International Council for
the Exploration of the Sea

Gear and Behaviour Committee
C.M. 1975/B:20

REPORT OF THE WORKING GROUP ON REACTIONS OF FISH TO FISHING OPERATIONS

Chairman: DR C S WARDLE
Rapporteur: DR S J DE GROOT

1. Meeting time and place: 24 - 25 April 1975, Ostend.

2. Participants:

Belgium	
F Delanghe	Rijksstation voor Zeevisserij - Oostende
G Vanden Broucke	"
J Van Hee	"
Canada	
G d'Entremont	Environment Canada, Fishing Operation
France	
G Kurc	Inst Scient et Technique des Pêches Maritimes
R Le Men	"
Germany	
K Lange	Inst f Fangtechnik
Netherlands	
C P Boonstra	Netherlands Institute of Fishery
S J De Groot	"
P Korbee	"
E J De Boer	"
R C Peters	Laboratory of comparative physiology, Univ Utrecht
A Schuijf	"
A Verbaan	Netherlands Institute of Fishery
Norway	
I Bjarkum	Inst of fish tech research - Trondheim
K Olsen	Fish Res inst Bergen
United Kingdom	
J F Foster	White Fish Authority - Hull
A R Margetts	Fisheries Laboratory - Lowestoft
USSR	
V P Simbirev	Ministry of Fisheries of the USSR, Moscow
A I Treschev	All Union Research Institute of Marine Fisheries and Oceanography - Moscow
Scotland	
P A M Stewart	Marine Laboratory - Aberdeen
C Wardle	Marine Laboratory - Aberdeen

*General Secretary, ICES, Charlottenlund Slot, 2920 Charlottenlund, Denmark.

3. Agenda:

1. Reactions of fish to electric fields; a joint discussion with members of the Sub-Working Group on Electrical Fishing Engineering. Possible discussion subjects of direct relevance to marine fishing operations:
   a. Attraction of fish by electricity
   b. Stunning of fish by electricity
   c. Herding and fencing of fish by electricity
   d. Tickler effect of electricity
   e. Tiring of fish by electricity
   f. Other applications of electricity known to delegates

2. Contributions or progress reports on other aspects of the reaction of fish to fishing processes.

3. Report on ad hoc aquarium meeting at Texel.

4. State of the 1974 Aquarium Survey.

5. Other subjects relevant to this Working Group.
6. Recommendations

4. Reaction of fish to electric fields.

Introduction

Dr Wardle summarized the main points of the previous meetings of this Working Group at Nantes in 1973 and Aberdeen in 1974 and introduced the subjects to be considered by the present meeting.

Proceedings

a. Experimental studies of direct stimulation of fish muscle.

Dr Wardle introduced the subject by presenting some new results on the effect of pulses used in electric fishing on isolated fish muscle. He described new observations on the contraction time of fish muscle where the contraction was related to size of fish. The results of these studies will be published in near future in Nature as well as an ICES paper to the next meeting of the Working Group at Hull. The significance of these measurements in relation to electric fishing was discussed. The importance of careful analysis of fish movements during anodic taxis was stressed. Ref. Nature London, 255, pp 725-727.

b. Attraction of fish by electricity

Mr Le Men presented the Blancheteau explanation why fishes are attracted to the anodes, basically a reaction of the nervous system. Dr Peters pointed out the difficulties in interpretation of such a system. Drs Stewart and Wardle presented an alternative system whereby both lateral muscles are stimulated by the field. However, due to the assymetric orientation of the fish within the field the two muscles are contracting unequally and the fish bends. This continues until the fish is within the intense zone of the field when both muscles are fully contracted and the fish appears to be narcotised. Dr Stewart suggested that this explanation allows a reverse effect and suggested experiments investigating this reversed effect should be carried out.

c. Stunning of fish by electricity

It was realized by the meeting that the practical application of stunning electric fields required too much energy to be applied in fishing gears in the sea.

d. Herding and fencing of fish by electricity

Dr Stewart explained the principle of the barrier experiments carried out in the circular tank at Aberdeen, using the now well known racing light technique. Mr K Olsen described attempts to use electric pulse fields to fence saithe in a Norwegian fjord.

e. Tickler effect of electricity

Dr Stewart presented a film illustrating a technique where by divers observe the reaction of flatfish as a tickling electric pulse field passes over the sand in which the fish are lying.

Dr Wardle suggested that a small investigation should be made by Dr Stewart to find out the importance of the pulse rise time.

f. Tiring of fish by electricity

Dr Wardle pointed out the importance of exhausting the anaerobic muscle system in the fish capture process and suggested that the rate of exhaustion could be increased using electric pulse fields at the correct frequency.

g. Other electric fishing topics

Dr Peters summarized the field of natural sensory systems that have been shown to respond to very low levels of electric field eg those used by some fish in nature for detecting food organisms (sharks, catfish).

Dr Peters concluded that it was unlikely that the system described could be used commercially except perhaps in the case of the eel (Anguilla anguilla).

Dr Stewart pointed out some of the problems in size selection of fish when using electric fields in fishing gear.

5. Progress reports

NORWAY. Mr Olsen described experiments investigating the practical application of the use of bubble curtains to concentrate and herd fish (saithe). He described successful experiments in the circular tank at Bergen where fish could be concentrated up to 30-40 fish/m^3 and in a small loch using two boats with a bubble curtain trail in between. One important drawback was the enlargement of the component bubbles when rising through water deeper than 15 meters. Norway is also undertaking research into long-line fish baits and studying the behaviour of fish around fish traps using underwater TV.

ENGLAND (UK). Mr Margetts showed a piece of illustrative sector-scanner film and described the present program where the reaction of individual cod (Gadus morhua), to the Granton trawl will be studied using the sector scanner and transponding tags. The problems of adaptation of the tagged fish were discussed.

USSR. Dr Treschev described experiments making use of light to concentrate fish (polar cod). He also mentioned the successful use of the towed vehicle (2 man) to examine the mid-water trawl and the fish escaping from the wings. He agreed that this apparatus was useful in conjunction with other observation techniques.

FRANCE. Open sea experiments were described investigating the use of artificial baits in the Tuna fishery. Results of the tests indicated that colour and/or brightness of the bait was important.

SCOTLAND (UK). Work continues on the swimming speed and endurance of fish. A film describing the action of the Danish-seine net and including examples of diver's observations of the reaction of fish to the gear is being prepared for publication and will be available during the next year.

The two-man towed vehicle is being completed after final modifications and will be available for experimental trials during the coming summer season. Experiments observing fish in the seine net will be made by divers using the new low light TV camera fitted with Sitcon tube.

6. Report on the Ad hoc Aquarium Meeting

The ad hoc meeting on design and practical operation of Research Aquarium systems at Texel, Netherlands took place from 7 - 10 April 1975 by kind invitation of the director of the Mussel Experimental Station. The draft report of the meeting was read to the working group at Ostend and it was agreed that it should be presented at the next council meeting.

7. Survey of fish behaviour research facilities in ICES countries

The questionnaire in final form was presented to the meeting for delegates to take to their home countries.

8. Recommendations

The appraisal of existing and new methods used to study the reactions of fish to gear. The Working Group approved that those should be the main subjects of the next meeting of the Working Group on the Reactions of Fish to Fishing Operations.

9. Appendix to this Working Group

C.M. 1975/B:19. Report of the Working Group on technical aspects of electric fishing.