Skýrsluágrip Rannsóknastofnunar fiskiðnaðarins
Icelandic Fisheries Laboratories Report Summary

Titill:	Literature Research on Artificial Bait		
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Ágrip á íslensku:

Yfir tuttugu erlendar og íslenskar greinar, ritgerðir og bækur um gervibeitu fyrir linuveiðar voru skoðaðar. Þær tilraunir sem gerðar hafa verið hafa ekki leitt til framleiðslu á vænlegri gervibeitu. Það er því greinilegt að framleiðsla á gervibeitu er flókið verkefni.

Áður enn fiskurinn gleypir beituna og festist á króknum gerir hann miklar athuganir. Fæðuörvandi efni draga fiskinn að svæðinu og þegar þangað er komið athugar fiskurinn bragð og áferð beitunnar. Við öflun heimilda var einblínt á línuveiðar á þorski við Íslandsstrendur. Í dag er engin góð gervfibeita til á markaðnum.

Lykilorð á íslensku: Gervibeita, fæðuörvandi efni, geðjun beitu

Summary in English:

Over twenty foreign and Icelandic articles, theses and books on artificial bait for long-line fishing were studied. The literature does not indicate that experiments have led to a successful commercial production of artificial bait. It is obvius that making an artificial bait is a complicatied task.

For the fish to swallow the bait and thus get hooked is preceeded by a major investigation by the fish. The chemical stimuli attracts the fish to the area, then the bait is investigated for texture and shape. Our major literature research is concentrated on longline fishing for cod in Icelandic waters. Today no effective artificial bait is on the market.

English keywords: Bait, Artificial bait, feeding stimulants, acceptance of bait, longline.

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INTRODUCTION

By reading the literature it can be seen that preparing an effective bait for longline fishing (cod, haddock) is a complicated task. For the fish to swallow the bait and thus get hooked is preceeded by a major investigation by the fish. Everything has to coincide; smell, texture and shape. The chemical stimuli attracts the fish to the area, then the bait is investigated for texture and shape. Sometimes the fish can take the whole thing in its mouth i.e. bait and hook and then spit it all out without getting hooked.

Our literature survey is concentrated on longline fishing for cod in Icelandic waters. The major feed for cod in Icelandic waters is capelin (*Mallotus villosus*) and shrimp (*P. borealis*). In attempt to formulate an artificial bait for this species the chemical stimulant that resembles cod's natural diet has to be take into account. Visual stimulant is very likely unimportant as the capelin does not give any phosphoric impact.

By going through the literature it can not be seen that an effective artificial bait is on the market. All kinds of projects have been tried in the trust of preparing an effective artificial bait, especially the ones that survive soaking for many hours without loosing all their feeding stimulants. In 1970 a literature study was made at the Icelandic Fisheries Laboratories on the possibility of using artificial baits. The literature research covered the years 1960- 1970 (Salómonsdóttir 1970). It was found out that a lot of work has been done, especially in developing phosphorescent plastic bait, but there were no positive results reported.

The impracticality thing with ordinary bait from cuts of herring for example, is that it only tolerates soaking for few hours before it becomes soggy and looses the smell stimuli to attract the fish to the line.

LITERATURE

Acceptance of bait and feeding stimulants

Johnstone and Mackie 1986, discussed research that was done at the Marine Laboratory in Aberdeen: Initially research was designed to make observations

