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SEASONAL VARIATION IN MACROFAUNAL ABUNDANCE ON THE DOGGER BANK IN RELATIONSHIP TO STOMACH CONTENT OF DAB (*LIMANDA LIMANDA*)

by

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ABSTRACT

Seasonal variation of the macrofauna abundance was investigated on the Dogger Bank from 1985 to 1988. In contrast to unimodal patterns characteristic of the German Bight coastal regions where abundance peaks in summer, a bimodal cycle was observed here, where distinct peaks in food availability occuring in spring and summer.

Because stomach contents of dab (*Limanda limanda*) varied correspondingly, it is suggested that an extended food supply enables these fishe to maintain a relatively uniform condition throughout the year on the Dogger Bank.

INTRODUCTION

In contrast to dab (Limanda limanda) from inshore region of the German Bight, KNUST (1987, 1990a, b) reported on little seasonal fluctuations in stomach content and condition of dab (*Limanda limanda*) from the Dogger Bank.

One possible explanation for this might be that macrofaunal, benthic prey items are abundant throughout the year in the latter area. Indeed, this species should themselves be assured of a constant food supply, seeing that phytoplankton production occurs throughout the year (RICHARDSON & OLSEN, 1987).

The long-term comparison between the macrofauna communities between spring of 1950-54 and 1985-87 by KRÖNCKE (1992) could give no informations.

These are the first data on seasonal variations in abundance and biomass of macrofauna on the Dogger Bank.

MATERIAL AND METHODS

The Dogger Bank is a shallow water area (18 to 40 m depth) in the central southern North Sea, approximately 300km long.

Figure 1 shows the station map of the macrofaunal sampling sites which were sampled in different extent during the several cruises (Table 1) from May 1985 to April 1987. A 0.2 m^2 Van Veen grab was used for sampling. The samples were fixed in 4% buffered formalin. Biomasses of systematic groups were established on a wet weight basis for pooled samples taken during a period May 1986 to April 1987.

For stomach analyses 163 dabs were fished at one station (55°10'N, 03°20'E) on the central Dogger Bank (Fig. 1) in 1984 to 1986. After dissection stomach contents were sorted according to systematic groups and species. Wet weights of the main taxa were determined with milligram accuracy.

RESULTS

MACROFAUNAL ABUNDANCE AND BIOMASS:

Figure 2 shows pooled abundance of each systematic group for the period May 1985 to April 1987. Crustaceans showed distinct seasonal variations with reproduction occurring mainly during winter (Fig. 2a, b). Within the polychaetes (Fig. 2c) the Errantia showed no seasonal variations, whereas the Sedentaria were most numerous during summer. Similarly, bivalve (Fig. 2d) and echinoid (Fig. 2f) abundances also were highest in August 1986. It is yet unknown whether densities of bivalves and echinoids were correspondingly high in August 1985, because sampling was delayed until October that year. If this were so, autumn wouldwould have been identified as a period of severe mortality for these systematic groups due for example to intense predation by dab.

In contrast, abundance of the remaining groups (i.e. gastropods, ophiurids vagile polychaetes, Fig. 2 c, d and f)remained uniformly low during the study period.

With the exception of echinoderms, who had relatively large biomasses, all other systematic groups showed similarly low biomass values for the period May 1986 to January 1987 (Fig. 3). An increase in biomass was obvious for all groups in April 1987.

STOMACH CONTENT:

Stomach contents of dab were compared between fish from the Dogger Bank and the German Bight (Fig. 4). In contrast to the German Bight where abundance profiles of food items were often unimodal (Fig. 4) bimodal patterns were evident for the Dogger Bank, particularly in the case of amphipods and cumaceans (Fig. 4d,e).

PREDATOR/PREY RELATIONSHIP:

Figure 5 shows the seasonal variations in mean monthly biomass and abundance of potential prey items and food composition (stomach contents) for station on the Dogger Bank. All parameters followed a bimodal distribution peaking in spring and in summer. The lowest values were recorded in early summer.

DISCUSSION

In contrast to the German Bight where macrofaunal abundance showed a distinct unimodal periodicity with maxima in summer and minima in winter (RACHOR & GERLACH 1978, in KNUST 1987), on the Dogger Bank seasonal fluctuations in both abundance and biomass had a bimodal pattern with one maximum in spring and another in autumn (Fig. 5).

