International Council for
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Fish Capture Committee

REPORT OF THE AD HOC WORKING GROUP ON ARTIFICIAL BAIT AND BAIT ATTRACTANCE

Convenor: Åsmund Bjordal, Inst. of Fishery Techn. Res., Bergen, Norway

Rapporteur: Erdmann Dahm, Inst. fur Fangtechnik, Hamburg, Germany F.R.

Meeting time and place: 2. - 4. May, 1984, Hirtshals - Denmark.

Terms of reference: This working group shall concentrate on the stimuli aspects, including two main topics: Bait attraction and bait acceptance. The working group shall also review past and current work on artificial bait and related subjects. During the meeting in Hirtshals, the following topics should be considered in particular:

a) Past and current research and development activities in different countries
b) The most important field of further research
c) Relevant methodology and experimental designs
d) Possible coordination of the activity within this field.

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Participants:

Å. Bjordal	Norway
W.E.S. Carr	USA
E. Dahm	Germany F.R.
K.B. Døving	Norway
A. Fernø	Norway
W. v.d. Hak	Netherlands
C.t. Hallers-Tjabbes	Netherlands
E. Larsen	Denmark
S. Løkkeborg	Norway
A.M. Mackie	United Kingdom
P. Solemdal	Norway
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AGENDA

1. Traditional longlining and longline baits.
2. Chemical attractants and feeding stimulants in fishes.
3. Research and development work on artificial bait.
4. Discussion.
5. Recommendations.

1. TRADITIONAL LONGLINING AND LONGLINE BAITS.

1.1 C. ten Hallers Tjabbes: "Bait fisheries - Data from History - Netherlands." Different bait types and methods of operations in traditional Dutch longlining are described.

1.2 Johnstone, A.: "Review of the status of line fishing in the United Kingdom." The paper reviews the present longline fishery in the U.K. according to landings and species. Longlining is definitely of minor importance nowadays and shows in general a declining trend.

1.3 Bjordal, Å.: "Traditional baits used in Norwegian longlining." In current Norwegian longlining mainly three bait types are used to catch four main target species. Annual bait consumption is about

15000 metric tons of mainly mackerel and squid. Several other bait types are described.

1.4 Bjordal, Å.: "Traditional and mechanized longline operation." Video presentation.

DISCUSSION

This session on traditional baits and longlining was followed by a short discussion dealing mainly with the following aspects:

a) Importance of lipids as carriers for taste stimuli: general experience is that fat fishes are good bait. This is however not necessarily due to the lipids as shown by Mackie and Johnstones laboratory studies.

b) Supposed reduction of bait quality after long term deep freezing: freesing affects both stimuli and texture quality.

c) The great variety in traditional longline baits clearly indicates a diverse bait preference for different target species and seasons.

2. CHEMICAL ATTRACTANTS AND FEEDING STIMULANTS IN FISHES.

2.1 Døving, K.B.: "Reaction patterns of cod to olfactory stimuli." Separate stimulation of the four main nerve bundles of the olfactory tract induces distinctly different behaviour patterns of which two are typically associated with feeding. Tauro chelate (Bile Salt) is shown to induce snapping.

2.2 Carr, W.E.S.: "Studies of chemically stimulated feeding behaviour in marine animals." First, Carr gave a movie presentation and some explanations to his experimental designs of behaviour studies in the laboratory. The experiments were carried out with snails, shrimps and pinfishes. This was followed by a review of the works on different chemical stimuli for fish.

2.3 Mackie, A.M.: "Studies into the chemical nature of feeding stimulants for fish." The paper reviews recent work on feeding stimulants for different marine fish species as found out in the development of artificial fish food.

2.4 Johnstone, A. and Mackie, A.M.: "Investigation of bait acceptance by the cod, Gadus morhua, L." Results of laboratory experiments on food acceptance by cod are given and the methodology is discussed.

2.5 ten Hallers-Tjabbes, C.: "Mechanisms for interaction between sublethal doses of pollutants and the attraction to food odours or other chemoreception mechanisms." The paper gives examples for interactions of different kinds between pollutants and important olfactory stimuli and raises questions about possible mechanisms for their effect.

This session was continued by a presentation by Steinar Olsen on computer model work on longlining and smell distribution in water at different current conditions - based on the papers:

2.6 Olsen, S. and T. Laevastu, 1983: "Factors affecting catch of longlines, evaluated with a simulation Model of longline fishing." NWAFC Processed Report 83-04.

2.7 Olsen, S. and T. Laevastu, 1983: "Fish attraction to baits and effects of Currents on the distribution of smell from baits." NWAFC Processed Report 83-05.

DISCUSSION

The discussion during the session following the presentation of the papers mentioned, mainly covered the following problems:

Is the feeding behaviour elicited by a single key substance or a mixture of different stimulants?
Most observations so far point to the latter and to seasonal and age-

depending changes in the composition of maximum attractivity.

