Preliminary Report
of
The Hakuhō Maru Cruise KH-79-4

Aug. 28-Nov. 9, 1979

Equatorial and Subequatorial

Western Pacific Ocean

Ocean Research Institute
University of Tokyo
1984

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Equatorial and Subequatorial
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by

The Scientific Members of the Expedition

Edited by

Nobuo TAGA

Preface

The KH-79-4 Cruise of the R.V. Hakuhō Maru of the University of Tokyo was conducted in Equatorial and Subequatorial Western Pacific Ocean during a period of 74 days from August 28, to November 9, 1979 with port calls at Honiara in the Solomon Islands, Brisbane in Australia and Noumea in New Caledonia.

This report contains biological, biochemical and hydrographical data obtained during this cruise and short summaries of research carried out by each scientist aboard.

On behalf of the scientists aboard, I wish to express our sincere thanks to the officers in the Japanese Ministry of Education, Science and Culture and the Ministry of Foreign Affairs for their diplomatic arrangement of permission to carry out marine scientific research in coastal waters. Thanks are also extended to Captain I. Tadama, officers and crew members of the Hakuhō Maru for their cooperation and capable assistance throughout this cruise.

Nobuo Taga
Chief Scientist

Contents

Outline of the cruise

Under the overall title of "Studies on Ecosystem in Equatorial and Subequatorial Western Pacific Ocean", the following research topics were investigated: (1) taxonomy, ecology and activity of microorganisms, (2) taxonomy, ecology and production of plankton, (3) taxonomy, ecology and production of benthos, (4) the method of fish stock assessment by means of an underwater acoustic—optical system, (5) biochemical activity and metabolism in the sea, (6) hydrographic observation of water temperature, salinity, dissolved oxygen and nutrient salts and (7) observation of gravity anomaly

The cruise consisted of four legs:
Leg 1 from Tokyo to Honiare (Solomon Islands), Leg 2 from Honiara to Brisbane (Australia), Leg 3 from Brisbane to Noumea (New Caledonia), Leg 4 from Noumea to Tokyo. The cruise itinerary is shown in Table 1. The location of observation lines and stations are given in Fig. 1.

The names and specialities of the 31 scientists who participated in the cruise are listed in Table 2.

Table 1. Cruise itinerary

	Arrival	Departure
Tokyo		Aug. 28, 1979
Honiara	Sept. 14	Sept. 17
Brisbane	Sept. 26	Oct. 1
Noumea	Oct. 12	Oct. 17
Tokyo	Nov. 9	

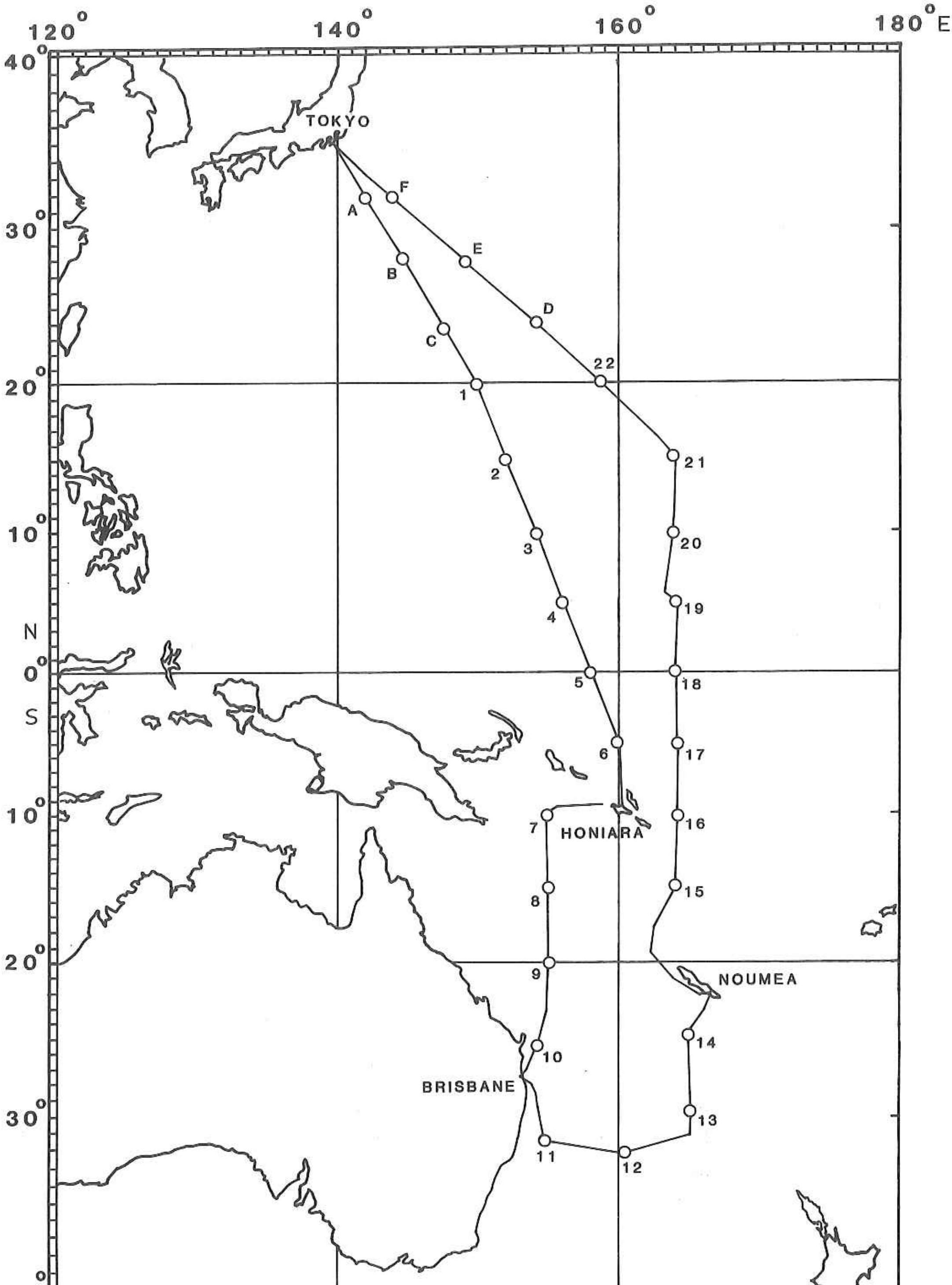

Fig. 1. Track chart and observation stations of the KH-79-4 cruise of the Hakuho-maru.

Table 2. Scientists aboard

Taga, Nobuo: Chief Scientist	Ocean Research Institute, Univ. of Tokyo
Nemoto, Takahisa:	Ocean Research Institute, Univ. of Tokyo
Simidu, Usio:	Ocean Research Institute, Univ. of Tokyo
Ishii, Takeo:	Ocean Research Institute, Univ. of Tokyo
Nakai, Toshisuke:	Ocean Research Institute, Univ. of Tokyo
Ishimaru, Takashi:	Ocean Research Institute, Univ. of Tokyo
Akagi, Yoshiharu:	Ocean Research Institute, Univ. of Tokyo
Hasumoto, Hiroshi:	Ocean Research Institute, Univ. of Tokyo
Tsuchida, Eiji:	Ocean Research Institute, Univ. of Tokyo
Nagashima, Kaoru:	Ocean Research Institute, Univ. of Tokyo
Lee, Won Jae:	Ocean Research Institute, Univ. of Tokyo
Furuya, Ken:	Ocean Research Institute, Univ. of Tokyo
Fukami, Kimio:	Ocean Research Institute, Univ. of Tokyo
Ogawa, Kahoru:	Ocean Research Institute, Univ. of Tokyo
Shirayama, Yoshihisa:	Ocean Research Institute, Univ. of Tokyo
Amano, Mitsuru:	Ocean Research Institute, Univ. of Tokyo
Matsumoto, Takeshi:	Ocean Research Institute, Univ. of Tokyo
Swinbanks, David Donald:	Ocean Research Institute, Univ. of Tokyo
Shiga Naonobu:	Faculty of Fisheries, Hokkaido Univ.
Harada, Koh:	Faculty of Fisheries, Hokkaido Univ.
Yamada, Masatoshi:	Faculty of Fisheries, Hokkaido Univ.
Dohi, Kazuhiko:	Faculty of Fisheries, Hokkaido Univ.
Nishizawa, Satoshi:	Faculty of Agriculture, Tohoku Univ.
Sasaki, Hiroshi:	Faculty of Agriculture, Tohoku Univ.
Okuzawa, Atsushi:	Faculty of Agriculture, Tohoku Univ.
Matsushita, Katsumi:	Faculty of Agriculture, Univ. of Tokyo
Maruyama, Takashi:	Tokyo University of Fisheries
Suzuki, Shigemi:	Tokyo University of Fisheries
Hara, Saburo:	Faculty of Science, Univ. of Osaka
Ikeda, Tsutomu:	Australian Institute of Marine Science
Mitchell, A. W.:	Australian Institute of Marine Science

1. Hydrographic characteristics

T. Nakai and H. Hasumoto

The vertical distributions of water properties were obtained through routine observations. Two hydrographic observational lines were occupied that ran from the sea adjacent to Japan to the east of Australia. Using these data, hydrographic characteristics are described for each section.

1. Temperature (Figs. 2 and 8)

A strong thermocline was found in the low latitude region and high temperature water covered the surface of this region. The thermocline in the vicinity of 10°N was shallowest and the vertical gradient of temperature largest. A vertical spreading of the thermocline just below the equator indicated the existence of the Equatorial Undercurrent. In the northern part of the section, the isotherms indicated the existence of stratification remaining from the immediately preceding summer, while in the southern part of the section, the isotherms indicated a state of convection stemming from the preceding winter. The distributional pattern of temperature around the equator corresponded well with that expected for the Equatorial Current System.

2. Salinity (Figs. 3 and 9)

The various water types encountered in the present sections can easily be identified from the distribution of salinity, because the sections cut across the lines of latitude. Low salinity water covered the surface between 20°N and 20°S as the Equatorial Surface Water. High salinity water with a salinity exceeding 35‰ extended equatorward from both hemispheres below the Equatorial Surface Water, and is called the North Pacific Tropical Water and South Pacific Tropical Water, respectively. The North Pacific major salinity minimum water can be traced from the north to 5°S as the North Pacific Intermediate Water. Another salinity minimum water was observed originating at the Antarctic Convergence and is called the Antarctic Intermediate Water.

3. Dissolved oxygen (Figs. 5 and 11)

The oxygen minimum water with a content less than 1.5 ml/l lay in the deeper layers of the North Pacific Intermediate water. In the southern hemisphere, the oxygen values were relatively high due to the effects of sinking at the Antarctic Convergence.

4. Watermasses and currents

The following watermasses are distinguished along the present observational lines on the basis of their temperature and salinity characteristics:

Watermass	Station
The Western North Pacific Central Water	1,2,21,22
The transition region of the Western North Pacific Central Water and the Pacific Equatorial Water	3,4,19,20
The Pacific Equatorial Water	5,6,17,18
The transition region of the Pacific Equatorial Water and the Western South Pacific Central Water	7,8,9,15,16
The Western South Pacific Central Water	11,12,13,14

Geostrophic currents were qualitatively evident from the sections of σ_t, and could be calculated quantitatively through dynamic computations. The Equatorial Current System of the present section may be divided into three major zones: (1) the North Equatorial Current flowing westward between 20°N and 10°N; (2) the Equatorial Countercurrent flowing eastward between 10°N and 5°N; (3) the South Equatorial Current between 5°N and 15°S. Just below the equator, the Equatorial Under Current can be detected from the spreading of isopleths at aobut 300-m depth in each section. A part of the South Equatorial Current flowed into the Solomon Sea and the Coral Sea, and streamed southward as the East Australian Current. The southern observatioanl stations were located on the western boundary of the South Pacific Subtropical Gyre.

2. Studies on phytoplanton, zooplankton and micronekton

T. Nemoto, K. Furuya and K. Ogawa

1. Abundance and community structure of phytoplankton

In order to study the abundance and community structure of phytoplankton, four kinds of quantitative assessment were carried out.

1) Water samples were collected by Van Dorn samplers in the layers from the surface to 300-m depth at all station. The abundance of phytoplankton was estimated by Tsuji's method using a fluorescent microscope (Tsuji et al. 1976). Cell volume of phytoplankton was also measured and converted to phytoplankton carbon by Strathmann's method (Strathmann 1976).

2) Portions (5 to 10 l) of water samples were also filtered through nylon gauze with a 20 µm apperture size and fixed with 1% glutal-aldehyde. These samples have been examined with electron and ordinary compound microscopes.

3) Larger phytoplankton in the upper water column (0-150 m) were collected by vertical tows with a NORPAC net (100 µm mesh) at all stations. Samples were fixed with neutralized formalin.

4) Phytoplankton were also collected by vertical layered hauls with a closing NORPAC net (100 µm mesh) at intervals of 50 m between 0- and 200-m depth at stations with odd numbers and at intervals of 20 m at Stns. 20 and 22, and fixed with 2% neutralized formalin.

Specimens collected using methods 3 and 4 above have been examined with an inverted microscope to assess the abundance and species composition and by scanning electron microscope to examine species and fine structures.

2. Measurement of growth rates of natural phytoplankton

Experiments to measure the <u>in situ</u> growth rates of phyto-plankton and to examine the effects of nutrients on them were carried out with the subsurface water at Stns. 3,5,8,13,15 and 19. Each water sample, filtered through gauze (100 µm mesh) to eliminate the larger zooplankton, was introduced into four 5-liter glass bottles. Two of the four bottles were enriched with sodium nitrate (2 µg-atN/l) and potassium phosphate (0.25 µg-atP/l). The bottles were enclosed with blue filter boxes. The transmi-ttance of the blue filter resembles closely that of clear oceanic water at 100-m depth. All the bottles were incubated in a deck incubator cooled by running surface water under natural sun light. Subsamples were extracted from the bottles at 8-hour intervals. Cell number, cell volume, chlorophyll a, nitrate and phosphate were determined for each subsample. Growth rates were calculated by analysis of the time evolution of cell volume, and they were compared with time variations in other parameters.

3. Abundance and composition of micronekton and zooplankton

Micronekton and zooplankton were collected with a Isaacs-Kidd midwater trawl and NORPAC net. Micronekton sampling by IKMT was carried out for Stns. 11,12,14,15,17,18 and 22. The trawl was towed obliquely paying out 2,000 m of wire. The main constituents of micronekton are pisces, cephalopods, decapods, euphausiids and amphipods. The biomass of micronekton was large at Stns. 11 and 12, where pisces were dominant at more than 140 g per tow. On the other hand, the biomass of pisces at stations 15 to 22 decreased considerably. This trend is also observed in other groups of micronekton organisms including euphausiids, decapods and amphipods and apparently coincides with changes in the sea current system, as shown in figures. Surface zooplankton were collected by NORPAC net of 300 µm mesh, towing from 150-m depth to the surface. These samples are now under examination.

3. Geographical distribution of appendicularians

N. Shiga

The geographical distribution of appendicularians was studied in the tropical and subtropical western Pacific Ocean. Vertical hauls from 150-m depth to the surface were carried out with a twin Norpac net which was composed of two 45 cm x 180 cm conical nets, one with a 0.35 mm mesh opening and one with 0.10 mm mesh, at 30 stations. In order to observe the vertical distribution of this animal group, separate vertical hauls were taken at 20-m intervals in the upper 200 m at 5 stations in the daytime and at night. The species composition of appendicularian communities will be analyzed in relation to the characteristics of the water masses they live in.

4. Vertical distribution of microzooplankton

K. Dohi

In order to inverstigate the vertical distribution of microzooplankton, samples of seawater were collected with Van Dorn bottles from various depths at 12 stations in the tropical and subtropical western Pacific Ocean. 40-liter samples of seawater were taken from several depths at stations 4, 9, 14, and 18 and filtered through a 20 μ-mesh net, the filtered materials being retained on 20 μ cloth. At the same time, each 1-liter sample of filtered seawater was preserved to examine animals smaller than 20 μ in size. At another 8 stations, 10-liter seawater samples were filtered with a 20 μ-mesh net to obtain microzooplankton. All the samples were preserved in 3% lugol-eosin fixative solution. After allowing to stand, the samples were concentrated to 10 ml by gently withdrawing the supernatant with a siphon and then the sample was examined under an inverted microscope.

Identification and examination of the numbers of microzooplankton are under way. Geographical differences in biomass and vertical distribution will be examined.

5. Microzooplankton in the tropical and subtropical Pacific Ocean

T. Maruyama and S. Suzuki

In order to examine the biomass, distribution and food of pelagic ciliates, especially tintinnids, water samples of 4-10 liters were collected by Van Dorn Samplers at 5-10 depths (0, 10, 30, 50, 75, 100, 125, 150, 175 and 200 m) at stations 1 to 9 from 20°N to 20°S, and were immediately concentrated to 100 ml after filtering through a 25 μ-mesh net and were then fixed with Phodohe's Iodine. At the same time, 1-liter water samples were also taken for the examination of the food of ciliates, and were fixed in neutralized formalin. Microscopical examination will carried out at the Research Laboratory of Fisheries Resources of Tokyo University of Fisheries.

6. Threshold response of copepod grazing

A. Okuzawa and S. Nishizawa

One of the major behavioral characteristics recently revealed in grazing by copepods is the threshold response of this type of animal to a reduced concentration of preferred food species if given a multiple choice of species for diet. This characteristic can be interpreted as serving as a significant factor in maintaining the population stability of the phytoplankton community. An attempt was made to carry out shipboard experiments during this cruise to get information on the functional response of copepods.

The structure of the feeding bottle (Fig. 15) was the same as the one used by Richman and Rogers (1969). The feeding bottle was a 1.8 liter pyrex test tube and contained three glass tubes and two net holders ((Teflon rings) covered with 40 μ (top) and 200 μ (bottom) mesh nets. Air was pumped down the inlet tube and collected by the funnel at the foot of the siphon tube. Injected air and the medium traveled up the siphon tube, and fecal pellets and phytoplankton contained in the medium were sieved through the top net thereby retaining the fecal pellets on the net.

The medium water was sampled either from the sea surface or from a depth of 100 m. Zooplankton were collected by gentle tows of a drift net at some stations.

Zooplankton animals in tropical or subtropical sea areas are usually small and are not easily cultivated in the laboratory, and so only a few experiments were performed during this cruise. Specimens of *Aetideus armatus* (Boeck) collected at St. 7 were successfully cultivated in natural sea water, and the results showed a grazing threshold of about 0.006 μg chlorophyll *a*/liter. This value is not significantly different from zero. As for the other sets of experiments, the data are still under processing.

Reference

Richman, S. and J. N. Rogers, 1969. The feeding of Calanus helgolandicus on synchronously growing population of the marine diatom Ditylum brightwellii. Limnol. Oceanogr., 14, 701-709.

7. Marine particle trapping experiments (Vertical transport of particles)

H. Sasaki and S. Nishizawa

Some studies (e.g. Iseki, 1977) have emphasized that large particles sinking rapidly constitute a major component in the downward vertical transport of organic matter produced in the upper euphotic layer. The large particles consist mainly of fecal pellets of zooplankton, loose particles of fecal origin and organic aggregates which are rarely collected by the use of conventional sampling bottles of small volume because of patchiness in the occurrence and distribution of these particles (Sasaki, 1979).

Two methods were employed to catch large marine particles during this cruise. One was the Particle Collector (PC) experiment which could give direct measurements of the vertical flux of particles, and the other method employed large volume water sampling with a 200-liter Van-Dorn bottle.

1) Particle Collector (PC) Experiment

The configuration of the PC and the suspension system for the PCs have already been shown in the Preliminary Report of the Hakuho-Maru Cruise KH-79-1 (Horikoshi, in preparation).

The PC experiments were carried out at two sampling stations, Sts. 4 and 9. A series of collectors were suspended at St. 4 in the equatorial Pacific for 24 hours, September 7 to 8, and at St. 9 in the Coral Sea for about 30 hours, September 22 to 23. 18 PCs were attached to a suspension rope at 13 depths, 50*, 100, 150*, 200, 300, 400, 500*, 750, 1,000*, 1,250, 1500, 1750 and 2,000*m, respectively, in each experiments (* : 2 PCs attached). During PC operation, seawater was collected with 23-liter Niskin bottles from the same depths to determine the vertical profile of background POC (particulate organic carbon) concentrations. This profile will be compared with that of vertical flux obtained using PCs to examine possible mechanisms controlling the processes of vertical material transport in these areas.

PC suspension and retrieval at Sts. 4 and 9 were successful. The PCs suspended at depths below about 400 m caught only a small amount of particles compared to those at shallower depths primarily because of inadequate sampling period. However, these catches contained a number of large particles such as fecal material indicating that these particles were the predominant contributors to the sedimentation processes in the deep layers. Their chemical and microscopic analyses are now in progress.

2) Large Volume Water Sampling

180-liter samples of seawater were dipped using a 200-liter Van-Dorn bottle and particles large than about 10 μm in diameter were concentrated on board the ship according to a modified method of Dodson and Thomas (1964), at stations, 4, 9, 14, 15, 17 and 19.

Since some large particles were found in the concentrated water samples, counting of these particles would possibly give an approximate measure of the "concentration" of large particles which usually escape from small volume water samples.

References

Dodson, A. N. and W. H. Thomas, 1964. Concentrating plankton in a gentle fashion. Limnol. Oceanogr., 9, 455-456.

Horikoshi, M. (ed). Preliminary Report of the Hakuho-Maru Cruise KH-79-1.

Iseki, K, 1977. A study of vertical transport system of particulate organic matter in the sea. Ph. D. Thesis, Tohoku University, 138 pp.

Sasaki, H., 1979. Direct observations of vertical flux of particulate material in the sea off Sanriku. Master's Thesis, Dept. Agricul. Graduate School, Tohoku University, 78 pp.

8. Studies of box core samples

Y. Shirayama, David D. Swinbanks and E. Tsuchida

Six USNEL box core samples were successfully taken during the Hakuhō Maru cruise KH-79-4. From each box core sample (50x50 cm in size), a total of 27 subcores were taken for various purposes. Eight cylindrical subcores (ϕ=3.6 cm i.e., 10.2 cm^2) were taken from the undisturbed area of the core for the study of meiobenthos, and the sediment in these subcores was sliced at intervals of 0-1, 1-2, 2-3, 3-6, 6-9, 9-12, 12-15, 15-20, 20-25 and 25-30 cm in order to study the vertical profile of meiobenthic distribution. Two other cylindrical subcores of the same size were taken for sediment analysis and were sliced at the same intervals as those for the study of meiobenthos. A further four cylindrical subcores of the same size were take and two of them were used for the study of benthic bacteria by Dr. Akagi, ORI, and the other two for the analysis of nutrinets in interstitial waters by Dr. Koike, ORI.

One large cylindrical subcore (ϕ=5 cm) was taken in order to measure the redox potential of the sediment.

