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Preliminary Studies on Feeding Habits of Demersal Fish Species in West Greenland Waters with Special Emphasis on Predation on Shrimp

by

S. A. Pedersen and F. Riget

Greenland Fisheries Research Institute, Tagensvej 135, 1.
DK-2200 Copenhagen N, Denmark

INTRODUCTION

The most important fishery grounds for shrimp (*Pandalus borealis*) off West Greenland are in Subarea 1B and 1C where the catches in the latest years have been about 40,000 tons. These areas are also important nursery grounds for Greenland halibut and redfish and it is well known that large quantities of mainly these two fish species are by-catch in the shrimp fishery (Smidt, 1969; Jensen, 1979; Riget et al., 1988; Pedersen and Lehmann, 1989).

Little is known about ecological interactions between shrimps and fish and between the key fish species in the marine ecosystem off West Greenland and little is known about the effects of the shrimp fishery on the ecosystem. In the latest years investigations of selective shrimp trawls which reduces the by-catches and discards of small shrimps and fish have been initiated. These investigations have raised the question if increased survival rates of fish will reduce the yield from the shrimp fishery due to increased predation on the shrimp stock.

In order to study the importance and level of predation on the shrimp stock by fish a sampling program for stomachs from the key fish species on the shrimp grounds was started in 1990. This paper presents preliminary results from investigations of the stomach content of seven demersal fish species: Redfish (*Sebastes spp.*), Greenland halibut (*Reinhardtius hippoglossoides*), Long rough dab (*Hippoglossoides platessoides*), Skates (*Raja spp.*), Atlantic halibut (*Hippoglossus hippoglossus*), Eelpout (*Lycodes spp.*), and Atlantic wolffish (*Anachrichas lupus*). A more detailed examination of food compositions of redfish and Greenland halibut are presented and discussed in Pedersen and Riget (1991) and Riget and Pedersen (1991).

MATERIALS AND METHODS

A total of 1,642 stomachs from seven demersal fish species were collected during five research surveys covering the period from late June to early November 1990. The research surveys were not designed to this study. The sampling gear was bottom trawl, and stomachs were sampled in day-time only. The study area was West Greenland (NAFO Subarea 1) on the continental shelf at depths between 150-550 m. This area is an important area for the shrimp fishery.(Table 1 and Fig. 1).

It was intended to collect stomachs stratified by length from the catch of each haul in the study area. Stomachs from fish with no signs of regurgitation (in most cases hole fish) were individually tagged and frozen (<-18°C) for later examination. In the laboratory the stomachs (hole fish) were thawed in water.

The stomach content was divided into taxonomic categories with equal degree of digestion. The degree of digestion of fish was judged by a six point scale and of invertebrate by a four point scale as proposed by Bromley and Last (1990). The identification was done to lowest taxonomic level as possible within a reasonable consume of time. Each food category were counted and weighed to nearest 0.1 g. Excess liquid was removed only mechanically. When possible fish prey were measured to nearest mm total length. Carapax and pleuron length of *Pandalus borealis* were measured with an accuracy of 0.1 mm.

In the present study of feeding habits the data have been analyzed using the following two indices:

1) Relative frequency of occurrence gives an estimate of how often one prey category appears relative to another (the number of stomachs with a given prey category as a percentage of number of stomachs of all prey categories)

2) Percent weight (total weight of a prey category p in all stomachs as a percentage of the total weight of all prey categories)

RESULTS

Redfish (*Sebastes spp.*) (Fig.2):

Stomachs from 578 redfish between 5-49 cm in length (mainly between 5-19 cm) were investigated. Of these 20% were identified as empty.

The food of redfish consisted of prey species belonging to five major animal groups (polychaetes, molluscs, crustaceans, echinoderms and fish). Crustaceans - copepods, mysiids, hyperiids - especially *Parathemisto sp.*, euphausiids and shrimps (*Pandalus borealis*), were the far most important prey items. *Parathemisto sp.* had the highest relative frequency of occurrence 35.5%, but comprised only 10.8% of the total prey weight. *Pandalus sp.* (mainly *Pandalus borealis*, shrimps were only identified as *P. montagui* in one stomach) were rare (RFO of 2.8%) , but comprised 30% of the total weight.

Greenland halibut (*Reinhardtius hippoglossoides*) (Fig. 3):

Stomachs from 665 Greenland halibut between 5-79 cm in length (mainly between 20-49 cm) were investigated. Of these 53% were identified as empty.

The food of Greenland halibut consisted of prey species belonging to four major animal groups (polychaetes, molluscs, crustaceans, and fish). Crustaceans - shrimps (*Pandalus borealis*) and fish (*Sebastes spp.*) were the far most important prey items measured by both frequency of occurrence and percent weight.

Long rough dab (*Hippoglossoides platessoides*) (Fig. 4):

Stomachs from 24 long rough dab between 10-49 cm in length (mainly between 15-29 cm) were investigated. Of these 42% were identified as empty.

The food of long rough dab consisted of prey species belonging to four major animal groups (polychaetes, molluscs, crustaceans, and fish). Crustaceans - shrimps (*Pandalus borealis*) and polychates are the most frequently occurring prey items. Bivalvia constituted 40.1% of the total prey weight. Fish (*Sebastes spp.*) is also represented in the diet.

Skates (*Raja spp.*) (Fig. 5):

Stomachs from 263 skates between 10-49 cm in length were investigated. Of these 27% were identified as empty.

The food of skates consisted of prey species belonging to five major animal groups (polychaetes, molluscs, crustaceans, echinoderms and fish). Crustaceans - gammarids, copepods, shrimps (*Pandalus borealis*), *Parathemisto spp.*, euphausiids, mysiids, Brachyura - and polychates are the most frequently occurring prey items. Measured by weight percent shrimps (*Pandalus borealis*), copepods and polychaetes are most important in the diet. Fish (mainly redfish (15 stomachs) and Greenland halibut (9 stomachs)) are also represented in the diet.