The composition of food in the stomachs of dab (*Limanda limanda*) varied correspondingly (Fig. 5c). An The additional supply of food in spring on the Dogger Bank might explain why, in

contrast to the German Bight, dab display a constant condition index in the area throughout the year (KNUST, 1990a, b).

The finding that many macrofaunal species from the Dogger Bank have more than one annual reproductive period may be explained by the phytoplankton production throughout the year in this shallow water area (RICHARDSON & OLSEN, 1987; BROCKMANN et al., 1990).

The present results confirm that the Dogger Bank should be considered an unique ecological area in the central North Sea (see KRÖNCKE, 1992).

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Table 1: Station list

Stat.	N	E	Depth (m)	Sampling in 5.85	10.85	1.86	5.86	8.86	1.87	4.87
5	55°40'	05°00'	40	*	*		*	*		
5.1	55°31'	04°51'	40		*				*	
6	55°48'	"	34	*	*	*	*	*		*
7	55°56'	"	37	*	*		*			
8	56°04'	"	43	*	*	*	*	*	*	*
9	55°54'	04°20'	43		*			*		*
10	55°46'	"	40			*				
11	55°38'	"	32							*
12	55°30'	"	34			*		*		*
13	55°22'	"	42							*
14	55°14'	"	40			*				
15	55°05'	03°40'	40	*						
16	55°13'	"	32	*			*	*	*	*
17	55°21'	"	26	*			*			
18	55°29'	"	31	*			*	*	*	*
19	55°37'	"	36	*			*			
20	55°45'	"	47	*	*		*	*	*	*
21	55°33'	03°00'	40		*	*		*		*
22	55°25'	"	32		*			*		
23	55°17'	"	29			*				*
24	55°09'	"	25		*			*		
25	55°01'	"	23			*				*
27	54°37'	"	33		*					*
28	54°28'	"	35					*		
29	54°21'	"	39		*					*
30	54°13'	"	42							
31	54°00'	02°20'	50		*			*		*
32	54°09'	"	51							*
33	54°15'	"	30	*	*			*		
34	54°23'	"	27	*						
35	54°31'	"	20	*			*	*		
36	54°39'	"	18	*	*		*			*
37	54°45'	"	22	*	*		*	*	*	
38	54°50'	"	27	*			*	*		*
39	55°03'	"	35		*		*	*	*	
40	55°11'	"	32				*			*
41	55°19'	"	37				*		*	
42	55°27'	"	44		*		*	*		*
43	55°11'	01°40'	36		*			*		*
45	54°47'	"	23		*			*		*
46	54°39'	"	20					*		
47	54°31'	"	18		*					*
49	54°23'	"	48				*			*
50	54°15'	"	48		*		*			
51	54°07'	"	68				*			
52	54°00'	"	37		*		*	*		
53	54°00'	01°00'	46		*		*	*		
54	54°10'	"	45				*			
55	54°23'	"	46		*		*	*		
56	54°31'	"	55				*			*
57	54°39'	"	60		*		*	*		
58	54°47'	"	50							*
60	55°03'	"	61		*			*		*

