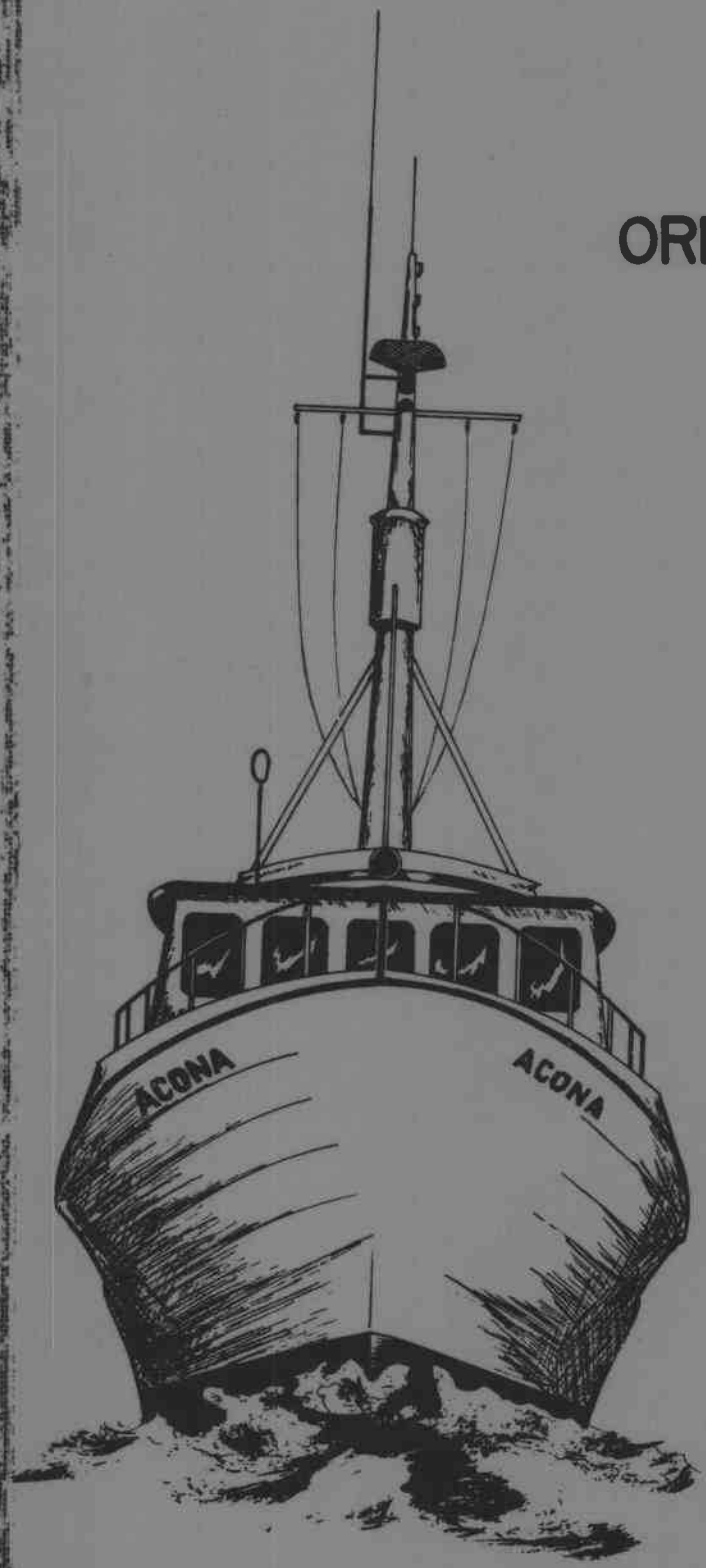
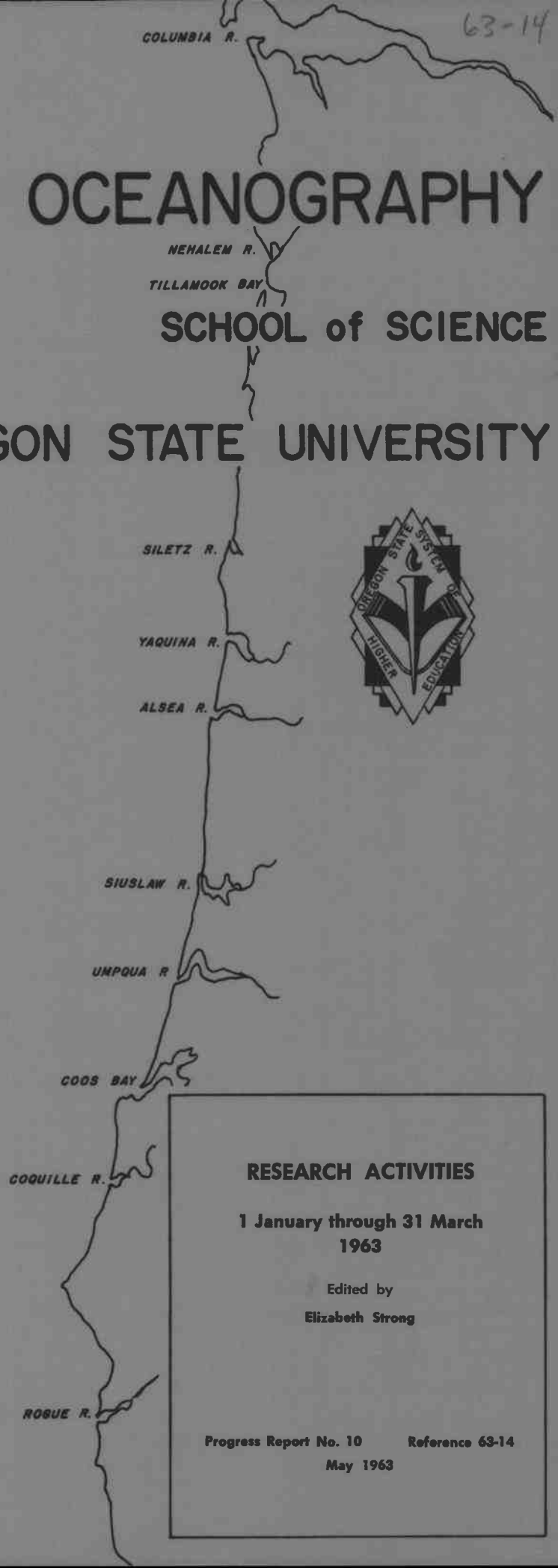
63-14