Eight square subcores, 10x10 cm in size, were taken for the study of macrobenthos and two other subcores of the same size were taken for the study of the vertical distribution of radio isotopes and organic matter by Dr. Yamada, Hokkaido Univ. and Dr. Handa, Nagoya Univ., respectively. These subcores were frozen immediately after sampling without any pretreatment.

Two rectangular subcores, 5x10 cm in size, were used to take X-ray radiographs of the sediment and to study the vertical distribution of solid phase Mn and Fe.

The remaining sediment was used for the study of radio isotopes and benthic bacteria by Dr. Yamada, Hokkaido Univ. and Dr. Hara, Osaka Univ., respectively.

9. Oligotrophic bacteria in the West Pacific Ocean

U. Simidu

The differences in bacterial numbers obtained by the direct microscopic method and the agar plate method often reach four orders magnitude. Although the direct viable count method (DVC) gave counts that are one to two orders higher than the agar plate method, the bacteria that grow on the DVC tubes have not been isolated, hence the characteristics of these DVC organisms are not known. During the present cruise an attempt was made to compare the different methods of counting bacteria and to isolate the bacteria that grew on media with different nutrient concentrations.

For the isolation of oligotrophic bacteria two media containing 115 mg/l and 4 mg/l of organic nutrinet were used. The composition of the media is given in Table 33. Total bacterial counts was obtained using the epifluorescent microscopic method, and DVC was determined according to Kogure et al. (1979). Plate counts were carried out using PPES-II medium and oligotrophic bacteria were counted by the MPN procedure using two different media. Seawater samples were collected aseptically at stations 16, 17 and 19 from depths of 0, 100, and 800 m.

The results of counting bacteria by different methods are shown in Table 34. The counts of oligotrohic bacteria for M medium that contained 4 mg/l of organic nutrients were higher by one order magnitude than those obtained for D medium, although the numbers on M medium were still lower than those obtained by the DVC method.

For the samples taken from St. 19, bacterial cultures grown on PPES-II agar plates and MPN tubes of both the M and D media were isolated. The cultures were examined for their cultural, morphological and biochemical characteristics, and classified into various genera. The results are shown in Table 35. The dominant bacteria groups were Vibrionaceae, Pseudomonas, Moraxella, Flavobacterium and Alcaligenes. An interesting feature was the differences in the proportion of Flavobacterium among the populations obtained with different media. The lower the content of organic nutrients in the medium, the higher the proportion of Flavobacterium in the population became. The percentage of flavobacteria in the isolates from M medium, which contained least nutrinet, reached 67 per cent.

These results indicate that the oligotrophic bacterial population in the sea may be comprised of bacteria groups that are different from those grown on conventional agar media.

Reference

Kogure, K., U. Simidu and N. Taga, 1979. A tentative direct microscopic method for counting living marine bacteria. Can. J. Microbiol., 25, 415-420.

10. Heterotrophic potential in seawater and sediment

Y. Akagi and N. Taga

Decomposing activity of organic matter in seawater or sediment sample, which has been usually expressed in the term of heterotrophic potential *in situ*, might be experimentally measured as a value of assimilation (uptake) or catabolism (CO_2-formation) for an isotope-labelled organic substrate added to the sample. On the KH-79-4 cruise, the values of both activities in samples were measured, after adding ^{14}C-amino acids mixture into 10 ml of seawater or 5 ml of sediment and reacting for 1 hour.

Heterotrophic potential in seawater samples was measured at Stations, 4, 9, 14 and 18 of this cruise. At St. 4 and 9, assimilation activities in the samples were scarcely found, though the CO_2-formation were considerably large values. On the other hand, there was found a phenomenon that the vertical fluctuation of assimilation values was identical with that of becterial viable counts in samples at St. 14, while the identical relation between the above fluctuations was not distinctly found at St. 18. A general tendency, that catabolism values in seawater samples were rather larger than the assimilation ones, was characteristically found throughout the observations in this cruise. This fact might indicate that the microorganisms in seawater of oligotrophic open-sea utilize organic matter *in situ* as energy source for their life maintenance much more than as substrate for their assimilation and biosynthesis.

As for heterotrophic potential in sediment samples, only the values of CO_2-formation for added organic substrate were measured, because the background of assimilation values was usually too high in sediment. Viable counts of bacteria in sediment samples were dropped suddenly in the cores deeper than 20 cm. However, the fluctuation of CO_2-formation values was similar with that of bacterial viable counts in sediment samples. It is assumed from this trend that a contribution of bacterial activity is actually large for mineralization process of organic matter in sediment.

11. Distribution of particulate organic carbon (POC) and nitrogean (PON)

K. Fukami, T. Maruyama and N. Taga

The concentrations of POC and PON between 0- and 300-m depth were determined. Seawater samples were collected with PVC Van-Dorn samplers. A 5-liter subsample was filtered through double-layered Reeve Angel 984H glass-fiber filters which were precombusted at 450°C for 1 hr to remove organic matter. The concentrations of POC and PON were determined by the method of Sharp (1974) using a CHN-corder (Yanagimoto MT-2). The value for the underlying filter acted as a blank and was subtracted from that of the upper filter. The POC maximum layers seldom coincided with the chl a maximum layers. High values of POC concentration were often observed at 300 m. The vertical fluctuations of PON showed roughly the same pattern as that of POC.

The C:N ratio of particulate organic matter (POM) increased with increasing depth down to 200 m. However, at several stations were the POC concetrations at 300 m were high, the C:N ratio of POM at 300 m was low. (Tables 27 and 28)

12. Dissolved free amino acid in the West Pacific Ocean

M. Amano and N. Taga

The water samples were collected with Van-Dorn samplers and filtered through Reeve Angel 984H glass-fiber filters. Aliquots of the filtrate were stored at -20°C until they were analyzed in the laboratory. Total dissolved free amino acid (DFAA) concetration was determined by the method of North (1974) using fluorescamine. The value was usually very low (around 1.0 μM), whereas relatively high concentrations (around 1.0 μM) were detected at Stns. 11-14 and 16. The DFAA maxima were often observed at 100 m.

Dissolved amino acid composition was also analyzed at Stn. 18. Gly, Ala, Orn and Ser were predominant components.

13. Muramic acid in sea water

S. Hara

In order to measure bacterial biomass, muramic acid which is a unique component of the bacterial cell wall was analyzed.

Water samples were collected in Van Dorn samplers. Immediately after collection, particulate matter was collected on a 984-ultra filter (H. Reeves Angel & Co.) by filtration of the seawater samples. Particulate samples were kept in a vacuum desicator over phosphorus pentoxide.

Filters containing particulate matter were hydrolyzed for 16 hr at 110°C with 6N HCl in vacuo. The hydrolysates were filtered to remove disintegrated filter fibers, then dried on a rotary evaporator at 55°C and dissolved in 0.2 N citrate buffer, pH 2.2. The samples thus obtained were analyzed by an amino acid analyzer (Hitach, Model 835-50). Fifty to five hundred pmoles of muramic acid per one liter of seawater were detected.

14. Survey of large-sized individual fish such as tuna species using an echo pattern counting system and underwater TV

T. Ishii and K. Nagashima

1. Collection of the echo pattern fish with a fish detector

The echo signals of fish, recorded on magnetic tape, were obtained at 13 stations. These signals were recorded at a ship speed of 6 knots for 30 minutes. At 4 of these stations video data were simultaneously recorded using an underwater TV.

The counting of echo patterns recorded during this cruise will be left to the future.

2. Development of an underwater TV system to monitor and check the target of the echo pattern.

It is extremely difficult to identify the species of the targat fish in the echo survey, and so, in order to overcome this difficulty, an underwater TV and film camera system was developed. This system includes a star-light SIT TV camera, an underwater 35m/m film camera, and a VTR. Also, it is possible to display and record the depth of the TV camera.

During this cruise, TV observations were made at 21 stations, a total 33 volumes of video tapes were obtained, and several targets were recorded in these observations.

Detailed analysis and cross-checks between echo data and video records are now in progress.

15. Studies on the distribution of eggs and larvae

K. Matsushita

It is considered that larval mortality caused by starvation is determined by the frequency of encounter with food organisms. The frequency of encounter is determined by the distribution structure of larvae and food organisms. The distribution of pelagic eggs and larvae is strongly influenced by ocen currents.

With these points in mind, a survey was carried out across a cross section of the Equatorial Current. In addition, in order to examine the general distribution of eggs and larvae during cruise, sea water was pumped up from beneath the ship and eggs and larvae were continuously collected by filtration of the sea water. Areas of high density of pelagic eggs were observed off the coast of Japan, the Mariana Islands, the Karoline Islands and in the equatorial area (Fig. 16).

MTD net towings across a cross section of the Equatorial Current (7 Sts., 9 layers) revealed peaks in the distribution of eggs in the 25-50-m layer, while larvae were mainly distributed below 50 m (Tables 36 and 37). High density areas of eggs and larvae were also observed, but it is considered that further analyses of their relation to the structure of the current are needed to understand their origin.

In order to determine differences caused by the direction of net towing, MTD nets and surface nets were towed in a triangular course at Sts. 7, 8 and 9.

The results of surface-net towings at St. 7, revealed clear differences that are thought to arise from the direction of towing (Fig. 17). The main cause of the differences is thought to be side slip of the ship in the wind which tends to sweep away floating matter at the surface. Differences due to variation in towing direction of the MTD net were not observed in the case of eggs, but were observed in the case of larvae (Tables 38 and 39). It is thought that the larvae have the ability to escape from the net.

The results of this survey suggest that the eggs and larvae show various types of distribution depending on ocean currents and other conditions.

16. Measurements of ETS activity and RNA content in pelagic fish (myctophids)

T. Ikeda and A. W. Mitchell

Specimens of myctophid fish were collected from the Coral Sea during this cruise of the Hakuho-Maru.

Collections were made at night with an ORI-net which was towed through surface water at a speed of 2 knots for 5-10 minutes. Sampling locations are shown in Table 40. Immediately following net retrieval, the fish specimens were sorted, rinsed with filtered seawater and frozen at -20°C within 30 minutes of capture. The specimens were kept at -20°C for 14-17 days before measurements of ETS activity and RNA content were made.

The analytical methods used were those of Owens and King (1975) for ETS assays and Dagg and Littlepage (1972) for RNA. The incubation temperatures used for the ETS assays were within ±0.2°C of the *in situ* temperature. All results were standardized on a protein basis as measured by the method of Lowry *et al*. (1951) (Table 41).

No marked differences were observed between ETS activity and RNA content of specimens frozen whilst still living and those which were already dead prior to freezing. Identification of species is tentative at present but will be completed shortly. Respiration rates of these myctophid fishes may be estimated from ETS activities using a factor obtained from two inshore fish species by similar techniques in our laboratory (ETS activity/ Respiration rate = 1.6±0.35, Ikeda and Mitchell unpublished data).

References

Owens, T. G. and F. D. King, 1975. Mar. Biol., 30, 27-36.
Dagg, M. J. and J. L. Littlepage, 1972. Mar. Biol., 17, 162-170.
Lowry, O. H., et al., 1951. J. Biol. Chem., 193, 265-275.

17. Chemical study on the removal of substances from the surface water with special reference to biological processes in a warm water region*

K. Harada and M. Yamada

In the surface layer various particles are formed chiefly by biological processes. The particles settle down to the abyss of the ocean and chemical substances in the surface water are removed by these particles. We have attempted to clarify this process quantitatively through the use of natural radionuclides such as ^{234}Th, ^{210}Pb and ^{210}Po as tracers. The main advantage in the use of radionuclides lies in the fact that we can estimate the removal rate from a water mass directly from the inventory of the radionuclide in the water mass. For this purpose we took the following samples and have analyzed them in part. The analysis of the data and detailed discussion will be made after all the chemical analysis are finished.

1. ^{234}Th, ^{226}Ra, ^{210}Pb and ^{210}Po in seawater

Surface seawater samples (50 liter) were obtained at 78 stations including all the hydrocast stations and the surface stations. At the following stations, the seawater samples were collected from various depths with Niskin bottles; Stn. 4 (13 samples), Stn. 17 (13), and Stn. 20 (14). At Stns. 6 and 12, the subsurface samples were collected with the aid of a suction pump and a 150-m long plastic hose.

The radioisotopes in seawater and yield tracers added were coprecipitated with carbonates and hydroxides. Po, Pb, Th and Ra were isolated successively from the precipitate using ion exchange and coprecipitation techniques (Tsunogai, et al. 1977). The β activity of ^{234}Th was counted on board the vessel. Further purification and counting procedures were carried out ashore.

2. ^{232}Th, ^{230}Th and ^{228}Ra in the surface and subsurface water

At Stns. 4, 9, 14, 18, and 21, large volume water samples (about 500 liter) were collected from the surface and the subsurface layer by using a suction pump and a plastic hose. The radionuclides were coprecipitated with carbonate and hydroxides. They were purified with an ion exchanger and their α activity was measured with a counter equipped with a Si detector and a pulse-height analyzer.

3. ^{234}Th, ^{210}Pb and ^{210}Po in the particulate matter

At Stns. 4 and 20, seawater samples of about 100 liter each were obtained from the surface and the subsurface, and filtered through HA Millipore filters. Pb, Po and Th were chemically separated and the β activity of ^{234}Th was counted on board the vessel.

4. Chemical composition of particulate matter in the surface water

Seawater samples (5-10 liter) collected from the surface stations were filtered through Nuclepore filters (pore size, 0.6 μm). The dry weight of particulate matter was determined by the method of Uematsu et al. (1978). The concentrations of metals such as Cu, Fe, Al and Mn were determined by an atomic absorption method. The dry weights of particulate matter in the surface water are shown in Tables 42 and 43.

5. Chemical studies of sediments

Sediment samples were obtained with a Spade corer at Stns. SC-5, 6, 7, 8, 9, 10 and with an Okean grab and a Phleger corer at Stns. 9, 12, 14, 18, 19 and 22. Their water contents, ignition losses, carbonate contents and concentrations of radioisotopes such as Th, U, ^{226}Ra and ^{210}Pb were or will be determined. The sediment samples will also be divided into various fraction by treating with redox reagents for the determination of metals such as Fe, Mn, Al, Zn, Co, Ni, Ba, Cu and Pb by an atomic absorption method.

6. Compositions of interstitial water

To obtain interstitial water, the following two types of squeezers (A and B) were used: A) 10 ml or more of interstitial water was squeezed out from about 50 ml of sediment in a temperature-controlled water bath at the in situ temperature of the bottom water. B) To obtain large volume samples of interstitial water, a large volume squeezer, which was cooled by ice, was used This squeezed out about 200 ml of interstitial water from about 600 ml of sediments.

The samples collected by method (A) were used for analysis of P, Si, Mn, Fe, Al, Zn, Co, Ni, Ba, Cu and Pb by colorimetric and atomic absorption methods. ^{226}Ra, ^{210}Pb and other radioisotopes were determined for the samples collected by method (B).

7. Hg concentration in the surface water

Surface water samples (500 ml for each sample) were collected in an acid-cleaned plastic backet at Stns. 12, 13, 14, 15, 17 and 20. The concentration of Hg in the seawater samples was determined by the method of Nishimura et al. (1975, 1979).

* This work was conducted in collaboration with M. Nishimura, S. Tsunogai, S. Noriki, N. Masuda, T. Kurata, T. Kondo and T. Kosuga, Laboratory of Analytical Chemistry, Faculty of Fisheries, Hokkaido University.

References

Tsunogai, S. and K. Harada, 1977. Proc. Ann. Meet. Geochem. Soc. Japan, Oct. 1977, Tokyo.

Uematsu, M., M. Minagawa, H. Arita and S. Tsunogai, 1978. Bull Fac. Fish. Hokkaido Univ., 29, 164.

Nishimura, M., K. Matsunaga and S. Konish, 1975. Bunseki Kagaku, 24, 655.

Matsunaga, K., S. Konishi and M. Nishimura, 1979. environ. Sci. Technol., 13, 63.

18. Gravity measurements at sea

T. Matsumoto

Observation period: 28 Aug. 1979, 00:00-07 Sep. 1979, 17:14

Gravity meter system: T.S.S.G.

Gravity meter: Model Z-68-7-14 (string type)

Vertical gyro: Model 72-A (a pair of single freedom gyros)

Data processing system: Model 76-1 (0.05 sec. sampling rate)

Trouble with gravity meter:

On 07 Sep. some trouble occurred with the data processing system. Some interfaces of NOVA (electronic computer for data processing), the power supplies for the Multi Purpose Input/Output System (for data sampling in real time), and one of the electronic parts of the digital timer (for time control of the whole system) successively went out of order. The observer, therefore, failed to make gravity measurements after Sept. 07.

Position fixing: Loran A and C, Dead reckoning and NNSS.

Time when NNSS was out of order:

Five times during the whole cruise, but none of these occurred during the observation period.

Time when PDR was out of order: None.

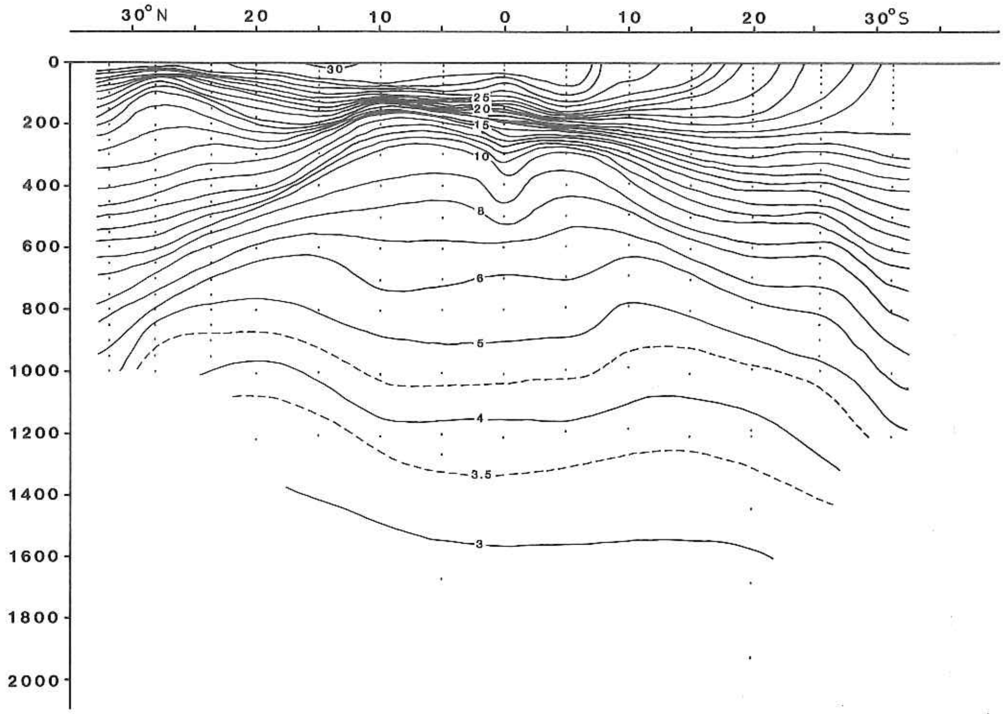

Fig. 2. Water temperature (°C) along Section I.

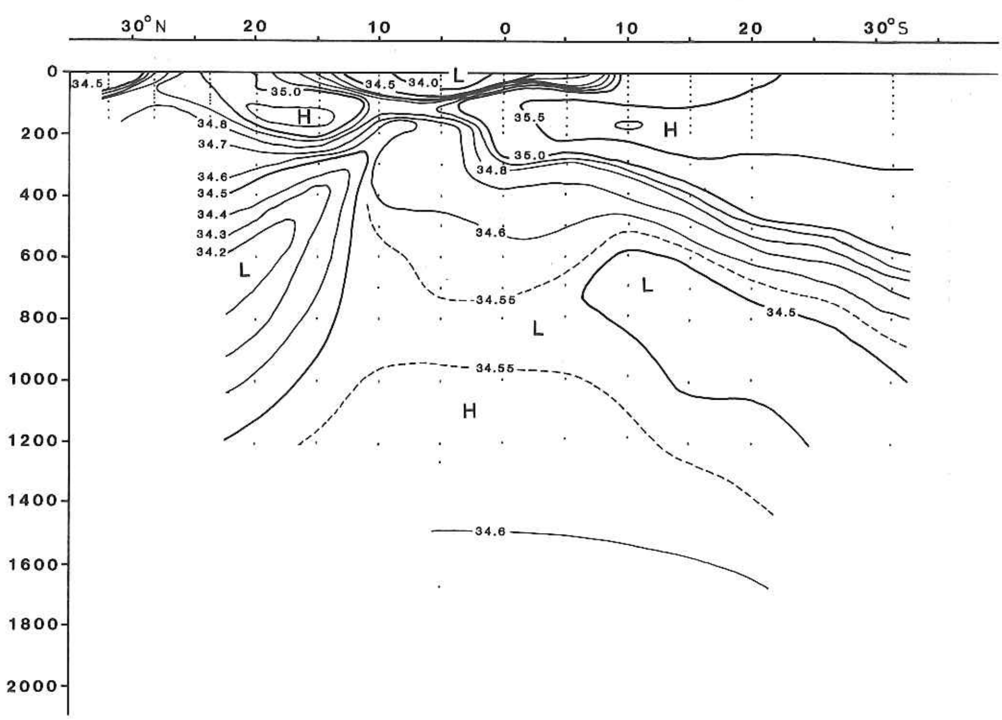

Fig. 3. Salinity (‰) along Section I.

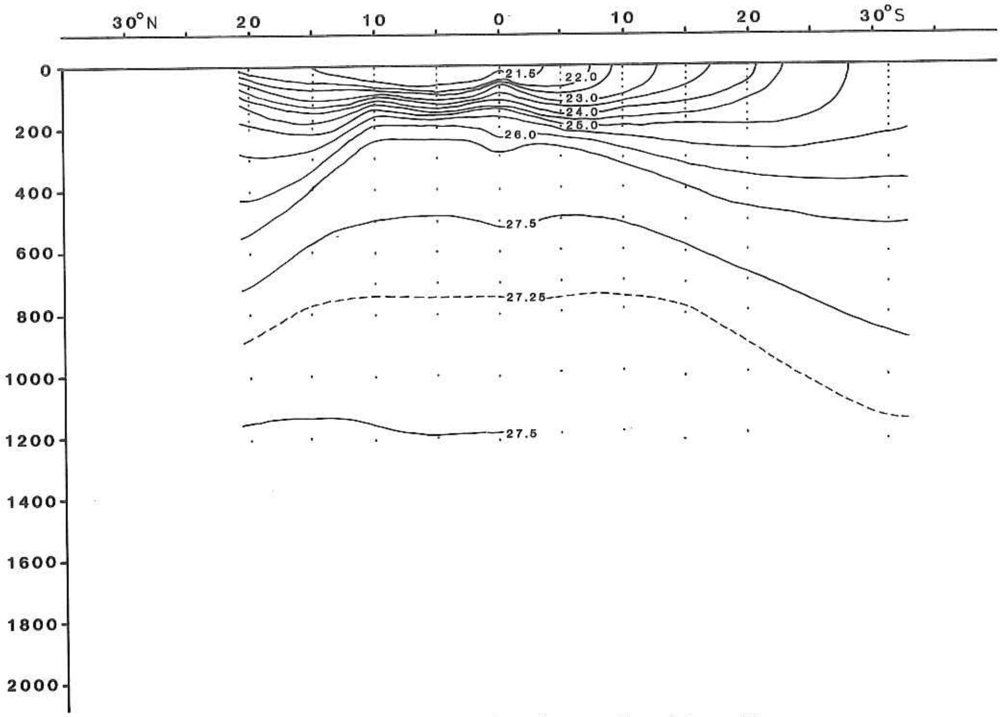

Fig. 4. Sigma-t along Section I.

