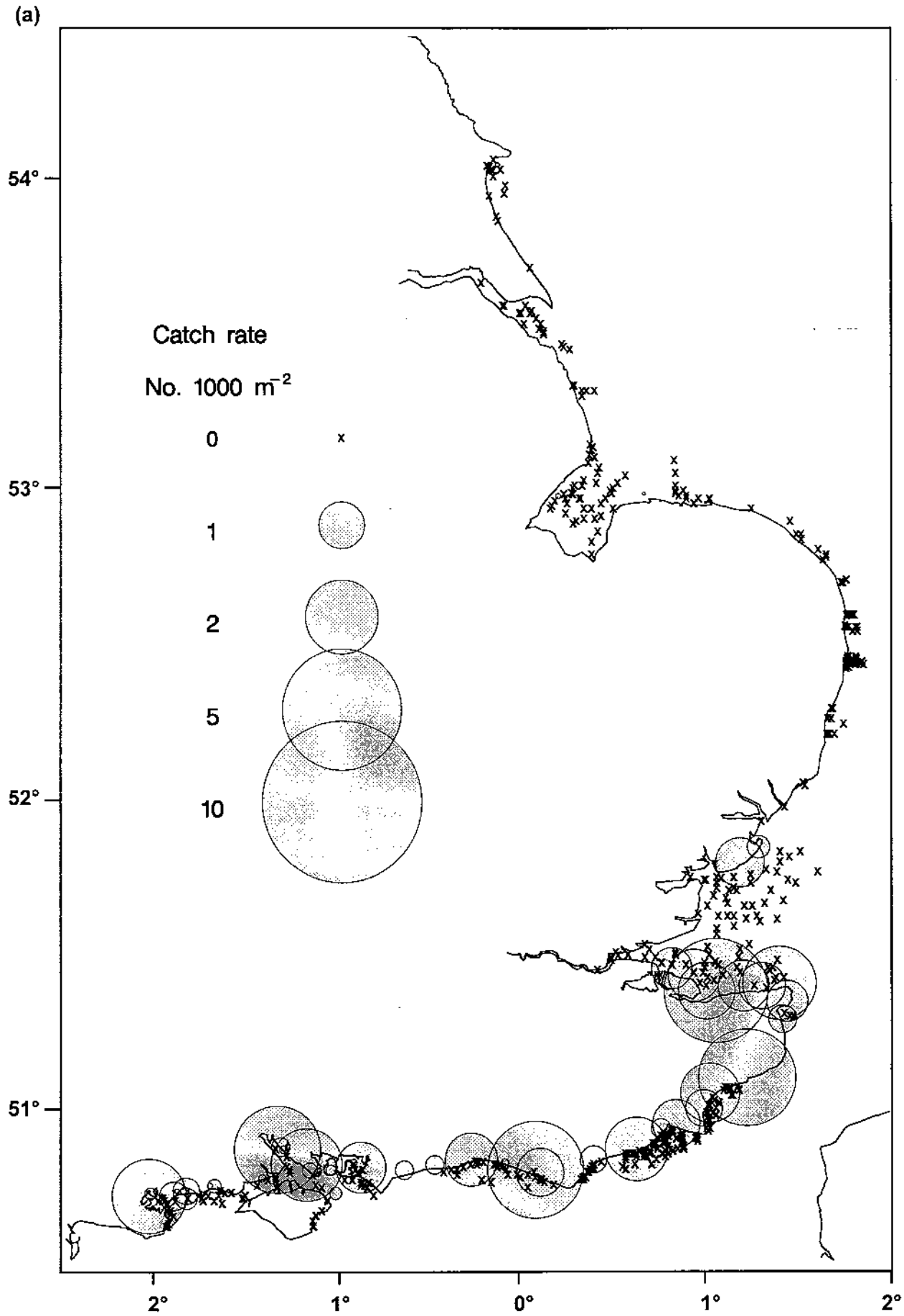


Figure 26. ***Dicentrarchus labrax*** **- sea bass**

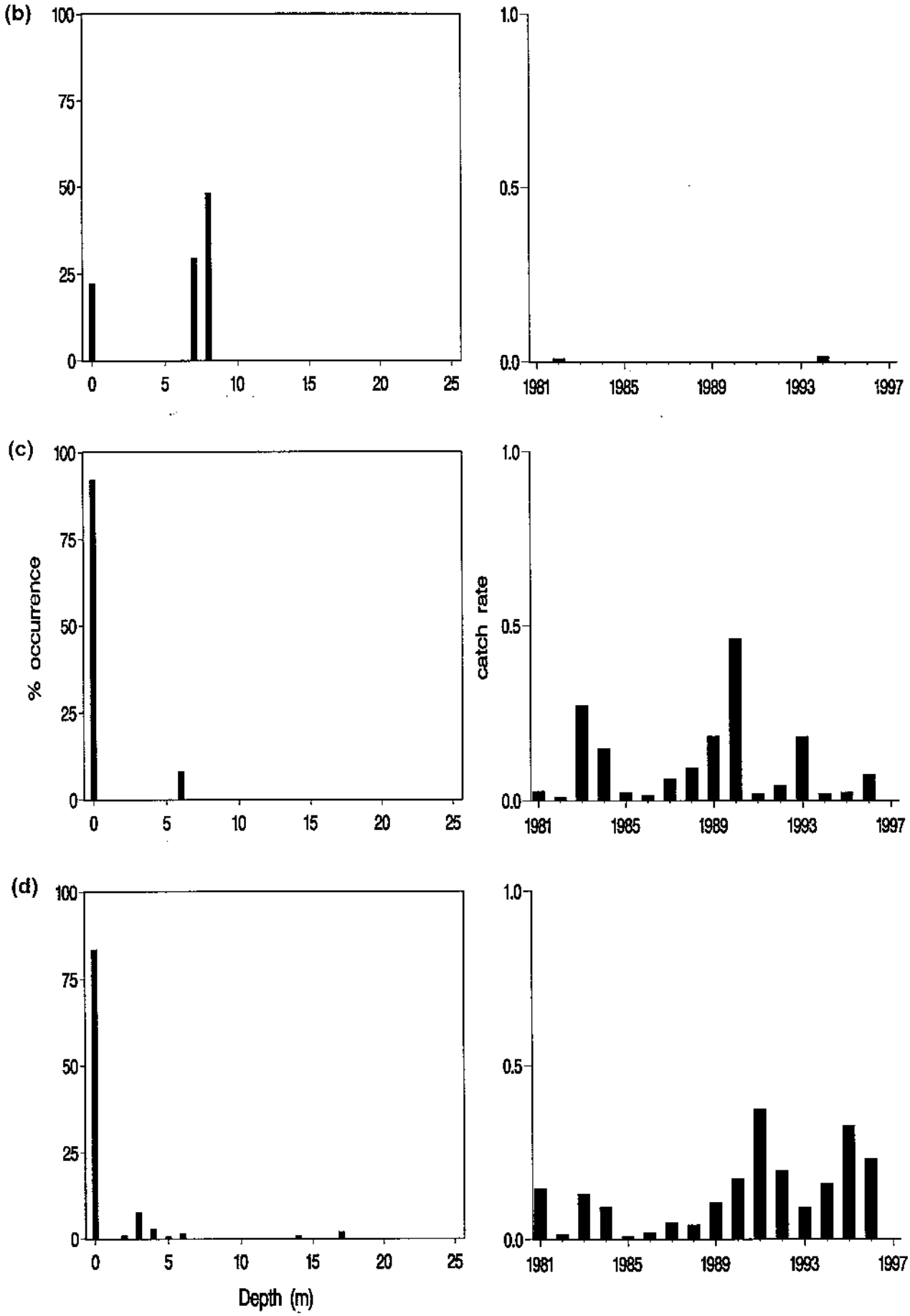


Figure 27. ***Labrus mixtus*** **- Cuckoo wrasse**

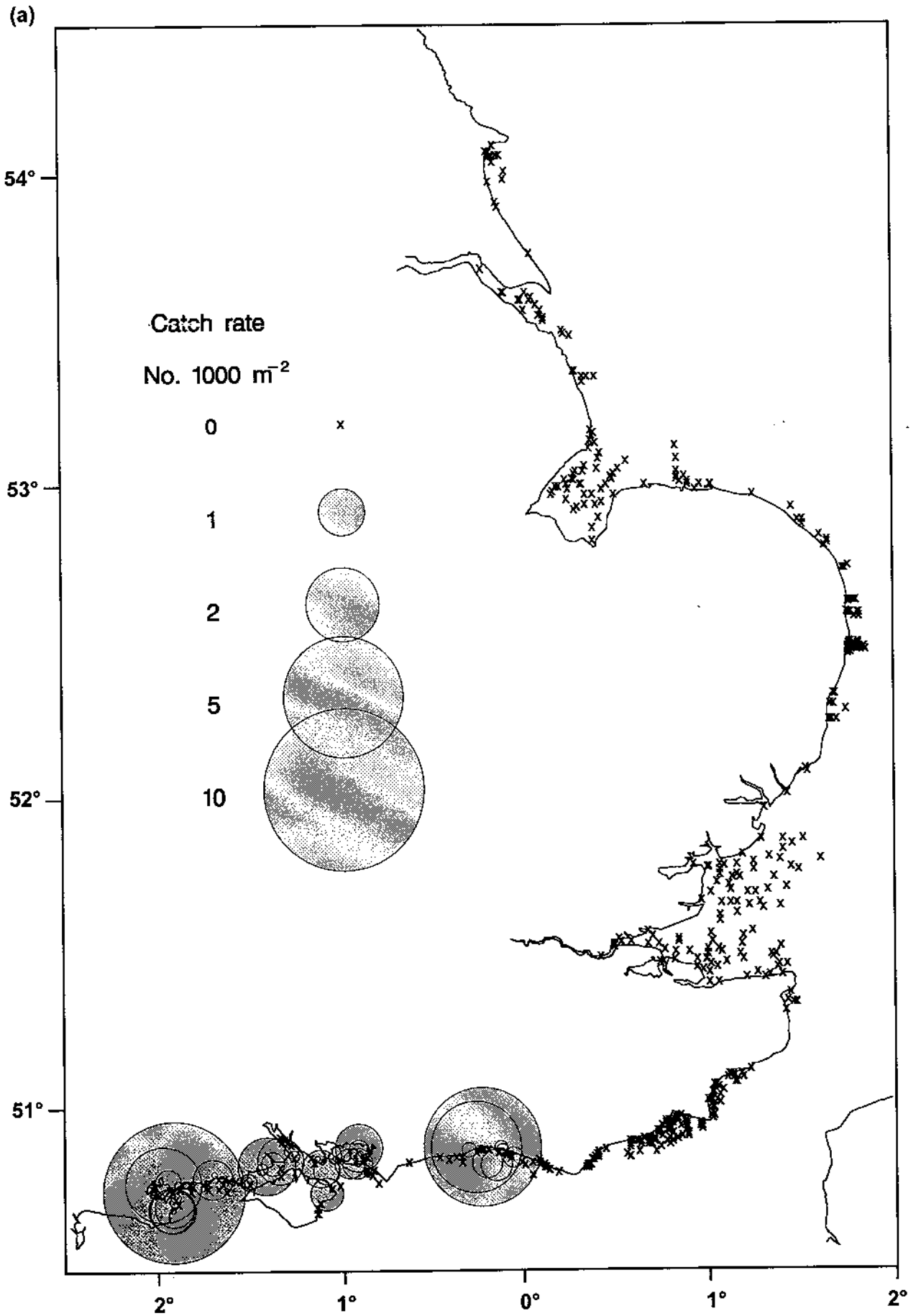


Figure 27. ***Labrus mixtus*** **- Cuckoo wrasse**

(b)

No data

(c)

No data

(d)

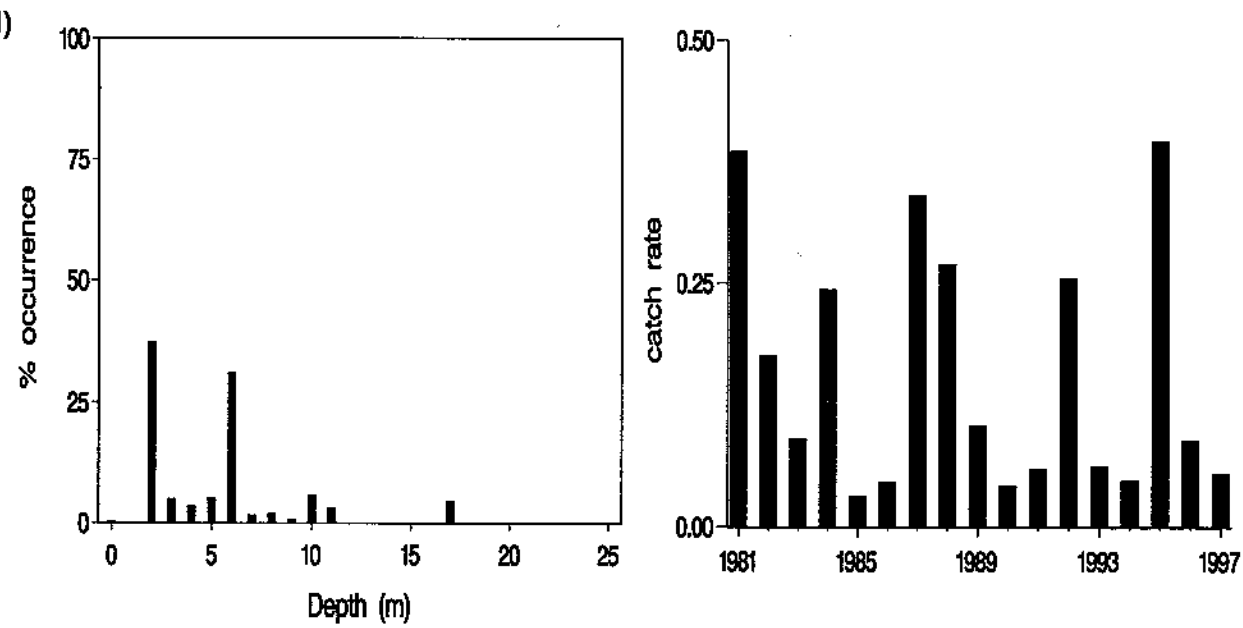


Figure 28. ***Labrus bergylta*** **- ballan wrasse**

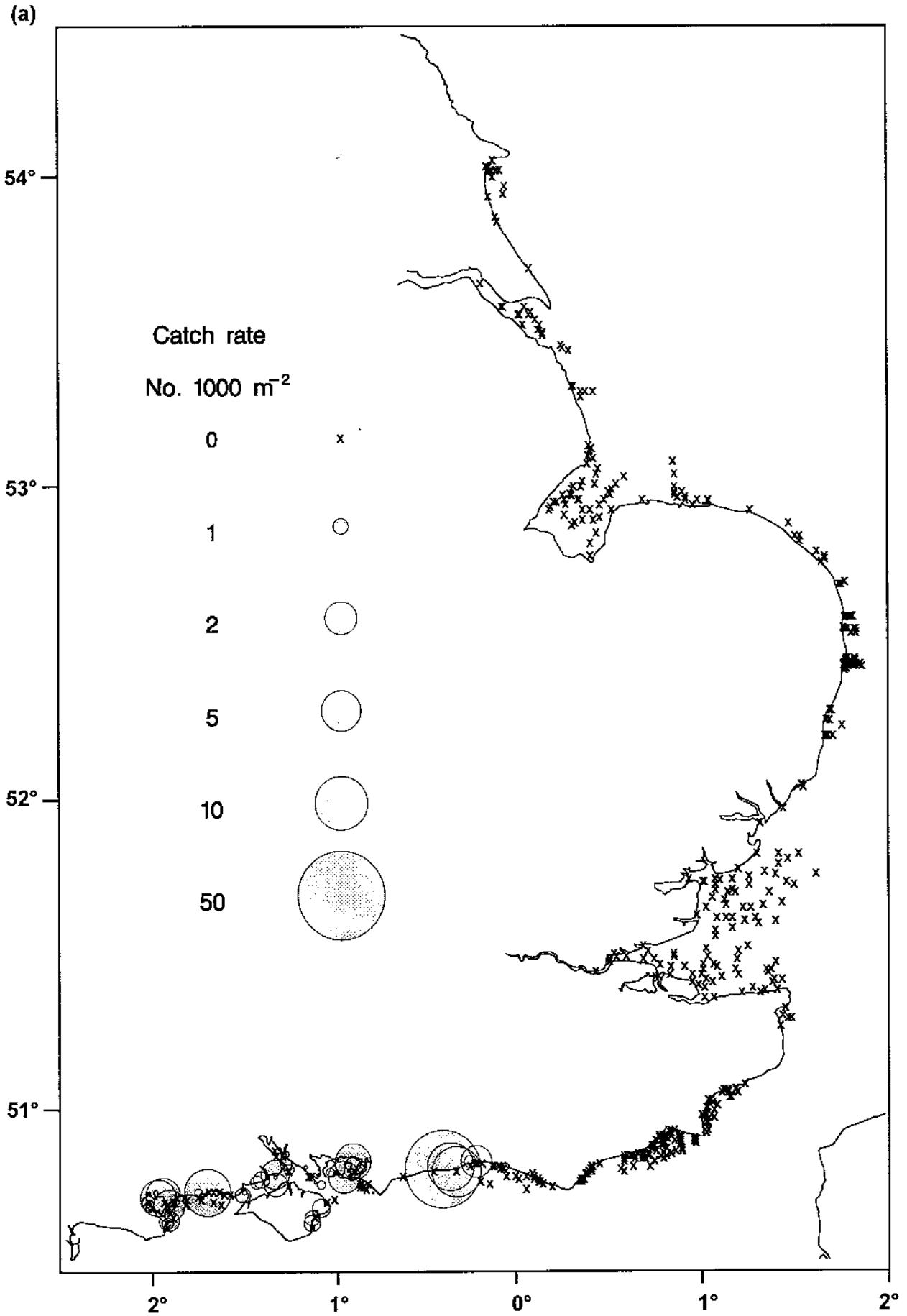


Figure 28. ***Labrus bergylta*** **- ballan wrasse**

(b)

No data

(c)

No data

(d)

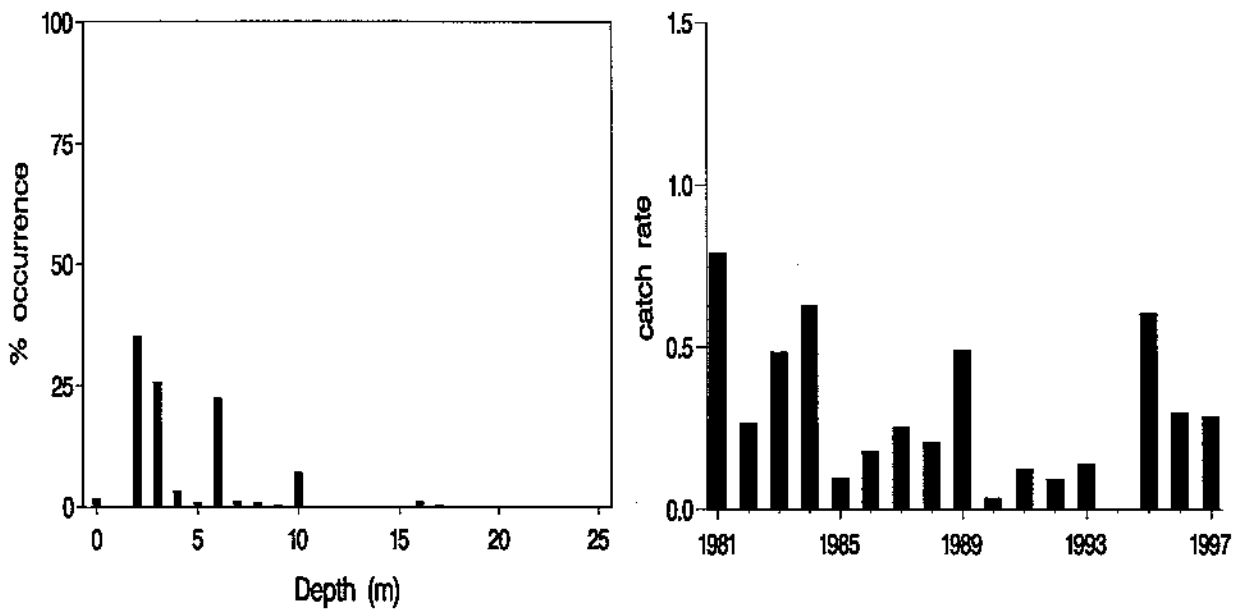


Figure 29. ***Ctenolabrus rupestris*** **- goldsinny**

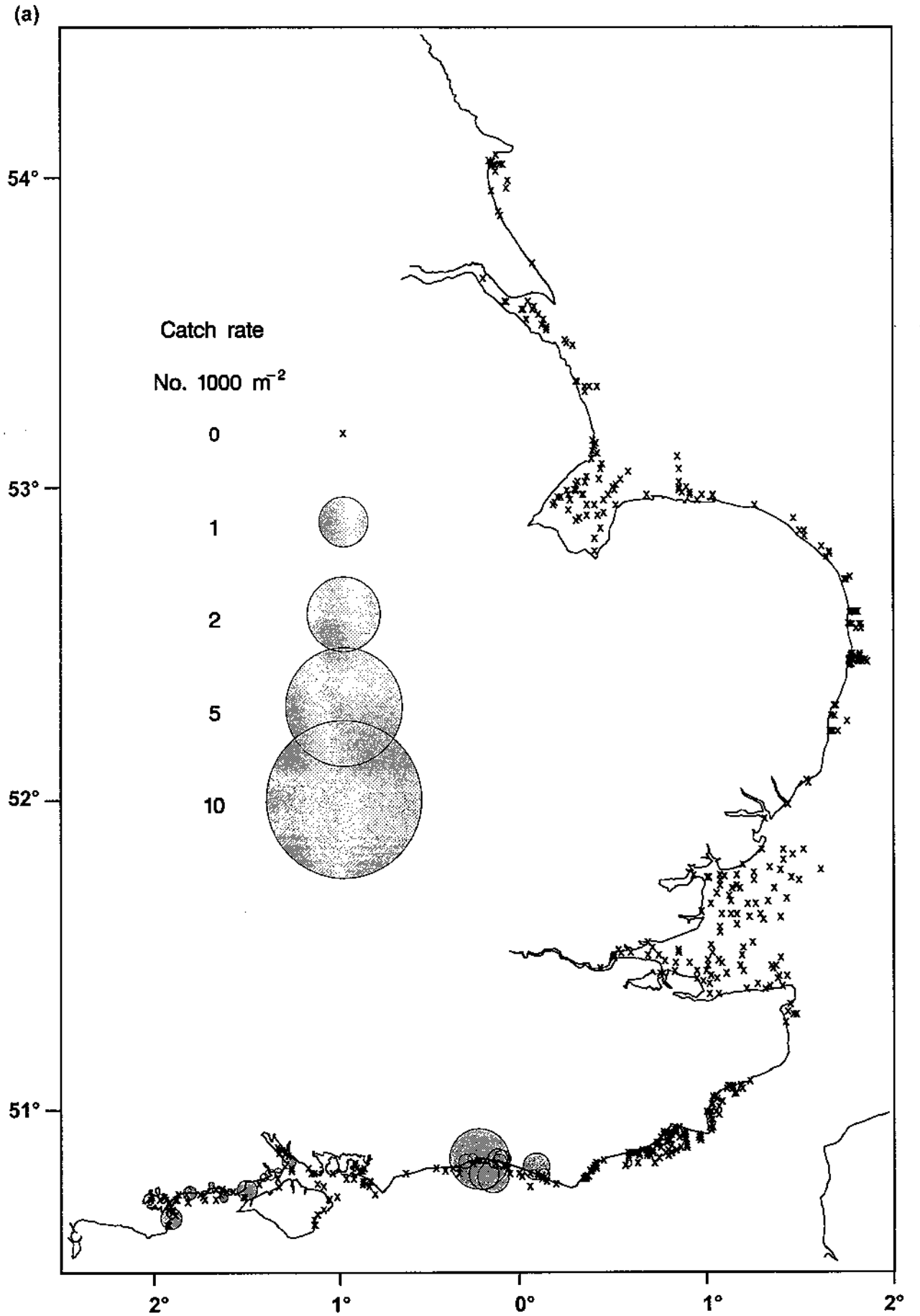


Figure 29. ***Ctenolabrus rupestris*** **- goldsinny**

(b)

No data

(c)

No data

(d)

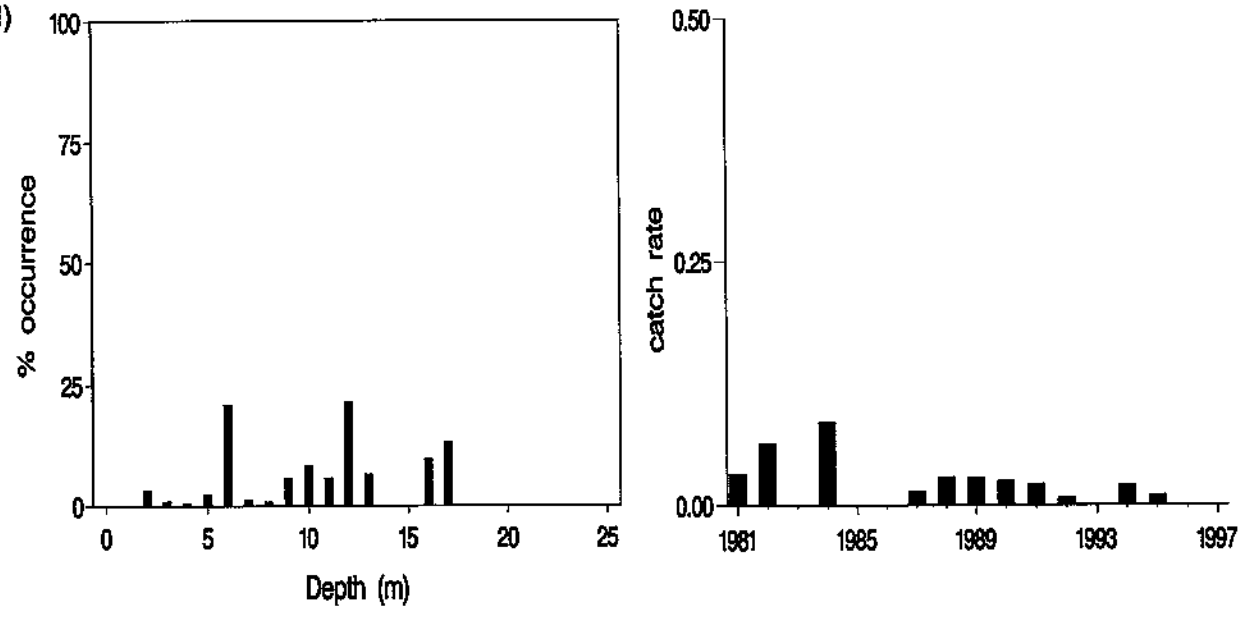


Figure 30. ***Crenilabrus melops*** **- corkwing wrasse**

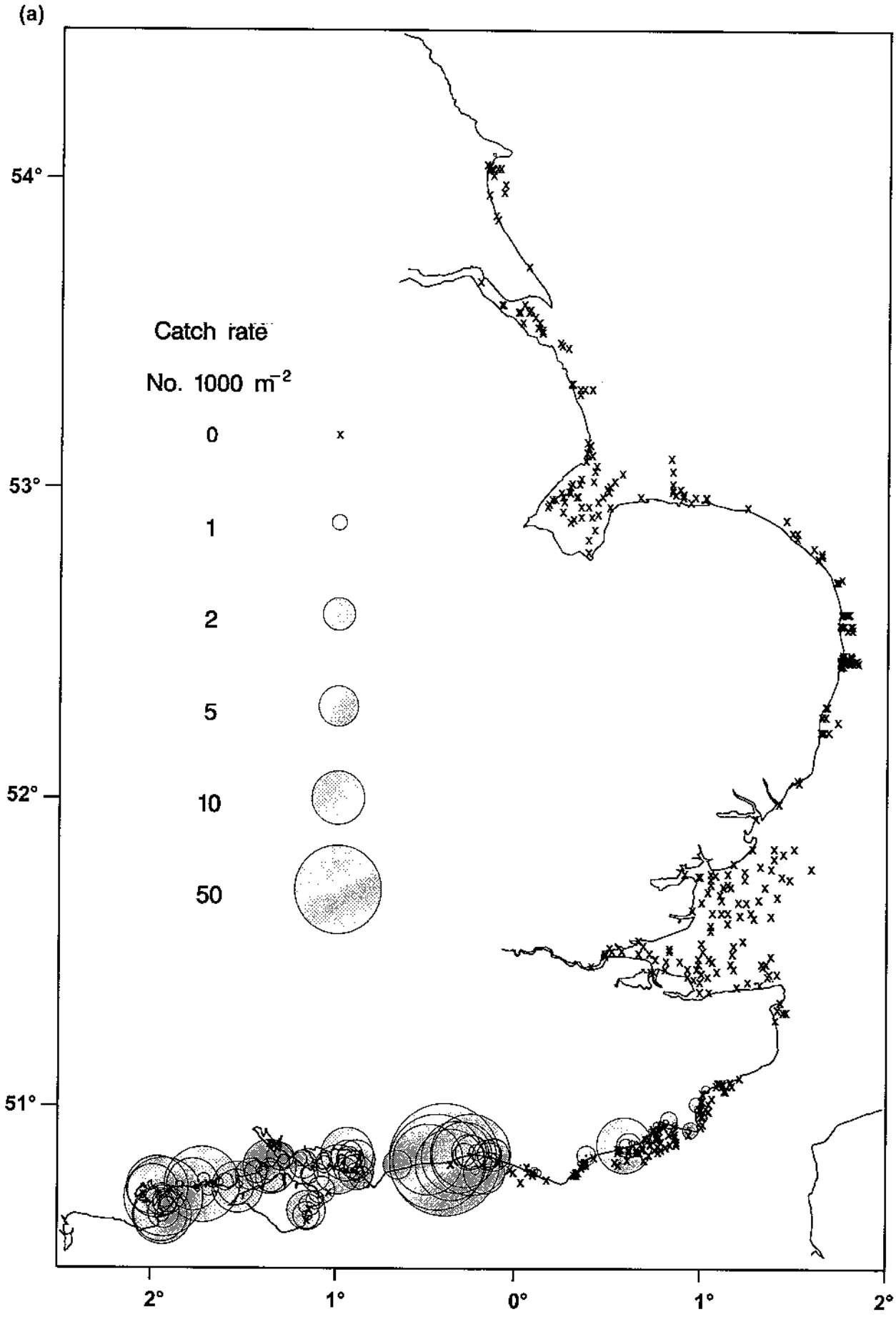


Figure 30. ***Crenilabrus melops*** **- corkwing wrasse**

(b)