DEPARTMENT of OCEANOGRAPHY

SCHOOL of SCIENCE

OREGON STATE UNIVERSITY





RESEARCH ACTIVITIES

1 January through 31 March 1963

Edited by

Elizabeth Strong

Progress Report No. 10 **Reference 63-14**

May 1963

Department of Oceanography
School of Science
Oregon State University

Wayne V. Burt
Chairman

Progress Report No. 10

RESEARCH ACTIVITIES

During the Period
1 January through 31 March 1963

Edited by

Elizabeth Strong

National Science Foundation
Grant GP 622
Grant G 23103
Grant G 24353
Grant GB 531

Air Force
Grant AF-AFOSR-62-376 (ARPA)
Grant AF-19(628)-2778 (AFCRL)

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

Atomic Energy Commission
Contract AT(45-1)1726
Contract AT(45-1)1750
Contract AT(45-1)1751
Contract AT(45-1)1758

Reference 63-14
May 1963

INTRODUCTION

This report summarizes the research conducted during the first quarter of the calendar year 1963 by the Department of Oceanography, Oregon State University, under contract Nonr 1286(02) Project NR 083-102 with the Office of Naval Research, grants GP 622, G 23103, G 24353, and GB 531 with the National Science Foundation, contracts AT(45-1)-1726, AT(45-1)-1750, AT(45-1)-1751, and AT(45-1)-1758 with the Atomic Energy Commission, grant AF-AFOSR-62-376 with the Advanced Research Projects Agency, and AF-19(628)-2778 with the Air Force Cambridge Research Laboratory.

PHYSICAL OCEANOGRAPHY

Hydrography of Oregon Coastal Waters - Wyatt, Kujala, Borden

One hydrographic cruise was taken during late March and early April and stations were made to 165 miles west of Astoria, Newport, Coos Bay, and Brookings, Oregon.

Summary of Samples Taken on Hydrographic and Drogue Cruises

Hydrographic casts	52
BT casts	90
Surface temperature and salinity observations	105
Drift bottle releases	576
Midwater trawl tows	26
Plankton tows (Clarke-Bumpus)	24
Plankton tows (meter net)	10
Chlorophyll (C_{14} samples)	235
Phytoplankton samples	49
Submarine photometer readings	29
Drogue current measurements	6

In addition to computer analysis of hydrographic observations, bathythermographic reproductions have been completed for all hydrographic cruises taken during 1962.

Shore Station Observations - Still, Wyatt

Visits were made to 12 shore stations this quarter to collect accumulated salinity samples and data sheets. Two additional stations were established at the U.S. Coast Guard Lighthouse at Cape Arago and at Long Beach, Washington. Observations of wind direction and force taken at four U.S. Coast Guard stations in 1962 were copied from log books. These stations are located at Cape Blanco, Cape Arago, Umpqua River entrance, and Yaquina Bay.

The Cape Arago station is serving as a monitor of daily oceanographic conditions. Arrangements have been made for immediate communication by telephone when characteristics indicating upwelling or other oceanic processes of interest are suspected.

Temperature and Salinity Variability - Denner, Pattullo

Analyses have been completed for all data discussed in earlier Progress Reports and for additional surface data at sea extracted from cruise reports of this and other institutions. The material has been compiled and submitted as Mr. Denner's thesis for the Master of Science degree. During the next quarter a technical report containing all analyses will be prepared, and a summary of the results will be written for publication.

Oceanic Fronts - Pattullo, Collins

The bathymetry and the intensity of the permanent front off the Oregon coast have been determined for all OSU cruises to date. The calculation of these parameters was completed using the IBM 1620 computer. These data are presently under analysis.

Subsurface Current Measurements - Pattullo, Wyatt, Maughan, Smith

One drogue cruise was made during mid-January. Direct current measurements and data for geostrophic flow calculations were obtained at #0, 50, 100, and 200 meters depth. Calm weather prevailed during the cruise and it was possible to complete all portions of the work.

The IBM program for computation of velocity components between each pair of fixes has been debugged and all data are being analyzed by computer. This program was written by Sue Borden.

A report on the year's results is in preparation.

Water Masses off the Oregon Coast - Rosenberg, Pattullo, Bernhardt

The analysis has been supplemented by the computation and examination of T-S correlations for the waters at depths greater than 200 meters. A paper is in preparation.

Heat and Water Budgets - Pattullo, Bernhardt

The computations are completed and a paper will be written within the next quarter.

Estuarine Studies: Seasonal Variations - McAlister, Blanton

Studies are continuing of distribution of properties and their seasonal variations in Oregon estuaries; particular emphasis has been given to Coos Bay. Seasonal variations in circulation patterns have been observed, and are being related to available sources of energy for mixing in the estuary.