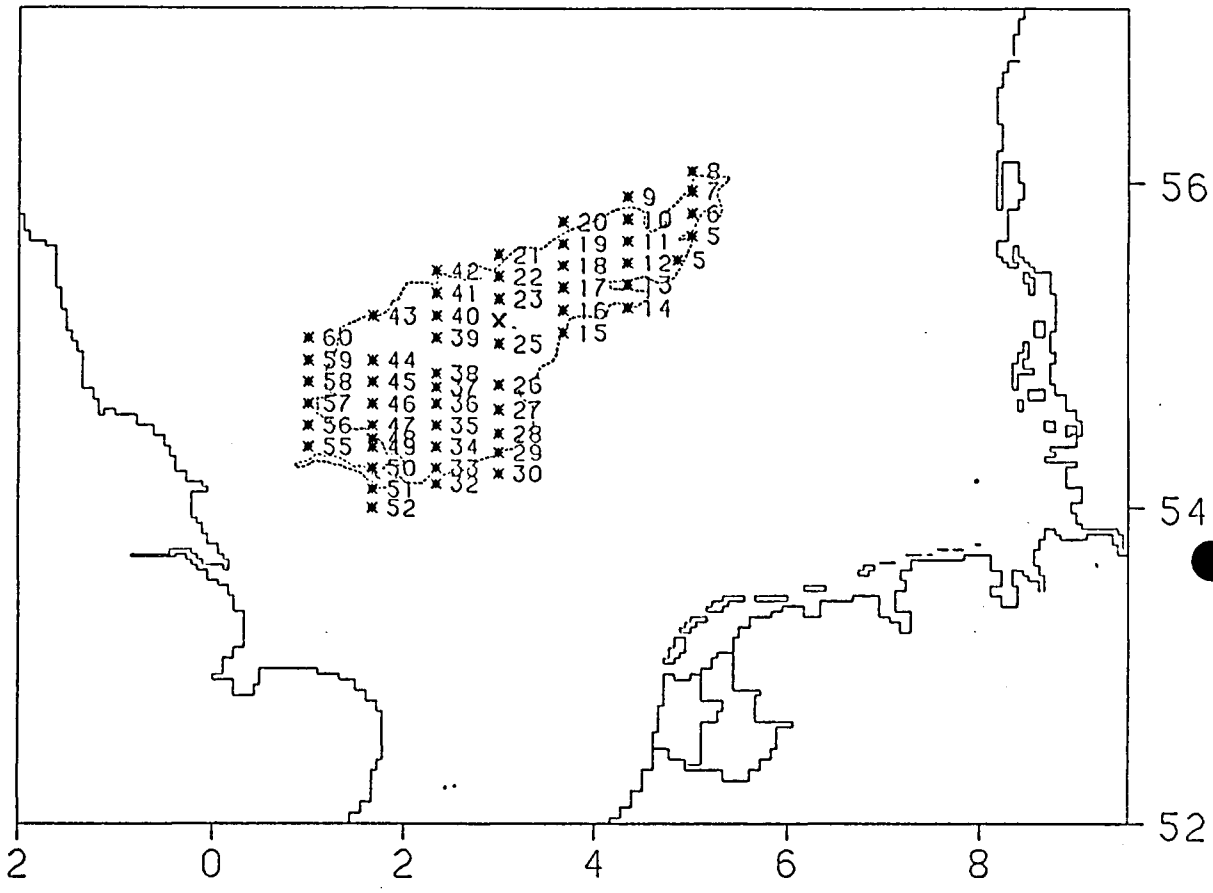

Fig. 1. Station map for macrofauna investigations,
x = sampling for stomach contents

