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FEEDING HABITS OF COMMON DAB (LIMANDA limanda L) IN THE SOUTHERN NORTH SEA

by R. De Clerck and E. Torreele

Fisheries Research Station
Ankerstraat 1 / 8400 Oostende- Belgium

SUMMARY

The paper describes the investigation on the feeding habits of common dab (Limanda limanda L.) in 1987 during two groundfish surveys in the Southern Nort Sea. A large variety of prey species (more than 30) were identified. The sequence in descending order of importance was Cumacea, Amphipoda and Ophiura albida. The results showed some relationship between predator size and prey size. Differences in prey selection occurred depending on the depth. Coastal dab mainly fed on Polychaeta. Crustacea dominated the diet in the depth range 20-50 meter and Echinodermata was the most important food in depths over 50 meter. Clear differences in stomach content were also noted during the course of the day.

RESUME

Ce rapport décrit les investigations en 1987 sur les habitudes alimentaires de la limande (Limanda limanda L.) lors de deux prélèvements sur des poissons démersaux dans la partie méridionale de la mer du Nord. Une grande variété de proies (plus de 30) a été identifiée. En importance décroissante il y avait Cumacea, Amphipoda et Ophiura albida. Les résultats indiquaient une certaine relation entre la taille du prédateur et la taille de la proie. Des differnces dans la sélection de la proie se produisaient suivant la profondeur. La limande de la zone côtière se nourrissait principalement de Polychaeta. Crustacea dominait le regime alimentaire pour les profondeurs entre 20-50 mètres et l' Echinidermata était la nouriture la plus importante pour les profondeurs de plus de 50 mètres. Des différences manifestes dans le contenu stomacal ont été noteés dans le courant de la journeé.

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INTRODUCTION

The dab population is very abundant all over the North sea and its biomass was estimated at a value of about 744 thousand tons (Jimming,1981) being by far the most important of all flatfishes in that area. Implications with regard to multispecies assessments can therefore be expected mainly concerning food competition with other flatfishes.
However the bibliography on the food of dab is rather limited. The aim of this study was to contribute to the rôle of the dab as a predator. To this end the species composition of the stomach content was analysed. Furthermore the influence of depth, predator size and time on the diet was studied.

MATERIAL AND METHODS

Stomach samples were collected as part of two groundfish surveys in 1987,viz the August beamtrawl survey and the September pre-recruit survey. The sampled area is shown on figure 1. The August survey covered the eastern part of IVc and consisted of 38 stations during which a total of 506 stomachs were analysed. During the September survey carried out along the Belgian coast 28 stations were sampled resulting in a total of 89 stomachs. Due to the nature of these surveys fishing was limited to the daytime.
On each haul the guts of a number of dab were dissected by cutting off at the pharynx and pylorus.Individual guts were preserved in 10 % buffered formaldehyde. Each stomach content was analysed to the species level where possible, digestion sometimes made prey identification difficult or even impossible.
The final results were expressed in percent composition by number for each prey species or prey group.

