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FISH SHAPED BAIT DOES NOT IMPROVE THE RESPONSE OF COASTAL COD

by

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ABSTRACT

The behaviour of coastal cod (*Gadus morhua*) towards baits of two shapes, one rectangular and one shaped to represent a fish, was observed in the sea with underwater television. Cod showed no difference in the response towards the two bait types. This is explained by a great breadth of diet of coastal cod, and other bait characteristics than shape being more important for bait selection. Large cod showed a more intense response towards the baits than small cod.

INTRODUCTION

Several aspects of the bait influence fish behaviour and responses towards a baited longline (Løkkeborg 1989). Stimulatory capacity, attractant release rate and physical strength affect the catching efficiency (Mackie et al. 1980; Løkkeborg 1985), whereas bait size is regarded as the most important factor affecting the size selectivity (Pope 1966; Johannessen 1983).

de Groot (1971) showed that turbot (*Scophthalmus maximus*) would respond in the laboratory to models of fish and shrimps but not to spherical models. Longline fishing trials for cod (*Gadus morhua*) showed a preference by smaller fish for natural shrimp bait over a rectangular artificial bait, whereas there was no difference for larger fish (Løkkeborg 1990). Thus, bait shape may also prove to be of importance for the fish capture process of longlining.

The present paper presents the results of a field study on the behaviour of coastal cod towards baits of two different shapes. The hypothesis tested was that a bait in the shape of a fish would elicit a stronger response than a rectangular bait. In addition, as smaller and larger cod prey on different organisms, difference in behaviour between small and large cod was investigated.

MATERIALS AND METHODS

The observations were made from a vessel in a sound near Arnøya (northern Norway) at 20 m depth in August 1989. A light-sensitive underwater camera was mounted vertically in a frame. A test longline was attached to the frame and positioned 1 m below the camera and 0.5 m above the bottom. Four hooks (Mustad EZ-Baiter, Qual. 39976, No. 9/0) with 35-cm long monofilament snoods were attached to the test line 35 cm apart.

The baits were prepared by filling minced mackerel (*Scomber scombrus*) into fine-meshed nylon bags of two different shapes, one rectangular and the other "fish-shaped" (Fig. 1). The rectangular bag was 5.5 cm long and 3.0 cm wide. The "fish-shaped" bag was 8.5 cm long and 2.5 cm wide (the maximum width), and counter-shaded.

Observations were made during day-time. At the beginning of each trial, the test

line was baited with the two baits on alternating hooks, and the frame placed on the bottom. Each trial lasted for 3 h or until there were free baits of only one type left. There were 10 trials.

The fish behaviour was videotaped for later analysis. The behaviour patterns described by Løkkeborg et al. (1989) were used to categorize the behaviour of fish responding to the baits. For fish making more than one behaviour sequence, only that of highest intensity was recorded. The fish were roughly classified in two size groups, small and large, respectively.

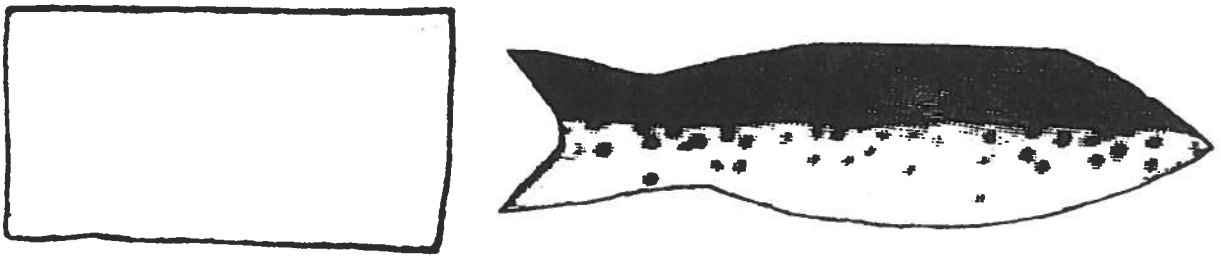

Fig. 1. Shape of baits used in field studies on the behaviour of cod.

RESULTS

Cod was the most abundant fish in the area. Table 1 shows the behaviour of cod towards the two bait types. There was no significant difference in the number of fish responding to the rectangular bait and the "fish-shaped" bait (233 and 208, respectively; binomial test, $p>0.20$). Also, the relative frequencies of behaviour sequences including approach, taste, bite and jerk/rush, respectively, were similar for the two bait types (chi-square test, $p>0.10$), indicating no difference in response intensity towards the baits.

The behaviour of small and large cod towards the baits was significantly different (Table 2; chi-square test, $p<0.05$). Large cod more often made sequences that included jerks and/or rushes than small cod (30.7% and 18.9%, respectively). Large cod therefore showed a more intense response.

Table 1. Behaviour of cod towards a rectangular bait and a "fish-shaped" bait. The percentages and numbers (in brackets) of responding fish making a behaviour sequence including approach, taste, bite and jerk/rush, respectively, are shown.

Type of bait	Behaviour sequences			
	Approach	Taste	Bite	Jerk/Rush
Rectangular	15.9% (37)	60.5% (141)	4.7% (11)	18.9% (44)
"Fish-shaped"	11.1% (23)	59.1% (123)	6.7% (14)	23.1% (48)

Table 2. Comparison between the behaviour of small and large cod towards baits. The percentages and numbers (in brackets) of responding fish making a behaviour sequence including approach, taste, bite and jerk/rush, respectively, are shown.

Size of fish	Behaviour sequences			
	Approach	Taste	Bite	Jerk/Rush
Small	12.8% (47)	62.8% (230)	5.7% (20)	18.9% (69)
Large	17.3% (13)	45.3% (34)	6.7% (5)	30.7% (23)

DISCUSSION

Prey selection by visual predators is affected by physical appearance involving cues such as movement, colour, size and shape (Holmes and Gibson 1986; Ibrahim and Huntingford 1989). In a fishing trial, a rectangular artificial bait caught fewer small cod than natural shrimp bait, whereas there was no difference in the number of large cod (Løkkeborg 1990). This difference was explained by a preference in smaller cod for shrimp, and a restrained response towards a novel prey like the artificial bait. The results of the present study were, therefore,

somewhat surprising in that they suggested that bait shape was not an important cue involved in the behaviour of cod towards baits.

The visual characteristics responsible for prey selection have been determined for turbot (Holmes and Gibson 1986) and three-spined sticklebacks (*Gasterosteus aculeatus*; Ibrahim and Huntingford 1989). Movement and colour were found to be the most important stimuli, whereas the shape of a prey was less important. In addition, chemical stimuli are of great importance in eliciting a response by cod towards a bait (Løkkeborg 1989).

The present finding may also reflect a relatively great breadth of diet of cod in the sound where this study was conducted. The diverse fauna of shallow waters and food waste from a fish farm located in this sound represent a great variety in potential prey items. There may be a general inverse relationship between euryphagy and the importance of prey shape (Holmes and Gibson 1986).

The responses of large cod towards the baits were shown to be more intense than those of small cod. Fish are the major prey category of larger cod (Mehl et al. 1985). Such prey is active, and may demand responses of high intensity. Crustaceans, which move more slowly, are the dominant prey of smaller cod.

The results obtained in the present study indicate that bait shape is not an important characteristic to consider in the development of artificial bait. However, if there is an inverse relationship between euryphagy and the importance of prey shape, bait shape may prove to be of importance in bait selection by fish living in less diverse communities. Thus, more research on bait appearance should be performed.

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