No data

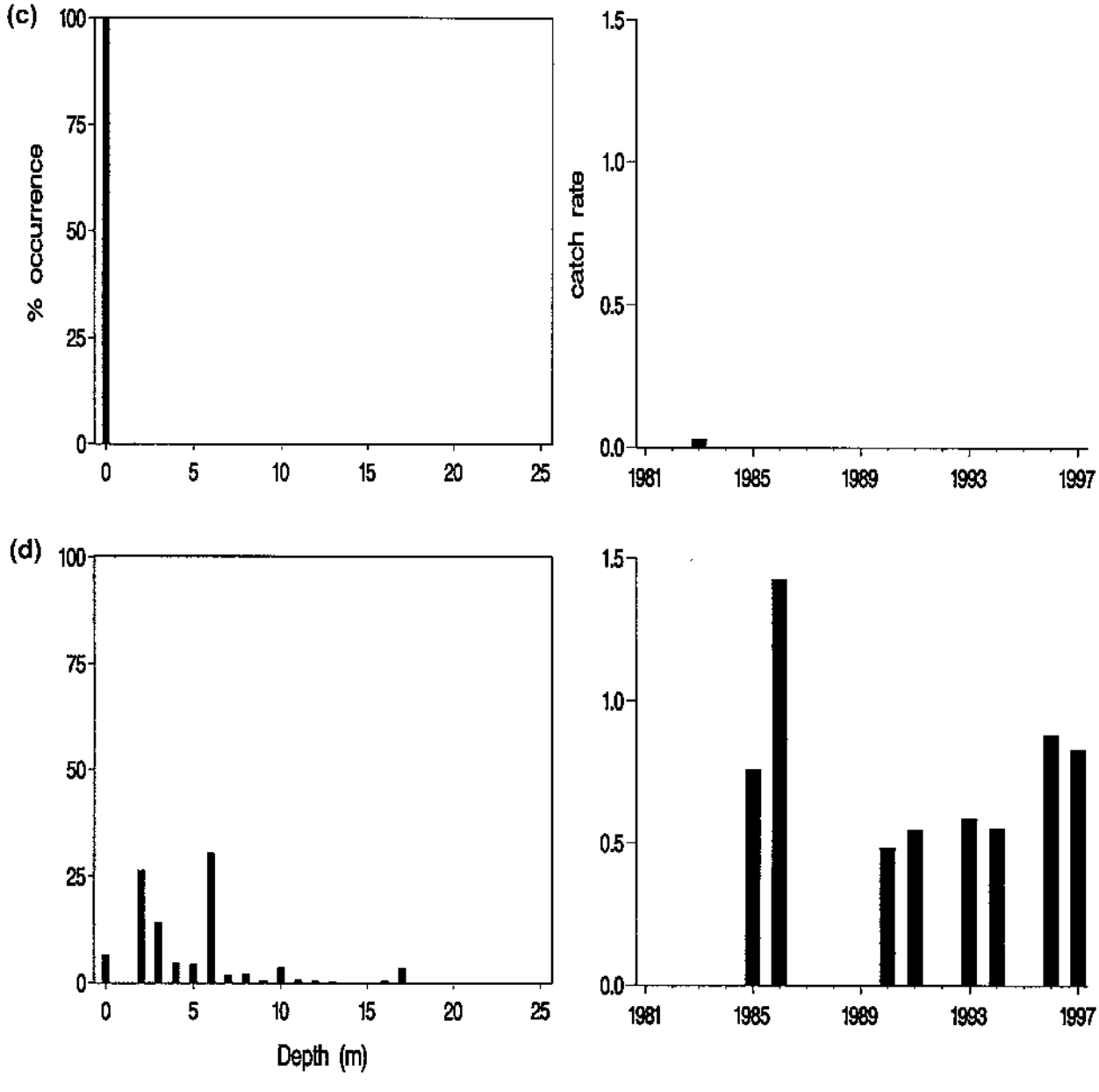


Figure 31. ***Ammodytidae*** **- sandeel**

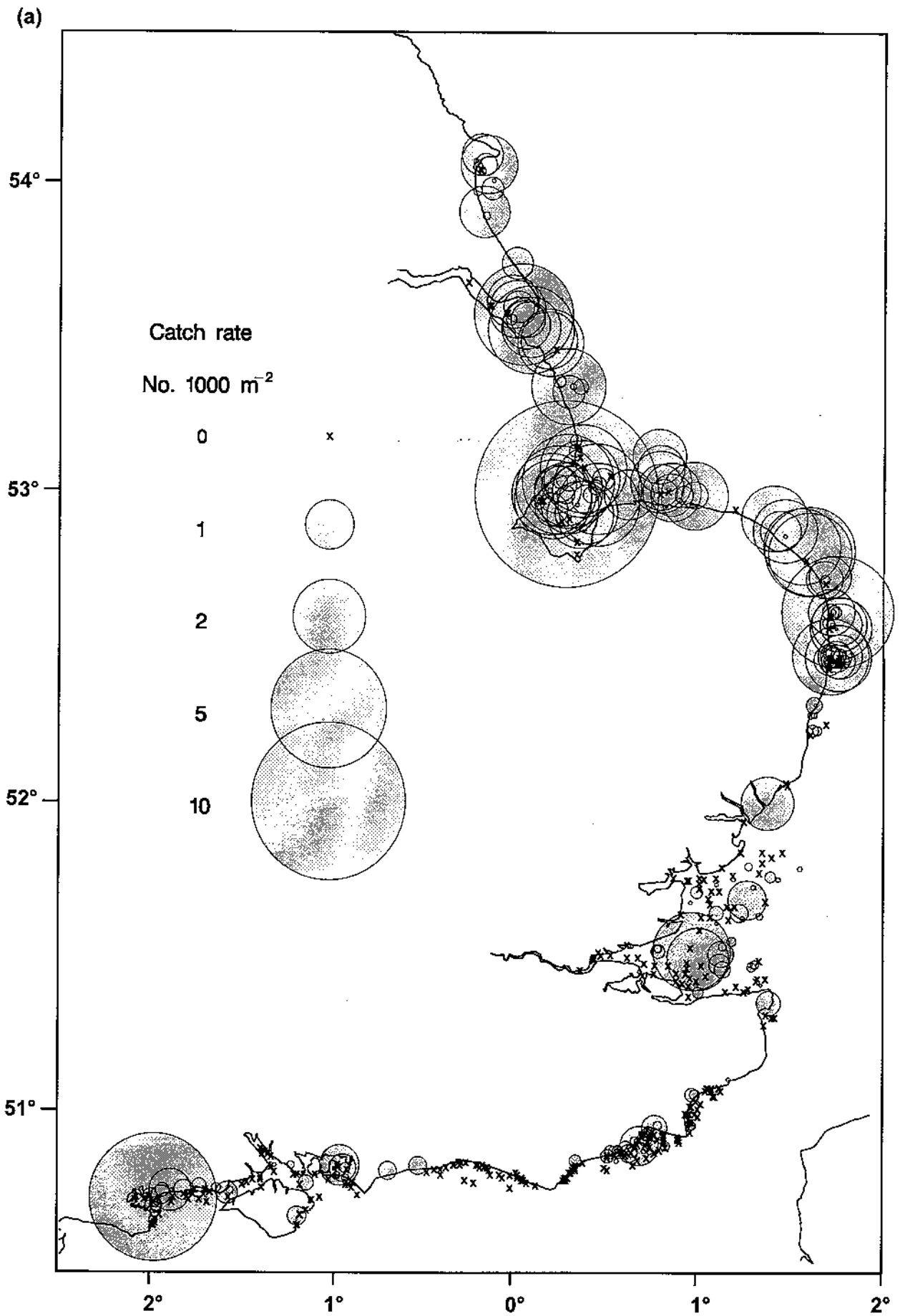


Figure 31. ***Ammodytidae*** **- sandeel**

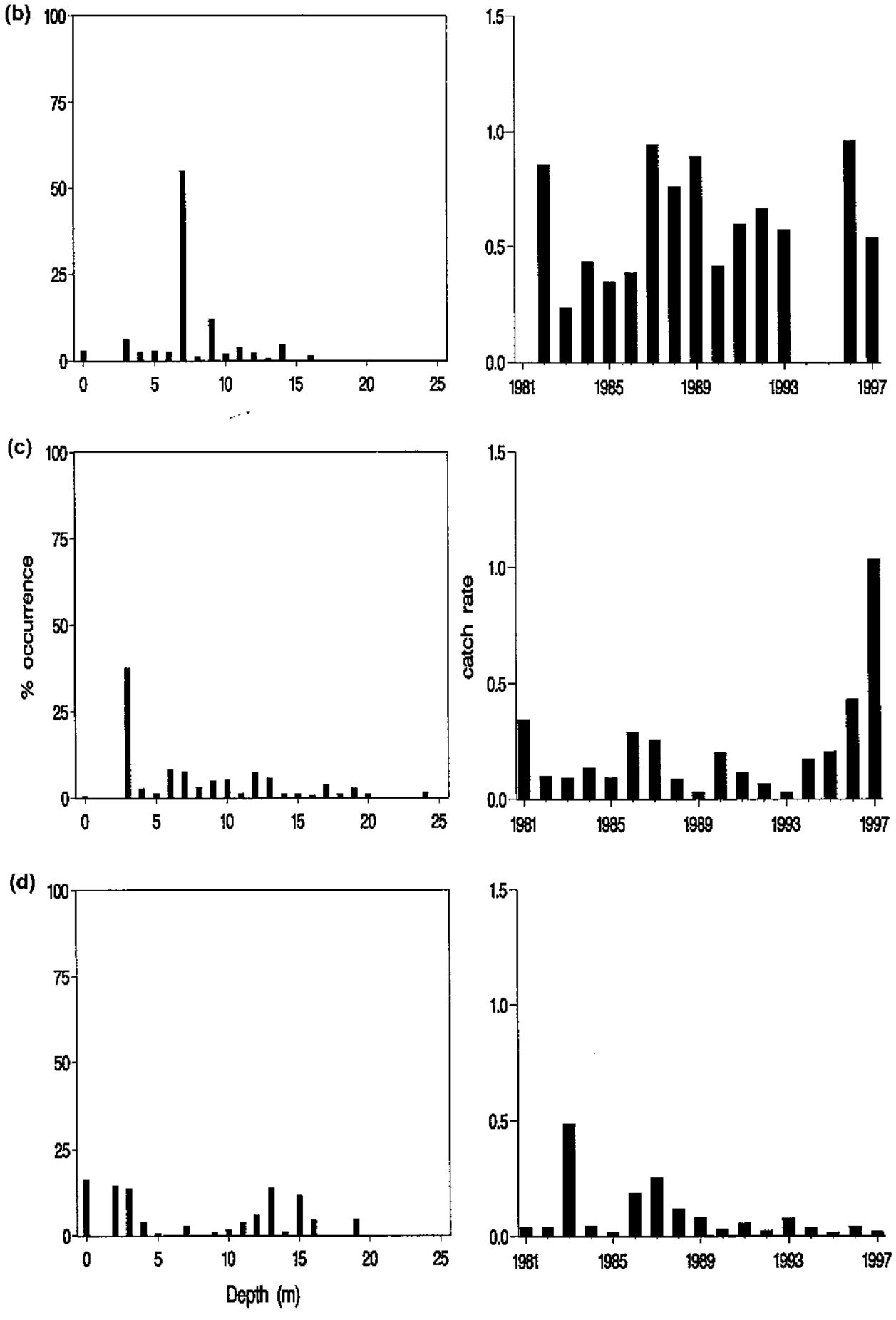


Figure 32. ***Echiichthys vipera*** **- lesser weever**

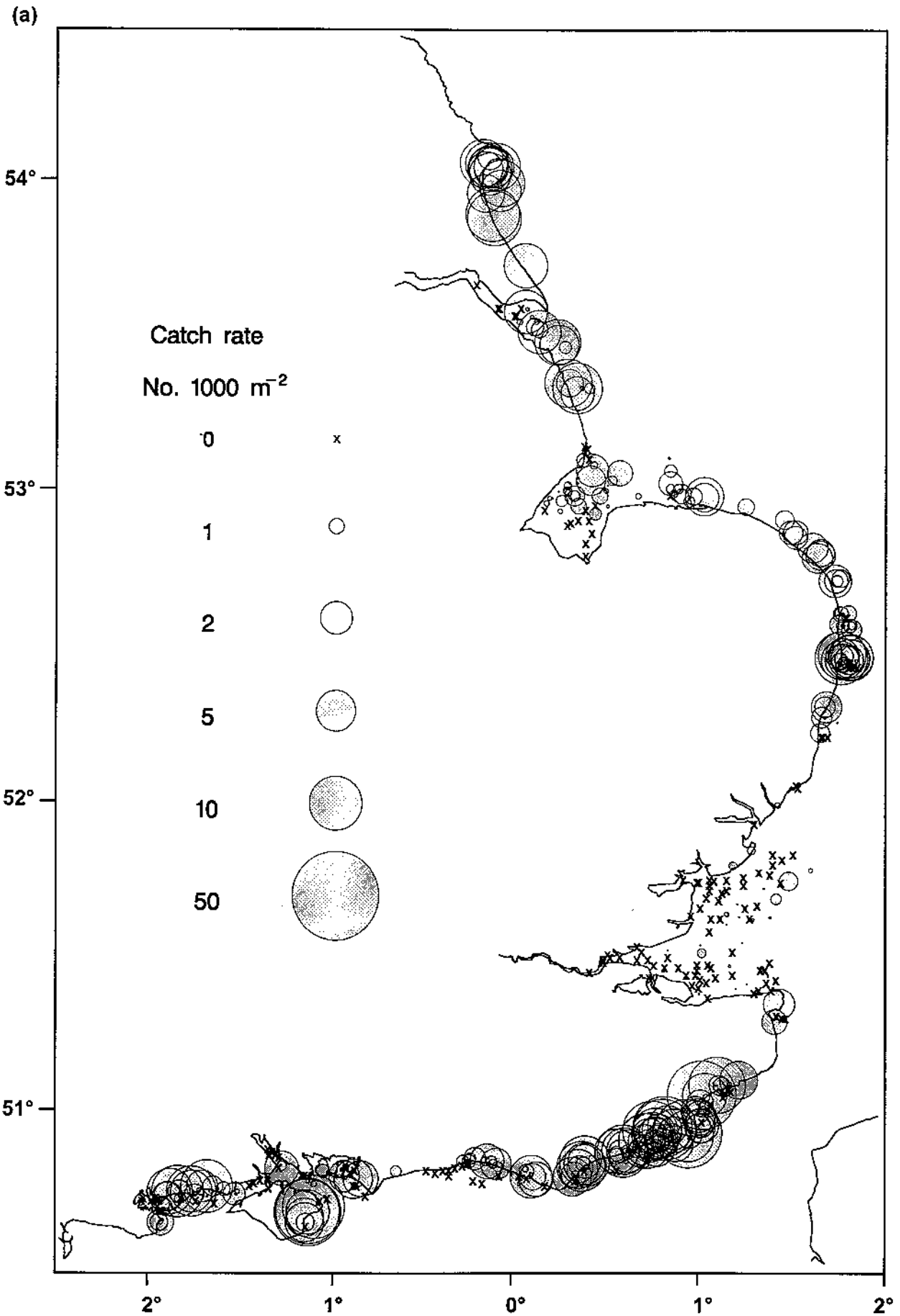


Figure 32. ***Echiichthys vipera*** **- lesser weever**

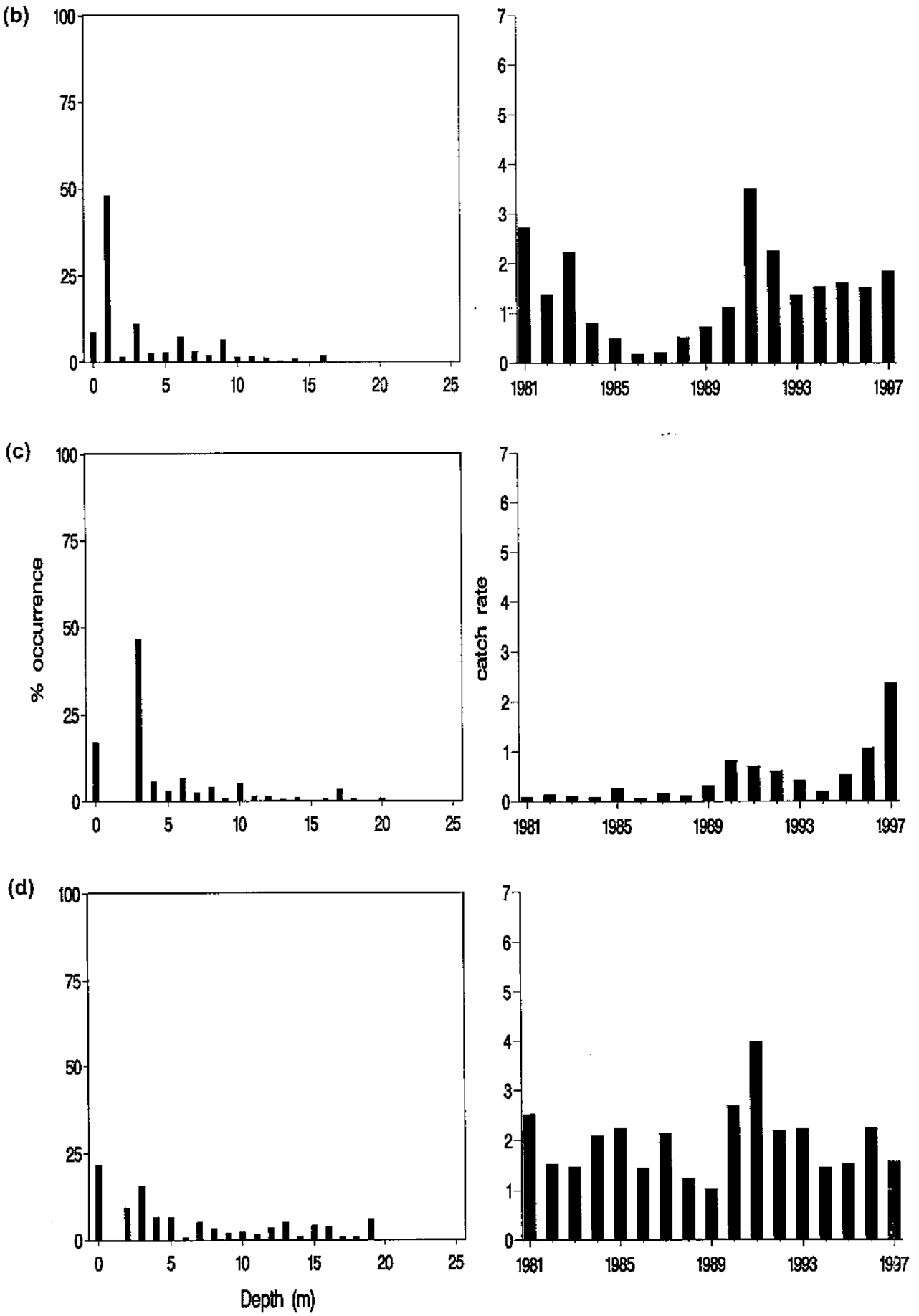


Figure 33. ***Zoarces viviparus*** **- viviparus blenny**

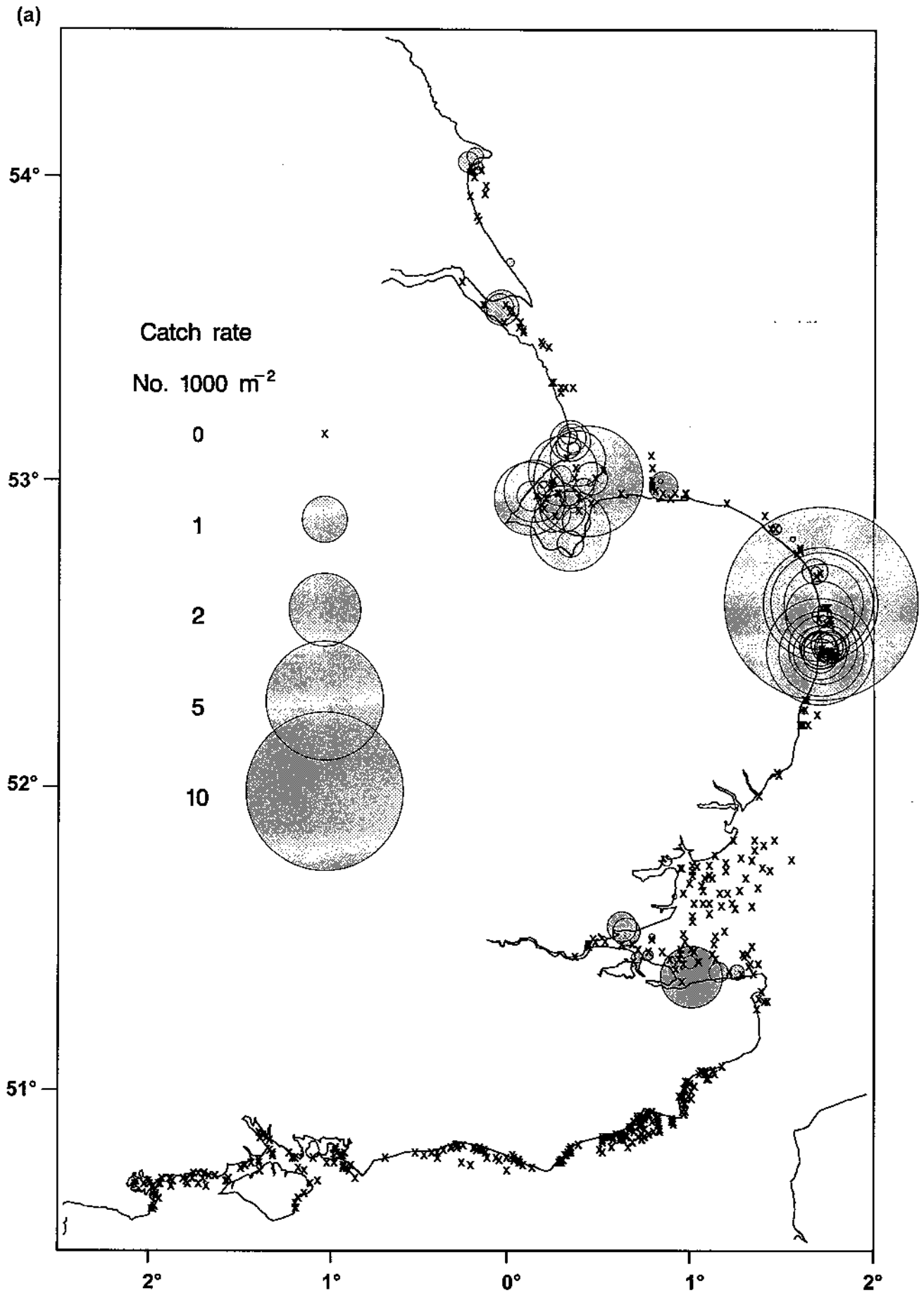
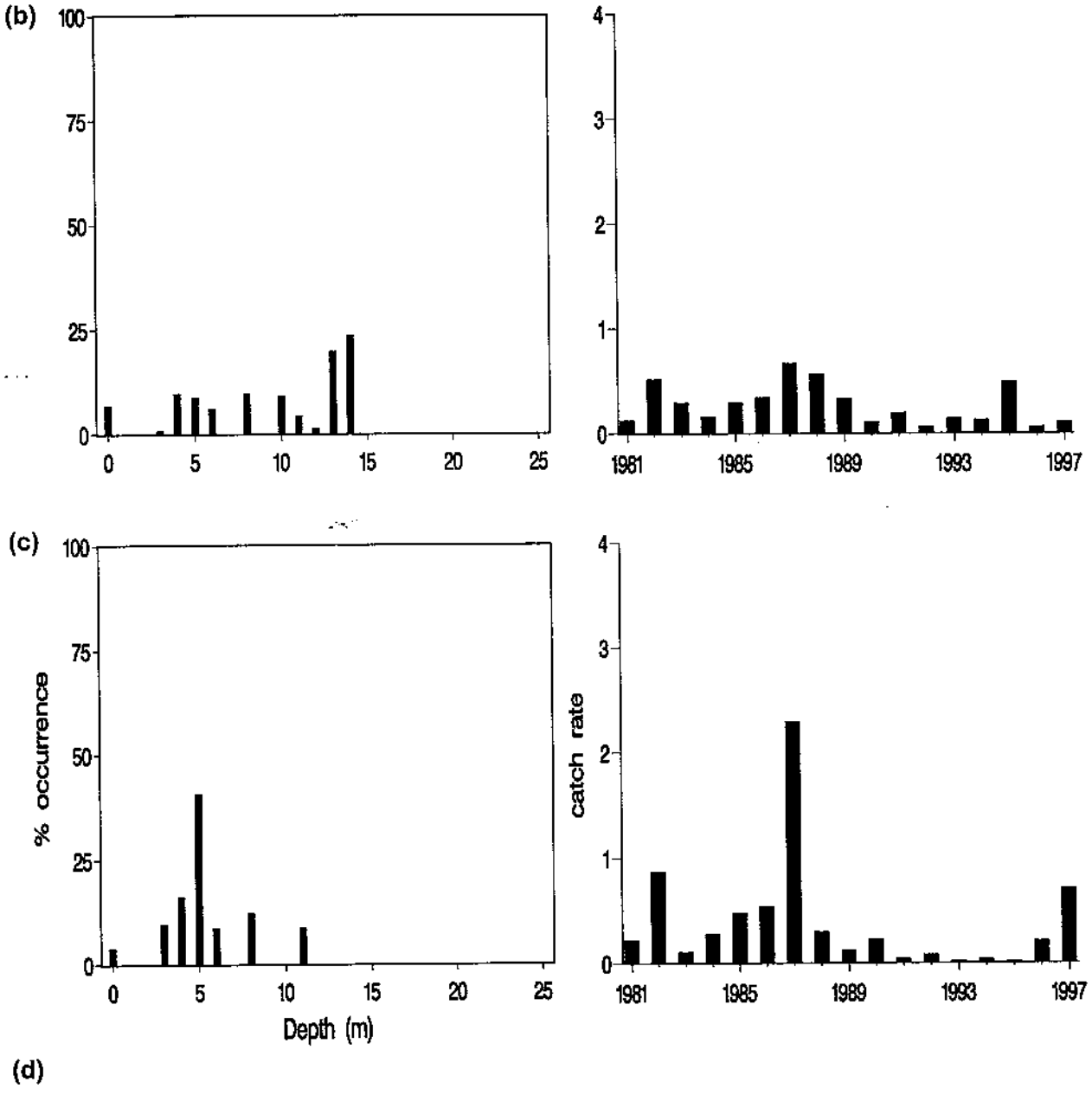