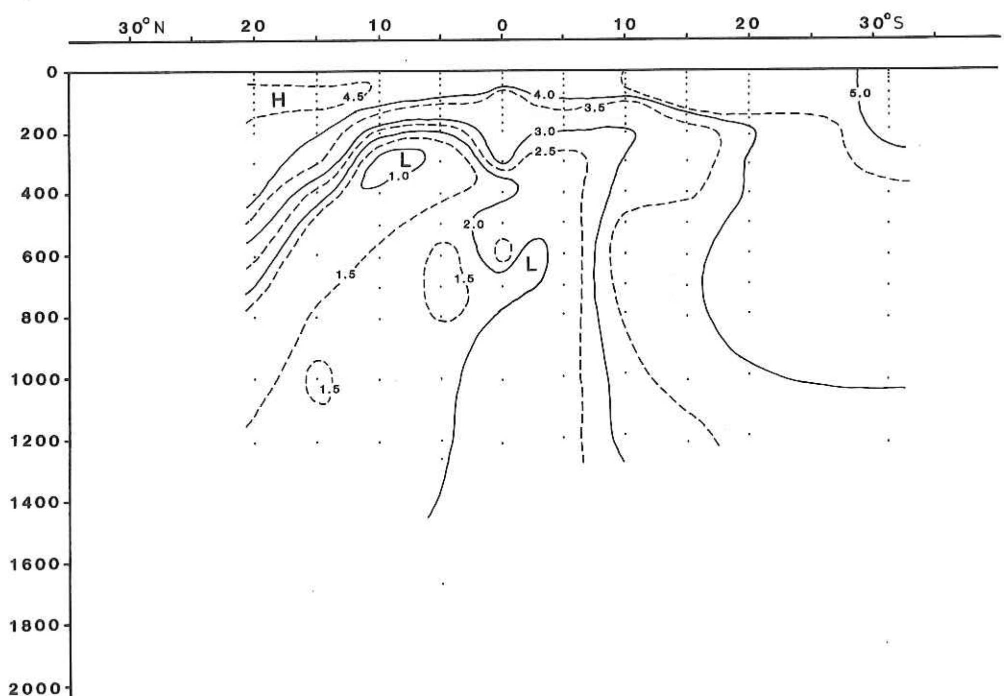

Fig. 5. Dissolved oxygen (ml/l) along Section I.

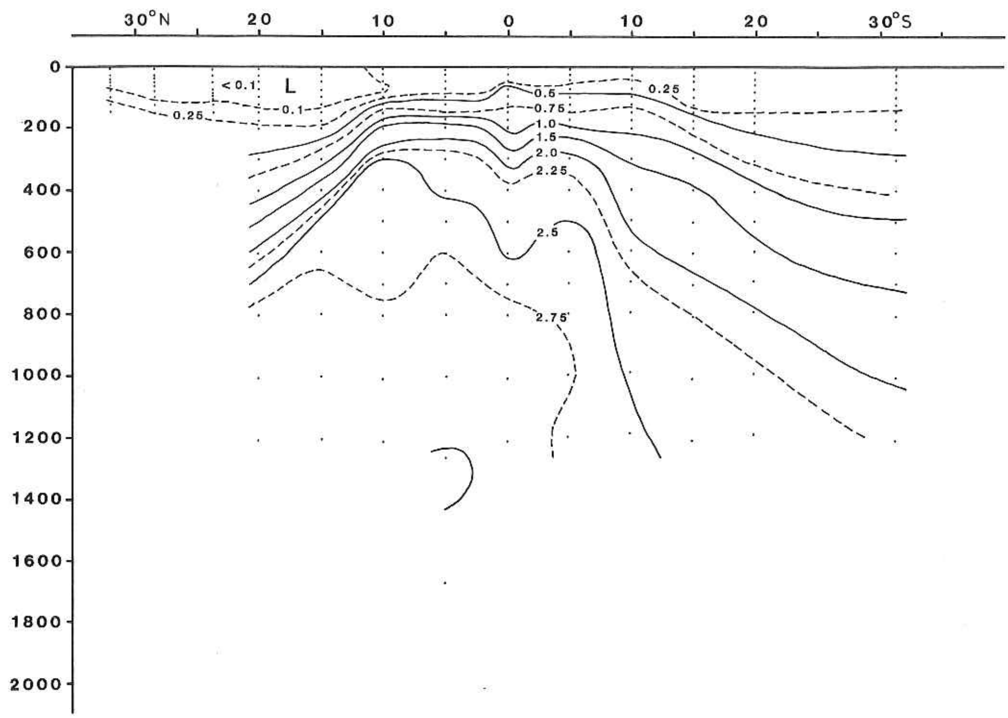

Fig. 6. Phosphate-P (μg-atoms/l) along Section I.

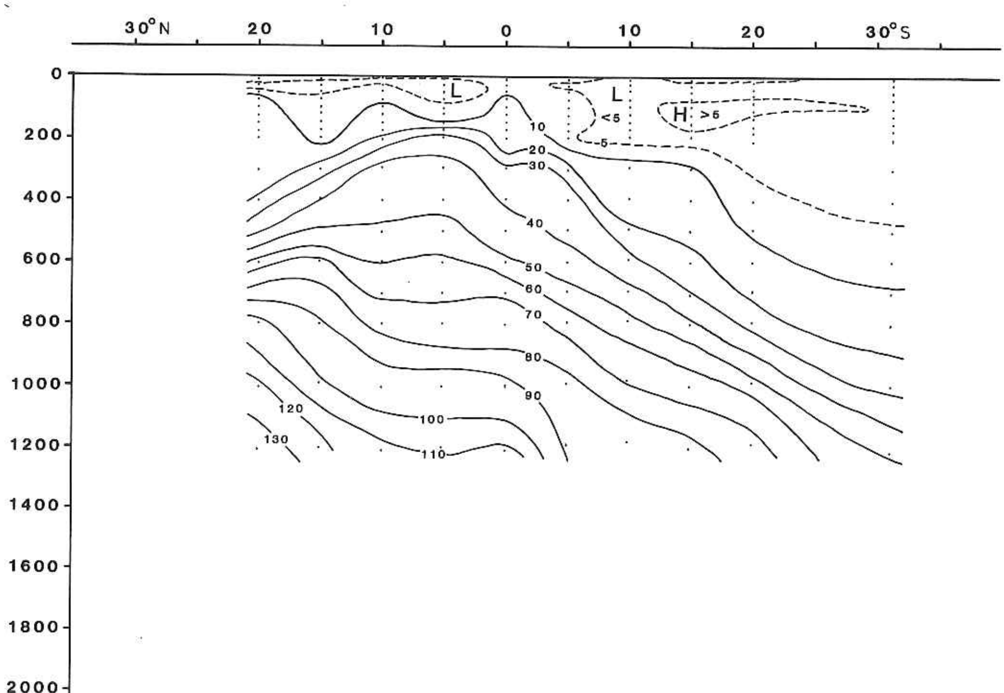

Fig. 7. Silicate-Si (μg-atoms/l) along Section I.

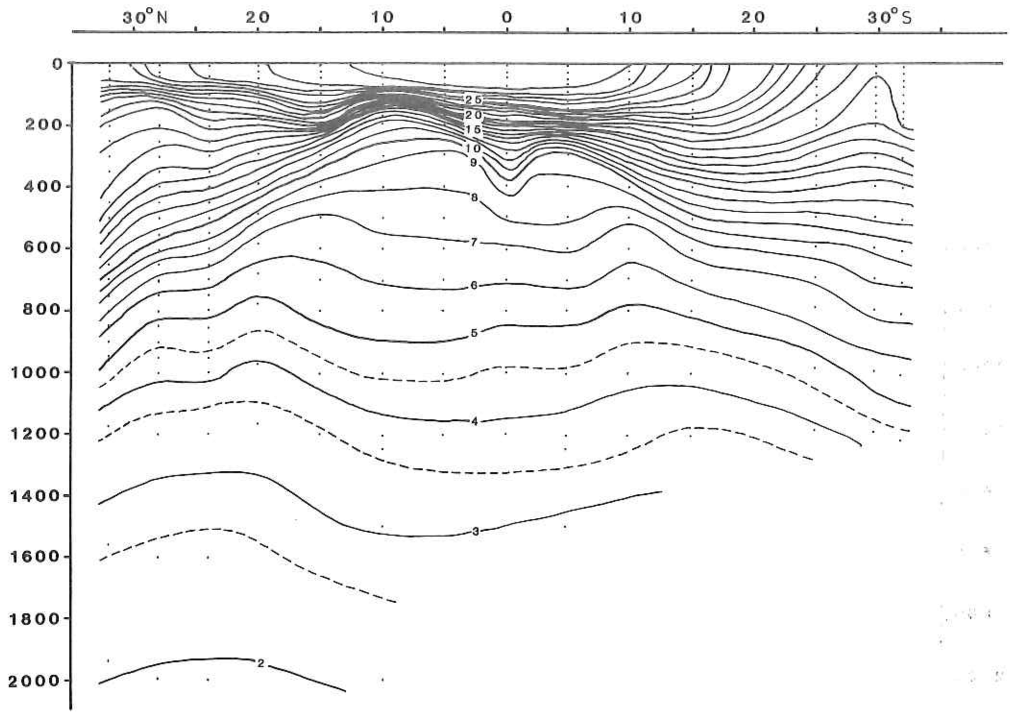

Fig. 8. Water temperature (°C) along Section II.

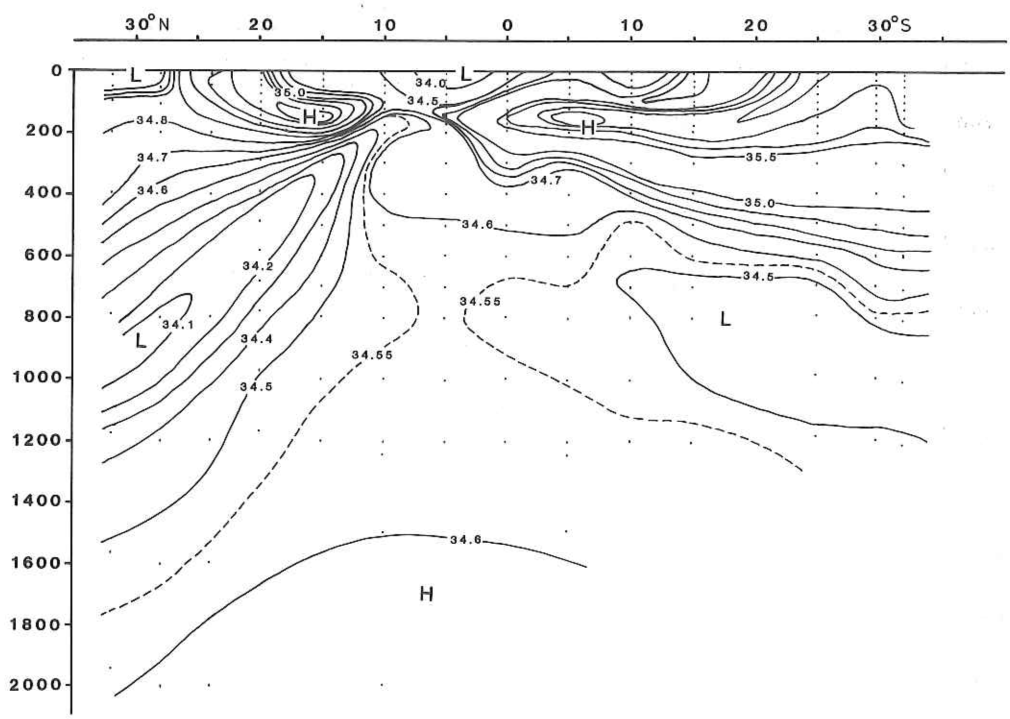

Fig. 9. Salinity (‰) along Section II.

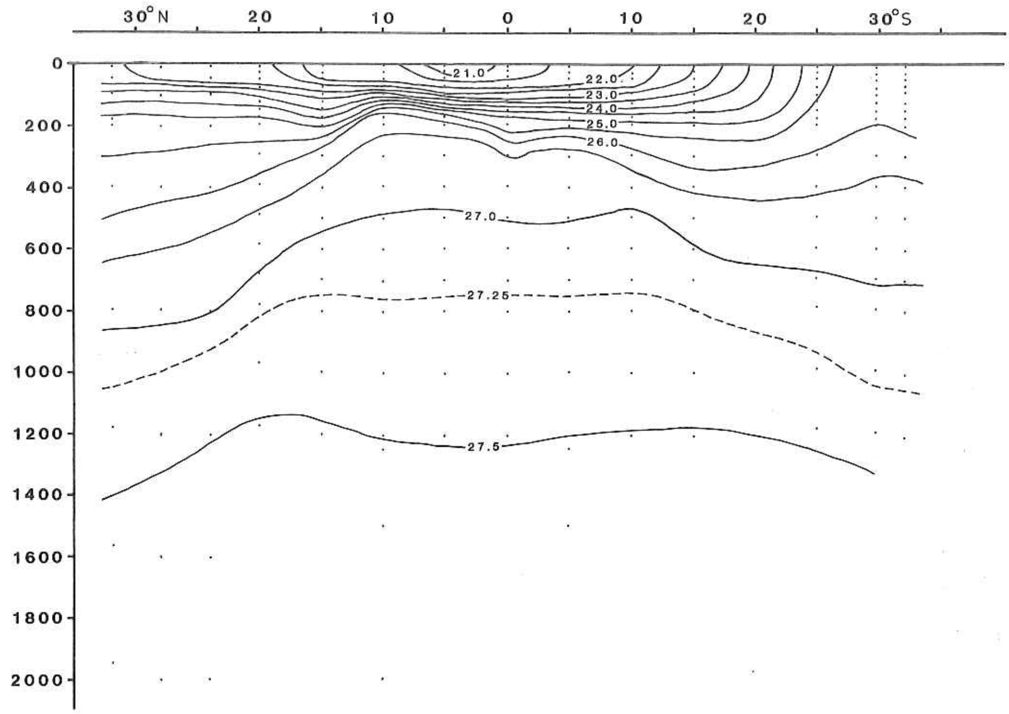

Fig. 10. Sigma-t along Section II.

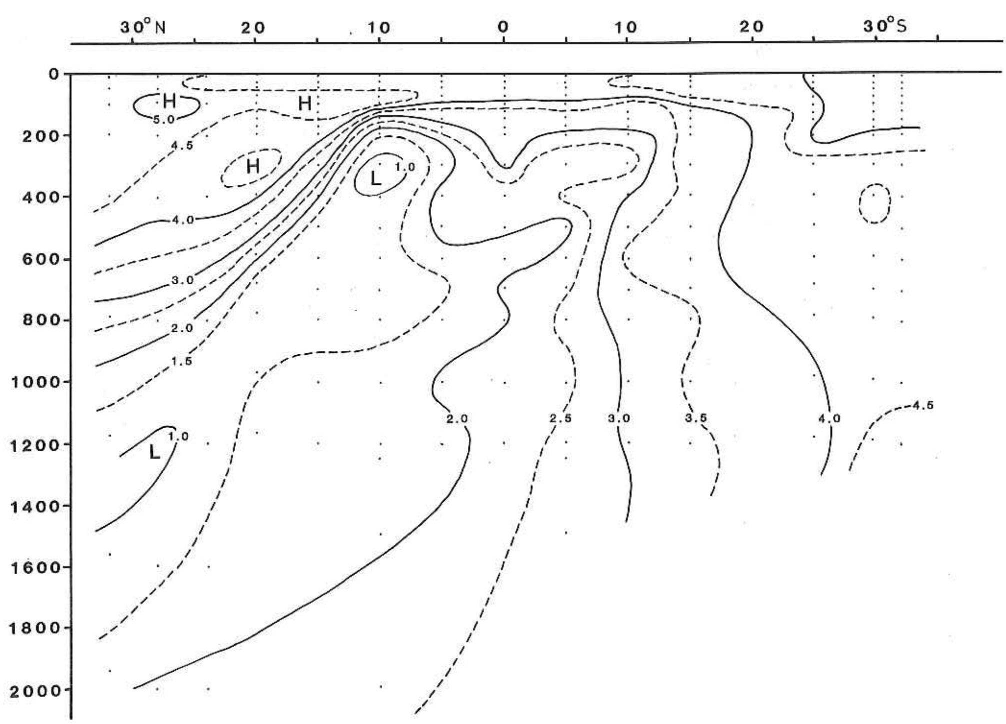

Fig. 11. Dissolved oxygen (ml/l) along Section II.

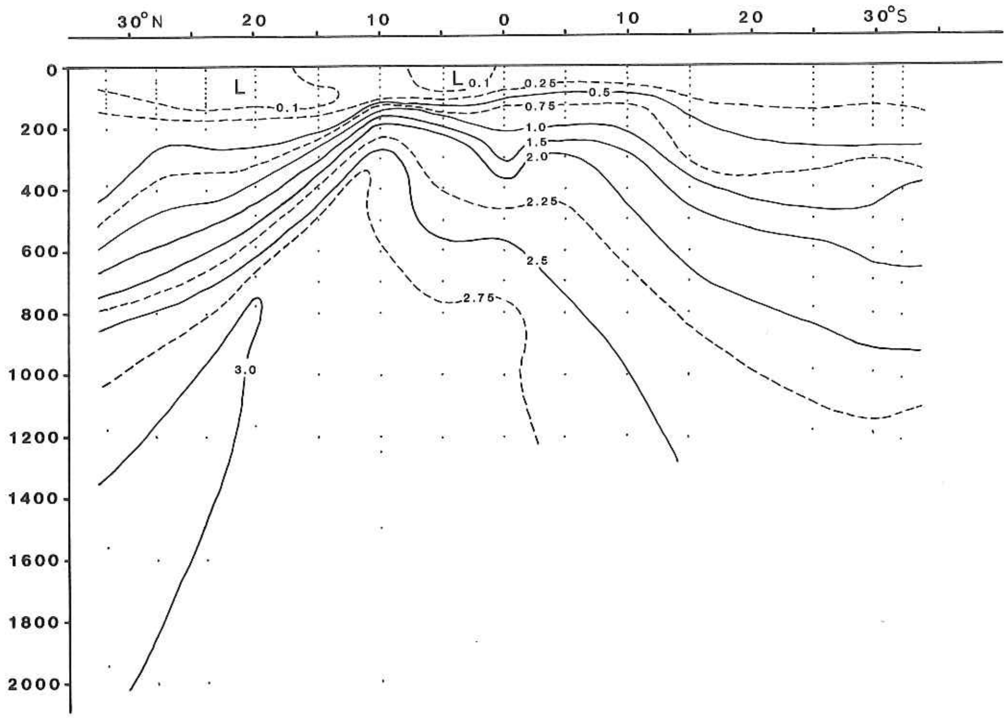

Fig. 12. Phosphate-P (μg-atoms/l) along Section II.

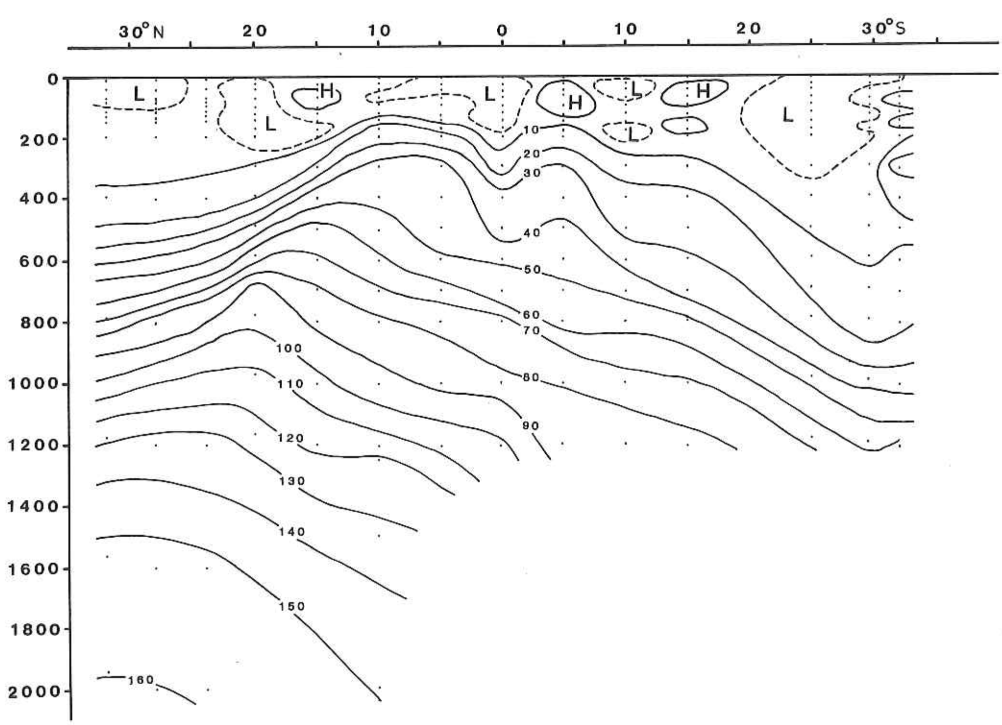

Fig. 13. Silicate-Si (μg-atoms/l) along Section II.

