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**Hydrology and Nutrient Data  
off Marmion, Perth, 1979–1982**

A. F. Pearce, R. E. Johannes, C. R. Manning,  
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## HYDROLOGY AND NUTRIENT DATA OFF MARMION, PERTH, 1979-1982

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### *Abstract*

Temperature, salinity and nutrient data from coastal waters off Marmion (Perth, Western Australia) are tabulated from 33 surveys made between June 1979 and June 1982. Monthly mean temperature and salinity are highest (22°C, 36.1 respectively) in summer and lowest (17°C, 35.3) in late winter; these ranges are greater than for offshore water near Rottnest Island. Nutrient levels near the coast tend to be higher than offshore, especially in winter.

## **Introduction**

When the CSIRO Coastal Ecology research program at Marmion was established in 1978, virtually nothing was known about the hydrology and nutrient regimes of the local coastal waters. In June 1979, the program undertook a series of coastal surveys to study the seasonal changes in sea temperature, salinity and selected nutrients. Spatial variability both within and beyond the nearshore reef/lagoon system was also to be examined. Initially, sampling was approximately monthly, and the station grid was modified as the first results were assessed. From January 1980, a standard grid was established, remaining generally unchanged until the measuring program ceased in June 1982. The sampling interval varied between one and two months, depending on the weather and on availability of staff.

This report contains the data for the 33 surveys that were undertaken. The analytical techniques are recorded, and a brief interpretation of the seasonal variability is given. Further analysis of the data will be presented in later publications.

## **Sampling and Analytical Techniques**

The sampling grid is shown in Figure 1; Table 1 summarises the data collected during each survey. Table 2 lists the water depth at each station.

The surveys were generally undertaken between 0900 h and noon (W.A. Standard Time; G.M.T. + 8). Most station positions were estimated by fixing from coastal landmarks, using a hand-held bearing compass (the accuracy therefore depending on visibility, sea state and distance offshore: a rough estimate is  $\pm 50$  m), but dead reckoning and echo-sounding had to be used for the stations too distant from the coast (E, X and F). An escarpment immediately inshore from the 20-m contour provided a check for controlling the offshore distance of Station E.

At all stations, surface samples were taken from the top 20 cm of water in a plastic bucket. Samples were then decanted into bottles for subsequent analysis ashore. The nutrient samples were stored in ice until filtered ashore through 0.45  $\mu$  Millipore filters. They were preserved with 0.4% solution of mercuric chloride before analysis. At a few selected stations (from 1980 onwards, these were A, E and H), near-bottom samples were taken in a Nansen bottle and stored in the same way as the surface samples.

*Temperature:* Water temperature was measured with a mercury thermometer immersed in the bucket immediately after sampling. Estimated accuracy was  $\pm 0.2^\circ\text{C}$ .

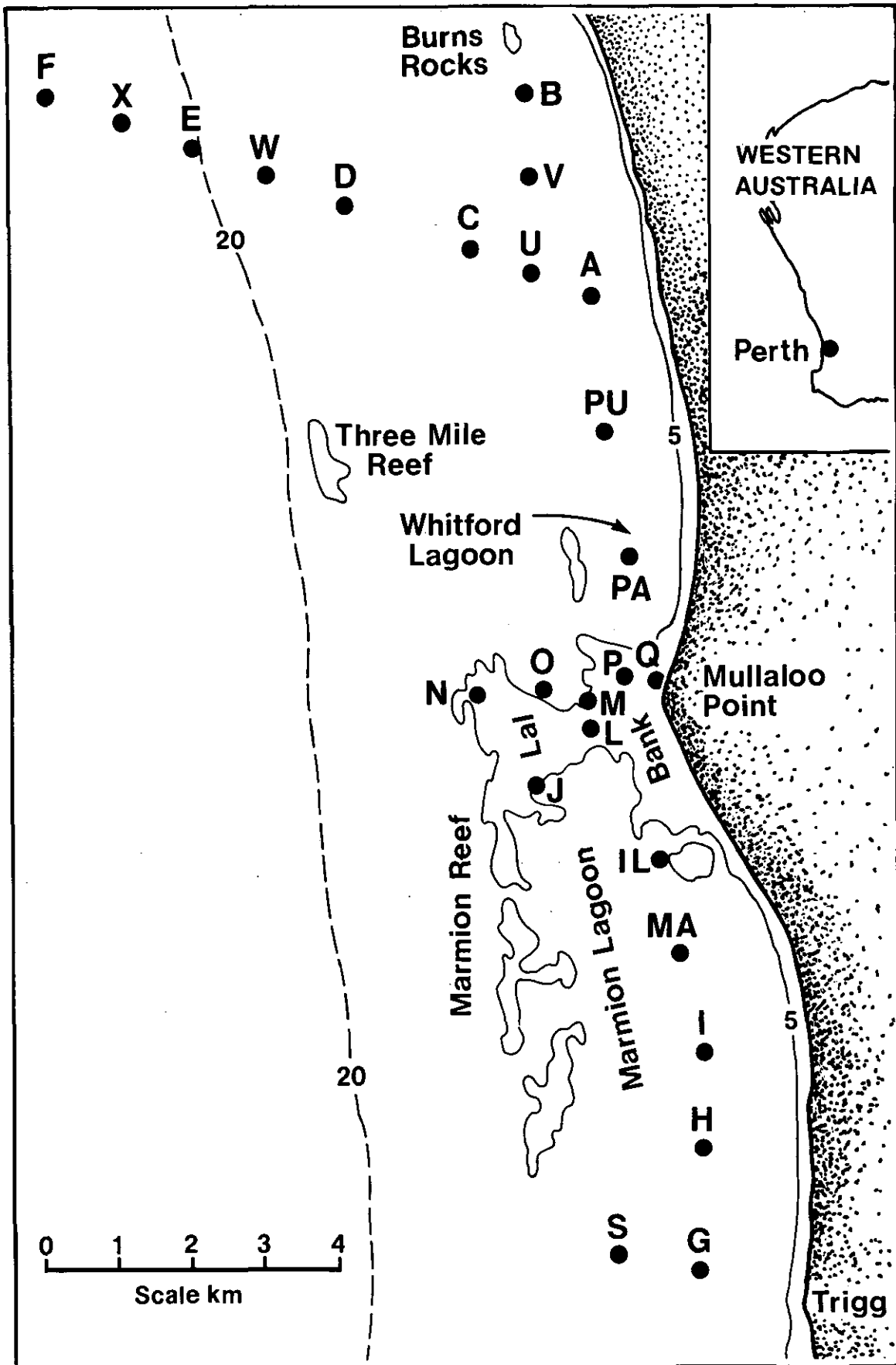
*Salinity:* Salinity samples were taken in glass bottles (rinsed three times) and analysed ashore. In the earlier surveys, the salinity was measured with an Autolab temperature-salinity meter (Hamon bridge), the accuracy being about  $\pm 0.05$ . From May 1981, the samples were analysed on an Autolab inductive salinometer, with an accuracy of  $\pm 0.003$ .

Table 1. Summary of coastal surveys off Marmion<sup>†</sup>

| Date     | No. of Stns | Nutrients Measured                                                     | Comments                              |
|----------|-------------|------------------------------------------------------------------------|---------------------------------------|
| 19.06.79 | 9           | None                                                                   | Original grid, Stns A,B,D,G,H,N,O,P,Q |
| 21.06.79 | 7           | None                                                                   | Omitted B,G,H,P; introduced C,E       |
| 19.07.79 | 10          | NO <sub>3</sub> , SiO <sub>2</sub>                                     | Introduced S; reintroduced G,P        |
| 31.07.79 | 11          | NO <sub>3</sub> , SiO <sub>2</sub> , PO <sub>4</sub>                   | Reintroduced B                        |
| 05.09.79 | 12          | NO <sub>3</sub> , SiO <sub>2</sub> , PO <sub>4</sub>                   | Reintroduced H                        |
| 17.10.79 | 12          | NO <sub>3</sub> , SiO <sub>2</sub> , PO <sub>4</sub> , NO <sub>2</sub> | Same grid as 05.09.79                 |
| 20.11.79 | 16          | NO <sub>3</sub> , SiO <sub>2</sub> , PO <sub>4</sub> , NO <sub>2</sub> | Omitted S; introduced F,I,J,L,M       |
| 19.12.79 | 16          | NO <sub>3</sub> , SiO <sub>2</sub> , PO <sub>4</sub> , NO <sub>2</sub> | Same grid as 20.11.79                 |
| 29.01.80 | 21          | All*                                                                   | Introduced U,V,W,X; reintroduced S    |
| 26.03.80 | 21          | All                                                                    | Same grid as 29.01.80                 |
| 02.04.80 | 25          | All                                                                    | 24-hour station off MAAC ( MA)        |
| 14.04.80 | 10          | All                                                                    | 'Lagoon stns' only; introduced PA,PU  |
| 07.05.80 | 21          | All                                                                    | Same grid as 29.01.80                 |
| 27.06.80 | 21          | None                                                                   |                                       |
| 09.07.80 | 21          | All                                                                    |                                       |
| 20.08.80 | 21          | All                                                                    |                                       |
| 25.09.80 | 21          | All                                                                    |                                       |
| 06.11.80 | 21          | All                                                                    |                                       |
| 22.12.80 | 21          | All                                                                    |                                       |
| 05.02.81 | 21          | All                                                                    |                                       |
| 26.03.81 | 21          | All                                                                    |                                       |
| 06.05.81 | 24          | All                                                                    | PA,PU reintroduced, A repeated        |
| 04.06.81 | 24          | All                                                                    | Same grid as 06.05.81                 |
| 16.07.81 | 24          | All                                                                    |                                       |
| 01.09.81 | 24          | All                                                                    |                                       |
| 20.10.81 | 24          | All                                                                    |                                       |
| 08.12.81 | 24          | All                                                                    |                                       |
| 27.01.82 | 24          | All                                                                    |                                       |
| 17.02.82 | 9           | All                                                                    | Line off Ocean Reef only              |
| 18.03.82 | 25          | All                                                                    | Introduced MA                         |
| 20.04.82 | 25          | All                                                                    | Same grid as 18.03.82                 |
| 19.05.82 | 25          | All                                                                    |                                       |
| 22.06.82 | 25          | All                                                                    |                                       |

<sup>†</sup> Temperature and salinity were measured at all stations.

\* All = NO<sub>3</sub>, SiO<sub>2</sub>, PO<sub>4</sub>, NO<sub>2</sub>, DOP



**Fig. 1.** Station positions used in the surveys, with the major topographic features. The solid contour is 5 m, the dashed is 20 m (beyond which the seabed is relatively flat and 25-30 m deep).

Table 2. Approximate water depths at each station

| Station | Depth (m) | Station | Depth (m) | Station | Depth (m) |
|---------|-----------|---------|-----------|---------|-----------|
| A*      | 9         | I       | 10        | S       | 15        |
| B       | 10        | J       | 6         | U       | 9         |
| C       | 12        | L       | 3         | V       | 11        |
| D       | 13        | M       | 5         | W       | 9         |
| E*      | 22        | N       | 3         | X       | 27        |
| F       | 28        | O       | 8         | PA      | 8         |
| G       | 7         | P       | 3         | PU      | 8         |
| H*      | 10        | Q       | 1         | MA      | 6         |

\* From January 1980 bottom samples were taken only at these stations.

*Nitrate* ( $\text{NO}_3^-$ ): The method is a modification of Wood *et al.* (1967). Glass self-levelling columns were used, thus eliminating the danger of exposed copper-cadmium reductant. Wash solutions were dispensed with in favour of larger samples, to which were added the conditioning agent ( $\text{NH}_4\text{Cl}$ ).

