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ORIGINAL ARTICLE

Ecology of poor-cod (*Trisopterus minutus*) on the Faroe Bank

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Abstract
Living in an oceanic ecosystem on the edge of its distribution range, the Faroe Bank's poor-cod occurs in a special habitat. This paper gives a general description of the ecology of poor-cod living on the Faroe Bank. Poor-cod live on the shallow part of the Bank in a habitat mainly consisting of shell sand and sand. They prefer depths between 121 and 133 m. The average length of fish caught is about 21 cm (range 14–28 cm), which is somewhat higher than normally found for this species in other areas. A sex-specific difference occurs in the growth pattern, with faster growth for females. Generally, the individual growth is high for poor-cod on the Faroe Bank compared to other areas, which is probably due to the favourable environmental conditions on the Bank, with high temperature and abundant food supply. The main spawning occurs in the second half of April. Females reach sexual maturity at an earlier age than males (1.7 *vs.* 2.7 years), but their length is the same, about 20 cm. Crustaceans form by far the greatest part of the food consumed and make up nearly 70% by weight of the food items; fish and polychaetes were also part of the food.

Key words: Trisopterus minutus, *Faroe Bank, life-history traits, spatial distribution, size and age composition*

Introduction

Poor-cod (*Trisopterus minutus* (Linnaeus, 1758)) is a small, benthopelagic gadoid fish that appears in small shoals at depths from 15 to 200 m on the continental shelf of the northeast Atlantic, from Trondheimsfjord (Norway) in the north to the Atlantic coast of Morocco in the south. To the northwest, the boundary of the distribution range is at the Faroe Islands (Cohen et al. 1990). Around the Faroe Islands, the poor-cod is mainly found on the Faroe Bank (Joensen & Tåning 1970) but, during the last few years, it has regularly been caught in bottom trawl surveys on the Faroe Plateau (Faroese Fisheries Laboratory, unpublished data).

A separate sub-species, the Mediterranean poor-cod (*T. minutus capelanus*), occurs in the Mediterranean Sea (Svetovidov 1948). However, new genetic evidence suggests that the Mediterranean poor-cod is more closely related to bib (*T. luscus*) than to Atlantic poor-cod and therefore should be considered as a separate species (Mattiangeli et al. 2000). Whereas the Mediterranean poor-cod is regularly found on the local fish markets, the Atlantic poor-cod is of little commercial value and is not targeted by fisheries (Cohen et al. 1990). However, the Mediterranean poor-cod will not be discussed further in this paper.

Poor-cod biology is poorly understood at present. However, sporadic knowledge on this species is available in the scientific literature. Menon (1950) described the general biology of poor-cod in the Plymouth area of southwest England. Nagabhushanam (1965) and Mattson (1990) investigated the food and feeding habits of poor-cod in the Manx Waters (in the Irish Sea), and off the Swedish west coast, respectively. Cooper (1983) investigated the reproductive biology of poor-cod off the west coast of Scotland, and Albert (1993) has given a general description of poor-cod in the Norwegian Deep. For the Faroe Bank poor-cod, Magnussen (2007) has carried out a minor study of the individual growth. Additionally, Mattiangeli et al. (2000, 2002, 2003) investigated the population genetics and taxonomic status of poor-cod throughout its distribution range

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in the Mediterranean and Atlantic. Furthermore, a lot of research has shown that poor-cod is an important constituent of the diet of some other fish species (see e.g. Wheeler 1969; Armstrong 1982; Crozier 1985; Hislop et al. 1991; Salvanes & Nordeide 1993; Collins et al. 1994; O'Sullivan et al. 2004; Trenkel et al. 2005).

The Faroe Bank is located approximately 70 km southwest of the Faroe Islands at 60°55′ N, 8°40′ W. It is separated from the Faroe Plateau by the narrow (20 km) and deep (850 m) Faroe Bank Channel, and thus resembles a seamount. Hydrographical investigations have shown that the water has an anticyclonic circulation on the bank and is isolated from the surrounding water masses (Hansen et al. 1999), which makes the Faroe Bank its own ecosystem. The position of the Faroe Bank as a separate ecosystem has resulted in specialization with respect to morphological, physiological and genetic properties for some of the fish species living there (Schmidt 1930; Love et al. 1974; Mattiangeli et al. 2000, 2002). The best known of these is probably the extremely fast-growing 'Faroe Bank cod' (*Gadus morhua* Linnaeus, 1758), which is considered to be one of the fastest-growing cod in the world (Jones 1966; Love et al. 1974; Ursin 1984; Magnussen 2007). General description of the Faroe Bank demersal fish assemblages and growth of the main fishes living there is given by Magnussen (2002, 2007).