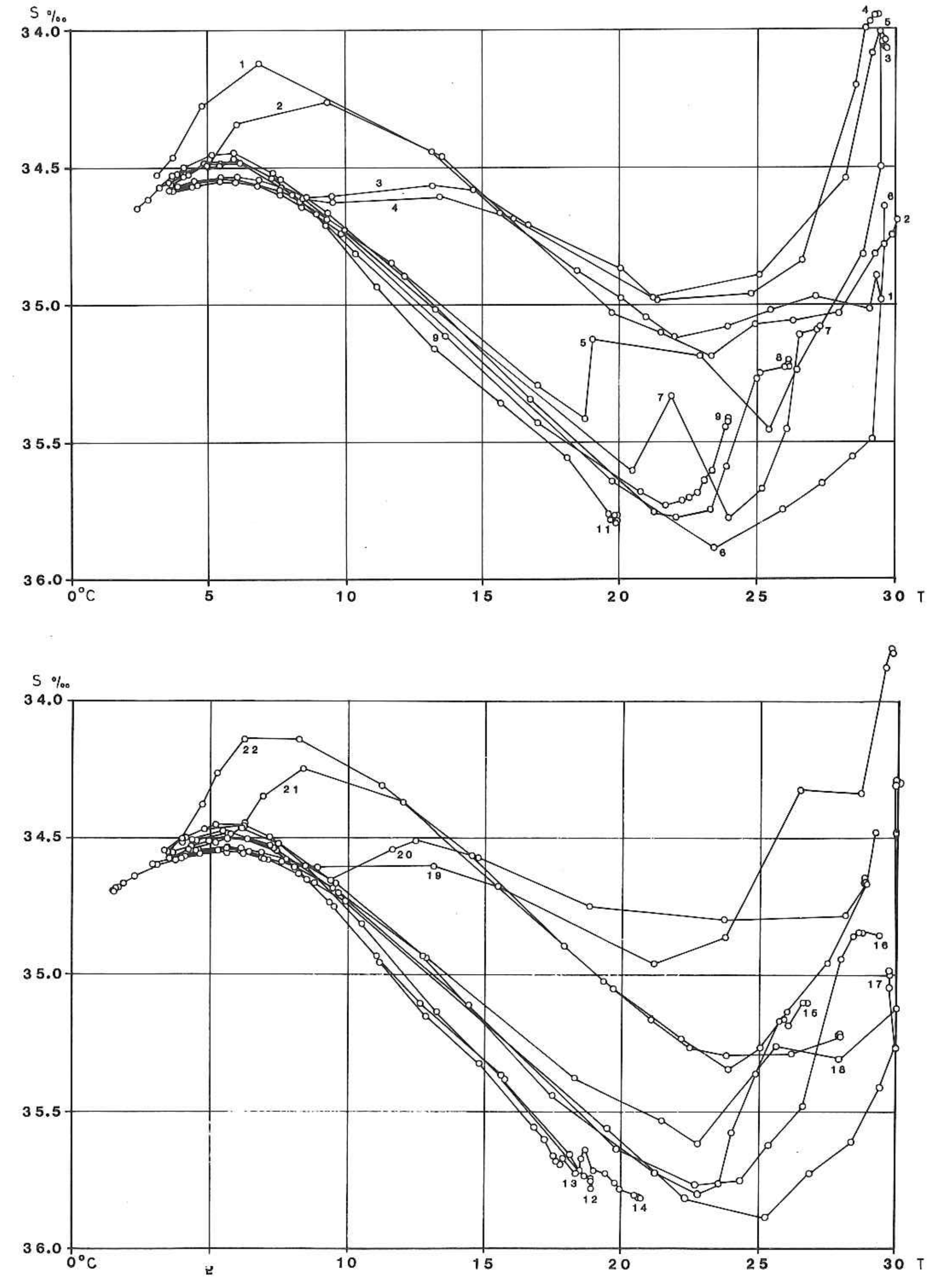

Fig. 14. T-S diagram.

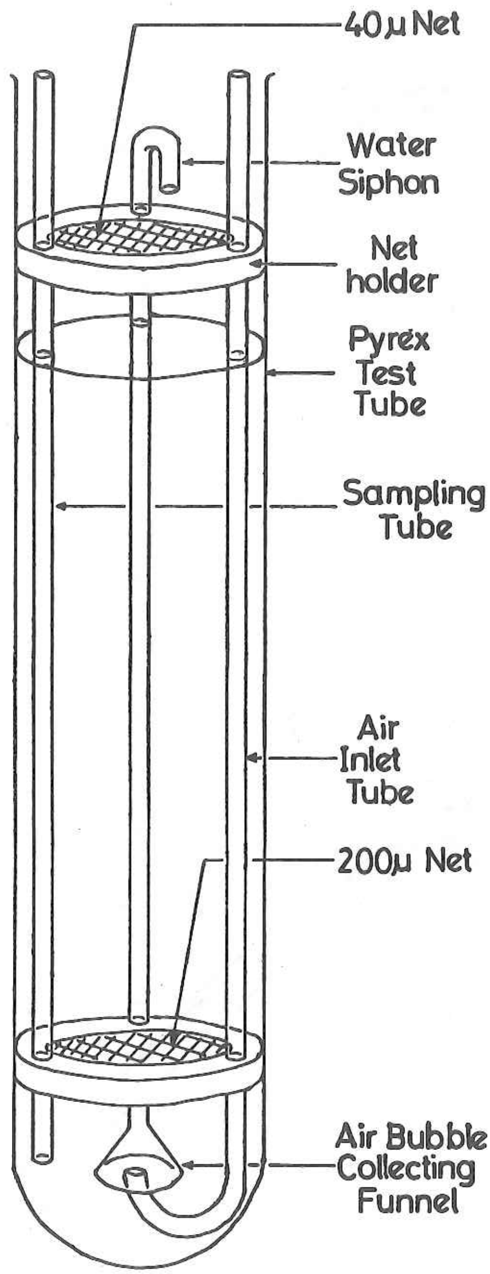

Fig. 15. Feeding bottle.

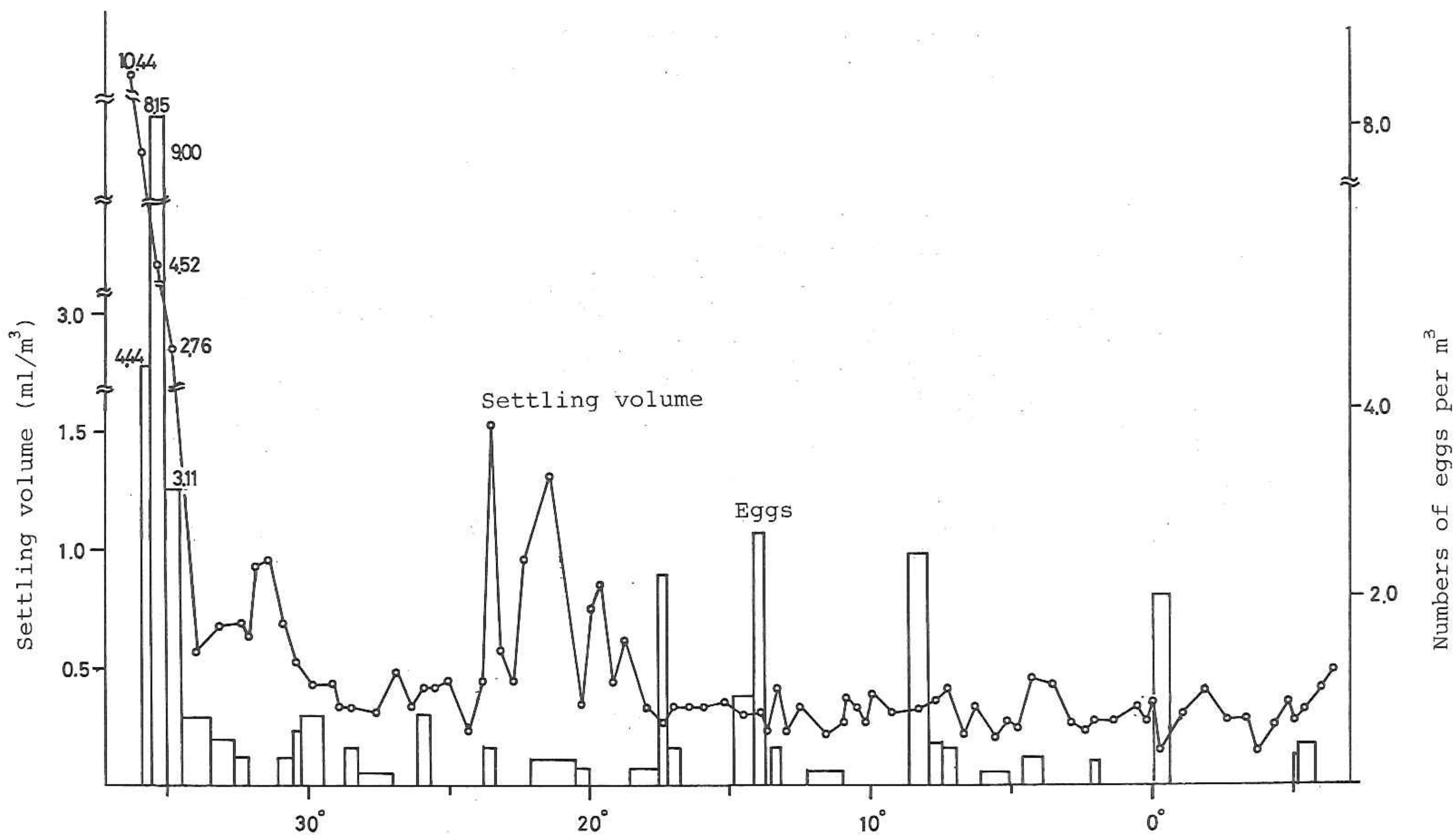

Fig. 16. The distribution of eggs and settling volume from the Tokyo Bay to the equatorial area.

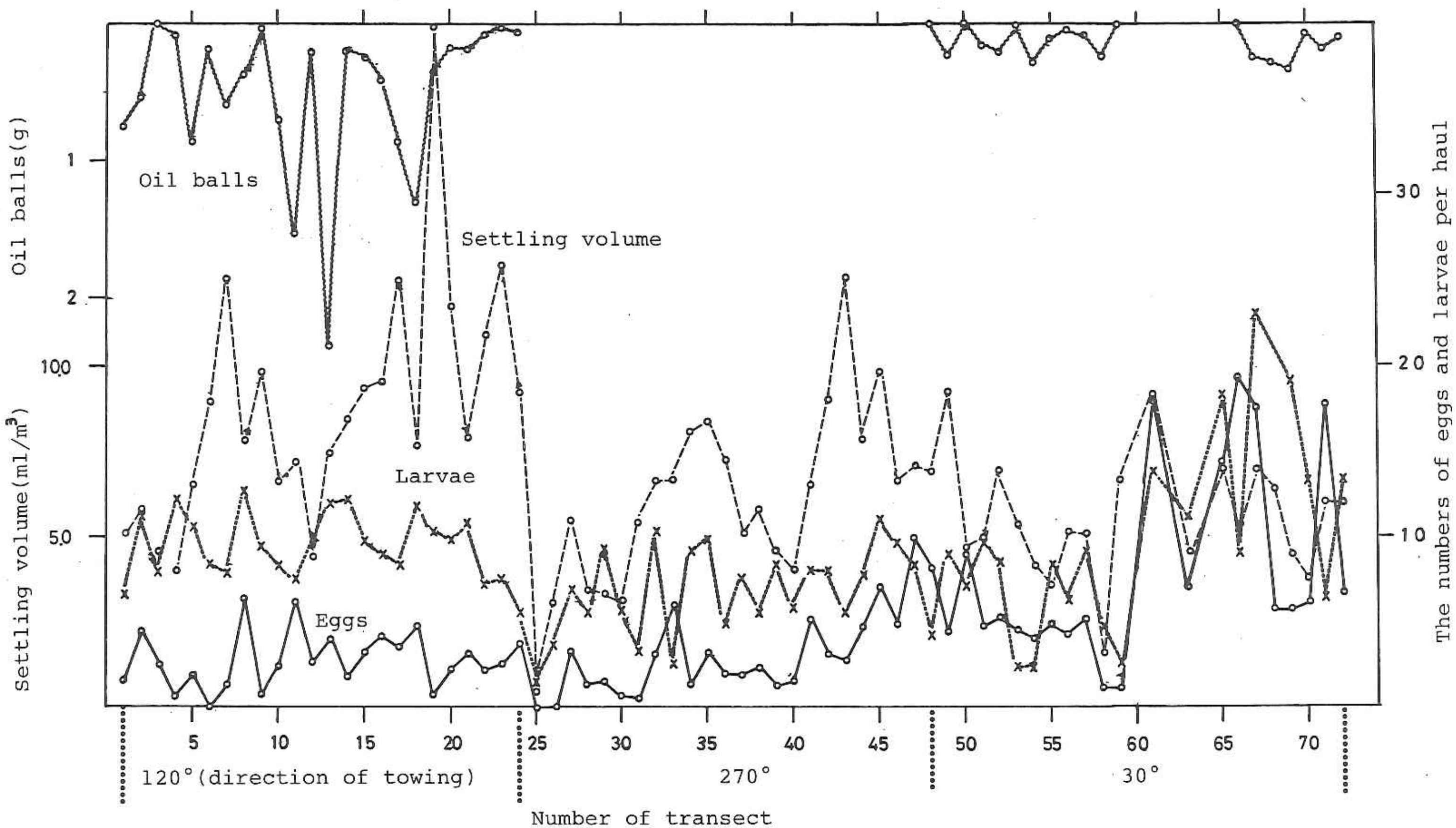

Fig. 17. The numbers of eggs, larvae, settling volume and oil balls by surface nets towings continuously in three directions.

Explanation of Tables 3 to 26.

Abbreviations and symbols used:

D	depth
T	temperature
S	salinity
σ_t	sigma t $[=(\rho-1)\times1000]$
DO	dissolved oxygen
O_2-Sat	percent oxygen saturation
ΔD	dynamic depth anomaly
Chl. a	chlorophyll-a
*	Niskin sampler (23 liter)
( )	unreliable data

Table 3.

Station 1   20°00.5'N, 150°00.5'E   Depth: 2750m   Date: Sep. 2, 1979   Time: 13:49-15:17   Weather: Fine

Air Temp.: 28.9°C   Wind Dir.: WSW   Wind Speed: 9.5 m/s   Sea: 3   Swell: 1

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)	Chl.a (mg/m³)
0	29.50	34.981	21.90	4.28	97.5	0.01	11.5	0.00	0.17	0.066
10	29.31	34.892	21.90	4.38	99.5	0.01	8.0	1.17	0.51	0.062
30	29.07	35.013	22.07	4.45	100.7	0.02	3.6	0.02	0.25	0.081
50	27.11	34.967	22.68	4.77	104.6	0.01	6.4	0.03	0.24	0.111
76	25.47	35.020	23.23	4.69	100.0	0.02	14.3	0.02	0.18	0.188
101	23.96	35.076	23.73	4.76	99.0	0.02	12.7	0.15	0.13	0.299
126	21.99	35.117	24.33	4.28	86.0	0.09	14.0	0.10	0.03	0.339
152	20.96	35.044	24.56	4.51	88.9	0.14	15.0	0.15	0.24	0.172
177	20.10	34.977	24.74	4.42	85.7	0.16	14.6	0.05	1.49	0.089
202	18.46	34.879	25.08	4.34	81.6	0.27	13.1	0.39	0.84	0.017
303	15.66	34.663	25.58	4.57	81.3	0.59	19.1	0.22	0.10	0.011
404	13.14	34.441	25.95	4.08	68.8	0.91	20.3	0.19	0.32	
606	6.86	34.122	26.77	2.63	38.6	2.14	60.2	0.28	0.51	
807	4.78	34.273	27.15	1.23	17.2	2.90	103.0	0.10	0.17	
1009	3.75	34.461	27.41	1.41	19.2	2.88	123.0	0.09	0.37	
1211	3.12	34.524	27.52	1.62	21.8	2.80	136.0	0.12	0.18	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	29.50	34.981	21.90	0.000
10	29.31	34.892	21.90	0.059
30	29.07	35.013	22.07	0.176
50	27.11	34.967	22.68	0.286
75	25.52	35.017	23.21	0.410
100	24.02	35.074	23.71	0.521
125	22.06	35.116	24.31	0.620
150	21.02	35.052	24.55	0.709
175	20.18	34.983	24.72	0.794
200	18.60	34.887	25.06	0.872
250	16.73	34.759	25.41	1.013
300	15.70	34.667	25.58	1.142
400	13.24	34.449	25.94	1.376
500	10.00	34.250	26.39	1.573
600	7.03	34.127	26.75	1.730
700	5.56	34.161	26.97	1.859
800	4.81	34.264	27.14	1.969
1000	3.78	34.454	27.40	2.149
1200	3.14	34.524	27.51	2.292

Table 4.

Station 2 14°59.1'N, 152°01.8' E Depth: 6000m Date: Sep. 4, 1979 Time: 00:33-02:00 Weather: Fine
Air Temp.: 28.7°C Wind Dir.: ESE Wind Speed: 2.0 m/s Sea: 2 Swell: 1

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (µg at/l)	SiO_2-Si (µg at/l)	NO_2-N (µg at/l)	NH_4-N (µg at/l)	Chl.a (mg/m³)
0	30.10	34.690	21.48	4.27	98.1	0.03	23.2	0.00	0.04	0.051
10	30.06	34.692	21.50	4.31	99.0	0.01	6.1	0.02	0.04	0.058
30	29.89	34.741	21.59	4.32	98.9	0.05	3.6	0.00	0.03	0.058
50	29.28	34.813	21.85	4.40	99.8	0.04	2.3	0.00	0.03	0.057
75	27.96	35.029	22.45	4.72	105.0	0.01	7.1	0.00	0.10	0.079
100	26.36	35.046	22.98	4.60	99.6	0.02	9.3	0.08	0.03	0.123
125	24.93	35.070	23.44	4.56	96.4	0.05	5.8	0.00	0.13	0.219
150	23.34	35.184	23.99	4.22	86.9	0.11	8.6	0.08	0.04	0.221
175	21.50	35.102	24.45	4.13	82.2	0.18	5.7	0.03	0.35	0.058
200	19.73	35.030	24.87	4.02	77.5	0.29	4.2	0.13	0.14	0.018
300	13.52	34.459	25.89	3.78	64.3	0.95	21.6	0.06	0.03	0.001
400	9.35	34.263	26.51	2.47	38.4	1.94	39.0	0.00	0.01	
601	6.06	34.349	27.05	1.29	18.6	2.70	75.7	0.08	0.14	
802	5.04	34.481	27.28	1.61	22.7	2.91	91.8	0.04	0.16	
1005	4.12	34.530	27.42	1.38	19.0	2.86	107.0	0.05	0.45	
1207	3.24	34.565	27.54	1.84	24.8	2.81	122.0	0.03	0.00	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	30.10	34.690	21.48	0.000
10	30.06	34.692	21.50	0.063
30	29.89	34.741	21.59	0.189
50	29.28	34.813	21.85	0.311
75	27.96	35.029	22.45	0.454
100	26.36	35.046	22.98	0.583
125	24.93	35.070	23.44	0.701
150	23.34	35.184	23.99	0.808
175	21.50	35.102	24.45	0.901
200	19.73	35.030	24.87	0.986
250	16.41	34.749	25.48	1.129
300	13.52	34.459	25.89	1.249
400	9.35	34.263	26.51	1.440
500	7.15	34.263	26.84	1.585
600	6.06	34.348	27.05	1.705
700	5.41	34.416	27.19	1.809
800	5.04	34.480	27.28	1.902
1000	4.14	34.529	27.42	2.067
1200	3.27	34.564	27.53	2.208

Table 5.

Station 3 10°00.1'N, 154°05.2'E Depth: 5570m Date: Sep. 5, 1979 Time: 19:30-20:55 Weather: Fine
Air Temp.: 28.8°C Wind Dir.: ENE Wind Speed: 7.0 m/s Sea: 3 Swell: 1

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (µg at/l)	SiO_2-Si (µg at/l)	NO_2-N (µg at/l)	NH_4-N (µg at/l)	Chl.a (mg/m³)
0	29.70	34.062	21.15	4.39	99.9	0.12	13.1	0.00	0.15	0.025
10	29.64	34.059	21.16	4.35	98.9	0.10	3.9	0.10	0.28	0.032
31	29.48	34.040	21.20	4.35	98.6	0.10	7.7	0.00	0.40	0.039
51	29.16	34.080	21.34	4.44	100.1	0.11	7.7	0.00	0.09	0.056
76	28.18	34.536	22.01	4.39	97.7	0.09	7.7	0.00	0.21	0.047
101	25.08	34.892	23.26	4.46	94.5	0.14	11.4	0.06	0.21	0.195
127	20.05	34.866	24.67	3.80	73.6	0.55	10.2	0.16	0.09	0.223
152	16.67	34.708	25.39	3.37	61.1	0.86	14.0	0.04	0.10	0.147
177	14.72	34.587	25.73	3.08	53.7	1.10	15.9	0.02	0.22	0.096
202	13.15	34.567	26.05	2.20	37.1	1.57	21.3	0.06	0.30	0.024
303	9.51	34.604	26.75	0.96	15.0	2.50	41.9	0.03	0.16	0.009
405	8.55	34.607	26.90	1.07	16.4	2.55	43.7	0.04	0.42	
506	7.66	34.564	27.00	1.36	20.4	2.63	52.6	0.07	0.32	
607	6.86	34.544	27.10	1.56	22.9	2.61	59.3	0.16	0.18	
708	6.06	34.534	27.20	1.57	22.7	2.68	67.8	0.42	0.42	
809	5.53	34.541	27.27	1.61	22.9	2.82	77.9	0.16	0.22	
1011	4.61	34.558	27.39	1.61	22.4	2.88	92.8	0.16	0.23	
1213	3.64	34.578	27.51	1.92	26.1	2.83	112.0	0.09	0.21	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	29.70	34.062	21.15	0.000
10	29.64	34.059	21.16	0.066
30	29.49	34.040	21.20	0.199
50	29.18	34.074	21.33	0.330
75	28.25	34.514	21.97	0.485
100	25.24	34.882	23.20	0.617
125	20.44	34.878	24.57	0.719
150	16.89	34.722	25.35	0.795
175	14.84	34.594	25.71	0.858
200	13.26	34.566	26.02	0.913
250	10.98	34.575	26.47	1.005
300	9.57	34.602	26.73	1.080
400	8.56	34.608	26.90	1.211
500	7.71	34.567	27.00	1.330
600	6.91	34.545	27.09	1.442
700	6.12	34.534	27.19	1.544
800	5.57	34.540	27.26	1.639
1000	4.66	34.557	27.38	1.811
1200	3.70	34.577	27.50	1.961

Table 6.