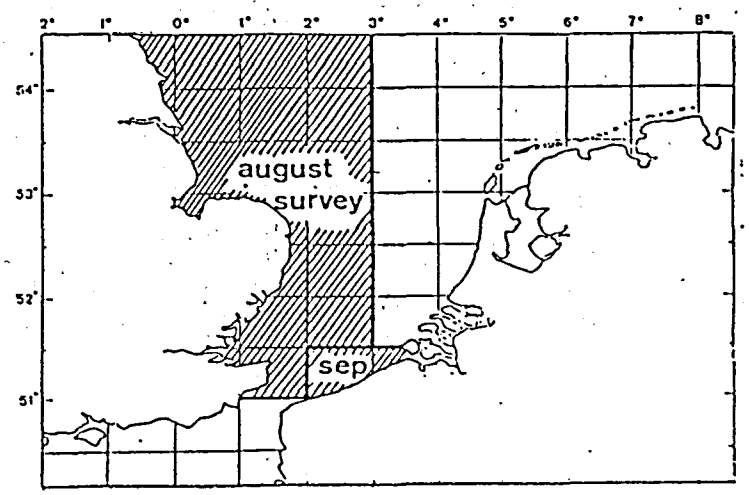

Figure 1.- Sampled are

RESULTS AND DISCUSSION

1.General species preference

The analysis of the stomach content clearly demonstrated that the food of dab is highly variable and extensive as shown in table 1. Dab seemed to be a typical non-selective feeder.
The different prey species and groups can be described as follows:

CNIDARIA-ANTHOZOA
This group of organisms constitutes an occasional food component. Its occurrence amounted only to 0.59 % . This coincides with the findings of Arntz (1971) and Kühl (1963). This group was represented only by one species,viz. Metridium senile L..

ANNELIDA-POLYCHAETA

Polychaet worms seemed to be an additional food component of the dab (4.9 %). However in shallow waters it constituted the main bulk of the food. Pectinaria koreni M. was by far the most important species of that group. Arntz (1971), De Groot (1971), Kuhl (1963) and Lande (1976) came to the same conclusions. In general the worm as well the tube were found together in the guts. The length of the worms varied between 5 to 40 mm.

MOLLUSCA
Molluscs also did not contribute very much to the diet of the dab. The percentage was 3.69. The most frequent species were Thracia papyracea Poli, Chlamys oppercularis L. and Spisula ssp.

ARTHROPODA-CRUSTACEA

Large amounts of Crustacea occurred in the stomachs of dab. This group represented more than 78 %. Moreover in the deeper waters this group was by far the major food supply. The fact that Crustacea dominate the diet of dab has also been reported by several authors as Arntz (1971),Hartley(1940),Jones (1952),Jonsson (1966), Knust (1986) ,Kuhl (1963), and Lee (1972). The three main groups were Cumacea (29.2 %), Amphipoda (27.27 %) and Anomura (15.69%).
The majority of the Amphipoda component in the diet consisted of Gammarus ssp with proportions ranging to 90%.

ECHINODERMATA
This group was the second most important group in the diet of dab (12.6 %). The main species consumed was Ophiura albida (11.88 %) which was also reported by Knust (1986),Kühl (1963) and Lee (1972). Whenever O. albida occurred a certain amount of sand in the guts was also noted.

CHORDATA
Only on very rare occasions Pomatoschistes ssp were detected indicating the unimportant role of this group as prey for dab. Ascideacea as reported by Knust (1986) and Lande (1976) were not recorded during this study.

2. Changes in diet with increasing size

To examine the diet associated with body length the data were divided into four predator lenght groups, as shown in table 2. The stomach content was expressed in percentages for each length group.
The main conclusion which could be drawn from this exercise was that dab smaller than 20 cm mainly fed on small sized Crustacea as Cumacea and Amphipoda.These findings do not conflict with the ones published by Arntz (1971) and Lee (1972). Generally they amounted to over 60 % of the total diet. Dab larger than 20 cm still fed on these two groups but the importance decreased gradually to less than 30 %. At the same time dab started to prey on larger Crustacea as P. longicornis. The latter constituted more than 50 % of the total food intake in the largest dab category.
The trend thus observed indicated the preference of young dab to feed on small and easy digestable food. Older dab ingested larger preys including shells and Ophiuridae with litlle nutritive value.