Estuarine Studies: Turbulence - McAlister, Blanton

The analysis of direct current measurements collected in Coos Bay is continuing. In this study, autocorrelation analyses of the current observations are being made. Present data permit the analysis of fluctuations of periods of one minute or more. Additional measurements are planned during the next few months in order to define more completely the turbulent spectrum for the tidal flow in the estuary.

GEOLOGICAL OCEANOGRAPHY

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

Lithology: The sampling program on the continental shelf was continued during this quarter. Grab samples and short gravity cores were obtained at 118 locations at three mile intervals between 44°20'N to 43°50'N. In addition, eight other cores and three samples of rock were obtained from the shelf in this area. The continental shelf has now been sampled from 43°50'N to 44°55'N. Laboratory analyses have been completed on the samples collected north of 44°20'N, and a report is in preparation.

Rocks were dredged from the upper part of the continental slope at five different locations.

Topography: Bathymetric charts of the continental shelf and continental slope based on unpublished soundings of the U.S. Coast and Geodetic Survey have been completed for the area off Oregon. Three charts have been prepared (42°00'N to 43°30'N, 43°30'N to 45°00'N, 45°00'N to 46°30'N) and will be used to evaluate the general geomorphology of the continental terrace off Oregon.

Detailed analyses of PDR records from the continental slope between 43°50'N and 44°40'N reveal the existence of several deep benches. Those benches which are laterally persistent occur in depth intervals of 160-200 and 420-535 fathoms in the north; 240-285, 635-785, 785-1200, and 1320-1390 fathoms in a central area; and 570-730 and 840-1000 fathoms in the south. The nature of these benches suggests that the continental slope has been extensively faulted in this region.

Coastal Studies - Byrne, Kulm, Runge

Erosion: A re-evaluation has been made of the geologic factors affecting the erosion of the 160 miles of Oregon coast north of the Siuslaw River. The results of this survey indicate that various factors maintain control along the coast as follows:

Factors	% of Coast
Lithologic	34
Structural	16
Lithologic-Structural	17
Stratigraphic-Structural	2

Landsliding is common along 25 per cent of the coast and is most common where lithologic factors or the lithologic-structural combination are important. An investigation of the geologic and physical oceanographic factors affecting landsliding will be initiated this summer.

Deposition: Petrographic studies of the sediments transported by the Oregon coastal rivers has been reinstituted with an investigation of sediments from the northern rivers. Samples from the Columbia River contain high percentages of hypersthene, but this mineral is rare or absent in sediments from most of the coastal rivers. Since hypersthene is common to the beaches of Oregon, it would appear that the chief source is the Columbia River.

A computer program has been established to determine the statistical parameters of sediments. The program is in the final stages of refinement and will be used in the future to facilitate the statistical aspects of the laboratory analyses of sediments. The program will be made available to other University departments engaged in the analysis of sediments.

A study is underway to determine the sedimentary characteristics useful in distinguishing beach from aeolian sands. The validity of criteria established by other investigators is being examined and the valid concepts applied to a study of phosphorite sands collected from Santo Domingo Island, Baja California. An attempt is being made to determine whether there is a relationship between the concentration of phosphorite in the sands and the environment of deposition.

GEOPHYSICS

Seismic Work at Sea - Berg, Whitcomb

Major emphasis in the Sparker project has been placed on the Yaquina Bay survey and the modification of equipment to achieve the best records possible in this area. The diesel engine of the MARJORIE C was modified to reduce record noise. Shock mounts were constructed for the recording and amplifying cabinent of the Sparker to reduce the effect of "microphonics," or mechanically induced noise, in the circuitry.

To increase energy output and thus depth of penetration, a gas exploder using oxygen and propane is being assembled as a second energy source.

Quality of records is greatly improved but continuity of reflections is still questionable because of filtering and instrumental effects on the signal. As yet, maximum depth of energy penetration is approximately 300 feet in the Oneatta Point area of the Bay.

Seismic Station - Dehlinger, Chiburis, Trembly, Mecham, Berg

The seismic station was operated continuously as a standard station during the entire quarterly period. USC&GS and Texas Instrument personnel have made instrumental modifications to the station. Arrival times of P, S, and sometimes other waves, have been sent to the USC&GS in Washington at regular intervals.

The equipment for a visual seismic recorder to be installed in the PC Building was ordered and received. The seismometer set up in the vault is connected by telephone line to the recorder in the PC Building. The timing mechanism to the seismograph is connected at the vault.

Seismicity of Oregon - Chiburis, Mecham, Dehlinger

Travel-time curves have been constructed based on four earthquakes in western Washington and Oregon as recorded at numerous stations. These curves are as complete as the data justify. Although more data will be obtained as additional shocks are recorded, the present curves demonstrate quite clearly that the sub-Moho velocities are approximately 7.6 and 4.1 km/sec for P_n and S_n waves in the western parts of Washington, Oregon, and California. The velocities in eastern Oregon appear to be higher than these values. A preliminary value for Poisson's ratio below the Moho is 0.29 in western Washington and Oregon. Seismograms from other stations in Canada and Washington have been requested for these four shocks; seismograms for a shock in Idaho on 27 January have also been requested for study.

The proposal for work on "Seismicity of Oregon" has been accepted by the Air Force Cambridge Research Laboratory. Preparations are being made to order the seismic equipment for the Klamath Falls station.

Comparison measurements have been made between a Wilson-Lamison vertical seismograph operating at the seismic station and the seismograms from the short-period vertical Benioff seismograph to determine the relative size of microseisms recorded for different magnifications of the W-L unit. A box for operating the W-L unit has been constructed. This seismograph is now ready for field measurements. Initial measurements will be made in Portland and on Mary's Peak.