*Reactive Silicate* ( $\text{SiO}_2^-$ ): As in Koroleff (1976).

*Inorganic Phosphate* ( $\text{PO}_4^{--}$ ): Determined by a single-solution method (Strickland and Parsons 1971).

*Nitrite* ( $\text{NO}_2^-$ ): The Griess-Iloway colorimetric method was modified to give one reagent by combining reagent (1) - sulphanilamide and hydrochloric acid; (2) - N-(1 naphthyl)-ethylenediamine dihydrochloride (Major and Manning, unpublished method).

*Dissolved Organic Phosphate (DOP)*: Determined by analysis for total organic phosphorus, with subsequent subtraction of inorganic phosphate (Menzel and Corwin 1965).

*General Measurements of Nutrients*: All the above methods are colorimetric determinations, and absorbance was measured using a Varian DMS90 spectrophotometer against distilled water. Blanks and standards covering the expected ranges were used for each assay, from which a standard curve was drawn. The slope of this curve was used to calculate the concentration of the species. Correlation coefficients, intercepts and random internal standards (where possible) provided a check for analytical reproducibility. For further details, see Major *et al.* (1972).

## Data Tabulation

In the data tables in this report, all times are in Western Australian Standard Time, i.e., GMT + 8 hours. Temperatures are in degrees Celsius, salinities in parts per thousand, and all nutrients in micromoles per litre.

The data are on file on an NEC-APC microcomputer. BASIC programs were written for the data tabulation and simple analysis in this report. Bottom samples at the appropriate stations (generally A, E and H) are shown by their depth in metres.

Density is calculated from temperature and salinity, using the new international equation of state (Millero and Poisson 1981). In some surveys, it appears that the water was statically unstable, with the values for bottom densities being lower than those at the surface. This was usually due to the limitations of the sampling and measurement methods; a temperature error of 0.2°C or a salinity error of 0.05 (the error limits during the earlier surveys) will both result in a density error of about 0.05 kg/m<sup>3</sup>.

Some nutrient data included occasional anomalously high values. We suspect these values were due to contamination, and have omitted them from the data tables.

As a summary of the data, and to assist in analysis of the gross seasonal pattern, the means and standard deviations of each parameter have been calculated for each of the surveys. For this, *only* the surface data have been used, and some of the stations that were infrequently sampled (PA, PU, MA and IL) or unrepresentative (Q, very close inshore) have been omitted. A summary of weather conditions, water colour, noteworthy slicks etc., is given for each survey.

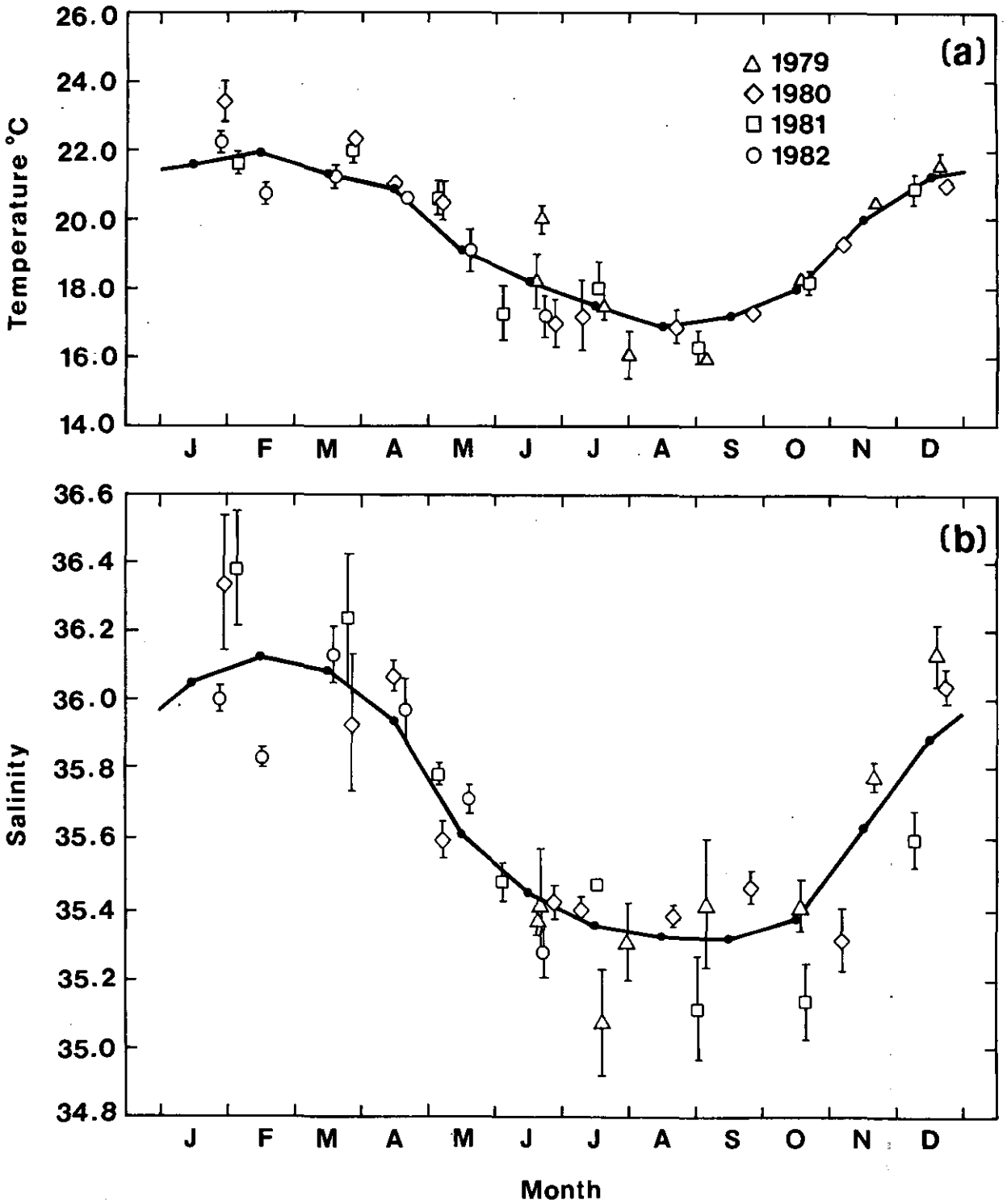
## Preliminary Data Analysis

Detailed examination and interpretation of the data will be left for future publications, but a simple assessment of the seasonal pattern can be made. Figure 2 is a summary graph of the various parameters to illustrate the annual cycle and the spatial variability (as indicated by the standard deviations about the survey means). The annual cycle has been determined from the 3-month running means (i.e. each monthly mean was calculated as the overall mean of all observations in overlapping 3-month periods, and attributed to the central month).

### *Temperature and Salinity (Figure 2a,b)*

As expected, the seasonal pattern in both temperature and salinity is clearly defined. Monthly mean temperatures near the coast reach a peak of 21-22°C between January and April, falling to 17°C in the winter months of July to September (Fig. 2a). This annual range of about 5°C is less than that in the semi-enclosed waters of Cockburn Sound, where the temperature difference between summer and winter is 8°C (Hodgkin and Phillips 1969). The standard deviations of the individual station temperatures about the survey means are less than 1°C, reflecting some degree of homogeneity in the coastal temperature field. They are greatest in early winter, when the sea temperature very close inshore can drop markedly through heat loss to the atmosphere. In 60-m water depth beyond Rottnest Island, by contrast, the mean winter temperature is relatively high at about 19°C (Edwards 1977), due to the warm Leeuwin Current (Cresswell and Golding 1980). Table 3 compares summer and winter conditions near Marmion with surface values on the open shelf (as represented by the Rottnest station data).





**Fig. 2.** Survey means of each quantity measured; each point is the survey mean of surface samples (excluding stations PA,PU,MA,IL,Q) and the bars are standard deviations. The solid curve joins the 3-month running means, to show the overall seasonal trends.

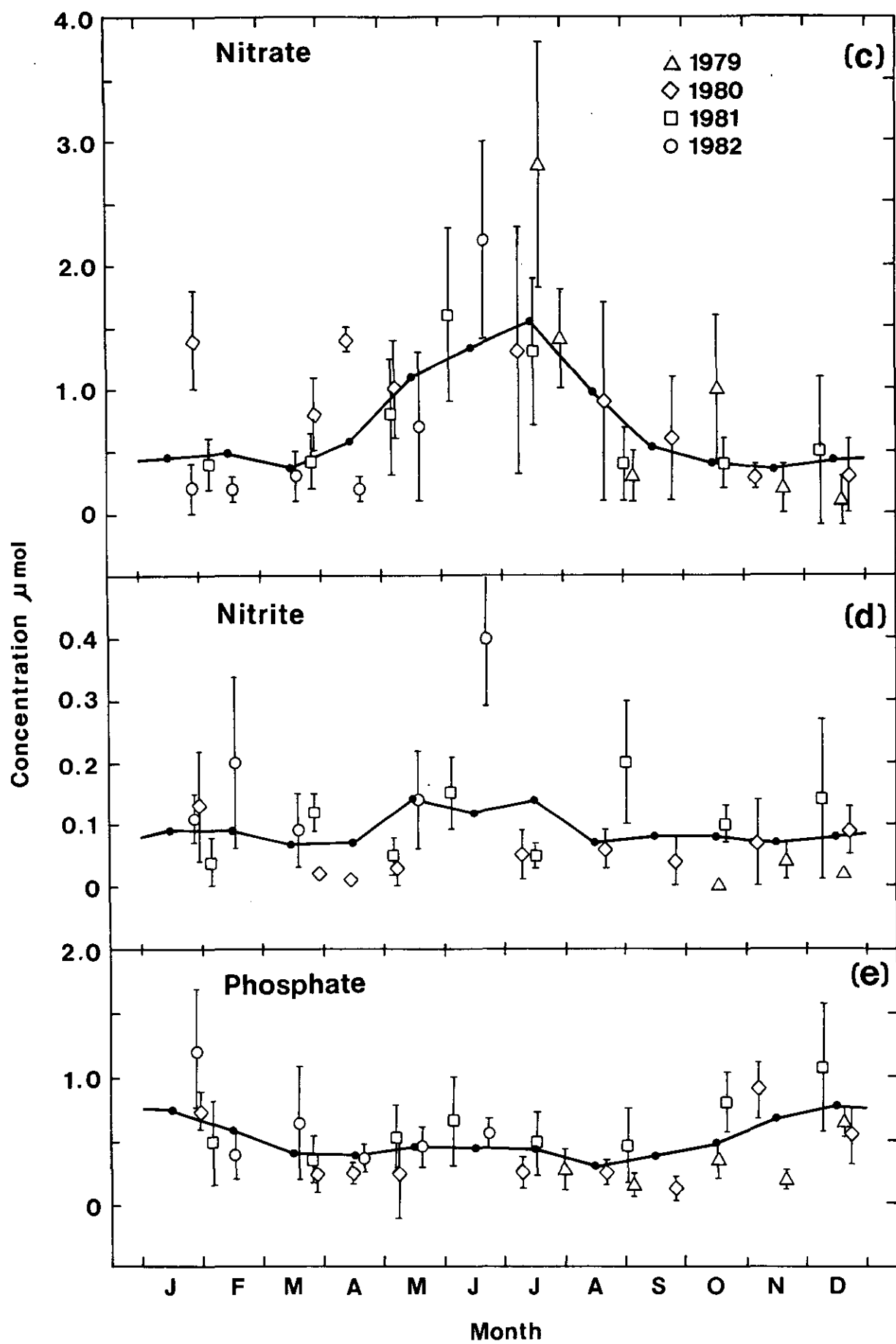


Fig. 2. Continued.