Station 4   5°00.9'N, 156°06.0'E   Depth: 3600m   Date: Sep. 7, 1979   Time: 06:20-07:26   Weather: Clear

Air Temp.: 28.4°C Wind Dir.: Calm Wind Speed: 0   Sea: 0   Swell: 1

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)	Chl.a (mg/m^3)
0	29.40	33.939	21.16	4.40	99.5	0.07	8.3	0.00	0.07	0.058
10	29.27	33.943	21.20	4.42	99.8	0.08	4.8	0.10	0.20	0.065
30	29.07	33.966	21.29	4.39	98.8	0.13	1.7	0.01	0.14	0.046
50	28.92	33.988	21.35	4.43	99.5	0.14	3.9	0.00	0.16	0.056
75	28.57	34.198	21.63	4.41	98.6	0.13	3.6	0.00	0.10	0.103
100	26.65	34.831	22.72	3.85	83.7	0.30	5.8	0.20	0.08	0.167
126	24.76	34.958	23.40	3.36	70.8	0.51	4.8	0.13	0.04	0.330
151	21.38	34.810	24.27	3.30	65.5	0.64	9.9	0.06	0.03	0.111
176	16.17	34.687	25.49	2.67	48.0	1.23	23.5	0.01	0.15	0.086
201	13.45	34.605	26.01	2.16	36.7	1.60	38.7	0.05	0.27	0.040
302	9.55	34.625	26.76	1.14	17.8	2.47	42.5	0.02	0.00	0.002
403	8.40	34.612	26.93	1.47	22.4	2.47	46.6	0.03	0.00	
504	7.59	34.585	27.03	1.60	23.9	2.61	55.8	0.06	0.00	
604	6.89	34.567	27.11	1.36	20.0	2.75	62.4	0.02	0.11	
705	6.05	34.551	27.21	1.44	20.8	2.84	65.6	0.04	0.03	
806	5.44	34.549	27.29	1.49	21.2	2.92	76.6	0.02	0.16	
1008	4.42	34.565	27.42	1.80	25.0	2.86	94.4	0.03	0.03	
1209	3.74	34.581	27.50	1.91	26.1	2.92	109.0	0.03	0.10	
1268*	3.53	(34.585)	27.53	1.92	26.1	3.03	119.0	-	0.00	
1672*	2.57	(34.615)	27.64	2.23	29.6	2.96	141.0	-	0.14	
2065*	2.01	34.644	27.71	2.60	34.0	2.85	148.0	-	0.28	
2597*	1.74	34.660	27.74	2.90	37.6	2.79	151.0	-	0.04	
3080*	1.59	34.673	27.76	3.24	41.9	2.73	148.0	-	0.36	
3575*	1.54	34.722	27.81	3.42	44.2	2.69	148.0	-	0.14	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	29.40	33.939	21.16	0.000
10	29.27	33.943	21.20	0.066
30	29.07	33.966	21.29	0.197
50	28.92	33.988	21.35	0.327
75	28.57	34.198	21.63	0.486
100	26.65	34.831	22.72	0.628
125	24.85	34.961	23.38	0.750
150	21.55	34.818	24.23	0.854
175	16.37	34.691	25.44	0.934
200	13.53	34.608	26.00	0.992
250	10.68	34.582	26.53	1.083
300	9.56	34.622	26.75	1.156
400	8.41	34.613	26.93	1.285
500	7.62	34.586	27.03	1.402
600	6.92	34.568	27.11	1.511
700	6.09	34.552	27.21	1.612
800	5.47	34.549	27.28	1.705
1000	4.45	34.564	27.41	1.872
1200	3.76	34.580	27.50	2.019

Table 7.

Station 5   0°00.2'N, 158°04.1'E   Depth: 2250 m   Date: Sep. 10, 1979   Time: 00:41-02:33   Weather: Cloudy

Air Temp.: 28.0°C Wind Dir.: WNW Wind Speed: 4.0 m/s   Sea: 2   Swell: 1

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)	Chl.a (mg/m^3)
0	29.60	34.036	21.16	4.43	100.6	0.07	15.6	0.00	0.07	0.060
10	29.40	34.001	21.20	4.44	100.5	0.10	6.1	0.04	0.15	0.044
30	29.47	34.494	21.55	4.50	102.2	0.16	6.4	0.00	0.20	0.124
50	28.82	34.812	22.00	4.48	100.9	0.22	6.7	0.00	0.13	0.140
75	26.44	35.237	23.10	3.31	71.9	0.64	11.2	0.16	0.00	0.341
100	25.43	35.452	23.57	3.29	70.3	0.68	16.9	0.13	0.05	0.229
125	22.91	35.185	24.12	3.20	65.4	0.67	10.8	0.04	0.05	0.071
150	19.01	35.125	25.13	3.24	61.6	0.90	14.3	0.04	0.04	0.026
176	18.76	35.411	25.41	3.33	63.2	0.88	13.1	0.01	0.04	0.003
201	17.00	35.294	25.76	3.36	61.6	0.98	10.8	0.00	0.05	0.002
302	11.63	34.849	26.56	3.04	49.8	1.66	30.1	0.03	0.13	0.010
403	9.32	34.682	26.84	1.86	28.9	2.27	39.0	0.01	0.21	
505	8.31	34.621	26.95	2.43	37.0	2.27	42.5	0.03	0.05	
606	6.80	34.559	27.12	2.52	37.0	2.41	50.7	0.01	0.00	
707	5.98	34.551	27.22	1.88	27.1	2.69	69.1	0.00	0.27	
808	5.44	34.543	27.28	2.06	29.3	2.78	76.6	0.04	0.09	
1011	4.43	34.554	27.41	2.27	31.5	2.71	94.0	0.00	0.01	
1214	3.66	34.582	27.51	2.10	28.6	2.81	114.0	0.00	0.12	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	29.60	34.036	21.16	0.000
10	29.40	34.001	21.20	0.066
30	29.47	34.494	21.55	0.195
50	28.82	34.812	22.00	0.316
75	26.44	35.237	23.10	0.449
100	25.43	35.452	23.57	0.564
125	22.91	35.185	24.12	0.667
150	19.01	35.125	25.13	0.751
175	18.75	35.400	25.41	0.820
200	17.08	35.302	25.74	0.882
250	14.03	35.058	26.24	0.987
300	11.71	34.856	26.55	1.072
400	9.36	34 684	26.83	1.216
500	8.35	34.623	26.95	1.342
600	6.89	34.562	27.11	1.455
700	6.02	34.551	27.22	1.555
800	5.48	34.544	27.28	1.648
1000	4.48	34.553	27.40	1.817
1200	3.71	34.580	27.50	1.964

Table 8.

Station 6   4°59.6'S, 159°59.2'E   Depth: 1650m   Date: Sep. 11, 1979   Time: 21:10-22:23   Weather: Rainy
5°00.4'S, 159°58.3'E   Sep. 12, 1979   00:07-01:05
Air Temp., 26.6°C   Wind Dir.: SE   Wind Speed: 8.0 m/s   Sea: 3   Swell: 1

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)	Chl.a (mg/m³)
0	29.6	34.644	21.62	4.43	100.9	0.20	8.6	0.00	0.10	0.066
10	29.59	34.639	21.62	4.42	100.7	0.19	8.6	0.03	0.30	0.069
30	29.59	34.777	21.72	4.39	100.1	0.19	4.2	0.00	0.09	0.080
50	29.53	34.779	21.74	4.41	100.5	0.21	7.7	0.00	0.06	0.134
75	29.19	35.487	22.39	4.22	96.0	0.40	9.9	0.27	0.20	0.309
100	28.46	35.552	22.68	3.90	87.7	0.55	9.3	1.97	0.19	0.340
125	27.35	35.648	23.11	3.66	80.9	0.69	6.1	0.58	0.14	0.239
150	25.94	35.746	23.64	3.42	73.9	0.73	7.7	0.06	0.05	0.164
175	23.47	35.884	24.49	3.13	64.8	0.84	9.6	0.02	0.79	0.087
200	19.76	35.642	25.33	2.89	55.9	1.04	5.2	0.06	0.22	0.013
299	9.83	34.737	26.80	2.40	37.8	2.03	28.9	0.03	0.24	0.012
399	8.34	34.640	26.96	2.32	35.3	2.28	35.2	0.03	0.26	
498	7.61	34.600	27.04	2.05	30.7	2.50	38.4	0.04	0.25	
598	6.75	34.565	27.13	2.08	30.5	2.57	45.0	0.04	0.16	
698	6.02	34.545	27.21	2.15	31.0	2.62	52.9	0.02	0.02	
797	5.40	34.539	27.28	2.26	32.1	2.73	63.0	0.01	0.20	
997	4.46	34.551	27.40	2.17	30.1	2.78	83.6	0.03	0.01	
1196	3.88	34.565	27.47	2.39	32.7	2.73	88.4	0.03	0.08	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	29.6	34.644	21.62	0.000
10	29.59	34.639	21.62	0.062
30	29.59	34.777	21.72	0.185
50	29.53	34.779	21.74	0.307
75	29.19	35.487	22.39	0.452
100	28.46	35.552	22.68	0.586
125	27.35	35.648	23.11	0.712
150	25.94	35.746	23.64	0.826
175	23.47	35.884	24.49	0.924
200	19.76	35.642	25.33	1.002
250	13.74	35.129	26.36	1.114
300	9.79	34.734	26.80	1.190
400	8.33	34.639	26.96	1.315
500	7.59	34.599	27.04	1.430
600	6.73	34.564	27.13	1.537
700	6.01	34.545	27.21	1.636
800	5.38	34.539	27.29	1.729
1000	4.45	34.551	27.40	1.896
1200	3.87	34.565	27.48	2.047

Table 9.

Station 7   9°59.4'S, 154°58.0'E   Depth: 3420m   Date: Sep. 18, 1979   Time: 16:35-17:32   Weather: Cloudy
Air Temp.: 26.0°C   Sind Dir.: E   Wind Speed: 12.0 m/s   Sea: 4   Swell: 3

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)	Chl.a (mg/m³)
0	27.20	35.081	22.74	4.50	98.9	0.27	3.6	0.00	0.50	0.207
10	27.22	35.078	22.73	4.50	98.9	0.23	2.6	0.05	0.20	0.178
30	27.17	35.078	22.74	4.51	99.0	0.22	3.3	0.04	0.34	0.200
50	27.13	35.084	22.76	4.51	99.0	0.26	2.0	0.01	0.23	0.196
75	26.50	35.109	22.98	4.22	91.6	0.29	3.9	0.29	0.13	0.363
99	26.05	35.451	23.38	3.50	75.6	0.64	3.6	0.10	0.20	0.253
124	25.18	35.669	23.81	3.23	68.8	0.72	2.0	0.04	0.19	0.133
149	24.00	35.777	24.25	3.10	64.8	0.82	3.9	0.07	0.04	0.023
174	21.89	35.331	24.52	3.20	64.3	0.72	2.3	0.08	0.21	0.014
199	20.49	35.703	25.19	2.98	58.5	0.91	3.6	0.07	0.23	0.018
298	13.23	35.012	26.37	3.04	51.6	1.48	11.2	0.06	0.00	0.024
396	9.95	34.728	26.77	3.42	54.0	1.73	15.6	0.05	0.04	
495	7.62	34.544	26.99	3.83	57.3	1.92	21.6	0.07	0.10	
594	6.18	34.489	27.15	3.82	55.3	2.07	31.1	0.00	0.13	
692	5.46	34.482	27.23	3.75	53.3	2.24	41.9	0.03	0.09	
791	4.94	34.485	27.30	3.65	51.3	2.36	51.7	0.03	0.11	
989	4.26	34.524	27.40	3.44	47.5	2.42	69.4	0.03	0.10	
1188	3.64	34.559	27.49	3.20	43.5	2.57	85.2	0.03	0.07	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	27.20	35.081	22.74	0.000
10	27.22	35.078	22.73	0.051
30	27.17	35.078	22.74	0.154
50	27.13	35.084	22.76	0.257
75	26.50	35.109	22.98	0.382
100	26.02	35.462	23.40	0.500
125	25.14	35.680	23.83	0.609
150	23.92	35.757	24.26	0.707
175	21.83	35.340	24.54	0.797
200	20.41	35.704	25.21	0.876
250	16.67	35.537	26.02	0.999
300	13.14	35.004	26.39	1.094
400	9.84	34.718	26.78	1.248
500	7.53	34.539	27.00	1.374
600	6.12	34.488	27.15	1.481
700	5.41	34.482	27.24	1.578
800	4.90	34.486	27.30	1.667
1000	4.22	34.526	27.41	1.832
1200	3.60	34.561	27.50	1.978

Table 10.

Station 8 15°00.9'S, 155°00.4'E Depth: 3430m Date: Sep. 20, 1979 Time: 10:04-11:19 Weather: Fine
Air Temp.: 25.2°C Wind Dir.: E Wind Speed: 9.0 m/s Sea: 4 Swell: 3

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)	Chl.a (mg/m³)
0	26.0	35.223	23.22	4.57	98.5	0.22	11.1	0.00	0.12	0.130
10	26.13	35.201	23.17	4.63	100.0	0.22	6.0	0.03	0.24	0.106
30	26.09	35.223	23.19	4.61	99.5	0.21	3.8	0.03	0.18	0.172
50	26.10	35.214	23.18	4.60	99.3	0.20	5.4	0.00	0.18	0.207
75	25.12	35.243	23.51	4.79	101.7	0.11	4.1	0.02	0.22	0.341
100	24.93	35.261	23.58	4.67	98.9	0.12	7.0	0.03	0.18	0.294
125	23.89	35.585	24.14	4.51	93.9	0.13	8.6	0.25	0.18	0.260
150	23.30	35.749	24.43	3.84	79.2	0.41	6.0	0.07	0.51	0.088
176	22.10	35.771	24.79	3.56	71.9	0.58	6.7	0.04	0.18	0.056
201	21.23	35.755	25.02	3.43	68.2	0.63	4.2	0.04	0.16	0.021
302	16.76	35.348	25.86	3.20	58.4	1.09	10.2	0.04	0.13	0.024
403	12.13	34.898	26.50	3.31	54.8	1.52	14.0	0.02	0.18	
505	9.36	34.661	26.81	3.69	57.5	1.73	18.1	0.02	0.02	
606	7.37	34.520	27.01	3.89	57.9	1.89	23.8	0.03	0.18	
708	5.94	34.449	27.15	3.93	56.5	2.11	31.2	0.00	0.02	
809	5.17	34.451	27.24	3.83	54.1	2.25	42.9	0.02	0.07	
1011	4.11	34.496	27.40	3.66	50.4	2.32	64.6	0.03	0.02	
1212	3.52	34.544	27.49	3.45	46.8	2.45	84.0	0.02	0.00	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	26.0	35.223	23.22	0.000
10	26.13	35.201	23.17	0.047
30	26.09	35.223	23.19	0.141
50	26.1	35.214	23.18	0.235
75	25.12	35.243	23.51	0.349
100	24.93	35.261	23.58	0.459
125	23.89	35.585	24.14	0.562
150	23.30	35.749	24.43	0.654
175	22.15	35.772	24.78	0.739
200	21.26	35.756	25.02	0.818
250	19.17	35.594	25.45	0.959
300	16.86	35.359	25.84	1.081
400	12.26	34.910	26.49	1.277
500	9.46	34.669	26.80	1.427
600	7.47	34.526	27.00	1.553
700	6.03	34.452	27.14	1.663
800	5.22	34.449	27.23	1.761
1000	4.15	34.493	27.39	1.934
1200	3.54	34.541	27.49	2.082

Table 11.

Station 9 20°02.0'S, 154°59.7'E Depth: 3170m Date: Sep. 22, 1979 Time: 09:24-10:28 Weather: Fine
Air Temp.: 22.9°C Wind Dir.: SE Wind Speed: 9.0 m/s Sea: 3 Swell: 1

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)	Chl.a (mg/m³)
0	23.85	35.412	24.02	4.84	100.6	0.13	10.8	0.01	0.06	0.079
23	23.96	35.410	23.98	4.75	99.0	0.12	4.2	0.02	0.05	0.079
43	23.93	35.422	24.00	4.81	100.2	0.14	3.0	0.03	0.06	0.077
63	23.37	35.604	24.30	4.88	100.7	0.12	3.3	0.00	0.13	0.092
88	23.08	35.640	24.41	4.72	97.0	0.14	7.3	0.00	0.18	0.154
113	22.83	35.683	24.52	4.43	90.6	0.25	8.3	0.13	0.06	0.344
138	22.52	35.702	24.62	4.81	97.9	0.16	3.9	0.21	0.05	0.509
162	22.29	35.712	24.70	4.31	87.4	0.30	3.0	0.07	0.04	0.103
187	21.68	35.730	24.88	4.00	80.2	0.44	4.8	0.01	0.14	0.115
212	20.78	35.680	25.09	3.94	77.7	0.47	2.0	0.00	0.13	0.026
310	17.01	35.436	25.86	4.02	73.7	0.70	4.8	0.00	0.11	0.003
406	13.61	35.115	26.38	4.01	68.6	1.06	6.1	0.00	0.08	
502	10.35	34.816	26.77	4.23	67.4	1.37	9.8	0.00	0.05	
599	8.94	34.672	26.89	4.35	67.1	1.54	11.1	0.00	0.08	
697	7.32	34.528	27.02	4.38	65.1	1.81	17.4	0.02	0.09	
796	5.93	34.464	27.16	4.22	60.7	2.07	29.9	0.01	0.19	
994	4.41	34.492	27.36	3.84	53.2	2.28	56.1	0.03	0.05	
1193	3.74	34.527	27.46	3.63	49.5	2.44	72.4	0.04	0.10	
1205*	3.67	34.528	27.47	-	-	-	-	-	-	
1446*	3.23	34.570	27.54	-	-	-	-	-	-	
1688*	2.82	34.611	27.61	-	-	-	-	-	-	
1931*	2.43	34.648	27.68	-	-	-	-	-	-	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	23.85	35.412	24.02	0.000
10	23.92	35.409	24.00	0.039
30	23.99	35.404	23.97	0.118
50	23.75	35.484	24.10	0.196
75	23.20	35.634	24.38	0.289
100	22.96	35.662	24.47	0.378
125	22.68	35.694	24.57	0.464
150	22.42	35.707	24.65	0.549
175	22.01	35.725	24.78	0.632
200	21.23	35.708	24.99	0.710
250	19.32	35.595	25.41	0.853
300	17.40	35.465	25.79	0.977
400	13.82	35.136	26.35	1.183
500	10.41	34.821	26.76	1.343
600	8.92	34.670	26.89	1.477
700	7.27	34.525	27.03	1.599
800	5.89	34.464	27.16	1.707
1000	4.38	34.493	27.37	1.890
1200	3.73	34.528	27.46	2.045

Table 12.

Station 11   31°23.1'S, 154°53.5'E   Depth: 4760m   Date: Oct. 3, 1979   Time: 09:00-10:20   Weather: Fine
Air Temp.: 17.3°C   Wind Dir.: ENE   Wind Speed: 8.0 m/s   Sea: 3   Swell: 1

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)	Chl.a (mg/m³)
0	19.9	35.769	25.39	5.18	100.6	0.17	3.4	0.16	1.14	0.503
10	19.85	35.779	25.41	5.16	100.1	0.18	2.8	0.20	0.32	0.515
30	19.84	35.785	25.42	5.16	100.1	0.16	1.6	0.19	0.29	0.643
50	19.85	35.796	25.43	5.12	99.3	0.15	3.4	0.16	0.19	0.595
75	19.84	35.776	25.41	5.05	97.9	0.17	0.7	0.20	0.15	0.129
101	19.78	35.769	25.42	5.09	98.6	0.18	4.9	0.36	0.10	0.122
126	19.74	35.777	25.44	5.23	101.2	0.20	1.6	0.50	0.08	0.120
151	19.74	35.765	25.43	5.05	97.8	0.26	1.9	0.48	0.12	0.068
202	19.62	35.762	25.46	5.19	100.2	0.26	1.3	0.37	0.22	0.051
303	18.08	35.552	25.69	4.35	81.5	0.56	3.4	0.04	0.08	0.011
403	15.65	35.358	26.12	4.18	74.6	0.74	3.1	0.04	0.10	0.006
504	13.21	35.158	26.49	4.29	72.8	1.04	6.1	0.01	0.26	
605	11.09	34.937	26.73	4.34	70.3	1.18	8.5	0.04	0.18	
706	9.25	34.706	26.87	4.38	68.1	1.46	10.6	0.04	0.07	
807	8.03	34.590	26.97	4.38	66.2	1.70	13.6	0.03	0.12	
1010	6.20	34.480	27.14	4.19	60.6	1.96	27.7	0.04	0.11	
1213	4.86	34.478	27.30	(2.43)	34.1	2.20	49.3	0.04	0.10	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	19.9	35.769	25.39	0.000
10	19.85	35.779	25.41	0.026
30	19.84	35.785	25.42	0.077
50	19.85	35.796	25.43	0.129
75	19.84	35.776	25.41	0.194
100	19.78	35.769	25.42	0.259
125	19.74	35.777	25.44	0.324
150	19.74	35.766	25.43	0.389
175	19.72	35.766	25.44	0.454
200	19.63	35.762	25.46	0.519
250	19.05	35.678	25.54	0.648
300	18.14	35.560	25.68	0.771
400	15.73	35.364	26.11	0.994
500	13.30	35.166	26.48	1.181
600	11.19	34.948	26.72	1.339
700	9.35	34.718	26.86	1.480
800	8.10	34.596	26.96	1.609
1000	6.27	34.482	27.13	1.841
1200	4.93	34.475	27.29	2.041

Table 13.

Station 12   31°59.7'S, 160°37.7'E   Depth: 1400m   Date: Oct. 5, 1979   Time: 06:03-07:15   Weather: Cloudy
Air Temp.: 15.0°C   Wind Dir.: ESE   Wind Speed: 7.5 m/s   Sea: 3   Swell: 1

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)	Chl.a (mg/m³)
0	18.83	35.755	25.66	5.28	100.5	0.19	19.7	0.16	0.38	0.341
10	18.89	35.787	25.67	5.24	99.8	0.20	3.3	0.17	0.40	0.553
30	18.92	35.754	25.64	5.20	99.1	0.19	7.2	0.18	0.43	0.376
51	18.92	35.769	25.65	5.24	99.9	0.19	8.4	0.17	0.31	0.270
76	18.92	35.750	25.63	5.22	99.5	0.19	10.6	0.18	0.28	0.317
101	18.90	35.747	25.63	5.13	97.8	0.22	11.2	0.21	0.24	0.351
127	18.83	35.741	25.65	5.16	98.2	0.21	5.4	0.31	0.30	0.364
152	18.65	35.736	25.69	5.17	98.0	0.28	10.6	0.48	0.18	0.052
177	18.60	35.736	25.70	5.12	97.0	0.28	10.3	0.55	0.26	0.043
203	18.15	35.661	25.76	4.87	91.4	0.35	7.5	0.07	0.34	0.020
304	15.59	35.370	26.14	4.26	76.0	0.73	21.5	0.01	0.24	0.001
405	12.67	35.107	26.56	4.37	73.3	1.02	10.6	0.01	0.20	
506	11.05	34.932	26.73	4.40	71.2	1.19	9.0	0.01	0.22	
607	9.30	34.735	26.88	4.41	68.6	1.42	14.8	0.00	0.11	
708	8.01	34.611	26.99	4.41	66.6	1.65	13.9	0.01	0.40	
809	7.13	34.530	27.05	4.44	65.7	1.82	18.8	0.00	0.15	
1010	5.44	34.477	27.23	4.15	59.0	2.07	36.1	0.00	0.08	
1211	4.32	34.508	27.38	3.86	53.4	2.32	62.5	0	0.23	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	18.83	35.755	25.66	0.000
10	18.89	35.787	25.67	0.023
30	18.92	35.754	25.64	0.070
50	18.92	35.768	25.65	0.118
75	18.92	35.751	25.63	0.177
100	18.90	35.747	25.63	0.237
125	18.84	35.742	25.65	0.297
150	18.66	35.736	25.69	0.357
175	18.61	35.737	25.70	0.416
200	18.21	35.672	25.75	0.474
250	17.06	35.524	25.92	0.587
300	15.71	35.381	26.13	0.691
400	12.80	35.119	26.54	0.870
500	11.13	34.941	26.73	1.023
600	9.42	34.748	26.87	0.160
700	8.10	34.619	26.98	1.286
800	7.20	34.536	27.05	1.404
1000	5.52	34.477	27.22	1.617
1200	4.37	34.504	27.38	1.797

Table 14.