3. Changes in diet with increasing depth

A close examination of stomach analysis from different fishing grounds (Arntz,1971, Kühl, 1963 an Lee, 1972) lead to the conclusion that the food composition tended to vary considerably depending on the area. However these differences could have been mainly caused by the depth.
The data of this study were classified into four depth categories, viz. less than 20 meter, 21 to 35 meter, 36 to 50 meter and more than 50 meter. The results are presented in table 3 . Clear differences in the diet became apparent as a function of the benthos distribution and abundance. Below 20 meter the feeding pattern was charactirized by the predominance of P.koreni (17.27 %) and other Polychaeta(33.77 %).In deeper areas Crustacea became the dominant prey group. Amphipoda were the main food supply for the areas between 21 and 35 meter (45.7%), whereas Cumacea was the most abundant prey group in deeper waters up to 50 meters. Another obvious trend was the fact that O. albida became also more important in deeper waters. The coverage of the areas over 50 meters was rather limited (only three stations)but the results were in line with the trend : O.albida formed the main part of the diet (53.5 %) followed by Amphipoda and Cumacea. The occurance of

Ophiuroidea in the dab stomach at higher depths must be related to the fact that Ophiuroidea are the dominant benthos component in deeper waters. Thus the dab depended on the Ophiuroidea as the most readily available food supply in the absence of other more nutrient prey .

4. Changes in diet with time

The data of the two most important depth zones, viz. 21-35 meter and 36- 50 meter, were further studied for differences in stomach fullness with time. This area is believed to have the highest densities of dab (Lee, 1972) and has shown clear differences in the diet composition of this study (part 3). The results as presented in tables 4a and 4b clearly show a marked difference of stomach fullness during the course of the day. The highest percentage of occurence was concentrated between 10 and 14 hour. After that period this percentage declined gradually up to a minimum value between 18 an 22 hour. The early morning samples (between 6 an 10 hour) however showed an increase comparing to the former evening value. This trend indicated that the highest feeding activity of dab was in the morning, whilst during the evening and the first part of the night food intake was minimal. Other authors came to similar conclusions (Artnz, 1971 and Knust, 1986).

Regarding the number of empty stomachs in the course of the day the following trend was observed:
6- 10 hour : 8.4 % empty
10-14 hour : 3.9 % empty
14-18 hour : 2.35 % empty
18-22 hour : 0.17 % empty
These results could be an indication that there was less feeding activity during the night.

CONCLUSIONS

This contribution tended to illustrate some aspects of the feeding pattern of dab and the role as a Crustacean feeder. In general the conclusions were in line with former studies in that field. However new information became available on the parameters which could influence the diet of dab, viz. the length of the predator, the depth and the time. Further research should be more directed into the quantitative approach.

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Table 1.- Analysis of stomach content : composition by number in percent

TAXONOMY ORGANISM	NUMBER	% COMPOSITION BY NUMBER
Cnidaria-Anthozoa		
Metridium senile	36	0.59
Polychaeta		
Nereis spp	30	0.50
Nephtys spp	41	0.68
Pectinaria koreni	80	1.32
Arenicola marina	4	+
Ophelia spp	2	+
Sabella spp	13	+
Lanice spp	2	+
Eggs of Polychaeta	58	0.96
Others (rests,...)	61	0.98
Mollusca		
Natica alderi	13	+
Chlamys oppercularis	52	0.86
Dorsina lupinus	6	+
Spisula spp	44	0.73
Gastrana fragilis	2	+
Ensis ensis	2	+
Mya spp	3	+
Mytilus edulis	2	+
Thracia payracea	104	1.72
Others (undeterminated)	4	+
Arthropoda-Crustacea		
Cumacea	1767	29.2
Mysidacea	248	4.09
Amphipoda	1653	27.27
Decapoda		
Crangon crangon	17	+
Pandalus spp	26	+
Galathea spp (juveniles)	311	5.13
Porcellana longicornis	556	9.17
Eupagurus bernhardus	59	0.97
Corystes carsivellanus	25	+
Macropipus holsatus	80	1.32
Echinodermata		
Ophiura albida	720	11.88
Ophiotrix fragilis	17	+
Psammechinus miliares	29	+
Chordata		
Pomatoschistes spp	3	+