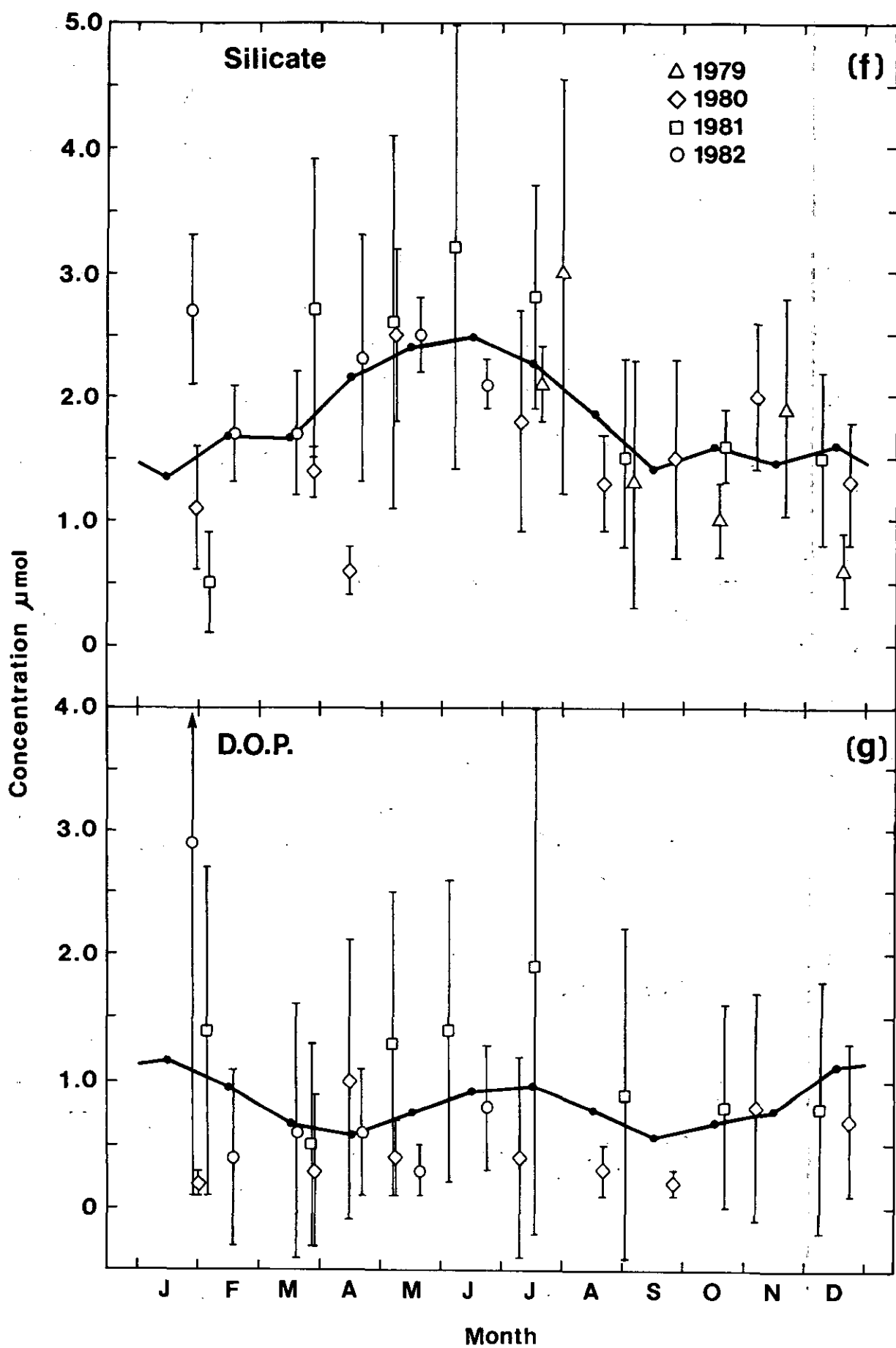


Fig. 2. Continued.

Table 3. Comparison of coastal and open-shelf surface data

| Parameter                 | Coastal surveys*       |        | Rottnest Island <sup>†</sup> |        |
|---------------------------|------------------------|--------|------------------------------|--------|
|                           | Summer                 | Winter | Summer                       | Winter |
| Temperature °C            | 22.                    | 17.    | 22.                          | 19.    |
| Salinity                  | 36.1                   | 35.3   | 35.8                         | 35.4   |
| Sigma-t                   | 25.1                   | 25.7   | 24.8                         | 25.3   |
| Nitrate $\mu\text{mol}$   | 0.5                    | 1.5    | (0.3-0.5) <sup>x</sup>       |        |
| Silicate $\mu\text{mol}$  | 1.5                    | 2.5    | 2.0                          | 2.5    |
| Phosphate $\mu\text{mol}$ | 0.7                    | 0.4    | (0.10-0.15) <sup>x</sup>     |        |
| Nitrite $\mu\text{mol}$   | 0.08                   | 0.13   | No data                      |        |
| D.O.P. $\mu\text{mol}$    | (0.6-1.2) <sup>x</sup> |        | No data                      |        |

\* 3-month smoothed means

† Monthly means from CSIRO 50-m station; 20 years data (CSIRO unpublished)

x Annual ranges of monthly mean values, with no clear summer-winter pattern

The annual salinity cycle generally follows the temperature pattern, both inshore and off Rottnest Island. The winter salinity minimum off Perth is partly an effect of the Leeuwin Current, particularly along the outer shelf region. In summer this low-salinity water is replaced by more saline subtropical water from the south (Rochford 1969). Closer inshore, however, the summer salinity rises dramatically as a result of coastal evaporation, so the annual salinity range inshore is almost 1, compared with only about 0.4 off Rottnest Island (Table 3). Within a few hundred metres of the shore, submarine groundwater discharge can cause local lowering of salinity (Johannes and Hearn, in press). This groundwater, the summer evaporation, and the winter runoff in the shallow areas are responsible for the spatial variability in salinity indicated by the standard deviations in Figure 2b.

#### *Dissolved Nutrients* (Figure 2c-g)

In general the dissolved nutrient concentrations in our study area are higher than the typical concentrations of coastal waters in the tropics (e.g. Crossland 1983), but in the lower part of the range of concentrations reported for temperate coastal waters (e.g. Spencer 1975).

Concentrations of nitrate and phosphate were generally higher in the coastal waters than off Rottnest Island, particularly in winter (Table 3), while silicate concentrations were about the same inshore and offshore.

Among the dissolved nutrients measured, only silicate and nitrate showed marked regular seasonal changes, with peak concentrations occurring in midwinter. The mean winter concentration of nitrate was  $1.5\mu\text{mol}$ , or three

times the mean summer concentration (Table 3). The mean winter concentration of silicate was  $2.5\mu\text{mol}$ , or almost twice the mean summer concentration (Table 3).

Several processes enrich the nutrients nearshore. Groundwater discharging into the sea in this area contains very high concentrations of nitrate (around  $400\mu\text{mol}$  (Johannes 1980)) and silicate (around  $220\mu\text{mol}$  (Johannes and Hearn, in press)). The decomposition of large accumulations of detached marine macrophytes on the beaches bordering our study area (Robertson and Hansen 1982) and the regeneration of nutrients from organic materials filtering through beach sands (e.g. McLachlan 1982) also contribute nutrients to the nearshore region.

Runoff from the Swan River, 20 km south of the southern limit of our study area, may also contribute nearshore dissolved nutrients. At this stage, little is known about the movement of Swan River water after its discharge, and is uncertain whether its influence extends to our study area. Significant runoff from the Swan River occurs only during the 3 or 4 rainy winter months, when the discharge plume is directed mainly southward, away from our study area (Steedman and Associates 1981).

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## References

- Cresswell, G.R. and Golding, T.J. (1980) Observations of a south-flowing current in the southeastern Indian Ocean. *Deep-Sea Research* **27A**, 449-466.
- Crossland, C.J. (1983) Dissolved nutrients in coral reef waters. In: *Perspectives on Coral Reefs*, Barnes, D.J. (ed.). Australian Institute of Marine Science: Townsville, 56-68.
- Edwards, R.J. (1977) Hydrological investigations on R.V. 'Sprightly'. *CSIRO Division of Fisheries and Oceanography Report* **73**.
- Hodgkin, E.P. and Phillips, B.F. (1969) Sea temperatures on the coast of south Western Australia. *Journal of the Royal Society of Western Australia* **52**, 59-62.
- Johannes, R.E. (1980) The ecological significance of the submarine discharge of groundwater. *Marine Ecology Progress Series* **3**, 365-373.
- Johannes, R.E. and Hearn, C. (In press) The effect of submarine groundwater discharge on nutrient and salinity regimes in a coastal lagoon off Perth, Western Australia. *Estuarine and Coastal Shelf Science*.
- Koroleff, F. (1976) Determination of silicon. In: *Methods of Seawater Analysis*, K. Grasshof (ed.) Verlag Chemie Wernheim: NewYork, 174-187.
- McLachlan, A. (1982) A model for the estimation of water filtration and nutrient regeneration by exposed sandy beaches. *Marine Environmental Research* **6**, 37-47.
- Major, G.A., Dal Pont, G., Klye, J. and Newell, B. (1972) Laboratory techniques in marine chemistry. *CSIRO Division of Fisheries and Oceanography Report* **51**.
- Menzel, D.W. and Corwin, N. (1965) The measurement of total phosphorus in seawater, based on the liberation of organically bound fractions by persulphate oxidation. *Limnology and Oceanography* **10**, 280-282.
- Millero, F.J. and Poisson, A. (1981) International one-atmosphere equation of state of seawater. *Deep-Sea Research* **28**, 625-629.
- Robertson, A.I. and Hansen, J.A. (1982) Decomposing seaweed: nuisance or a vital link in coastal food chains. *CSIRO Marine Laboratories Research Report 1979-1981*, 75-83.
- Rochford, D.J. (1969) Seasonal interchange of high and low salinity waters off south-west Australia. *CSIRO Division of Fisheries and Oceanography Technical Paper* **29**.
- Spencer, C.P. (1975) The micronutrient elements. In: *Chemical Oceanography*, Vol. 2, Riley, J.P. and Skirrow, G. (eds) (2nd ed.), 245-300.
- Steedman, R.K. and Associates (1981) Cape Peron waste water ocean outlet effluent dispersion studies. RKSA Report **R124** prepared for Binnie and Partners Pty Ltd.

Strickland, J.D.H. and Parsons, T.R. (1972) *A Practical Handbook of Seawater Analysis*. Fisheries Research Board of Canada: Ottawa.

Wood, E.D., Armstrong, F.A.J. and Richards, F.A. (1967) Determination of nitrate in seawater by cadmium-copper reduction to nitrite. *Journal of the Marine Biological Association U.K.* 47, 23-31.

