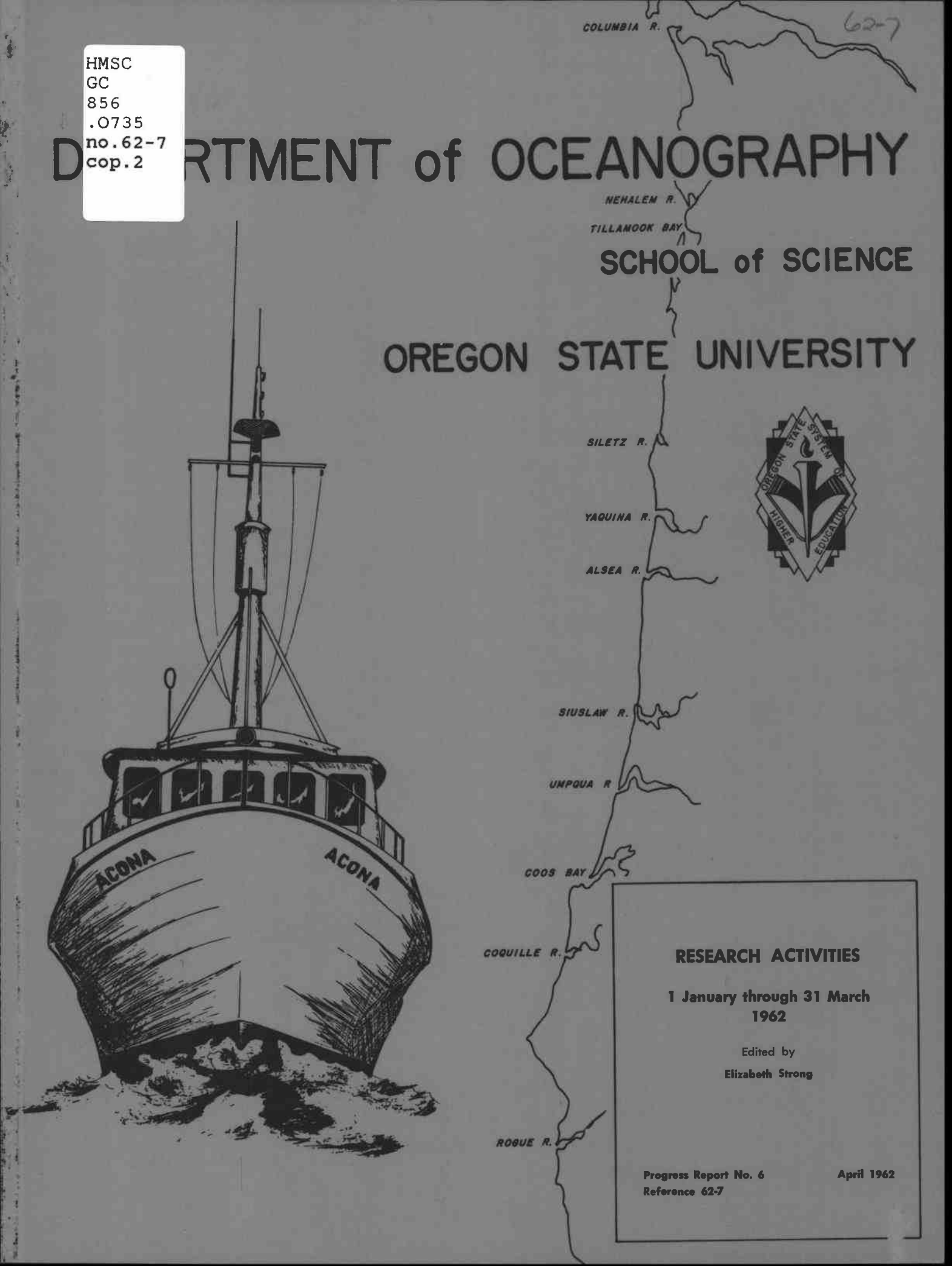
62-7

# DEPARTMENT of OCEANOGRAPHY

## SCHOOL of SCIENCE

## OREGON STATE UNIVERSITY




OREGON STATE SYSTEM OF HIGHER EDUCATION

# RESEARCH ACTIVITIES

**1 January through 31 March 1962**

Edited by

**Elizabeth Strong**

**Progress Report No. 6** **April 1962**
**Reference 62-7**

Department of Oceanography
School of Science
Oregon State University

Wayne V. Burt
Chairman

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Office of Naval Research
Contract Nonr 1286(02)
Project NR 083-102

National Science Foundation
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Atomic Energy Commission
Contract AT(45-1)-1726
(Nekton and Macroplankton Program)



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## INTRODUCTION

This report summarizes the research conducted during the first quarter of the calendar year 1962 by the Department of Oceanography, Oregon State University, under contract Nonr-1286(02) Project NR 083-102 with the Office of Naval Research, Grant No. G 19783 with the National Science Foundation, and Contract AT(45-1)-1726 with the Atomic Energy Commission.