Atlantic halibut (*Hippoglossus hippoglossus*) (Fig. 6):

Stomachs from 45 halibuts between 15-129 cm in length (mainly between 60-79 cm) were investigated. Of these 47% were identified as empty.

The food of halibut consisted of prey species belonging to four major animal groups (molluscs, crustaceans, echinoderms and fish). Fish were dominant prey items for halibut - redfish, Greenland halibut, *Myxine glutinosa*, cod, *Lycodes*. Cephalopods were relatively frequently occurring.

Eelpout (*Lycodes spp.*) (Fig. 7):

Stomachs from 63 *Lycodes spp.* between 10-49 cm in length (mainly between 15-29 cm) were investigated. Of these 48% were identified as empty.

The food of *Lycodes* consisted of prey species belonging to five major animal groups (polychaetes, molluscs, crustaceans, echinoderms and fish). Crustaceans were dominant prey items for *Lycodes*. Shrimps (*Pandalus borealis*) constituted 81.5% of the total prey weight.

Atlantic wolffish (*Anachrichas lupus*) (Fig. 8):

Stomachs from only 4 wolffish between 15-59 cm in length were investigated. Of these no stomach identified as empty.

The food of wolffish consisted of prey species belonging to two major animal groups (molluscs and echinoderms). Gastropods were dominant.

DISCUSSION

Predation accounts probably for the major part of natural mortality for shrimps. To improve the fishery management of the West Greenland shrimp stock it is important to estimate the magnitude of predation losses from the shrimp stock. In order to do so it is necessary to identify the predators, variations in their feeding habits and in their abundance with size and in space and time.

Except for Atlantic wolffish and Atlantic halibut shrimps (*Pandalus borealis*) seems to be an important part of the diet for all the investigated fish species. More information on feeding habits of these fish species seems to be important for future research.

By-catch data during shrimp surveys on the West Greenland shrimp grounds indicate that the most abundant fish species are redfish and Greenland halibut (Carlsson and Kanneworff, 1991; Parsons Veitch, 1991). These two species therefore seems to be the most important predators on shrimps. However little is known about the catchability of shrimp trawls for the different investigated fish species and the abundances of these fishes are therefore estimated with uncertainties.

ACKNOWLEDGEMENTS

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Table 1 Numbers of investigated stomachs by species and length group (cm).

Number of stomachs	LENGTH												
	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-49	50-59	60-79	80-99	100-129	ALL
	N	N	N	N	N	N	N	N	N	N	N	N	N
SPECIES													
Anarhichas lupus	.	.	1	.	.	.	.	2	1	.	.	.	4
H. hippoglossus	.	.	1	.	.	.	1	.	7	22	12	2	45
H. platessoides	.	1	4	2	11	3	2	1	.	.	.	.	24
Lycodes spp.	.	7	9	20	18	7	1	1	.	.	.	.	63
R. hippoglossoides	2	20	39	110	163	142	94	79	15	1	.	.	665
Raja spp.	.	15	66	75	36	24	21	26	.	.	.	.	263
Sebastes spp.	123	273	147	22	6	7	3	1	.	.	.	.	578