Gravity Studies - Berg, Dehlinger, Rinehart, Odegard

Land: A gravity base station network has been initiated at the minor airports in the state. Stations have been established at Bend-Redmond, John Day, Pelecum Point, Boise, Ontario, Baker and Burns.

Sea: A free-air gravity map (2 milligal contour interval) has been prepared using the data of the nearshore marine gravity range at Newport.

Arrangements have been completed with the U.S. Coast Guard 13th District to make surface-ship gravity measurements aboard the USCGC YOCONA 3-29 May. Surface-ship measurements on the R/V ACONA are planned during June and July. The LaCoste-Romberg surface-ship meter S-9, now being used by Dr. J. C. Harrison, will be obtained for this work. Mr. B. R. Jones of Texas A and M will join us for six weeks this June and July as surface-ship meter operator and gravity computer.

The Office of Naval Research has granted supplemental funds to the Department of Oceanography for surface-ship gravity work during summer 1963.

Theoretical: The Tulwani-Ewing line integration method of two-dimensional gravity modeling was programmed in FORTRAN. A gravity model was constructed using this method. The computed gravity value was analyzed using the Tomoda-Aki $(\sin x)/x$ method. Good correspondence between the computed structure and the original model structure was obtained.

The structure obtained about a year ago from analysis of gravity data on and off the coast of Oregon using the $(\sin x)/x$ method was used in the two-dimensional model. The correspondence between the computed gravity and the observed gravity was good except at the ends of the profile.

Gravity data used were taken from Woollard's map and Harrison's two profiles through Astoria and Florence. The results obtained using an estimated depth of 30 km were in serious error. An investigation of the method showed that the $(\sin x)/x$ method of analysis fails when the ratio of D/a is greater than one (D = estimated depth, a = station spacing).

The Astoria profile has been run using an estimated depth of 8 km. The average depth of the computed structure was about 9.1 km. To every station was added 20.9 km (difference between 30 km and the average depth). This modified structure appears reasonable and will be used to compute the theoretical gravity to compare with the observed gravity.

Theoretical and Model Seismology - Berg, Dehlinger, Redo, Trembly, Laun, Papageorge, Chiburis

An annual report has been written on research activities during the past year.

Thermal Studies - Berg

A thermal probe has been ordered. Plans are being made to conduct initial heat flow measurements during the summer.

Instrumentation - Bales

A nuclear precession magnetometer is currently being constructed. All electronic and mechanical supplies have been ordered. The instrument should be completed and ready for field tests by the middle of June.

CHEMICAL OCEANOGRAPHY

Offshore Chemistry - Park, Oliphant, Catalfomo

During this quarter salinity and dissolved oxygen analyses were made for all hydrographic stations occupied. In addition, samples taken off Brookings were frozen at sea and later analyzed for inorganic phosphate in the campus laboratory.

Initial work was begun on construction of a compact, portable titration setup for dissolved oxygen analyses with a digital read-out following plans developed by Dr. Carpenter of the Johns Hopkins University.

Plotting of all chemical parameters from hydrographic data for the past 20 months is nearing completion.

Estuarine Chemistry - Matson, Frolander, Park

In addition to regular salinity, dissolved oxygen and inorganic phosphate analyses, the determination of soluble silicate in the waters of the Yaquina Bay was initiated. We have found that there is a good inverse correlation between the silicate concentration and the salinity of the bay water; over 100 μg-atom Si/L for waters below 15 ‰ S, and less than 30 μg-atom Si/L for waters above 30 ‰ S. We intend to apply this inverse correlation to determine the effect of river runoff on the dilution of sea water.

Comparison of Estuarine and Offshore Chemistry - Park, Frolander

Intrusion of open sea water into the Yaquina Bay and the effect of runoff on the chemical composition of open sea water near Newport, Oregon, are being analyzed from the chemistry data obtained in the bay and the open waters for the past two years.

Surface Chemistry of Marine Sediments - Stump

In order to identify clay minerals and to study their behavior with respect to various interlayer ions, X-ray diffractograms have been made on eight sediment samples obtained from the region of 44°20' and 45°00'N and within 40 miles off the Oregon coast.

Conductometric Analysis of Alkalinity of Sea Water - Park, Oliphant, Freund

Alkalinities obtained by conductometric analysis were compared with those obtained by the pH method of Anderson and Robinson. Deviations between the two methods were not greater than 1%. An advantage of the new method is that it uses the salinometer, which is already being used aboard the research ship for salinity determinations. A scientific communication on the new method was submitted to Analytical Chemistry.

Gold and Silver Assay of a Manganese Nodule - Caldwell (Chemistry Dept.)

A two-pound manganese nodule was received from Professor F. P. Shepard of Scripps Institution of Oceanography. Partial analysis of the nodule gave 19% (weight) of Mn, 24% SiO_2, 16% Fe, 0.3% Ni, and 0.2% Co, but negligible amounts of gold or silver. The nodule analyzed retains its interest as selective residues of various metals, but not for gold or silver.

Radioanalysis of Marine Organisms - Osterberg, Larsen, Cutshall

The ND 130A gamma-ray spectrometer is in daily use analyzing plankton and nekton samples. Calibration is being maintained so that when computations of efficiency factors are completed, the data can be reduced quantitatively, using an IBM 1620 computer. The first calibration, using a potassium-40 standard which was counted both at Hanford and at Corvallis, showed that the efficiency factor for 1.46 Mev gammas was essentially the same for our instrument and the one at Hanford.