## RESEARCH IN PROGRESS

Hydrographic Survey of Oregon Coastal Waters -- Wyatt, Kujala, Oliphant

Two hydrographic cruises were made during the quarter. From 16 to 18 January, lines of stations were completed to 165 miles west of Astoria, Newport, and Coos Bay. From 3 to 5 February, a line of stations to 165 miles west of Newport was completed. The March cruise was difficult due to continuous high seas and strong winds. Winds in excess of 60 knots were experienced during an attempt to complete hydrographic stations west of Coos Bay. The entire three-line cruise was finally completed during the first week in April.

To supplement hydrographic data, current measurements will be made monthly at a station 50 miles west of Newport. Parachute drogues will be placed at 0, 50, 100, 150, 200 and 1000 meters. The first of these studies were made 29 to 31 January and 26 to 28 February with the deepest drogue at 200 meters.

Summary of Samples taken on Hydrographic Cruises*

| | |
|---|---|
| Hydrographic casts | 74 |
| BT casts | 109 |
| Surface temperature and salinity observations | 128 |
| Drift bottle releases | 600 |
| Clarke-Bumpus plankton tows | 46 |
| Midwater trawl tows | 26 |
| Night light stations | 2 |
| Productivity (C-14) measurements | 20 |
| Chlorophyl measurements | 40 |
| Drogue measurements | 18 |
| Geology dredge tows | 1 |
| Geology grab samples | 3 |

*See also FACILITIES.

Shore Station Observations -- Oliphant, Wyatt

A report summarizing the results from shore stations for 1961 is nearly complete.

Beginning this quarter, additional data on wind direction and force are being collected from Coast Guard stations located at Newport, Umpqua River, Cape Arago Lighthouse and Cape Blanco.

Temperature Variability Studies -- Denner, Pattullo

Daily surface data were collected at both the Newport and Oceanlake stations. The first collection of salinities has been analyzed and is now being studied. More stations are planned.

Water Masses off the Oregon Coast -- Rosenberg, Pattullo

Definition of distinctive water types found in the area was undertaken and completed during this quarter. Delineation of areas of influence with different seasons is now in progress.

Marine Geophysics -- Berg, Rinehart

The effort during this period of time was directed toward (1) establishing computer programs and (2) planning work programs.

(1) Establishing computer programs - Fortran programs to perform gravity reductions, Fourier analyses, autocorrelations, power spectra, and other analytical techniques have been written for the IBM 1620 computer located on campus. These and additional programs will be used in future data analyses.

(2) Planning work programs - (a) Tentative arrangements have been made to establish a gravity range off the coast using an underwater gravity meter. It is expected that this range will be instituted during the summer of 1962.

(b) Work has been planned to do reflection studies off Newport and other areas using sparker-gas gun continuous seismic profiling equipment. Delivery of the equipment is expected during April; the work will be started during the summer of 1962.

(c) Experiments are currently being conducted to establish more precise control for ship positioning. Three radar corner reflectors are mounted on top of a 40-foot mast as a target for the ship's radar. Initial tests show this target is well defined to ranges of about ten miles. Further tests will be conducted to determine if the range can be increased. Three similar targets will be spaced at intervals along the coast. This system, if successful, will be used for high precision location of stations established during programs (2a) and (2b).

(d) Planning is in the initial stages for using a sea-surface gravity meter during April, May, and June, 1963. The tentative plans include determining gravity profiles off the Pacific Northwest coast to study the transition between the continent and ocean. If possible, additional geophysical work will be done in the area of the Aleutian Basin, Ridge, and Trench, or the Gulf of Alaska.

Geology of the Oregon Continental Terrace -- Byrne, Bushnell, Maloney

Size analyses have been completed for 50 samples from the continental shelf and slope between 43°20'N and 45°00'N. Median diameters range from less than 0.003 mm to 0.325 mm, with the finer-grained sediment occurring mainly on the upper slope. Coarse fractions of 120 samples have been examined and the percent of glauconite determined by visual inspection. Although this mineral is essentially absent from the near-shore sands, it is extremely abundant on the topographic highs of the continental slope.

