This Report not to be cited without prior reference to the Council[x)]

International Council for
the Exploration of the Sea

C.M. 1976/B:3
Gear and Behaviour Committee

REPORT BY SPECIAL JOINT SESSION ON THE METHODS FOR OBSERVING GEAR AND THE REACTIONS OF FISH TO GEAR

Chairman: Dr C S Wardle

Rapporteur: Dr S J De Groot

1. Meeting time and place: Tuesday 30 March 1976, Hull

2. Participants:

Belgium

G Vanden Broucke
Station de Pêche Maritime
Ankerstraat, 1
8400 Ostende

Canada

P J G Carrothers
Fisheries & Marine Service
Environment Canada
Biological Station
St Andrews NB EOG 2XO

France

G Kurc
ISTPM
B.P. 1049 rue de l'Ille d'Yeu
44037 Nantes Cédex

A Maucorps
ISTPM
B.P. 1049 rue de l'Ille d'Yeu
44037 Nantes Cédex

M Portier
ISTPM
B.P. 1049 rue de l'Ille d'Yeu
44037 Nantes Cédex

Germany, Federal Republic of

G Freytag
Institut für Fangtechnik
2 Hamburg 50
Palmaille 9

K Lange
Institut für Fangtechnik
2 Hamburg 50
Palmaille 9

x) The General Secretary
ICES
Charlottenlund Slot
DK 2920 Charlottenlund
DENMARK

T Nentjes
Institut für Fangtechnik
2 Hamburg 50
Palmaille 9

Netherlands

H B Becker
Netherlands Institute for Fishery Investigations
Postbus 68
Haringkade 1
Ijmuiden 1620

E J de Boer
Netherlands Institute for Fishery Investigations
Postbus 68
Haringkade 1
Ijmuiden 1620

S J de Groot
Netherlands Institute for Fishery Investigations
Postbus 68
Haringkade 1
Ijmuiden 1620

R C Peters
Laboratory of Comparative Physiology
University of Utrecht
Netherlands

A Schuyf
University of Utrecht
Netherlands

Norway

A Endal
Institute of Fishery Technology Research
PO Box 2900
5011 Bergen-Nordes

A Ferno
The Norges Fiskerihøgskole

A Johannessen
Institute of Fishery Technology Research
PO Box 2900
5011 Bergen-Nordes

K Olsen
Institute of Marine Research
PO Box 2906, Nordnesparken 2
5011 Bergen-Nordes

S Olsen
Institute of Fishery Technology Research
PO Box 2900
5011 Bergen-Nordnes

J W Valdermarsen
Institute of Fishery Technology Research
PO Box 2900
5011 Bergen-Nordnes

Sweden

J K Lunde
Charmes University of Technology

United Kingdom

C Baker
WFA Industrial Development Unit
St Andrews Dock
Hull

A J Dean
WFA Industrial Development Unit
St Andrews Dock
Hull

J J Foster
DAFS Marine Laboratory
PO Box 101
Aberdeen

J F Foster
WFA Industrial Development Unit
St Andrews Dock
Hull

M Hatfield
WFA Industrial Development Unit
St Andrews Dock
Hull

A D Hawkins
DAFS Marine Laboratory
PO Box 101
Aberdeen

R Margetts
MAFF Fisheries Laboratory
Lowestoft

D N MacLennan
DAFS Marine Laboratory
PO Box 101
Aberdeen

J L Robertson
WFA Industrial Development Unit
St Andrews Dock
Hull

W Siddle
WFA Industrial Development Unit
St Andrews Dock
Hull

P A M Stewart
DAFS Marine Laboratory
PO Box 101
Aberdeen

C S Wardle
DAFS Marine Laboratory
PO Box 101
Aberdeen

USSR

A I Treschev
VNIRO
Verkhne-Krasnoselskaya 17
Moscow B-140

Observers

J Scharfe
FAO
Fisheries Department
Via delle Terme di Caracalla
00100 Rome

3. Agenda

C. Res. 1975/2:6 (ii) approved a special subject for the Working Group on reaction of fish to fishing operations to be convened by Dr C S Wardle, to appraise existing and proposed methods for studying the reactions of fish to fishing operations. However in organising this meeting it was realised that members of the Working Groups on research on engineering aspects of fishing gear, vessels and equipment would be equally interested in methods used to observe fishing gears. It was therefore arranged with the Chairman of that Working Group that a special joint session should be held to discuss these common methods at Hull, taking advantage of the combined Working Group meetings in Hull. The aim of the meeting was to learn about successful observation techniques as well as those that had been tried and had failed and so help to find the most appropriate techniques for the various aspects of gear and behaviour research. The meeting dealt with four major observation methods.