A 1-1/8" thick bismuth (99.999%) shield has been cast and delivered. This will surround the 5-inch crystal and minimize background noise.

During the period of this report, approximately 85 samples were analyzed at Hanford, and 30 at Oregon State University.

Radionuclides in Phytoplankton - Osterberg, Curl

Assays of filterable particles from large volumes of sea water show the presence of fission products, Cr^{51}, and traces of Zn^{65} (Cr^{51} and Zn^{65} are from the Hanford reactors). Our techniques and instrumentation have been improved and further studies are in progress.

Experiments have been conducted in the laboratory on the uptake of chromium by phytoplankton and by the membrane filters used in these studies. Chromium chloride ($Cr^{51}Cl_3$) was used in a final liter of 3×10^{-3} μg/50 ml of sea water. The initial counting rate indicated that chromium at pH's of from six to eight behaved as a hydrocolloid which became bound to filters, glass beads and living and dead phytoplankton. There was no indication of biological uptake.

Radioanalysis of Inland Sands - Larsen, Cutshall, Osterberg

Analyses for natural gamma emitters on samples of sand and gravel from throughout the Willamette Valley are underway. Because of the long half-life of the natural radionuclides in these samples, analyses can await available "counting" time on the spectrometer.

Radioanalysis of Natural Waters - Osterberg, Larsen, Cutshall

A total of 64 filter samples from various rivers have been collected, and about two-thirds of these have already been analyzed for gamma emitters. Most of the rivers of the state have been sampled twice. Included are:

A. Coastal streams: Nehalem, Nestucca, Siletz, Alsea, Siuslaw, Umpqua, Coquille, Rogue

B. Central Valley: Willamette, North, Middle, and Coast Forks of Willamette, McKenzie, Marys, North Santiam, South Santiam, Yamhill Clackamas

C. East of the Cascades: Metolius, Deschutes, John Day, Malheur, Owyhee, Snake, Burnt, Boise

D. Columbia River

A rain collector was placed on the roof of the Physics-Chemistry Building in January. Since then, one sample of snow and four samples of rain water have been collected and analyzed. The levels of fission products measured are very much higher than those observed by us in rivers and ocean waters.

Zinc-65 in Sea Water - Osterberg, Park, Curl, Cutshall, Larsen

Tests with ion exchange and chelating resins with Columbia River water have been completed. Samples (500 ml) of the resins were analyzed in the well of the 9-inch Hanford detector. A comparison of the efficiency of the column method versus the "batch" method for concentrating radionuclides suggests that the latter will be better suited for use at sea. Further work is scheduled.

Chemistry of Cr^{51} in Natural Waters - Cutshall, Osterberg, Park, Curl

A preliminary library study of the chemistry of chromium has been completed and several field and laboratory experiments have been carried out with various exchange resins. Mr. Cutshall tentatively plans to trace the Cr^{51} in the Columbia River through the estuary and into the ocean, paying particular attention to its chemistry and ultimate fate in the ocean. This study is expected to be developed into part of his thesis research for the Ph.D. degree in Chemical Oceanography.

Radioanalysis of Arctic Specimens - Larsen, Osterberg, McCauley

Nine samples of organisms collected by Dr. McCauley on a cruise of the NORTHWIND to the Arctic were analyzed for gamma emitters. Zr^{95}-Nb^{95} and Ce^{141} were the principal radionuclides found, and the sessile tunicate Boltenia echinata contained the most radioactivity. Shrimp (Eualis gaimardii belcheri) also contained fission products. A small but distinct peak of Zn^{65} was observed in the spectrum of the Arctic cod Boreogadus saida.

Trace Element Analysis by Neutron Activation - Osterberg, Stump, Cutshall

Replicate samples of specially collected (i.e., no preservatives) Euphausia pacifica were sealed in quartz and irradiated (10^{19} neutrons/cm^2) at Hanford Laboratories. Several months' delay will be required for nuclear decay before analysis (by gamma-ray spectrometry) can be completed.

Replicate samples of the same euphausiid sample were sealed in plastic and sent to Dr. Harold Dodgen, Washington State University, for irradiation. The lower heat encountered in the "swimming pool" reactor seems more favorable for irradiating biological material.

Future work will depend on results of these initial tests.

BIOLOGICAL OCEANOGRAPHY

Plankton Inventories at Yaquina Bay - Frolander

Weekly sampling program: The study at Yaquina Bay of properties of coastal estuaries is being continued. Zooplankton samples and measurements of temperature, salinity and dissolved oxygen were taken weekly at two stations in Yaquina Bay, one located two miles from the bridge and one six miles upstream.

Thirty-five pairs of zooplankton samples were taken with quantitative #6 mesh and #12 mesh nets, in addition to 21 half-meter net hauls. Measurements of temperature, salinity, and oxygen were made at surface and bottom to accompany each pair of quantitative zooplankton samples.

Special winter survey: During 1-2 February a special survey under winter conditions was made in the bay. This consisted of two parts: (1) a spatial survey and (2) a time survey. For the spatial survey, six stations were sampled progressing from the bridge at Newport to nine miles upstream (Buoy 45. This survey was timed to cover half a tidal cycle (ebb tide) in order to minimize back-flushing effects due to tidal flow. The purpose of the spatial survey is to determine the variability of biological and physical-chemical properties with distance upstream.

The time survey covered the 24 hours immediately following the spatial survey. To determine advection effects, one station was sampled over the entire time period. The station chosen was centrally located within the line of six stations used for the spatial survey.

