FINAL REPORT FOR F.I.R.T.A. PROJECT 85/42

Project: Underwater filming and observation of bottom trawl gear including an A.M.C. separator panel trawl, by the Australian Maritime College, the New South Wales Division of Fisheries, Department of Agriculture and the South Australian Department of Fisheries.

1. Introduction

Following approval for Project No. 85/42 arrangements were made for FTV Bluefin to conduct filming trials in conjunction with personnel from the N.S.W. Division of Fisheries and S.A. State Fisheries, in Jervis Bay N.S.W. In addition to the work specified in Project No. 85/42 the diving teams were also asked to dive on and observe the performance of a set of trawlboards, designed and supplied by Mr Cliff Collins of Tweed Heads.

2. Objectives

1. To dive on and observe the performance of twin and quad rigged prawn trawls.

2. To dive on and observe the performance of the AMC separator panel fish trawl.

3. To train AMC personnel in the techniques of underwater photography to enable the AMC to initiate its own underwater filming program at a later date.

4. To dive on and observe the performance of Mr. Cliff Collins trawl boards. This segment was not included in the original FIRTA proposal, but was arranged separately through discussions with the FIRTA secretary.

3. Area of Operation

The area of operation was Jervis Bay on the NSW coast. The Bay is approximately eight miles long by four miles wide and provided protection from most weather conditions with ample clear seabed for trawling.

The area generally worked was the south western end of Jervis Bay, north of the Naval establishment. This area offered a clear towing run of one nautical mile with the seabed consisting of clean white sand and working depths between 7-12 metres.

4. Vessels

FTV Bluefin Australian Maritime College.
FRV Kapala NSW Department of Agriculture, Division of Fisheries.
FRV Dasyurus NSW Department of Agriculture, Division of Fisheries.
Inflatable rubber dinghy, NSW Department of Agriculture, Division of Fisheries.

5. Personnel

(a) NSW Department of Agriculture - FRV Kapala

Terry Gorman	- Senior Biologist; Diver
Ken Graham	- Biologist; Diver
Terry Butcher	- Technical Officer; Diver
John Matthews	- Research Assistant;Diver/still photographer
Gary Hamer	- Biologist; boatman
Geoff Henry	- Netmaker

Allan Norton-Smith	- Master
Peter Ashworth	- Engineer
Dario Rossi	- Mate
Luis Moreno	- Motorman deckhand

(b) SA Department of Fisheries

Kevin Branden	- Senior Technical Officer Video Cameraman
Alan Knight	- Diving sled pilot

(c) Australian Maritime College-: FTV Bluefin

John Boyes	- Master
Malcolm Mann	- Mate
David Phillips	- Crew
John McLeod	- Crew-Diver
Frank Chopin	- Fishing Gear Technologist-Diver

(d) Industry Personnel (on board Bluefin)

Victor Embling	- KFV Skipper
John French	- KFV Skipper
Cliff Collins	- Otterboard designer

6. Camera Equipment

Details of still camera and video equipment are in Appendix I.

7. Fishing Gear for Testing

The following equipment was observed and filmed underwater.

(a) 47.8 m AMC separator panel trawl.

(b) 1 x 14.6 m (8 fm) headline Qld Florida Flyer prawn trawl.

(c) 1 x 14.6 m (8 fm) headline South Australian " Gundry" prawn trawl

(d) 2 x 11 m (6 fm) headline Qld Sandakan prawn trawls.

(e) 2 x 14.6 m (8 fm) Headline combination prawn trawls with (10' x 4') otterboards supplied by KFV Pty Ltd., Townsville.

(f) 2.4 m x 1.1 m (8'x 3'6") Humphrey otterboards.

(g) 2.1 m x 0.9 m (7' x 3') horizontal louvre otterboards (designed by C. Collins).

Design details are included in Appendix II.

8. Diving Procedures

8.1 Free Diving

Divers using scuba entered the water from the stern ramp of Bluefin, swam along the surface to trawl warp, followed it down to the otterboard and then to the net. Observations and photographs of the net were carried out, and measurements made of the net and otterboard spread. At the completion of the run the diving team was picked up on the surface by an inflatable boat.