COASTAL SURVEY ON 19 / 6 / 79

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04 | N02 | DOP |
|-----|------|------|--------|--------|-----|------|-----|-----|-----|
| A   | 1010 | 18.4 | 35.40  | 25.48  |     |      |     |     |     |
| 9   | 1010 | 18.3 | 35.40  | 25.51  |     |      |     |     |     |
| B   | 0950 | 17.8 | 35.31  | 25.56  |     |      |     |     |     |
| D   | 1030 | 19.8 | 35.33  | 25.07  |     |      |     |     |     |
| G   | 1350 | 18.6 | 35.41  | 25.44  |     |      |     |     |     |
| 7   | 1350 | 18.5 | 35.41  | 25.46  |     |      |     |     |     |
| H   | 1250 | 18.3 | 35.41  | 25.51  |     |      |     |     |     |
| 10  | 1250 | 18.3 | 35.40  | 25.51  |     |      |     |     |     |
| N   | 1105 | 17.5 | 35.39  | 25.69  |     |      |     |     |     |
| 3   | 1105 | 17.5 | 35.39  | 25.69  |     |      |     |     |     |
| O   | 1200 | 17.8 | 35.36  | 25.60  |     |      |     |     |     |
| 8   | 1200 | 17.6 | 35.37  | 25.65  |     |      |     |     |     |
| P   | 1205 | 17.1 | 35.34  | 25.75  |     |      |     |     |     |
| 3   | 1205 | 17.2 | 35.35  | 25.74  |     |      |     |     |     |
| Q   | 1300 | 17.2 | 35.10  | 25.54  |     |      |     |     |     |

SUMMARY OF SURFACE DATA FOR SURVEY 19 / 6 / 79  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 8     | 18.2   | 0.8   | 17.1  | 19.8  |
| SALINITY    | 8     | 35.369 | 0.039 | 35.31 | 35.41 |

Present Conditions: Clear sky; calm wind and smooth sea.

Previous Conditions: Clear, light N.E. breeze 1-2 days previous; rain 3 days previous.

Water Quality: Turbid, except clear near Stn N.



COASTAL SURVEY ON 21 / 6 / 79

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04 | N02 | DOP |
|-----|------|------|--------|--------|-----|------|-----|-----|-----|
| A   | 1010 | 19.8 | 35.37  | 25.10  |     |      |     |     |     |
| 9   | 1010 | 17.9 | 35.40  | 25.60  |     |      |     |     |     |
| C   | 1000 | 20.2 | 35.62  | 25.18  |     |      |     |     |     |
| 12  | 1000 | 19.6 | 35.41  | 25.18  |     |      |     |     |     |
| D   | 0950 | 20.3 | 35.62  | 25.16  |     |      |     |     |     |
| 13  | 0950 | 20.4 | 35.62  | 25.13  |     |      |     |     |     |
| E   | 0930 | 20.4 | 35.30  | 24.89  |     |      |     |     |     |
| 22  | 0930 | 19.6 | 35.61  | 25.33  |     |      |     |     |     |
| N   | 1135 | 19.7 | 35.32  | 25.09  |     |      |     |     |     |
| 3   | 1135 | 19.7 | 35.32  | 25.09  |     |      |     |     |     |
| O   | 1200 | 19.3 | 35.32  | 25.19  |     |      |     |     |     |
| 8   | 1200 | 17.8 | 35.32  | 25.57  |     |      |     |     |     |
| Q   | 1100 | 18.2 | 35.31  | 25.46  |     |      |     |     |     |

SUMMARY OF SURFACE DATA FOR SURVEY 21 / 6 / 79  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 6     | 20.0   | 0.4   | 19.3  | 20.4  |
| SALINITY    | 6     | 35.425 | 0.153 | 35.30 | 35.62 |

Present Conditions: Overcast, calm wind, smooth seas, low swell.

Previous Conditions: Clear, calm to light breezes past 3 days.

COASTAL SURVEY ON 19 / 7 / 79

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04 | N02 | D0P |
|-----|------|------|--------|--------|-----|------|-----|-----|-----|
| A   | 1345 | 17.2 | 34.84  | 25.34  | 3.3 | 2.0  |     |     |     |
| 9   | 1345 | 16.8 | 34.89  | 25.48  | 2.7 | 1.7  |     |     |     |
| C   | 1330 | 17.0 | 34.84  | 25.39  | 2.1 | 1.9  |     |     |     |
| 12  | 1330 | 16.8 | 34.87  | 25.46  | 2.1 | 1.9  |     |     |     |
| D   | 0955 | 17.2 | 35.02  | 25.48  | 1.9 | 1.7  |     |     |     |
| E   | 1020 | 18.2 | 35.25  | 25.42  | 2.0 | 2.0  |     |     |     |
| 22  | 1020 | 18.2 | 35.25  | 25.42  |     |      |     |     |     |
| G   | 1215 | 17.6 | 35.18  | 25.51  | 3.0 | 2.2  |     |     |     |
| 7   | 1215 | 17.3 | 35.11  | 25.53  | 3.5 | 2.0  |     |     |     |
| N   | 1255 | 17.5 | 35.13  | 25.49  | 5.0 | 2.1  |     |     |     |
| 3   | 1255 | 17.5 | 35.12  | 25.49  | 5.7 | 2.1  |     |     |     |
| O   | 1240 | 17.6 | 35.20  | 25.52  | 2.9 | 2.7  |     |     |     |
| 8   | 1240 | 17.5 | 35.16  | 25.52  | 2.6 | 2.1  |     |     |     |
| P   | 1235 | 17.4 | 35.09  | 25.49  | 1.9 | 2.1  |     |     |     |
| 3   | 1235 | 17.4 | 35.07  | 25.47  | 1.9 | 2.1  |     |     |     |
| Q   | 1230 | 17.3 | 34.93  | 25.39  | 3.8 | 3.0  |     |     |     |
| S   | 1200 | 18.1 | 35.21  | 25.41  | 3.3 | 2.2  |     |     |     |
| 15  | 1200 | 18.0 | 35.20  | 25.43  | 3.6 | 2.0  |     |     |     |

SUMMARY OF SURFACE DATA FOR SURVEY 19 / 7 / 79  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 9     | 17.5   | 0.4   | 17.0  | 18.2  |
| SALINITY    | 9     | 35.084 | 0.155 | 34.84 | 35.25 |
| NITRATE     | 9     | 2.8    | 1.0   | 1.9   | 5.0   |
| SILICATE    | 9     | 2.1    | 0.3   | 1.7   | 2.7   |

Present Conditions: Partly cloudy; light N breeze shifting to SW during the day; weak NW set evident at noon.

Previous Conditions: Clear with intermittent cloudy periods, moderate NE breeze, moderate swell 1-2 days previous; partly overcast, strong breeze, moderate to heavy swell 3 days previous.

COASTAL SURVEY ON 31 / 7 / 79

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02 | DOP |
|-----|------|------|--------|--------|-----|------|------|-----|-----|
| A   | 1337 | 15.6 | 35.25  | 26.03  | 1.5 | 1.4  | 0.56 |     |     |
| 9   | 1337 | 15.5 | 35.21  | 26.02  | 1.5 | 1.3  | 0.28 |     |     |
| B   | 1404 | 15.6 | 35.20  | 25.99  | 1.4 | 3.7  | 0.37 |     |     |
| 10  | 1404 | 15.9 | 35.21  | 25.93  | 0.3 | 2.2  | 0.46 |     |     |
| C   | 1348 | 15.5 | 35.16  | 25.99  | 1.2 | 5.5  | 0.07 |     |     |
| 12  | 1348 | 15.6 | 35.14  | 25.95  | 1.3 | 2.3  | 0.38 |     |     |
| D   | 1015 | 15.5 | 35.22  | 26.03  | 1.6 | 2.2  | 0.32 |     |     |
| 13  | 1015 | 15.5 | 35.16  | 25.99  | 1.3 | 1.3  | 0.90 |     |     |
| E   | 1030 | 17.5 | 35.44  | 25.73  | 1.4 |      | 0.04 |     |     |
| 22  | 1030 | 17.5 | 35.46  | 25.75  | 1.2 | 2.7  | 0.20 |     |     |
| G   | 1230 | 16.4 | 35.41  | 25.97  | 1.1 | 2.2  | 0.26 |     |     |
| 7   | 1230 | 16.4 | 35.38  | 25.95  | 1.6 | 2.0  | 0.21 |     |     |
| N   | 1312 | 16.5 | 35.35  | 25.90  | 1.9 | 1.7  | 0.28 |     |     |
| 3   | 1312 | 16.6 | 35.39  | 25.91  | 2.9 | 4.3  | 0.47 |     |     |
| O   | 1259 | 15.9 | 35.35  | 26.04  | 1.3 | 2.1  | 0.25 |     |     |
| 8   | 1259 | 15.8 | 35.36  | 26.07  | 1.8 | 1.4  | 0.15 |     |     |
| P   | 1251 | 15.2 | 35.22  | 26.10  | 1.9 | 1.8  | 0.20 |     |     |
| Q   | 1247 | 15.5 | 35.16  | 25.99  | 1.9 | 1.6  | 0.14 |     |     |
| S   | 1218 | 16.9 | 35.47  | 25.90  | 0.6 | 6.5  | 0.27 |     |     |
| 15  | 1218 | 17.0 | 35.44  | 25.85  | 1.2 | 2.6  | 0.21 |     |     |

SUMMARY OF SURFACE DATA FOR SURVEY 31 / 7 / 79  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 10    | 16.1   | 0.7   | 15.2  | 17.5  |
| SALINITY    | 10    | 35.307 | 0.111 | 35.16 | 35.47 |
| NITRATE     | 10    | 1.4    | 0.4   | 0.6   | 1.9   |
| SILICATE    | 9     | 3.0    | 1.8   | 1.4   | 6.5   |
| PHOSPHATE   | 10    | 0.26   | 0.15  | 0.04  | 0.56  |

Present Conditions: Clear sky; light S-SE breeze; seas slight; swell low inshore, low to moderate offshore.

Previous Conditions: Clear sky, light E wind previous day; showers, N winds 2-3 days previous.

## COASTAL SURVEY ON 5 / 9 / 79

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02 | DOP |
|-----|------|------|--------|--------|-----|------|------|-----|-----|
| A   | 0910 | 15.5 | 35.43  | 26.19  | 0.2 |      | 0.25 |     |     |
| 9   | 0910 | 15.5 | 35.43  | 26.19  | 0.4 | 0.5  | 0.33 |     |     |
| B   | 1313 | 15.9 | 35.53  | 26.18  | 0.2 | 2.1  | 0.00 |     |     |
| 10  | 1313 | 15.7 | 35.48  | 26.19  | 0.3 | 2.2  | 0.36 |     |     |
| C   | 0923 | 16.0 | 35.38  | 26.04  | 0.2 | 1.0  | 0.24 |     |     |
| 12  | 0923 | 15.9 | 35.59  | 26.23  | 0.7 | 0.9  | 0.21 |     |     |
| D   | 0940 | 16.1 | 35.60  | 26.19  | 0.0 | 1.3  | 0.02 |     |     |
| 13  | 0940 | 16.1 | 35.59  | 26.18  | 0.4 | 2.8  | 0.36 |     |     |
| E   | 0953 | 16.4 | 35.59  | 26.11  | 0.6 | 3.6  | 0.13 |     |     |
| 22  | 0953 | 16.4 | 35.58  | 26.10  | 0.3 | 1.3  | 0.26 |     |     |
| G   | 1127 | 15.9 | 35.21  | 25.93  | 0.3 | 0.5  | 0.12 |     |     |
| 7   | 1127 | 15.8 | 35.41  | 26.11  | 0.0 | 0.2  | 0.24 |     |     |
| H   | 1208 | 16.0 | 35.16  | 25.87  | 0.5 | 1.8  | 0.17 |     |     |
| N   | 1242 | 16.2 | 35.55  | 26.13  | 0.6 | 1.1  | 0.29 |     |     |
| 3   | 1242 | 16.2 | 35.55  | 26.13  | 0.8 | 1.3  |      |     |     |
| O   | 1233 | 16.1 | 35.54  | 26.14  | 0.4 | 0.7  | 0.13 |     |     |
| 8   | 1233 | 16.1 | 35.56  | 26.16  | 0.2 | 3.2  | 0.28 |     |     |
| P   | 1224 | 15.9 | 35.48  | 26.14  | 0.4 | 0.4  | 0.19 |     |     |
| 3   | 1224 | 15.9 | 35.45  | 26.12  | 0.0 | 0.6  | 0.25 |     |     |
| Q   | 1220 | 15.9 | 35.30  | 26.00  | 0.2 | 1.6  | 0.17 |     |     |
| S   | 1120 | 15.9 | 35.12  | 25.86  | 0.2 | 0.6  | 0.16 |     |     |
| 15  | 1120 | 15.9 | 35.16  | 25.89  | 0.3 | 0.7  | 0.20 |     |     |

SUMMARY OF SURFACE DATA FOR SURVEY 5 / 9 / 79  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 11    | 16.0   | 0.2   | 15.5  | 16.4  |
| SALINITY    | 11    | 35.417 | 0.177 | 35.12 | 35.60 |
| NITRATE     | 11    | 0.3    | 0.2   | 0.0   | 0.6   |
| SILICATE    | 10    | 1.3    | 1.0   | 0.4   | 3.6   |
| PHOSPHATE   | 11    | 0.15   | 0.09  | 0.00  | 0.29  |

Present Conditions: Overcast; light E-NE breeze becoming moderate W breeze by 1030 h; seas slight tending moderate by 1120 h; swell low inshore, moderate offshore.