Direct observation by scuba divers.

Television cameras and video tape.

Submarine observation chambers and towed underwater vehicles.

What use can be made of acoustic systems.

Written or prepared contributions describing details of these or related observation techniques were invited. The authors had been asked to point out which particular research aspect it was most suitable for and assess the usefulness of the technique in a) observation or recording of gear in action and b) observation of reaction of fish to gear. Film, video tape, slides or other material presenting relevant techniques or examples of results of the observation techniques were welcome at the meeting.

4. Introduction

The written and spoken contributions to the meeting reviewed a large number of practical methods used by scientists of ICES countries to observe fish reaction and fishing gears in action. The technology is wide ranging and complex and any endeavour to summarise the whole in a permanent form would be quickly outdated due to the continuous developments in these frontiers of underwater technology.

It is therefore considered worthwhile to recommend that the written contributions to the meeting be published as ICES papers which together with the account of this meeting form an up to date outline of the technology of gear and fish observation techniques. The extended discussions on use of ultra-sounding techniques was useful in showing those attending that there were numerous slight variations in the use of sounders, scanners, computing sonars etc each one developed to solve a particular problem. The tabulation of sonar technique against application (Table 1), discussed at the meeting, served to illustrate the specialisation inherent in applying sonar techniques to any particular observation problem. This table does not attempt to define the complete range of techniques or applications. There are now many developments of instrumentation systems designed for metering fishing gears and it was not the intention of this meeting to survey or evaluate them. However inclusion of the description and demonstration of the WFA trawl instrument package brought many of us up to date in this field. The demonstration of the new WFA flume tank was very relevant to this joint session as an immediate and instructive method of observing gears in action. The detailed specification of this tank and the scaling procedure is therefore included as a contribution to this session report (CM1976/B22 and B23).

5. Proceedings

Direct observation by scuba divers. C S Wardle presented the paper by J Main and G I Sangster title 'The Aberdeen Gear Diving Technique' (CM1976/B20). This paper was illustrated by film and video tape examples and the limits of observation by the diving technique were discussed in relation both to fish reaction and gear observations.

Television cameras and video tape. C S Wardle presented a paper by Wardle and Priestley title 'The Basic Principles of Closed Circuit Television Systems for Laboratory and Field Use in Fisheries Research' (CM 1976/B21). The meeting discussed the light levels required for using existing television cameras and also the possibility of using single wave length light sources which might not be seen by the fish. The Norwegians are considering whether it is possible to engineer a flashing light where the pulses are so short that the fish no longer sees them, yet are illuminated by them. Gating of these short pulses as in sonar devices was also discussed and thought to be impractical at present. The gating technique would avoid seeing the particles in the water between the camera and the object being observed. It was realised that further development in low light cameras was required before observation in many fishing conditions could be made without artificial light.

Submarine observation chambers and towed underwater vehicles. No written contributions were presented on these subjects. A I Treschev reported on the Soujet-Bathyplane, a towed sledge connected to the headline and otterboards of a trawl. The Bathyplane can be manned with two divers and cameras. He mentioned a dry and a wet version was used in Russia. J J Foster outlined the history of the Aberdeen towed vehicle and indicated the difficulties met with during the developments. Current developments include experiments with the stability of the vehicle when towed and the correct shapes for steering fins. The life support systems of the vehicle have proved themselves suitable for long observations by two scientists for up to 3 hours at depths down to 100 m.

Flume Tank. A demonstration of the new gear testing flume tank was very relevant to this combined Working Group meeting and two valuable contributions were made by the White Fish Authority, firstly a contribution entitled 'Design, Construction and Calibration of the White Fish Authority Flume Tank' (CM 1976/B22) presented by W Siddell and J L Robertson and secondly a related

contribution 'Flume Tank Facility - Net Modelling Techniques' (CM 1976/B23) was presented by D Wileman. A number of net models including both pelagic and demersal trawls were demonstrated in the flume tank to the delegates. It was notable that during this short demonstration the effect of modifying the towing characters and parts of the gear were immediately seen by the delegates.

WFA Developments in Gear Instrumentation. C Baker presented a new gear instrumentation package which in principle sends coded readings of the instruments via a netsonde cable from the gear instruments to the towing ship. A field report FR393 is available from WFA, Industrial Development Unit, Hull.

