Scottish Marine Biological Association

Dunstaffnage Marine Research Laboratory

CRUISE REPORT

R R.S Frederick Russell

Cruise 8/86

17 - 29 September 1986

S.M.B.A., P.O. Box No. 3, Oban, Argyll, Scotland.

Cruise Report

R.R.S. Frederick Russell 8/86

Duration: 17 - 29 September 1986

Location: Firth of Lorn, Firth of Clyde, North Channel, Scottish continental shelf 55°46' - 56°44'N and east of 8°45'W.

Scientific Staff:

Professor J.B.L. Matthews	SMBA Principal scientist
Dr K.J. Jones	SMBA
Dr J.M. Graham	SMBA
Mr C. Grier	SMBA
Mr B.E. Grantham	SMBA
Mrs C.M.L. Petre	SMBA
Dr D. Mills	(University College,North Wales

Aims:

1. To retrieve one current meter mooring and to check on condiitons of other SMBA moorings in operation.

2. To obtain vertical CTD profiles in the Firth of Lorn, Firth of Clyde, North Channel and across the west Scottish continental shelf, augmented by water samples for caesium analysis in order to chart the distribution and record the characteristics of the main water masses.

3. To obtain measurements of nutrient levels, chlorophyll, and light attenuation and scattering in order to assess the conditions for primary production and the standing stock of phytoplankton.

4. a) To obtain estimates of primary production and community respiration using ^{14}C and O_2 techniques in the study area and conduct a comparison of techniques.

b) To determine phytoplankton community structure by size fractionation of chlorophyll standing crop and partition production and respiration within size fractions.

5. To obtain samples of zooplankton for analysis of community composition near the surface in the main areas, and to estimate zooplankton grazing pressure by gut-pigment analysis.

Narrative: The vessel was moored alongside at Dunstaffnage for a couple of days before the cruise and all equipment and supplies were loaded on board at this time. Cruise personnel were embarked by 09.00 BST on Wednesday 17 September and the ship sailed for the first station at the southern end of the Lynn of Lorn, west of Dunstaffnage. Equipment was /

was set up and tested at this station and the first samples and measurements taken. Work continued on the next day on the scheduled stations in the Firth of Lorn and on the 'FL' transect along 56°10'N as far as 8°45'W, including retrieving the last of the current meter moorings deployed on 16 May from the 'G.A. Reay'. This mooring had lost its surface marker buoy but was successfully retrieved by grapple, without loss of the current meters.

In spite of poor weather conditions, which caused some restriction of pump sampling, the 'D' transect eastwards along 55°46'N from 8°W to the coast of Islay was completed by Saturday 20 September, after which the ship made for Red Bay, Northern Ireland, to allow running repairs to be made to the nutrient autoanalyser in calm conditions. Sampling continued in the North Channel ('A', 'Y' and 'Z' transects) before moving into the Clyde Sea Area on Sunday 21 September.

Work continued in the Clyde Sea Area for the next three days at a total of 54 stations, including stations in Loch Fyne, East and West Kyle, the lower Firth of Clyde and Kilbrannan Sound. In the course of this work all surface markers of SMBA and DAFS current meter moorings were checked. Naval exercises encouraged us to move offshore again by late Wednesday 24 September.

The 'C' transect from W of Portrush, N. Ireland to Loch Indaal, Islay, was completed by early on Thursday 25 September after which two stations were revisited on the 'D' transect, on either side of the Islay Front, for further study of primary productivity. The ship then sailed a zig-zag course north to Barra Head in order to maximise coverage of the area for continuous or regular monitoring of conditions near the surface. Opportunity was taken during the daylight hours to record sea-bird sightings along the ship's course.

The 'G' transect from Barra Head to Ardnamurchan was taken on Friday 26 September, the current meter mooring in Tiree Passage was checked, then one 'G' station was revisited for primary productivity studies. The weather worsened rapidly on Saturday 27 September, so the ship anchored for the night in Bloody Bay, Mull. The final stations in the Sound of Mull and Lynn of Lorn were taken on Sunday before anchoring for the last night of the cruise in Scallastle Bay, Mull.

The cruise ended at Dunstaffnage on 29 September at 12.00 hrs.

Results /

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Aim 1) Although the marker spar buoy was missing, the mooring was successfully grappled and the current meters recovered.

Aim 2) A total of 128 CTD dips was conducted using the Neil Brown Smart CTD. Apart from a few problems introduced by an excessive lowering speed, there were no major operational difficulties. Subsequent to the cruise some loss of fluid from the pressure chamber was observed and may have a small influence on the pressure calibrations at lower pressures.

Aim 3) Vertical profiles of chlorophyll, NO_3-N and silicate concentration were measured at 105 stations. Additionally, profiles of phosphate and NH_4-N were made in the early part of the cruise, until an autoanalyser fault developed and further measurements had to be abandoned. Chlorophyll concentrations were highest (1-3 mg m^{-3}) in the salinity stratified region of the inner shelf and stratified Firth of Clyde. Elsewhere concentrations were < 1 mg m^{-3}. Measurements of downwelling, scalar and surface irradiance were made during the cruise, allowing computation of attenuation coefficients for 44 stations within the study area.

Aim 4) Seven experiments were carried out to obtain information on the photosynthetic capacity of phytoplankton in the Firths of Lorn and Clyde and inner and outer shelf regions. These results will enable values of instantaneous production to be determined. Fractionation of biomass (chlorophyll) and ^{14}C assimilation revealed differences in phytoplankton community structure and activity in different regions of the study area. In stratified shelf regions $> 65\%$ of the chlorophyll standing crop was in organisms $< 5\mu m$, the Firth of Lorn was dominated by organisms $> 5\mu m$, whilst in the Firth of Clyde these fractions had equal importance. The chlorophyll fraction $< 1\mu m$ contributed 0.1 - 13% of total chlorophyll having greatest importance on the outer shelf. ^{14}C assimilation into the size fractions reflected biomass distribution in the Firth of Lorn populations. In shelf waters and the Firth of Clyde, however, uptake of ^{14}C into $< 5 > 1$ μm fraction appeared to be lower than might be expected on the basis of biomass. A high measured O_2 consumption for this fraction in the Clyde suggests that the anomalous ^{14}C uptake might be explained by rapid turnover into larger grazers in this fraction.