A bathymetric chart of the area from the shoreline to the 1000-fathom contour between 43°30'N and 45°00'N has been prepared from U.S. Coast and Geodetic Survey "smooth sheets." A 10-fathom contour interval was used from 0 to 100 fathoms, and a 50-fathom interval for depths greater than 100 fathoms. This chart used in conjunction with PDR traces has made possible an evaluation of the geomorphology of the continental terrace off central Oregon, which will be published in May by the State of Oregon Department of Geology and Mineral Industries.

A detailed bathymetric chart of the continental slope between 44°10'N and 44°36'N is being prepared from PDR traces made along east-west traverses at 1.5-mile intervals. This chart will be of assistance in determining the geologic structure of the continental terrace in this area.

Coastal Deposition -- Byrne, Kulm, Maloney

Petrographic analyses of sands from the Oregon rivers which discharge into the Pacific south of Siletz Bay are currently under way. To date, the heavy mineral suits from all of the rivers have been examined and quantitative analyses have been completed for seven of them. Sands from the southern Oregon and northern California rivers are characterized by minerals derived from basic igneous and metamorphic rocks. These minerals (e.g. serpentine, glaucophane, clinozoisite, hypersthene, sillimanite) are less abundant or absent from the sands of the central Oregon coastal rivers.

Due to the high percentage of heavy minerals in many of the well-sorted sands along the Oregon coast, the validity of standard methods of size analysis is questionable. Preliminary results of a re-evaluation of these methods indicate that when sands containing more than 10 to 15 percent heavy minerals are analyzed the settling tube produces median diameter values which are too high and the values obtained by weighing sieve fractions are too low. A more accurate method of analysis is being developed.

Estuarine Sedimentation -- Byrne, Kulm, Maloney

Sedimentary and microfaunal analyses have been completed for the preliminary study of Yaquina Bay sediments; reports on each phase of the investigation are in the final stages.

Chemical Oceanography -- Park, Latimer, DeBen

Since receiving an inductive salinometer (Hamon, Australia) in January, analysis of all salinity samples from the monthly hydrographic cruises has been completed. A rate of approximately 40 analyses per hour was obtained in the analyses of a thousand samples. The average reproducibility of the salinometer during a one-hour operating period was found to be about $\pm$ 0.004 ‰ salinity.

On 24 February 1962, a chemical survey of Yaquina Bay was undertaken. The R/V ACONA was used as a shipboard chemistry laboratory. Eighty samples were collected and analyzed for salinity, inorganic phosphate, dissolved oxygen, and pH.

A method for recovery of silver nitrate from silver chloride precipitate by the use of Dowex-50 cation exchange resin is being undertaken.

Surface Area and Porosity of Ocean Sediments -- Stump

Surface area determinations have been made with nitrogen and water vapor by the B.E.T. method on four samples of terrigenic sediments off the Oregon coast and on one sample of pure glauconitic mineral. Various methods of extractions have been used in order to develop a standardized procedure for the determination and comparison of surface areas.

Adsorption-desorption isotherms have been drawn for each sample to study the characteristics of the desorption hysteresis and to determine the pore size distribution.

Plans are being made to examine all samples by both differential thermal analysis and X-ray diffraction to determine which minerals are contributing to the total pore volume and surface area.

Plankton Inventories -- Frolander

Ten samples were collected at the two standard stations in Yaquina Bay at intervals of approximately a week. In addition, the first winter study was made of the time and space variations in populations.

On 1 February, hydrographic and plankton samples were collected on one ebb tide at six stations from near the head of the bay to the mouth. This was immediately followed by a 24-hour study at one central station.

During August, 1961, a similar sampling program revealed the presence near the upper end of the bay (upstream) of a species of marine copepod not previously reported this far north on the west coast. This species was absent from the samples collected in February 1962. Two upstream stations have been added to the weekly sampling program to study the seasonal changes in distribution of this organism. (In East Coast waters this organism is absent in winter but appears in early summer.)

Data obtained during this quarter:

Physical data:

Surface and bottom water samples at each station, from which temperature, salinity, and dissolved oxygen have been measured. Total of 112 measurements of each variable.