Safety Procedures

All diving operations were carried out with the swimmers operating in pairs, one staying above and outside the net at all times. Each of the divers was fully briefed on the configuration of the net and the expected dimensions of the opening. When working in water deeper than 10 m a log of each divers time underwater was kept to avoid decompression problems. The depth of each run was recorded on Bluefin's echosounder. If divers were to operate along the footrope of the net, the bottom topography was checked before the run to ensure that there were not sudden depth changes which could force a diver to let go and end up in the net. While divers were operating, an observer kept watch astern of Bluefin for prearranged hand signals from divers to stop the tow. This was to be used if any member of the team was in trouble, and would allow escape from the net while it was stationary.

8.2 Video Sled

Description and Operation

The video camera was mounted on a two-man underwater sled constructed and operated by the SA Department of Fisheries. The design of the sled was after Hold (1963). The camera was attached to the sled by a twin knuckle coupling which allowed sufficient camera movement and eliminated diver fatigue associated with prolonged support of the camera. An additional mount was located at the rear of the sled to allow filming from in front of a net.

The sled was towed astern of Bluefin by the power cat Dasyurus. This arrangement was to allow the sled to be manoeuvered easily around the net while filming.

Underwater, the depth and lateral movement of the sled was controlled by the sled's pilot; The position of the sled along the body of the trawl was altered by Dasyurus on instructions relayed by the cameraman over the two-way communication system (see Appendix I). The communication and towing cables were secured together and floats on the cables kept them clear of the seabed.

As a safety procedure, communication was maintained at all times. In the event of communication failure, the sled immediately surfaced.

Operational problems

Because of the shallow trawling depth, the towing warps for the prawn trawls were kept short to maintain a reasonable warp length to depth ratio. Therefore for the sled to maintain station Dasyurus was often very close to the stern of Bluefin and was either between or beside one of the bridles. When instructed to alter position to port or starboard the Dasyurus could only comply by dropping back to clear warps before moving forward to a new position.

The effect of mounting the video camera on one side of the sled also caused some problems.

The drag on the housing caused the sled to crab through the water necessitating the sled pilot to continually correct the sled course. This resulted in pilot fatigue. However despite these problems, the sled was successfully manoeuvered about the nets and some good video footage was obtained.

The sled crew felt that most of the problems associated with the sled and video system could be rectified with a few modifications to the sled and camera position.

On most occasions the visibility did not exceed 5 metres and at times only about 3 metres or less. In addition the light towards the end of the trials was poor. To a certain extent however the camera was able to compensate for both of these. Poor visability also prevented longer range filming, consequently large sections or full shots of the net could not be taken. Most close up shots of the net and boards were sharp, indicating that excellent results could be obtained with good visibility using this

camera system.

9. Results and Discussion

Bluefin departed Beauty Point on the evening of Sunday 29th June and arrived Jervis Bay late evening Tuesday 2nd July. Prior to departure, arrangements were made to use the jetty at the Cresswell Naval base. At 0800 hours Bluefin came alongside to load equipment and personnel from SA State Fisheries. Late the same morning diving equipment and staff from NSW Division of Fisheries joined Bluefin from Kapala. With all personnel aboard sounding runs were then made to ensure smooth ground for the commencement of filming trials.

Filming took place during daylight hours over a seven day period. During this time the weather conditioned remained fair except for the last day when strong south-easterly winds made diving conditions unfavourable.

Over four hours of underwater video film and 200 still camera shots of nets and otterboards were collected during the seven days. An article detailing some of the more interesting aspects of the project has been produced for "Australian Fisheries" (see Appendix III). Copies of the unedited videos were retained by SA State Fisheries Department, NSW Division of Fisheries and the Australian Maritime College. To date, they have been used during flume tank short courses to back up work carried out in the tank on prawn trawl rigging variations.

Available light limited diving from 1000 h to 1600 h consequently the number of different rigs that could be tested in any one day was restricted. Water visibility in the area chosen deteriorated markedly towards the end of the period, severely affecting the quality of both video and still camera shots.

In order to attain sufficient light for photography and also to reduce the risk of running into decompression dives, the depth of water chosen was mostly between 8 and 10 metres. Whilst allowing the divers longer time on the net, it did affect the trawl geometry. In particular, problems were experienced with the otterboard heel as well as otterboard spread. The bridles on Bluefin are much heavier than those used by the average Australian trawler and the weight of these undoubtedly had some affect on the attitudes of the prawn trawl otterboards. (Fig 7 Appendix III)

Towing speeds were restricted to speeds at which free divers could hang onto the net (3.0 knots or less) and were difficult to maintain at a constant level because of the windage on Bluefin and lack of a calibrated speed log.