Figure 33. ***Zoarces viviparus*** **- viviparus blenny**



No data

Figure 34. ***Pholis gunnellus*** **- butterfish**

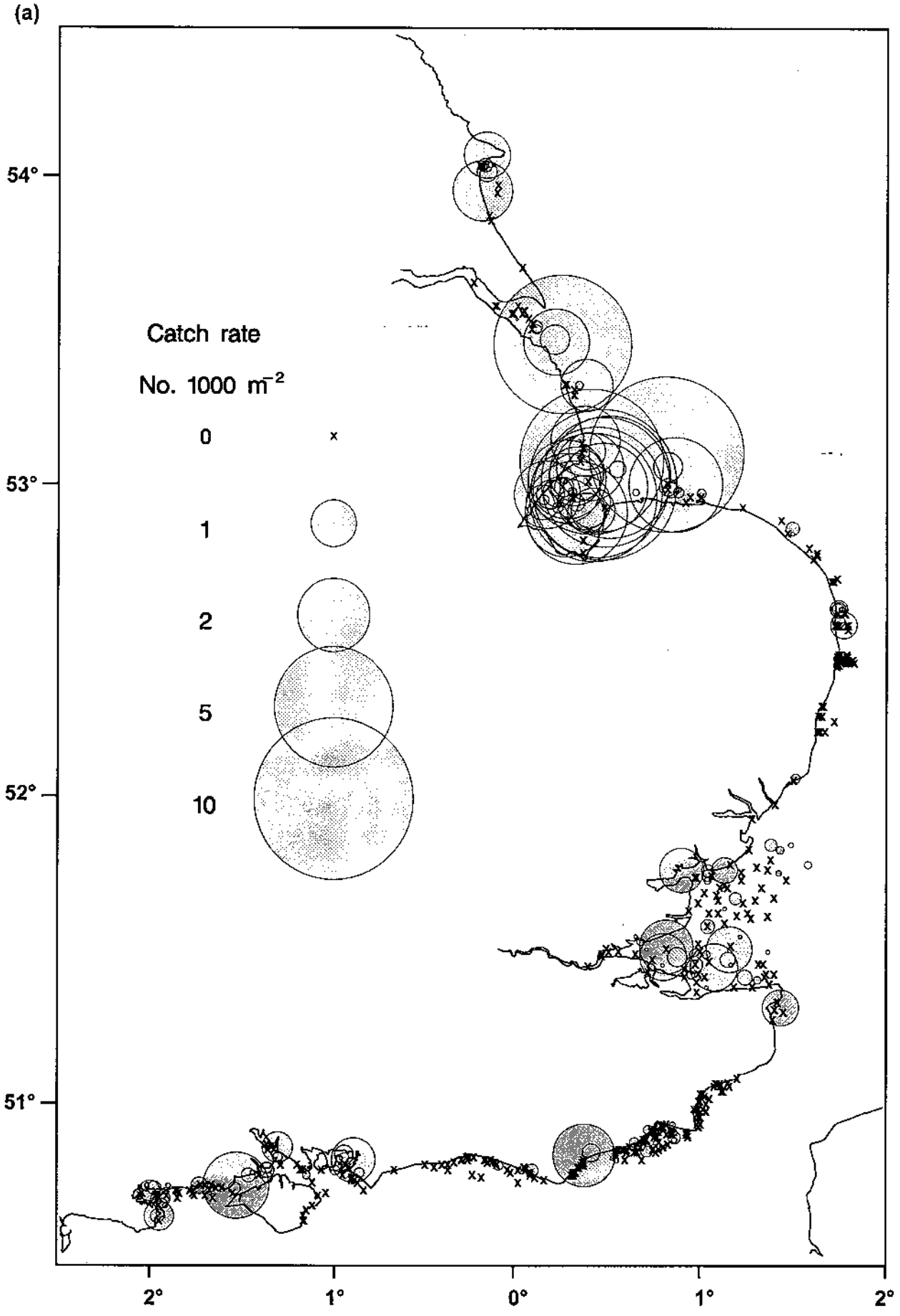


Figure 34. ***Pholis gunnellus*** **- butterfish**

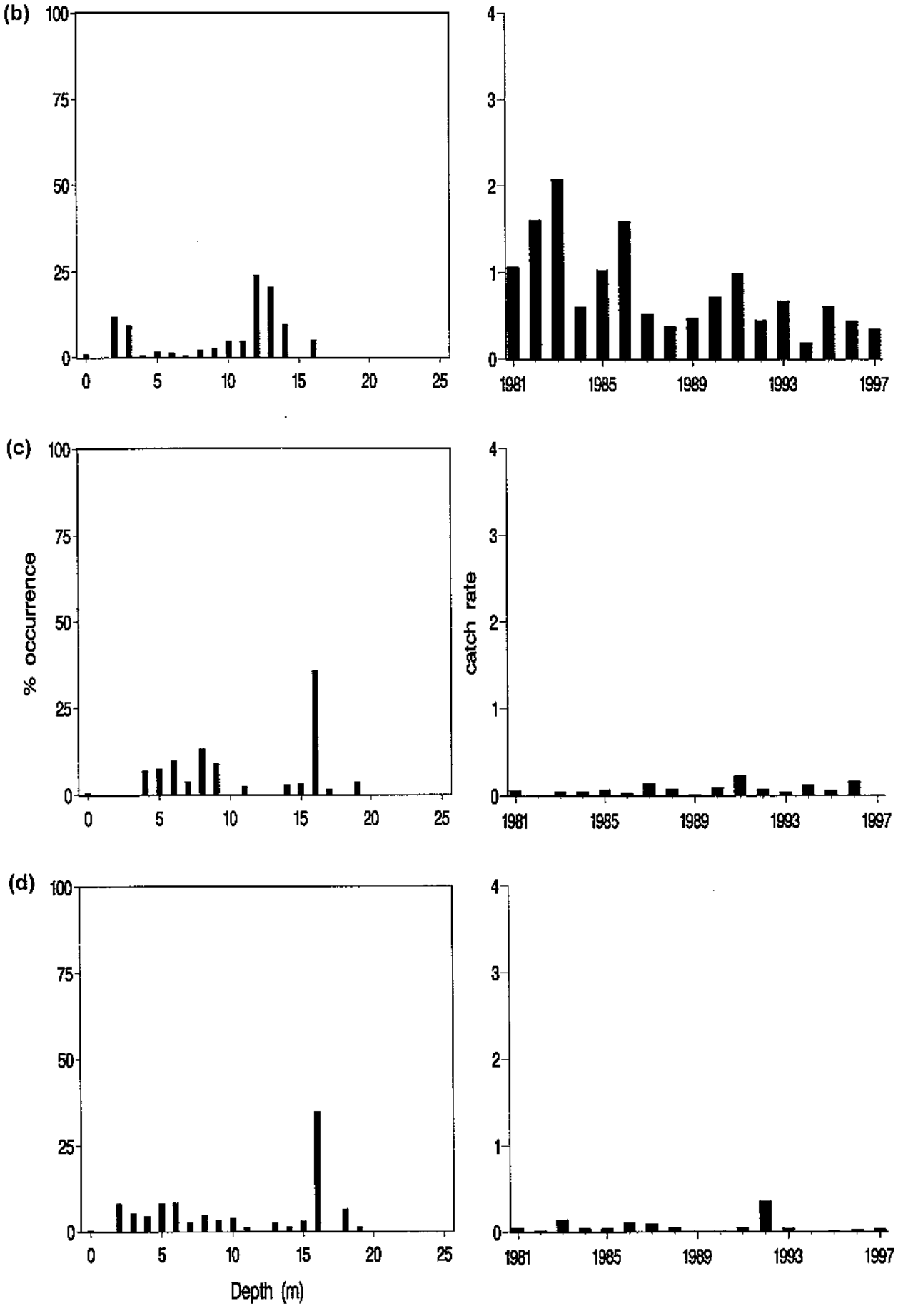


Figure 35. ***Diplecogaster bimaculata*** **- two-spotted clingfish**

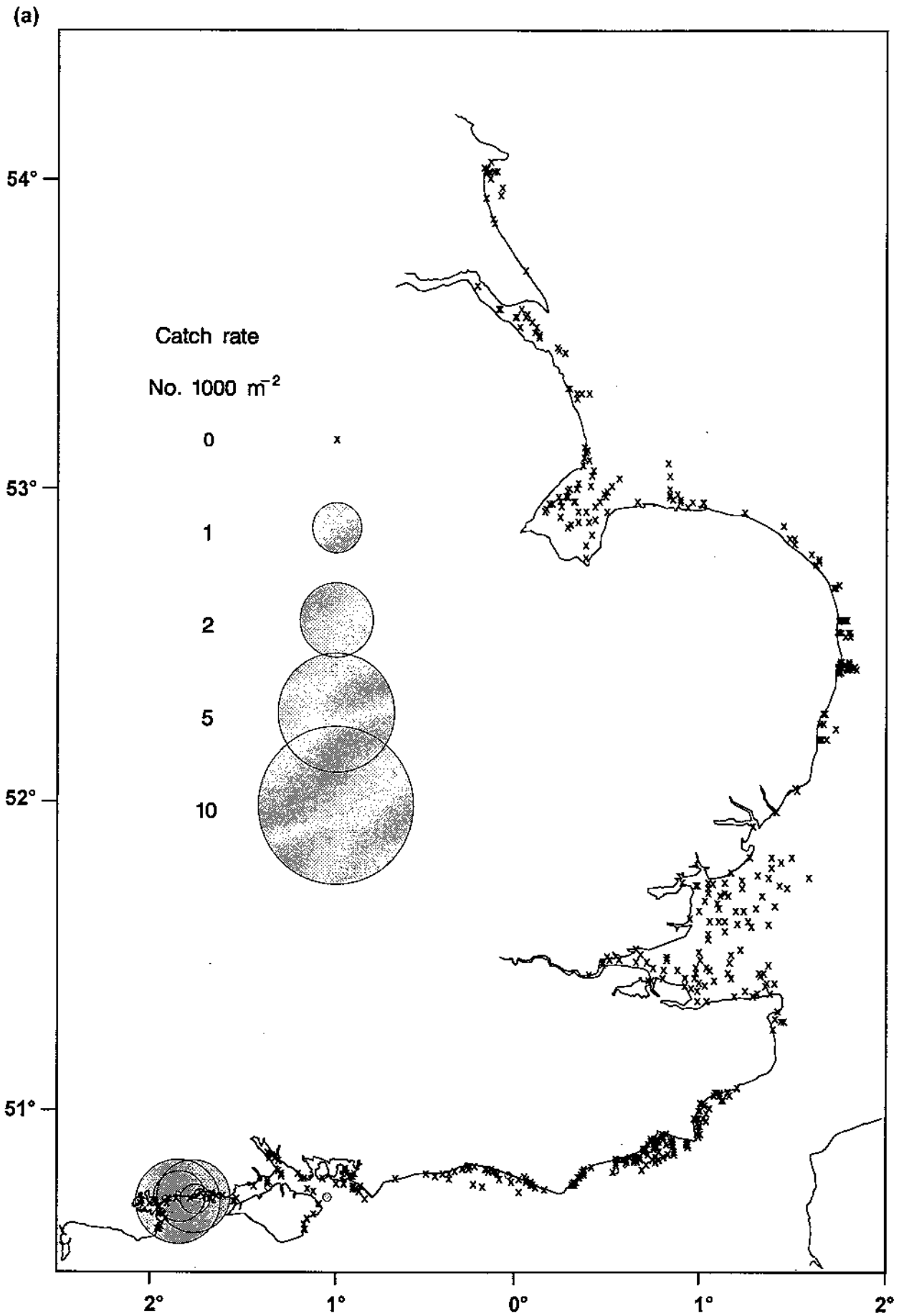


Figure 35. Diplecogaster bimaculata - two-spotted clingfish

(b)

No data

(c)

No data

(d)

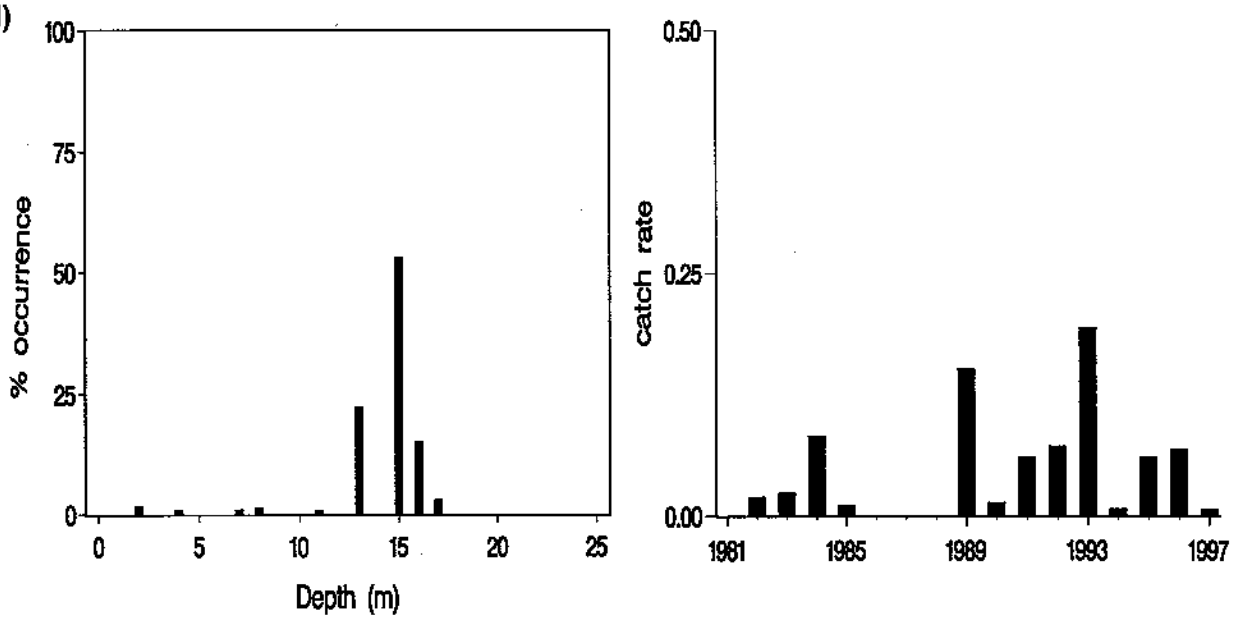


Figure 36. ***Callionymidae*** **- dragonets**

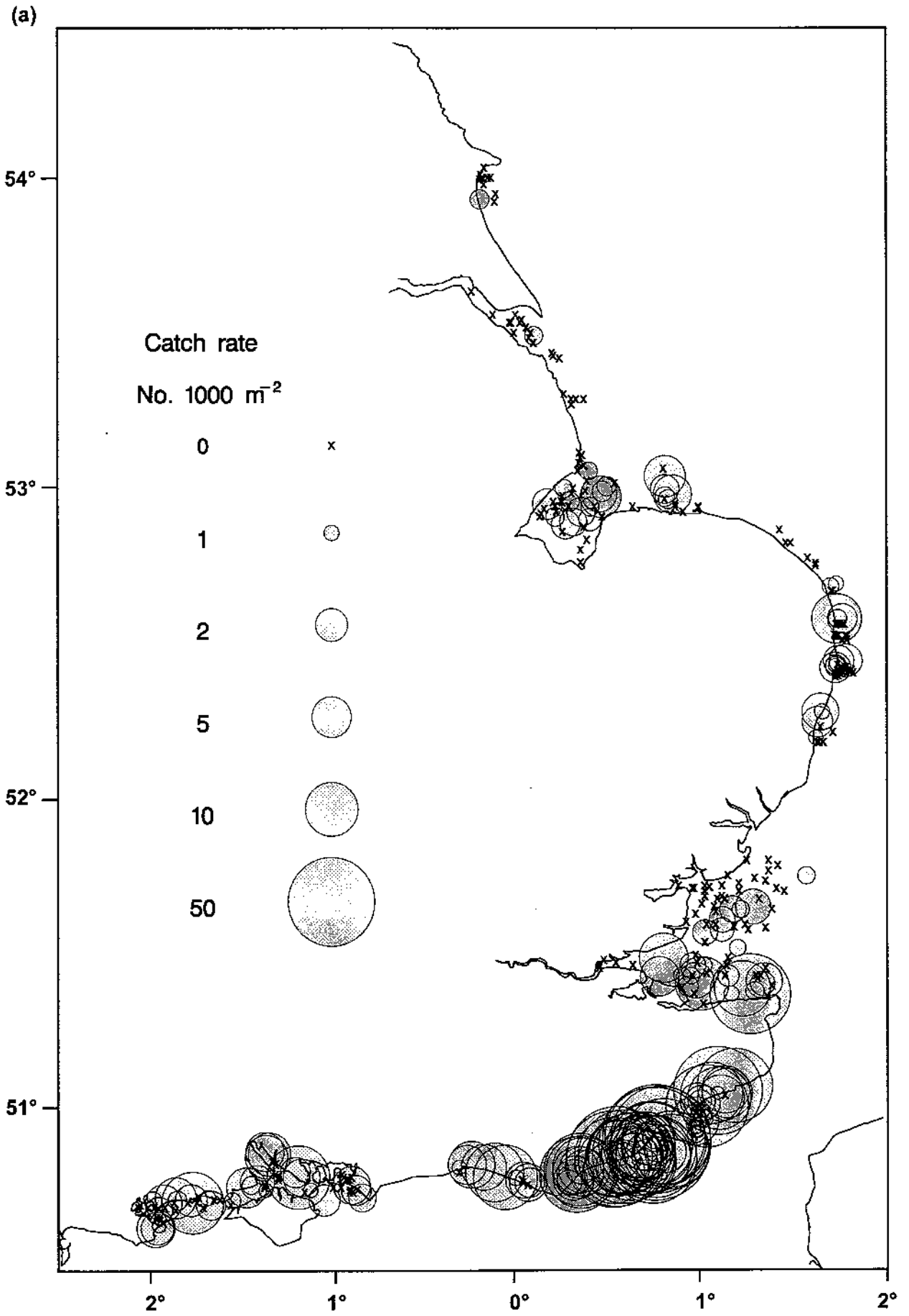


Figure 36. ***Callionymidae*** **- dragonets**

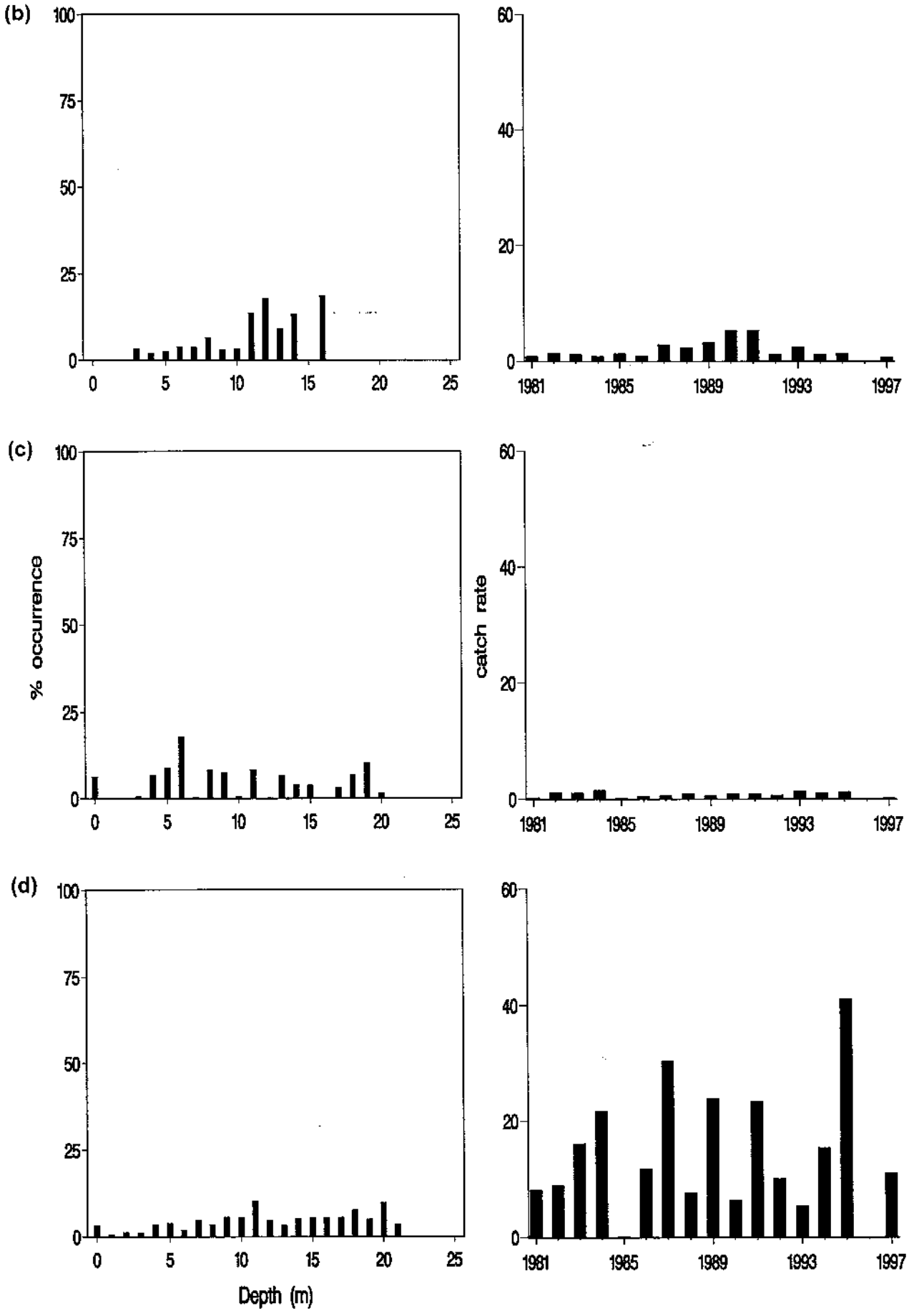


Figure 37. ***Gobius paganellus*** **- rock goby**

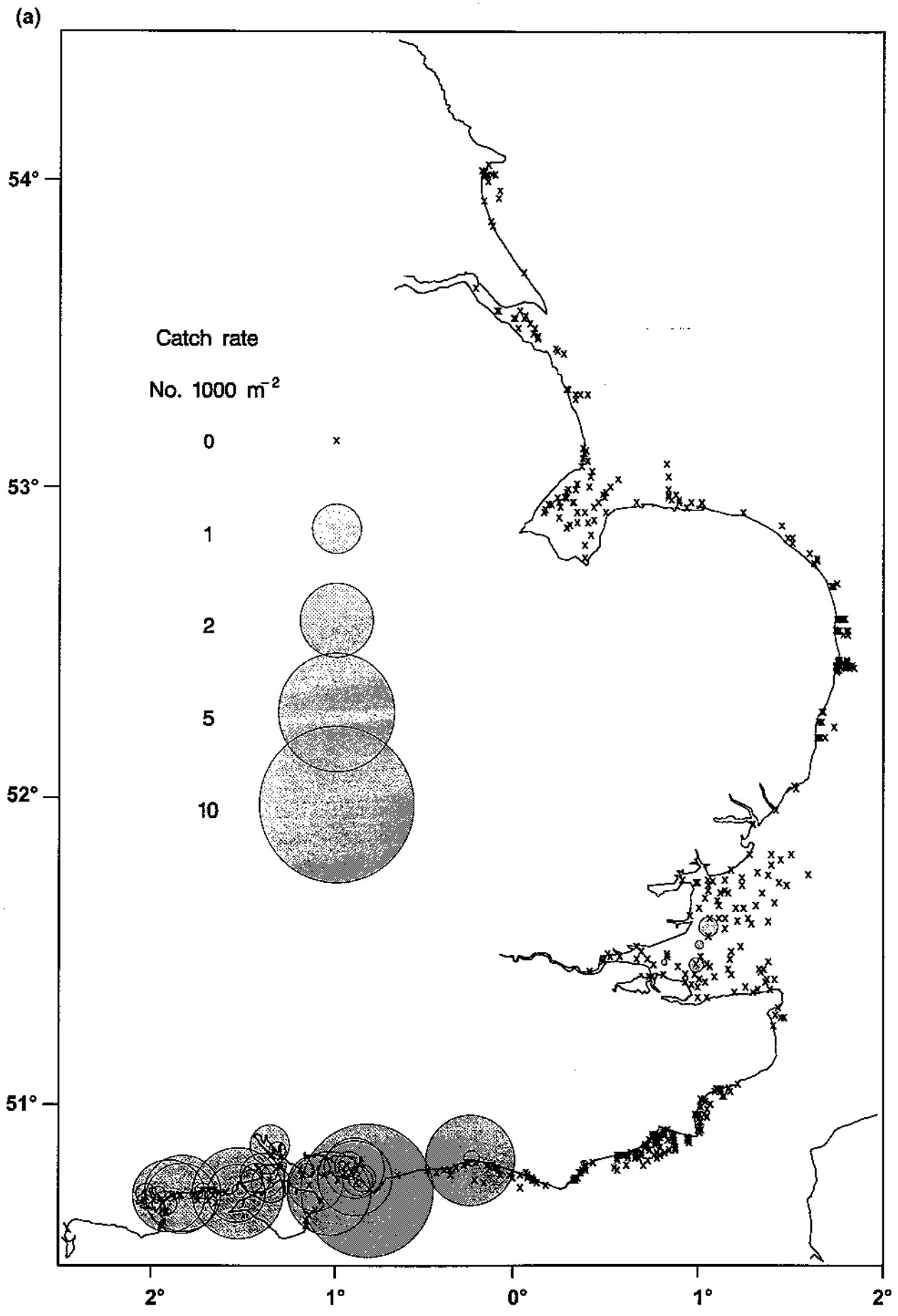


Figure 37. ***Gobius paganellus*** **- rock goby**

(b)

No data

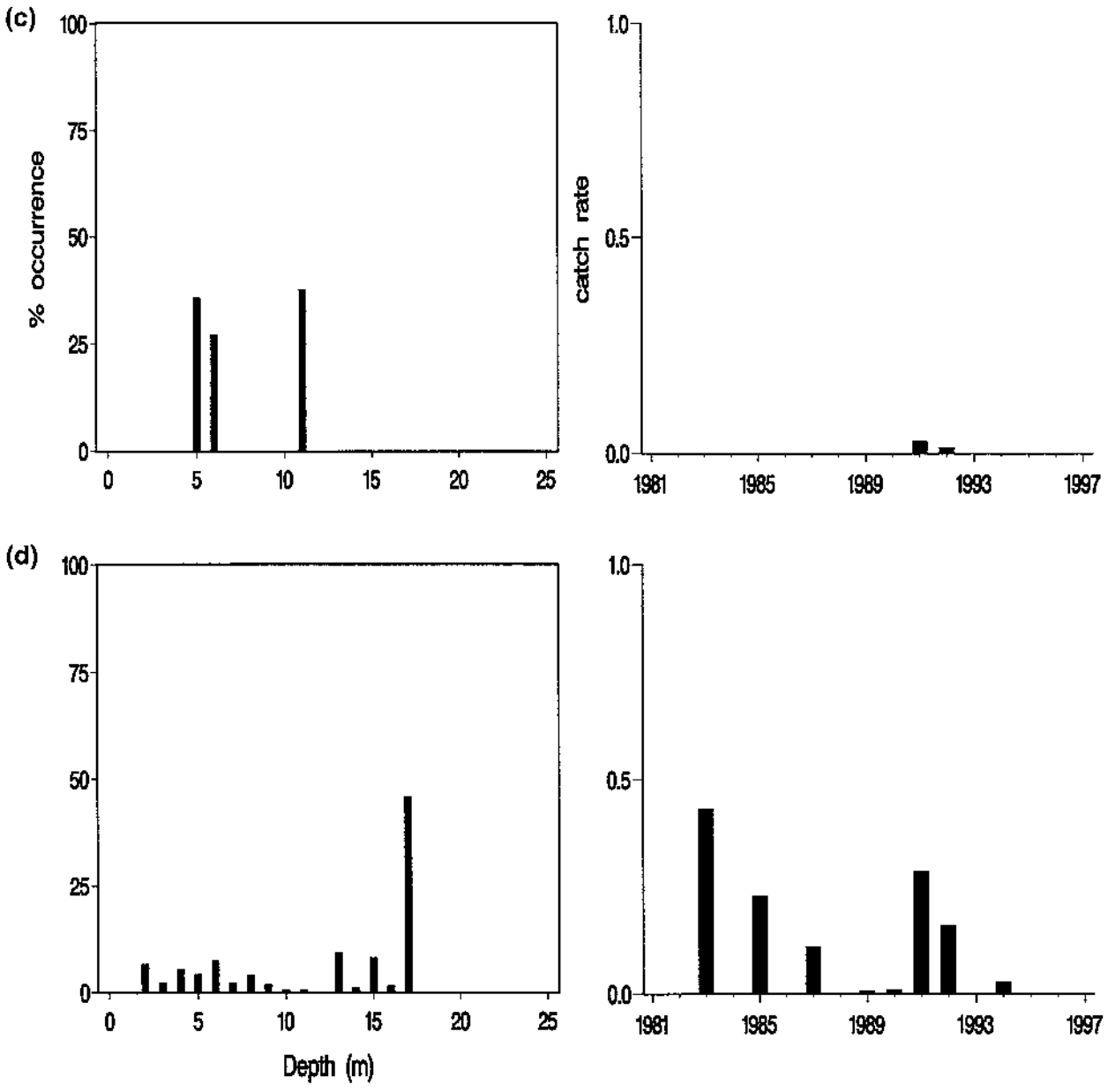


Figure 38. ***Gobius niger*** **- black goby**

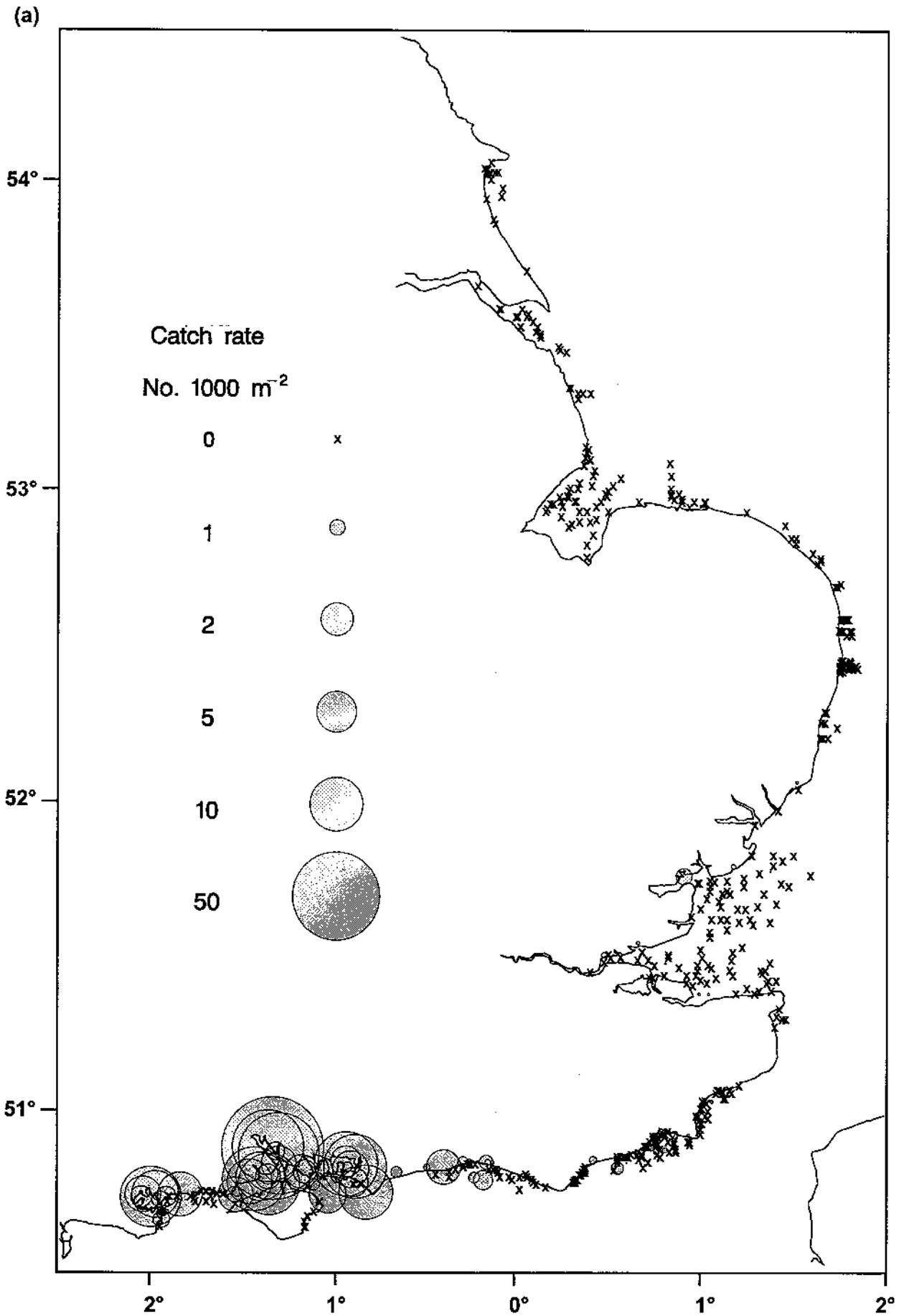


Figure 38. ***Gobius niger*** **- black goby**

(b)

