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MINISTRY OF AGRICULTURE, FISHERIES AND FOOD
FISHERIES LABORATORY, LOWESTOFT, SUFFOLK, ENGLAND

1981 RESEARCH VESSEL PROGRAMME

REPORT: RV CLIONE: CRUISE 11
(PROVISIONAL: Not to be quoted without prior reference to the author)

STAFF

- G P Arnold
- M H Beach (3-11 September)
- B H Holford (diver)
- P R Withames
- T J Storeton-West (12-20 September)
- B F Riches
- P H Cook (NERC) (diver)
- K M Brander } shore based divers
- J R J Tipple }

DURATION

Left Lowestoft 1030 h, 3 September
Arrived Lowestoft 1300 h, 20 September
All times are Greenwich Mean Time

LOCALITY

Start Bay

AIMS

1. To investigate the orientation and behaviour of plaice in relation to bottom topography and near-bed currents using:-
 - (a) sector scanning sonar and transponding acoustic compass tags;
 - (b) sector scanning sonar, transponding acoustic tags and divers equipped with a 300 kHz hand held acoustic torch;
 - (c) direct observation and photography of small plaice confined on the seabed in a cage spanning several small sand ridges.
2. To retrieve spat collecting bags from a marked site in Start Bay and relay scallop spat in Salcombe estuary.

NARRATIVE

CLIONE left Lowestoft at 1030 h 3 September and arrived in Start Bay 1530 h 4 September. An echo survey of the Skerries Bank was commenced that evening and completed the following morning. The proposed anchor station was surveyed with the sector scanner and the vessel anchored fore and aft. The underwater TV camera was deployed, contact established with the shore-based divers and a 13h IRCM station completed. The miniature propeller current meter rig designed to measure the velocity profile close to the seabed was deployed on 6 September but serious problems were encountered with the electronics.

CLIONE anchored in Plymouth Sound at 0730 h 7 September and took on board live plaice from the MBA Laboratory brought out by RV GAMMARUS. CLIONE sailed again at 1000 h, returning to Start Bay at slow speed in fog, and was anchored on station again by 1600 h. The fish cage was deployed during the evening but during the night the wind freshened from the southwest and the vessel swung away from the cage dragging her stern anchor. On the following morning the stern anchor was relaid using the heavier spare bow anchor and the divers began to make direct observations of fish in the cage. Work continued until 1250 h 10 September when two divers were put ashore and CLIONE sought shelter in Torbay from a southerly gale. CLIONE returned to the anchor station at 0900 h the following morning and fish observations continued. But in attempting to re-anchor the ship fore and aft the cage was damaged by the stern warp. The cage was retrieved on the morning of 12 September, repaired by the Chief Engineer and relaid the same evening. A group of smaller plaice was released in the cage the following morning and the divers made direct observations throughout the day after retrieving 2 scallop spat collectors for Mr Pickett.

At 0700 h 14 September CLIONE sailed for Plymouth to take on water, docking there at 1100 h. The 2 shore-based divers accompanied by Mr Pickett relaid the scallop spat in the Salcombe estuary.

CLIONE left Plymouth at 0800 h 15 September and arrived back in Start Bay at 1300 h. Diving work was recommenced immediately and continued until 1710 h 17 September. CLIONE again took shelter in Torbay overnight returning to her station in Start Bay at 1000 h 18 September. A heavy swell curtailed diving operations at 1250 h. After an abortive attempt to track an acoustically tagged plaice over the sandridges in the vicinity of the cage site, a brief survey was made of the larger bottom features on the outside of the Skerries Bank. CLIONE then steamed for Lowestoft taking shelter from storm force winds in Margate Roads from 1600 h 19 September until 0530 h 20 September.

RESULTS

- 1 (a) Plaice behaviour. Experiments were conducted in the cage with two groups of plaice of approximately 20 and 30 cm length. The larger fish were observed over a full tidal cycle at neaps when the bottom consisted of small sand ripples ($\lambda = 10-20$ cm; $h = 1-3$ cm) on the back of larger ridges ($\lambda = 12$ m; $h = 50$ cm). These fish were buried in the sand apparently randomly orientated and reacting neither to the current nor to the sand ripples; there was no difference in orientation between slackwater and the peak ebb (south west going) or flood (northeast going) tides. With a light swell of approximately 4s period two of the fish were eroded from the sand by vortices formed in the lee of the ripples by the combined wave and current action. These fish surfaced and reburied but did not orientate to the current. Twenty four hours later with a long swell of 8-10 s period from the southwest the behaviour was strikingly different. At the beginning of the ebb tide 4 out of 6 fish were on the surface of the sand heading northeast against the maximum velocity of the combined swell and tide. At the peak of the ebb tide all size fish were buried but still headed against the flow. There was local erosion of sand from around the head but no net scouring of sand from around the body of the fish as a whole. The traction carpet of sand moving along the seabed appeared to afford the fish complete protection from erosion. The smaller fish were observed 3 days before peak spring tides. The sand was rippled as before but a ridge was generated in the cage growing to a height of 30 cm. At the beginning of the flood tide the fish were all buried in the sand but half were buried by vortex flow in the lee of the ripples. These fish became active but did not orientate to the flow. On the peak of the flood tide, however, half

the fish were found to be buried on the lee side of the ridge headed against the flow. The other half were swimming around the cage heading against the flow on the upstream but not on the downstream side of the ridge. On the peak of the ebb tide half the fish were again buried on the lee side of the ridge and headed against the flow, having crossed the crest after the intervening slackwater.

- (b) Current Measurements. Two 13h DROM stations were completed at neap and spring tides and velocity profiles measured at half-hour intervals. Two sets of measurements were made with the miniature propeller current meter rig once the electronic problems were overcome. The near-bed velocity profile was measured at heights of 10, 20 and 30 cm at low water slack tide. A swell of 9 s period was recorded with a peak speed of 45 cm/s at 30 cm. The nearbed profile was also recorded at the peak speed of the ebb spring tide in the presence of a large swell and a confused sea. There was a considerable quantity of fine weed in the water and the probes were at the limit of their capability, requiring constant attention by the divers. The velocity profile was measured inside the wave boundary layer at heights of 5, 10 and 20 cm. A long swell of 15-20 s period was recorded together with waves of 5-8 s period. The combined peak speed of the swell and the current was approximately 1.1 m/s at a height of 20 cm.
 - (c) Sand ridge profiles. The divers measured the profiles of two of the sand ridges in the vicinity of the cage at the peak speed of the ebb tide and at the end of the flood tide. There was no evidence of crest reversal even at peak spring tides.
 - (d) Underwater TV observations. The television was used to observe isolated fish in the cage and the operation of the miniature propeller current meters. It revealed a striking difference in the flow conditions on the seabed between neap and spring tides.
 - (e) Acoustic torch. Attempts to use the divers 300 kHz hand-held acoustic torch to locate a standard acoustic tag buried in the sand proved unsuccessful as did an attempt to observe large plaice in the cage.
2. Spat collection. Two out of three scallop spat collectors were retrieved from Start Bay and the spat relayed at Salcombe.

G P Arnold
2 October 1981

SEEN IN DRAFT: G R Oliver - Master
G F Lee - Fishing Skipper

INITIALLED: DJG

DISTRIBUTION:

Basic List	J R J Tipple
G P Arnold	B D Pickett
M H Beach	Dr J D Gilpin Brown (MBA Plymouth)
B H Holford	Dr K R Dyer (IOS Taunton)
P R Witthames	Clerk to Devon Sea Fisheries Committee
T J Storeton-West	
B F Riches	
P H Cook	
K M Brander	