Measurement of trawl geometry were carried out, but because of the influence wind, shallow water and variable towing speeds, they do not necessarily reflect the true parameters of the gear in deeper water. Gear spread was measured by stopping Bluefin and measuring the distance between the wings and otterboards when the gear collapsed. Vertical opening was estimated from the diver depth gauges.

In summary there were inherent advantages and disadvantages in the two methods of gear observation. The sled required time to get into position and was restricted in its movements around the net because of the short bridles used. It did, however, have the advantage that a video camera could be carried aboard the sled allowing the trawl gear to be monitored continously. The divers holding onto the net could only carry still cameras. Their presence on the headline may have influenced gear performance.

The configuration of gear when towed in shallow water may differ from that when towed in deeper water. Therefore the value of filming and measuring gear in shallow water should be judged accordingly.

The value of colour video, even in shallow water, for trawl gear observation is questionable. Much higher resolution can be obtained using low light monochrome systems. Even though some picture smear may occur, the overall advantages of such systems are clearly recognised.

The areas where safe underwater filming of trawl gear can be carried out are not usually commercial fishing grounds. Consequently it is difficult to record the behaviour of commercial species or quantities of fish or crustaceans in the path of the fishing gear.

If fish or crustacean behaviour in the path of trawl gear is considered to be worthwhile filming, the approach adopted by many overseas fisheries research organisations of using a remote controlled vehicle (eg. Main and Sangster, 1983) would be preferable particularly if used with a low light monochromatic video system. An edited version of fish behaviour and trawls produced by the Aberdeen laboratory is forwarded for the information of the committee.

REFERENCES

Hold,J. (1960). New Diving sled for Underwater photography, Commercial Fisheries Review 22 (5), 10-12

Main,J. AND G.I. Sangster (1983) TUV 11- A towed wet submersible for use in fishing gear research. Scottish Fisheries Research Report: No 29 (ISSN 0308 8022).

APPENDIX I

DIVING AND CAMERA EQUIPMENT

SOUTH AUSTRALIAN DEPARTMENT OF FISHERIES VIDEO CAMERA AND DIVING EQUIPMENT

The camera and housing is an underwater self contained colour video system. The housing was manufactured by Jay Mar Engineering in California USA and has external fittings which allow diver voice input and coaxil cable to the surface to provide surface viewing. Other features include a dome port to provide a 100 degree field of view when using an optical expander attached to the camera. The optical expander increases the depth of field from about 100 mm to infinity (average light).

Camera Model GZ-S3

The video camera is a JVC compact unit which incorporates a 38 mm static magnetic high-resolution SATICON single tube. The unit is powered by 12V DC batteries.

Recorder

The recorder uses 30 minute VHS compact video tapes (MODEL HR-C3). A unique record lock allows the system to be shut down to save battery power. An external switch on the outside of the housing is used to activate the system into a recording mode.

Monitor Model TM-P3

A 76 mm colour monitor allows the operator an unrestricted view. It also provides an indication of what the final product will look like.

The monitor is also useful when playing back the recorded tape - this can

be done while all equipment remains in place in the housing.

Note: At present this particular self-contained underwater system is the only one in Australia.

DIVING EQUIPMENT

Apart from the diver communication system, all diving equipment used was standard Scuba diving gear.

All scuba tanks were aluminium 2.5 m^3 with K valves. Back packs and vests were SCUBA PRO. (B.C.D.)

Communication Equipment

Diver/surface communication was used on all dives which involved the underwater sled.

The communication system includes an AGA full mask which incorporates a microphone and receiver.

Diver surface communication is transmitted by cable from the surface to the diver through a surface control unit which is fitted with headphones and microphone.

N.S.W. DEPARTMENT OF AGRICULTURE DIVISION OF FISHERIES

CAMERA AND DIVING EQUIPMENT

Camera Equipment

All the still photographs were taken using Nikonos 35 mm underwater camera equipment fitted with a Nikon 15 mm lens and view finder. Light readings were taken with a hand held Sekonic L series meter in a housing. The film used was 400 I.S.O. colour positive material.

Diving Equipment

Standard SCUBA gear was used. The demand valves were fitted with side mounted exhaust outlets and purge buttons. This eliminated the bubble stream caused by water pressure at high towing speeds on front mounted purge buttons.