No data

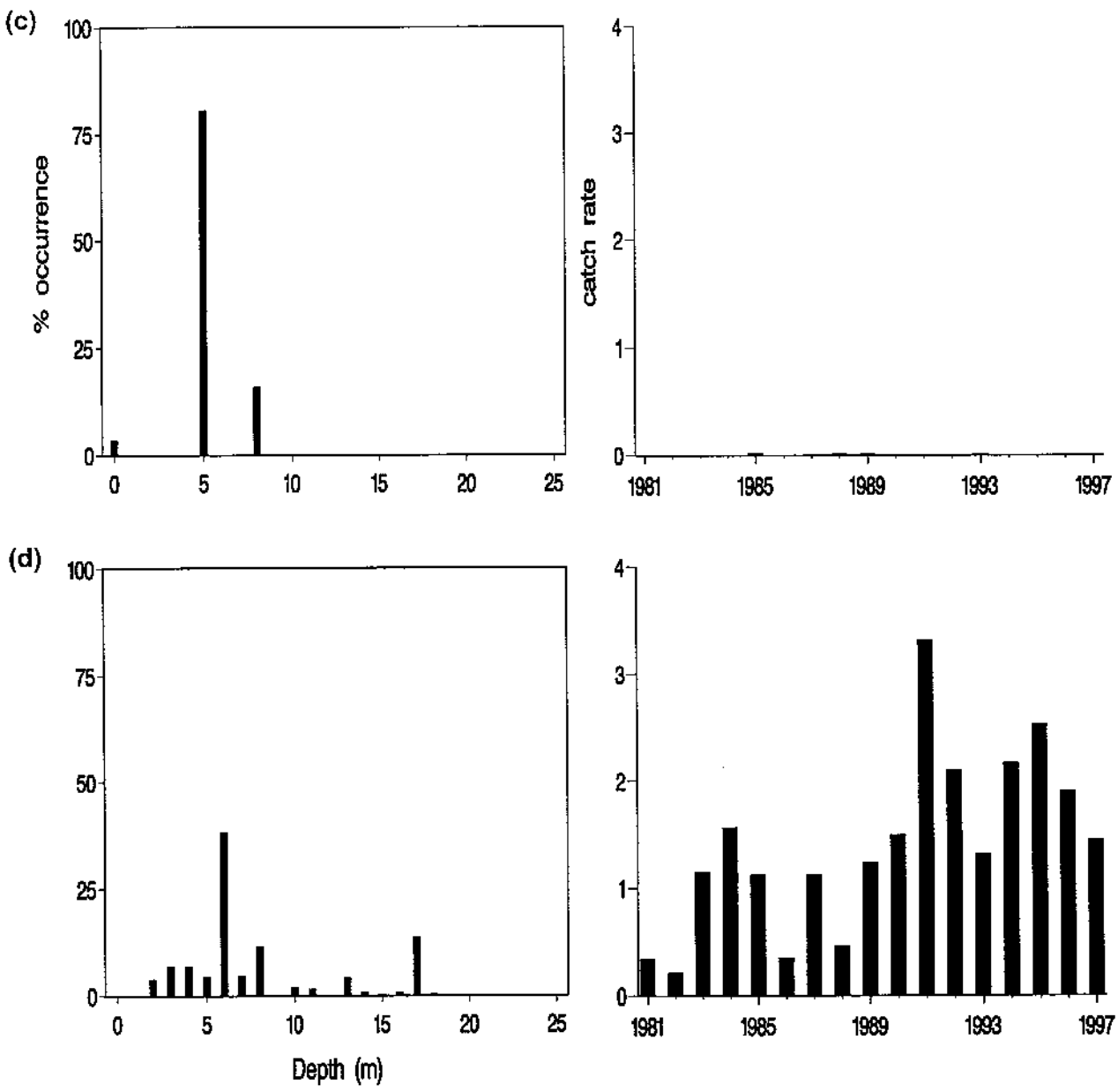


Figure 39. ***Gobius cobitis*** **- giant goby**

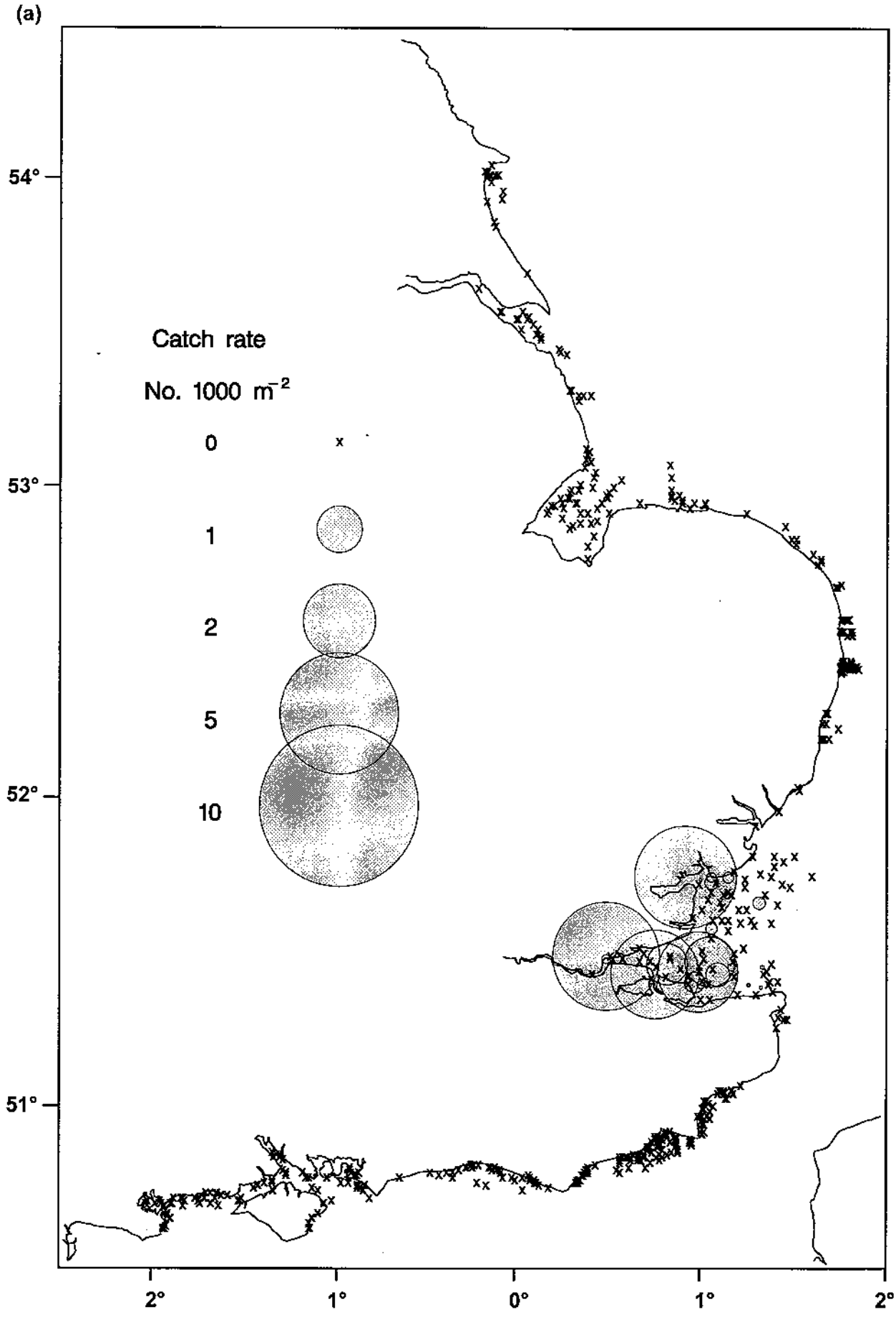
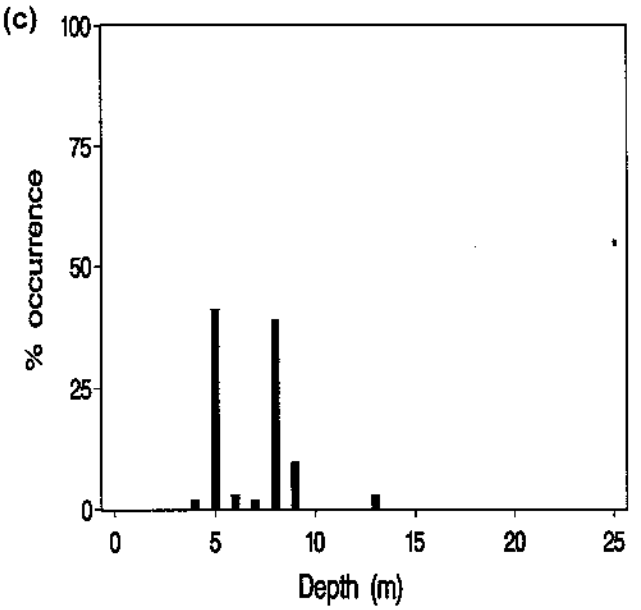


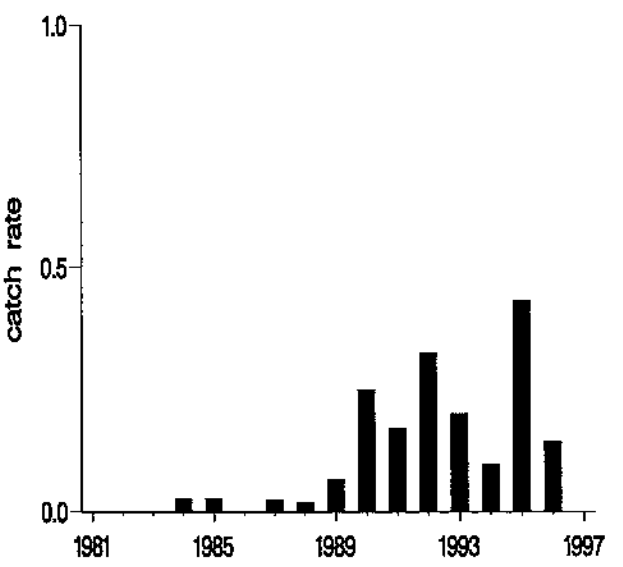
Figure 39. ***Gobius cobitis*** **- giant goby**

(b)

No data

(c)





(d)

No data

Figure 40. ***Pomatoschistus spp.*** **- sand gobies**

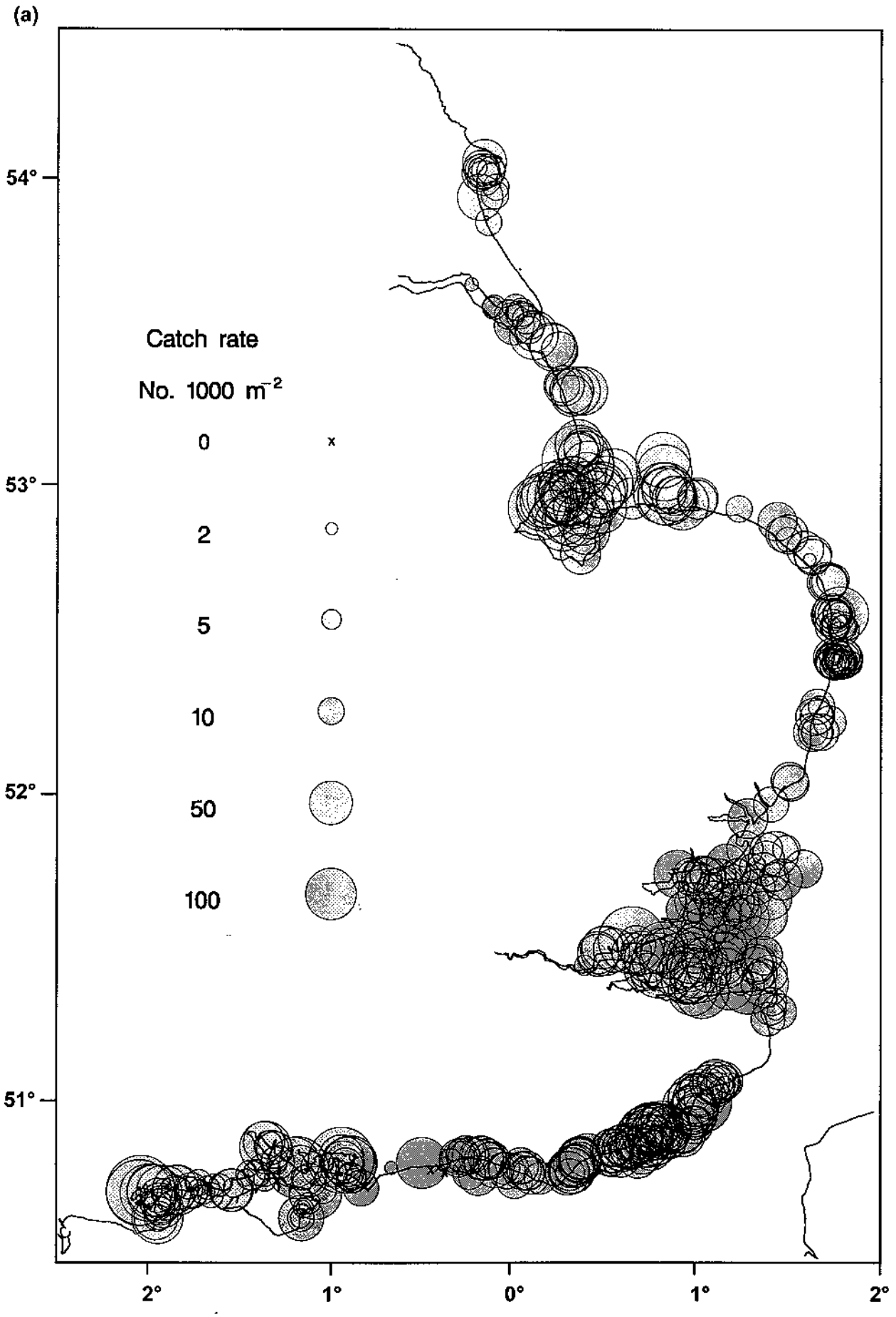


Figure 40. ***Pomatoschistus spp.*** **- sand gobies**

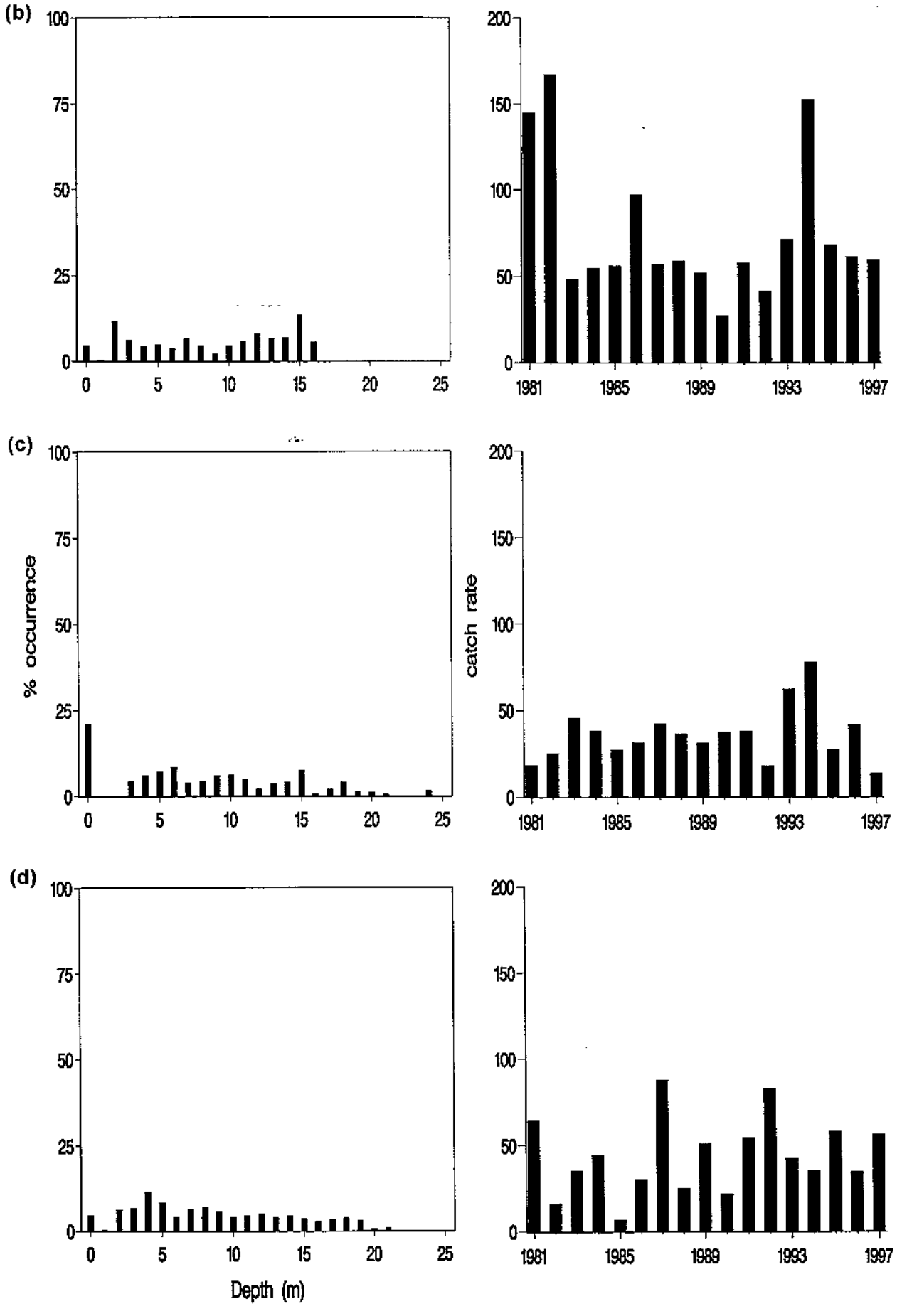


Figure 41. ***Gobiusculus flavescens*** **- two-spotted goby**

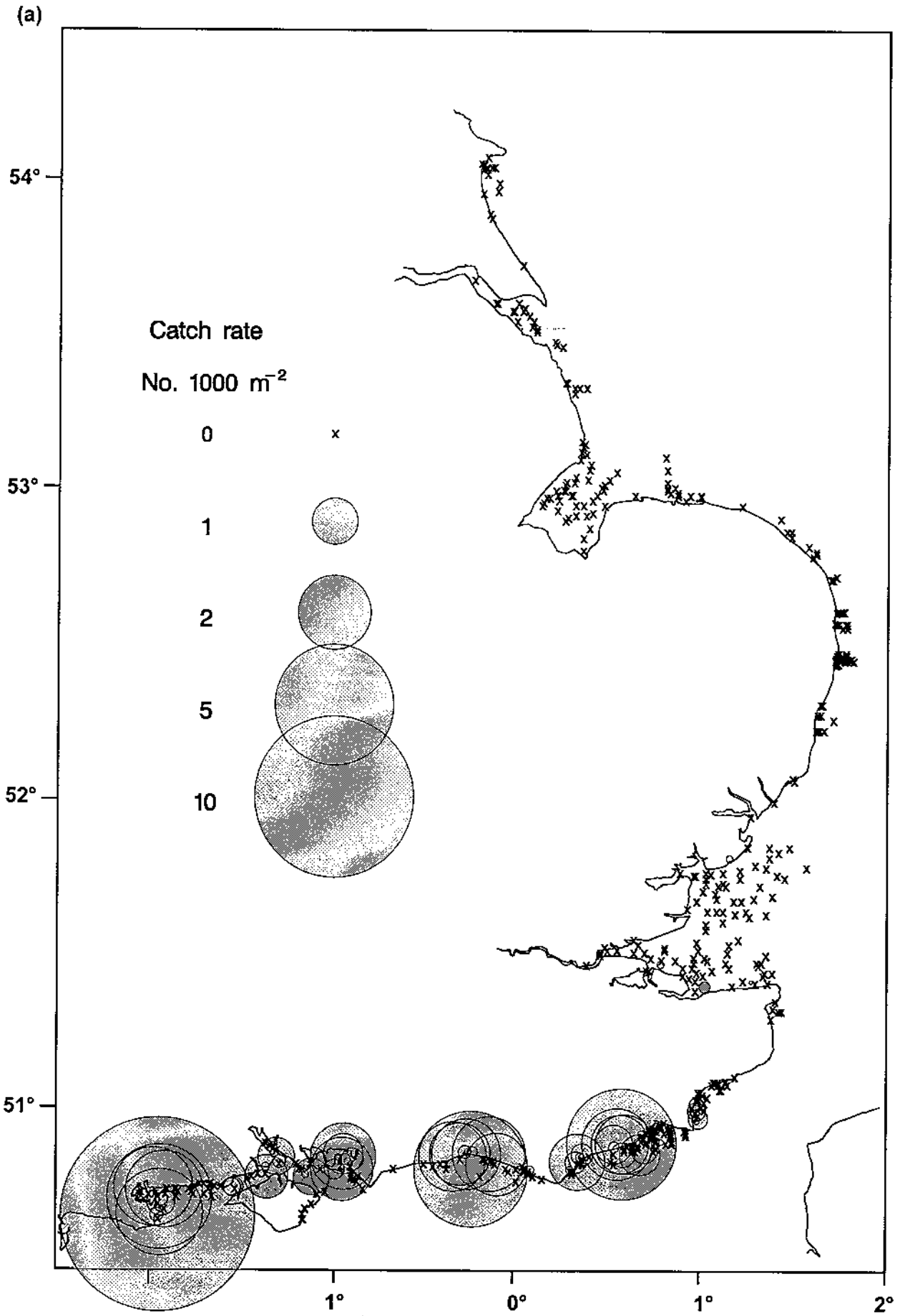


Figure 41. ***Gobiusculus flavescens*** **- two-spotted goby**

(b)

No data

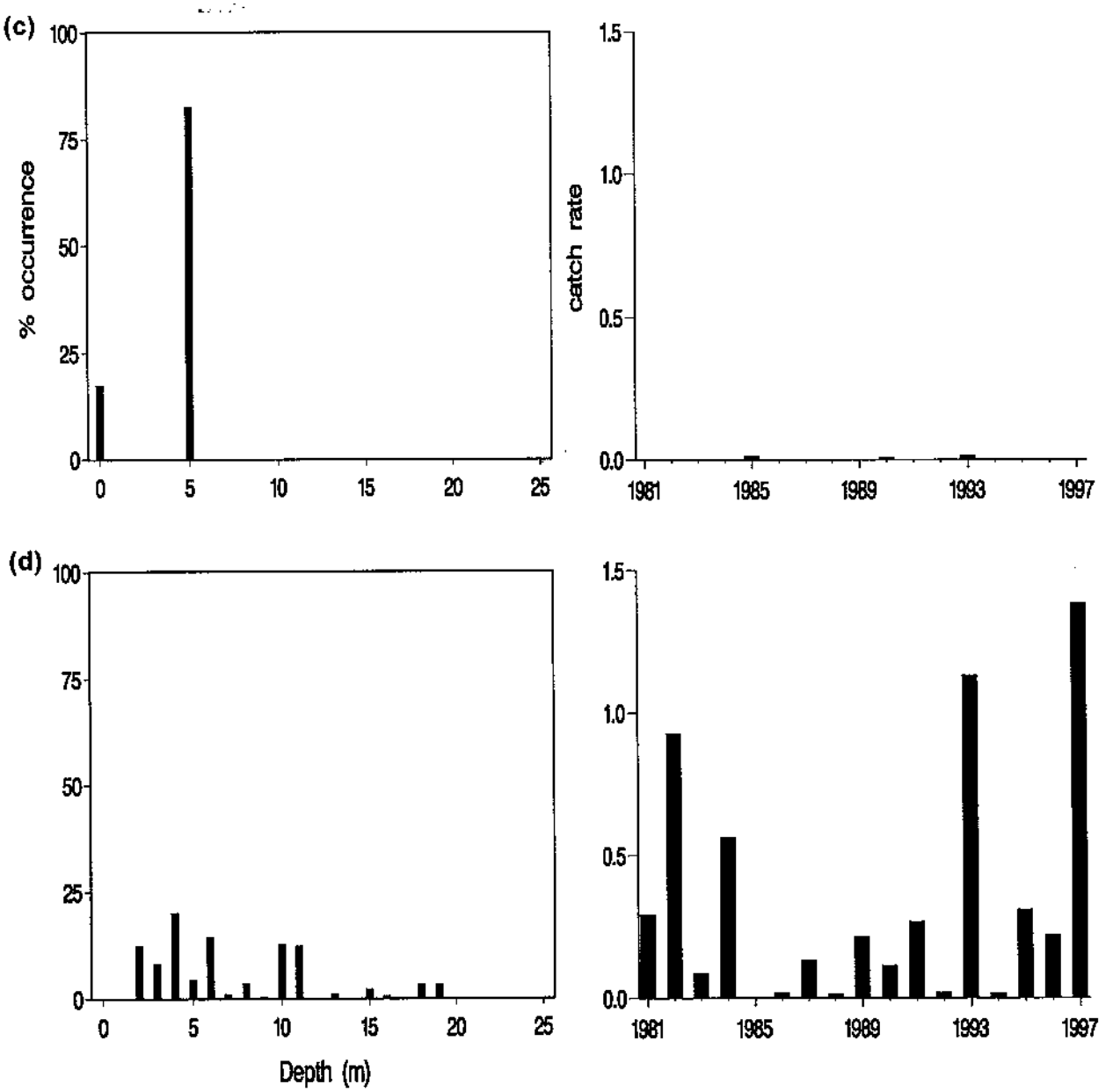


Figure 42. ***Aphia minuta*** **- transparent goby**

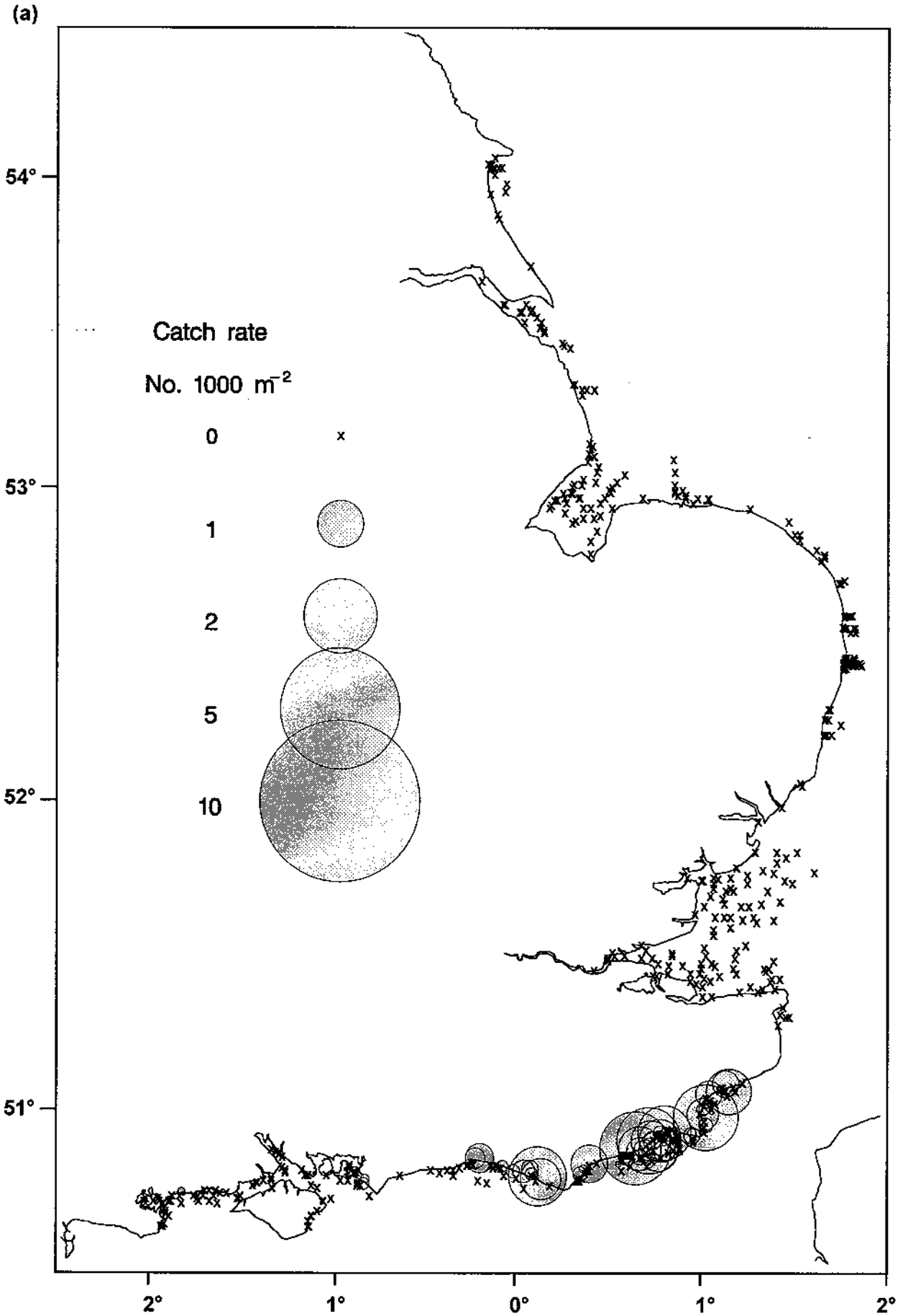


Figure 42. ***Aphia minuta*** **- transparent goby**

(b)

No data

(c)

No data

(d)