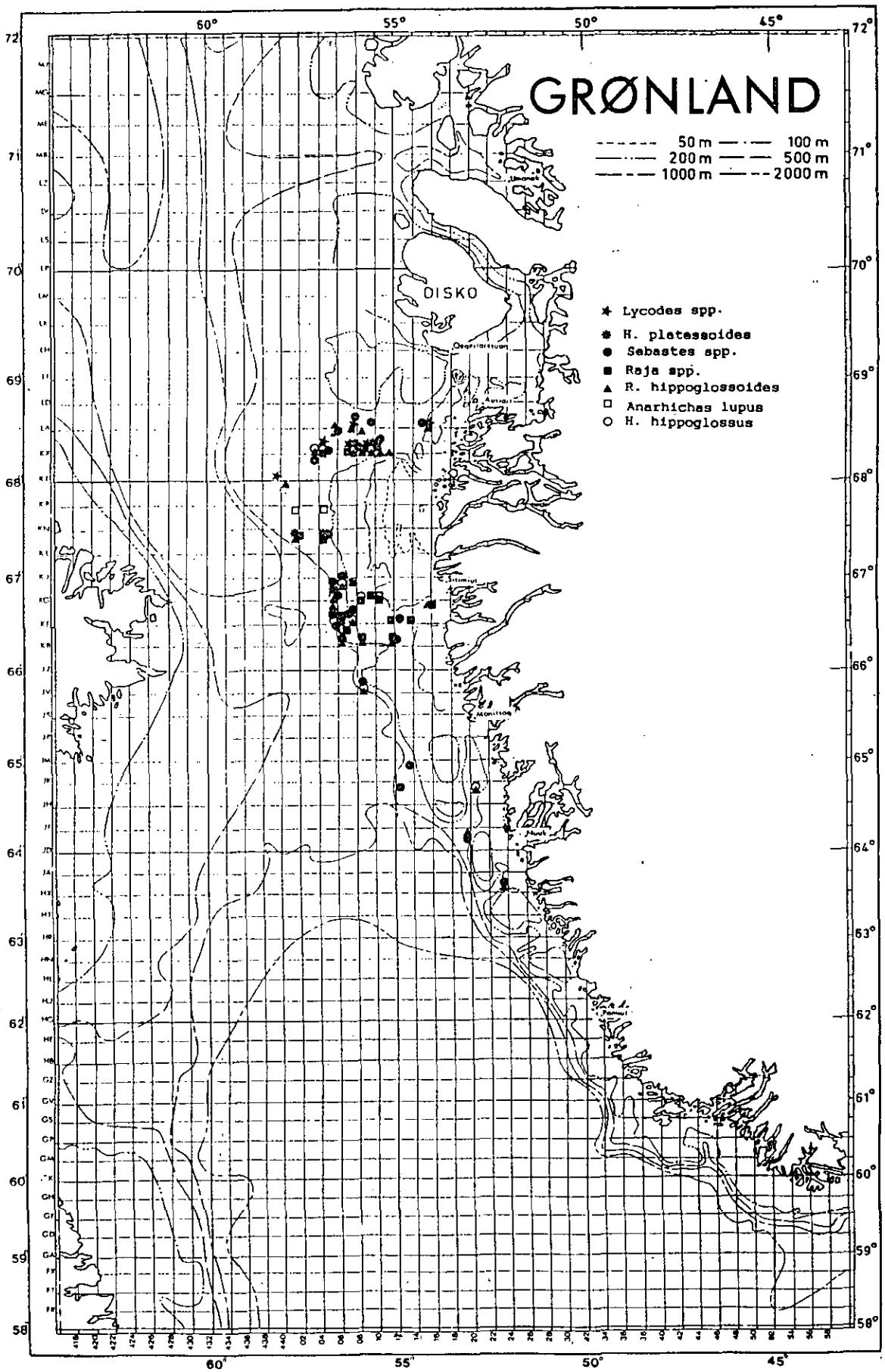
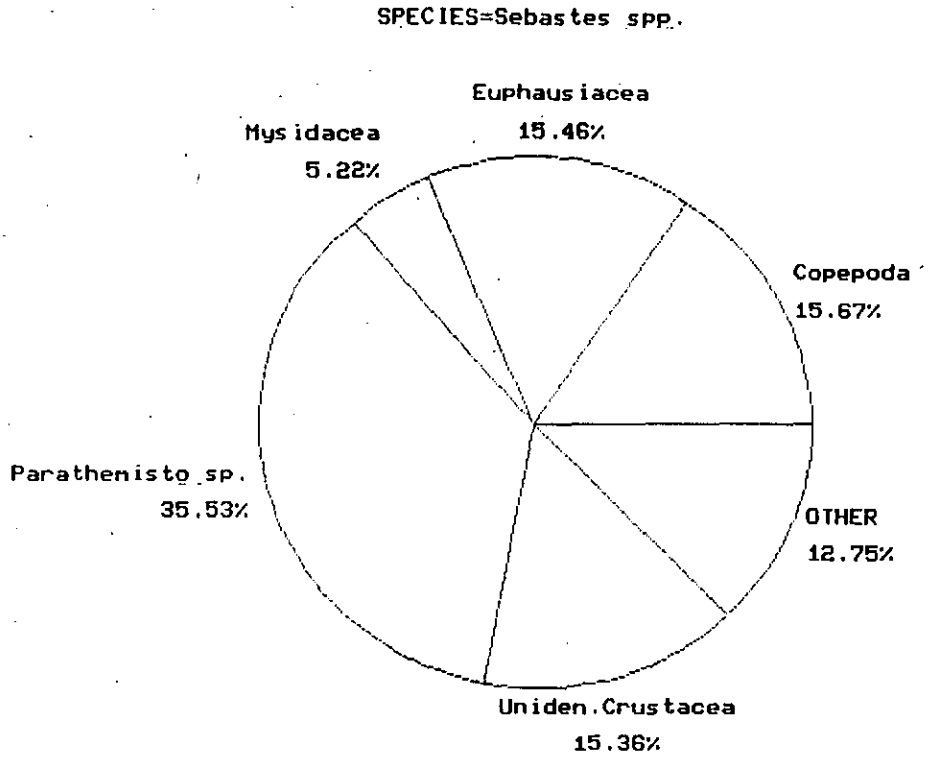
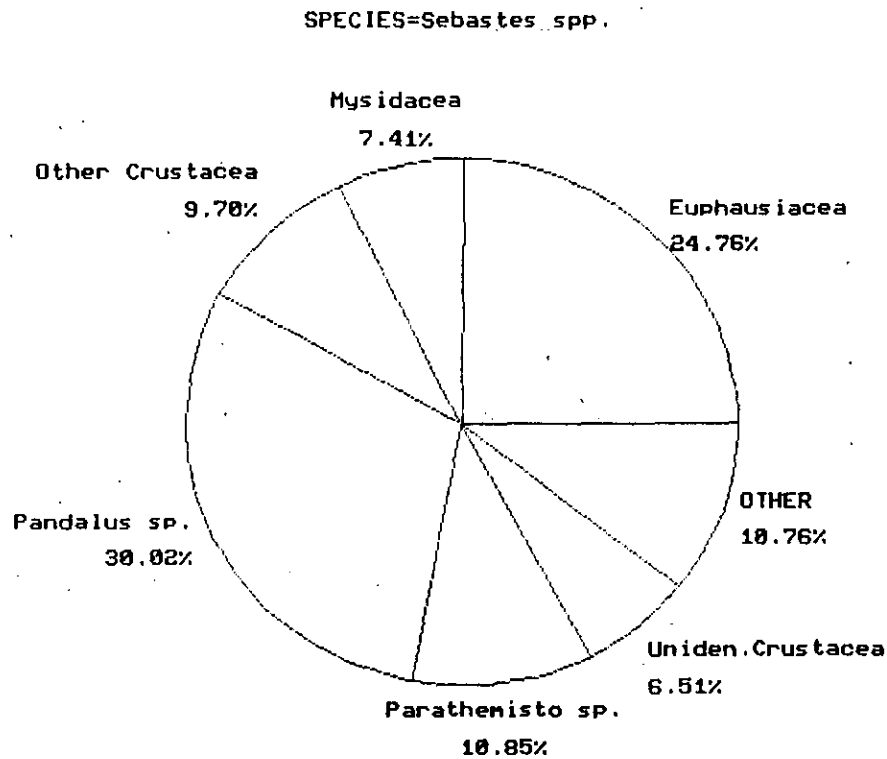


Fig. 1 Sampling locations for fish stomachs collected off West Greenland June - November 1990.