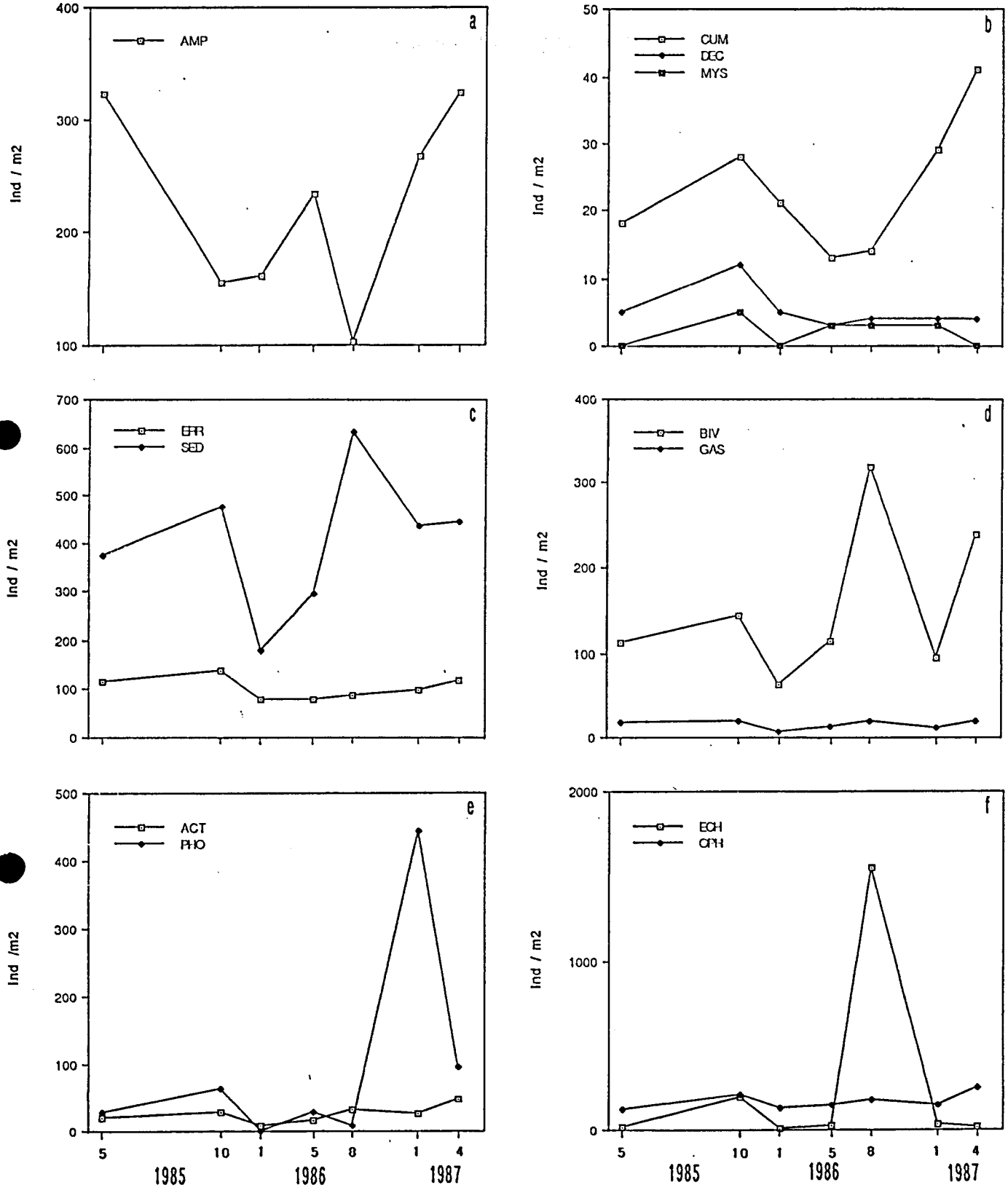

Fig. 2. Abundance (Individuals per m^2) for systemtic groups from May 1985 to April 1987. a: Amphipoda, b: Cumacea, Decapoda and Mysidacea, c: Polychaeta: Errantia and Sedentaria, d: Bivalvia and Gastropoda, e: Actiniaria and Phoronida, f: Echinoidea and Ophiuroidea.

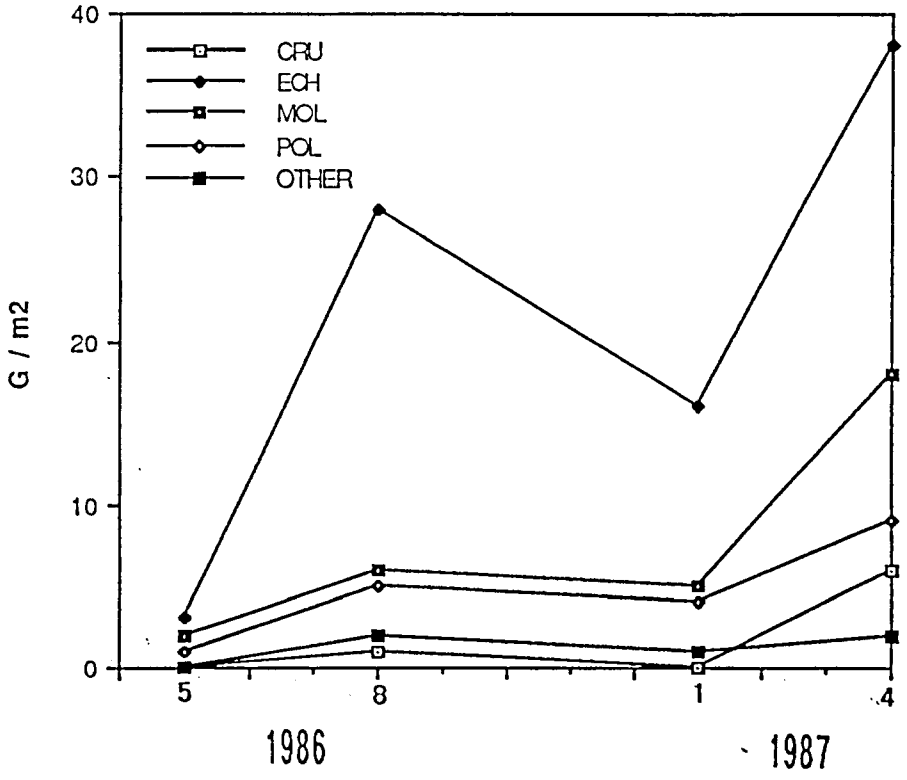

Fig. 3. Biomass (g/m² wet weight) per systematic group: Crustacea, Echinodermata, Mollusca, Polychaeta and others.