During the survey, samples for quantitative measurements of zooplankton, salinity and dissolved oxygen, as well as concurrent temperature measurements, were taken. Additional water samples collected will be analyzed for phosphate determinations.

Volumetric analyses: Quantitative samples of zooplankton collected during 1962 have been analyzed by vacuum displacement method. These analyses will be continued on later collections.

Accessioning: The accessioning and cataloging of zooplankton samples has been continued and is completed through March 1963.

Analyses of Physical-Chemical Data - Frolander

Oxygen saturation values for the ranges of salinities and temperatures encountered in the bay were calculated for both surface and bottom levels. These saturation values were plotted against the actual observed oxygen values.

During the winter months of 1960, the measured values were higher than the calculated saturation values. Cold fresh water runoff in conjunction with low biological activity would lead to the high winter oxygen values recorded.

During the summer, the observed values dropped below the calculated saturation values. Undoubtedly, both biological activity and advection effects contribute to low summer oxygen values in the bay. Preliminary analyses indicate a greater discrepancy between the calculated and observed oxygen values at the downstream station than at the upstream station. At the downstream station, oceanic advection is probably the chief contributor to the lower observed oxygen values; whereas at the upstream station, *in situ* biological activity within the bay is probably the main factor contributing to an oxygen deficit.

Herring Feeding Habits - Frolander, Russell

A study of the feeding habits of Yaquina Bay herring (*Clupea pallasii*) has recently begun.

Various methods for capturing the fish have been tried. Seine nets were found to be inadequate for taking larger fish of any species. Gill nets will take herring but are selective for the larger forms. Furthermore, fish taken with gill nets always had empty stomachs, suggesting that they regurgitated their stomach contents. Fishing with a herring jig has been the most fruitful method tried, but this technique yields rather small catches and is selective for the larger forms. A fyke net is currently on order and should yield qualitative catches.

Preliminary results suggest:

1. Yaquina Bay herring feed primarily on bay species of zooplankton.

2. The herring population moves in and out of the bay with the tide. The data suggests that at low tide they may be found in the littoral environment.

3. Herring appear to select food organisms according to size. Adult copepods constitude the great bulk of their stomach contents.

Summary of observations:

Number of sampling days	6
Number of fish taken	21
Number of stomachs examined	12

Energy and Element Transfer at Lower Trophic Levels - Small, Curl, Cross

The effects of increasing concentrations of chromium-51 on the direct uptake of this radioisotope by *Artemia nauplii* over different time periods has been investigated. Temperature, light, nutrients, salinity, and pH were held constant. The effect of double and triple distilled water rinses on the count rate of blank filters has been studied also.

Experiments on direct and food web uptake of radioisotopes by *Calanus finmarchicus* are to begin next quarter.

Species Associations of Pelagic Copepods - Cross, Small

Data from opening-closing meter nets are being collected and analyzed in order to describe the distribution and interspecies associations of oceanic copepods off the Oregon coast. Early work has involved identification of species and comparisons of catchability of larger pelagic copepods by the meter net and 10-inch Clarke-Bumpus sampler.

Phytoplankton Ecology - Curl, Small, Verity, Trione

Three complete and one incomplete daylight *in situ* experiments were conducted at NH-25. Eighty-nine samples from this station were analyzed for productivity by the C^{14} method. Thirty-five samples were collected for studies of photosynthetic pigments and fifteen for analysis of species composition. Ambient illumination and depth attenuation measurements were made on all cruises. A pyrheliometer with recorder has been received and will be permanently mounted on the ACONA to give a continuous record of solar radiation.

A total of 235 pigment samples and 46 fixed samples, plus concurrent light measurement, were taken on the two hydrographic cruises made this quarter.

Enzyme Respiration Studies of Oceanic Animals - Curl, Pearcy, Karinen

Data on the succinoxidase activity of many species of fish and larger zooplankton are being analyzed. Major modifications in the method have been made to correct for absorption at 490 mμ by carotenoids and to give accurate weight-based data. Work is being conducted on an examination of alternative pathways to the succinoxidase system, since low activity may be a result of shunts rather than inherent low respiration. Instrumentation has been designed to measure gaseous (O_2) metabolism before the enzymatic method is applied to a specimen.

Phytoplankton Physiology - Curl, Small, Trione, Davey

Eight species of phytoplankton diatoms, including *Skeletonema costatum*, *Thalassiosira sp.*, *Fragillaria oceanica*, and *Chaetoceros sp.*, have been isolated from nutrient-enrichment cultures of coastal waters and are now in persistent culture. They are currently being made bacteria-free. Enrichment cultures are being made on all hydrographic cruises for the purpose of isolating additional species.

Light fixtures have been obtained for the "aquastat" and construction has begun on this piece of equipment.

Distribution and Abundance of Pelagic Organisms as Related to Upwelling - Laurs, Pearcy

In continuation of a program initiated in June 1962 to study possible relationships between physical-chemical properties and the biomass of pelagic trophic levels, one cruise in March 1963 was made to Brookings. Observations included regular hydrographic observations, tows with a quarter-inch mesh, six-foot, Isaacs-Kidd midwater trawl and a one-meter plankton net with #0 mesh, and millipore filtrations for pigment samples.

Oceanic Nekton Studies - Pearcy, Laurs

Investigation of the seasonal and geographic distribution of small oceanic nekton continued. A total of 68 collections were taken; 33 of these were in conjunction with routine hydrographic cruises at four latitudes off the Oregon coast.

The remaining samples were collected on cruises planned to assess vertical distribution and migration of animals. Trials with an opening-closing device as a bucket on the midwater trawl provided four series of samples from three depth intervals. In five series, however, the last net failed to function properly.