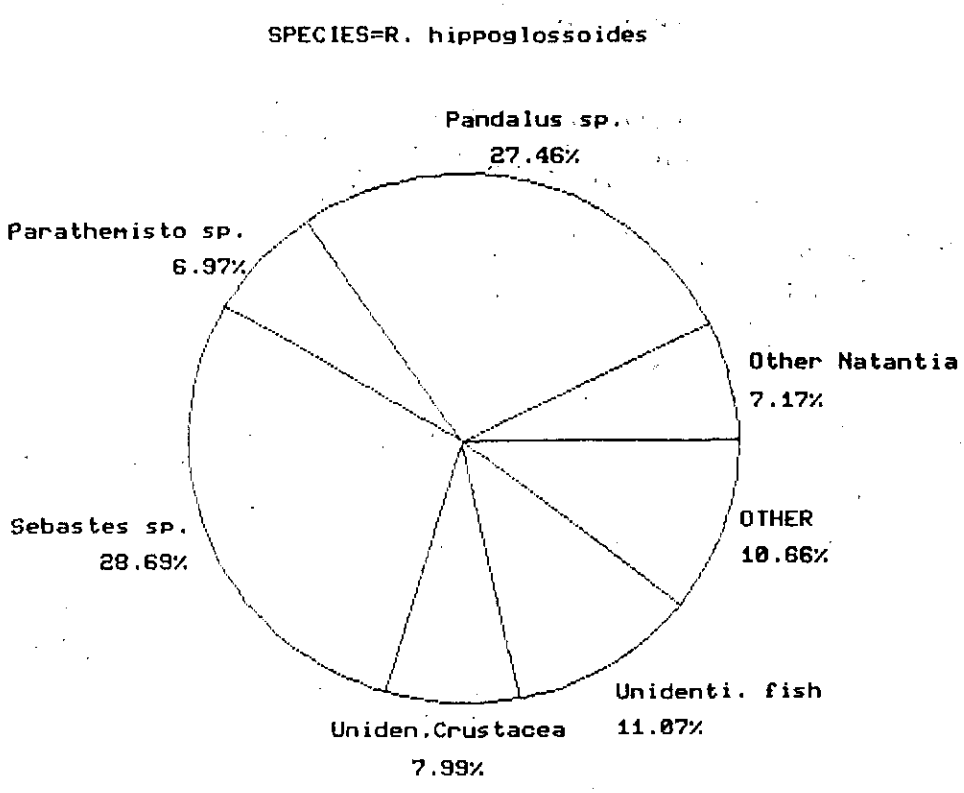


Relative frequency of occurrence



Percent weight

Fig. 2 Food composition of redfish, *Sebastes spp.*, based upon all investigated stomachs.