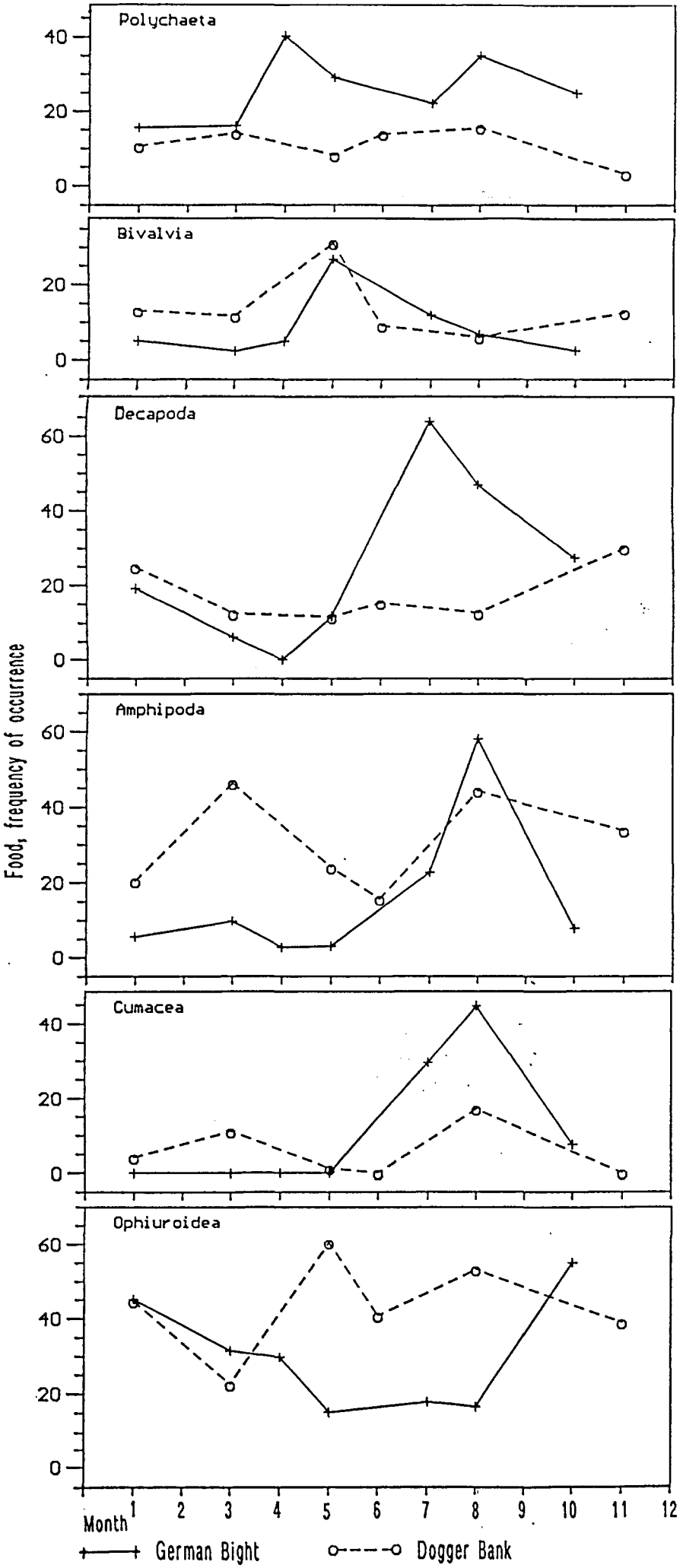

Fig. 4. Composition of food in stomachs of dab (Limanda limanda) given for the Dogger Bank and the German Bight.