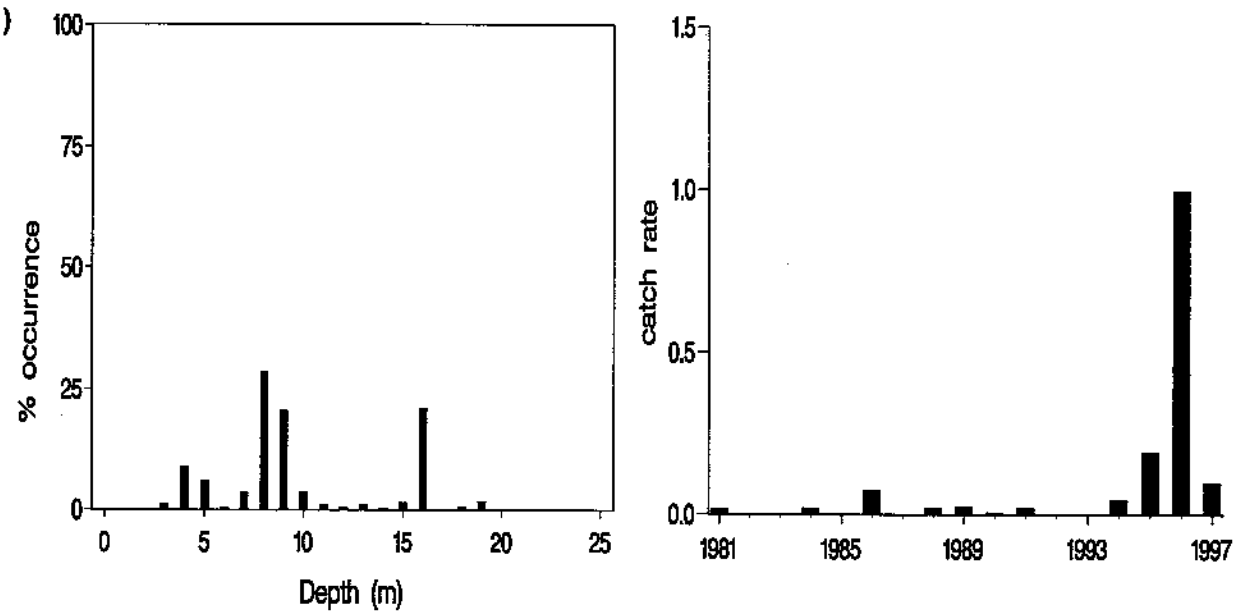


Figure 43. ***Atherina presbyter*** **- sand-smelt**

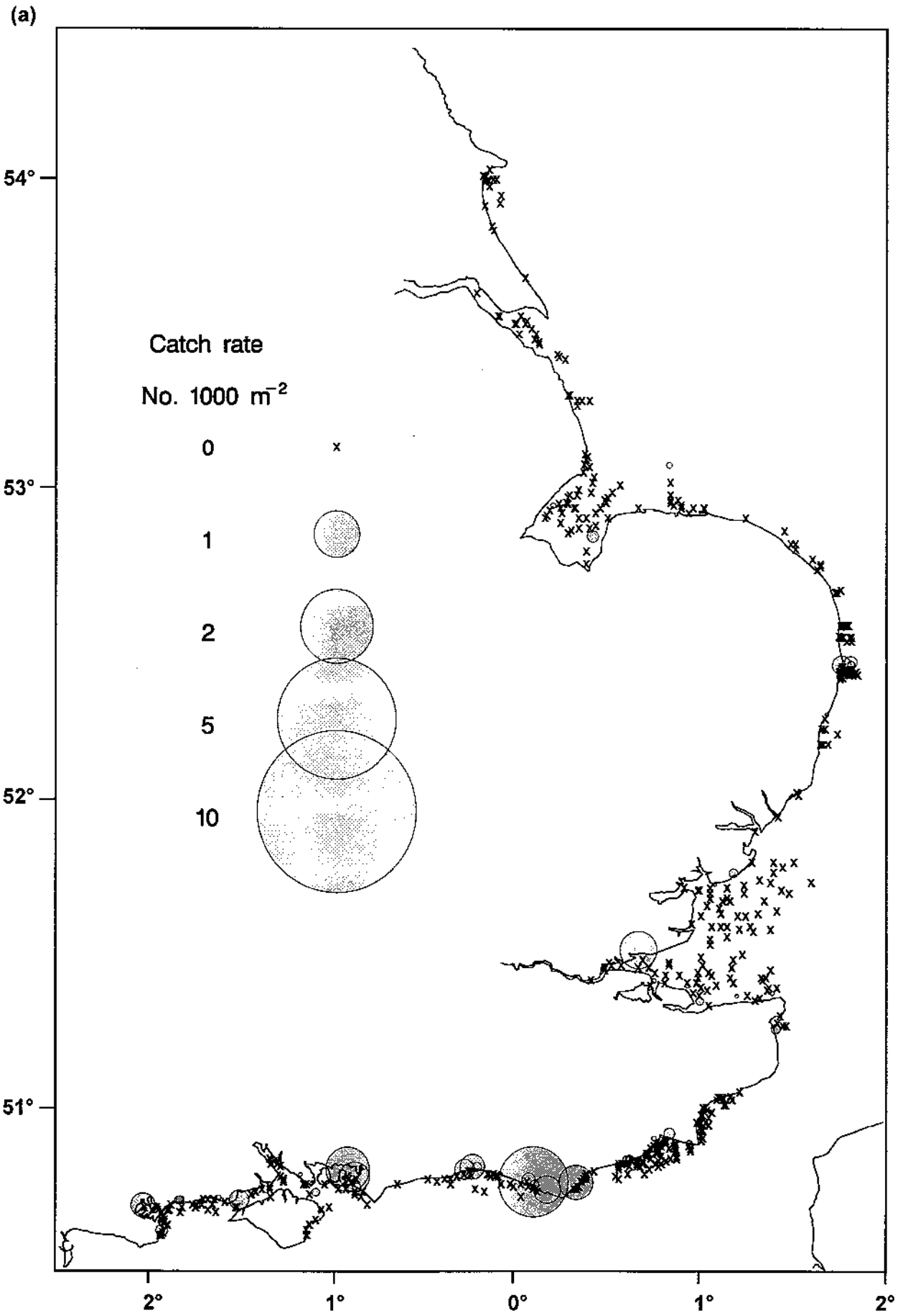


Figure 43. Atherina presbyter - sand-smelt

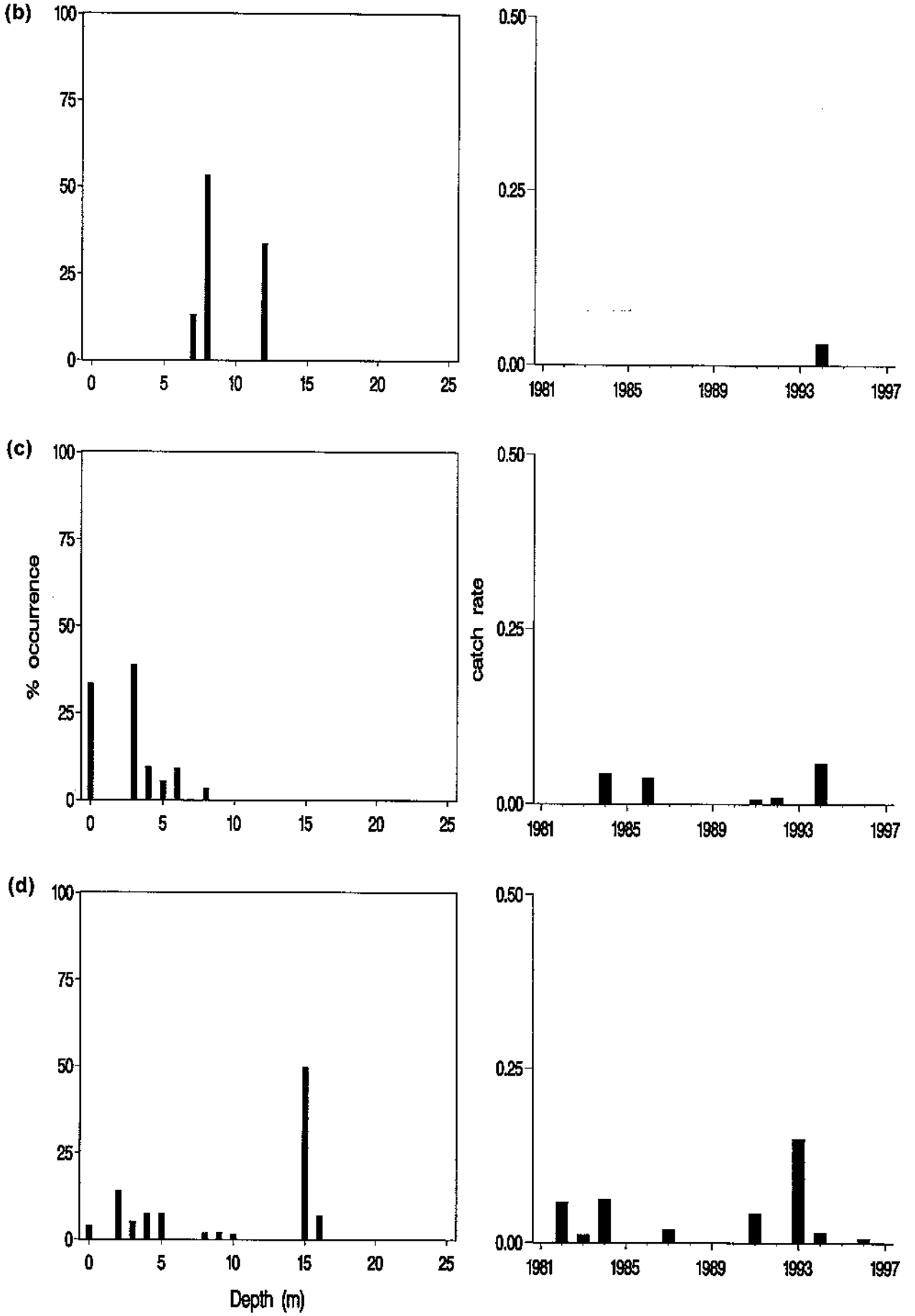


Figure 44. ***Solea solea*** **- sole (0-group)**

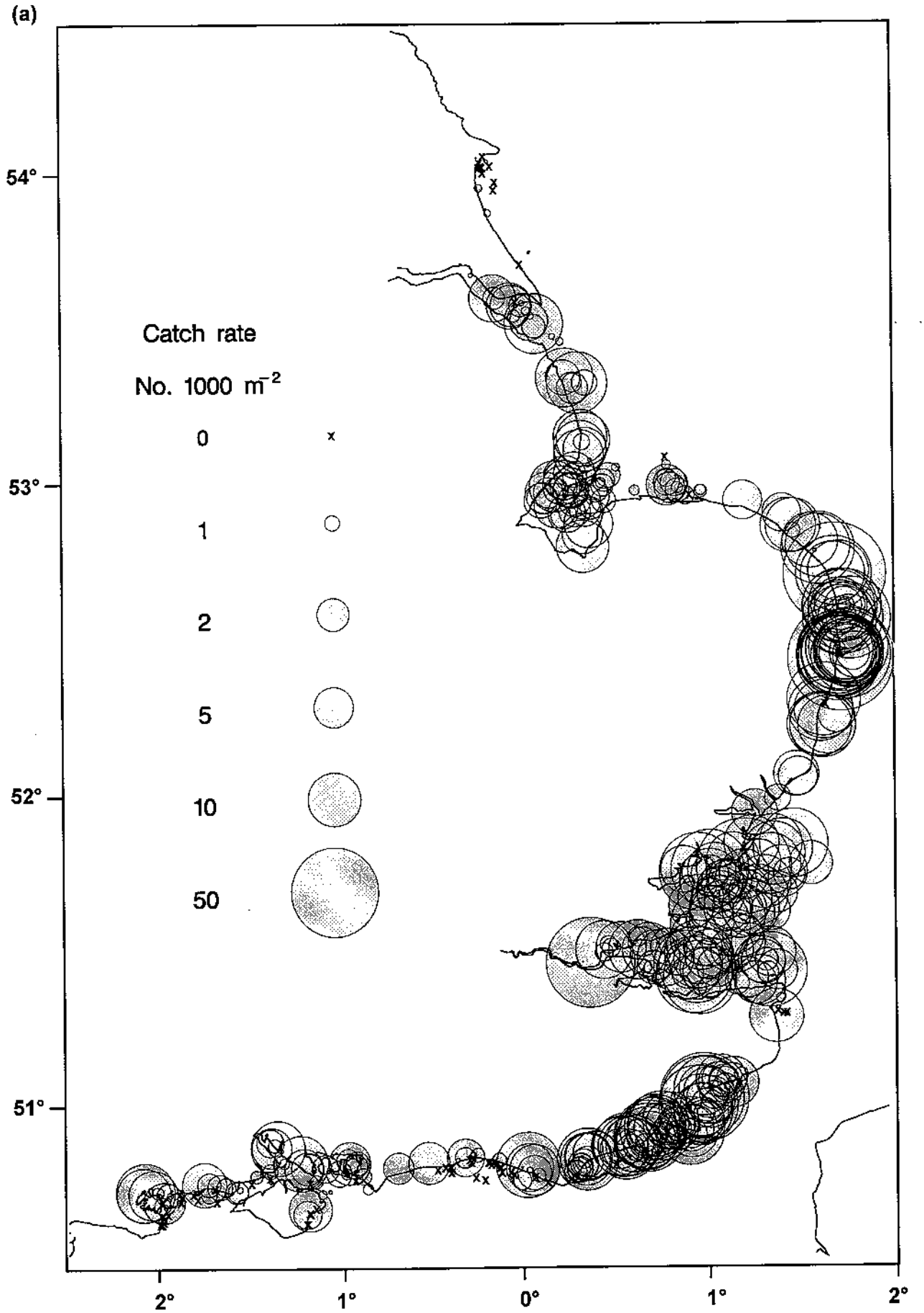


Figure 44. ***Solea solea*** **- sole (0-group)**

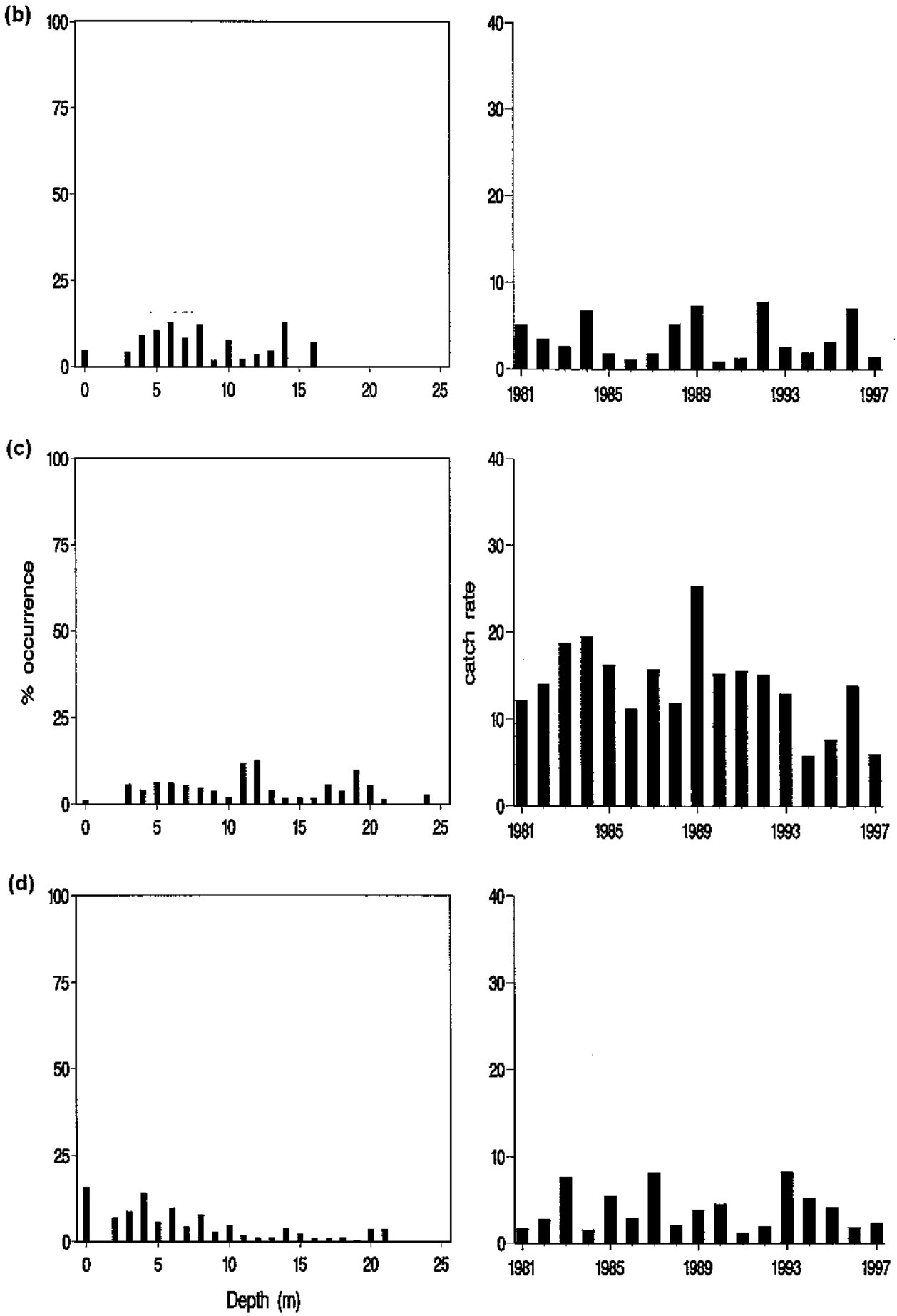


Figure 45. ***Pegusa lascaris*** **- sand sole**

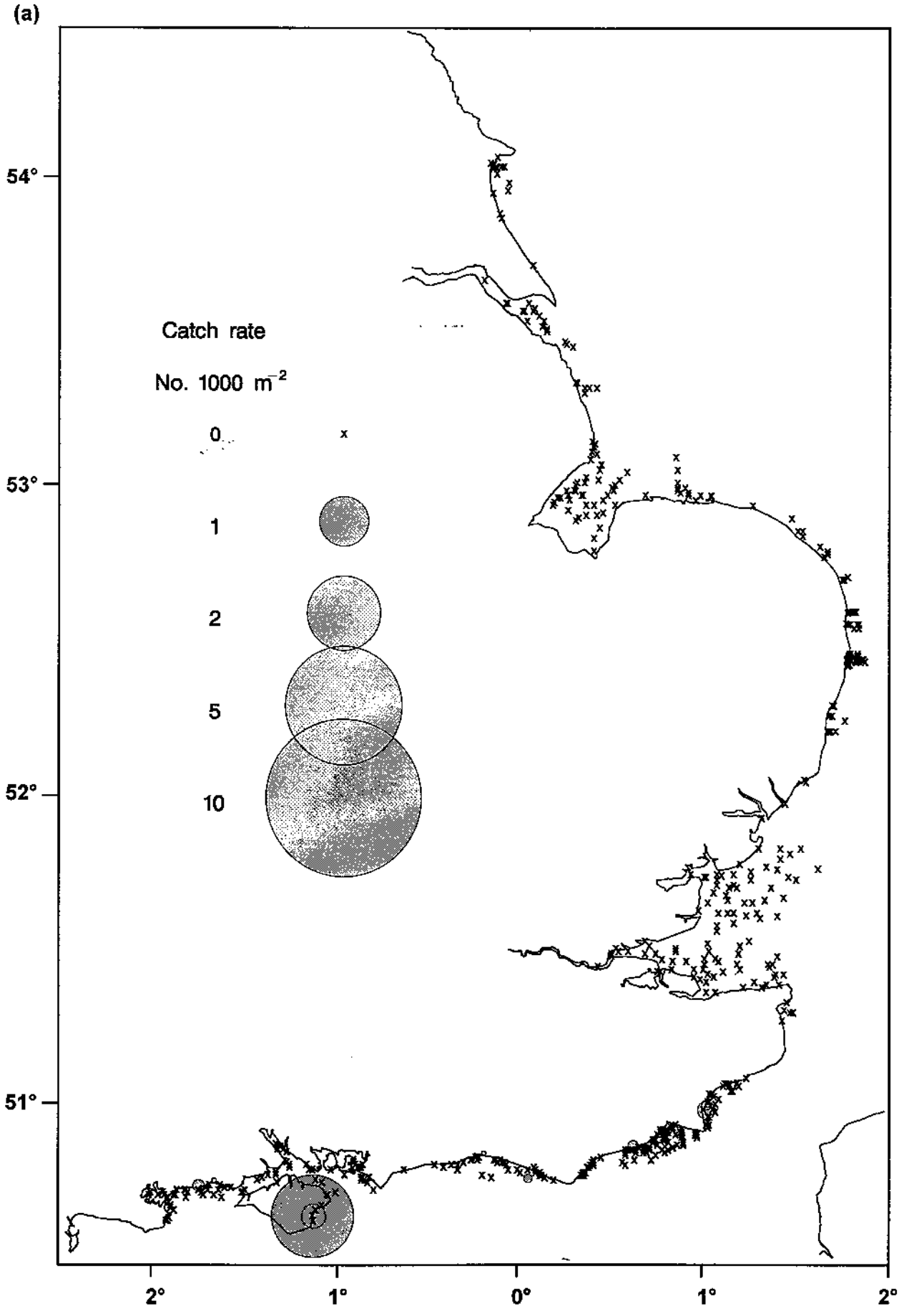


Figure 45. ***Pegusa lascaris*** **- sand sole**

(b)

No data

(c)

No data

(d)