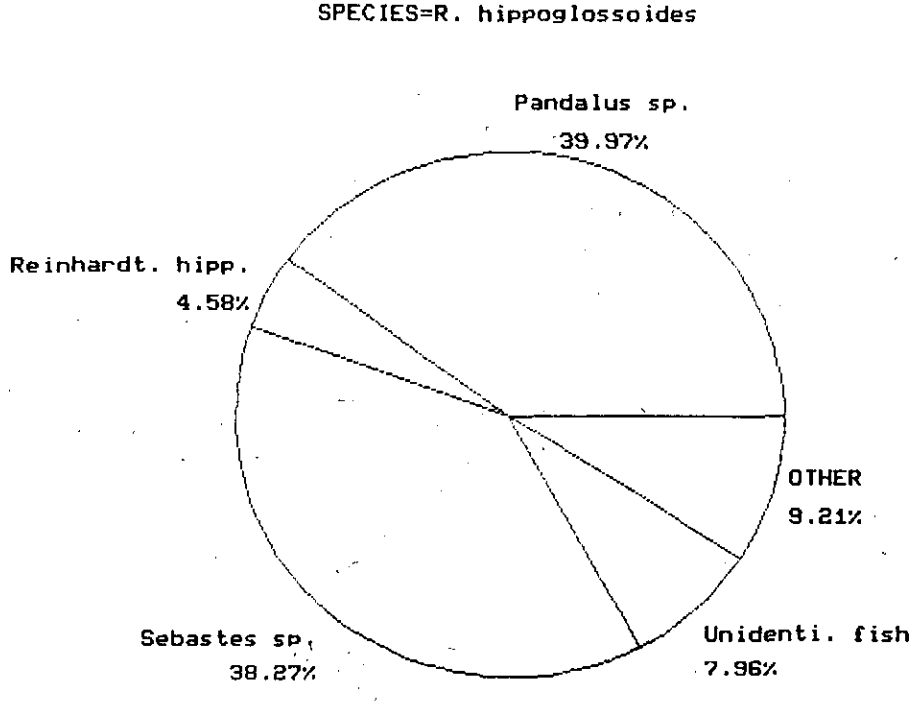
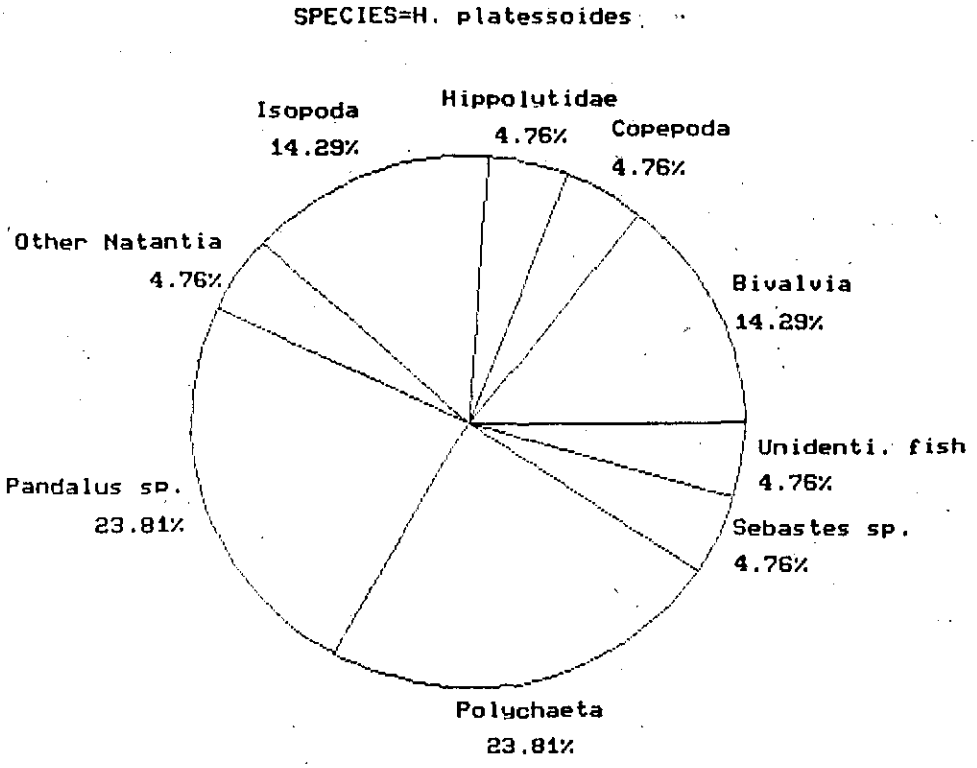
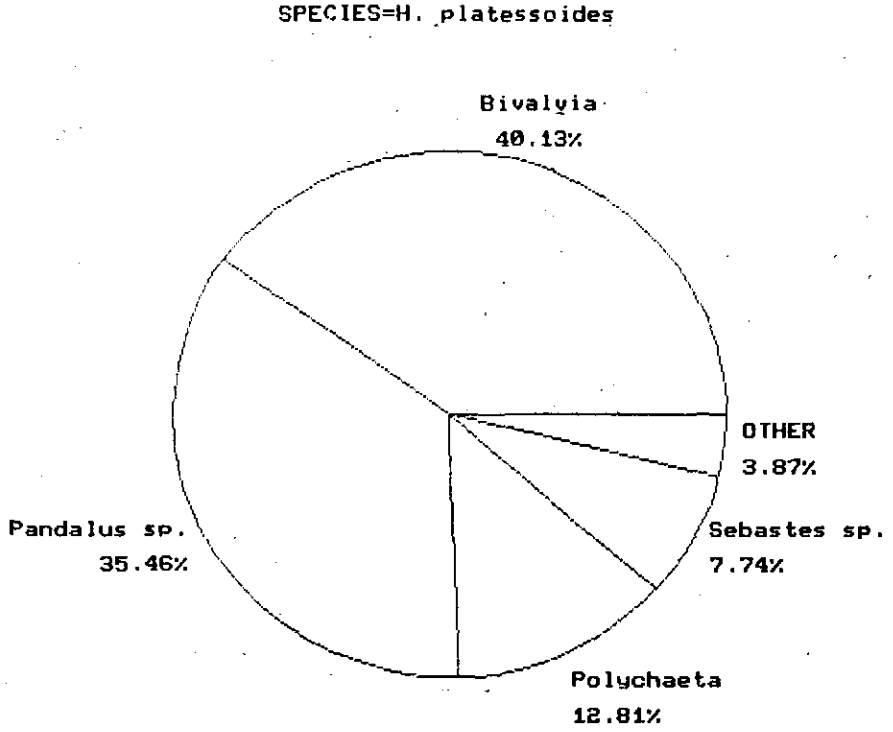


Fig. 3 Food composition of Greenland halibut, *Reinhardtius hippoglossoides*, based upon all investigated stomachs.