Being an oceanic ecosystem rather than coastal, the Faroe Bank habitat is very different from that of other areas where poor-cod live. While other habitats are mainly fjords or coastal areas, the Faroe Bank is an oceanic bank ecosystem, with a minimum depth of 92 m. Somehow, this must affect the biology and ecology of the poor-cod living on the Bank and unusual characteristics have also been observed for this species on the Bank. On the basis of single-locus microsatellite and allozymes data, Mattiangeli et al. (2000, 2002) suggested a reproductively isolated poor-cod population for the Faroe Bank and stated that, of the nine poor-cod populations investigated covering the species entire geographic range, the Faroe Bank population had the highest genetic deviation. As in the case for the 'Faroe Bank cod', Magnussen (2007) found the individual growth of poor-cod on the Faroe Bank to be very high and to exceed the growth in other populations.

The purpose of this paper is to present a general description of the ecology of the poor-cod living on the Faroe Bank, including spatial distribution, size and age composition, growth, sexual maturity and feeding biology.

Material and methods

Data were collected by the R/S *Magnus Heinason* on two bottom-trawl surveys on the Faroe Bank in 2003: one in spring (28 March–1 April), when 17 hauls were taken, and again in the autumn (11–16 September), when 27 hauls were taken (Figure 1). The poor-cod were caught using a 116-foot (35.4 m) 4-panel bottom trawl with 18 m between the ground wings and 40 mm nominal mesh size in the codend. Tows were of 60 min duration. The sampling protocol for these surveys is described by Magnussen (2002).

Individual specimens of poor-cod, used for analysis of life-history parameters and feeding biology, were randomly collected from hauls with a sufficient number of fish (Table I).

Spatial distribution

Geographic distribution maps are based on catches (in number) from each station, which were fixed for the two trips. The preferred depth for poor-cod was calculated as average fishing depth for each station weighed by catches of poor-cod on each of the respective stations.

Growth

Ages of the fish were determined from the otoliths after they were embedded in black orthopolyester, sliced and the year-rings counted under a microscope. The calendar year was assigned when ageing the fish.

Total length and ungutted weight of each fish was measured to the nearest millimetre and gram, respectively. Growth in length and weight are described as size at age, using the von Bertalanffy growth equations:

$$L_{Age} = L_{\infty}(1 - e^{-K_{length}*Age})$$
$$W_{Age} = W_{\infty}(1 - e^{-K_{weight}*Age})^3$$

where $L\infty$ and $W\infty$ are the asymptotic length and weight, respectively, and K_{length} and K_{weight} are the rates of growth towards these asymptotic values. The parameters were fitted by the SYSTAT 11 PC-program (SYSTAT 2004), using a non-linear regression technique with least-squares estimates and the Gauss–Newton method.

The relationship between weight (W) and length (L) was calculated as:

$$W = a * L^b.$$

The a and b parameters were fitted by linear regression on the log-transformed weight and length