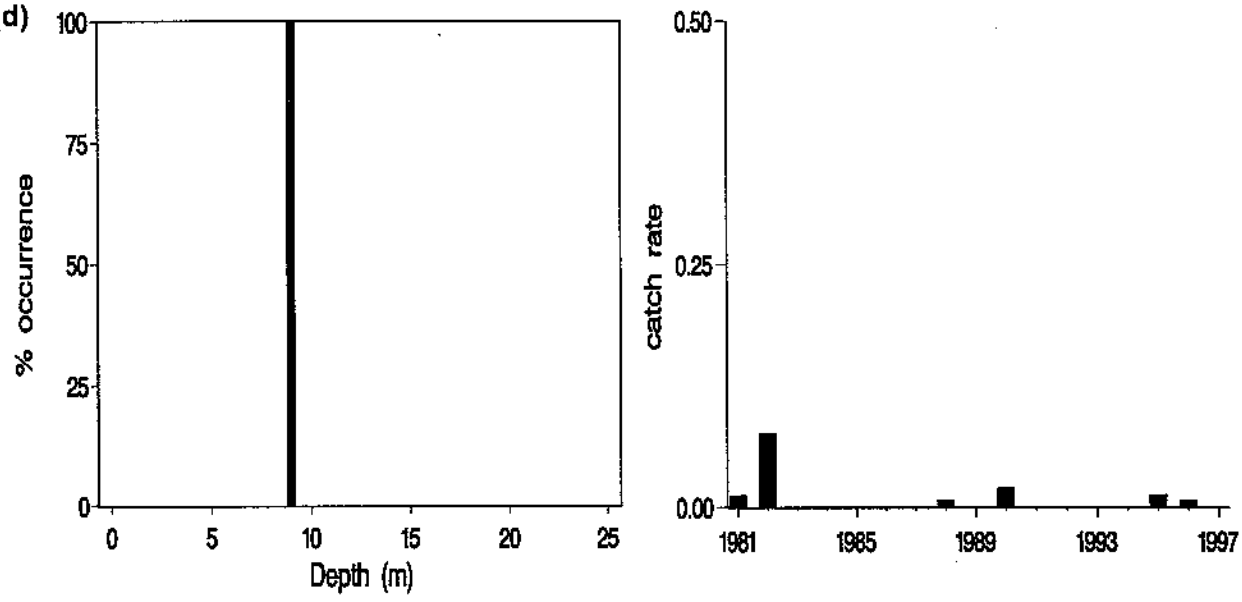


Figure 46. ***Buglossidium luteum*** **- solenette**

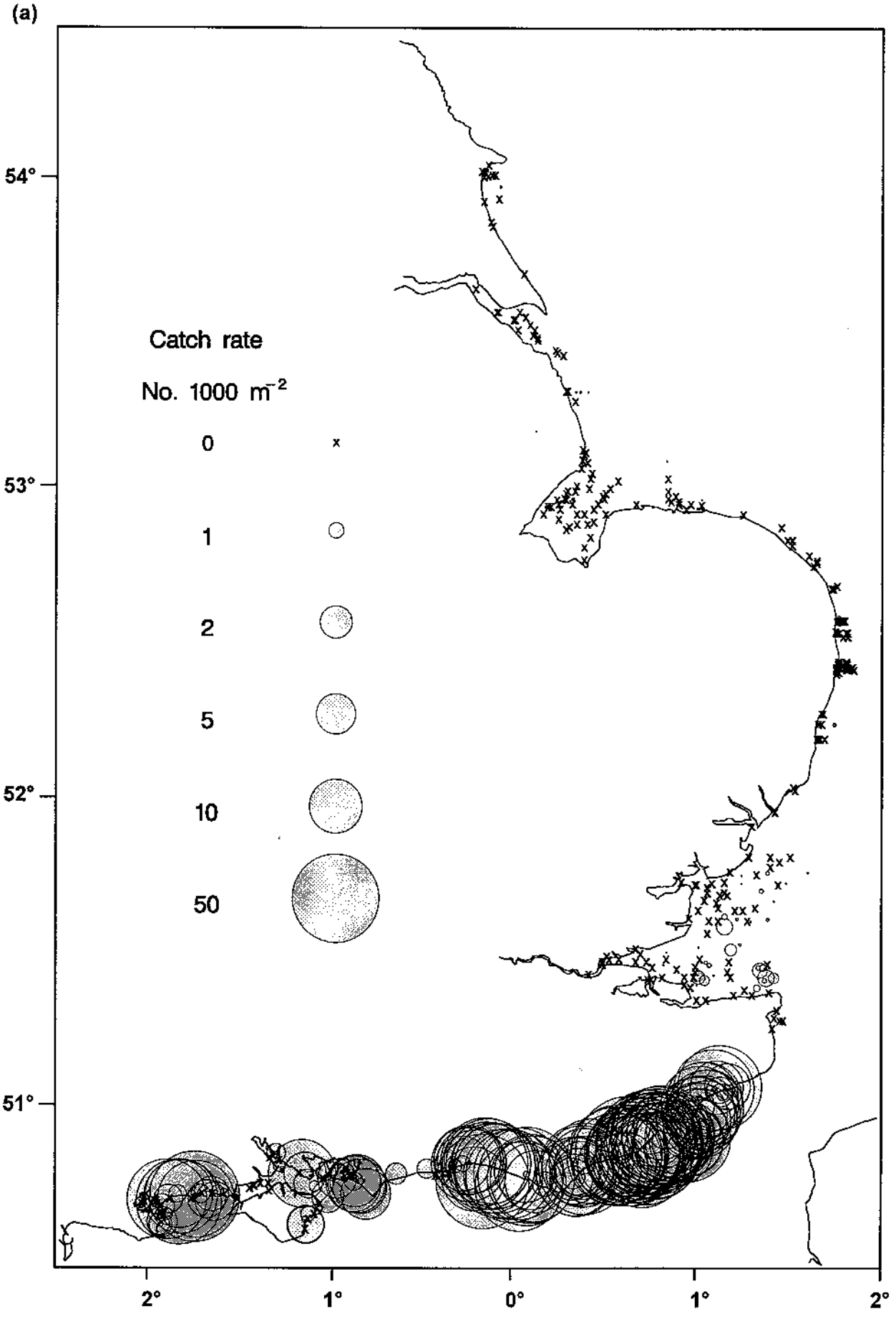


Figure 46. ***Buglossidium luteum*** **- solenette**

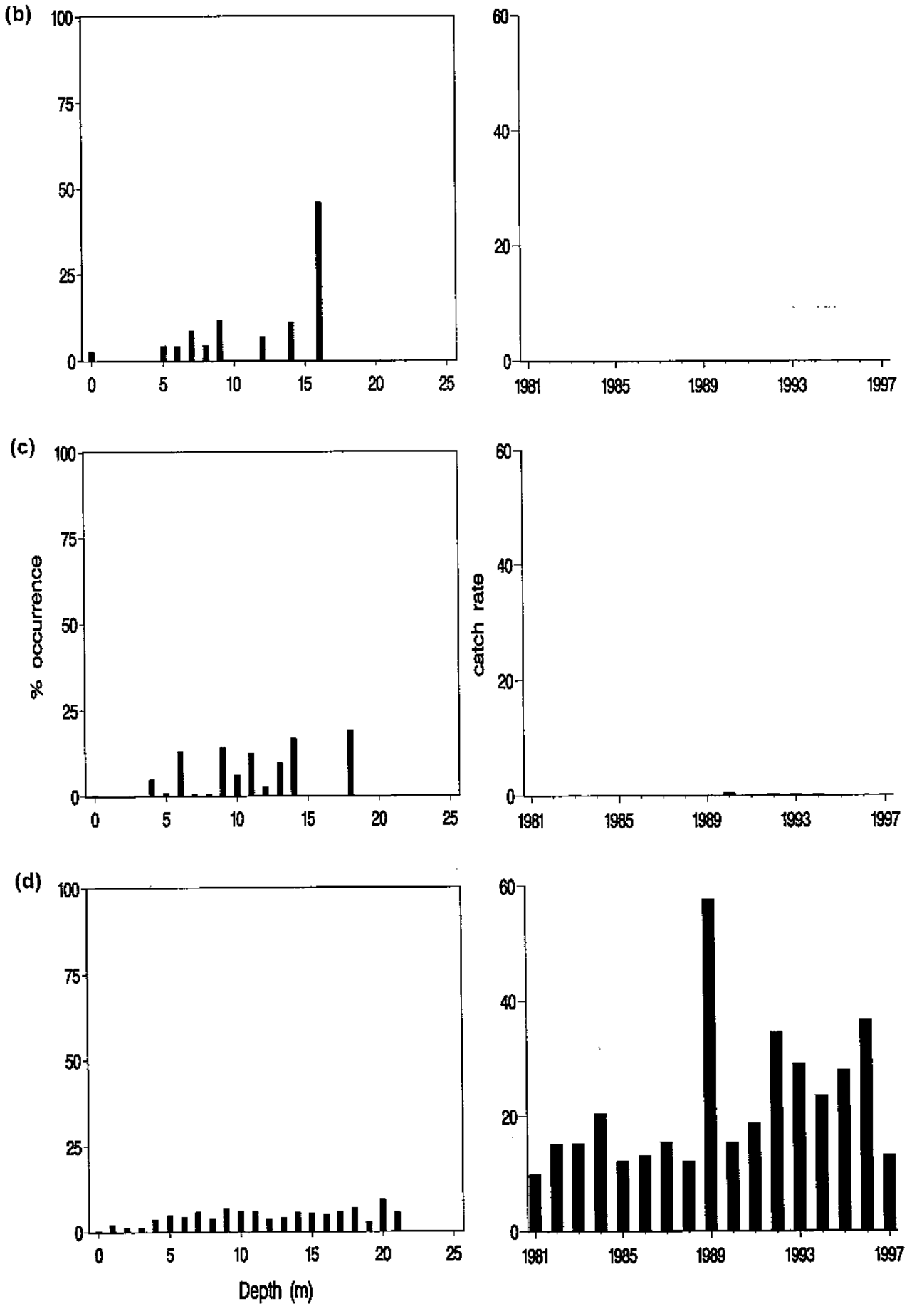


Figure 47. ***Pleuronectes platessa*** **- plaice (0-group)**

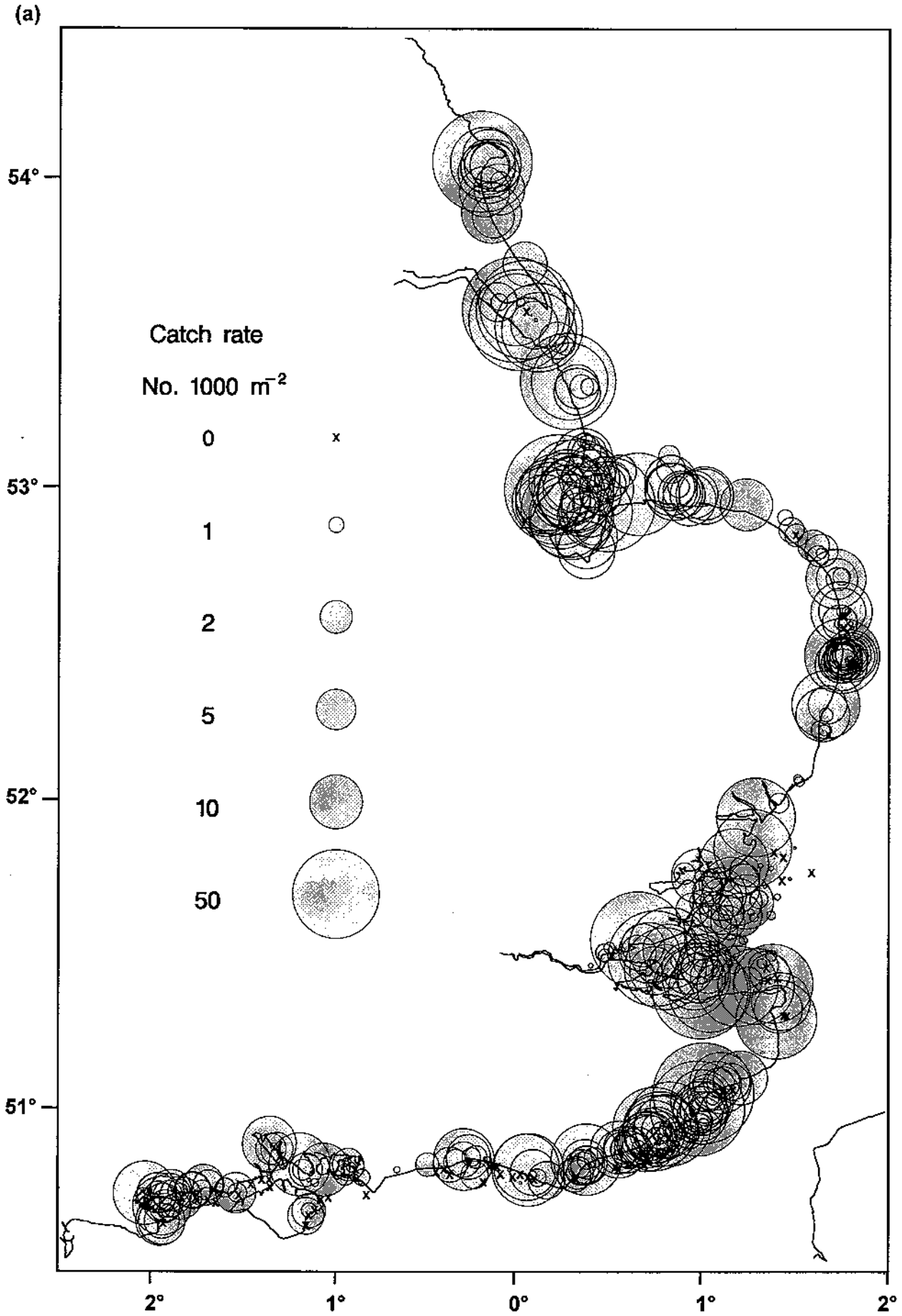


Figure 47. ***Pleuronectes platessa*** **- plaice (0-group)**

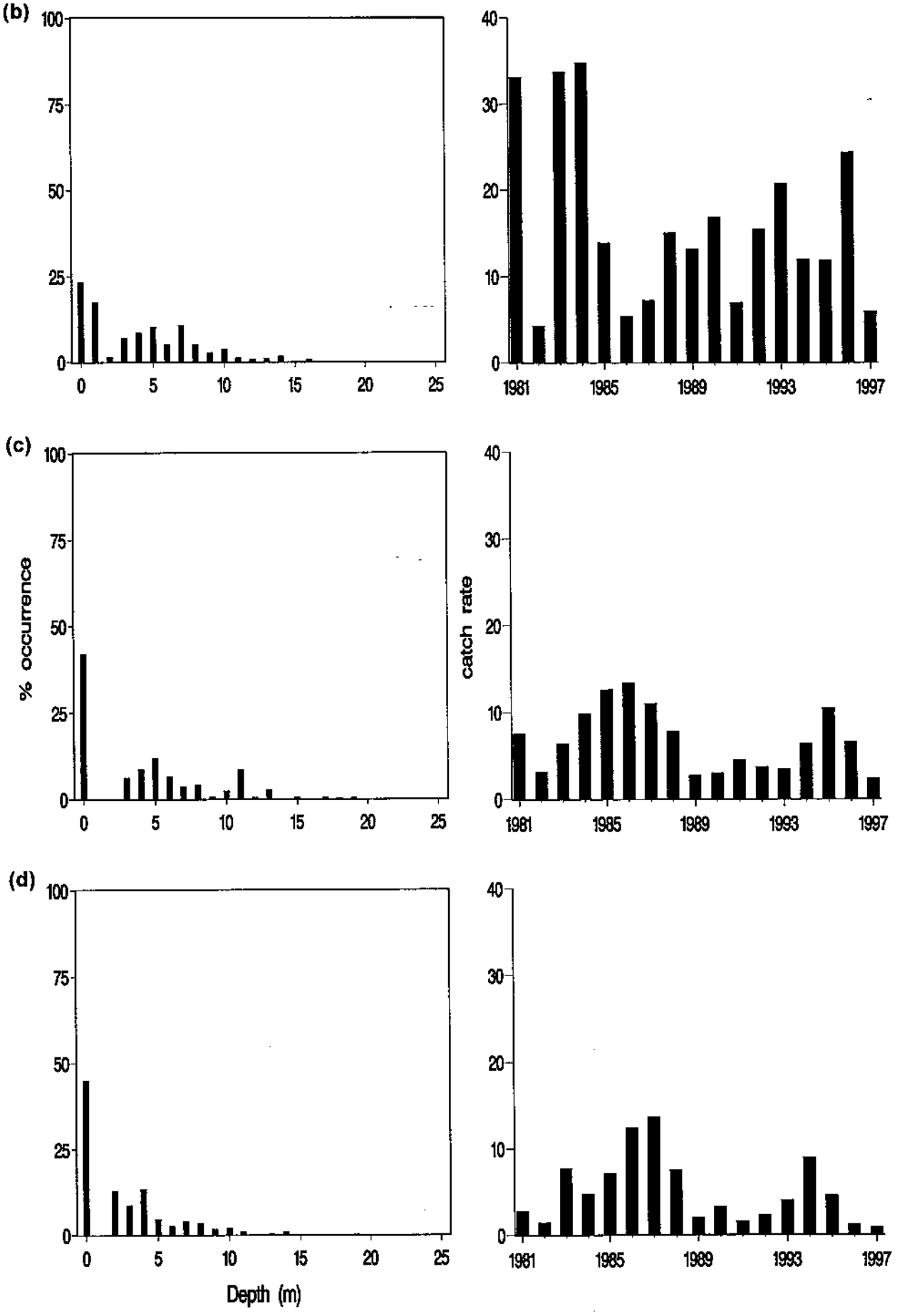


Figure 48. ***Platichthys flesus*** **- flounder**

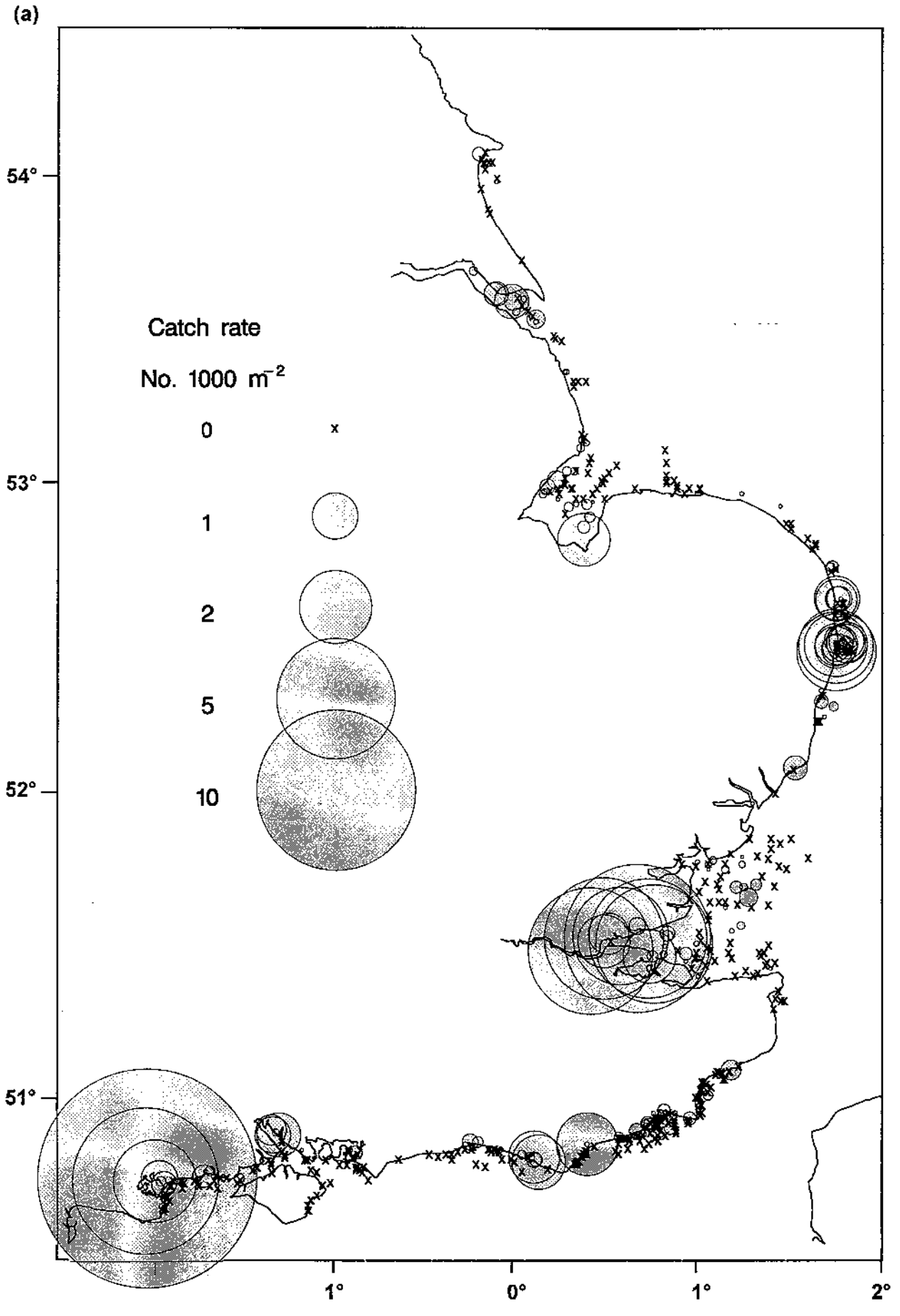


Figure 48. ***Platichthys flesus*** **- flounder**

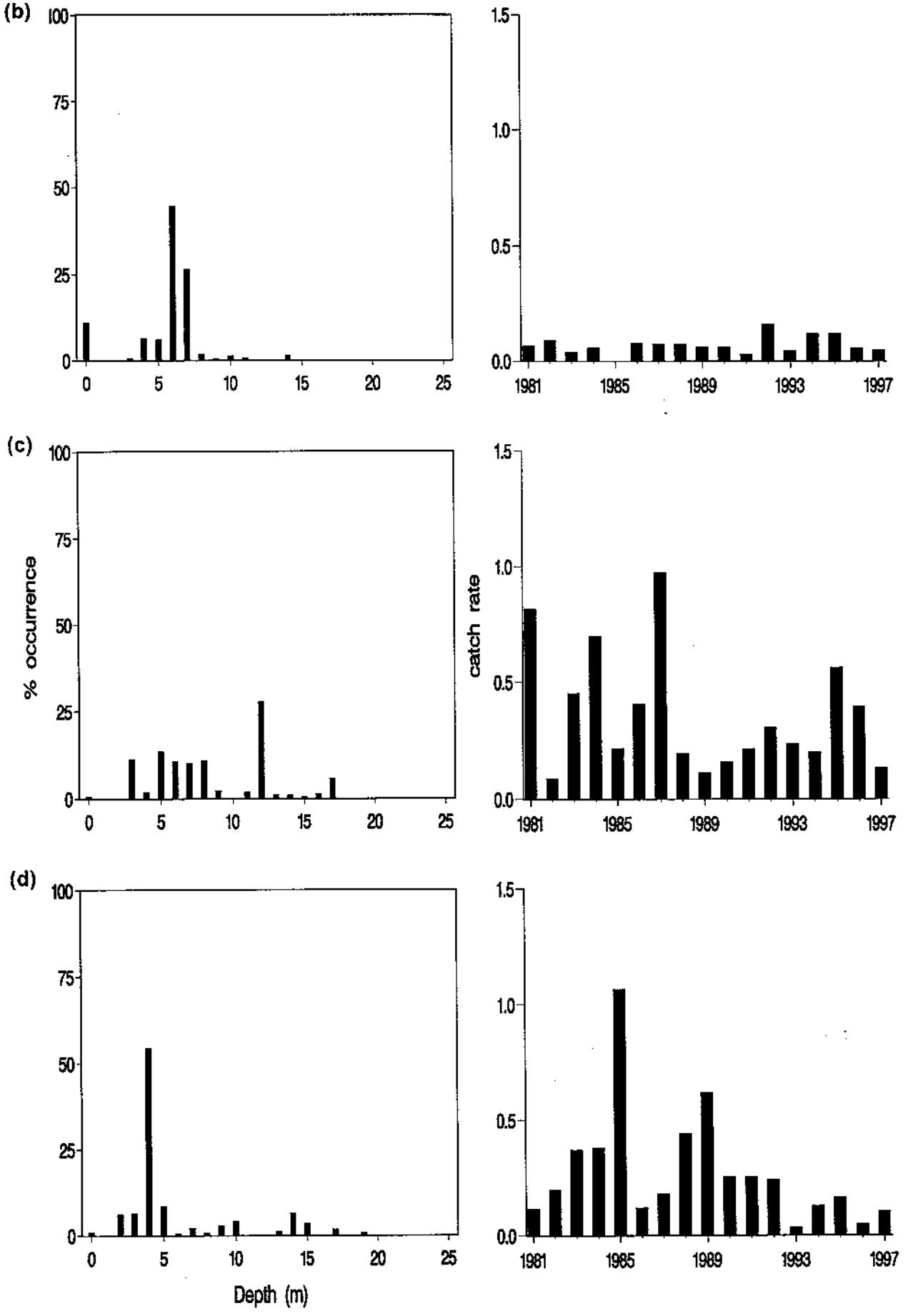


Figure 49. Limanda limanda - dab

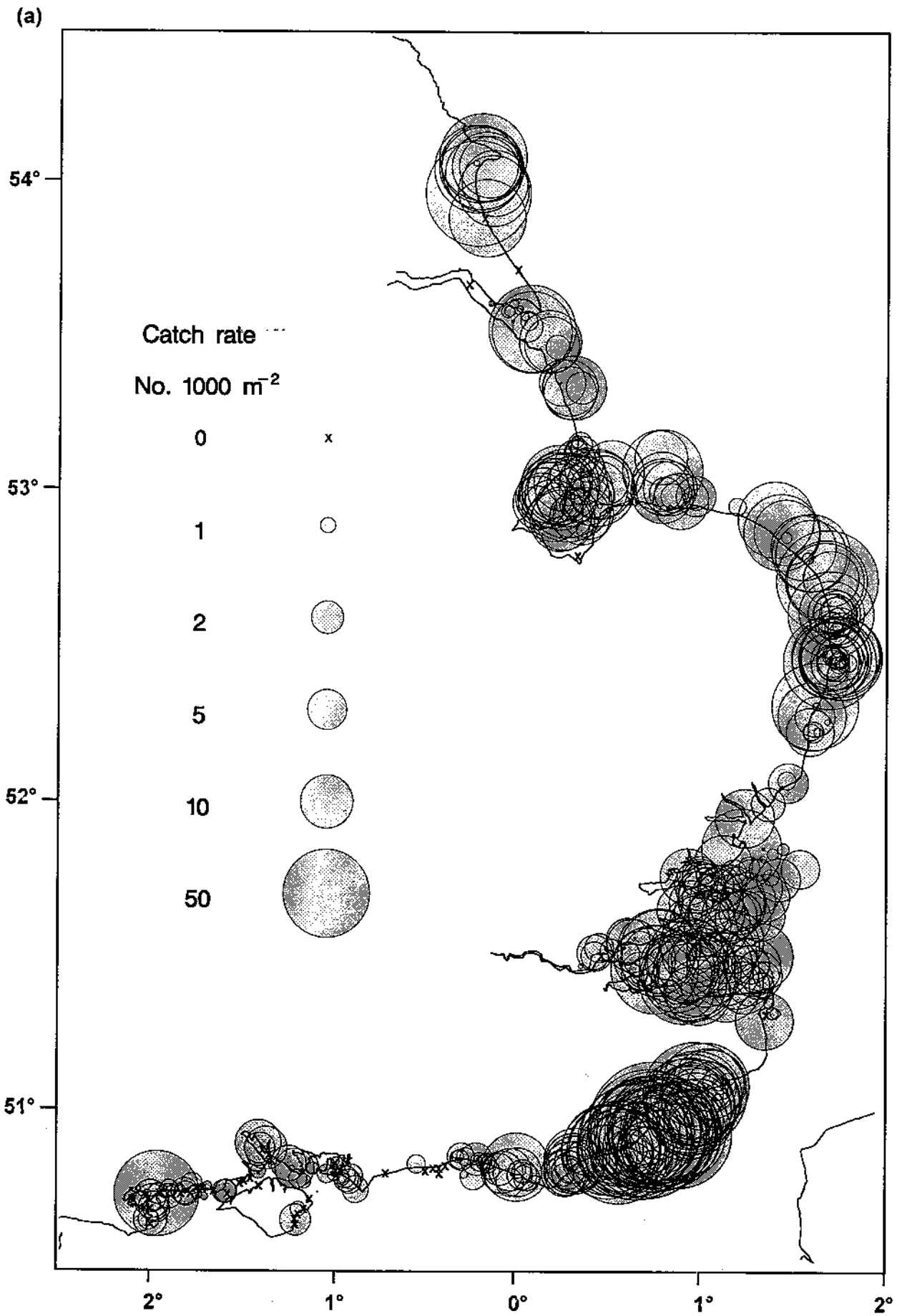


Figure 49. ***Limanda limanda*** **- dab**

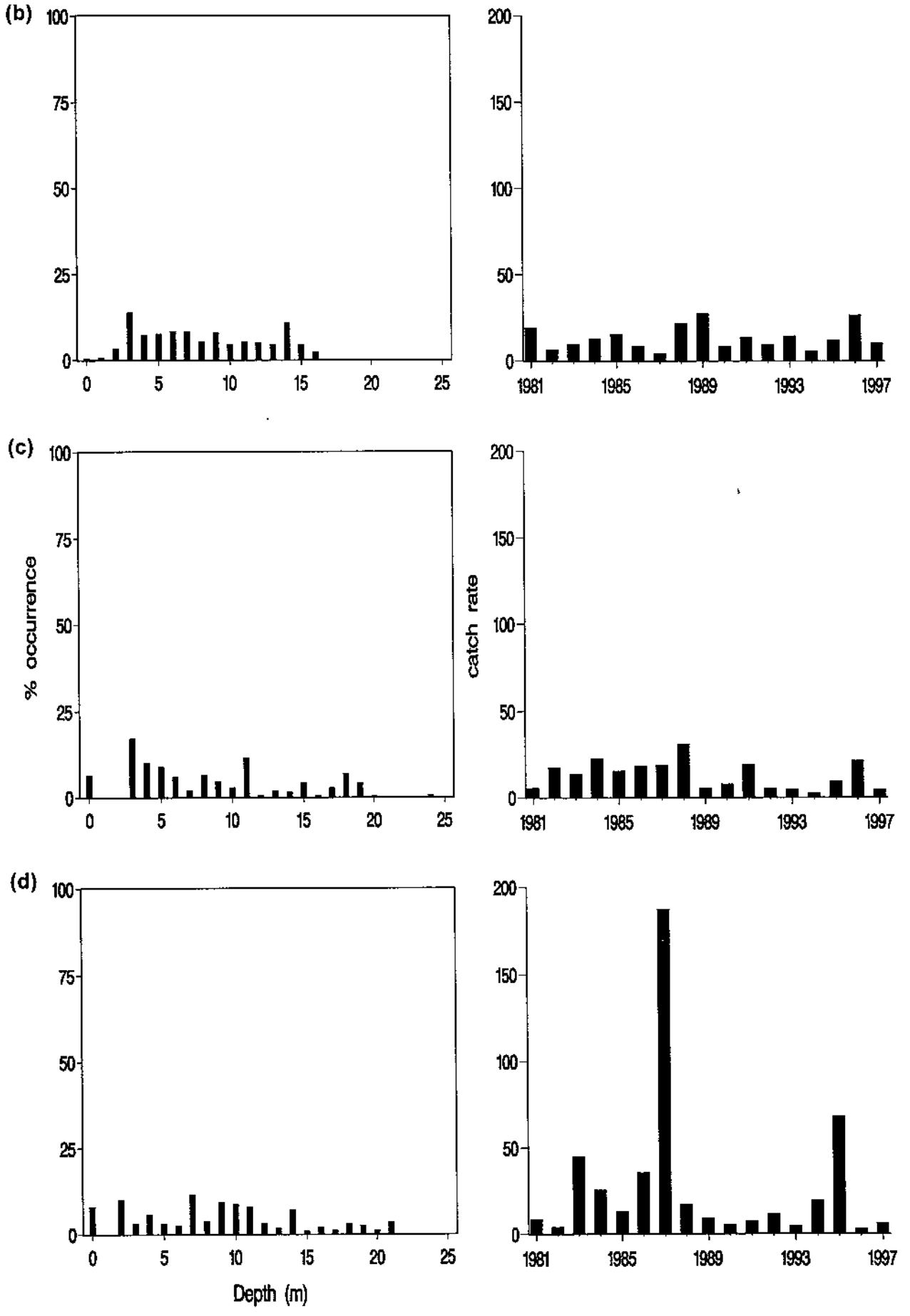


***Figure 50. Microstomus kitt* - lemon sole**

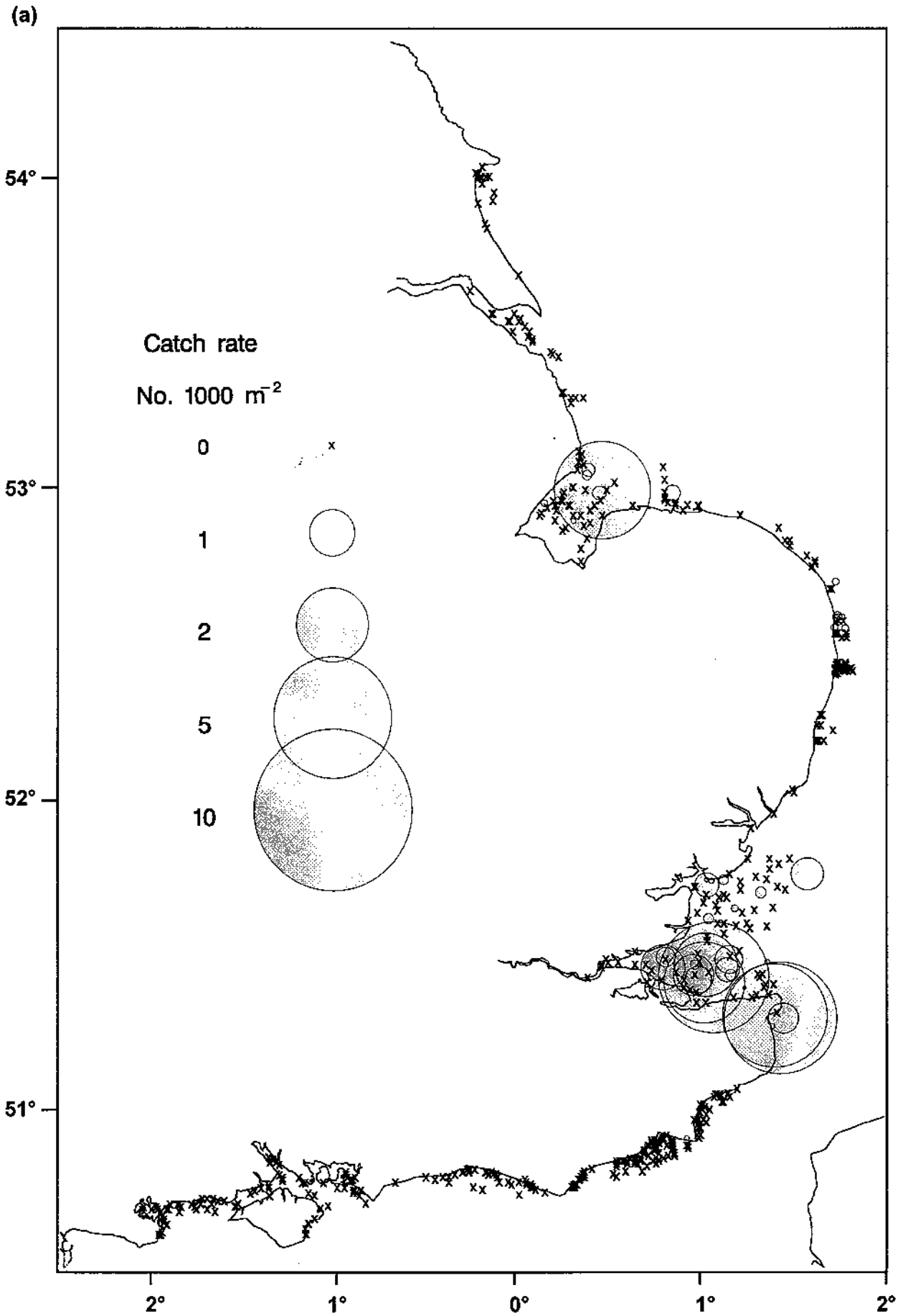


Figure 50. ***Microstomus kitt*** **- lemon sole**

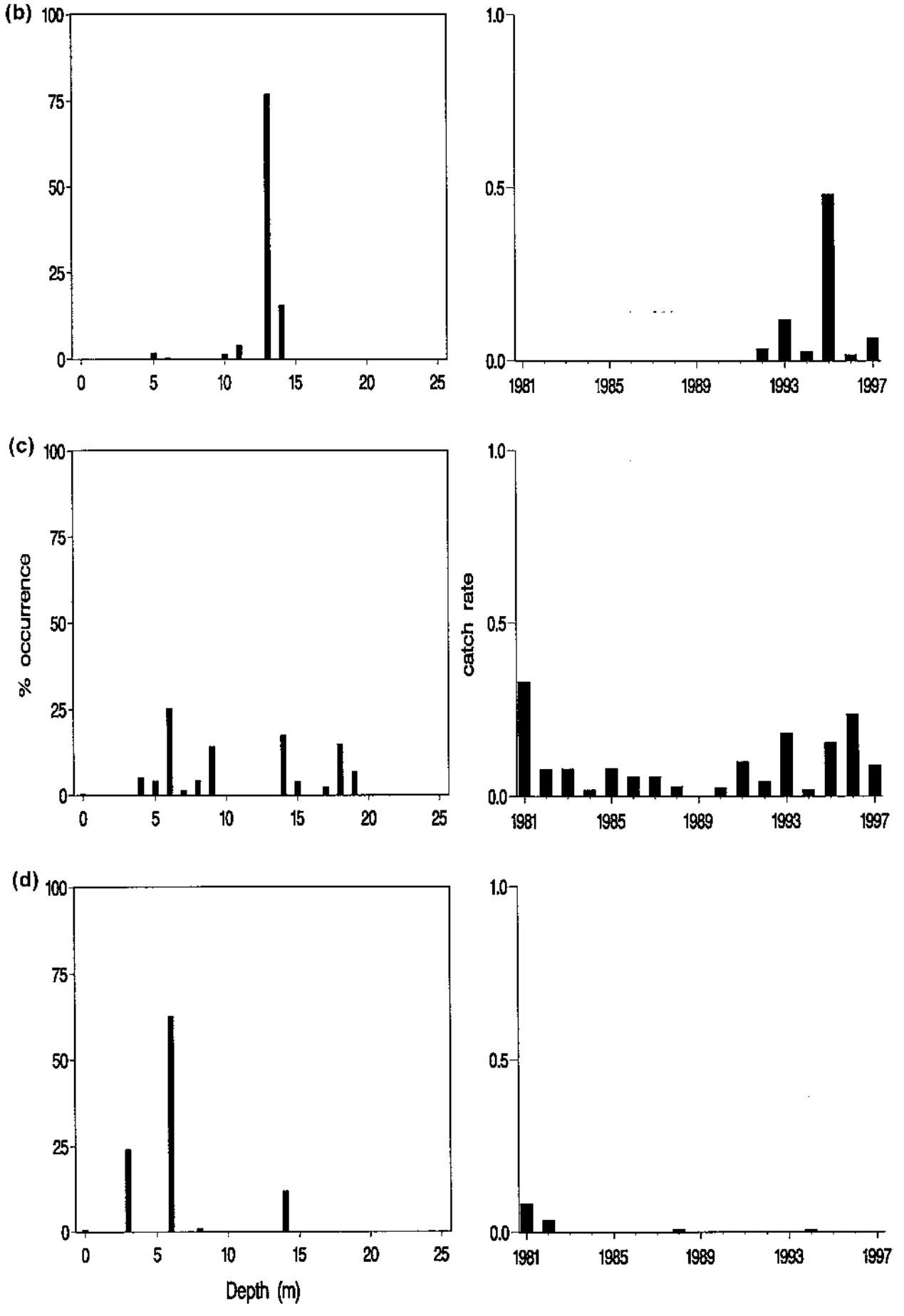


