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Charter vessel RV 'Calanus'

REPORT

5–18 June 1989

Personnel

M Heath	PSO
J Pirie	SSO (8–9 June)
R Mitchell	SSO
S Hay	HSO
J Dunn	HSO
D Baird	SO
[illegible] Brown (Mrs)	ASO (8–9 June)
[illegible] Heaney	ASO
B Ritchie	PTO (6–7 June)
N Owens	Visitor PML (10–11 June)
A Rees	Visitor PML (10–11 June)

Objectives

1. To investigate the fine scale distribution of hydrographic parameters, phytoplankton and zooplankton along a transect through Loch Linnhe and the Firth of Lorne.

2. To investigate the metabolic rates of phytoplankton size classes, zooplankton and micronekton at contrasting sites along the transect line.

Narrative

Scientific staff travelled to Dunstaffnage on 4 June, and returned on 18 June. Except for the period 14–17 June when 'Calanus' was involved in "24 h studies", the vessel operated a 12 h working day from 0800–2000, berthing overnight at Dunstaffnage. Substantial quantities of scientific equipment were stored ashore, and only that necessary for each day's work was carried aboard the vessel.

Setting up, testing and de-bugging of equipment was carried out on 5 and 6 June. Between 7 and 9 June, sampling was carried out with the 5 m^2 Methot net at each of the positions on the attached chart. During 9, 10, 11 and 13 June the entire survey line from station 1 to 15 was sampled by 12 consecutive successful tows with the Autosampling and Recording Instrumented Environmental Sampler (ARIES). Detailed studies of phytoplankton and zooplankton physiology were carried at 3 stations on 7 and 12 June.

During 14–15 June, replicate hydrographic and phsiology studies were carried out over a 24 h period adjacent to a drifting buoy rig in the Firth of Lorne. The drift rig was equipped with an Argos transmitter and a self recording Decca navigation system. A second 24 h sampling study was carried out during 16–17 June in Loch Linnhe. On this occasion, a mooring with 4 current meters and 3 sediment traps was deployed and the vessel anchored nearby. Continuous vertical profiling of zooplankton was carried out for 24 h using a hose and pump system, CTD and environmental sensor dips were carried out at 2 h intervals, and plankton physiology studies undertaken at 8 h intervals.

Results

1. Methot Net Sampling

Depth integrated samples of fish larvae, macrozooplankton and jellyfish were obtained at each station. All jellyfish were sorted from the catch and a subsample of each species measured. Subsamples of each species of the remaining catch were measured and preserved for nitrogen analysis. The distribution of jellyfish showed marked variation along the survey line. An area of particularly high abundance of Aurelia was found at the mouth of Loch Linnhe.

2. ARIES Deployments

ARIES was towed at 4.5 kn undulating between the surface and approximately 10 m above the sea bed and proved to be very successful for high resolution hydrographic and biological sampling of the study area. Discrete water and plankton samples were obtained at 2 min intervals along the 120 km survey track, each having a known sampling time, location and depth. At the same time, data from 9 environmental sensors on the ARIES were recorded at 5 sec intervals, providing approximately 10^5 observations from each sensor over the whole survey. Half the plankton samples were preserved in formaldehyde solution and the remainder preserved by freezing for particulate nitrogen analysis. Subsamples of water were saved for nutrient analysis and the remainder filtered for pigment and particulate nitrogen analyses.

3. Physiology Studies

Primary production measurements (size fractionated after the incubation) were carried out at each detailed study station (total of 5). In addition, ammonia excretion rates were measured on replicate samples of at least 2 species of copepod and one species of gelatenous zooplankton at each station. Copepod egg production was measured by 24 h incubations at each position. The initial results indicated that although zooplankton biomass was low in the Firth of Lorne, egg production rate was relatively high compared to the rates recorded in the areas of high biomass (Loch Linnhe).

4. 24 h Studies

The self recording Decca buoy recorded data at 10 min intervals throughout the drifting deployment on 14/15 June and the data agreed well with the Argos data from the same rig. The rig was attached to a drogue at a mean depth of 15 m. The drift rate was slow (approximately 3.5 km over 24 h) and towards the southwest. Results from the replicated physiology experiments have not yet been analysed.

At the anchor station in Loch Linnhe, the water column was stratified, having a warm low salinity surface layer approximately 5 m thick. Chlorophyll biomass was concentrated at the pycnocline, but bioluminescent organisms were contained within the surface layer. Pump sampling was carried out from 7 depths, and a total of 62 samples of 10 min pumping (equivalent to 3600 litres) were completed during the study. Each sample was fractionated into >350 µ, 200–350 µ, 95–200 µ and 30–95 µ size categories. Half the samples were preserved in formaldehyde and the remainder frozen for particulate nitrogen analysis. The sampling revealed a clear vertical migration pattern of the zooplankton. Organisms in the >350 µ size category were found mainly in the deepest samples (70 m, 92 m) during daylight but ascended towards the surface at night. Organisms in the 95–200 µ category undertook less pronounced migrations. The results from the 8 h interval physiology studies have not yet been analysed.

The sediment traps deployed at the anchor station all contained substantial quantities of predominantly algal detritus. The deepest trap appeared to contain the most material and this concurred with the observation of a deep turbid layer from transmissometer data recorded during the anchor station. Subsamples of the sediment material were preserved in formaldehyde, and deposited onto filters for pigment and particulate nitrogen analysis.

M Heath

17 July 1989

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SAMPLING POSITIONS