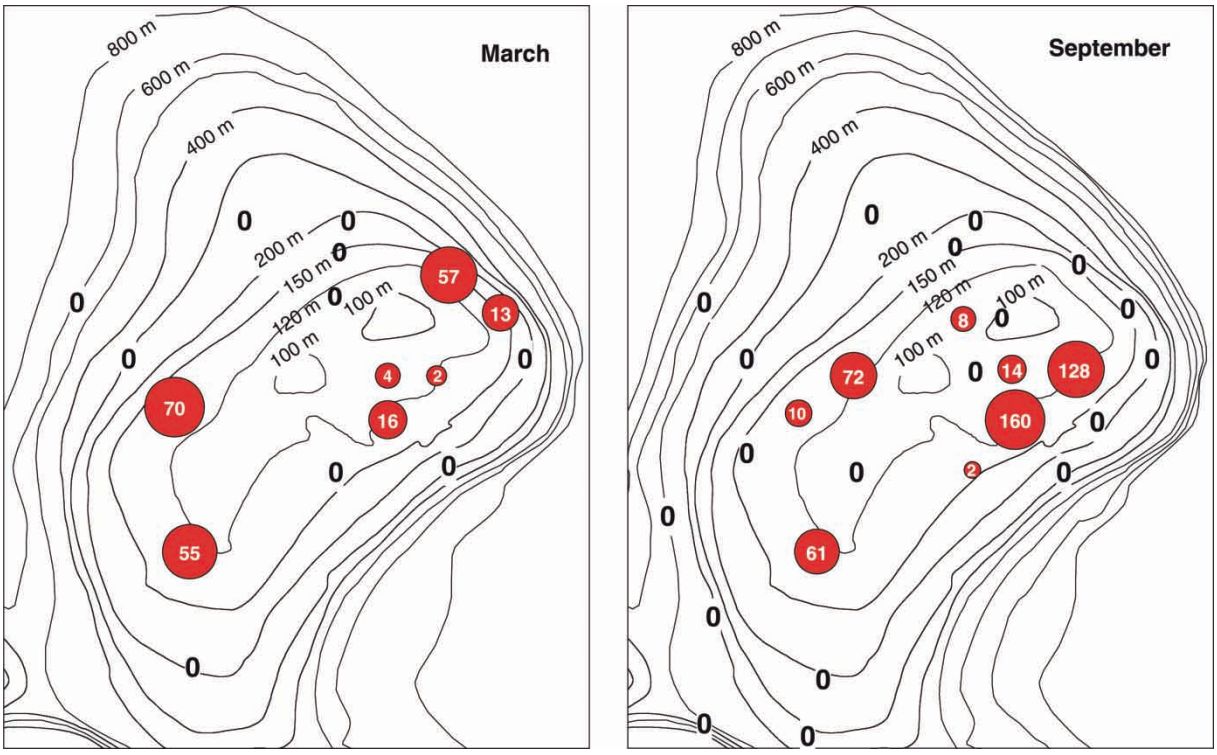

Figure 1. Distribution of poor-cod on two trips on the Faroe Bank 2003. The numbers within circles indicate number per hour fishing. Zero values indicate stations without poor-cods.

values. The Fulton condition factor (K) was calculated as:

$$K = \frac{W}{L^3}.$$

Maturity

Maturity stage was estimated visually on a scale from 1 to 7, modified after FAO (1960), where stage 1 is immature and =2 are different stages for mature fish. Age at maturity (A_{50}) is found from:

$$P_{Age} = \frac{\pi/2}{1 + e^{-m^*(Age - A_{50})}}$$

as described by Chen & Paloheimo (1994), where P_{Age} is the proportion of mature fish at a particular age. There are two parameters in the model: A_{50} is the age at which 50% of the population has reached maturity and the m-value represents the rate at which the population attains maturity. Parameterization is based on arcsine square-root transformation of proportion data. Given the maturity age, the corresponding length and weight were estimated using the von Bertalanffy growth equation with the respective parameters found earlier in this investigation.

Food

The food composition is based on analysis of stomach contents. The stomachs were collected immediately after the weight and length of the fish had been measured, then the stomachs were frozen onboard. Afterwards, analysis of the stomach content was performed in the laboratory. The stomach filling was visually judged on a scale from 1 to 6

Table I. Samples collected on the Faroe Bank in 2003 used for individual analyses of poor-cod.

	Date	Start time of fishing	Mean fishing depth (m)	Mean position	Number of fish
Spring	28 March	08:24	131	61°10.422′N, 08°13.705′W	16
	30	14:40	128	60°43.888′N, 09°04.970′W	55
	31	08:22	119	60°56.279′N, 08°25.899′W	16
Autumn	13 September	11:01	129	60°43.785′N, 09°04.383′W	6
	15	12:59	117	61°01.017′N, 08°13.262′W	50
	15	14:58	114	60°56.400′N, 08°25.225′W	13
	16	06:39	131	60°56.892′N, 09°07.861′W	10
	16	08:14	124	61°03.393′N, 08°56.801′W	19

(1 = empty, 2 = just a little content, 3 = half-full, 4 = full, 5 = distended and 6 = turned inside out). Then, the stomach content was sorted, the prey items identified to the lowest possible taxonomic levels and quantified in number and blotted wet-weight. For each prey item, the degree of digestion was measured on a scale from 1 to 5 (1 = fresh, 2 = digestion started, all species identifiable, 3 = half-digested, prey identifiable, to taxonomic group, 4 = almost digested, only part of the prey identifiable, and 5 = fully digested, not identifiable).

Statistical methods

Statistical analyses were performed on a SYSTAT 11 PC-program (SYSTAT 2004). Temporal and sex-specific differences in age and size distributions, as well as the preferred depths were tested by the Mann–Whitney U-test. Differences in growth curves between sexes and seasons were compared with a likelihood ratio test (Kimura 1980). Sex-specific differences and temporal changes in the length–weight relationship were performed with ANCOVA on log-transformed lengths and weights with sex as the grouping variable. Linear regressions were used to test changes in the feeding intensity during the day.

Results

In total, 217 poor-cod (21 kg) were caught in March and 455 (49 kg) in September. In March, poor-cod were caught in 7 out of the 17 (41%) trawl hauls conducted on the Faroe Bank. In September, they were caught in 8 out of 27 hauls (30%) (Figure 1).