Previous Conditions: Sunny, light SE breeze, heavy swell previous day; drizzle, strong S breeze 2 days previous.

## COASTAL SURVEY ON 17 / 10 / 79

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0920 | 18.1 | 35.35  | 25.52  | 0.2 | 1.7  | 0.36 | 0.00 |     |
| 9   | 0920 | 18.0 | 35.43  | 25.60  | 0.1 | 1.1  | 0.12 | 0.00 |     |
| B   | 1337 | 18.2 | 35.27  | 25.43  | 0.1 | 1.5  | 0.20 | 0.00 |     |
| 10  | 1337 | 17.9 | 35.43  | 25.63  | 0.1 | 0.7  | 0.19 | 0.00 |     |
| C   | 0945 | 18.1 | 35.40  | 25.55  | 0.1 | 0.8  | 0.33 | 0.00 |     |
| 12  | 0945 | 17.9 | 35.50  | 25.68  | 1.0 | 0.9  | 0.23 | 0.02 |     |
| D   | 0958 | 18.0 | 35.47  | 25.63  | 1.0 | 1.1  | 0.35 | 0.00 |     |
| 13  | 0958 | 17.8 | 35.43  | 25.65  | 1.4 | 1.8  | 0.38 | 0.00 |     |
| E   | 1007 | 18.0 | 35.46  | 25.63  | 1.4 | 0.8  | 0.34 | 0.01 |     |
| 22  | 1007 | 18.0 | 35.54  | 25.69  | 1.2 | 3.6  | 0.24 | 0.01 |     |
| G   | 1200 | 18.6 | 35.50  | 25.51  | 1.4 | 1.2  | 0.26 | 0.00 |     |
| 7   | 1200 | 18.3 | 35.46  | 25.55  | 1.4 | 1.4  | 0.32 | 0.00 |     |
| H   | 1222 | 18.5 | 35.46  | 25.50  | 1.4 | 0.8  | 0.07 | 0.01 |     |
| 10  | 1222 | 18.1 | 35.44  | 25.59  | 1.5 | 3.1  |      | 0.00 |     |
| N   | 1310 | 18.3 | 35.40  | 25.51  | 1.5 | 0.7  | 0.45 | 0.00 |     |
| 3   | 1310 | 18.3 | 35.43  | 25.53  | 1.4 | 0.8  | 0.43 | 0.01 |     |
| O   | 1300 | 18.1 | 35.41  | 25.56  | 1.2 | 1.0  | 0.52 | 0.00 |     |
| 8   | 1300 | 18.2 | 35.38  | 25.51  | 1.2 | 0.9  | 0.26 | 0.01 |     |
| P   | 1245 | 18.4 | 35.36  | 25.45  | 1.2 | 0.7  | 0.37 | 0.00 |     |
| 3   | 1245 | 18.4 | 35.27  | 25.38  | 1.1 | 1.9  | 0.36 | 0.01 |     |
| Q   | 1240 | 18.3 | 35.31  | 25.44  | 1.6 | 2.1  | 0.18 | 0.01 |     |
| S   | 1154 | 18.5 | 35.51  | 25.54  | 1.4 | 0.8  | 0.61 | 0.01 |     |
| 15  | 1154 | 18.3 | 35.54  | 25.61  | 1.4 | 0.9  | 0.37 | 0.01 |     |

SUMMARY OF SURFACE DATA FOR SURVEY 17 / 10 / 79  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 11    | 18.3   | 0.2   | 18.0  | 18.6  |
| SALINITY    | 11    | 35.417 | 0.072 | 35.27 | 35.51 |
| NITRATE     | 11    | 1.0    | 0.6   | 0.1   | 1.5   |
| SILICATE    | 11    | 1.0    | 0.3   | 0.7   | 1.7   |
| PHOSPHATE   | 11    | 0.35   | 0.15  | 0.07  | 0.61  |
| NITRITE     | 11    | 0.00   | 0.00  | 0.00  | 0.01  |

Present Conditions: Clear sky; light S breeze at first becoming moderate SW seabreeze by 1045 h; slight to moderate seas; low swell inshore, moderate to heavy swell offshore.

Previous Conditions: Overcast, occasional drizzle, calm 1 day previous; mostly sunny, calm 2-3 days previous.

Water Quality: Water unusually green. Particulates looking like phytoplankton bloom inshore.

## COASTAL SURVEY ON 20 / 11 / 79

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0835 | 20.5 | 35.72  | 25.18  | 0.2 | 1.5  | 0.21 | 0.03 |     |
| B   | 0900 | 20.4 | 35.75  | 25.23  | 0.0 | 0.7  | 0.31 | 0.01 |     |
| C   | 0907 | 20.4 | 35.71  | 25.20  | 0.2 | 2.6  | 0.18 | 0.10 |     |
| D   | 0915 | 20.4 | 35.82  | 25.28  | 0.0 | 0.9  | 0.08 | 0.02 |     |
| E   | 0925 | 20.5 | 35.82  | 25.26  | 0.2 | 0.9  | 0.16 | 0.04 |     |
| F   | 0934 | 20.5 | 35.76  | 25.21  | 0.0 | 1.7  | 0.10 | 0.03 |     |
| G   | 1020 | 20.4 | 35.75  | 25.23  | 0.2 | 3.8  | 0.16 | 0.05 |     |
| H   | 1031 | 20.5 | 35.72  | 25.18  | 0.0 | 2.0  | 0.30 | 0.02 |     |
| I   | 1040 | 20.5 | 35.78  | 25.22  | 0.2 | 1.2  | 0.10 | 0.02 |     |
| J   | 1051 | 20.5 | 35.83  | 25.26  | 0.6 | 1.8  | 0.23 | 0.10 |     |
| L   | 1105 | 20.5 | 35.79  | 25.23  | 0.2 | 3.2  | 0.18 | 0.04 |     |
| M   | 1112 | 20.5 | 35.85  | 25.28  | 0.2 | 2.4  | 0.23 | 0.02 |     |
| N   | 1128 | 20.6 | 35.81  | 25.22  |     | 2.0  | 0.23 | 0.09 |     |
| O   | 1133 | 20.6 | 35.80  | 25.21  | 0.4 | 1.3  | 0.23 | 0.02 |     |
| P   | 1137 | 20.6 | 35.76  | 25.18  | 0.2 | 1.8  | 0.18 | 0.02 |     |
| Q   | 1141 | 21.3 | 35.74  | 24.98  | 0.0 | 4.2  | 0.23 | 0.05 |     |

SUMMARY OF SURFACE DATA FOR SURVEY 20 / 11 / 79  
 (omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 15    | 20.5   | 0.1   | 20.4  | 20.6  |
| SALINITY    | 15    | 35.778 | 0.044 | 35.71 | 35.85 |
| NITRATE     | 14    | 0.2    | 0.2   | 0.0   | 0.6   |
| SILICATE    | 15    | 1.9    | 0.9   | 0.7   | 3.8   |
| PHOSPHATE   | 15    | 0.19   | 0.07  | 0.08  | 0.31  |
| NITRITE     | 15    | 0.04   | 0.03  | 0.01  | 0.10  |

Present Conditions: Clear sky, moderate E breeze, slight seas,  
 low swell inshore, moderate swell  
 offshore.

Previous Conditions: Not recorded.

Water Quality: Water green and turbid inshore and  
 offshore, except clear near station N.

## COASTAL SURVEY ON 19 / 12 / 79

| STN | TIME | TEMP | SALNTY | SIGMAT | NO3 | SI02 | P04  | NO2  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0830 | 21.6 | 36.13  | 25.19  | 0.0 | 0.3  | 0.83 | 0.02 |     |
| B   | 0842 | 21.6 | 36.13  | 25.19  | 0.0 | 0.4  | 0.67 | 0.02 |     |
| C   | 0853 | 21.6 | 36.11  | 25.18  | 0.0 | 1.0  | 0.56 | 0.01 |     |
| D   | 0909 | 21.6 | 36.11  | 25.18  | 0.0 | 0.5  | 0.47 | 0.02 |     |
| E   | 0923 | 21.6 | 36.13  | 25.19  | 0.8 | 1.0  | 0.51 | 0.05 |     |
| F   | 0940 | 20.8 | 35.84  | 25.19  | 0.0 | 1.0  | 0.44 | 0.01 |     |
| G   | 1040 | 21.6 | 36.16  | 25.21  | 0.0 | 0.2  | 0.67 | 0.02 |     |
| H   | 1045 | 21.6 | 36.10  | 25.17  | 0.2 | 0.4  | 0.70 | 0.01 |     |
| I   | 1050 | 21.6 | 36.11  | 25.18  | 0.0 | 0.4  | 0.80 | 0.01 |     |
| J   | 1102 | 21.7 | 36.21  | 25.22  | 0.0 | 0.2  | 0.59 | 0.01 |     |
| L   | 1110 | 21.8 | 36.17  | 25.16  | 0.0 | 0.9  | 0.58 | 0.01 |     |
| M   | 1112 | 21.8 | 36.14  | 25.14  | 0.0 | 0.4  | 0.61 | 0.02 |     |
| N   | 1117 | 21.8 | 36.19  | 25.18  | 0.4 | 0.6  | 0.66 | 0.02 |     |
| O   | 1121 | 21.8 | 36.21  | 25.20  | 0.0 | 1.0  | 0.81 | 0.01 |     |
| P   | 1128 | 22.0 | 36.17  | 25.11  | 0.0 | 0.9  | 0.76 | 0.02 |     |
| Q   | 1133 | 22.3 | 35.70  | 24.67  | 0.6 | 5.0  | 0.79 | 0.03 |     |

SUMMARY OF SURFACE DATA FOR SURVEY 19 / 12 / 79  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 15    | 21.6   | 0.3   | 20.8  | 22.0  |
| SALINITY    | 15    | 36.127 | 0.087 | 35.84 | 36.21 |
| NITRATE     | 15    | 0.1    | 0.2   | 0.0   | 0.8   |
| SILICATE    | 15    | 0.6    | 0.3   | 0.2   | 1.0   |
| PHOSPHATE   | 15    | 0.64   | 0.12  | 0.44  | 0.83  |
| NITRITE     | 15    | 0.02   | 0.01  | 0.01  | 0.05  |

Present Conditions: Overcast at 0830 h, 7/8 cloud at 0940 h, reducing to 2/8 at 1130 h; light to moderate SW breeze shifting to S and freshening by 1130 h; sea slight at first becoming moderate by 0940 h; low swell inshore, moderate swell offshore.