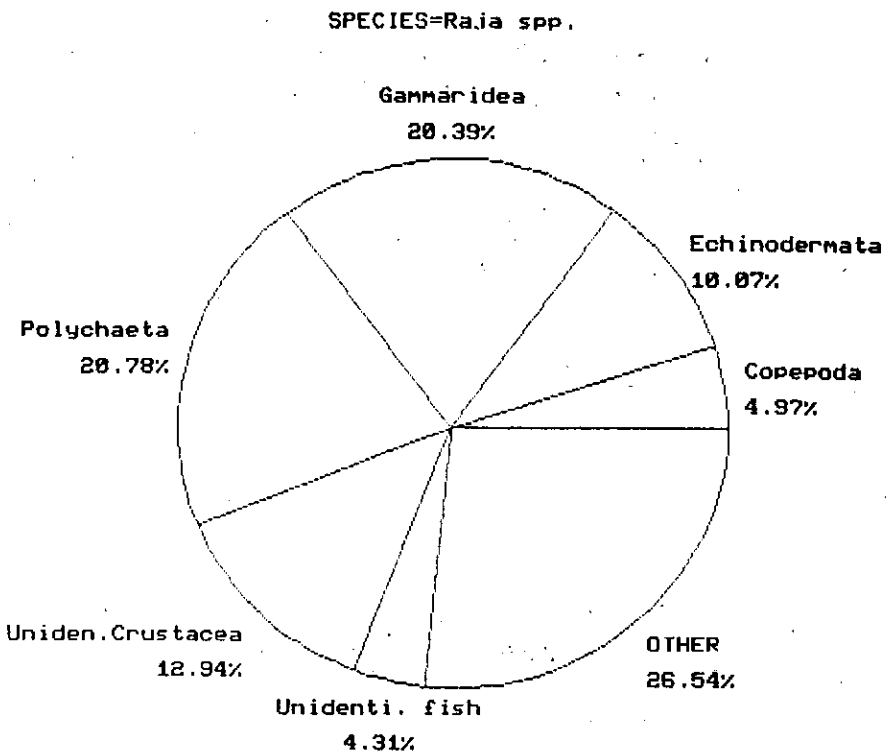


Relative frequency of occurrence

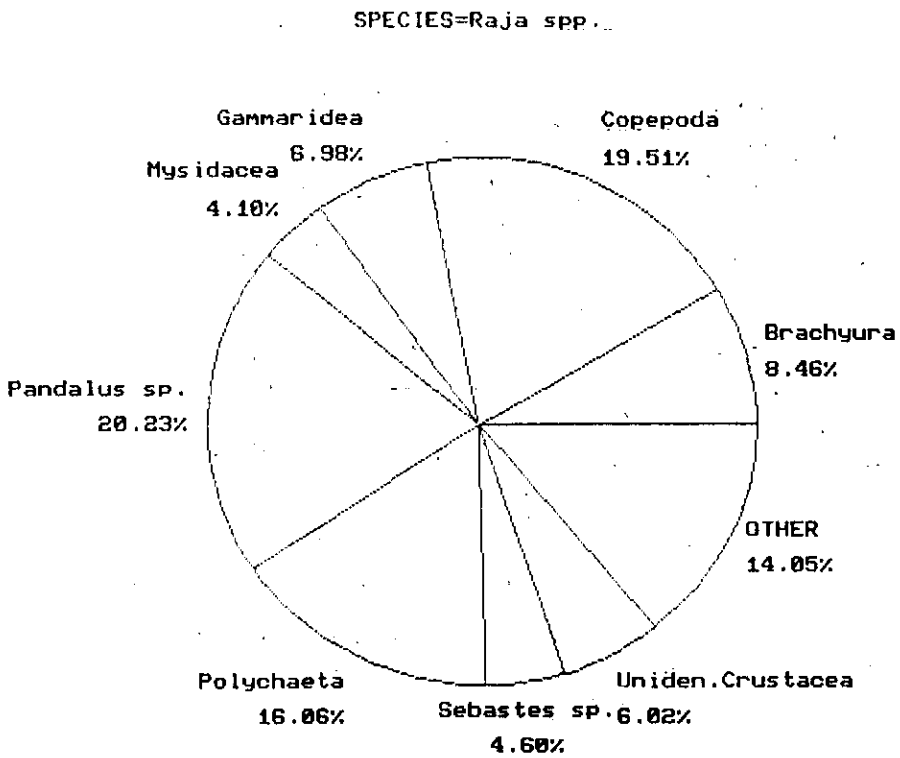


Percent weight

Fig. 4 Food composition of long rough dab, *Hippoglossoides platessoides*, based upon all investigated stomachs.

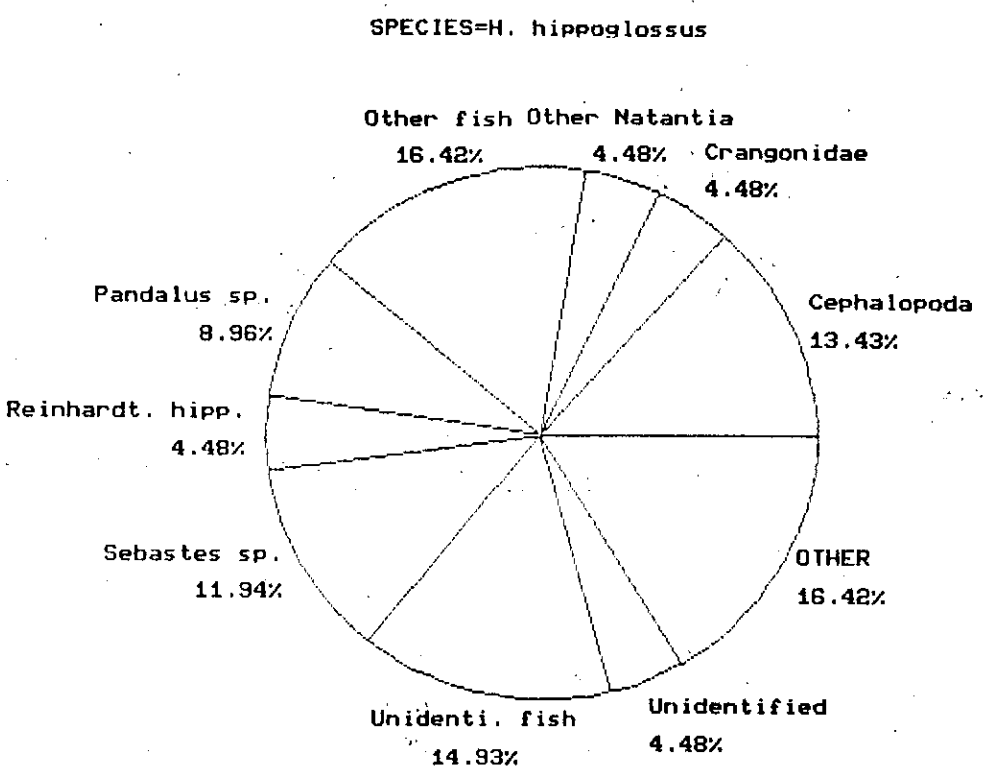


Relative frequency of occurrence



Percent weight

Fig. 5 Food composition of skate, *Raja spp.* , based upon all investigated stomachs.