Poor-cod occurred only on the shallow part of the Bank, at depths between 107 and 160 m. There was no difference between the preferred depth of poor-cod in spring and autumn ($P = 0.49$). In March the preferred depth was, on average, 133 m (range 107–160 m) and in September it was 121 m (range 107–142 m).

The ages of the investigated poor-cod ranged from two to seven years, without well-defined age classes. There were no differences in median age between males and females, either in spring ($P = 0.20$) or in autumn ($P = 0.85$). Combined over seasons, the average age was 3.2 years for females and 3.4 years for males. The respective medians were the same for both sexes, 3 years. Length of the investigated poor-cod ranged from 14 to 28 cm (Figure 2), with an average length for pooled data of 20.9 cm in March, compared to 21.4 cm in September ($P = 0.495$). Females were significantly larger than males in both seasons ($P = 0.012$ and $P < 0.001$). The average length of females was 21.9 cm in March and 22.8 cm

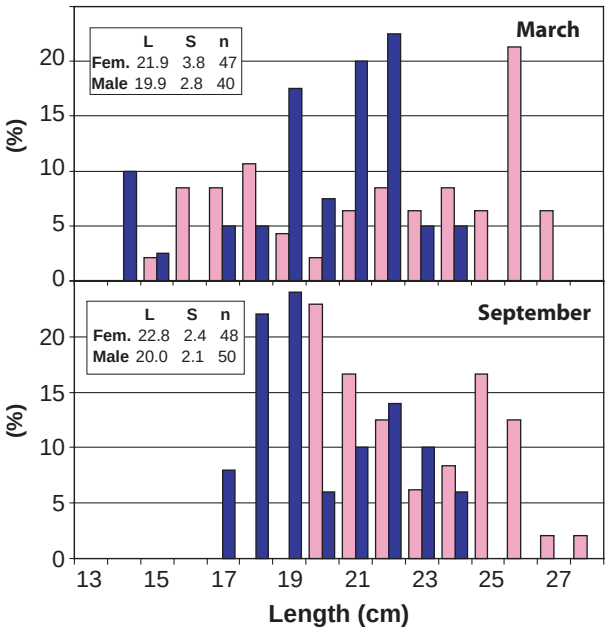

Figure 2. Length–frequency distributions of male and female poor-cod on the Faroe Bank. The symbols *L*, *S* and *n* refer to average length, standard deviation and number of investigated fish, respectively.

in September, compared with 19.9 cm and 20.0 cm for the males (Figure 2).

This sexual dimorphism was even more obvious for the weight ($P < 0.003$). For females, the averages were 117 g and 123 g in March and September, respectively, whereas it was only 77 g for the males, for both seasons.

In both seasons, females grew significantly faster than males (Figure 3) ($P = 0.013$ and $P = 0.005$), which also was expressed by higher $L\infty$ and $W\infty$ values of borderline significance in both seasons ($P < 0.07$) (Table II). The *k*-values, on the other hand, did not vary between sexes, neither for the length ($P > 0.41$) nor for the weight ($P > 0.46$). Comparing the Bertalanffy growth parameters between seasons, males had a significantly higher *K*-value in September than in March ($P = 0.05$). For the other parameters, no seasonal differences occurred ($P > 0.12$).

As for the growth, significant sex-specific differences ($P < 0.001$) in the length–weight relationship were observed in both seasons, with heavier female than males. The length–weight relationship did not change with the season, neither for females ($P = 0.109$) nor males ($P = 0.507$). For season-combined data, the length–weight relationship was $W = 0.01007 * L^{3.001}$ for the females and $W = 0.01664 * L^{2.809}$ for the males. Expressed in condition factors, they were, on average, 1.012 for females and 0.942 for males.