Preliminary examination of the feeding habits of some intermediate consumers was made by means of stomach content analyses in order to relate the trophic level of certain animals with their radioactivity.

Macroplankton Studies - Hebard, Renshaw, Hubbard, Pearcy

During the past quarter, the meter net sampling program has been improved by the following means:

(1) A cable clamp has been designed which allows the net to freely turn around the cable, thus eliminating twisting the towing lines around the cable.

(2) A new depressor has been constructed which should help reduce the wire angle.

(3) Meter nets have been modified, with the cinch ring being moved forward to a position four feet behind the mouth of the net.

Euphausiids, chaetognaths, siphonophores, and Medusae collections from the series of midwater trawl samples taken on the east-west station lines have been identified and are presently being analyzed for horizontal and seasonal distribution.

Benthic Studies - Carey, Kirk

Benthos research off Newport is being continued. One cruise in January was completed this quarter; eight quantitative anchor dredge hauls were collected. A trial run with a 23-foot shrimp-type otter trawl was also made at the 800-meter station. Sampling with this gear will continue for collection of the larger epibenthic invertebrates.

Laboratory analysis of the samples is continuing. Animals have been picked from seven samples and sorted into major groups. Identification of the organisms is underway.

Radioanalysis of Benthic Organisms - Carey, Osterberg

Radioanalysis of organisms and sediments are now underway. Zinc-65 and fallout radioisotopes have been found in the fauna and sediments.

Benthic Fauna of the Chukchi Sea - McCauley

Most of the material collected from the U.S. Coast Guard Cutter NORTHWIND during October 1962 has been examined. More than 300 species were collected and about 120 have been identified. All of the decapod crustaceans have been identified and studied and a report submitted. The decapods include two true crabs: *Chionoecetes opilio* and *Hyas coarctatus alutaceus*; three hermit crabs: *Pagurus pubescens*, *P. rathbuni*, and *P. splendescens*; and twelve shrimps: *Pandalus borealis*, *P. goniurus*, *Eualis gaimardii belcheri*, *Spirontocaris groenlandica*, *S. murdochi*, *S. spina*, *S. turgidus*, *Argis crassa*, *A. lar*, *Crangon dalli*, *C. alaskensis*, and *Sclerocrangon boreas*. *S. groenlandica*, *A. crassa*, *C. dalli*, and *C. alaskensis* have not been reported previously from the Chukchi Sea.

A new animal relationship has been discovered from the Chukchi Sea and a report is being prepared. This relationship consists of an unidentified gastropod mollusc which deposits its egg capsules on the ventral surface of an ovigerous shrimp among the eggs of the shrimp.

General Benthic Fauna - McCauley

The identification and enumeration of benthic invertebrates off the Oregon coast is continuing. A study of the genus *Chionoecetes* is being inaugurated to classify the systematics of these tanner crabs. *C. opilio* *C. bairdi*, *C. tanneri*, and *C. angulatus* have been reported along the west coast of North America and all except *C. angulatus* are presently in the OSU collection. Present taxonomic criteria are unsatisfactory and the species need to be redescribed.

Marine Microbiology - Morita

Several isolates from the ocean fit the classical definition of a psychrophile. A few of these isolates have been characterized as to their temperature range (maximum, minimum, and optimum growth temperatures) in a polythermostat. Most of these isolates grow above 20°C, although some show optimum growth at temperatures of less than 20°C.

The effect of moderate temperature (i.e., 30° and 35°C) on the malic dehydrogenase system of a marine psychrophilic vibrio has been completed and is now being readied for publication. In essence, the results show that permeability characteristics of cell membranes may be one of the major factors which cause psychrophiles to expire at moderate temperatures.

Characterization of a marine psychrophilic DNA (deoxyribonucleic acid) has been initiated. Excellent growth of cells at 15°C has permitted the initial crude extraction of the DNA from the cells.

STAFF

Dr. Peter K. Weyl has joined the staff as Professor of Chemical Oceanography.

Dr. Weyl comes to Oregon State from the Shell Oil Company, Houston, Texas, where he held the rank of senior physicist. He has published a number of papers on his work there on the thermoluminescence of rocks and also on the mechanisms of solution alteration that convert sediments into sedimentary rocks. Prior to his affiliation with Shell Oil Company he spent a year in Brazil as assistant professor at the Brazilian Center for Physical Research.

Dr. Weyl was born in Germany and attended schools in Europe but he completed his high school education in the United States. He served with the U.S. Army for three years in the European theater. After

World War II he attended the University of New Hampshire and the University of Chicago. From the latter institution he received his M.S. in Physics in 1951 and the Ph.D. in the same major in 1953. His minors were in chemistry and mathematics.

Dr. Weyl will be working on research and the training of graduate students in physical chemistry of the oceans and geochemistry in the marine environment.

FACILITIES

Research Vessel ACONA

The ACONA spent 39 days at sea during the first three months of 1963. Work accomplished included hydrographic studies, drogue study, geologic (dredge) cruises, and biological studies of benthos, nekton and phytoplankton.

FS-210

A 750-ton FS class vessel has been obtained from the Army and moved to Portland where it is ready to be converted to a research vessel. It is expected that this ship, now named the YAQUINA, will be available for service in early 1964.

Oceanography Building

Construction on the new oceanography building on the campus is proceeding rapidly. The new four-story building should be ready for occupancy by the staff at the end of 1963.

Coastal Marine Sciences Laboratory

The architect is preparing the final plans for the marine sciences laboratory to be constructed on the coast at Newport. Plans have already been approved for the dock and waterfront shop, and construction will be started on these units in the immediate future. Models have been constructed of the proposed structures and site layout.