Aim 5) /

Aim 5) The plankton pump functioned well throughout the cruise, enabling size-fractionated samples to be taken at 10 and 30 m depth from a total of 48 stations throughout the survey area. The samples were divided into two equal portions, one being filtered, rinsed in distilled water and frozen for subsequent analysis of consumed plant pigments, the other being fixed in formalin and preserved for subsequent specific analysis. There were clear signs of differences in species composition and in biomass within the area sampled. The opportunity was taken on several occasions to sample at the same place both day and night; this has given some indication of diurnal differences in vertical distribution which must be taken into account in interpreting results in terms of horizontal distribution.

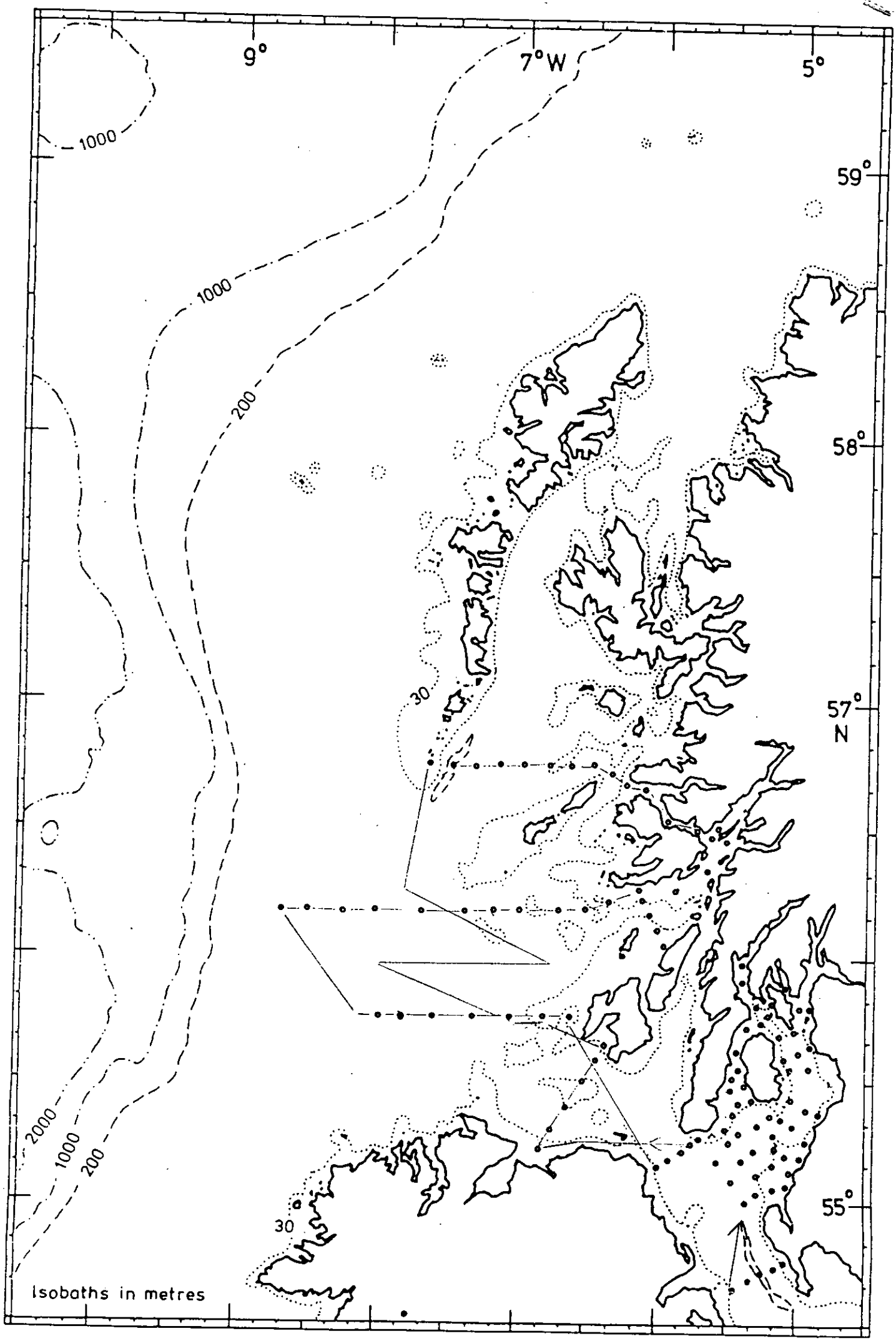
Responsibility for and Availability of Data

CTD	Dr J.M. Graham
Nutrients	Mr B.E. Grantham
Phytoplankton and primary production	Dr K.J. Jones
Zooplankton and sea birds	Professor J.B.L. Matthews

General Comments and Acknowledgements

The combination of wet and dry laboratories suited our multidisciplinary needs well, except in one point of detail: the height of the water-bottle rack and the width of the draining board underneath it are best suited to taller people. The winches, crane and A-frame were well positioned for deployment of equipment overboard and for retrieving the current meter mooring. The unencumbered after-deck was a particular advantage.

The Captain, officers and crew provided a high standard of seamanship. On behalf of the scientists on board, I would like to thank them for their willing assistance throughout the cruise.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