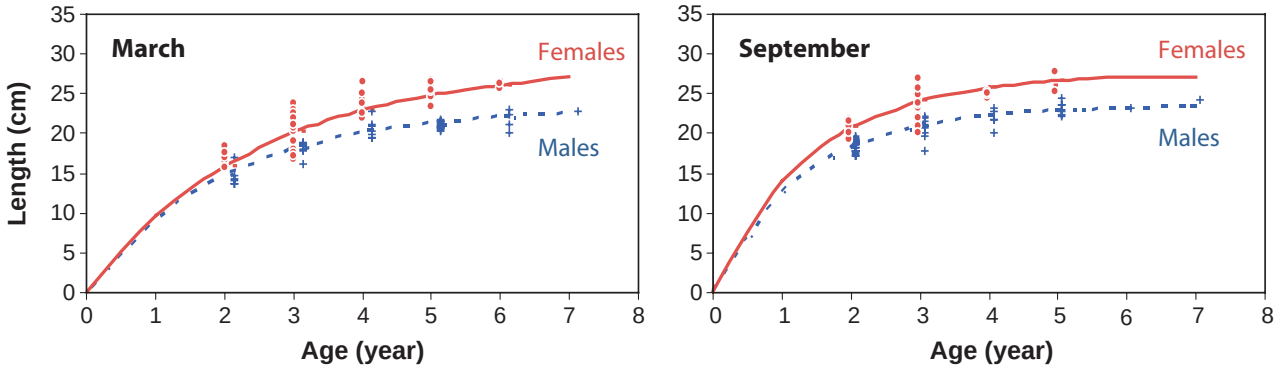

Figure 3. Difference in the growth pattern between female and male poor-cod caught on two trips on the Faroe Bank. Lines and dotted lines are fitted Bertalanffy growth curves while marks (•, +) are the observed length for females and males, respectively.

At the end of March, the spawning had just begun. However, the maturity status for most of the specimens was either developing or mature. Only one fish was spawning. Females were both younger and smaller than males when they became sexually mature. In September, the average maturity age (A_{50}) was 1.7 years for females and 2.7 years for males (Figure 4). The corresponding L_{50} and W_{50} were 19 cm and 71 g for the females, compared to 20 cm and 79 g for the males.

Crustaceans formed, by far, the greatest part of the food consumed by poor-cod on the Faroe Bank in both seasons (Table III).

In March, crustaceans were eaten by 52% of the poor-cod. Of these, galatheids (*Galathea* sp.) and shrimps (Caridea) were the most common food items and together made up 59% of the number and 35% of the total biomass eaten. Among the crustaceans, galatheids formed the most important fraction eaten. This was especially clear in March, when 23% of the fish had galatheids in their stomachs, making up 22% of the weight. In September, crustaceans were still the most common food (occurrence 50%), but now the galatheids made up only a minor part of the food and they were only found in one of the 60 stomachs containing food, corresponding to 2% of the food-weight eaten. Instead, shrimps now formed the bulk of the food, and made up 42% by weight of the identified food items.

A large proportion of the investigated stomachs were empty, both in March and September. Of the 87 stomachs collected in March, 49% were empty, and in September, 39% of the 98 stomachs were empty. Only 33% of the stomachs in March and 25% of those in September had contents corresponding to half-full or more. Due to the high levels of empty stomachs, the average number of prey species per stomach was low; 1.2 in March and 0.6 in September.

Although the stomachs were sampled during the daytime only, the stomach analysis indicated that poor-cod mainly feed during the night and early in the morning (Figure 5). The highest 'average content per stomach' and 'stomach filling' was found in the morning, while the 'proportion of empty stomachs' and the degree of digestion increased during the day. However, only in the case of 'stomach filling', was the slope of the trend line significantly different from zero ($P < 0.013$).

Discussion

Distribution

The Faroe Islands form the northwestern boundary of the poor-cod's distribution range (Joensen &

Table II. Estimated Bertalanffy growth parameters (and standard errors) on length and weight of poor-cod from the Faroe Bank. N refers to number of fish investigated.

				Length		Weight	
Season	Sex	N	Age range (year)	$L\infty$ (cm)	K (year^{-1})	$W\infty$ (g)	K (year^{-1})
March							
	Female	47	2–6	29.6 (1.07)	0.402 (0.033)	258 (28.3)	0.417 (0.042)
	Male	39	2–7	23.6 (0.43)	0.513 (0.029)	115 (5.3)	0.562 (0.036)
September							
	Female	48	2–5	27.2 (0.68)	0.713 (0.052)	203 (15.8)	0.717 (0.062)
	Male	50	2–7	23.3 (0.31)	0.764 (0.033)	119 (4.2)	0.760 (0.034)

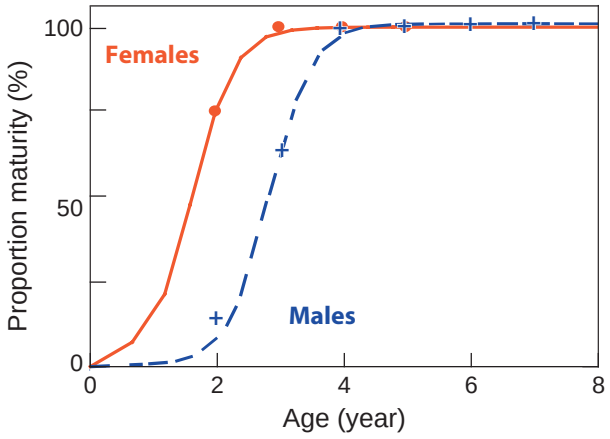

Figure 4. Difference in the maturity level between female (----) and male (——) poor-cod caught on the Faroe Bank.