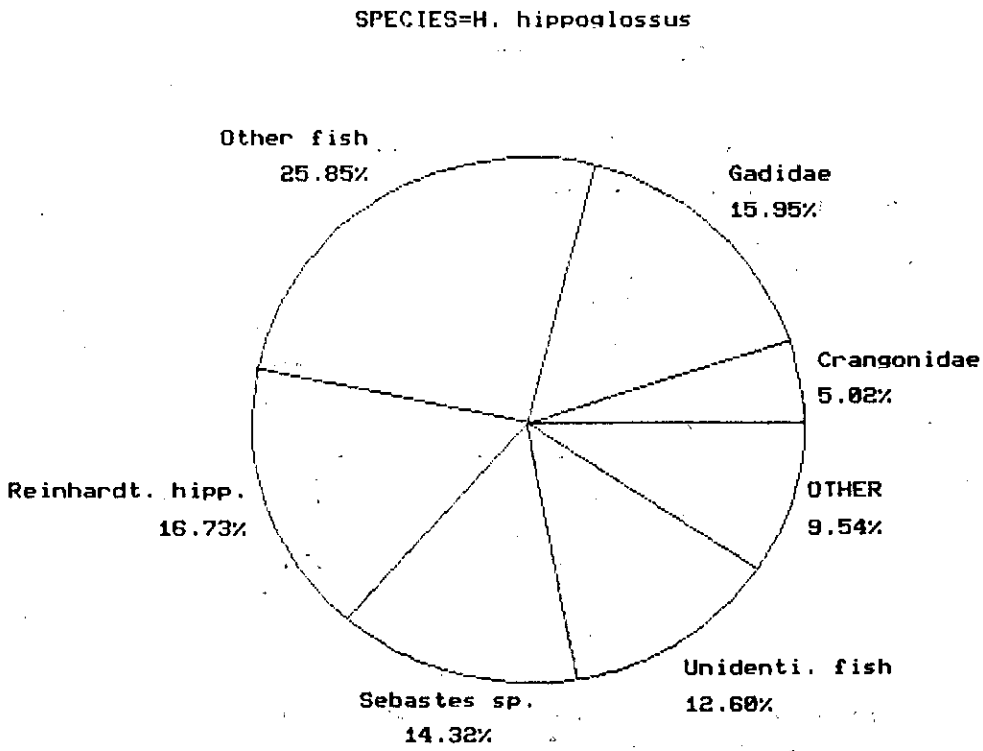
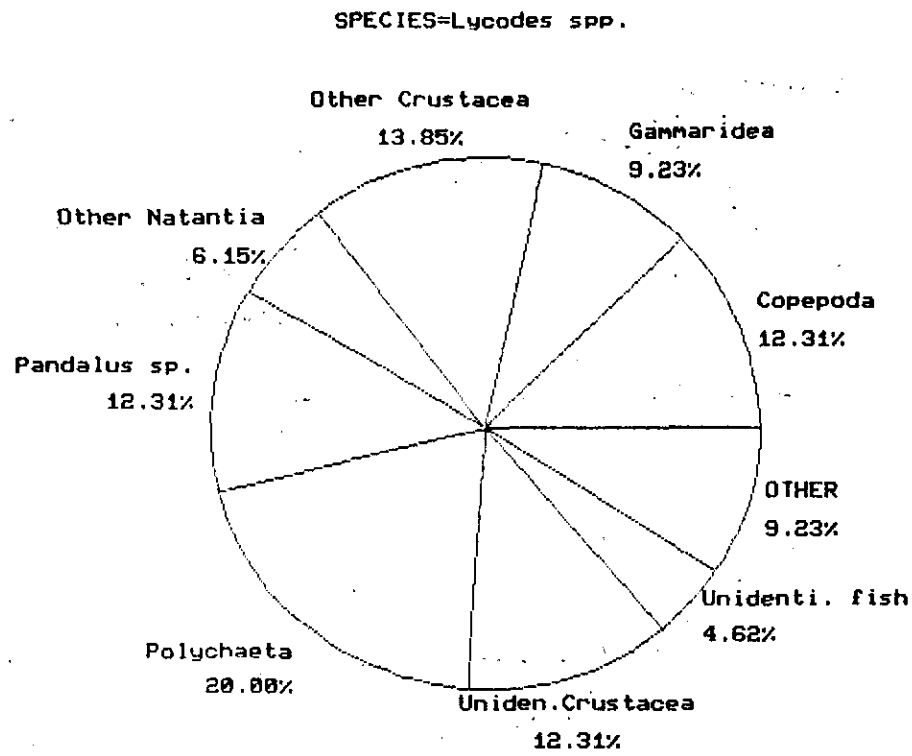


Fig. 6 Food composition of Atlantic halibut, *Hippoglossus hippoglossus*, based upon all investigated stomachs.