+ : < 0.5 %

Table 2.- Analysis of stomach content : diet with increasing size

TAXONOMY ORGANISM	LENGTH (CM)				
	<15	16-20	21-25	26-30	31-35
P. koreni	0.97	1.37	1.32	1.25	0.35
Other Polychaeta	2.90	4.52	3.71	0.66	-
T. papyracea	13.54	0.55	0.21	0.42	-
Other Mollusca	0.19	2.27	1.23	2.08	3.54
Cumacea	38.30	16.71	42.68	29.25	8.8
Mysidacea	-	2.38	8.50	-	-
Amphipoda	33.46	47.95	11.4	5.23	23.18
Galathea spp	1.74	11.15	1.67	1.08	2.12
P. longicornis	-	5.01	9.28	31.60	53.09
E. bernhardus	2.90	0.55	1.48	1.67	0.88
M. holsatus	1.35	2.36	0.74	0.42	3.54
Other Arthropoda	0.29	1.89	0.82	0.67	-
O. albida	4.45	5.37	16.83	23.75	0.68
Other Echinodermata	0.19	0.55	0.80	1.92	-

Table 3.- Analysis of stomach content : diet with increasing depth

TAXONOMY ORGANISM	DEPTH (M)			
	<20	21-35	36-50	>51
P. koreni	17.27	0.75	0.65	-
Other Polychaeta	33.77	1.49	2.83	2.07
T. papyracea	-	2.98	0.60	-
Other Mollusca	3.40	0.56	3.02	0.59
Cumacea	8.64	26.37	32.97	22.20
Mysidacea	-	0.44	8.54	-
Amphipoda	8.38	45.70	16.14	25.15
Galathea spp	-	4.75	6.48	-
P. longicornis	-	11.42	8.50	-
E. bernhardus	2.09	0.24	1.81	-
M. holsatus	9.95	1.21	0.95	2.36
Other Arthropoda	5.67	1.15	0.07	-
O. albida	10.73	2.32	16.70	53.30
Other Echinodermata	-	0.60	0.72	2.36

Table 4a : Analysis of stomach content of dab : changes in diet with time , depth 21-35 m.

TAXONOMY ORGANISM	TIME 6-10	10-14	14-18	18-22
P. koreni	-	0.77	-	-
Other Polychaeta	0.58	0.73	0.47	0.06
T. papyracea	-	2.88	0.21	-
Other Mollusca	-	0.21	0.06	0.06
Cumacea	4.17	3.85	16.02	0.62
Mysidacea	-	-	0.44	-
Amphipoda	6.39	25.73	14.94	0.62
Galathea spp	4.23	0.29	0.37	-
P. longicornis	-	9.02	2.01	0.62
E. bernhardus	-	0.12	0.06	0.48
Other Arthropoda	0.31	0.31	0.06	0.41
O. albida	0.17	1.24	0.58	0.41
Other Echinodermata	0.37	0.12	0.06	0.41
TOTAL	16.22	45.27	35.28	2.66

Table 4b .- Analysis of stomach content of dab : changes in diet with time,depth 36-50

TAXONOMY ORGANISM	TIME 6-10	10-14	14-18	18-22
P. koreni	0.37	0.05	-	0.14
Other Polychaeta	0.12	1.65	-	1.09
T. papyracea	-	0.63	-	-
Other Mollusca	0.30	2.06	-	0.81
Cumacea	0.84	29.24	-	-
Mysidacea	-	-	8.54	0.46
Amphipoda	0.58	15.13	0.32	0.12
Galathea spp	1.53	3.52	1.41	1.39
P. longicornis	-	-	5.29	3.23
E. bernhardus	0.19	0.49	0.60	0.49
M. holsatus	0.12	0.70	0.05	6.12
Other Arthropoda	-	0.07	-	-
O. albida	14.85	2.67	-	-
Other Echinodermata	0.05	0.70	-	-
TOTAL	18.95	56.91	16.21	13.85