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International Council for the  
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Gear and Behaviour Committee

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REPORT OF THE WORKING GROUP ON RESEARCH ON SOUND AND  
VIBRATION IN RELATION TO FISH CAPTURE

Ostende, 21 and 22 April 1975

Convenor: K Olsen

Rapporteur: C S Wardle

Introduction

In accordance with C.Res.1974/2:14e the Working Group on Research on Sound and Vibration in relation to Fish Capture reconvened in Ostende on 21 and 22 April 1975. The meeting was attended by representatives from Belgium, France, Federal Republic of Germany, Netherlands, Norway and the United Kingdom.

As Dr A D Hawkins was unable to undertake the convening of this meeting, the Chairman of the Gear and Behaviour Committee proposed that Mr K Olsen convene the meeting.

Proceedings

At the start of the present meeting it was found that the main business proposed by the Working Group meeting in Bergen in 1974 and recommended by the Gear and Behaviour Committee, could not take place. It had been recommended to consider the plans of cooperative work between Scotland, Poland, the Federal Republic of Germany and Norway involving sonograph analysis of noise and measurements of noise from trawls and the effect of towing speed and gear size. It was pointed out by the Convenor that this cooperative work is already going on and for scientific reasons the investigations are taking place during the period of the present meeting. Consequently Working Group members taking part in the investigations were unable to attend the meeting.

In order to obtain the maximum return from the cooperative work, the meeting found it necessary to propose to the Gear and Behaviour Committee that a second meeting of this Working Group should take place by the time the obtained data can be presented. Such a meeting has already been suggested by the Working Group meeting in Bergen 1974 for August/September 1975 in Aberdeen, Scotland.

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Those present agreed with a second proposal of the Bergen 1974 Meeting to discuss their countries' current interest in acoustic methods used to observe the reaction of fish under open sea conditions, and also to report current research projects known to representatives. It was also agreed to include a report of the Symposium on Sound Reception in Fish held in Utrecht University 16-18 April 1975.

### Progress Reports

#### France

G Kurc explained a serious problem with the characters (probably acoustic) of the French tuna fishing vessels. He translated parts of a research programme "Analyses des bruits sous-marins émis par des navires thoniers" and suggested that Noel Diner should present this work at a future meeting of the Working Group. No work had yet been done and no equipment bought, but essentially careful analyses of 20 or more good and bad tuna fishing vessels are planned, looking for acoustic characters that might attract tuna to or frighten tuna from the baited hooks. Many other features of the boats or gear had been examined and no correlation found. It was suggested that this programme should be examined by the meeting of experts proposed for August/September 1975 in Aberdeen. If this did not materialize then the programme should be sent to the experts of the Working Group for their advice before starting the experiments planned for June 1975.

#### Belgium

R Fonteyne described experiments in location of gear noise in trawls. He was using a system similar to the German "eel-system" with a hydrophone mounted on the gear and sending its information along a netzsonde cable to the towing vessel. Sound sources could be located by moving the hydrophone to various parts of the gear. Due to their small research vessel, they are not able to work in deeper water necessary for good acoustic analyses.

#### Germany (Fed. Rep.)

K Lange described a similar system used in Germany, a second system in cooperation with the German Navy, and a third project involving attempts to measure the pressure wave ahead of the fishing gear.

The F.R.G. vessel "Walter Herwig" was at that very moment taking part in the cooperative work of measuring noises from pelagic trawls.

#### Scotland

J J Foster described briefly current studies in the Loch Torridon field station, investigating the possible use of low frequency sound to attract fish. He described the continuing use of a hydrophone range to examine the movement of gear and fish and natural behaviour patterns of tagged fish and the details of a range used to analyse the noise of fishing gear as they pass. He described the cooperative venture where it is intended to compare the two methods of analysing gear noise as described.

#### Netherlands

S J de Groot reported that the experiments on directional hearing in cod in a Norwegian loch had been successfully undertaken and a model of the mechanics of directional hearing in cod has now been presented (Dr A Schuijf).

#### Norway

K Olsen reported that problems of propeller noise disturbing acoustic instrumentation on a new research vessel had been successfully solved by injecting air around the propeller tube.

Experiments of attracting schools of saithe by sound have been undertaken. A feeding condition technique is used and it is hoped to apply the method in the industry in recapturing saithe stored in small closed-off inlets.

Report of a Symposium on "Sound reception in fish" at Utrecht University  
16-18 April 1975, in honour of Prof. S Dijkgraaf

Directional hearing in fish was recognized by the Working Group meeting in 1974 to be a subject of considerable importance and more information should if possible be obtained.

At the Symposium in Utrecht, special attention was given to this subject and from the work presented it can now be concluded (reported by de Groot and Olsen who attended the Symposium), that:

- a) It is evident that fish possess directional hearing.
- b) Directional hearing is especially adapted to sounds at low frequency ( $\leq 300$  Hz) (as is their hearing).
- c) Perception of direction of sound is shown at any distance from the source.
- d) The existing model of directional hearing in fish is apparently capable of describing the basic facts of the mechanisms involved.
- e) Determination of distance to a sound source by fish is still questionable.

The Symposium also paid attention to the existing knowledge of the significance of sound in fish and concluded that the knowledge is still very scarce. Unconditioned attraction to sound sources was reported for sharks, squids and mackerel. Conditioned attraction has been obtained for several species of codfish.

Finally, the Symposium concluded that behaviour experiments for further elucidation of such questions ought to be undertaken in the field.

Acoustic methods to use in studies of fish behaviour: As the knowledge of hearing capacities in fish has now increased considerably, and the knowledge of occurring acoustic stimuli in fishing is rapidly increasing, it seems evident that work aiming at a more direct verification of sound-stimulated behaviour should get higher priority.

Observation systems based on ultrasonic technique represent the most promising tools for such tasks and it is known that several countries work with such methods. At the present meeting, the members from Scotland and Norway were able to give brief reviews of their current activity.

In a field station in Scotland studies of fish reactions to low frequency sound and noise have been undertaken by use of a stationary sector scanning sonar. Observation systems based on acoustic tags have also come into extended use. Both a simple system using a single directivity hydrophone for receiving position information and a more advanced system using an array of listening hydrophones on the bottom are used.

Norway reported a recently developed advanced system for position plotting of acoustic-tagged fish (the "PIN POINT"- system). This system can plot movement of free swimming fish at ranges up to 1 km within an accuracy of  $\pm 1$  m. Position is updated every 2 sec. The life time of the tag is 2-3 months, but can be extended if necessary. Further development of the system will also include telemetation of temperature and depth information as well as physiological data as heart beat rate or feeding activity.

The system has so far been used to observe conditioned attraction of saithe towards sound sources, reactions of the same species to moving bubble curtains and for studies of its natural behaviour. More simple versions of the system have also been used to track migrating salmon in fjords and cod in the open sea.

A computer-assisted sonar system with great potentials for studies of behaviour of schooling fish during fishing operations is now commercially available in Norway.

### Conclusions

The present meeting found that the proposed cooperative work was well underway and the meeting concluded that efforts should be made to arrange a second meeting to consider the results of the cooperative work, at a time when the results of the experiments were known.

If possible, the next meeting of the Working Group should include a discussion of the relevant aspects involved in measuring the noise characteristics of 20 or more tuna vessels as proposed by Dr Kurc from France.

The meeting concluded that this Working Group should continue to survey the current use and development of acoustic devices used for examining fish behaviour and attempt to encourage cooperation in their use and further development.

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