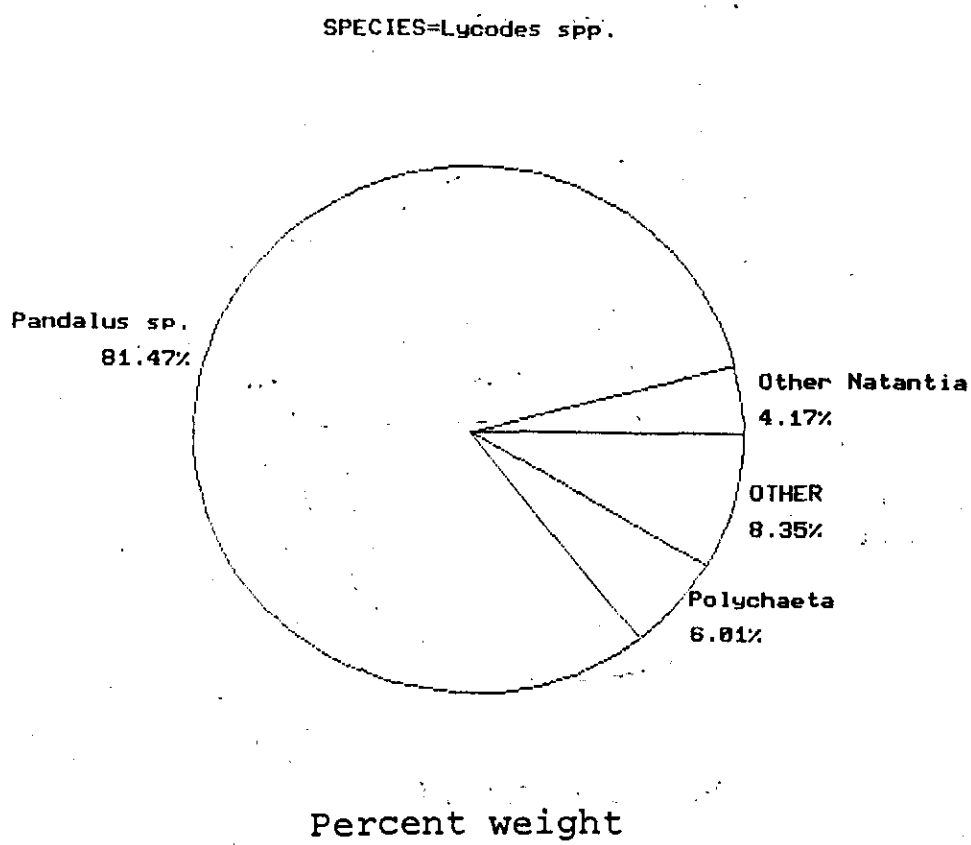
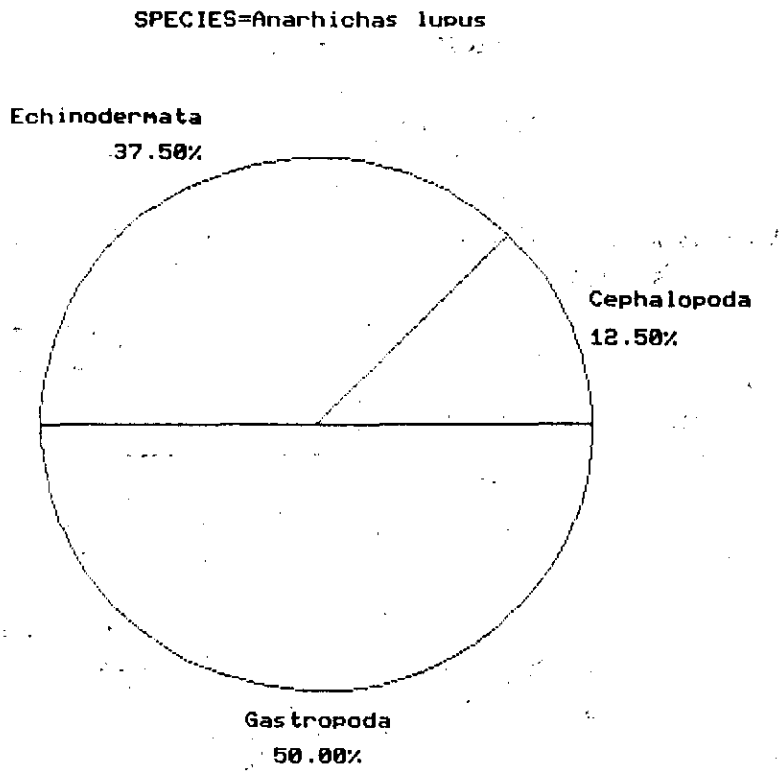
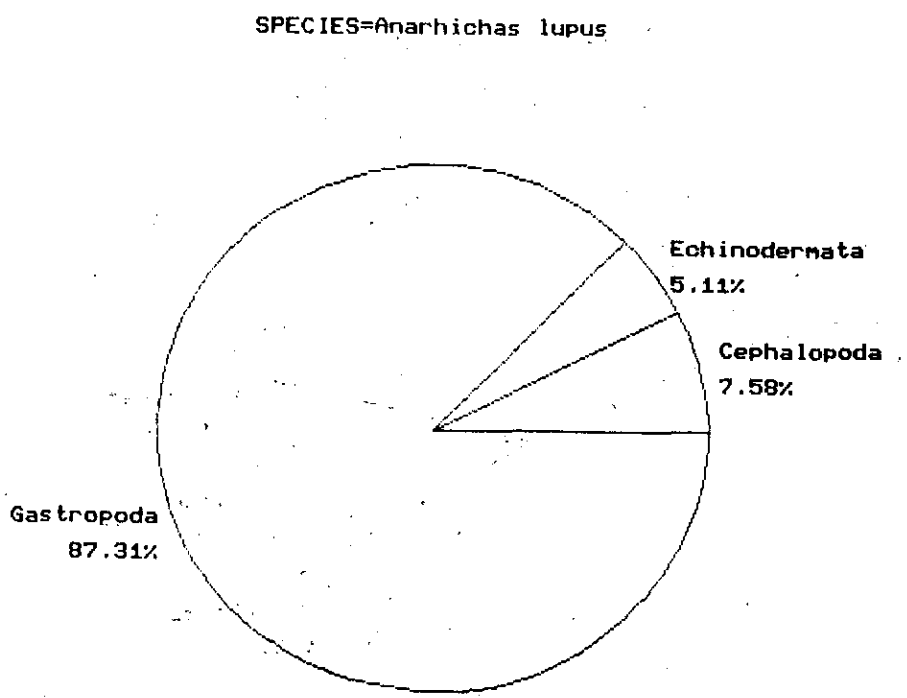


Fig. 7 Food composition of *Lycodes spp.* based upon all investigated stomachs.



Relative frequency of occurrence



Percent weight

Fig. 8 Food composition of Atlantic wolffish, *Anarhichas lupus*, based upon all investigated stomachs.