PUBLICATIONS AND PAPERS

Publications

Berg, Joseph W., Jr., and Charles D. Baker, 1963. Oregon Earthquakes, 1841 Through 1958. Bull. Seism. Soc. Am., 53: 95-108.

Curl, Herbert, Jr., 1962. Analyses of Carbon in Marine Plankton Organisms. J. of Mar. Res., 20: 181-188.

Dehlinger, P. (with D. K. Chowdhury), 1963. Elastic wave propagation along layers in two-dimensional models. Bull. Seism. Soc. Am., 53: 593-618.

Lane, Robert K., 1962. A Short-tailed Albatross off British Columbia. The Canadian Field-Naturalist, 76: 178.

McCauley, J. E., and W. V. Burt, 1962. Oceanography at Oregon State University, p. 58. In Underwater Yearbook, Underwater Soc. Am., Chicago.

Osterberg, Charles, L. D. Kulm, and J. V. Byrne, 1963. Gamma emitters in marine sediments near the Columbia River. Science, 139: 916-917.

Osterberg, Charles, L. F. Small, and L. T. Hubbard, 1963. Radioactivity in large marine plankton as a function of surface area. Nature, 197: 883-884.

Pattullo, June G., 1963. Seasonal changes in sea-level, p. 485-496. In M. N. Hill, The Sea, Vol. 2, Composition of Sea Water, Comparative and Descriptive Oceanography, Interscience Publishers, London.

Pearcy, William G., 1962. Distribution and origin of demersal eggs within the order pleuronectiformes. J. du. Cons. 27: 232-235.

Pearcy, William G., 1962. Egg masses and early developmental stages of the scorpaenid fish, Sebastolobus. J. Fish. Res. Bd. Canada, 19: 1169-1173.

Papers Submitted

Byrne, John V., Oceanography and the hydrologic cycle. Elementary School Science Bull. (for publication in the September issue).

Dehlinger, P., R. G. Bowen, C. F. Chiburis, and W. H. Westphal. Investigations of the earthquake of November 5, 1962, north of Portland. The Ore Bin.

McCauley, J. E. Observations on some Arctic decapod crustaceans. Arctic.

Park, Kilho, Malcolm Oliphant, and Harry Freund. Conductometric analysis of alkalinity of sea water. Anal. Chem.

Park, Kilho (with W. T. Williams, J. M. Prescott, and D. W. Hood). Amino acids in Redfish Bay, Texas. Publ. Inst. Mar. Sci. Univ. Tex.

Pearcy, W. G. Distribution of mesopelagic fishes over the continental slope off Oregon. Limnol. and Oceanogr.

Rinehart, W. A., and J. W. Berg, Jr. Nearshore marine gravity range, Newport, Oregon. J. Geoph. Res.

Papers Delivered at Scientific Meetings

Berg, J. W. and George Papageorge. Elastic displacement from explosive sources. Seismological Society of America, April 1963.

Byrne, J. V. Geomorphology of the Oregon continental terrace south of Coos Bay. Oregon Academy of Sciences, Corvallis, 23 February 1963.

Carey, A. G. The ecology of two benthic animal populations in Long Island Sound. Department of Oceanography, University of Washington.

Curl, H. C. The effects of upwelling on nutrients and the resulting phytoplankton bloom. 12th Pac. N.W. Oceanogr. Conf., Victoria, B. C., 31 January-2 February 1963.

Lane, R. K. The correlation between sea surface temperature and wind at the coast as an indication of upwelling. 12th Pac. N.W. Oceanogr. Conf., Victoria, B. C., 31 January-2 February 1963.

Larsen, I. L. Gamma-ray analysis of marine arctic specimens. Oregon Academy of Science, Corvallis, 23 February 1963

McCauley, J. E. Crabs and hermit crabs from the Chukchi Sea. Oregon Academy of Science, Corvallis, 23 February 1963.

Osterberg, Charles. Atomic waste disposal monitoring and predictions - fact and fancy. Panel discussion (with Dr. Richard Foster, Chairman; Dr. Allyn Seymour, and Mr. Harold Bissell) at Pacific Fisheries Biologists meeting, Gearhart, Oregon, 20-22 March 1963.

Osterberg, Charles. Radioactivity in plankton. Roundtable discussion (Dr. John Strickland, Chairman) at 12th Pac. N.W. Oceanogr. Conf., Victoria, B. C., 31 January-2 February 1963.

Osterberg, Charles. Radionuclide studies in plankton and nekton. 12th Pac. N.W. Oceanogr. Conf., Victoria, B. C., 31 January-2 February 1963.

Pearcy, W. G. Deep sea animals off the Oregon coast. Marine Biological Soc. Oregon, Portland, 30 March 1963.

Small, L. F. and H. C. Curl, Jr. Primary production off the coast of Oregon. Oregon Academy of Science, Corvallis, 23 February 1963.

VISITING SCIENTISTS

During this quarter the Department of Oceanography sponsored lecture visits to Corvallis of the following scientists:

20 February	Earl J. Wheelwright, Hanford Labs, Richland, Washington. "Applications of ion-exchange in the processing of radioactive fission products and transuranics."
21 February	Robert S. Dietz, Naval Electronics Laboratory, San Diego, California. "Astroblemes: ancient meteorite impact scars on the earth," and "The evolution of continents and ocean basins: commotion in the ocean."
29 March	Alan J. Kohn, Department of Zoology, University of Washington. "Ecology of closely related species in the Gastropod genus *Conus*."