Station 13 29°45.3'S, 164°56.5'E Depth: 3400m Date: Oct. 7, 1979 Time: 08:12-09:17 Weather: Fine
Air Temp.: 19.6°C Wind Dir.: NNW Wind Speed: 13.5 m/s Sea: 5 Swell: 3

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)	Chl.a (mg/m³)
0	18.5	35.732	25.72	5.21	98.5	0.27	8.9	0.02	0.19	0.451
10	18.33	35.731	25.77	5.22	98.4	0.23	4.6	0.03	0.34	0.533
30	18.31	35.736	25.78	5.22	98.4	0.22	1.9	0.04	0.22	0.453
50	17.86	35.676	25.84	5.19	96.9	0.29	6.8	0.08	0.18	0.352
75	17.76	35.696	25.88	5.42	101.0	0.23	5.6	0.07	0.74	0.373
100	17.63	35.692	25.91	5.32	98.9	0.23	8.9	0.08	0.40	0.313
125	17.60	35.683	25.91	5.41	100.5	0.25	2.2	0.08	0.31	0.206
149	17.55	35.665	25.91	5.41	100.4	0.29	4.9	0.15	0.41	0.095
174	17.19	35.605	25.95	5.10	94.0	0.38	5.9	0.12	0.29	0.098
199	16.81	35.560	26.01	4.91	89.8	0.42	0.3	0.02	0.18	0.056
299	14.77	35.325	26.29	4.48	78.6	0.75	8.3	0.01	0.19	0.009
399	12.82	35.151	26.56	4.53	76.2	0.92	7.1	0.01	0	
498	11.14	34.951	26.73	4.50	73.0	1.18	5.9	0.00	0.26	
598	9.46	34.748	26.87	4.45	69.5	1.39	8.9	0.00	0.09	
697	8.44	34.655	26.96	4.34	66.2	1.58	13.6	0	0.18	
797	7.27	34.549	27.05	4.28	63.5	1.81	11.1	0	1.13	
996	5.59	34.483	27.22	4.13	58.9	2.11	38.2	0	0	
1195	4.47	34.516	27.37	3.91	54.3	2.26	55.8	0	0.19	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	18.5	35.732	25.72	0.000
10	18.33	35.731	25.77	0.026
30	18.31	35.736	25.78	0.067
50	17.86	35.676	25.84	0.112
75	17.76	35.696	25.88	0.166
100	17.63	35.692	25.91	0.219
125	17.60	35.683	25.91	0.273
150	17.54	35.663	25.91	0.327
175	17.18	35.603	25.95	0.380
200	16.79	35.558	26.01	0.432
250	15.82	35.442	26.15	0.533
300	14.75	35.323	26.29	0.627
400	12.80	35.149	26.57	0.798
500	11.10	34.946	26.73	0.949
600	9.44	34.746	26.87	1.086
700	8.40	34.652	26.96	1.213
800	7.24	34.547	27.05	1.332
1000	5.56	34.483	27.22	1.545
1200	4.45	34.518	27.38	1.726

Table 15.

Station 14 24°57.2'S, 165°08.7'E Depth: 3640m Date: Oct. 9, 1979 Time: 14:42-15:50 Weather: Clear
Air Temp.: 22.2°C Wind Dir.: SW Wind Speed: 2.5 m/s Sea: 2 Swell: 1

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)	Chl.a (mg/m³)
0	20.7	35.818	25.22	5.07	99.9	0.09	4.3	0	0.12	0.179
10	20.69	35.811	25.21	5.14	101.3	0.11	2.1	0.09	0.28	0.211
30	20.50	35.807	25.26	5.13	100.7	0.10	1.8	0.01	0.20	0.324
50	19.92	35.786	25.40	5.12	99.5	0.13	2.7	0.08	0.13	0.266
75	19.75	35.765	25.43	4.95	95.8	0.19	4.0	0.14	0.41	0.176
100	19.40	35.729	25.49	4.79	92.1	0.24	2.7	0.08	0.36	0.086
125	19.00	35.717	25.59	4.89	93.3	0.22	2.4	0.16	0.32	0.062
150	18.69	35.646	25.61	4.60	87.3	0.37	1.8	0.04	0.12	0.033
175	18.52	35.677	25.68	4.83	91.3	0.30	2.7	0.08	0.23	0.047
200	18.46	35.721	25.73	5.07	95.8	0.25	0.3	0.29	0.14	0.038
299	15.67	35.377	26.13	4.28	76.5	0.71	2.7	0	0.10	0.003
397	13.22	35.137	26.47	4.29	72.8	0.95	5.5	0	0.17	
494	10.47	34.812	26.74	4.32	69.0	1.31	9.8	0	0.03	
591	8.40	34.604	26.92	4.41	67.2	1.59	12.5	0	0.09	
689	7.10	34.496	27.03	4.45	65.8	1.78	17.7	0	0	
788	6.21	34.460	27.12	4.35	63.0	1.98	25.4	0	0.14	
985	4.77	34.470	27.30	3.99	55.8	2.22	48.6	0	0.03	
1184	3.93	34.516	27.43	3.74	51.2	2.38	69.1	0	0.03	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	20.7	35.818	25.22	0.000
10	20.69	35.811	25.21	0.028
30	20.50	35.807	25.26	0.083
50	19.92	35.786	25.40	0.136
75	19.75	35.765	25.43	0.201
100	19.40	35.729	25.49	0.265
125	19.00	35.717	25.59	0.327
150	18.69	35.646	25.61	0.388
175	18.52	35.677	25.68	0.448
200	18.46	35.721	25.73	0.508
250	17.29	35.592	25.92	0.621
300	15.64	35.374	26.13	0.724
400	13.13	35.127	26.48	0.907
500	10.32	34.796	26.76	1.060
600	8.26	34.590	26.93	1.192
700	6.99	34.490	27.04	1.311
800	6.11	34.458	27.13	1.420
1000	4.69	34.472	27.31	1.612
1200	3.89	34.521	27.44	1.775

Table 16.

Station 15 14°55.6'S, 163°54.6'E Depth: 3710m Date: Oct. 20, 1979 Time: 06:45-08:62 Weather: Cloudy
Air Temp.: 25.6°C Wind Dir.: SSW Wind Speed: 9.5 m/s Sea: 4 Swell: 1

observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)	Chl.a (mg/m³)
0	26.6	35.103	22.94	4.64	100.9	0.17	24.5	0.02	0.10	0.071
10	26.74	35.103	22.90	4.59	100.1	0.19	18.0	0.01	0.10	0.078
30	26.04	35.189	23.18	4.64	100.0	0.17	12.1	0.00	0.37	0.091
50	25.91	35.168	23.21	4.66	100.2	0.15	12.8	0.02	0.12	0.111
75	25.70	35.172	23.28	4.67	100.1	0.12	10.0	0.00	0.12	0.103
100	24.86	35.361	23.68	4.45	94.1	0.17	17.1	0.10	0.18	0.235
125	24.01	35.579	24.10	3.95	82.4	0.26	7.7	0.08	0.07	0.350
150	23.53	35.768	24.38	3.81	78.9	0.44	16.8	0.05	0.03	0.202
175	22.77	35.799	24.62	3.82	78.1	0.52	22.3	0.06	0.03	0.086
200	21.18	35.725	25.01	3.55	70.5	0.48	7.2	0.04	0.10	0.057
301	17.50	35.443	25.75	3.70	68.5	0.68	21.2	0.01	0.09	0.009
401	12.65	34.932	26.43	3.54	59.3	1.28	22.8	0.02	0.09	
501	9.56	34.665	26.78	3.68	57.6	1.69	24.0	0.03	0.07	
602	7.46	34.522	27.00	3.86	57.5	1.85	32.4	0.02	0.07	
703	6.17	34.466	27.13	3.76	54.4	2.06	37.6	0.01	0.11	
804	5.16	34.454	27.25	3.76	53.1	2.23	51.7	0.03	0.14	
1005	4.05	34.500	27.41	3.59	49.3	2.37	70.3	0.02	0.09	
1207	3.40	34.552	27.51	3.44	46.5	2.46	85.6	0.01	0.07	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	26.6	35.103	22.94	0.000
10	26.74	35.103	22.90	0.050
30	26.04	35.189	23.18	0.146
50	25.91	35.168	23.21	0.240
75	25.70	35.172	23.28	0.357
100	24.86	35.361	23.68	0.468
125	24.01	35.579	24.10	0.570
150	23.53	35.768	24.38	0.664
175	22.77	35.799	24.62	0.751
200	21.18	35.725	25.01	0.832
250	19.16	35.598	25.46	0.973
300	17.53	35.446	25.75	1.097
400	12.70	34.937	26.42	1.301
500	9.58	34.667	26.78	1.455
600	7.49	34.524	27.00	1.583
700	6.20	34.467	27.13	1.693
800	5.19	34.454	27.24	1.792
1000	4.07	34.498	27.40	1.962
1200	3.41	34.550	27.51	2.108

Table 17.

Station 16 9°59.9'S, 163°59.9'E Depth: 3800m Date: Oct. 21, 1979 Time: 15:46-17:16 Weather: Overcast
Air Temp.: 27.9°C Wind Dir.: W Wind Speed: 3.0 m/s Sea: 2 Swell: 1

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)	Chl.a (mg/m³)
0	29.3	34.857	21.88	4.43	100.6	0.24	9.0	0.00	0.13	0.067
10	28.72	34.846	22.06	4.53	101.9	0.24	5.6	0.08	0.24	0.064
30	28.61	34.844	22.10	4.46	100.1	0.22	3.2	0.01	0.12	0.063
50	28.36	34.862	22.19	4.50	100.6	0.23	4.2	0	0.20	0.119
75	27.92	34.944	22.40	4.49	99.7	0.26	2.9	0.01	0.16	0.406
100	26.52	35.484	23.26	3.38	73.6	0.63	6.3	0.32	0.33	0.328
125	25.29	35.620	23.74	3.05	65.1	0.70	3.9	0.07	0.05	0.190
150	24.33	35.751	24.13	3.25	68.3	0.80	5.3	0.04	0.12	0.112
175	22.69	35.769	24.62	3.03	61.9	0.84	2.2	0.02	0.01	0.017
200	19.87	35.639	25.30	2.95	57.2	0.97	3.2	0.02	0.07	0.012
300	14.38	35.112	26.21	2.45	42.6	1.60	12.7	0.01	0.08	0.015
400	9.59	34.708	26.81	3.00	47.0	1.88	22.9	0.01	0.09	
501	7.19	34.541	27.05	3.46	51.3	2.09	28.6	0.01	0.07	
601	6.29	34.505	27.15	3.55	51.5	2.12	35.7	0.00	0.04	
701	5.59	34.499	27.23	3.38	48.2	2.28	44.5	0.01	0.15	
802	4.91	34.515	27.32	3.18	44.6	2.48	59.4	0.00	0.13	
1003	4.22	34.532	27.41	3.11	42.9	2.50	71.9	0.00	0	
1206	3.57	34.554	27.50	3.15	42.8	2.52	87.5	0	0	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	29.3	34.857	21.88	0.000
10	28.72	34.846	22.06	0.059
20	28.61	34.844	22.10	0.174
50	28.36	34.862	22.19	0.288
75	27.92	34.944	22.40	0.427
100	26.52	35.484	23.26	0.554
125	25.29	35.620	23.74	0.665
150	24.33	35.751	24.13	0.766
175	22.69	35.769	24.62	0.857
200	19.87	35.639	25.30	0.933
250	16.50	35.368	25.93	1.056
300	14.38	35.112	26.21	1.158
400	9.59	34.708	26.81	1.319
500	7.20	34.542	27.05	1.440
600	6.29	34.505	27.15	1.546
700	5.60	34.499	27.23	1.643
800	4.92	34.515	27.32	1.733
1000	4.23	34.532	27.41	1.895
1200	3.59	34.553	27.49	2.042

Table 18.

Station 17 4°59.0'S, 164°00.5'E Depth: 1600m Date: Oct. 23, 1979 Time: 06:43-07:53 Weather: Overcast
Air Temp.: 27.6°C Wind Dir.: E Wind Speed: 1.8 m/s Sea: 2 Swell: 1

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)	Chl.a (mg/m^3)
0	29.7	34.985	21.84	4.38	100.1	0.20	6.9	0.01	0.33	0.109
10	29.68	34.989	21.85	4.35	99.4	0.23	6.2	0.02	0.42	0.104
30	29.70	35.046	21.88	4.35	99.5	0.20	18.6	0.02	0.48	0.125
50	29.92	35.260	21.97	4.39	100.9	0.24	14.3	0.02	0.54	0.135
75	29.36	35.411	22.27	4.29	97.8	0.34	16.9	0.42	0.45	0.295
100	28.30	35.613	22.78	3.86	86.6	0.56	13.9	2.00	0.23	0.222
125	26.78	35.722	23.35	3.51	76.9	0.71	10.6	0.35	0.33	0.166
150	25.15	35.887	23.99	3.20	68.2	0.79	9.5	0.08	0.10	0.087
175	22.26	35.815	24.78	3.13	63.4	0.89	16.9	0.07	0.23	0.062
200	19.50	35.592	25.36	2.82	54.3	1.05	10.1	0.03	0.12	0.026
300	9.84	34.734	26.79	2.45	38.6	2.05	30.3	0.02	0.00	0.009
400	8.71	34.663	26.92	2.51	38.5	2.12	32.9	0.01	0.07	
501	8.13	34.632	26.99	1.98	30.0	2.41	41.1	0.01	0.10	
601	7.05	34.579	27.10	2.28	33.7	2.41	45.5	0.02	0.13	
701	6.32	34.550	27.18	2.42	35.1	2.47	51.2	0.02	0.22	
802	5.56	34.532	27.26	2.64	37.6	2.55	56.5	0.03	0.23	
1004	4.47	34.549	27.40	2.42	33.6	2.65	79.1	0.02	0.00	
1208	3.65	34.573	27.50	2.62	35.7	2.67	78.2	0.01	0.03	
1250*	3.53	34.574	27.52	2.64	35.8	2.76	98.2			
1500*	2.87	34.598	27.60	2.80	37.4	2.80	114.8			

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	29.7	34.985	21.84	0.000
10	29.68	34.989	21.85	0.060
30	29.70	35.046	21.88	0.179
50	29.92	35.260	21.97	0.298
75	29.36	35.411	22.27	0.441
100	28.30	35.613	22.78	0.575
125	26.78	35.722	23.35	0.697
150	25.15	35.887	23.99	0.804
175	22.26	35.815	24.78	0.894
200	19.50	35.592	25.36	0.969
250	14.00	35.110	26.29	1.081
300	9.84	34.734	26.79	1.160
400	8.71	34.663	26.92	1.287
500	8.14	34.632	26.99	1.406
600	7.06	34.580	27.10	1.518
700	6.33	34.550	27.18	1.621
800	5.57	34.532	27.26	1.717
1000	4.49	34.548	27.40	1.888
1200	3.68	34.572	27.50	2.037
1500	2.87	34.598	27.60	2.230

Table 19.

Station 18 0°00.7'S, 163°59.7'E Depth: 4450m Date: Oct. 24, 1979 Time: 17:01-17:58 Weather: Fine
Air Temp.: 29.2°C Wind Dir.: NW Wind Speed: 6.0 m/s Sea: 3 Swell: 1

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)	Chl.a (mg/m^3)
0	29.9	34.287	21.25	4.47	102.1	0.14	5.0	0	0.02	0.060
10	29.95	34.299	21.19	4.40	100.6	0.13	4.1	0.01	0.05	0.052
30	29.86	34.307	21.28	4.42	100.9	0.14	2.1	0	0.05	0.071
50	29.92	34.487	21.39	4.44	101.6	0.14	4.4	0	0.03	0.111
75	30.05	35.119	21.82	4.44	102.2	0.23	3.4	0.01	0.44	0.157
100	27.87	35.303	22.69	3.87	86.1	0.49	4.4	0.30	0.39	0.446
125	25.59	35.260	23.38	3.18	68.1	0.68	4.4	0.03	0.00	0.143
150	22.76	35.617	24.49	3.26	66.6	0.81	3.7	0.03	0.06	0.086
175	21.44	35.531	24.80	3.27	65.2	0.76	3.7	0.02	0.09	0.143
200	18.28	35.379	25.51	3.32	62.4	0.88	5.4	0	0.11	0.016
300	12.79	34.934	26.40	3.18	53.4	1.44	16.3	0.02	0.09	0.013
400	9.46	34.684	26.82	2.07	32.3	2.17	30.9	0	0.42	
500	8.02	34.608	26.98	2.41	36.4	2.28	34.9	0	0.23	
601	6.89	34.578	27.12	1.62	23.8	2.66	49.8	0	0.08	
701	6.01	34.544	27.21	2.06	29.7	2.66	57.5	0.01	1.27	
802	5.25	34.544	27.31	1.97	27.9	2.82	72.1	0.03	0.02	
1004	4.46	34.556	27.41	2.17	30.1	2.77	88.0	0.03	0.26	
1208	3.92	34.573	27.48	2.09	28.6	2.84	101.3	0.01	0.03	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	29.9	34.287	21.25	0.000
10	29.95	34.229	21.19	0.066
30	29.86	34.307	21.28	0.197
50	29.92	34.487	21.39	0.327
75	30.05	35.119	21.82	0.483
100	27.87	35.303	22.69	0.624
125	25.59	35.260	23.38	0.746
150	22.76	35.617	24.49	0.847
175	21.44	35.531	24.80	0.931
200	18.28	35.379	25.51	1.003
250	14.69	35.128	26.16	1.115
300	12.79	34.934	26.40	1.207
400	9.46	34.684	26.82	1.358
500	8.02	34.608	26.98	1.483
600	6.90	34.578	27.12	1.594
700	6.02	34.544	27.21	1.694
800	5.26	34.544	27.30	1.785
1000	4.47	34.556	27.40	1.951
1200	3.94	34.572	27.47	2.101

Table 20.

Station 19 5°03.4'N, 163°55.3'E Depth: 4655m Date: Oct. 27, 1979 Time: 06:08-07:21 Weather: Fine
Air Temp.: 28.9°C Wind Dir.: E Wind Speed: 5.0 m/s Sea: 2 Swell: 1

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)	Chl.a (mg/m^3)
0	29.7	33.821	20.97	4.46	101.3	0.05	9.7	0.00	0.49	0.059
10	29.76	33.822	20.95	4.42	100.5	0.03	2.7	0.01	0.08	0.054
30	29.65	33.807	20.97	4.41	100.1	0.03	3.3	0.00	0.13	0.049
50	29.49	33.875	21.08	4.44	100.6	0.04	4.7	0.01	0.53	0.061
75	28.65	34.337	21.70	4.47	100.1	0.08	6.7	0.02	0.19	0.112
100	26.44	34.326	22.41	3.96	85.5	0.14	7.7	0.11	0.28	0.293
125	23.73	34.868	23.64	3.48	72.0	0.47	5.4	0.04	0.23	0.181
150	21.13	34.960	24.45	3.44	68.0	0.61	8.7	0.04	0.05	0.058
175	15.49	34.680	25.64	2.96	52.5	1.16	19.3	0.02	0.05	0.021
200	13.13	34.606	26.08	2.52	42.5	1.49	23.9	0.02	0.10	0.014
300	8.88	34.610	26.85	1.57	24.2	2.38	40.9	0.01	0.12	0.006
400	8.02	34.610	26.99	2.29	34.6	2.25	41.9	0.02	0.01	
501	7.52	34.590	27.04	2.23	33.3	2.38	44.2	0.02	0.12	
601	6.89	34.576	27.12	1.87	27.5	2.52	51.1	0.02	0.14	
702	6.16	34.562	27.21	1.43	20.7	2.72	65.8	0.02	0.04	
802	5.57	34.556	27.28	1.85	26.4	2.76	73.1	0.02	0.06	
1004	4.67	34.566	27.39	2.08	29.0	2.68	88.4	0.02	0.00	
1207	3.91	34.585	27.49	1.96	26.9	2.77	108.3	0.02	0.04	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	29.7	33.821	20.97	0.000
10	29.76	33.822	20.95	0.068
30	29.65	33.807	20.97	0.205
50	29.49	33.875	21.08	0.341
75	28.65	34.337	21.70	0.502
100	26.44	34.326	22.41	0.647
125	23.73	34.868	23.64	0.769
150	21.13	34.960	24.45	0.867
175	15.49	34.680	25.64	0.942
200	13.13	34.606	26.08	0.997
250	10.27	34.578	26.60	1.084
300	8.88	34.610	26.85	1.154
400	8.02	34.610	26.99	1.274
500	7.52	34.590	27.04	1.387
600	6.90	34.576	27.12	1.495
700	6.17	34.562	27.21	1.596
800	5.59	34.556	27.28	1.689
1000	4.69	34.566	27.39	1.860
1200	3.93	34.584	27.48	2.012

Table 21.