Tåning 1970). At the Faroe Islands, poor-cod mainly live on the Faroe Bank, where they are found on the shallower parts of the bank, with preferred depths of about 120–130 m (Figure 1). The habitat favoured by poor-cod on the Faroe Bank consists mainly of shell sand and sand. This is in contrast to what has been found earlier for poor-cod in other areas, where they prefer to live on soft bottom (Albert 1993; Pethon 1998). Poor-cod normally live in coastal areas rather than oceanic, at depths of 15–200 m (Cohen et al. 1990), and are usually considered as a relatively shallow-water species (Albert 1993), although they can descend deeper. In the Norwegian Deep, Albert (1993) found its depth to range from 40 m to over 450 m in winter, while in summer they ascend to depths of 30–140 m. The preferred depth of poor-cod found in the present investigation is shallower than that found earlier by Magnussen (2002), namely 173 m. In that investigation, poor-cod was found to belong to the 'shallow fish assemblages' of the bank, ranging from 120 to 210 m depth. Other fishes belonging to this assemblage were: cod, lemon sole *Microstomus kitt* (Walbaum, 1792), dab *Limanda limanda* (Linnaeus, 1758), Atlantic wolf-fish *Anarhichas lupus* Linnaeus, 1758, haddock *Melanogrammus aeglefinus* (Linnaeus, 1758) and grey gurnard *Eutrigla gurnardus* (Linnaeus, 1758).

Size and growth

The average length of poor-cod caught on the Faroe Bank is somewhat higher than found in other areas, but the length-range is similar (Figure 2 and Table IV). However, comparing fish size among ecosystems requires caution, since size of the collected specimens will always depend on the sampling gear. In those investigations that we compared, the gear selection was unspecified in most cases.

The individual growth of poor-cod found in the present investigation is higher than found for this species in other areas (Menon 1950; Beverton & Holt 1959; Jennings et al. 1999) but fits very well with the growth found earlier for this species on the

Table III. Stomach contents of poor-cod in spring and autumn in terms of frequency of occurrence (proportion of 'not-empty' stomachs with the respective prey) percentages by number (%-N) and weight (%-W) and average content of stomachs containing food. The bold figures in parenthesis for crustaceans are based on pooled values of the four crustacean taxa recognized.

	Frequency of occurrence (%)		Proportion of food for the respective prey				Average contents per stomach			
			%-N		%W		Number		Weight (mg)	
Taxa	Mar	Sep	Mar	Sep	Mar	Sep	Mar	Sep	Mar	Sep
Crustacean	**(52)**	**(50)**	**(76)**	**(89)**	**(44)**	**(58)**	**(0.91)**	**(0.53)**	**(573)**	**(377)**
Galathea spp.	23	2	23	0	22	2	0.27	0	280	12
Portunidae	0	2	0	3	0	1	0	0.02	0	8
Caridea	21	18	36	56	13	31	0.43	0.33	164	202
Other crustacean	25	28	17	31	10	24	0.20	0.18	130	155
Polychaeta										
Polychaeta	9	2	8	6	7	2	0.09	0.03	86	15
Pisces										
Pisces	2	3	2	3	14	14	0.02	0.02	184	93
Other										
Other prey	41	47	15	3	35	25	0.18	0.02	445	163
Number of stomachs:										
Not-empty	44	60								
Empty	43	38								
Number of food items			53	36			1.20	0.60		
Weight of food items (mg)					56.7	38.9			1289	648