employing underwater television of the behaviour of fish towards several conventional baits such as mussels and squid fished on a short section of small line. From these observations the process of fish capture during baited line fishing can be broadly divided into four stages. The first stage involves the orientation of fish from a distance and is termed "attraction" . The second stage, termed "attack" or "bite", is the initiation of feeding involving taste and touch. Thirdly, "hooking" occurs when the hook engages in the fish during bait sampling or after acceptance and finally, "capture", when the hooked fish is landed on deck. In general the average catch rate of 15 cod per 100 baited hooks is a reasonable return from commercially baited small lines. The low rate of successful capture was particularly surprising in view of the activity observed around the baited hooks. Television observations of the responses of fish to artificial baits in the sea demonstrated some of the shortcomings. Baits which attracted fish, often did not stay on the hook sufficiently firmly to withstand repeated sampling or attack. The bait was usually taken and devoured but was often dislodged from the hook before being swallowed. It appears that, even if a bait attracts fish and the bait is taken, examination continues within the mouth. If the bait is not acceptable it is often rejected at this stage, complete with hook. The problem thus seems to be to create the correct texture and taste of bait which, once taken, will stimulate a swallowing response and thereby prevent rejection of the ingested hook. In fishing trial (Løkkeborg 1991) on torsk (*Brosme brosme),* ling *(Molva molva)*, cod *(Gadus morhua),* and haddock *(Melanogrammus aeglaefinus)* were minced raw material were used as feeding stimulants and nylon bag was used as reinforcement. The texture of the nylon bag had a negative effect on the catching rate, most pronounced for cod and haddock. Since most fish eat a variety of natural food materials with a wide range of textures. It appears that the crucial thing in development of artificial bait is to find the right taste.

Bait lost and release rate of attractants

Immediately after the bait is dropped into the sea it starts to loose its catching ability. There are three major reasons involved: Bait is lost in handling, that is how the bait is hooked on and how the longline is put into the sea, pillage such as starfish, crabs and other creadures and at last decreased flow of feeding stimulants from the bait.

Mackie and Shelton 1972, Robert E. Muller and W.F. Van Heukelem 1986, and Løkkeborg 1989 are all unanimous about the importance of amino acids, not as a single substance but in combination with other organic compounds such as quaternary ammonium compounds, nucleosides and nucleotides, and organic acids. Løkkeborg 1990 (1) used a fluorometric detection to determine chemical flow from mackerel and an artificial bait based on shrimp extract and carrageenan, by estimating the release rate of amino acids. The results showed that the release rate of amino acids from both baits is at highest level in the first 1,5 hours and is followed by a much slower release rate the next 2 -24 hours. The release rate for this particular artificial bait is similar to the release rate of mackerel but the artificial bait declined slightly more rapidly. In artificial bait one should be able to control the rate of realise by using a different type of binding agent and supporting material. In above trial were Løkkeborg used foam rubber plus 2 % carregenan, similar release rate were experienced as for a natural bait. Løkkeborg and Johannessen (1992) studied the importance of chemical stimuli in bait fishing. In fishing trials for torsk (*Brosme brosme*) they compared the catching power of baits soaked in sea water prior to baiting with a fresh bait. Mackerel baits pre-soaked for 2, 4 and 24 hours gave 87%, 84% and 50% of the catch rate of fresh bait, respectively. Compared with fresh bait, all pre-soaked baits gave a significantly lower catch of torsk and the difference in catch rate increased with increasing time of pre-soaking. The bait loss was significantly lower for the pre-soaked bait than for fresh bait in all comparisons. To trigger bait intake, taste stimuli are probably of great importance. Fish responding to the bait without being hooked indicates that pre-soaking may have made the bait less attractive to predators. Fish caught on pre-soaked baits may have been attracted to the vicinity of the longline by the odour plume from fresh baits, thereby causing an underestimation of the difference in catching power. Bait soaked for 24 hours prior to baiting gave a much lower catch rate than bait pre-soaked for 2 and 4 hours. This indicates that the release of attractants after 24 hours of soaking has decreased to a level that influences the catching efficiency considerably.