Station 20 9°59.7'N, 163°58.5'E Depth: 5000m Date: Oct. 28, 1979 Time: 17:57-19:12 Weather: Cloudy
Air Temp.: 27.7°C Wind Dir.: ESE Wind Speed: 5.5 m/s Sea: 3 Swell: 3

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)	Chl.a (mg/m^3)
0	29.15	34.474	21.64	4.31	97.4	0.22	12.4	0.00	0.17	0.038
10	29.26	34.476	21.61	4.37	98.9	0.09	7.9	0.00	0.15	0.037
30	29.21	(34.480)	21.62	4.32	97.7	0.14	3.7	0.02	0.15	0.034
50	28.85	(34.664)	21.88	4.41	99.3	0.18	6.3	0.00	0.23	0.043
75	28.10	(34.780)	22.22	4.56	101.5	0.19	4.3	0.00	0.18	0.071
100	23.73	(34.800)	23.59	4.53	93.7	0.16	7.6	0.02	0.15	0.113
126	18.81	(34.750)	24.90	3.85	72.8	0.51	8.5	0.12	0.19	0.234
151	14.75	(34.570)	25.71	2.72	47.5	1.26	19.3	0.04	0.13	0.192
176	12.48	34.509	26.13	2.11	35.1	1.80	24.5	0.00	0.19	0.084
201	11.61	34.541	26.33	1.54	25.2	2.05	27.7	0.00	0.17	0.024
301	9.36	34.652	26.81	0.78	12.1	2.74	40.8	0.00	0.10	0.007
402	8.42	34.608	26.92	1.05	16.0	2.60	48.6	0.02	0.12	
502	7.61	34.580	27.02	1.29	19.3	2.65	53.1	0.00	0.13	
603	6.83	34.558	27.12	1.31	19.2	2.88	61.6	0.01	1.29	
703	6.07	34.548	27.21	1.29	18.6	2.79	72.3	0.00	0.06	
804	5.53	34.546	27.27	1.44	20.5	2.88	82.1	0.00	0.06	
1005	4.65	34.561	27.39	1.58	22.0	2.90	94.8	0.00	0.00	
1206	3.85	34.580	27.49	1.86	25.4	2.86	111.0	0.00	0.01	
1249*	3.64*	34.580*	27.51	1.93*	26.3	2.97*	121.4*	-	-	
1499*	3.03*	34.600*	27.59	1.94*	26.0	2.93*	132.4*	-	-	
1998*	2.21*	34.642*	27.69	2.33*	30.6	2.84*	149.0*	-	-	
2498*	1.82*	34.665*	27.74	2.75*	35.8	2.75*	153.0*	-	-	
2998*	1.63*	34.680*	27.77	3.07*	39.7	2.64*	154.3*	-	-	
3497*	1.50*	34.687*	27.78	3.38*	43.6	2.57*	147.7*	-	-	
3997*	1.46*	34.699*	27.79	3.70*	47.7	2.47*	145.7*	-	-	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	29.15	34.474	21.64	0.000
10	29.26	34.476	21.61	0.062
30	29.21	34.480	21.62	0.186
50	28.85	34.664	21.88	0.308
75	28.10	34.780	22.22	0.453
100	23.72	34.800	23.59	0.578
125	19.00	34.754	24.85	0.672
150	14.89	34.577	25.69	0.740
175	12.54	34.509	26.12	0.794
200	11.63	34.539	26.32	0.840
250	10.30	34.607	26.61	0.922
300	9.37	34.651	26.80	0.992
400	8.43	34.610	26.92	1.118
500	7.63	34.580	27.02	1.235
600	6.85	34.558	27.11	1.344
700	6.09	34.548	27.21	1.445
800	5.55	34.546	27.27	1.539
1000	4.67	34.560	27.39	1.710
1200	3.87	34.579	27.49	1.862

Table 22

Station 21 15°00.3'N, 164°00.8'E Depth: 5140m Date: Oct. 30, 1979 Time: 07:55-09:10 Weather: Cloudy
Air Temp.: 28.3°C Wind Dir.: ENE Wind Speed: 11.5 m/s Sea: 4 Swell: 3

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)	Chl.a (mg/m^3)
0	28.9	34.658	21.86	4.40	99.1	0.16	13.6	0.00	0.20	0.032
10	28.81	34.665	21.90	4.42	99.5	0.15	11.6	0.00	0.21	0.035
30	28.80	34.642	21.88	4.42	99.4	0.15	8.3	0.00	0.13	0.037
50	28.83	34.656	21.88	4.37	98.4	0.14	11.6	0.00	0.25	0.038
75	27.47	34.958	22.56	4.72	104.1	0.07	11.0	0.00	0.24	0.066
100	26.01	35.137	23.15	4.74	102.1	0.06	10.0	0.01	0.49	0.095
125	25.02	35.264	23.56	4.69	99.4	0.07	9.3	0.00	0.19	0.165
150	23.92	35.345	23.95	4.56	94.9	0.12	7.4	0.09	0.09	0.209
175	22.17	35.235	24.37	4.15	83.7	0.30	4.7	0.03	0.09	0.122
200	19.71	35.051	24.90	4.03	77.6	0.36	4.4	0.01	0.10	0.062
300	11.99	34.367	26.12	3.22	53.0	1.43	25.7	0.00	0.14	0.009
400	8.27	34.248	26.66	2.11	32.0	2.27	48.0	0.01	0.13	
500	6.90	34.350	26.94	1.28	18.8	2.75	67.0	0.01	0.05	
600	6.21	34.449	27.11	1.23	17.8	2.78	70.7	0.01	0.00	
700	5.61	34.492	27.22	1.35	19.3	2.84	81.2	0.00	0.09	
800	5.16	34.518	27.30	1.42	20.1	2.87	86.7	0.00	0.10	
1000	4.17	34.543	27.43	1.63	22.5	2.96	103.8	0.01	0.01	
1200	3.47	34.574	27.52	1.78	24.1	2.92	116.2	0.01	0.04	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	28.9	34.658	21.86	0.000
10	28.81	34.665	21.90	0.059
30	28.80	34.642	21.88	0.178
50	28.83	34.656	21.88	0.298
75	27.47	34.958	22.56	0.439
100	26.01	35.137	23.15	0.565
125	25.02	35.264	23.56	0.679
150	23.92	35.345	23.95	0.785
175	22.17	35.235	24.37	0.880
200	19.71	35.051	24.90	0.965
250	15.39	34.668	25.65	1.104
300	11.99	34.367	26.12	1.214
400	8.27	34.248	26.66	1.385
500	6.90	34.350	26.94	1.518
600	6.21	34.449	27.11	1.630
700	5.61	34.492	27.22	1.729
800	5.16	34.518	27.30	1.821
1000	4.17	34.543	27.43	1.984
1200	3.47	34.574	27.52	2.126

Table 23.

Station 22 20°02.7'N, 158°36.0'E Depth: 5500m Date: Nov. 1, 1979 Time: 07:44-09:02 Weather: Fine
Air Temp.: 27.8°C Wind Dir.: ENE Wind Speed: 11.5 m/s Sea: 4 Swell: 3

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)	Chl.a (mg/m^3)
0	27.9	35.220	22.61	4.44	98.7	0.06	6.0	0.01	0.06	0.057
10	27.93	35.214	22.60	4.42	98.3	0.01	2.5	0.00	0.06	0.062
30	27.92	35.222	22.61	4.47	99.4	0.04	2.5	0.00	0.03	0.062
49	27.95	35.226	22.60	4.49	99.9	0.03	2.5	0.00	0.14	0.054
74	26.14	35.289	23.23	4.96	107.2	0.00	0.8	0.00	0.05	0.106
98	23.84	35.296	23.93	4.62	96.0	0.05	1.8	0.01	0.02	0.207
123	22.47	35.265	24.31	4.48	90.9	0.10	1.1	0.09	0.04	0.188
148	21.06	35.161	24.62	4.44	87.7	0.14	2.5	0.04	0.16	0.127
172	19.29	35.028	24.99	4.14	79.1	0.33	2.2	0.02	0.01	0.042
197	17.89	34.891	25.23	4.18	77.7	0.43	3.6	0.02	0.06	0.006
295	14.53	34.562	25.76	4.53	78.7	0.67	10.2	0.01	0.04	0.002
392	11.20	34.312	26.22	4.24	68.6	1.18	17.9	0.01	0.01	
489	8.18	34.143	26.60	3.21	48.5	1.95	41.3	0.03	0.00	
585	6.22	34.140	26.87	2.04	29.5	2.48	67.8	0.01	0.04	
682	5.20	34.265	27.09	1.23	17.4	2.90	90.2	0.01	0.01	
778	4.74	34.380	27.24	1.18	16.5	3.05	97.8	0.02	0.14	
973	3.97	34.500	27.41	1.50	20.6	2.90	112.9	0.01	0.03	
1169	3.31	34.543	27.51	1.74	23.5	2.90	126.5	0.01	0.00	

Interpolated

D (m)	T (°C)	S (‰)	σ_t	ΔD
0	27.9	35.220	22.61	0.000
10	27.93	35.214	22.60	0.053
30	27.92	35.222	22.61	0.158
50	27.90	35.228	22.62	0.263
75	26.04	35.290	23.26	0.387
100	23.71	35.296	23.97	0.495
125	22.37	35.259	24.33	0.590
150	20.91	35.150	24.65	0.678
175	19.10	35.011	25.02	0.757
200	17.76	34.878	25.26	0.830
250	15.86	34.688	25.56	0.962
300	14.35	34.547	25.78	1.083
400	10.93	34.293	26.26	1.291
500	7.91	34.135	26.63	1.459
600	6.01	34.155	26.91	1.596
700	5.09	34.288	27.12	1.709
800	4.64	34.399	27.26	1.805
1000	3.87	34.510	27.43	1.970
1200	3.22	34.543	27.52	2.110

Table 24.

Station D

24°00.0'N, 154°17.6'E Depth: 5150m Date: Nov. 3, 1979 Time: 04:50-06:30

Weather: Fine Air Temp.: 26.6°C Wind Dir.: ENE Wind Speed: 6.0 m/s Sea: 3

Swell: 1

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)
0	27.8	35.092	22.55	4.54	100.7	-	-	-	-
10	27.94	35.088	22.50	4.41	98.1	-	-	-	-
50	27.90	35.110	22.53	4.46	99.1	-	-	-	-
100	22.25	34.997	24.17	4.99	100.6	-	-	-	-
200	18.23	34.854	25.12	4.48	83.8	-	-	-	-
400	13.33	34.486	25.95	4.46	75.6	0.84	15.0	0.01	0.15
800	5.34	34.159	26.99	1.79	25.3	2.72	86.4	0.00	0.49
1200	3.19	34.460	27.46	1.14	15.3	3.01	136.0	0.04	0.00
1600	2.32	34.573	27.63	1.72	22.6	2.98	152.0	0.02	0.20
2000	1.91	34.631	27.71	2.33	30.4	2.86	157.0	0.00	0.17

Table 25.

Station E

28°01.6'N, 149°07.5'E Depth: 6000m Date: Nov. 4, 1979 Time: 18:09-19:43

Weather: Fine Air Temp.: 24.6°C Wind Dir.: ENE Wind Speed: 11.0 m/s Sea: 4

Swell: 3

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)
0	26.3	34.621	22.68	4.67	100.8	-	-	-	-
10	26.50	34.592	22.59	4.66	100.9	-	-	-	-
50	26.51	34.602	22.60	4.68	101.4	-	-	-	-
100	19.51	34.826	24.78	5.26	100.8	-	-	-	-
200	16.74	34.746	25.40	4.77	86.7	-	-	-	-
400	13.43	34.507	25.94	4.36	74.0	0.82	15.0	0.00	0.45
800	5.03	34.076	26.96	2.27	31.9	2.61	84.2	0.00	0.41
1200	3.22	34.401	27.41	0.92	12.4	3.09	135.9	0.00	0.00
1600	2.43	34.536	27.59	1.41	18.6	3.04	154.4	0.00	0.11
2000	1.99	34.610	27.68	2.02	26.4	3.94	160.3	0.00	0.18

Table 26.

Station F

31°57.8'N, 143°46.0'E Depth: 5830m Date: Nov. 6, 1979 Time: 06:15-07:40

Weather: Fine Air Temp.: 24.9°C Wind Dir.: SSW Wind Speed: 16.0 m/s Sea: 5

Swell: 4

Observed

D (m)	T (°C)	S (‰)	σ_t	DO (ml/l)	O_2 sat. (%)	PO_4-P (μg at/l)	SiO_2-Si (μg at/l)	NO_2-N (μg at/l)	NH_4-N (μg at/l)
0	24.1	34.510	23.26	4.79	99.5	-	-	-	-
10	24.17	34.512	23.24	4.68	97.4	-	-	-	-
49	24.17	34.510	23.24	4.64	96.5	-	-	-	-
99	20.21	34.837	24.60	4.70	91.3	-	-	-	-
197	17.82	34.793	25.17	4.64	86.1	-	-	-	-
395	16.18	34.718	25.51	4.80	86.3	0.40	11.9	0.02	0.09
787	6.77	34.213	26.85	2.66	38.9	2.25	69.2	0.02	0.12
1176	3.62	34.386	27.36	1.38	18.8	2.93	129.0	0.01	0.03
1561	2.57	34.503	27.55	1.27	16.8	3.07	158.2	0.00	0.00
1943	2.11	34.582	27.65	2.55	20.3	3.01	159.2	0.01	0.04

Table 27. Particulate organic carbon (POC).

Depth (m)	Station 1	2	3	4	5	6	7	8	9	11	12	13	14	15	16	17	18	19	20	21	22
0	115	36	41	46	33	29	49	44	40	70	53	74	28	39	48	55	15	32	18	18	37
10	72	47	45	66	26	15	51	39	64	88	61	53	52	53	43	38	16	35	14	13	43
30	91	49	52	43	37	47	47	55	97	83	98	58	41	44	33	38	22	53	22	18	41
50	88	47	60	36	14	41	57	46	54	62	94	58	27	45	55	61	23	35	31	21	51
75	90	43	49	45	8.0	30	52	41	52	28	60	46	31	49	59	47	26	31	35	20	32
100	61	51	55	67	28	58	43	29	49	33	73	53	18	64	34	31	43	48	17	19	35
125	54	55	57	46	15	48	18	31	45	31	70	69	14	50	46	40	14	34	15	13	81
150	88	42	38	29	42	29	46	31	38	60	160	32	37	36	51	29	10	30	11	14	42
175	135	38	58	18	22	13	45	18	26	187	36	34	14	68	14	41	18	37	40	9.1	18
200	40	21	40	36	57	-	27	26	20	119	46	43	12	34	23	29	2.9	23	39	8.8	19
300	38	68	45	88	24	44	47	38	52	86	94	43	4.7	43	115	48	2.5	37	38	7.4	81

Table 28. Particulate organic nitrogen (PON).

Depth (m)	Station 1	2	3	4	5	6	7	8	9	11	12	13	14	15	16	17	18	19	20	21	22
0	15	6.3	6.0	6.2	4.8	3.7	7.0	8.1	6.4	11	9.8	13	6.0	6.3	8.5	8.9	2.8	4.5	2.2	2.1	5.7
10	9.6	5.9	6.8	11	3.9	2.7	8.6	5.9	8.5	13	10	9.4	8.7	8.7	7.0	6.5	3.0	5.7	2.6	1.3	6.2
30	11	6.6	6.6	5.6	5.6	7.8	8.3	8.4	11	13	16	11	7.1	7.5	5.0	6.7	4.3	8.9	3.0	2.6	5.8
50	12	6.5	13	4.6	2.0	6.9	9.7	7.3	7.4	10	16	8.1	5.2	7.0	8.3	11	3.6	6.0	5.1	2.6	8.1
75	14	4.9	4.4	5.8	0.9	4.8	7.6	6.3	7.0	4.2	10	7.1	5.5	7.1	10	9.6	3.9	4.8	5.3	2.8	5.6
100	9.4	6.3	-	10	4.0	9.1	6.9	4.5	7.2	3.6	12	8.3	3.5	10	5.8	6.6	7.4	8.7	3.0	2.2	6.2
125	7.9	7.5	-	6.6	1.9	8.0	3.2	4.8	6.3	4.0	11	8.2	2.7	8.4	6.2	6.7	2.8	4.9	2.5	2.0	12
150	8.4	4.7	-	3.7	6.3	3.9	6.6	4.5	5.8	5.2	14	3.7	4.1	5.1	8.4	4.8	1.5	4.4	2.0	1.4	6.5
175	4.5	5.0	6.8	2.0	2.6	1.7	6.8	2.5	2.4	6.8	2.9	4.3	3.2	6.1	1.8	5.5	3.5	4.7	4.0	1.1	2.9
200	4.0	2.4	4.8	5.2	5.0	1.3	3.8	2.8	2.3	3.7	4.5	5.6	2.3	5.6	3.2	5.1	0.6	2.9	4.8	0.8	1.8
300	2.8	8.2	4.9	11	3.5	3.8	5.2	6.0	8.4	5.2	8.8	5.8	2.5	7.3	16	6.5	1.1	4.7	4.9	0.6	16

Table 29. Data on plankton sampling with Norpac net and the biomass in the upper 150 m.

Station	Position	Date	Ship's time	Depth* of net reached (m)	Kind of net cloth	Volume** of water filtered (m^3)	Wet weight of sample per haul (g)	Wet weight of sample per $1000m^3$ (g)	Settling volume of sample per haul (ml)	Settling volume of sample per $1000m^3$ (ml)
B	28-17.8 N 147-38.7 E	Aug. 30	2303 2312	149	Pylen #60 #200	23.6 22.3	0.9 1.2	38.1 53.8	4.3 5.4	182.2 242.2
C	23-47.4 N 147-38.5 E	Sept. 1	0857 0907	150	#60 #200	22.3 20.7	0.7 1.5	31.4 72.5	3.8 6.8	170.4 328.5
1	20-00.8 N 150-00.6 E	Sept. 2	1625 1635	149	#60 #200	20.4 19.0	0.7 1.0	34.3 52.6	2.9 4.3	142.2 226.3
2	14-58.5 N 152-02.9 E	Sept. 4	0408 0415	150	#60 #200	20.2 18.3	- -	- -	- -	- -
3	09-59.5 N 154-05.4 E	Sept. 5	2240 2249	150	#60 #200	23.7 21.3	1.0 1.5	42.2 70.4	5.6 6.2	236.3 291.1
4	05-02.1 N 156-10.0 E	Sept. 8	1029 1037	150	#60 #200	19.0 18.5	0.5 0.9	26.3 48.6	2.2 3.9	115.8 210.8
4-1	03-29.4 N 156-43.4 E	Sept. 8	2210 2217	151	#60 #200	23.1 21.4	1.3 1.6	56.3 74.8	6.9 5.1	298.7 238.3
4-2	01-57.7 N 157-13.0 E	Sept. 9	1145 1155	150	#60 #200	23.9 22.4	2.5 3.3	104.6 147.3	10.0 9.4	418.4 419.6
5	00-00.7 N 158-02.5 E	Sept. 10	0440 0449	150	#60 #200	32.1 29.7	2.3 4.3	71.7 144.8	8.2 18.0	255.5 606.1
5-1	01-40.2 S 158-38.6 E	Sept. 10	2004 2011	150	#60 #200	24.1 22.5	1.9 3.5	78.8 155.6	8.7 11.3	361.0 502.2
5-2	03-19.2 S 159-19.0 E	Sept. 11	0711 0719	150	#60 #200	19.8 18.3	1.4 2.8	70.7 153.0	4.5 7.4	227.3 404.4
6	05-00.4 S 159-57.7 E	Sept. 12	0229 0239	151	#60 #200	23.3 22.8	2.7 1.9	115.9 83.3	8.9 8.4	382.0 368.4
7	09-57.0 S 154-56.2 E	Sept. 18	2224 2234	150	#60 #200	25.9 23.5	3.7 8.2	142.9 348.9	13.0 24.1	501.9 1025.5
8	15-01.0 S 155-00.3 E	Sept. 20	1231 1240	150	#60 #200	24.4 22.2	2.2 3.5	90.2 157.7	13.4 19.0	549.2 855.9

* Estimated from angle of wire.
** Calculated from flow-meter readings

Table 30. (Continued).

Station	Position	Date	Ship's time	Depth* of net reached (m)	Kind of net cloth	Volume** of water filtered (m^3)	Wet weight of sample per haul (g)	Wet weight of sample per 1000m^3 (g)	Settling volume of sample per haul (ml)	Settling volume of sample per 1000m^3 (ml)
9	20-04.3 S	Sept. 22	1438	150	Pylen #60	23.2	1.5	64.7	4.5	194.0
	154-57.3 E		1445		#200	20.3	1.2	59.1	4.9	241.4
11	31-22.7 S	Oct. 3	1148	150	#60	26.6	3.8	142.9	16.2	609.0
	154-53.1 E		1200		#200	22.5	5.0	222.2	28.8	1280.0
12	32-00.4 S	Oct. 5	0757	150	#60	21.0	2.5	119.0	11.3	538.1
	160-38.1 E		0806		#200	17.9	4.6	257.0	20.0	1117.3
13	29-44.8 S	Oct. 7	1008	150	#60	24.4	6.1	250.0	18.3	750.0
	164-55.5 E		1020		#200	21.8	4.6	211.0	18.2	834.9
14	24-56.3 S	Oct. 9	1606	150	#60	22.1	3.1	140.3	10.5	475.1
	165-10.0 E		1615		#200	19.0	12.5	657.9	35.4	1863.2
15	14-55.5 S	Oct. 20	0839	150	#60	20.7	1.8	87.0	6.0	289.9
	163-5 . E		0852		#200	17.0	1.6	94.1	8.2	482.4
16	10-00.2 S	Oct. 21	1808	150	#60	21.8	2.2	100.9	10.8	495.4
	163-58.8 E		1815		#200	19.9	3.5	175.9	16.0	804.0
17	04-59.5 S	Oct. 23	0544	151	#60	24.2	1.6	66.1	4.2	173.6
	164-00.4 E		0548		#200	22.0	2.0	90.9	10.5	477.3
18	00-00.8 S	Oct. 25	0811	148	#60	33.9	1.0	29.5	6.2	182.9
	164-00.9 E		0820		#200	32.8	1.8	54.9	4.6	140.2
19	05-03.2 N	Oct. 27	0441	150	#60	20.7	1.5	72.5	4.9	236.7
	163-54.3 E		0450		#200	18.8	1.6	85.1	8.3	441.5
20	10-00.1 N	Oct. 28	2007	150	#60	23.8	1.4	58.8	4.9	205.9
	163-57.7 E		2018		#200	22.4	1.6	71.4	7.0	312.5
21	15-03.6 N	Oct. 30	1625	148	#60	21.4	0.2	9.3	1.8	84.1
	164-01.6 E		1631		#200	20.0	1.1	55.0	4.3	215.0
22	20-03.4 N	Nov. 1	0940	150	#60	25.7	1.0	38.9	5.0	194.6
	158-34.8 E		0948		#200	23.7	2.1	88.6	10.0	421.9

* Estimated from angle of wire.
** Calculated from flow-meter readings.

Table 31. (Continued).

Station	Position	Date	Ship's time	Depth* of net reached (m)	Kind of net cloth	Volume** of water filtered (m^3)	Wet weight of sample		Settling volume of sample	
							per haul (g)	per $1000m^3$ (g)	per haul (g)	per $1000m^3$ (ml)
D	24-00.0 N 154-17.2 E	Nov. 3	0435 0442	149	Pylen #60 #200	21.9 19.9	1.4 1.8	63.9 90.5	5.1 9.3	232.9 467.3
E	28-03.8 N 149-07.6 E	Nov. 4	2139 2147	151	#60 #200	25.0 23.0	1.9 1.3	76.0 56.5	7.2 9.0	288.0 391.3
F	31-56.1 N 143-44.9 E	Nov. 6	0939 0952	150	#60 #200	57.2 52.8	2.9 4.1	50.7 77.7	11.0 14.9	192.3 282.2

* Estimated from angle of wire.
** Calculated from flow-meter readings.