Is stimulus perception inhibited or enforced by environmental conditions? Positioning of the gear in the right way to the current might increase catch results. Despite of many adverse effects, some pollutants might enforce stimulus perception or even act as stimulus.

3. RESEARCH AND DEVELOPMENT WORK ON ARTIFICIAL BAIT.

3.1 Solemdal, P. and S. Tilseth: "Reactions of cod (Gadus morhua L.) to smell stimuli from bait, laboratory and fields studies." This paper reviews a comprehensive development of artificial bait, including behaviour studies in laboratory and field trials in commercial longlining in Norway from 1976 ot 1982.

3.2 Solemdal, P.: "Individual variation in response from smell stimuli by cod (Gadus morhua L.)." In the selection of experimental fish for behaviour studies on bait response, it should be noted that the response strength is affected by spawning season, feeding intensity and other (unknown) factors. Individual variation in response strength and bait preference is large. This variation might be reduced by controlled feeding.

3.3 Løkkeborg, S.: "Testing of artificial baits by behaviour studies on cod (Gadus morrhua L.) in the laboratory." Artificial bait based on shrimp extract and two different carriers - Carrageenan and Alginate - proved to be as effective as reference bait (Mackerel).

3.4 Fernø, A. and Å. Bjordal: "A field study on the behaviour of cod and haddock towards natural and artificial bait." The same artificial baits as mentioned in the above paper showed low effectiveness towards haddock, while mackerel ensilage gave encouraging results. The presentation also included a video film from the field studies.

3.5 Johannessen, T.: "Fishing experiments with different longline baits for cod, February 1984." Presoaking of bait (boiled shrimp) showed little effect on catch rate. Shrimp in nylon bags gave reduced catch rate but had a selective effect towards bigger fishes. Artificial bait based on shrimp extract and fish meal gave lower catch - 30% - compared to boiled shrimp.

4. FINAL DISCUSSION

The meeting was closed by a final discussion covering the following aspects:

4.1 The discussion during the meeting have made clear that the simple term "bait attraction" covers a lot of different aspects. An effective artificial bait must have the properties of an effective smell (long distance perception), effective taste (short distance examination) and effective texture. In addition it ought to owe a sufficient suitability to mechanical handling, storing and transportation as well as low cost and selectivity towards chosen target species. General availability of all components should allow continous production to avoid seasonal shortages.

4.2 This aim can only be reached in a joint effort of researchers working on the different aspects of the whole problem. Meetings as in Hirtshals uniting fishery biologists, physiologists, biochemists, gear technologists and behaviourists are to be considered as most useful for the exchange of scientific information on the subject. With regard to future work incorporation of nutritional technologists into the group should be aspired.

4.3 Work done so far has lead to some kind of agreement on effective substances for long distance perception (smell) but much has still to be done on stimuli responsible for biting and divouring behaviour (taste). fish silages seem to contain some of the effective factors and might therefore be a cheap and easily available component of future artificial baits. The effectiveness of a.b. can probably be enlarged by stimulus enhancement in connection with

low-level lights in the vicinity of the bait. Self-bouyancy of the bait could eventually reduce predation by food competitors.

4.4 Ingestion of food is apperantly influenced by the right structure of the carrier. It ought to withstand mechanical handling during baiting and repeated attacks of the target species without loosing much of its attractive properties. Its surface should have a structure ensuring sufficient leachout rates. "Swiss-roll" and "sausage" constructions of artificial bait have shown so far as well as rubber foam pieces less attractivity compared with natural bait.

4.5 The present status on a world-wide scale in the development of artificial longline bait is that in controlled comparative fishing, artificial bait have nowhere reached more than 50% of the catch rate of natural bait. However, an a.b. developed for sport fishing in the USA has proved to be effective (Ref.: W.E.S. Carr).

4.6 Laboratory and field studies on artificial bait often do not show similar results. Involuntarily introduced conditioning should be carefully avoided in experimental set ups in laboratories. Conditioned reflexes may on the other hand be useful tools to test for attractivity of single substances or fractions of press juices.

4.7 The participants agreed on the following problems being the most urgent for future research:

- Definition of the optimum concentration for different food stimuli
- Definition of the optimum leach-out rate
- Texture and structure of the carrier
- Inventory of the specific stimuli effective in the feeding behaiour of different species
- Stimulus enhancement by other than chemical means
- Reduction of bait predation by other organisms

5. RECOMMENDATIONS

5.1 With regard to the financial situation in most member countries the group sees at present no possibilities for direct cooperation in an

international project. To avoid double work constant exchange of information on research results is emphasized. However, if it is possible to obtain appropriate funding, international cooperation is highly recommended.

5.2 The group recommends a follow-up meeting in about one year. The meeting should be held at a place which can be reached by most participants at moderate costs and offers the possibility to demonstrate some of the laboratory and field trial set-ups currently used in artificial bait investigations. It is therefore recommended that the Ad hoc Working Group on Artificial Bait and Bait attraction meet in Bergen/Norway, 28th to 31st of May, 1985.