Size of bait and reduced catch of under sized cod

Løkkeborg (1990) (2) did an experiment where he found out that artificial bait in longlining can be size selective for the catch i.e it reduces catch of under-sized cod (*Gadus morhua*). The bait he used was provided by Whitney Marine Laboratory, University of Florida. The baits were composed of a reinforced polyurethane foam impregnated with feeding attractants that occur in natural shrimp bait. No further details of the feed attractant was given. The foam was cut into three different sizes; small (35x20x2 mm), medium (35x20x5 mm) and large (50x20x8 mm). The concentration of attractants in each bait was normalised so that each bait released the same amount of attractants irrespective of size. The bait swell when soaked in water and the real sizes when fishing were, (35x21x4 mm), (39x24x9 mm) and (56x22x15 mm). The natural control bait was shrimp (*Pandalus borealis* Kr∅yer) of one size (mean 79x33x14 mm). The natural bait was therefore larger than the artificial bait and differed also in shape. The total catch rate ranged from 20 to 43 fish per 100 shrimp-baited hooks. The small artificial bait gave nearly the same catch rate as the natural shrimp bait, whereas artificial bait of larger sizes compared inferiority with the shrimp bait. In all comparison artificial bait caught a lower number of small cod, whereas there was no difference in the number of large cod. The proportion of under-sized cod (< 42 cm) caught on artificial bait was significantly lower than for natural shrimp bait. This difference cannot be explained by the effect of absolute bait size. Larger baits have been shown to catch less longer cod than smaller baits (McCracken 1963;Johannessen 1983). Also larger cod have a greater diet breadth (Mehl et al 1985) and therefore have greater experience of different prey types.

Material for making artificial bait

Løkkeborg (1991) did a fishing experiments with an alternative longline bait using surplus fish products. Bag-enclosed bait of minced herring gave higher catch rate for torsk, ling and haddock than natural bait.

Johnstone and Macke (1990) did a comparison of feeding stimulant activity of squid (*Loligo forbesi* Steenstup) a mantle ethanol extract, synthetic squid mixture and component of that mixture for juvenile cod. That ethanol extract of squid and synthetic squid mixture were eaten in equal amounts shows that all the chemicals

acting as feeding stimulants are present in the synthetic squid mixture and that lipids are not involved. The results demonstrate that L-amino acids are the major feeding stimulants for cod. The aromas, basic- and acidic amino acids were feeding deterrents. This study demonstrates also absolute stereospecificity at the receptors surface. L-neutral amino acids were less effective than the L- amino acid mixtures but D- neutral amino acids were inactive. In paper published Mackie (1973) were he is looking at feed stimulants for lobster (*Homarus gammarus*), his results indicate that a high degree of stereospecificity is involved. Mackie and Shelton (1972) showed that a number of single amino acids attract lobster (*Homarus americanus*) but that certain mixtures were more attractive than any of the amino acids individually. They also tried the attractiveness of the bait when lipids were removed from the filtered extract and found out that attractiveness was unimpaired, which indicates that oils and fats are not involved. Therefor the main concern in preparing an attractant should be on the amino acids and amines.

DISCUSSION

For many years people have tried hard to make an artificial bait for long line fishing that fishes well and is easier to handle than the ordinary bait from cuts of herring or cuts of other raw fish. In Iceland people started to look seriously into making artificial bait around 1970 (Salómonsdóttir, 1970) and now, 27 years later no prosperity has become of it neither in Iceland nor other countries as far as can be seen. The research that have been done on artificial bait and how fish respond to a baited hook have shown that the factors involved in the act of a fish getting hooked on a longline are many. The bait undergoes a major investigation before the fish accepts it and bites on the hook. The smell has to be tempting, strong and long lasting enough to attract the fish to the bait, the texture has to be the right one and the bait has to have an acceptable taste. If the fish does not accept the taste of the bait when nibbling into it, the bait is not swallowed and the fish of course does not get hooked.

It is certain that a lot of investigations and testing are not reputed in the literature. Even though a lot of brainstorming, mixing and testing have been done on artificial bait, there is still no known artificial bait on the market today. Yet, each research

project brings us nearer to the end point and that is making artificial bait that fish will bite on.

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