



# Prey selection of early juvenile cod (*Gadus morhua* L.) in the Barents Sea



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## Introduction

From 1977 through 1991 the Institute of Marine Research (IMR) conducted an annual early juvenile survey in June and July along the coast of northern Norway and in the western Barents Sea. The main purpose of these surveys was to generate an index of abundance for the early juvenile fish with particular emphasis on early juvenile cod (here defined as fish 2-3 months old). In 1989, zooplankton samples were also collected at 161 trawl stations during the period 2 to 23 of July. These stomach and zooplankton samples were analyzed both quantitatively and qualitatively and various methods to estimate prey preferences were applied. Based on these analyses, it appears that early juvenile cod select the largest copepodite stages (IV and V) of *Calanus finmarchicus*. Capelin larvae were also found in the stomachs but no correlation between the abundance of capelin in the sea and in the stomachs was established.

## Materials and methods

A total of 161 zooplankton samples and the stomach contents of 848 early juvenile cod were examined both quantitatively and qualitatively. The survey area was divided into three subareas; area 1 is the Norwegian Sea, area 2 is the shallow bank area Tromsøflaket and area 3 is the Barents Sea (Figure 1).

A number of species were found both in the sea and in the stomachs, but the absolute dominating species were *Calanus finmarchicus* and the much smaller *Oithona similis*. Only these two species were used in the analyses. *C. finmarchicus* was sorted into nauplii and the different copepodite stages. (For more information see Helle, 1993).

Two simple methods were used to determine food selection: the percentage of a prey in the sea versus the percentage of the prey in the stomach and Ivlev's electivity index (Ivlev, 1961). This index is given by

$$E_i = (r_{ik} - p_k) / (r_{ik} + p_k),$$

where  $p_k$  is the proportion of the  $k^{th}$  prey species in the water at a station and  $r_{ik}$  is the proportion of the prey item in the stomach of the  $i^{th}$  fish. The value of the index,  $E$ , varies between -1 and 1. Values near -1 indicate that the fish avoid the prey, values near 0 indicate that the fish neither avoid nor prefer the prey and values near 1 indicate preference for the prey

## Results and discussion

The average length of the early juveniles were: 30.5 mm in area 1, 33.3 in area 2 and 35.0 mm in area 3. Since the Barents Sea has very few species and *C. finmarchicus* constitutes nearly the total bulk of the zooplankton biomass, it is difficult to say anything about species selection. Size selection appears to be easier to detect. The methods used here and in Helle (1993) confirm that *Calanus finmarchicus* copepodite stages IV and V were the most important prey. *Oithona similis* was present in large amounts in all areas but was eaten in a much smaller proportion than was available (Figure 2). This was especially apparent when Ivlev's electivity index is considered (Table 1).

Table 1. Ivlev's electivity index

Area	<i>Calanus finmarchicus</i>					<i>Oithona similis</i>
	Nauplii	I-III	IV	V	VI	
1	-0.84	-0.33	0.41	-0.08	-0.58	-0.41
2	-0.56	-0.30	0.01	0.07	0.09	-0.44
3	-0.70	-0.28	-0.09	0.17	0.18	-0.65

## References

Helle, K. 1993. Distribution and abundance of early juvenile Arcto-Norwegian cod (*Gadus morhua* L.) in relation to water mass properties and prey abundance. Cand. Scient. Thesis. University of Bergen. 116pp.  
Ivlev, V. W. 1961. Experimental Ecology of the Feeding of Fishes, Yale University Press, New Haven, Conn.

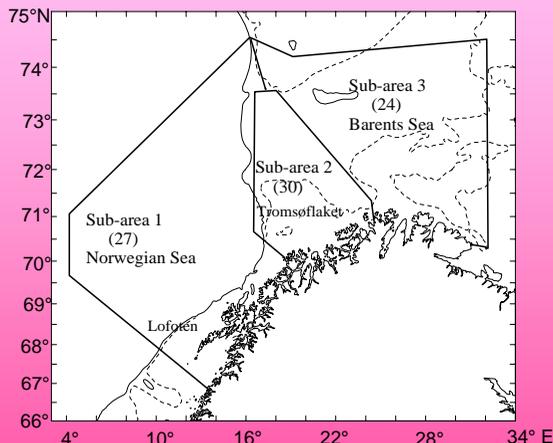


Figure 1. The survey area and sub-areas. The number in the parentheses is the number of stations where stomach samples were taken. The solid line denotes the 500m bottom contour and the dashed line, the 300m bottom contour.

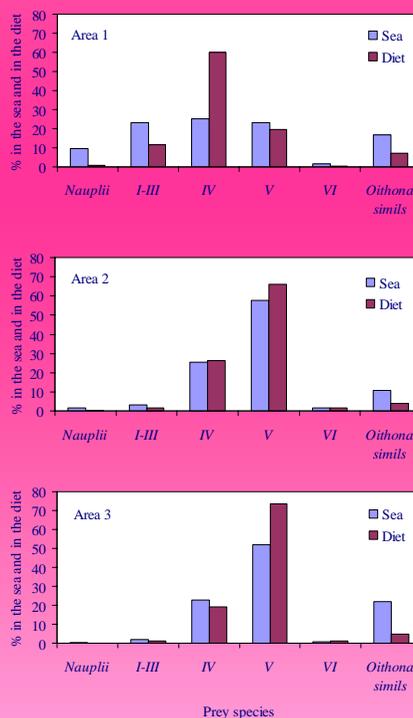


Figure 2. Percentage of *Calanus finmarchicus* (nauplii and copepodite stages) and *Oithona similis* in the sea and in the stomachs.

### Capelin as prey

- Capelin were found in 39 of the stomachs, sampled at 19 stations.
- No correlation between the number of capelin in the sea and in the stomachs was found.
- There was a tendency for more capelin to be in the stomachs when the zooplankton biomass in the sea was low, but no significant relation was found.
- Cod juveniles can eat capelin larvae that are over 2/3 their own body length (a 30 mm cod juvenile had a 24 mm capelin in its stomach)