Figure 51. ***Scophthalmus rhombus*** **- brill**

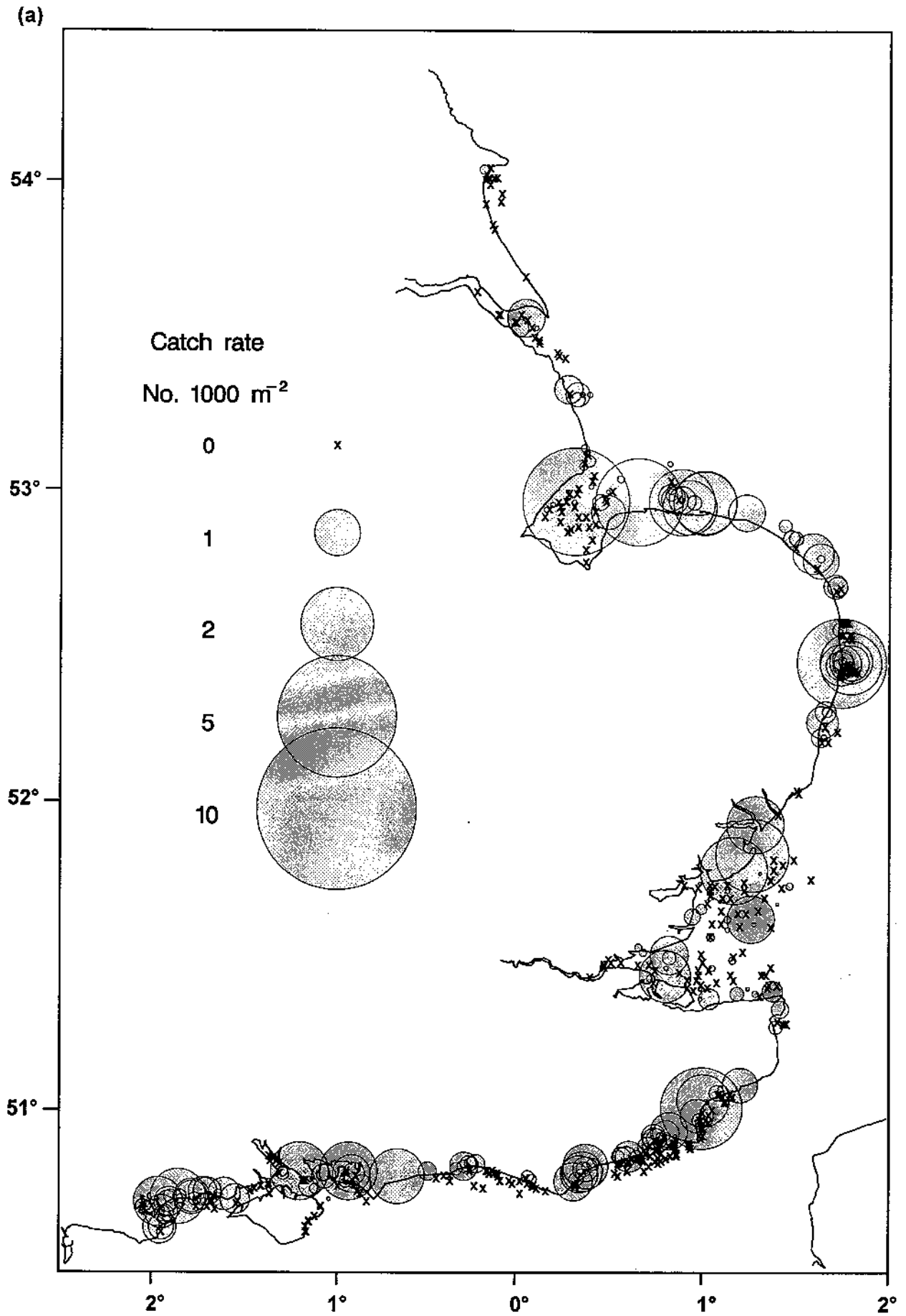


Figure 51. ***Scophthalmus rhombus*** **- brill**

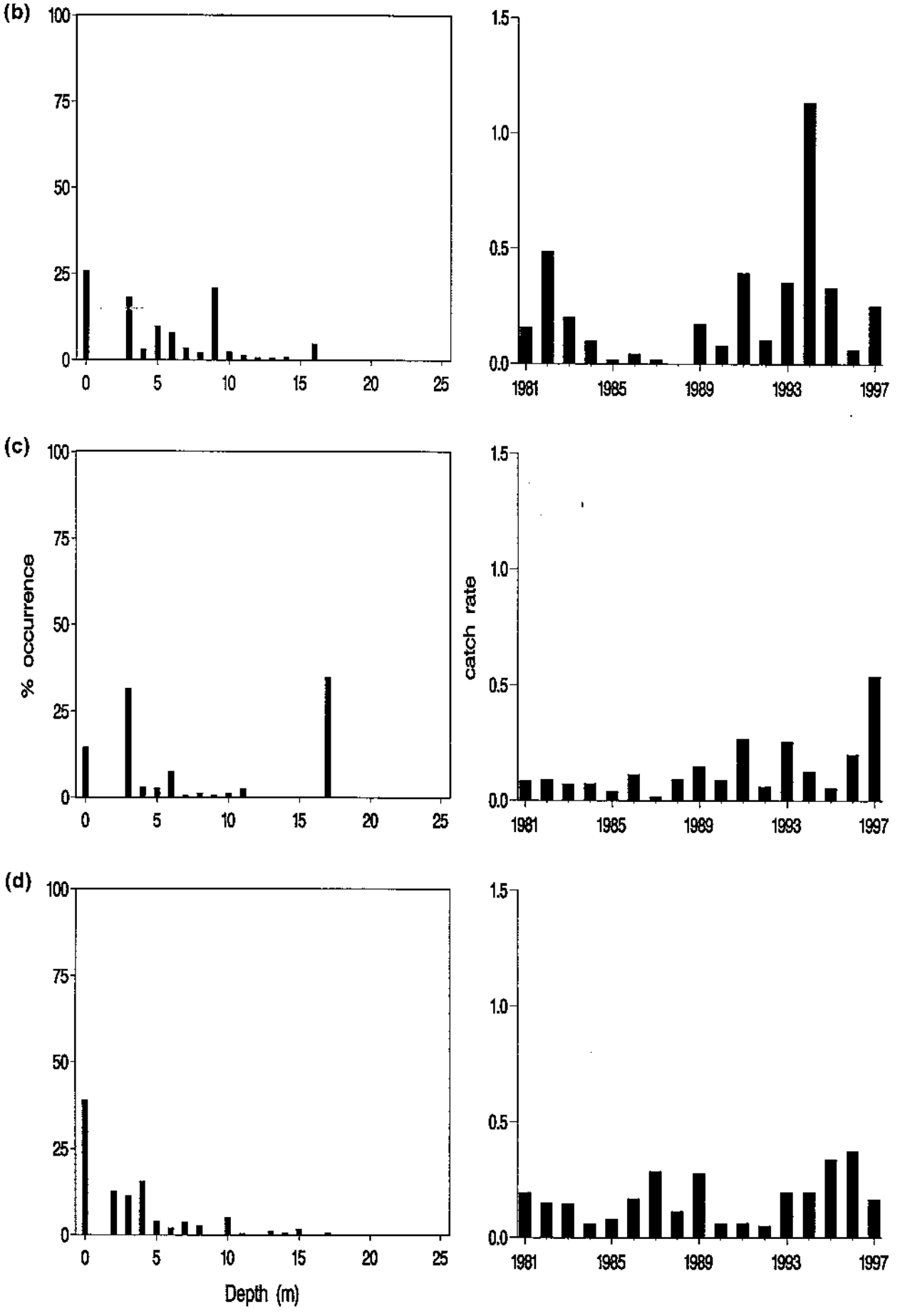


Figure 52. ***Scophthalmus maximus*** **- turbot**

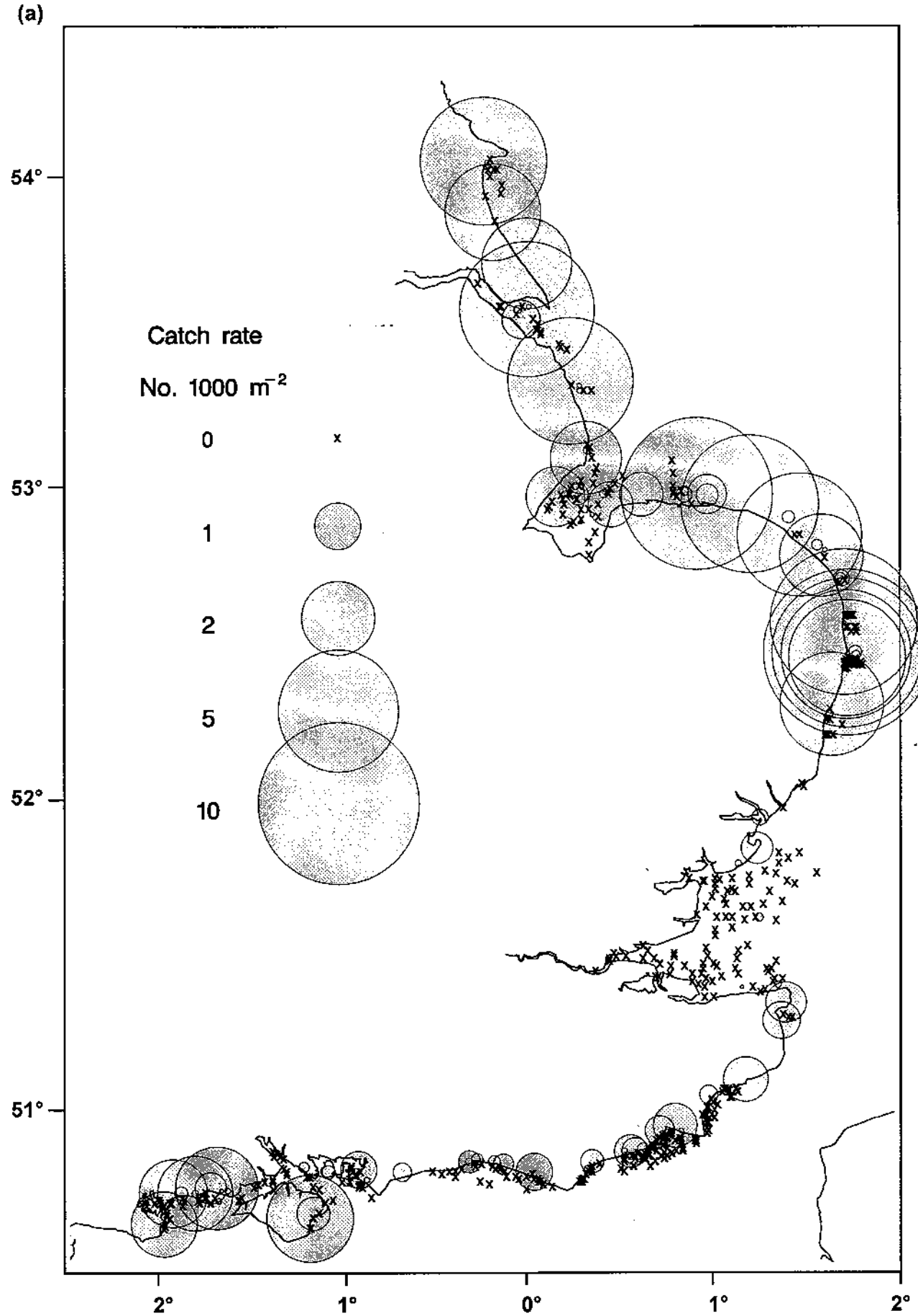


Figure 52. ***Scophthalmus maximus*** **- turbot**

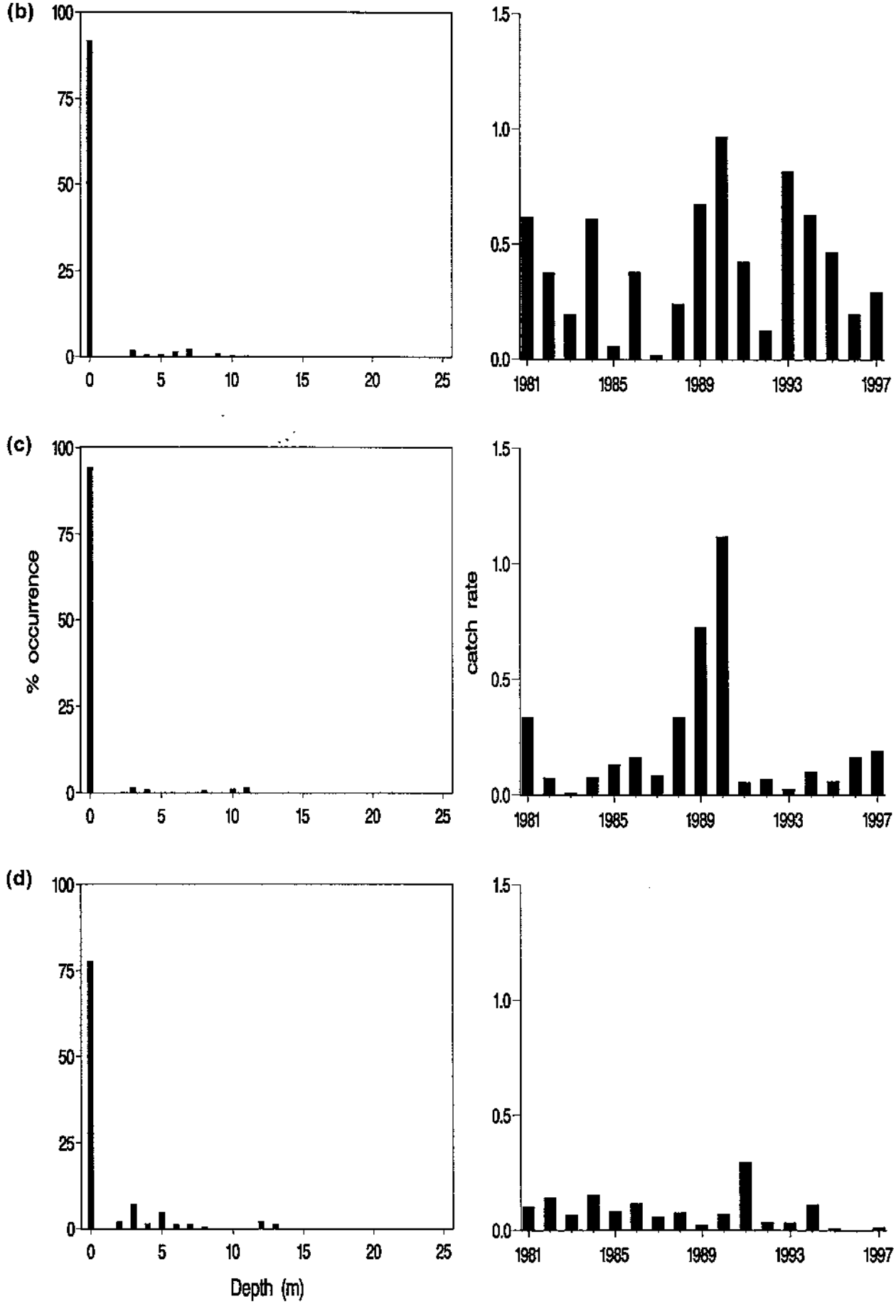


Figure 53. ***Arnoglossus laterna*** **- scaldfish**

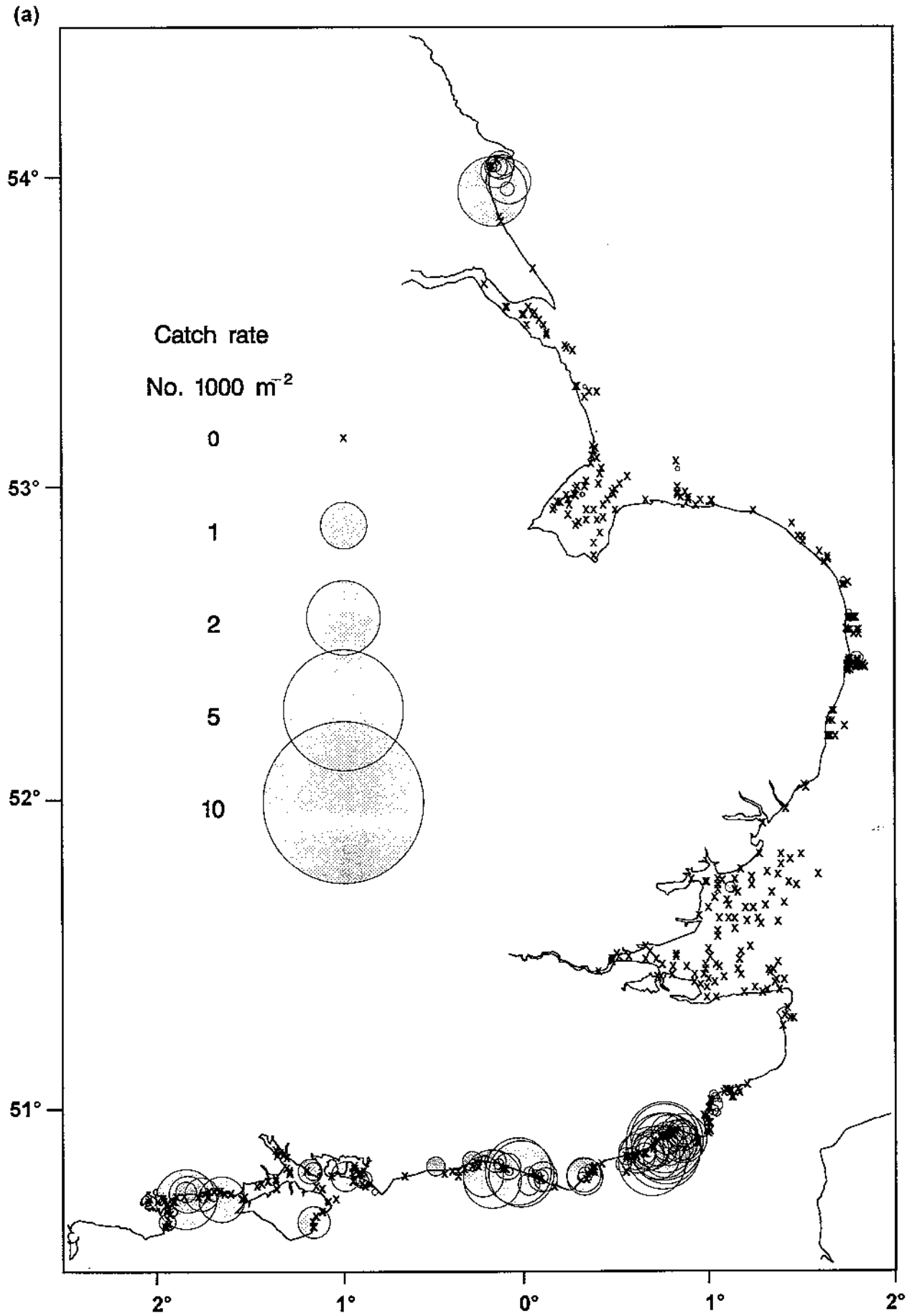


Figure 53. ***Arnoglossus laterna*** **- scaldfish**

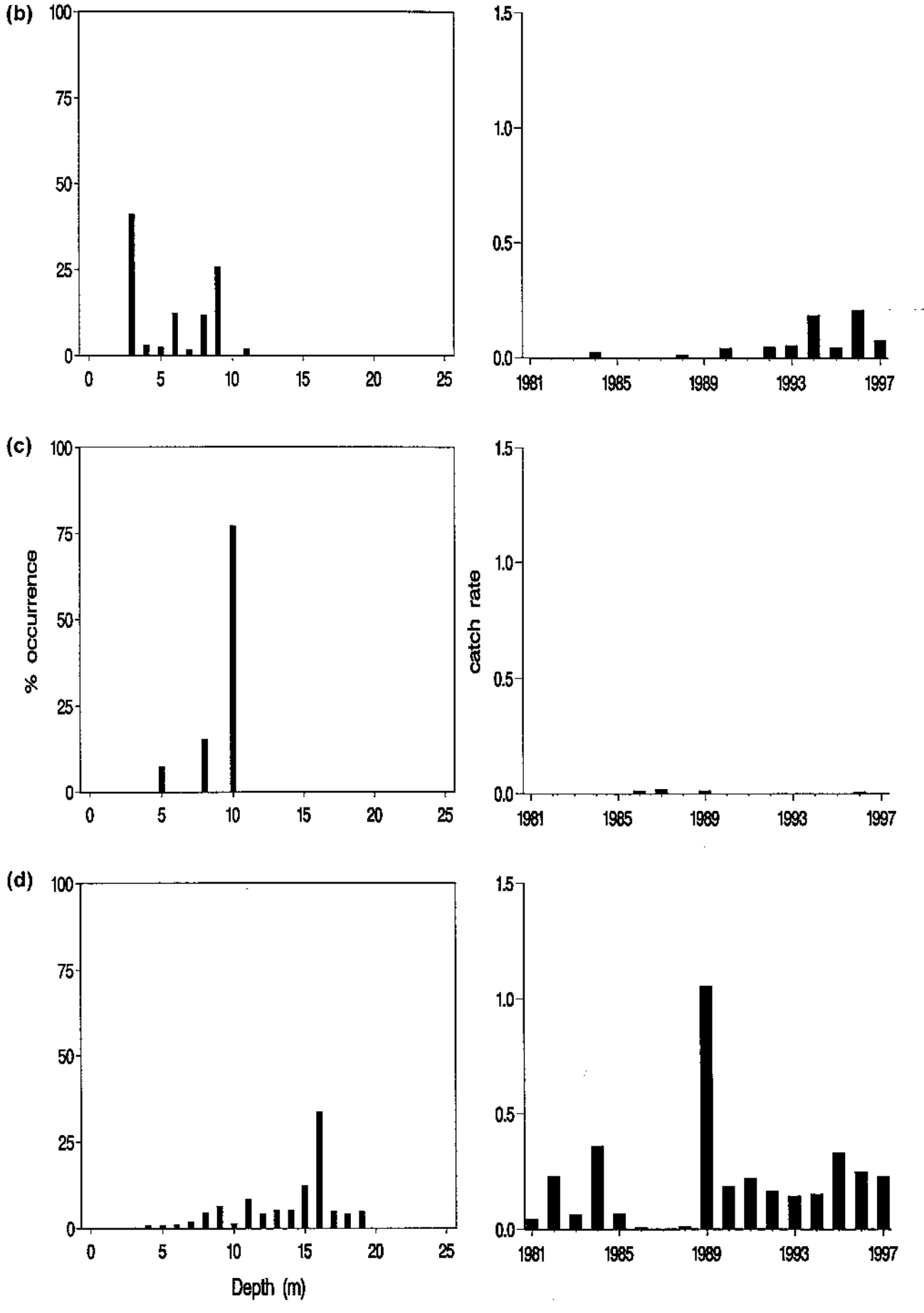


Figure 54. ***Trigla lucerna*** **- tub gurnard**

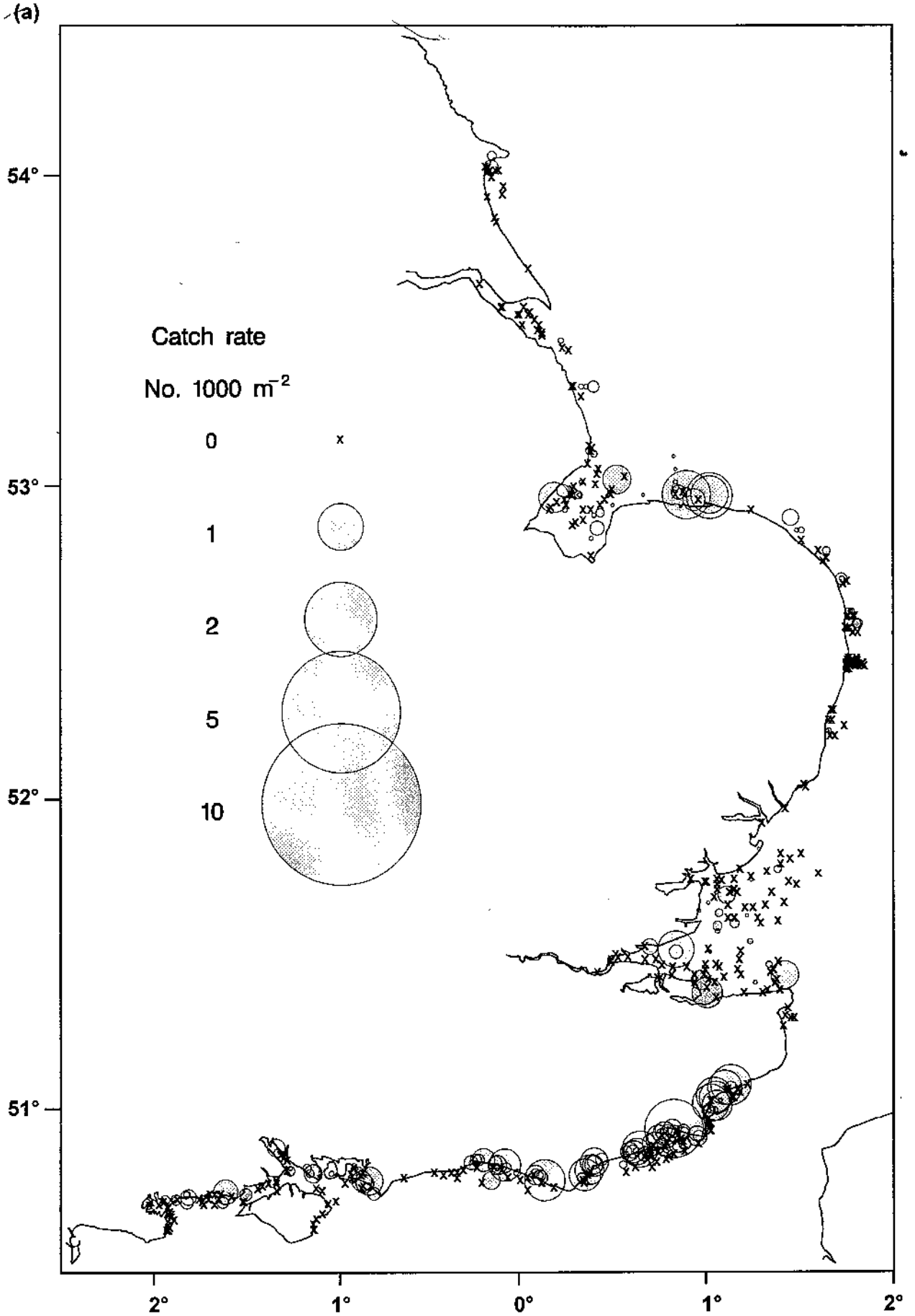


Figure 54. ***Trigla lucerna*** **- tub gurnard**

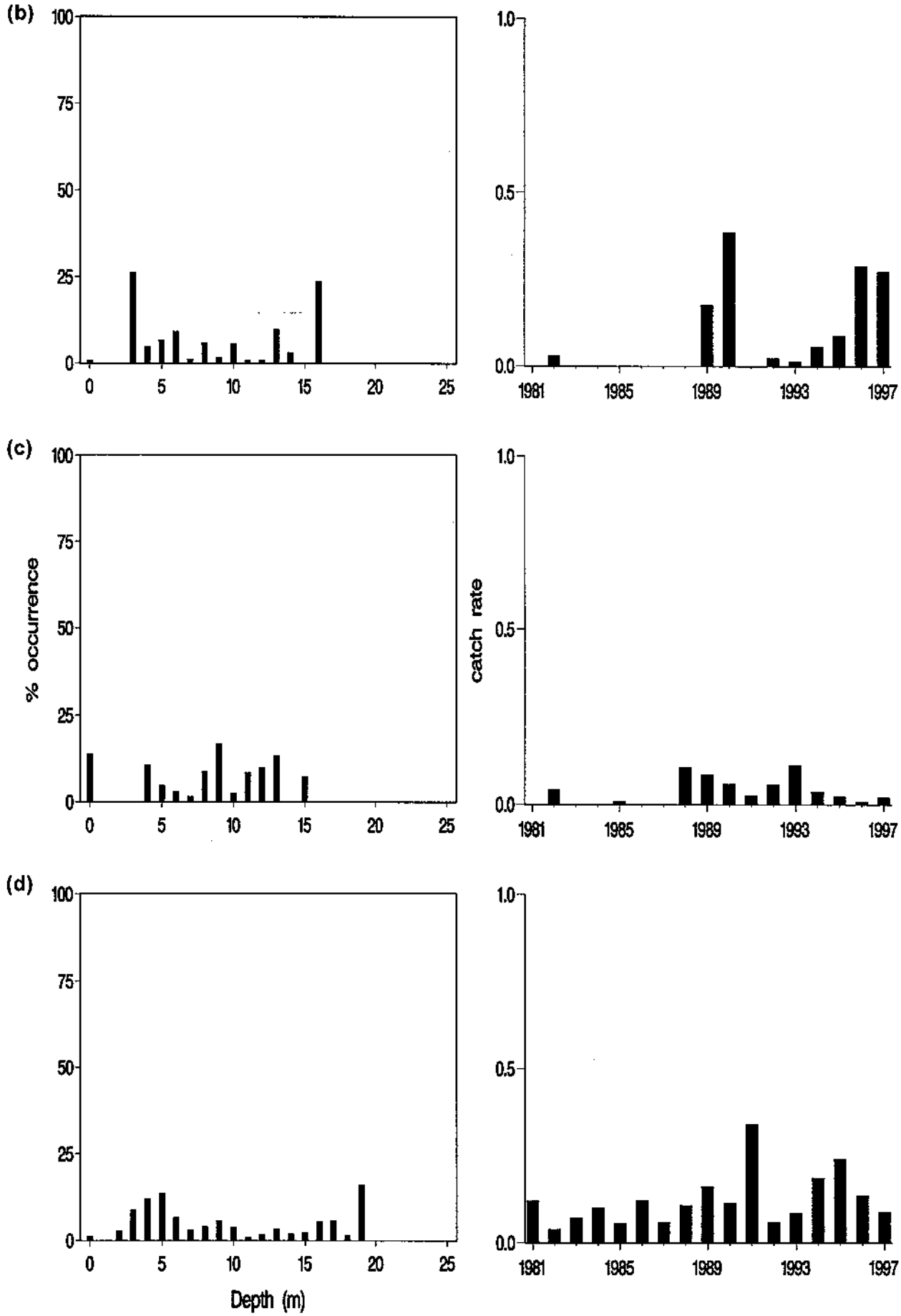


Figure 55. ***Eutrigla gurnardus*** **- grey gurnard**

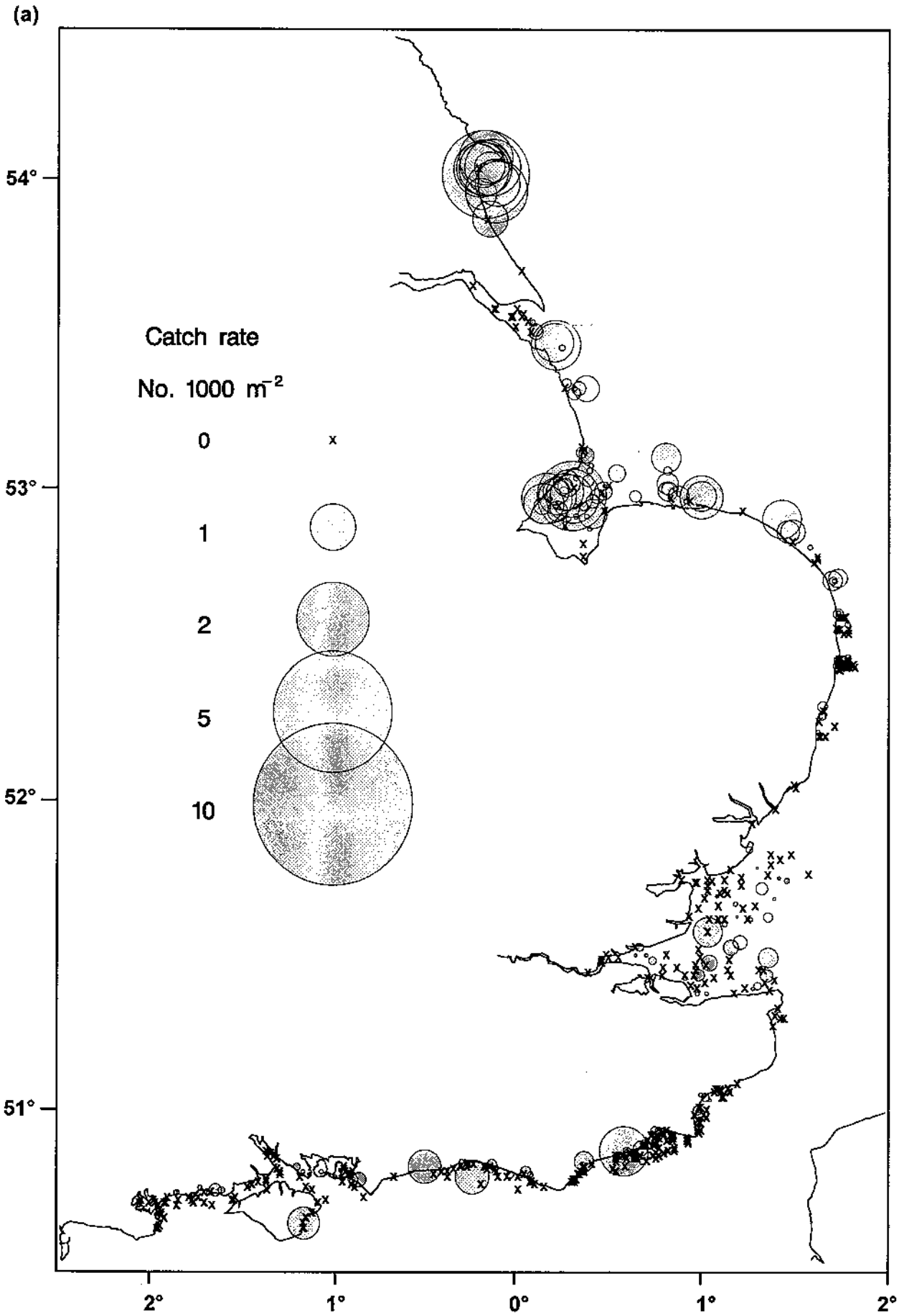


Figure 55. ***Eutrigla gurnardus*** **- grey gurnard**

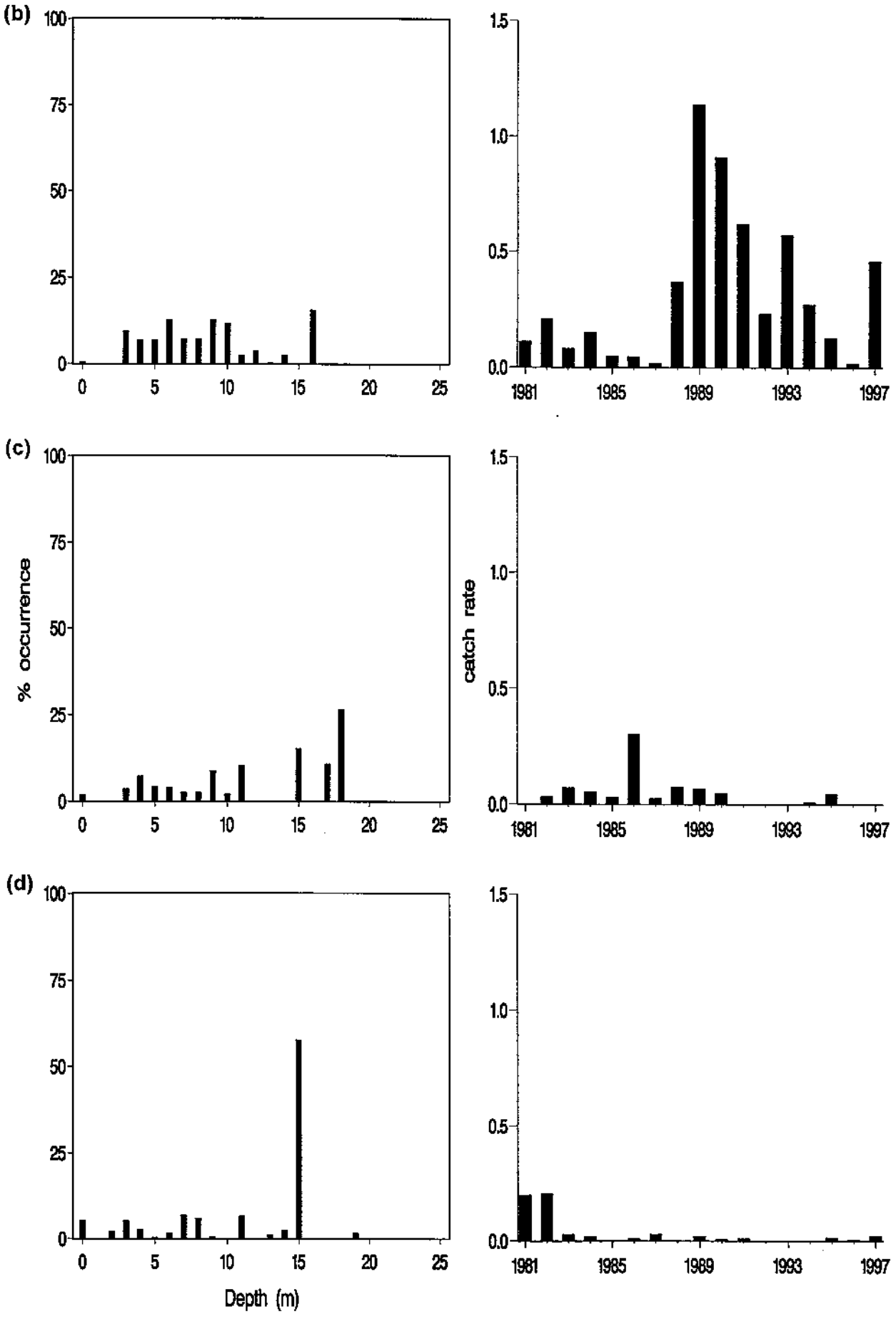