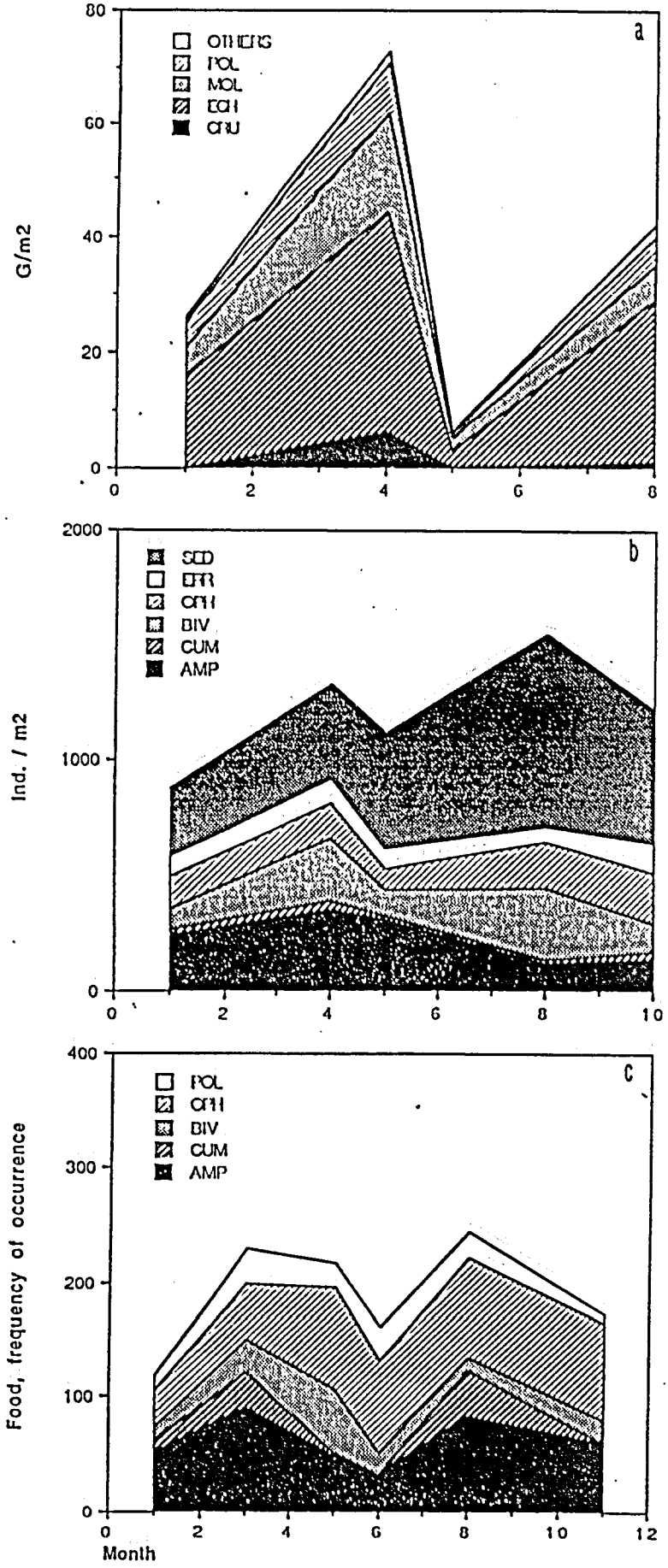

Fig. 5: Macrofauna biomass (a) and abundance (b) and food composition of dab (Limanda limanda) (c) per year. a: Crustacea, Echinodermata, Mollusca, Polychaeta, Others; b: Amphipoda, Cumacea, Bivalvia, Ophiuroidea, Polychaeta: Errantia and Sedentaria; c: Amphipoda, Cumacea, Bivalvia, Ophiuroidea, Polychaeta.

GROUP	CONVERSION INDEX	SPECIFIC GROWTH(%)
1	1.3 - 2.6	1.6 - 0.5
2	1.5 - 2.2	1.1 - 0.7
3	1.6 - 3.2	1.1 - 0.4
4	1.2 - 2.8	1.9 - 0.6
5	1.8 - 2.9	1.3 - 0.7
6	1.5 - 2.5	1.8 - 0.6
7	1.8 - 1.9	2.6 - 0.9
8	2.6 - 2.6	1.8 - 0.6
9	1.3 - 3.6	2.1 - 0.6
10	2.6 - 3.7	2.1 - 0.4

TABLE 1

FOOD CONVERSION INDEX AND SPECIFIC GROWTH

(Begining and ending of experiment)