Previous Conditions: Overcast, hot, light E breeze becoming fresh NE then NW breeze previous day; clear, very hot (max. ~ 38°C), strong morning E breeze and late weak SW seabreeze 2-3 days previous.

Water Quality: Water grey-green and moderately turbid inshore near Ocean Reef, green and slightly turbid inside Marmion Reef and blue and clear offshore.

## COASTAL SURVEY ON 29 / 1 / 80

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0835 | 24.0 | 36.47  | 24.76  | 1.2 | 1.3  | 0.74 | 0.13 | 0.1 |
| 9   | 0835 | 23.9 | 36.47  | 24.79  | 1.5 | 1.4  | 0.68 | 0.15 | 0.2 |
| B   | 0900 | 23.7 | 36.46  | 24.84  | 1.7 | 1.4  | 0.73 | 0.12 | 0.1 |
| C   | 0906 | 23.8 | 36.50  | 24.84  | 1.9 | 1.7  | 0.77 | 0.10 | 0.1 |
| D   | 0913 | 22.8 | 36.13  | 24.85  | 2.2 | 2.2  | 0.69 | 0.11 | 0.2 |
| E   | 0926 | 22.5 | 36.01  | 24.85  | 1.2 | 1.3  | 0.50 | 0.12 | 0.1 |
| 22  | 0926 | 22.4 | 35.94  | 24.82  | 1.1 | 1.0  | 0.48 | 0.14 | 0.1 |
| F   | 0959 | 22.6 | 36.04  | 24.84  | 1.1 | 1.0  | 0.49 | 0.04 | 0.2 |
| G   | 1048 | 23.5 | 36.31  | 24.78  | 1.2 | 0.5  | 0.62 | 0.04 | 0.2 |
| H   | 1104 | 23.7 | 36.36  | 24.76  | 1.2 | 0.5  | 0.70 | 0.16 | 0.1 |
| 10  | 1104 | 23.6 | 36.26  | 24.72  | 1.1 | 0.7  | 0.69 | 0.04 | 0.1 |
| I   | 1113 | 23.8 | 36.43  | 24.79  | 1.1 | 0.6  | 0.80 | 0.19 | 0.1 |
| J   | 1121 | 23.4 | 36.49  | 24.95  | 1.1 | 0.5  | 0.71 | 0.06 | 0.2 |
| L   | 1130 | 23.9 | 36.54  | 24.84  | 1.1 | 0.6  | 0.77 | 0.08 | 0.2 |
| M   | 1137 | 23.9 | 36.55  | 24.85  | 1.2 | 0.6  | 0.82 | 0.14 | 0.2 |
| N   | 1145 | 24.1 | 36.55  | 24.79  | 1.5 | 0.7  | 0.88 | 0.06 | 0.2 |
| O   | 1150 | 23.9 | 36.53  | 24.83  | 1.1 | 0.7  | 0.83 | 0.18 | 0.2 |
| P   | 1154 | 23.9 | 36.49  | 24.80  | 1.1 | 0.9  | 0.77 | 0.08 | 0.2 |
| Q   | 1159 | 23.9 | 36.32  | 24.67  | 1.2 | 2.2  | 0.75 | 0.09 | 0.3 |
| S   | 1057 | 23.0 | 36.14  | 24.80  | 1.2 | 1.1  | 0.47 | 0.08 | 0.1 |
| U   | 0848 | 23.7 | 36.40  | 24.79  | 2.3 | 2.1  | 1.12 | 0.43 | 0.2 |
| V   | 0856 | 23.6 | 36.37  | 24.80  | 2.3 | 1.6  | 0.80 | 0.25 | 0.1 |
| X   | 0947 | 22.5 | 35.98  | 24.82  | 1.0 | 0.9  | 0.49 | 0.08 | 0.5 |
| W   | 0920 | 22.5 | 36.04  | 24.87  | 1.4 | 1.1  | 0.62 | 0.14 | 0.1 |

SUMMARY OF SURFACE DATA FOR SURVEY 29 / 1 / 80  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 20    | 23.4   | 0.6   | 22.5  | 24.1  |
| SALINITY    | 20    | 36.340 | 0.203 | 35.98 | 36.55 |
| NITRATE     | 20    | 1.4    | 0.4   | 1.0   | 2.3   |
| SILICATE    | 20    | 1.1    | 0.5   | 0.5   | 2.2   |
| PHOSPHATE   | 20    | 0.72   | 0.16  | 0.47  | 1.12  |
| NITRITE     | 20    | 0.13   | 0.09  | 0.04  | 0.43  |
| D.O.P.      | 20    | 0.2    | 0.1   | 0.1   | 0.5   |

Present Conditions: Clear sky at first becoming 2/8 light cloud by 1000 h and 5/8 light cloud by 1120 h; fresh E breeze shifting to moderate SW breeze by 1145 h; sea slight inshore and slight to moderate offshore; low swell inshore, low to moderate swell offshore.

Previous Conditions: Sunny and hot to very hot for previous 10 days, with general summer pattern of morning E breeze and afternoon SW seabreeze.

Water Quality: Water blue-green and clear inshore, and blue offshore with visible white particulates, jellyfish and salps.



## COASTAL SURVEY ON 26 / 3 / 80

| STN | TIME | TEMP | SALNTY | SIGMAT | NO3 | SI02 | P04  | NO2  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0840 | 22.2 | 36.10  | 25.00  | 0.6 | 1.6  | 0.85 | 0.02 | 1.3 |
| 9   | 0840 | 22.2 | 36.20  | 25.07  | 0.6 | 0.9  | 0.27 | 0.02 | 0.2 |
| B   | 0907 | 22.2 | 36.12  | 25.01  | 0.6 | 0.9  | 0.23 | 0.01 | 0.1 |
| C   | 0918 | 22.3 | 36.05  | 24.93  | 0.6 | 1.3  | 0.24 | 0.02 | 0.4 |
| D   | 0928 | 22.3 | 36.03  | 24.92  | 0.6 | 1.2  | 0.27 | 0.01 | 0.1 |
| E   | 0948 | 22.1 | 35.60  | 24.65  | 1.2 | 1.7  | 0.11 | 0.01 | 0.1 |
| 22  | 0948 | 22.1 | 35.61  | 24.65  | 1.1 | 1.5  | 0.14 | 0.04 | 0.2 |
| F   | 1014 | 22.1 | 35.50  | 24.57  | 0.4 | 1.8  | 0.12 | 0.02 | 0.1 |
| G   | 1112 | 22.4 | 36.00  | 24.87  | 1.3 | 1.3  | 0.19 | 0.02 | 2.4 |
| H   | 1128 | 22.3 | 35.88  | 24.80  | 0.7 | 1.4  | 0.17 | 0.03 | 0.1 |
| 10  | 1128 | 22.5 | 36.05  | 24.88  | 0.4 | 1.3  | 0.28 | 0.02 | 0.1 |
| I   | 1138 | 22.5 | 36.05  | 24.88  | 0.4 | 1.4  | 0.20 | 0.02 | 0.1 |
| J   | 1149 | 22.6 | 36.02  | 24.82  | 0.6 | 1.4  | 0.22 | 0.01 | 0.1 |
| L   | 1154 | 22.6 | 36.05  | 24.85  | 0.8 | 1.5  | 0.43 | 0.02 | 0.3 |
| M   | 1157 | 22.6 | 36.05  | 24.85  | 0.7 | 1.7  | 0.27 | 0.02 | 0.1 |
| N   | 1201 | 22.4 | 35.81  | 24.72  | 1.0 | 1.8  | 0.21 | 0.04 | 0.1 |
| O   | 1207 | 22.6 | 36.03  | 24.83  | 0.8 | 1.4  | 0.20 | 0.02 | 0.1 |
| P   | 1210 | 22.7 | 36.07  | 24.83  | 0.9 | 1.6  | 0.21 | 0.02 | 0.1 |
| Q   | 1215 | 23.6 | 36.00  | 24.52  | 0.7 | 1.4  | 0.34 | 0.02 | 0.1 |
| S   | 1120 | 22.2 | 35.84  | 24.80  | 1.4 | 1.4  | 0.18 | 0.02 | 0.3 |
| U   | 0858 | 22.2 | 36.10  | 25.00  | 0.8 | 1.2  | 0.22 | 0.03 | 0.4 |
| V   | 0903 | 22.2 | 36.10  | 25.00  | 0.9 | 1.0  | 0.36 | 0.02 | 0.1 |
| X   | 1006 | 22.1 | 35.58  | 24.63  | 1.1 | 1.6  | 0.10 | 0.02 | 0.1 |
| W   | 0940 | 22.1 | 35.62  | 24.66  | 0.9 | 1.5  | 0.10 | 0.02 | 0.1 |

SUMMARY OF SURFACE DATA FOR SURVEY 26 / 3 / 80  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 20    | 22.3   | 0.2   | 22.1  | 22.7  |
| SALINITY    | 20    | 35.930 | 0.201 | 35.50 | 36.12 |
| NITRATE     | 20    | 0.8    | 0.3   | 0.4   | 1.4   |
| SILICATE    | 20    | 1.4    | 0.2   | 0.9   | 1.8   |
| PHOSPHATE   | 20    | 0.24   | 0.16  | 0.10  | 0.85  |
| NITRITE     | 20    | 0.02   | 0.01  | 0.01  | 0.04  |
| D.O.P.      | 20    | 0.3    | 0.6   | 0.1   | 2.4   |

Present Conditions: Sky 7/8 cloud at 0840 h, clearing by 1000 h; light to moderate SW breeze; sea slight to moderate; low swell inshore, moderate swell offshore.

Previous Conditions: Not recorded.

Water Quality: Water green and clear inshore, blue and clear offshore, green and moderately turbid near Stn Q.