Figure 56. ***Myoxocephalus scorpius*** **- bull rout**

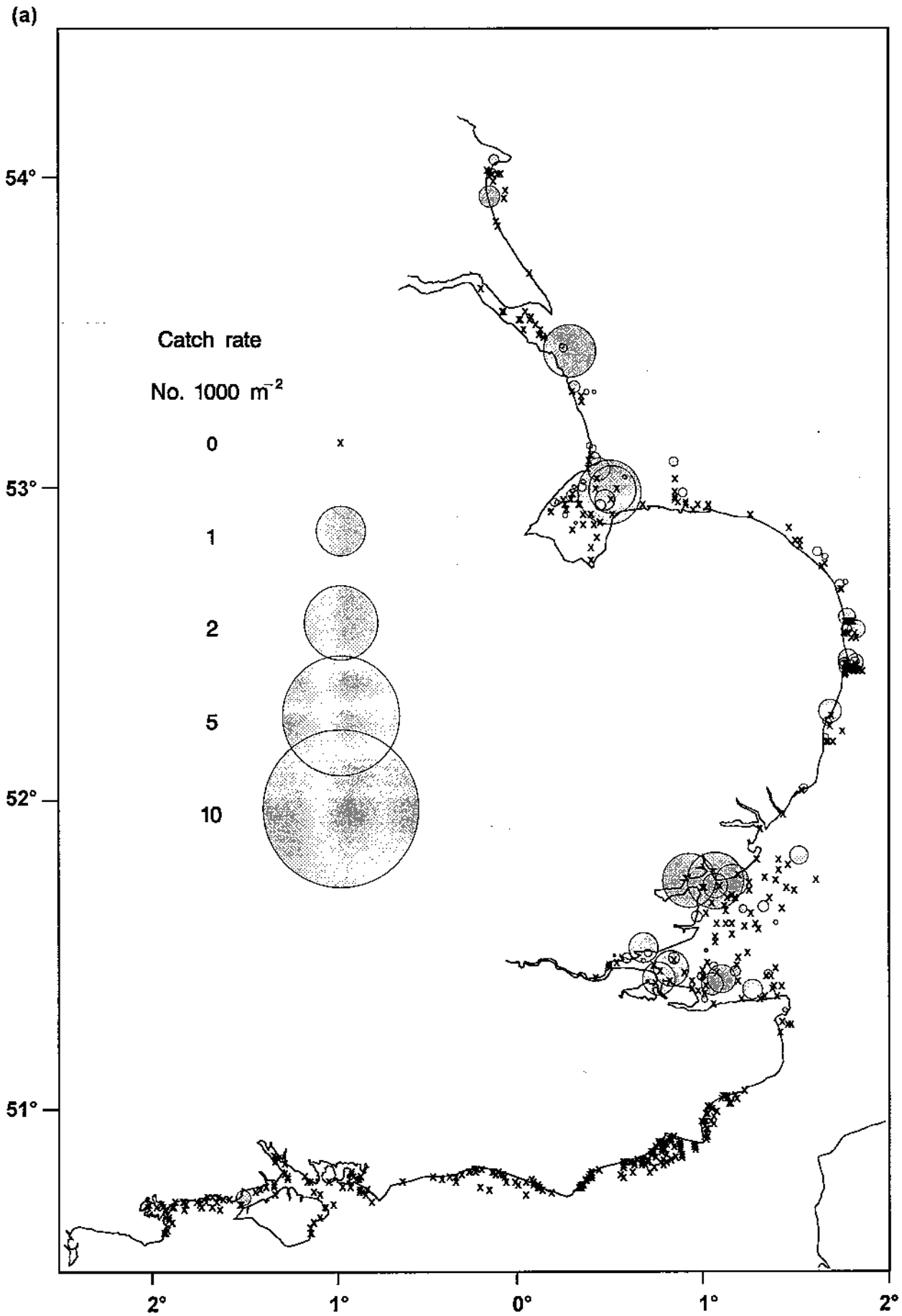


Figure 56. ***Myoxocephalus scorpius*** **- bull rout**

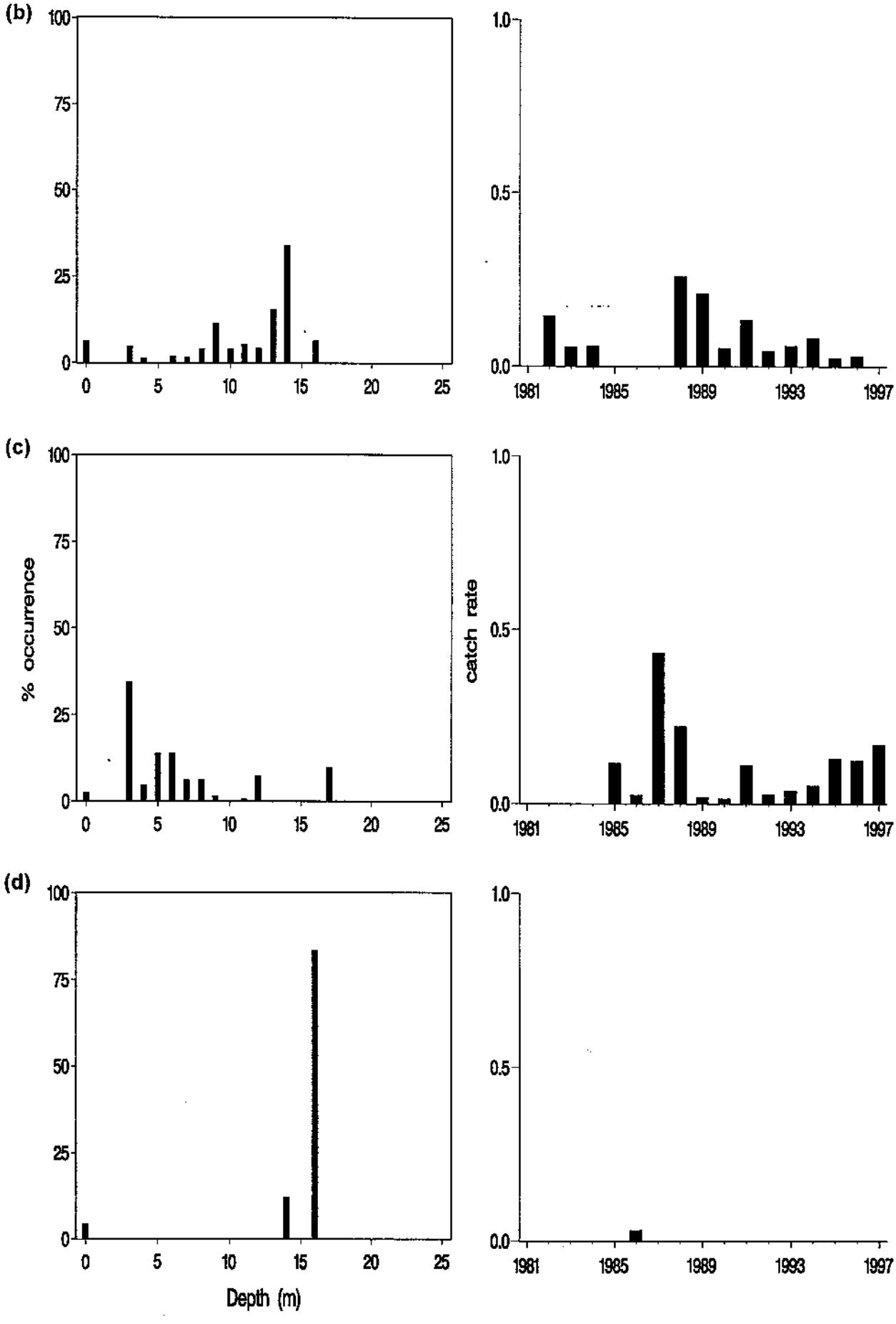


Figure 57. ***Taurulus bubalis*** **- sea scorpion**

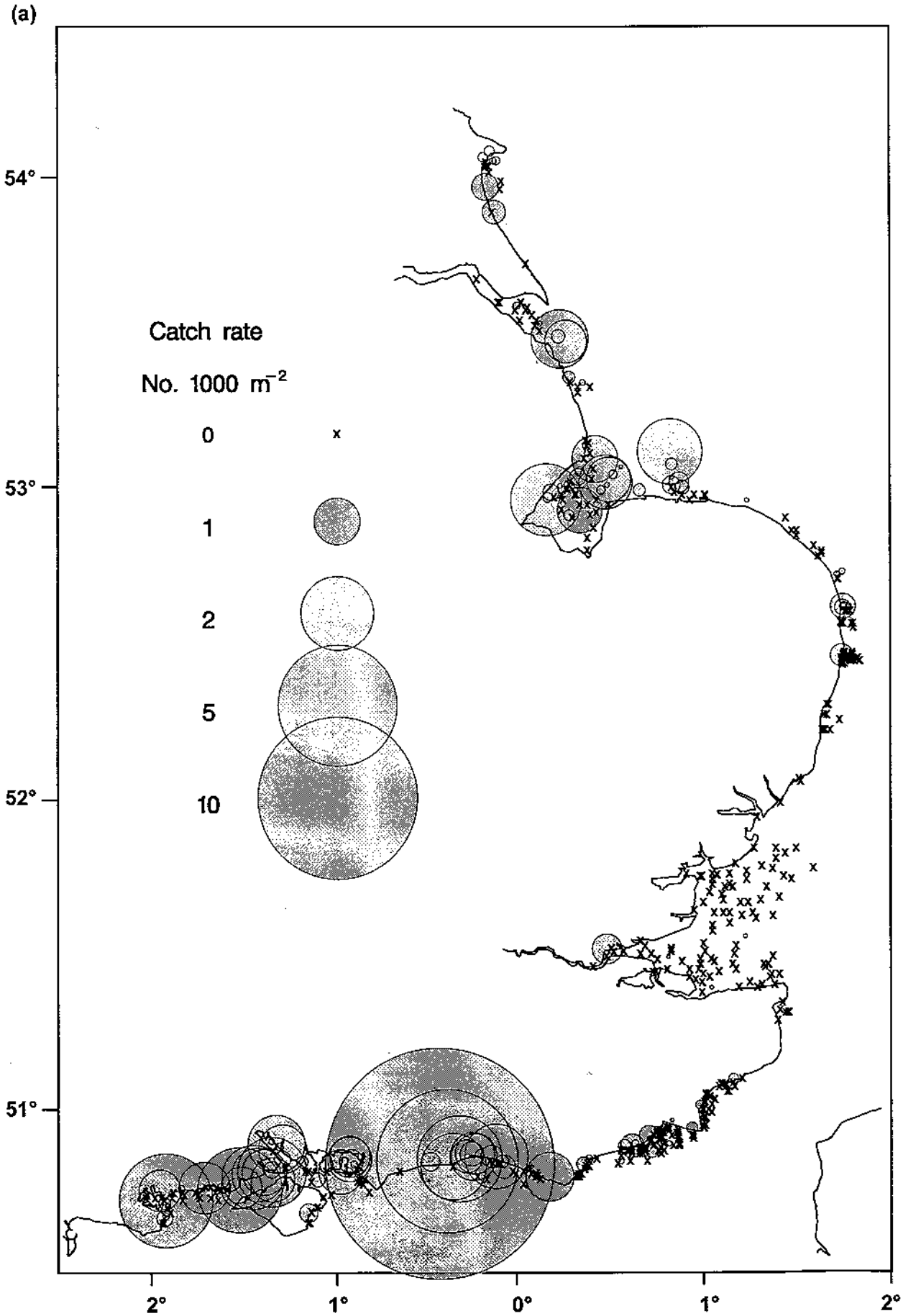


Figure 57. ***Taurulus bubalis*** **- sea scorpion**

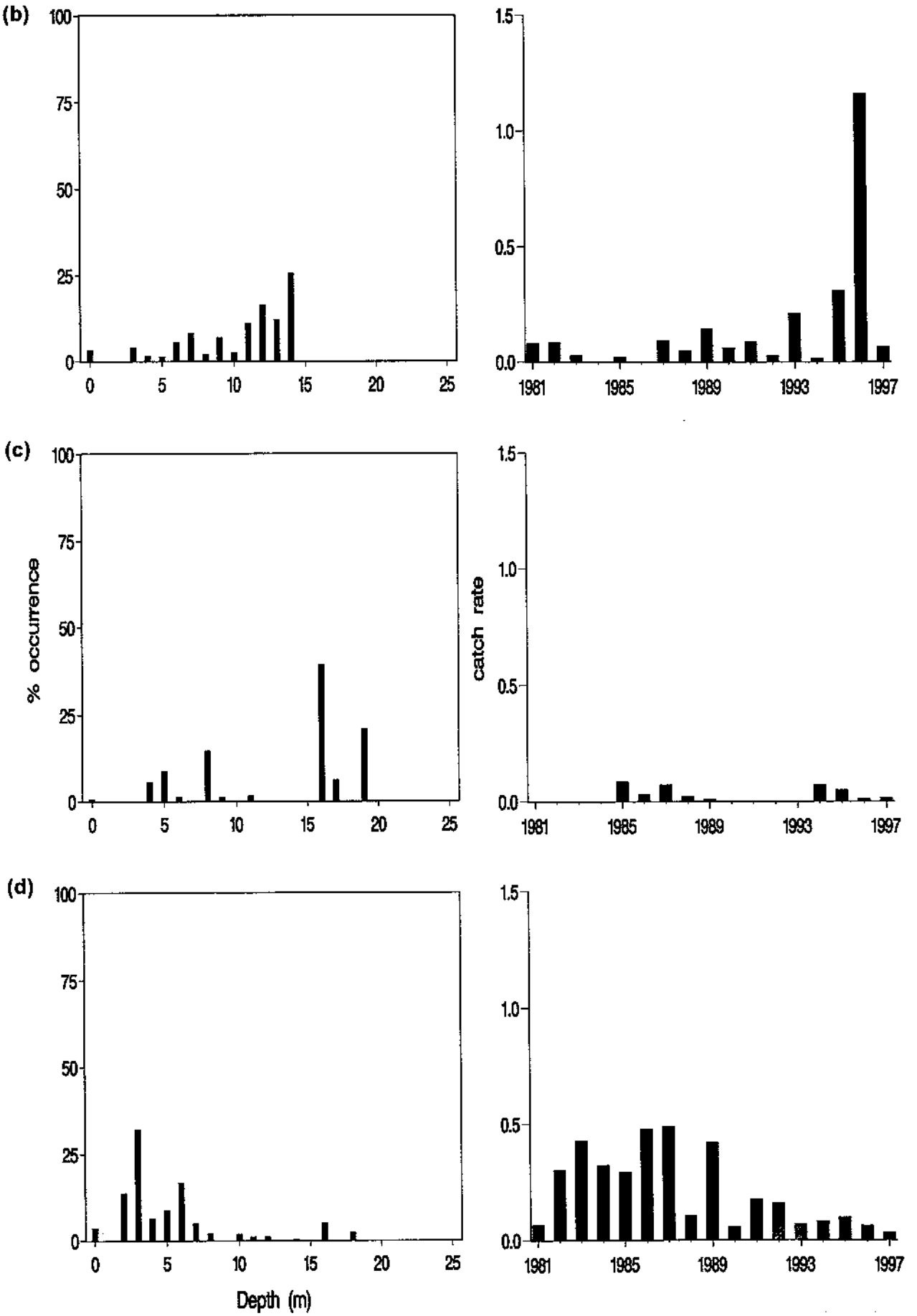


Figure 58. ***Agonus cataphractus*** **- pogge**

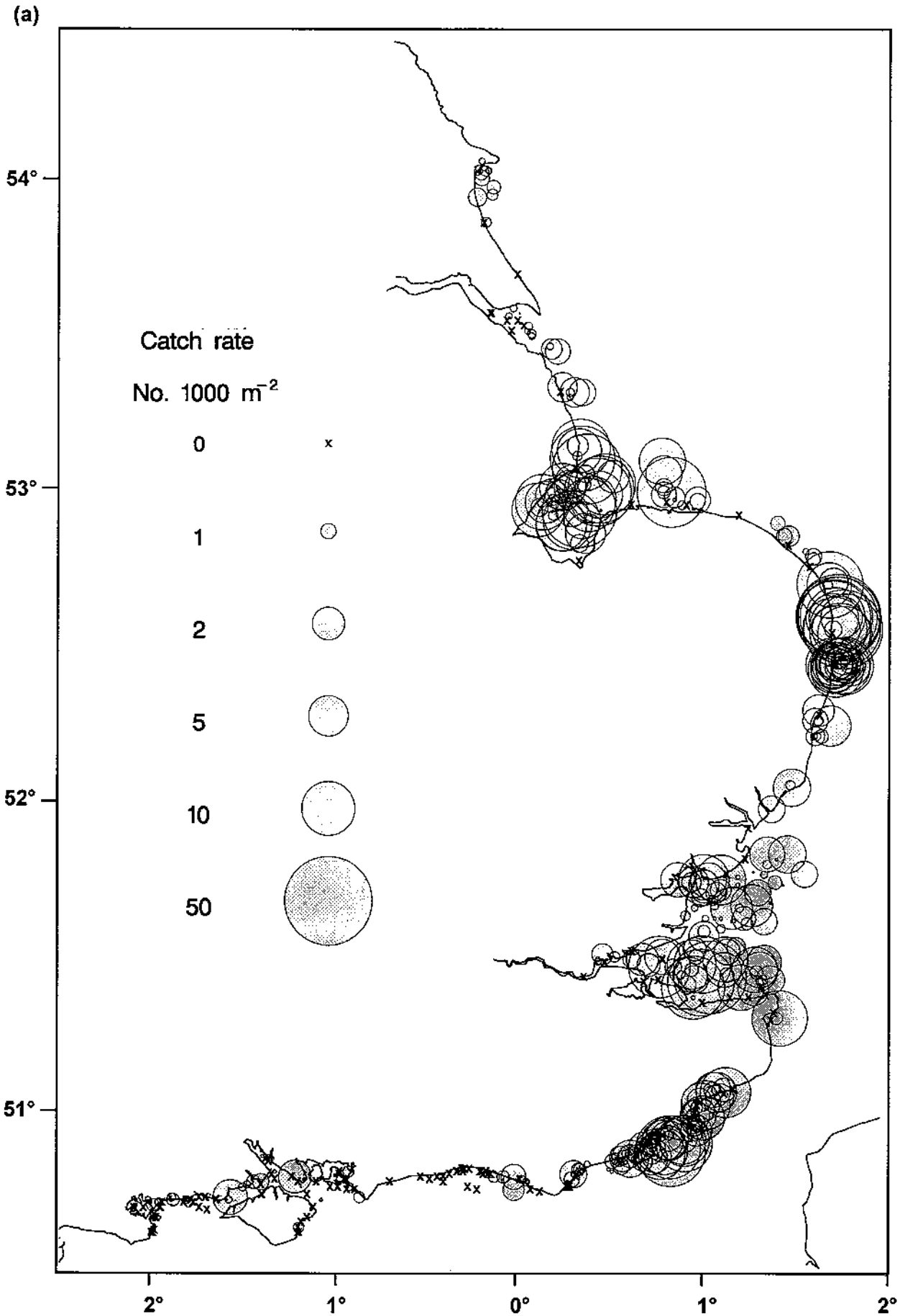


Figure 58. Agonus cataphractus - pogge

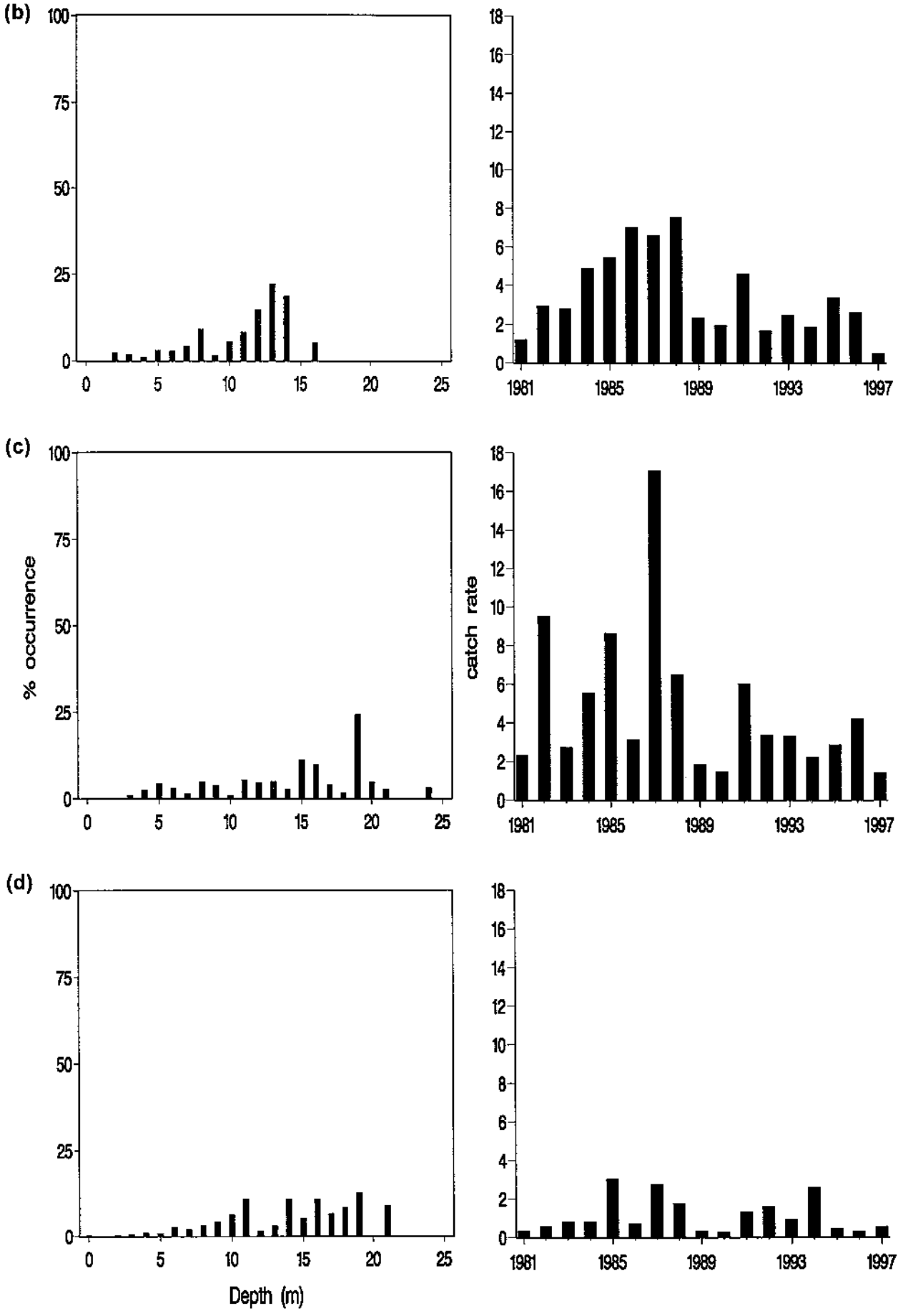


Figure 59. ***Liparis liparis*** **- sea snail**

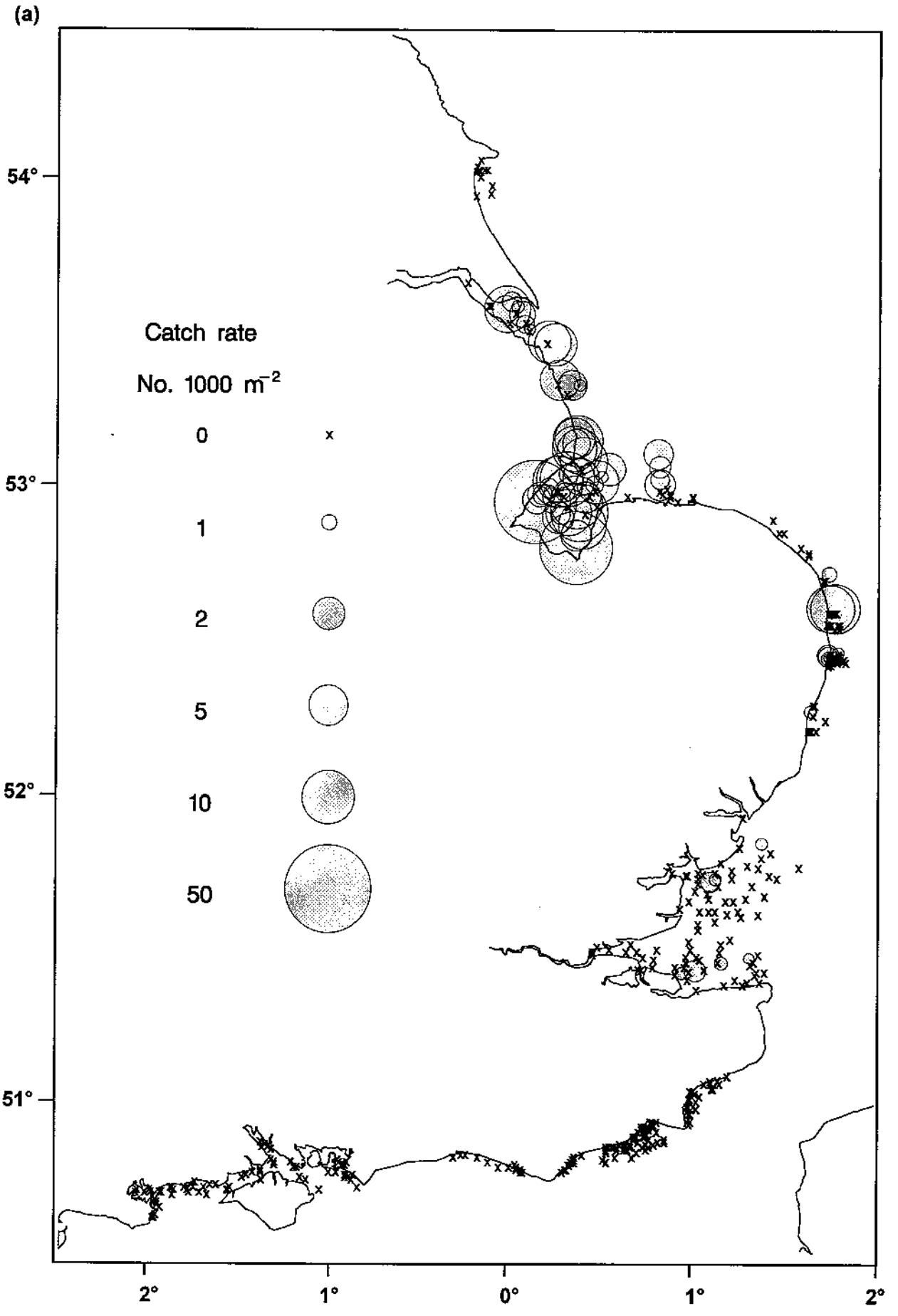
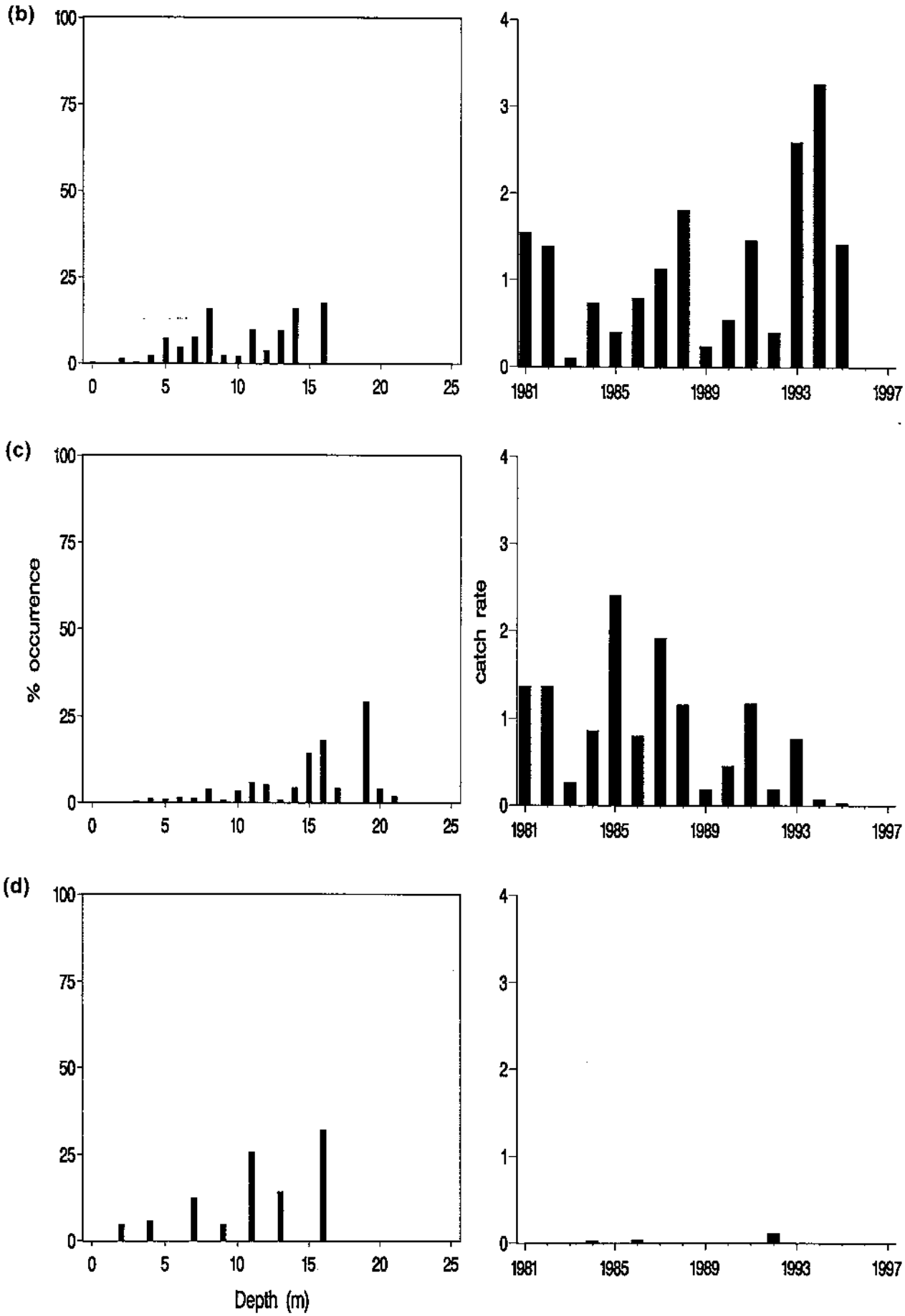


Figure 59. ***Liparis liparis*** **- sea snail**



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The distribution and abundance of young fish on the east and south coast of England (1981 to 1997)

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