Table 32A. Bacterial population in seawater samples

Depth (m)	Station 1		Station 2		Station 3		Station 4		Station 5		Station 6		Station 7	
	V.C.	D.C.	V.C.	D.C.	V.C.	D.C.	V.C.	D.C.	V.C.	D.C.	V.C.	D.C.	V.C.	D.C.
0	4.5×10^{3}	3.2×10^{6}	2.1×10^{3}	1.2×10^{6}	2.3×10^{3}	1.9×10^{6}	2.1×10^{2}	3.1×10^{6}	1.1×10^{3}	2.8×10^{6}	3.2×10^{3}	3.7×10^{6}	2.4×10^{3}	2.7×10^{6}
10	7.4×10^{2}	3.8×10^{6}	7.8x10	3.3×10^{6}	6.2x10	2.4×10^{5}	3.7x10	3.2×10^{6}	5.1x10	1.0×10^{6}	6.9x10	2.4×10^{6}	1.2×10^{2}	1.5×10^{6}
30	2.5×10^{2}	3.4×10^{6}	5.0x10	2.3×10^{6}	2.5x10	2.1×10^{6}	4.9x10	1.9×10^{6}	4.2x10	1.7×10^{6}	6.9x10	1.2×10^{6}	1.3×10^{2}	3.7×10^{6}
50	2.4×10^{2}	3.3×10^{6}	1.4×10^{2}	3.4×10^{6}	7.3x10	6.6×10^{5}	4.7x10	1.0×10^{6}	6.4x10	3.7×10^{6}	7.0x10	1.4×10^{6}	1.5×10^{2}	3.0×10^{6}
75	3.9x10	4.3×10^{6}	6.3x10	3.0×10^{6}	3.3x10	1.6×10^{6}	4.1x10	2.4×10^{6}	6.1x10	1.7×10^{6}	4.3x10	3.0×10^{6}	2.8×10^{2}	1.2×10^{6}
100	5.8x10	2.3×10^{6}	4.7x10	3.3×10^{6}	1.5x10	1.0×10^{5}	5.1x10	1.1×10^{5}	3.0x10	2.1×10^{6}	4.0x10	2.0×10^{6}	9.6×10^{2}	1.8×10^{6}
150	1.5x10	9.8×10^{5}	1.6x10	1.5×10^{6}	1.3x10	2.3×10^{5}	2.1x10	1.2×10^{6}	2.8x10	1.4×10^{6}	2.1x10	1.2×10^{6}	3.0x10	1.5×10^{6}
200	2.6x10	9.8×10^{5}	3.6x10	1.2×10^{6}		5.9×10^{5}	1.3x10	7.6×10^{5}	2.4x10	1.0×10^{6}	1.6x10	6.7×10^{5}	3.0x10	5.2×10^{5}
400	2.4x10	9.4×10^{5}	2.0x10	1.0×10^{6}	4	6.8×10^{5}	3	8.7×10^{5}	8	1.0×10^{6}	7	7.9×10^{5}	9	1.0×10^{6}
800	2.3x10	7.5×10^{5}	3	7.6×10^{5}	2	1.5×10^{5}	1.3x10	5.8×10^{5}	4	7.1×10^{5}	1.4x10	5.7×10^{5}	2	7.1×10^{5}
1200	2.1x10	4.3×10^{5}	1	2.2×10^{5}	0.4	8.4×10^{4}	3	5.4×10^{5}	9	4.8×10^{5}	5	4.6×10^{5}	7	1.3×10^{6}

V.C. : Viable counts of bacteria (c.f.u./10 ml).

D.C. : Total microscopic counts of bacteria by epifluorescent method (No./10 ml).

Table 32B. (Continued).

Depth (m)	Station 8 V.C.	Station 8 D.C.	Station 9 V.C.	Station 9 D.C.	Station 11 V.C.	Station 11 D.C.	Station 12 V.C.	Station 12 D.C.	Station 14 V.C.	Station 14 D.C.	Station 15 V.C.	Station 15 D.C.	Station 16 V.C.	Station 16 D.C.
0	5.7×10^{3}	1.9×10^{6}	4.4×10^{3}	2.5×10^{6}	2.3×10^{2}	3.5×10^{6}	1.6×10^{2}	1.7×10^{6}	5.8×10^{3}	2.4×10^{6}	6.0×10^{2}	1.5×10^{6}	2.7×10^{2}	2.4×10^{6}
10	4.0x10	1.4×10^{6}	2.0x10	3.0×10^{6}	9.3x10	1.1×10^{6}	6.3x10	1.2×10^{6}	4.5x10	2.2×10^{6}	5.8x10	1.7×10^{5}	9.0x10	6.5×10^{6}
30	9.3x10	1.6×10^{6}	4.1x10	3.7×10^{6}	9.2x10	2.3×10^{6}	3.2x10	1.5×10^{6}	3.1x10	1.4×10^{6}	1.2x10	1.7×10^{6}	1.4×10^{2}	3.9×10^{6}
50	7.9x10	1.2×10^{6}	3.9x10	3.4×10^{6}	6.6x10	3.1×10^{6}	4.3x10	7.6×10^{5}	4.5x10	2.7×10^{6}	2.3x10	3.1×10^{5}	1.2×10^{2}	1.1×10^{5}
75	6.8x10	3.3×10^{6}	3.7x10	2.1×10^{6}	6.1x10	6.1×10^{5}	8.5x10	9.3×10^{5}	2.9x10	4.0×10^{6}	4.2x10	2.7×10^{6}	5.8x10	3.3×10^{6}
100	3.3x10	1.8×10^{6}	3.3x10	7.8×10^{5}	3.7x10	4.6×10^{5}	5.9x10	9.3×10^{5}	4.4x10	1.7×10^{6}	5.5x10	2.6×10^{6}	7.7x10	1.8×10^{6}
150	2.4x10	4.4×10^{5}	4.2x10	4.4×10^{5}	3.5x10	2.4×10^{6}	5.1x10	1.8×10^{6}	4.3x10	3.9×10^{6}	2.3x10	1.3×10^{6}	3.3x10	1.9×10^{6}
200	3.3x10	5.3×10^{5}	7.0x10	8.8×10^{5}	3.1x10	3.6×10^{5}	8.5x10	1.3×10^{6}	3.7x10	2.3×10^{6}	1.7x10	9.6×10^{5}	1.9x10	4.8×10^{5}
400	1.9x10	6.3×10^{5}	1.3x10	8.7×10^{5}	1.8x10	1.0×10^{6}	2.6x10	3.2×10^{5}	2.1x10	1.4×10^{6}	1.6x10	4.2×10^{5}	2.9x10	5.3×10^{5}
800	3	7.0×10^{4}	1	2.5×10^{5}	4	5.9×10^{5}	5	4.6×10^{5}	4	7.3×10^{5}	3	1.6×10^{5}	4.2x10	2.1×10^{5}
1200	6	2.3×10^{5}	1	2.1×10^{5}	2	6.0×10^{5}	6	3.7×10^{5}	1	2.0×10^{6}	0.9	3.3×10^{5}	2	2.7×10^{5}

Table 33C. (Continued).

Depth (m)	Station 17 V.C.	Station 17 D.C.	Station 18 V.C.	Station 18 D.C.	Station 19 V.C.	Station 19 D.C.	Station 20 V.C.	Station 20 D.C.	Station 21 V.C.	Station 21 D.C.	Station 22 V.C.	Station 22 D.C.
0	2.8×10^{2}	2.7×10^{6}	1.4×10^{2}	2.1×10^{6}	1.9x10	3.7×10^{6}	5.5×10^{0}	3.9×10^{6}	1.2×10^{1}	3.7×10^{6}	3.4×10^{1}	4.7×10^{6}
10	1.0×10^{2}	8.6×10^{5}	1.4×10^{2}	2.0×10^{6}	6.5×10^{0}	1.8×10^{6}	4.2×10^{1}	2.8×10^{6}	9.2×10^{0}	3.2×10^{6}	1.0×10^{1}	4.2×10^{6}
30	9.6x10	9.3×10^{5}	1.4×10^{2}	2.2×10^{6}	5.8×10^{0}	2.2×10^{6}	1.7×10^{1}	3.6×10^{6}	1.1×10^{1}	3.8×10^{6}	1.7×10^{1}	3.1×10^{6}
50	6.9x10	8.6×10^{5}	3.1×10^{2}	2.8×10^{6}	5.3×10^{0}	2.9×10^{6}	1.0×10^{1}	2.2×10^{6}	9.4×10^{0}	3.4×10^{6}	1.4×10^{1}	4.4×10^{6}
75	5.9x10	7.2×10^{5}	8.3x10	2.7×10^{6}	9.2×10^{0}	3.5×10^{6}	8.4×10^{0}	3.2×10^{6}	1.0×10^{1}	2.7×10^{6}	1.5×10^{1}	5.0×10^{6}
100	6.6x10	3.2×10^{5}	5.5x10	2.1×10^{6}	4.0×10^{0}	1.3×10^{6}	4.8×10^{0}	2.1×10^{6}	1.8×10^{1}	1.0×10^{6}	7.5×10^{0}	3.0×10^{6}
150	3.9x10	1.2×10^{6}	2.7x10	1.2×10^{6}	2.5×10^{0}	1.8×10^{6}	4.0×10^{0}	8.8×10^{5}	4.3×10^{0}	1.0×10^{6}		1.6×10^{6}
200	4.2x10	4.5×10^{5}	2.1x10	1.5×10^{6}	1.5×10^{0}	1.1×10^{6}	1.5×10^{1}	1.1×10^{6}	2.6×10^{0}	5.4×10^{5}	4.9×10^{0}	9.0×10^{5}
400	3.5×10^{2}	6.0×10^{5}	9	6.7×10^{5}	3.9×10^{-1}	7.4×10^{5}	1.8×10^{0}	4.2×10^{5}	4.6×10^{-1}	8.7×10^{5}	1.3×10^{0}	7.3×10^{5}
800	2.9×10^{2}	2.8×10^{5}	2	5.4×10^{5}	5.5×10^{-1}	4.9×10^{5}	8.8×10^{0}	3.3×10^{5}	1.3×10^{-1}	3.2×10^{5}	1.1×10^{0}	4.8×10^{5}
1200	2.0×10^{2}	1.3×10^{5}	2	3.2×10^{5}	1.2×10^{-1}	3.8×10^{5}	6.1×10^{-1}	2.0×10^{5}	4.0×10^{-2}	3.3×10^{5}	3.4×10^{-1}	3.1×10^{5}

V.C. : Viable counts of bacteria (c.f.u./10 ml).

D.C. : Total microscopic counts of bacteria by epifluorescent method (No./10 ml).

Table 33. Composition of the MPN media

	D	M
	mg/L	
Proteose Peptone No.3(Difco)	50	1
Bacto Yeast Extract(Difco)	50	1
Ferric citrate ---------	5	0.1
Glucose ----------------	2.5	0.5
Mannitol ---------------	2.5	0.5
Sodium acetate ---------	2.5	0.5
Sodium malate ----------	2.5	0.5

Table 34. Bacterial counts by different methods (The Pacific Ocean)

		TC	DVC	MPN M	MPN D	PC	DVC/TC
St 16	0m	$1.4x10^5$	$2.3x10^3$	$1.7x10^2$	$4.0x10^1$	$2.7x10^1$	1.6%
	100m	$1.2x10^5$	$1.7x10^3$	$1.1x10^2$	$2.7x10^1$	$7.7x10^0$	1.4
St 17	0m	$1.1x10^5$	$2.7x10^3$	$7.9x10^2$	$3.5x10^2$	$2.8x10^1$	2.5
	100m	$5.5x10^4$	$1.2x10^3$	$1.3x10^2$	$1.3x10^1$	$6.1x10^0$	2.2
	800m	$2.3x10^4$	$1.9x10^3$	$3.4x10^2$	$1.1x10^2$	$2.9x10^1$	8.3
St 19	0m	$5.0x10^4$	$1.6x10^3$	$4.9x10^1$	$2.3x10^1$	$1.9x10^1$	3.2
	100m	$7.6x10^4$	$6.8x10^2$	$4.9x10^1$	$3.5x10^1$	$4.0x10^0$	0.9
	800m	$3.0x10^4$	$6.4x10^2$	$3.3x10^0$	$3.3x10^0$	$5.5x10^{-1}$	2.1

Table 35. Composition of the isolates
(The Pacific Ocean, St. 19)

	Plate PPES-II	MPN D	MPN M
Conc.of nutrients mg/1	5100	115	4.1
Vibrionaceae	19.4 %	21.4 %	5.6 %
Pseudomonas	22.6	21.5	16.7
Alcaligenes	11.3	7.1	0.0
Moraxella	37.0	21.4	11.1
Flavobacterium	8.1	28.6	66.6
Chromobacterium	1.6	0.0	0.0
No. of strains	62	14	18

Table 36. The distribution of eggs at the cross section of the Equatorial Current.

Station / Depth	4	4-1	4-2	5	5-1	5-2	6
0 m	0	0	0	828	9	47	683
10	0	0	0	0	13	61	220
25	524	0	0	0	0	30	19
50	188	0	13	122	0	12	0
75	99	9	0	12	6	0	0
100	0	0	0	12	13	0	6
125	12	3	0	0	16	6	0
150	7	3	9	0	20	0	0
200	27	8	9	0	13	51	0
Total	857	23	31	974	90	207	925

Table 37. The distribution of the larvae at the cross section of the Equatorial Current.

Station / Depth	4	4-1	4-2	5	5-1	5-2	6
0 m	0	0	0	0	0	0	0
10	14	0	0	31	45	7	6
25	12	17	17	21	0	0	71
50	0	23	66	29	32	43	70
75	8	9	46	17	166	61	83
100	10	131	55	65	513	28	97
125	12	97	61	35	94	23	100
150	15	100	46	64	60	26	67
200	0	50	35	0	32	17	36
Total	71	427	326	262	942	205	530

Table 38. The numbers of the eggs collected by MTD nets towings in three directions.

Station / Depth	8			9		
	A	B	C	A	B	C
0 m	72	21	40	49	53	17
10	20	20	39	73	97	84
25	4	25	23	77	64	76
50	-	34	97	17	119	49
75	62	38	6	8	4	38
100	-	43	37	7	35	8
125	38	76	32	20	26	5
150	-	24	10	4	0	24
200	6	17	4	8	12	0
Total	202	298	288	263	410	301

Table 39. The numbers of the larvae collected by MTD nets towings in three directions.

Station / Depth	8			9		
	A	B	C	A	B	C
0 m	120	117	170	49	8	0
10	111	53	120	321	9	12
25	41	46	107	12	40	34
50	-	61	90	4	15	0
75	23	42	34	12	0	27
100	-	22	59	26	9	30
125	49	46	25	24	32	5
150	-	29	19	22	7	8
200	6	9	14	4	36	7
Total	350	425	638	474	156	123

Table 40. Sampling data

Station code	Date	Time	Position	Surf Temp (°C)	Frozen specimen collected	Type of net
A1	Sept 17	1752-1808	9 14.8S 159 09.2E- 9 14.9 159 08.3	27.2	0	ORI
A2	Sept 18	1814-1830	9 58.8 154 08.3- 9 59.2 154 57.3	27.2	10	ORI
A3	Sept 19	1836-1841	12 29.6 154 47.10 12 29.7 154 47.0	25.6	2	ORI
A4	Sept 20	2200-2205	15 40.5 154 58.7 15 40.5 154 58.9	25.4	1	ORI
A5	Sept 21	1836-1841 1845-1850 1854-1859 1904-1909 1912-1917	18 06.6 154 54.6- 18 06.7 154 54.5 18 06.7 154 54.4- 18 06.8 154 64.3 18 06.8 154 54.1 18 06.9 154 54.1 18 07.0 154 54.0- 18 07.1 154 53.9 18 07.1 154 53.9- 18 07.2 154 53.8	24.6	13	ORI
A6	Sept 22	2123-2131	20 02.3 154 54.9- 20 02.3 154 50.8	23.8	4	ORI
A7	Sept 23	1835-1840	20 04.8 154 56.8- 20 05.0 154 56.7	23.9	2	ORI
A8	Sept 23	0311-0353	20 02.3- 154 54.9- 10 01.4 154 53.3		0	IKMT

Table 41. ETS activity and RNA content of myctophid fish. Refer Table 40 for sample code.

Sample Code	Species Code*	Condition before frozen (L:Living; D:Dead)	Wet wt. (gr.)	Protein (% wet wt.)	ETS activity (μl O_2/mg protein/h)	RNA content (mg/ng protein)
A2(1)	M	L	1.101	12	5.41	0.015
A2(2)	M	L	0.437	12	5.21	0.016
A2(3)	M	L	0.179	14	5.21	0.021
A2(4)	M	L	0.330	13	4.60	0.017
A2(5)	M	D	0.471	12	4.98	0.017
A2(6)	H	D	0.108	11	3.44	0.020
A2(7)	M	D	0.201	12	11.72	0.017
A2(8)	M	D	0.121	14	11.42	0.018
A2(9)	M	D	0.232	12	12.74	0.016
A2(10)	M	D	0.189	12	11.44	0.018
A3(1)	M	L	0.089	15	9.50	0.019
A3(2)	C	L	0.360	13	9.27	0.012
A4(1)	S	L	0.112	12	6.13	0.021
A5(1)	M	L	0.040	15	6.53	0.024
A5(2)	S	L	0.364	13	6.17	0.009
A5(3)	S	L	0.398	13	6.52	0.011
A5(4)	M	L	0.206	17	7.10	0.014
A5(5)	M	L	0.037	16	4.75	0.023
A5(6)	M	L	0.030	17	6.24	0.023
A5(7)	M	D	0.051	16	5.22	0.022
A5(8)	M	D	0.039	15	6.34	0.025
A5(9)	M	D	0.136	14	7.52	0.019
A5(10)	M	D	0.102	14	5.04	0.015
A5(11)	M	D	0.096	15	6.18	0.015
A5(12)	M	D	0.071	14	7.66	0.021
A5(13)	M	D	0.167	12	6.84	0.023
A6(1)	M	D	0.225	13	8.07	0.018
A6(2)	M	D	0.134	13	7.66	0.018
A6(3)	M	D	0.026	16	7.10	0.033
A6(4)	M	D	0.032	13	7.42	0.033
A7(1)	M	L	0.038	13	9.54	0.031
A7(2)	M	L	0.048	13	8.82	0.025

* M : Myctophum sp.

H : Hygophum proximum

C : Centrobranchus nigrocellatus

S : Symbolophorus evermanni

Table 42. Dry weight of particulate matter in the surface matter

No. of stations	Dry weight	No. of stations	Dry weight	No. of stations	Dry weight	No. of stations	Dry weight
A	72	S-15	93	S-26	303	S-39	91
S-1	99	S-16	53	Stn.14	145	Stn.20	51
S-2	31	Stn.6	48	S-27	130	S-40	65
B	91	Stn.7	38	S-28	107	S-41	36
S-3	84	S-17	77	S-29	87	Stn.21	34
S-4	64	Stn.8	70	Stn.15	91	S-42	65
C	76	S-18	74	S-30	57	S-43	80
S-5	110	Stn.9	59	S-31	85	Stn.22	79
S-6	111	S-19	49	Stn.16	88	S-44	91
Stn.1	105	Stn.10	100	S-32	54	S-45	266
S-7	114	S-20	193	S-33	63	D	63
S-8	159	Stn.11	142	Stn.17	41	S-46	87
Stn.2	72	S-21	126	S-34	38	S-47	85
S-9	201	S-22	27	S-35	94	E	96
Stn.3	30	Stn.12	78	Stn.18	143	S-48	105
S-11	63	S-23	82	S-36	64	S-49	87
S-12	84	Stn.13	80	S-37	90	F	97
Stn.4	80	S-24	88	Stn.19	54	S-50	82
S-13	96	S-25	98	S-38	17		µg/1
	µg/1		µg/1		µg/1		

The position of the stations are given in Table 43.

Table 43. Positions of the stations where surface-water samples were collected

Station	Date	Position Latitude	Position Longitude	Station	Date	Position Latitude	Position Longitude
S-1	Aug. 29	30°59.0'N	142°45.4'E	S-26	Oct. 8	25°34.3'S	164°58.7'E
S-2	Aug. 30	29°58.3'N	143°30.2'E	S-27	Oct. 18	21°00.5'S	163°47.9'E
S-3	Aug. 31	27°00.0'N	145°33.3'E	S-28	Oct. 18	19°22.9'S	162°18.3'E
S-4	Aug. 31	25°33.6'N	146°32.6'E	S-29	Oct. 19	17°30.7'S	162°17.8'E
S-5	Sep. 1	22°31.8'N	148°28.1'E	S-30	Oct. 20	13°33.5'S	163°54.8'E
S-6	Sep. 2	21°05.8'N	149°19.2'E	S-31	Oct. 21	11°50.0'S	163°56.5'E
S-7	Sep. 3	18°34.8'N	150°34.1'E	S-32	Oct. 22	8°10.5'S	164°05.8'E
S-8	Sep. 3	16°54.1'N	151°15.0'E	S-33	Oct. 22	6°36.0'S	164°00.8'E
S-9	Sep. 4	13°26.1'N	152°39.7'E	S-34	Oct. 23	3°10.2'S	164°04.0'E
S-10	-	-	-	S-35	Oct. 24	1°41.3'S	164°04.8'E
S-11	Sep. 6	8°23.9'N	154°48.1'E	S-36	Oct. 26	1°42.0'N	164°05.9'E
S-12	Sep. 6	6°24.0'N	155°34.3'E	S-37	Oct. 26	3°40.7'N	164°01.9'E
S-13	sep. 8	3°29.4'N	156°43.4'E	S-38	Oct. 28	7°10.7'N	163°20.0'E
S-14	Sep. 9	1°41.8'N	157°18.5'E	S-39	Oct. 28	8°44.7'N	163°39.8'E
S-15	Sep. 10	1°40.7'S	158°38.4'E	S-40	Oct. 29	11°31.0'N	163°57.0'E
S-16	Sep. 11	3°19.1'S	159°18.7'E	S-41	Oct. 29	13°19.2'N	163°59.1'E
S-17	Sep. 19	12°29.7'S	154°47.0'E	S-42	Oct. 31	16°53.7'N	162°57.7'E
S-18	Sep. 21	15°00.9'S	155°00.4'E	S-43	Oct. 31	18°27.0'N	160°21.7'E
S-19	Sep. 24	23°04.5'S	154°57.2'E	S-44	Nov. 2	21°32.6'N	157°04.7'E
S-20	Oct. 2	29°18.5'S	154°09.2'E	S-45	Nov. 2	22°55.0'N	155°31.0'E
S-21	Oct. 4	30°52.6'S	154°40.6'E	S-46	Nov. 3	25°10.2'N	152°46.0'E
S-22	Oct. 4	31°26.6'S	155°32.3'E	S-47	Nov. 4	26°43.1'N	150°44.4'E
S-23	Oct. 6	31°26.5'S	163°06.2'E	S-48	Nov. 5	29°20.5'N	147°24.5'E
S-24	Oct. 8	27°37.0'S	165°00.4'E	S-49	Nov. 5	30°38.5'N	145°41.8'E
S-25	Oct. 8	26°41.8'S	164°58.8'E	S-50	Nov. 6	32°38.9'N	142°48.4'E