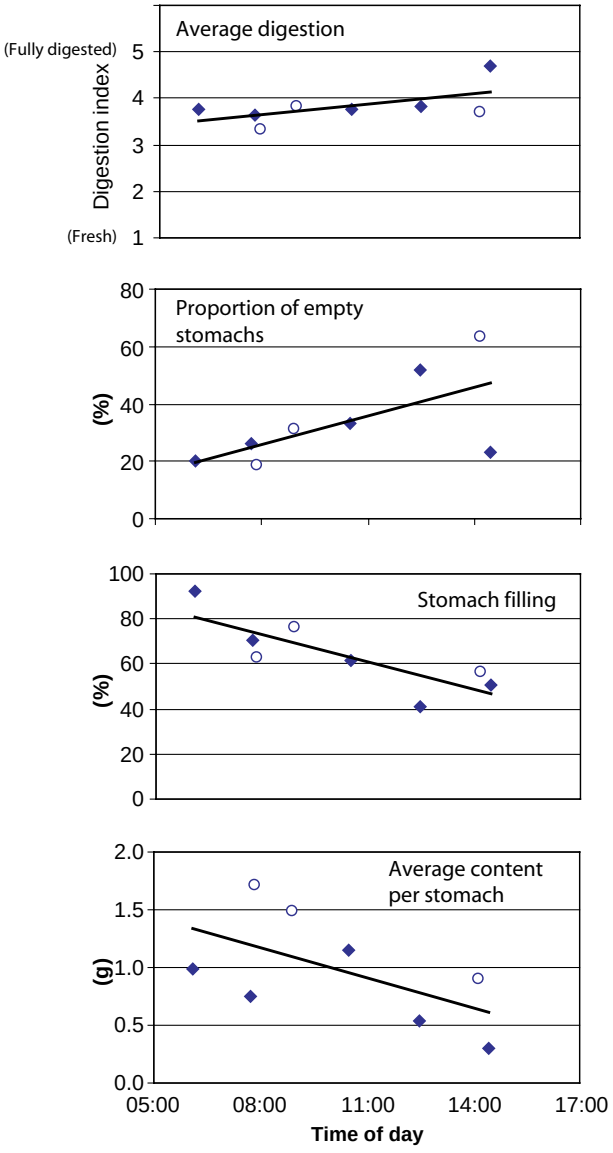

Figure 5. Stomach contents and degree of digestion of food at different time of day for poor-cod caught on the Faroe Bank. Open symbols are for March while filled are for September observations.

Bank (Magnussen 2007). This high growth performance seems to be a general fact for resident fishes on the Faroe Bank. In an interpopulation comparison of growth patterns of 14 common fish species on the Faroe Bank, Magnussen (2007) found that the resident species on the bank were, on average, 36% larger when they reach sexual maturity than individuals of the same age in other populations. This high individual growth was mainly ascribed to high primary production and favourable temperature. For poor-cod specifically, they were 36% larger on the Faroe Bank than in other populations compared.

With bottom temperatures of 8°C in March and almost 11°C in September (Magnussen 2007), the ambient temperature for poor-cod on the Faroe Bank is high compared to other North Atlantic populations. This condition will most likely enhance the individual growth, since growth of fish mainly depends on environmental factors (Gjedrem 2000). However, the high growth cannot be explained by the high temperature alone because in some of the other habitats occupied, the ambient temperature is even higher than on the Faroe Bank. In the Celtic Sea and Eastern English Channel, the mean annual bottom temperature is 11°C. In the Irish Sea and west of Scotland, it is 10°C (Lee & Ramster 1981). Despite that, these populations have a lower individual growth than poor-cod on the Faroe Bank (Menon 1950; Beverton & Holt 1959).

In regard to age composition, no differences were detected between females and males in the present investigation. However, females were larger than males in both seasons (Figure 2). This difference indicates separate growth rates, with faster growth for females, which also is reflected in the growth curves, the length–weight relationship as well as in the asymptotic sizes ($L\infty$ and $W\infty$), females being larger in both seasons (Figure 3 and Table II). Combined over seasons, the condition factors were 1.01 for females and to 0.94 for males. These values are somewhat lower than found for poor-cod in the Plymouth area (Menon 1950), where, over the year, they vary from 1.16 to 1.42 for females and 1.18 to 1.35 for males (Menon 1950). The asymptotic lengths were 26.8 and 22.6 cm for females and males, respectively, which for both sexes was greater than found for this species in most other areas (Menon 1950; Beverton & Holt 1959; Jennings et al. 1999). Such sex-specific difference in the growth pattern has also been observed for the poor-cod in the Plymouth area (Menon 1950) and occurs often in fishes. Generally, it is explained as a consequence of sexual selection and difference in allocation of energy for somatic growth (see e.g. Echeverria 1986; Pyron 1996; Henderson et al. 2003; Curtis & Shima 2005).

Spawning

Generally, poor-cod spawn at depths of 500–100 m, with water temperature not less than 8°C and salinity 32.0–35.4‰ (Svetovidov 1948). On the Faroe Bank, the reproduction biology of poor-cod has never been studied systematically. However, based on results from previous bottom and pelagic 0-group surveys, we know that at the end of March poor-cod is almost ready for spawning, but the main

Table IV. Comparison of life-history parameters among poor-cod populations. F refers to females and M to males.