## COASTAL SURVEY ON 2 / 4 / 80

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| MA  | 1400 | 22.7 | 36.54  | 25.19  | 0.7 | 1.4  | 0.35 | 0.06 | 0.3 |
| 6   | 1400 | 22.7 | 36.56  | 25.21  | 0.5 | 1.4  | 0.52 | 0.05 | 0.2 |
| MA  | 1500 | 23.0 | 36.53  | 25.10  | 0.6 | 1.2  | 0.25 | 0.03 | 0.3 |
| 6   | 1500 | 22.5 | 36.53  | 25.24  | 0.8 | 1.0  | 0.32 | 0.03 | 0.3 |
| MA  | 1600 | 23.0 | 36.56  | 25.12  | 0.7 | 1.8  | 0.37 | 0.06 | 0.3 |
| 6   | 1600 | 23.0 | 36.53  | 25.10  | 0.7 | 1.1  | 0.28 | 0.04 | 0.2 |
| MA  | 1700 | 23.0 | 36.51  | 25.08  | 0.6 | 1.4  | 0.31 | 0.03 | 0.3 |
| 6   | 1700 | 23.0 | 36.53  | 25.10  | 0.7 | 1.0  | 0.26 | 0.02 | 0.4 |
| MA  | 1800 | 23.0 | 36.56  | 25.12  | 0.6 | 1.3  | 0.30 | 0.02 | 0.4 |
| 6   | 1800 | 23.0 | 36.52  | 25.09  | 0.7 | 1.0  | 0.27 | 0.01 | 0.3 |
| MA  | 1900 | 23.0 | 36.54  | 25.10  | 0.7 | 0.8  | 0.33 | 0.06 | 0.3 |
| 6   | 1900 | 23.0 | 36.53  | 25.10  | 0.5 | 2.2  | 0.29 | 0.03 | 0.3 |
| MA  | 2000 | 23.0 | 36.55  | 25.11  | 0.7 | 1.0  | 0.32 | 0.05 | 0.3 |
| 6   | 2000 | 23.0 | 36.54  | 25.10  | 0.7 | 2.4  | 0.33 | 0.02 | 0.3 |
| MA  | 2100 | 22.5 | 36.56  | 25.26  | 0.6 | 0.7  | 0.22 | 0.02 | 0.3 |
| 6   | 2100 | 22.5 | 36.54  | 25.25  | 0.7 | 0.8  | 0.28 | 0.01 | 0.3 |
| MA  | 2200 | 22.7 | 36.54  | 25.19  | 0.7 | 0.9  | 0.24 | 0.02 | 0.2 |
| 6   | 2200 | 22.7 | 36.51  | 25.17  | 0.8 | 1.0  | 0.31 | 0.01 | 0.2 |
| MA  | 2300 | 22.7 | 36.54  | 25.19  | 0.6 | 1.0  | 0.25 | 0.03 | 0.3 |
| 6   | 2300 | 22.7 | 36.51  | 25.17  | 0.7 | 0.9  | 0.30 | 0.04 | 0.3 |
| MA  | 2400 | 22.5 |        |        | 0.6 | 0.9  | 0.27 | 0.02 | 0.4 |
| 6   | 2400 | 22.5 | 36.47  | 25.19  | 0.7 | 0.9  | 0.28 | 0.02 |     |
| MA  | 0100 | 22.5 | 36.51  | 25.23  | 0.8 | 1.0  | 0.26 | 0.01 | 0.4 |
| 6   | 0100 | 22.5 | 36.49  | 25.21  |     | 1.2  | 0.42 |      | 0.3 |
| MA  | 0200 | 22.5 | 36.53  | 25.24  | 0.8 | 1.0  | 0.23 | 0.02 |     |
| 6   | 0200 | 22.5 | 36.46  | 25.19  | 0.6 | 0.9  | 0.22 | 0.01 | 0.2 |
| MA  | 0300 | 22.5 | 36.50  | 25.22  | 0.7 | 1.0  | 0.20 | 0.03 |     |
| 6   | 0300 | 22.5 | 36.54  | 25.25  | 0.7 | 0.8  | 0.12 | 0.02 | 0.3 |
| MA  | 0400 | 22.5 | 36.49  | 25.21  | 0.6 | 1.3  | 0.19 | 0.04 | 0.3 |
| 6   | 0400 | 22.5 | 36.45  | 25.18  | 0.6 | 1.2  | 0.20 | 0.02 | 0.1 |
| MA  | 0500 | 22.5 | 36.46  | 25.19  | 0.7 | 1.4  | 0.17 | 0.05 | 0.4 |
| 6   | 0500 | 22.5 | 36.49  | 25.21  | 0.6 | 0.7  | 0.19 | 0.05 | 0.2 |
| MA  | 0600 | 22.5 | 36.54  | 25.25  | 0.8 | 1.1  | 0.21 | 0.06 | 0.3 |
| 6   | 0600 | 22.5 | 36.47  | 25.19  | 0.7 | 1.2  | 0.14 | 0.02 | 0.3 |
| MA  | 0700 | 22.3 | 36.54  | 25.30  | 0.7 | 1.2  | 0.18 | 0.04 | 0.3 |
| 6   | 0700 | 22.4 | 36.45  | 25.21  | 0.7 | 0.8  | 0.10 | 0.01 | 0.5 |
| MA  | 0800 | 22.4 | 36.49  | 25.24  | 0.6 | 1.0  | 0.27 | 0.01 | 0.2 |
| 6   | 0800 | 22.4 | 36.46  | 25.22  | 0.8 | 1.2  | 0.21 | 0.02 | 0.3 |
| MA  | 0900 | 22.4 | 36.51  | 25.25  | 0.7 | 1.0  | 0.18 | 0.01 | 0.3 |
| 6   | 0900 | 22.4 | 36.49  | 25.24  | 0.6 | 0.8  | 0.13 | 0.01 | 0.4 |
| MA  | 1000 | 22.4 | 36.55  | 25.28  | 0.7 | 1.0  | 0.20 | 0.01 |     |
| 6   | 1000 | 22.5 | 36.46  | 25.19  | 0.7 | 1.1  | 0.15 | 0.01 | 0.3 |
| MA  | 1100 | 23.0 | 36.56  | 25.12  | 0.6 | 1.0  | 0.18 | 0.01 | 0.2 |
| 6   | 1100 | 23.0 | 36.46  | 25.04  | 0.6 | 1.7  | 0.26 | 0.02 | 0.1 |
| MA  | 1200 | 22.6 | 36.48  | 25.17  | 0.6 | 0.7  | 0.13 | 0.01 | 0.5 |
| 6   | 1200 | 22.5 | 36.48  | 25.20  | 0.6 | 0.9  | 0.17 | 0.01 | 0.1 |
| MA  | 1300 | 22.9 | 36.49  | 25.09  | 0.8 | 1.0  | 0.19 | 0.01 | 0.2 |
| 6   | 1300 | 22.6 |        |        | 0.6 | 0.6  | 0.22 | 0.02 | 0.2 |
| MA  | 1400 | 22.7 | 36.54  | 25.19  | 0.6 | 1.4  | 0.20 | 0.01 | 0.2 |
| 6   | 1400 | 22.6 | 36.49  | 25.18  | 0.7 | 1.1  | 0.39 | 0.04 | 0.0 |

No observations recorded.

## COASTAL SURVEY ON 14 / 4 / 80

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0858 | 21.2 | 36.07  | 25.26  | 1.4 | 0.5  | 0.34 | 0.02 | 0.4 |
| I   | 0932 | 20.9 | 36.16  | 25.41  | 1.3 | 0.5  | 0.16 | 0.00 | 0.6 |
| L   | 0954 | 21.0 | 36.05  | 25.29  | 1.4 | 0.5  | 0.25 | 0.01 | 0.7 |
| M   | 0958 | 21.1 | 36.09  | 25.30  | 1.4 | 0.6  | 0.22 | 0.03 | 3.3 |
| P   | 1003 | 20.9 | 36.05  | 25.32  | 1.4 | 0.9  | 0.32 | 0.00 | 0.3 |
| U   | 1027 | 21.2 | 36.03  | 25.22  | 1.2 | 0.6  | 0.23 | 0.02 | 0.4 |
| PA  | 1008 | 20.9 | 36.05  | 25.32  | 1.1 | 1.7  | 0.20 | 0.01 | 1.3 |
| PU  | 1015 | 20.9 | 36.10  | 25.36  | 1.5 | 0.6  | 0.24 | 0.02 | 4.6 |
| IL  | 0945 | 20.7 | 36.10  | 25.41  | 1.1 | 0.4  | 0.14 | 0.00 | 0.5 |
| A   | 1034 | 21.0 | 36.04  | 25.29  | 1.4 | 0.6  | 0.29 | 0.02 | 1.6 |

SUMMARY OF SURFACE DATA FOR SURVEY 14 / 4 / 80  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 7     | 21.0   | 0.1   | 20.9  | 21.2  |
| SALINITY    | 7     | 36.070 | 0.044 | 36.03 | 36.16 |
| NITRATE     | 7     | 1.4    | 0.1   | 1.2   | 1.4   |
| SILICATE    | 7     | 0.6    | 0.2   | 0.5   | 0.9   |
| PHOSPHATE   | 7     | 0.26   | 0.06  | 0.16  | 0.34  |
| NITRITE     | 7     | 0.01   | 0.01  | 0.00  | 0.03  |
| D.O.P.      | 7     | 1.0    | 1.1   | 0.3   | 3.3   |

Present Conditions: Sky 7/8 cloud at 0900 h, clearing to 2/8 cloud by 1015 h; moderate to fresh W-SW breeze; sea moderate, swell low.

Previous Conditions: Not recorded.

Water Quality: Water green and moderately turbid; northern areas more turbid than southern.

## COASTAL SURVEY ON 7 / 5 / 80

| STN | TIME | TEMP | SALNTY | SIGMAT | NO3 | SI02 | PO4  | NO2  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0853 | 19.9 | 35.65  | 25.29  | 1.2 | 3.0  | 0.00 | 0.13 | 0.6 |
| 9   | 0853 | 20.0 | 35.65  | 25.26  | 1.3 | 2.7  | 0.08 | 0.17 | 0.6 |
| B   | 0916 | 20.6 | 35.56  | 25.03  | 0.1 | 3.1  | 0.01 | 0.02 | 0.3 |
| C   | 0925 | 20.0 | 35.60  | 25.22  | 0.7 | 3.0  | 0.09 | 0.02 | 0.3 |
| D   | 0933 | 20.3 | 35.60  | 25.14  | 1.5 | 2.1  | 0.07 | 0.04 | 0.4 |
| E   | 0948 | 21.4 | 35.54  | 24.80  | 0.8 | 4.2  | 0.00 | 0.01 | 0.2 |
| 22  | 0948 | 20.7 | 35.60  | 25.03  | 1.2 | 1.5  | 0.02 | 0.01 | 0.3 |
| F   | 1005 | 21.7 | 35.51  | 24.69  | 0.6 | 1.9  | 0.06 | 0.01 | 0.2 |
| G   | 1047 | 20.7 | 35.60  | 25.03  | 0.9 | 3.0  | 0.10 | 0.01 | 0.2 |
| H   | 1105 | 20.7 | 35.60  | 25.03  | 1.0 | 2.0  | 0.05 | 0.01 | 0.3 |
| 10  | 1105 | 20.1 | 35.67  | 25.25  | 1.2 | 1.9  | 0.20 | 0.03 | 0.3 |
| I   | 1114 | 20.7 | 35.60  | 25.03  | 0.8 | 2.4  | 0.20 | 0.02 | 1.0 |
| J   | 1125 | 20.3 | 35.62  | 25.16  | 1.0 | 2.2  | 0.07 | 0.03 | 0.8 |
| L   | 1131 | 19.9 | 35.67  | 25.30  | 1.9 | 2.4  | 1.49 | 0.06 | 0.0 |
| M   | 1134 | 20.0 | 35.67  | 25.27  | 1.7 | 3.1  | 0.38 | 0.05 | 0.4 |
| N   | 1142 | 20.2 | 35.62  | 25.18  | 1.5 | 1.2  | 0.33 | 0.03 | 0.3 |
| O   | 1147 | 20.0 | 35.67  | 25.27  | 1.5 | 2.2  | 0.12 | 0.03 | 0.3 |
| P   | 1152 | 19.9 | 35.65  | 25.29  | 0.8 | 2.6  | 0.10 | 0.02 | 0.3 |
| Q   | 1157 | 20.0 | 35.69  | 25.29  | 1.2 | 2.9  | 0.14 | 0.03 | 0.3 |
| S   | 1054 | 20.8 | 35.60  | 25.01  | 0.6 | 1.4  | 0.12 | 0.01 | 0.2 |
| U   | 0905 | 19.9 | 35.60  | 25.25  | 1.0 | 2.6  | 0.11 | 0.02 | 0.3 |
| V   | 0911 | 20.4 | 35.59  | 25.11  | 1.1 | 2.2  | 0.29 | 0.02 | 0.4 |
| X   | 0958 | 21.6 | 35.49  | 24.70  | 0.6 | 1.7  | 0.05 | 0.01 | 0.8 |
| W   | 0939 | 20.6 | 35.60  | 25.06  | 1.5 | 3.0  | 0.90 | 0.04 | 0.0 |

SUMMARY OF SURFACE DATA FOR SURVEY 7 / 5 / 80  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 20    | 20.5   | 0.6   | 19.9  | 21.7  |
| SALINITY    | 20    | 35.602 | 0.049 | 35.49 | 35.67 |
| NITRATE     | 20    | 1.0    | 0.4   | 0.1   | 1.9   |
| SILICATE    | 20    | 2.5    | 0.7   | 1.2   | 4.2   |
| PHOSPHATE   | 20    | 0.23   | 0.36  | 0.00  | 1.49  |
| NITRITE     | 20    | 0.03   | 0.03  | 0.01  | 0.13  |
| D.O.P.      | 20    | 0.4    | 0.3   | 0.0   | 1.0   |

Present Conditions: Sky overcast; moderate W breeze; sea slight tending moderate by 1000 h; low swell inside Marmion Reef, moderate swell elsewhere.