What use can be made of acoustic systems? A written contribution title 'Acoustic Tracking of Fish and Fishing Gears' (CM 1976/B24) was presented by D N MacLennan and summarised the principles and applications of this form of acoustic range as used at Aberdeen. R Margetts presented a paper by M Greer-Walker title 'MAFF Sector Scanning Sonar' (CM 1976/B25). The paper gives a general description of the properties of the instrument mounted on the research vessel 'Clione' and outlined the procedure used when following the reaction of a fish to a Granton trawl. K Olsen makes use of a system comparable to the one described by D N MacLennan where a fish can be pinpointed and followed for several days. S Olsen described the new integrated trawl instrumentation recently installed in G O Sars. Here information from: Loran, ship log, giro, compass, echo sounder, sonar, multi-trawlsonde (MTS), trawl filling indicator and temperature are fed to the central processing computer and the results displayed on a colour cathode ray tube. Coloured symbols are used to identify gear, ship, fish shoals, track of shoals and fish etc. Alternative modes include a display of a plan, a section, or a time integrated display etc. Various levels of development of complexity of similar computing sonar systems suitable for various projects were described by the Norwegian participants. A Schuyf described a "split element hydrophone system" designed by D Nelson (State University, Los Angeles, California, USA) developed for tracking large sharks with attached transponding multi-channel tags. The tag could transmit the depth, temperature, light level, compass heading and other parameters. The tag was also equipped with a releasing mechanism to recover the tag. The working range of this tag was up to 3 miles at 30kHz. By using different frequencies several animals can be monitored simultaneously and the battery life is increased by the transponding switch off system. K Olsen described the use of a sonar system to analyse the movements of the cod in the Lofoten breeding areas by catching and tagging with acoustic tags approximately 20 fish north of Lofoten and watching their passage at a more southerly station.

An extended discussion on acoustic methods demonstrated that there were many possible ways of using this technology. Many of the specialised pieces of apparatus are limited to particular types of observation, for example a simple directional hydrophone held from a small boat or held by a swimming diver can be used to locate the fish with a transmitting tag or at the other extreme a complex computed sonar system built into a research ship can be used to follow shoals of fish reacting to gears. Table 1; where the type of acoustic device is tabulated against the possible application; was discussed at the meeting, however the complexities of both these parameters made it difficult to draw detailed conclusions, but did point out the sort of complication and specialisation inherent in selecting the correct sonar observation techniques for any particular observation problem.

Acoustic methods for pelagic and demersal stock assessment. Following gear and behaviour committee C. Res. 1975/5:4 members of the combined Working Group meeting were made aware of the need to be familiar with the subject matter involved, for future discussions.

6. List of Contributions

(Submitted separately to Gear and Behaviour Committee)

1. The Aberdeen Gear Diving Technique
by John Main and G I Sangster, Marine Laboratory, PO Box 101, Aberdeen
(presented by C S Wardle). (CM1976/B20).

2. The Basic Principles of Closed Circuit Television Systems for Laboratory and Field Use in Fisheries Research
by C S Wardle and R Priestley, Marine Laboratory, PO Box 101, Aberdeen
(presented by C S Wardle). (CM 1976/B21).

3. Design, construction and calibration of the White Fish Authority Flume Tank
by W Siddle, WFA, Industrial Development Unit, St Andrews Dock, Hull
(presented by W Siddle and J L Robertson). (CM1976/B22).

4. Flume Tank Facility - Net Modelling Techniques
by D Wileman, WFA, Industrial Development Unit, St Andrews Dock, Hull
(presented by D Wileman). (CM1976/B23).

5. Acoustic Tracking of Fish and Fishing Gears
by D N MacLennan, G Urquhart, and A D Hawkins, Marine Laboratory, PO Box 101, Aberdeen
(presented by D N MacLennan and A D Hawkins). (CM1976/B24).

6. MAFF Sector Scanning Sonar
by M Greer-Walker, MAFF, Fisheries Laboratory, Lowestoft
(presented by R Margetts). (CM1976/B25).

Table 1 Summary of the types of sonar devices and their application in fish behaviour and fishing technology research.

A - normally useful: B - may be useful: C - not normally useful

TYPE OF INSTRUMENT	Portable tag finder (can be diver held)	fixed array of directional hydrophones	fixed array of hydrophones acoustic range	sector scanner	echo sounder	sonar	various computed sonars	Gloria N10 side scanner
APPLICATION								
movement of fish shoals	C	C	C	A	B	B	A	A
movement of individual fish	C	C	C	B	C	C	B	C
movement of individual tagged fish in limited area	A	A	A	A	C	C	B	C
movement of a tagged fish in unlimited area	A	B	B	A	C	C	B	C
geometry of fishing gears	C	B	A	A	C	B	B	C
identifying sounds produced by gear and ships	C	B	A	B	C	C	C	C
sea floor mapping	C	C	C	A	B	B	C	A