Population	Length of fish Average (range) (cm)	Spawning period Main (duration)	Maturity Age (year)	Maturity Length (cm)	Condition factor	Empty stomachs (%)	References
Faroe Bank	21 (14–28)	Second half of April	1.7 F 2.7 M	19 F 20 M	1.01 F 0.94 M	39–49	Present study
West of Scotland	–	April (Mar–June)	<2	16 F 14 M	–	–	Cooper (1983)
Swedish west coast	– (9–27)	–	–	–	–	12	Mattson (1990)
Norwegian Deep	17 (11–27)	–	–	–	–	–	Albert (1993)
Plymouth area	14 (8–20)	– (Feb–May)	2	13 F 11 M	1.16–1.42 F 1.18–1.35 M	5–18	Menon (1950)

spawning has not really started. Additionally, pelagic juvenile poor-cod (i.e. metamorphosed) are, in some years, caught in the 0-group survey, which is in the beginning of July. At that time of the year, they have a length of 7–29 mm. In others years they are not to be found in the catch, probably because they have settled, which according to Pethon (1998) occurs at a length of 10–12 mm. Based on these facts, we conclude that the main spawning of poor-cod on the Faroe Bank most likely occurs in the middle or second half of April, which is quite similar to what has been found for this species in other populations in the North Atlantic (Table IV). Females reach sexual maturity at an earlier age than males (1.7 and 2.7 years, respectively). However, because of the higher individual growth rates for females, the maturity length is about the same, around 20 cm. The maturity age found in this study is similar to what has been found for poor-cod in other populations, but the lengths are somewhat greater (Table IV).

Food

The present investigation indicates that poor-cod on the Faroe Bank feed mainly during the night and early in the morning (Figure 5), which is in accordance with earlier findings on the forage of poor-cod in other areas (Armstrong 1982; Mattson 1990; Albert 1993). On the Faroe Bank poor-cod feed mainly on prey living on or near the bottom (hyperbenthos). Crustaceans form by far the greatest part of the food consumed and make up nearly 70% by weight of the food items identified (Table III). With the crustaceans as the main food, the Faroe Bank poor-cod followed the same feeding habits as found for this species in other areas in the Atlantic (Menon 1950; Nagabhushanam 1965; Armstrong 1982; Mattson 1990; Albert 1993).

Although there are many similarities in terms of major food organisms between poor-cod on the Faroe Bank and in other areas, differences have also been observed in the feeding habits. One of these differences is fish. On the Faroe Bank, fish makes up only a small fraction of the food, only one stomach containing fish in March and two in September (Table III). This is completely different from what has been found for poor-cod in other populations: for the Plymouth area, fish makes up, on average, 20% of the food volume eaten over the year, with a peak in July, when fish occurred in almost 62% of the stomachs (Menon 1950). Polychaetes also usually form an important part of the food eaten by the poor-cod, but on the Faroe Bank they only form a minor component. In the Norwegian Deep, polychaetes occurred in 83% of the poor-cod stomachs (Albert 1993) and, for the Plymouth area, they were found in 4–44% of the stomachs over the year, with a peak in April, when as much as 16% of the food volume consisted of polychaetes (Menon 1950). The low fraction of polychaetes in the food of poor-cod on the Faroe Bank is probably due to the poor habitat conditions for polychaetes on the Bank. The relatively strong tidal current (Simonsen 1999) carries off a heavy load of organic sediment. This causes clean shell sand to predominate over most of the bottom at depths of less than 200 m (Magnussen 2002), giving poor conditions for infauna. Therefore the occurrence of polychaetes on the Faroe Bank is extremely low, both regarding the number of species and the number of individuals (Ditlevsen 1929). The same is probably the case for the burrowing crustaceans.

In both seasons, a large portion of poor-cod stomachs were empty: 49% in March and 39% in September (Table III). This is much higher than reported for this species in other areas. For the Plymouth area, it ranged between 5 and 18% during the year (Menon 1950), and off the Swedish west coast 12% of the stomachs were empty (Mattson

1990). As mentioned earlier, poor-cod tends to feed during the early hours of the night (Figure 5). The majority of the samples both in March and September were caught in the middle of the day, so by midday most of the food intake had probably been digested. Unfortunately, no reported data on poor-cod have been found describing the temporal variation of stomach filling. However, our investigation indicates that the proportion of empty stomachs increases during the day (Figure 5). The assumption of an early hour for food consumption is further supported by the degree of food digestion. In both seasons, more than 60% of the eaten food had a digestion level of 4, meaning that almost all the food was digested and only parts of the prey were identifiable. Thus, the high number of empty stomachs on the Faroe Bank could possibly be due to the time of day of sampling.

In conclusion, the present study shows in some detail, that poor-cod on the Faroe Bank differ from other poor-cod populations. On the Faroe Bank, poor-cod live on the shallower part of the Bank at preferred depths of about 120–130 m, in a habitat consisting mainly of shell sand and sand. The length range of the specimens varies from 14 to 28 cm, with an average length of approximately 21 cm. Females have higher growth rates than males and, thus, were larger than males in both seasons. Females reach sexual maturity one year earlier than males but, because of the higher growth rates, both sexes have similar maturity lengths, about 20 cm. Crustaceans were found to be the main food for poor-cod living on the Faroe Bank; but also fish and polychaetes were part of the food.

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