Biological data:

Quantitative net tows:

| | |
|---|---|
| # 6 mesh tows | 56 |
| #12 mesh tows | 52 |
| Qualitative half-meter net tows | 232 |

Volumetric analyses of zooplankton completed:

| | |
|---|---|
| # 6 mesh samples | 22 |
| #12 mesh samples | 23 |

Nekton and Macroplankton Studies -- Pearcy, Hubbard, Hebard, Renshaw, Laurs, Carey

This part of the program is supported by the Atomic Energy Commission. This quarter, using the modified Isaacs-Kidd midwater trawl, we made 60 tows ranging from the surface to over 1000 meters in depth. Our sampling program followed three basic courses:

1. Sampling during the night on the regular hydrographic cruises.

2. Sampling at one station over a 24-hour period to provide information on sampling variability and the diurnal migration of nektonic organisms.

3. Deep trawls to 500 and 1000 meters as a continuation of the study of the depth distribution of bathypelagic organisms. A depth gauge was used routinely to determine maximum depths of trawling.

Volumes showed an increase over the previous quarter and were comparable to the same season a year ago.

Methods to be used in analysis of midwater trawl samples have been selected.

They include removal of the nekton, medusae, siphonophores and the larger shrimp, followed by extraction of an aliquot of the remaining sample. A large-volume Folsom splitter is used for obtaining the aliquot.

The aliquot is examined for species composition, and wet weight is then determined. This is followed by examination of the whole sample for rare forms which were not abundant enough to be found in the aliquot.

At the present time, aliquots have been taken for samples through January 1962 and the larger forms have been removed from those through March 1962.

Identification of the various forms present in the whole samples, as well as in the aliquot samples, is in progress.

Benthic Fishes -- Day, Pearcy

An analysis is being made of fishes from 44 otter trawl collections taken in the area from Cape Foulweather to Waldport, in water depths from 20 to 1000 fathoms. The fishes identified thus far represent 14 families and 36 species. For the more numerous species taken, depth ranges have been determined and seasonal changes in depth range are being investigated.

Benthic Fauna -- McCauley

No new collections were made during the quarter. Sorting and identifying the previously collected materials have continued. The collections have been moved to the new wing of the Physics-Chemistry Building and reorganized.

Two new Smith-McIntyre spring-loaded bottom samplers have been ordered and will be used on the monthly benthic cruises which will start in April.

Primary Production off the Oregon Coast -- Curl, Small

Photosynthetic rate of phytoplankton was analyzed by radiocarbon (C-14) uptake at five hydrographic stations in January, and at six stations in February. This included a total of seventeen surface samples and thirteen 10-meter samples. Analysis of samples from the March cruise will be undertaken very shortly. Productivity rates ranged from essentially no production to about 1.9 $mgC/m^3/hr$ in January, and from essentially no production to about 8.8 $mgC/m^3/hr$ in February.

Pigment contents of the phytoplankton crops were analyzed from thirteen surface samples and twelve 10-meter samples in January, and from eleven surface samples and four 10-meter samples in February. Most of these samples were taken concurrently with radiocarbon uptake samples. Chlorophyll "a" values range from about 0.36 to 2.65 $mg/m^3$ in January and 0.29 to 2.10 $mg/m^3$ in February. Samples for particulate carbon analysis were taken simultaneously with pigment samples, and are in the process of being analyzed.

Phytoplankton Taxonomy and Species Composition -- Curl, Small

Thirteen surface samples and twelve 10-meter samples (500 ml each) were collected in February. The preserved specimens are now being run through the settling and fixative-removal process prior to counting in a sedimentation chamber and mounting on slides for permanent records.

A sedimentation chamber has been constructed to speed up the lengthy settling and washing procedure. Cursory microscope examinations of several January samples have shown a paucity of phytoplankton. This was to be expected in view of the very low productivity and pigment values in January.

Grazing and Energy Transfer in Lower Trophic Levels -- Small

A light-gradient, temperature-gradient "aquastat" is being constructed to study the effects of temperature, light, salinity, and radioisotope type and concentration on (1) direct uptake of isotope from sea water, and (2) food web uptake and energy transfer by second trophic level herbivores.

Artemia salina will be the initial grazer. Techniques of culturing, handling, filtering, and isotope counting of these animals have been worked out in preliminary experiments in the laboratory. Covariance analysis has shown both a slight animal weight effect and a "rinsing" effect on direct C-14 uptake per unit weight of animals. The increase in cpm/mg dry weight with increased dry weight is linear over fairly large ranges of weights, and thus a correction can be applied to the counts. The radioisotope count difference between rinsed (distilled water) and non-rinsed samples is almost certainly a salt effect and not a true animal uptake difference. Standard rinsing techniques must be adopted in all future direct uptake work.

## FACILITIES

Oceanography Building

A grant has been received from the National Science Foundation for construction of an oceanography building on campus. (Oregon state funds will also be required for completion.) An architectural firm, Jeppsen and Miller, Corvallis, has been retained to design the building.

## Research Vessel ACONA

During the winter quarter, the ACONA operated a total of 38 days. In addition, groups of students from Newport High School and Ocean Lake Elementary School, and a group of elementary teachers taking advanced courses in science visited the ACONA.

Cruises taken during the quarter are as follows:

| Cruise Type | Dates | Nautical Miles |
|---|---|---|
| Hydrographic | 8 to 16 January | 1040 |
| Midwater trawl | 23 to 25 January | 120 |
| Drogue | 29 to 31 January | 160 |
| Yaquina Bay plankton study | 1 to 2 February | |
| Drogue | 19 to 20 February | 120 |
| Equipment testing | 24 February | 5 |
| Drogue | 26 to 28 February | 160 |
| Hydrographic | 1 to 2 March | 160 |
| Coos Bay current study | 5 to 6 March | 40 |
| Hydrographic | 7 to 9 March | 230 |
| Geology | 14 to 17 March | 630 |
| Hydrographic | 26 to 29 March | 260 |
| Total nautical miles | | 2925 |

In addition to the observations taken during hydrographic cruises, the following observations were made:

| | |
|---|---|
| Midwater trawl tows | 22 |
| Otter trawl tows | 2 |
| Hydrographic casts (Coos Bay) | 12 |
| Depth soundings (Detailed soundings over 630-mile cruise track) | |
| Drogue measurements of currents | 12 |

## Marine Science Laboratory

The University is executing an arrangement with the Port of Newport, Oregon, for a 32-acre tract on Yaquina Bay to be used for a site to construct a proposed Marine Science Laboratory. The site will be used for construction, maintenance and operation of buildings, docks, moorage and other facilities for research relating to oceanography, water quality, fisheries, and marine life.

# PUBLICATIONS AND PAPERS

## Published:

Byrne, John V. and L. D. Kulm, 1962. An inexpensive lightweight piston corer. Limnology and Oceanography, 7:106-108.

Curl, Herbert, Jr. and Judith Sandberg, 1961. The measurement of dehydrogenase activity in marine organisms. J. Marine Research, 19:123-138.

Frolander, H. F. and Ivan Pratt, 1962. A bottom skimmer. Limnology and Oceanography, 7:104-106.

Pattullo, June G. and W. Bruce McAlister, 1962. Evidence for oceanic frontogenesis off Oregon. Science, 135:106-107.

Riley, C. M. and J. V. Byrne, 1961. Genesis of primary structures in anhydrite. J. Sedimentary Petrology, 31:553-559. (Dr. Riley is with Humble Oil and Refining Co. This report was prepared before Dr. Byrne joined the Department of Oceanography.)

## Accepted for Publication:

Byrne, J. V. Coastal erosion, northern Oregon. Miscellaneous Papers of the Allan Hancock Foundation, Univ. Southern California Press.

Byrne, J. V. Geomorphology of the continental terrace off central Oregon. The Ore-Bin, Oregon Department of Geology and Mineral Industries.

Byrne, J. V. Variations in fluvial gravel imbrication. J. Sedimentary Petrology.

Curl, H., Jr. Standing crops of carbon, nitrogen, and phosphorus, and transfer between trophic levels, in continental shelf waters south of New York. Rapports et Proces-Verb.

Hood, D. W. and Kilho Park. Bicarbonate utilization of marine phytoplankton in photosynthesis. Physiologia Plantarum.

Pearcy, W. G. A tail less flounder. Trans. Am. Fish. Soc.

## Submitted for Publication:

Curl, H., Jr. Analysis of carbon in marine plankton organisms. J. Marine Research.

Curl, H., Jr. The effect of divalent sulfur and vitamin $B_{12}$ in controlling the distribution of Skeletonema costatum Limnology and Oceanography.

Small, Lawrence F. A note on the use of radioisotopes in laboratory food assimilation studies with Daphnia. Nature.

Presented at Scientific Meetings:

Continental terrace off central Oregon. Presented 3 March 1962 to the Oregon Academy of Science by J. V. Byrne.

Various aspects of the research program at Oregon State University presented 10 February 1962 to the Northwest Pacific Oceanographers meeting in Vancouver, B. C.

Biological collecting instruments by Herbert F. Frolander.

Water masses by Robert K. Lane.

Deep benthos by James E. McCauley.

Intermediate forage animals by William G. Pearcy.

Radio-nuclide by Charles L. Osterberg.

Phytoplankton by Lawrence F. Small.