Previous Conditions: Overcast, showers, moderate to strong NW-SW breeze past 2 or 3 days.

Water Quality: Water inshore dark grey-green and moderately turbid; southern area more turbid than northern; offshore dark blue and clear.

COASTAL SURVEY ON 27 / 6 / 80

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04 | N02 | D0P |
|-----|------|------|--------|--------|-----|------|-----|-----|-----|
| A   | 0918 | 16.2 | 35.42  | 26.03  |     |      |     |     |     |
| 9   | 0918 | 16.2 | 35.42  | 26.03  |     |      |     |     |     |
| B   | 0936 | 16.0 | 35.32  | 25.99  |     |      |     |     |     |
| C   | 0943 | 16.4 | 35.43  | 25.99  |     |      |     |     |     |
| D   | 0951 | 17.2 | 35.45  | 25.81  |     |      |     |     |     |
| E   | 1007 | 17.7 | 35.47  | 25.71  |     |      |     |     |     |
| 22  | 1007 | 17.1 | 35.45  | 25.84  |     |      |     |     |     |
| F   | 1032 | 18.5 | 35.44  | 25.49  |     |      |     |     |     |
| G   | 1123 | 16.7 | 35.37  | 25.87  |     |      |     |     |     |
| H   | 1137 | 17.3 | 35.44  | 25.78  |     |      |     |     |     |
| 10  | 1137 | 17.3 | 35.44  | 25.78  |     |      |     |     |     |
| I   | 1152 | 17.3 | 35.45  | 25.79  |     |      |     |     |     |
| J   | 1204 | 17.4 | 35.45  | 25.76  |     |      |     |     |     |
| L   | 1209 | 17.1 | 35.45  | 25.84  |     |      |     |     |     |
| M   | 1215 | 17.1 | 35.45  | 25.84  |     |      |     |     |     |
| N   | 1221 | 17.1 | 35.43  | 25.82  |     |      |     |     |     |
| O   | 1226 | 16.9 | 35.45  | 25.88  |     |      |     |     |     |
| P   | 1230 | 16.7 | 35.48  | 25.95  |     |      |     |     |     |
| Q   | 1234 | 16.1 | 35.01  | 25.73  |     |      |     |     |     |
| S   | 1130 | 17.5 | 35.45  | 25.74  |     |      |     |     |     |
| U   | 0926 | 16.2 | 35.40  | 26.01  |     |      |     |     |     |
| V   | 0932 | 16.1 | 35.34  | 25.99  |     |      |     |     |     |
| X   | 1025 | 18.1 | 35.45  | 25.59  |     |      |     |     |     |
| W   | 0957 | 17.1 | 35.46  | 25.84  |     |      |     |     |     |

SUMMARY OF SURFACE DATA FOR SURVEY 27 / 6 / 80  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 20    | 17.0   | 0.7   | 16.0  | 18.5  |
| SALINITY    | 20    | 35.430 | 0.042 | 35.32 | 35.48 |

Present Conditions: Sky clear; light to moderate NE breeze; calm and slight seas; moderate swell inshore, tending heavy offshore.

Previous Conditions: Cloudy with occasional rain squalls and intermittent sunny periods; moderate to fresh NW-SW breezes; rough seas, moderate swell for past 5 days.

Water Quality: Inshore water milky-green and turbid; offshore water green and slightly turbid.

## COASTAL SURVEY ON 9 / 7 / 80

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0933 | 17.1 | 35.41  | 25.81  | 1.1 | 2.1  | 0.26 | 0.04 | 0.4 |
| 9   | 0933 | 16.9 | 35.43  | 25.87  | 0.9 | 1.7  | 0.29 | 0.05 | 0.0 |
| B   | 1000 | 17.0 | 35.42  | 25.84  | 1.2 | 1.8  | 0.48 | 0.06 |     |
| C   | 1007 | 17.3 | 35.42  | 25.77  | 2.1 | 4.8  | 0.15 | 0.09 | 1.0 |
| D   | 1016 | 17.6 | 35.40  | 25.68  | 2.3 | 1.7  | 0.15 | 0.04 | 0.1 |
| E   | 1042 | 19.0 | 35.35  | 25.29  | 0.3 | 1.7  | 0.27 | 0.01 | 3.4 |
| 22  | 1042 | 19.0 | 35.35  | 25.29  | 1.6 | 2.4  | 0.17 | 0.03 | 0.2 |
| F   | 1107 | 19.2 | 35.35  | 25.24  | 0.4 | 1.4  | 0.21 | 0.00 | 0.1 |
| G   | 1150 | 17.1 | 35.42  | 25.81  | 0.9 | 1.0  | 0.25 | 0.05 | 0.2 |
| H   | 1212 | 16.4 | 35.41  | 25.97  | 0.5 | 2.5  | 0.37 | 0.03 | 0.1 |
| 10  | 1212 | 16.4 | 35.42  | 25.98  | 2.5 | 0.7  | 0.08 | 0.02 | 0.5 |
| I   | 1223 | 16.0 | 35.43  | 26.08  | 0.2 | 0.7  | 0.29 | 0.00 | 0.1 |
| J   | 1240 | 16.6 | 35.42  | 25.93  | 0.9 | 1.3  | 0.27 | 0.05 | 0.1 |
| L   | 1253 | 16.4 | 35.42  | 25.98  | 1.3 | 1.4  | 0.13 | 0.02 | 0.3 |
| M   | 1256 | 16.4 | 35.42  | 25.98  | 1.9 | 1.4  | 0.11 | 0.02 | 0.2 |
| N   | 1303 | 16.6 | 35.42  | 25.93  | 2.6 | 1.6  | 0.14 | 0.14 |     |
| O   | 1309 | 16.4 | 35.42  | 25.98  | 1.2 | 1.6  | 0.15 | 0.04 | 0.3 |
| P   | 1313 | 16.4 | 35.42  | 25.98  | 1.7 | 1.6  | 0.52 | 0.13 | 0.5 |
| Q   | 1318 | 16.0 | 35.23  | 25.93  | 2.2 | 2.2  | 0.13 | 0.08 | 2.0 |
| S   | 1157 | 17.6 | 35.41  | 25.69  | 1.2 | 1.5  | 0.29 | 0.03 | 0.1 |
| U   | 0946 | 17.2 | 35.41  | 25.78  | 0.3 | 1.4  | 0.26 | 0.05 | 0.2 |
| V   | 0954 | 17.2 | 35.41  | 25.78  | 3.4 | 1.7  | 0.29 | 0.05 | 0.1 |
| X   | 1102 | 19.2 | 35.35  | 25.24  | 0.2 | 1.7  | 0.18 | 0.00 | 0.3 |
| W   | 1022 | 17.8 | 35.40  | 25.63  | 2.9 | 3.3  | 0.12 | 0.05 | 0.1 |

SUMMARY OF SURFACE DATA FOR SURVEY 9 / 7 / 80  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 20    | 17.2   | 1.0   | 16.0  | 19.2  |
| SALINITY    | 20    | 35.406 | 0.025 | 35.35 | 35.43 |
| NITRATE     | 20    | 1.3    | 1.0   | 0.2   | 3.4   |
| SILICATE    | 20    | 1.8    | 0.9   | 0.7   | 4.8   |
| PHOSPHATE   | 20    | 0.24   | 0.11  | 0.11  | 0.52  |
| NITRITE     | 20    | 0.05   | 0.04  | 0.00  | 0.14  |
| D.O.P.      | 18    | 0.4    | 0.8   | 0.1   | 3.4   |

Present Conditions: Sky 7/8 cloud; moderate to fresh N-NE breeze swinging NW by 1100 h; sea moderate inshore, moderate to rough offshore; moderate swell inshore, heavy swell offshore.

Previous Conditions: Sky clear, light to moderate E breeze with light SW breeze some afternoons; heavy swell but slight seas for previous 9 days.

Water Quality: Water blue green and slightly turbid in northern inshore area, green and moderately turbid in southern inshore area, and blue and clear offshore.

## COASTAL SURVEY ON 20 / 8 / 80

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0955 | 16.4 | 35.31  | 25.89  | 0.3 | 1.1  | 0.26 | 0.07 | 0.1 |
| 9   | 0955 | 16.4 | 35.36  | 25.93  | 0.4 | 0.7  | 0.22 | 0.07 | 0.1 |
| B   | 1021 | 17.0 | 35.40  | 25.82  | 0.5 | 1.0  | 0.27 | 0.07 |     |
| C   | 1028 | 16.9 | 35.39  | 25.84  | 0.6 | 1.5  | 0.37 | 0.06 | 0.2 |
| D   | 1045 | 16.8 | 35.39  | 25.86  | 1.0 | 1.7  | 0.36 | 0.05 | 0.2 |
| E   | 1110 | 17.7 | 35.41  | 25.66  | 0.6 | 1.8  | 0.19 | 0.02 | 0.3 |
| 22  | 1110 | 17.6 | 35.43  | 25.70  | 0.5 | 0.9  | 0.28 | 0.07 | 0.2 |
| F   | 1136 | 17.9 | 35.40  | 25.60  | 0.4 | 1.2  | 0.28 | 0.02 | 0.1 |
| G   | 1234 | 17.1 | 35.44  | 25.83  | 0.4 | 0.8  | 0.19 | 0.08 | 0.9 |
| H   | 1245 | 17.0 | 35.44  | 25.85  | 0.3 | 1.4  | 0.27 | 0.05 | 0.2 |
| 10  | 1245 | 17.0 | 35.43  | 25.85  | 0.5 | 0.6  | 0.19 | 0.05 | 0.2 |
| I   | 1300 | 16.7 | 35.43  | 25.92  | 0.4 | 0.9  | 0.31 | 0.02 | 0.3 |
| J   | 1329 | 16.8 | 35.39  | 25.86  | 0.4 | 0.6  | 0.23 | 0.02 | 0.3 |
| L   | 1337 | 16.5 | 35.36  | 25.91  | 0.4 | 0.7  | 0.31 | 0.08 | 0.3 |
| M   | 1340 | 16.4 | 35.35  | 25.93  | 2.0 | 1.5  | 0.06 | 0.08 | 0.4 |
| N   | 1348 | 16.8 | 35.39  | 25.86  | 2.8 | 1.9  | 0.09 | 0.13 | 0.4 |
| O   | 1353 | 16.5 | 35.35  | 25.90  | 1.6 | 1.4  | 0.52 | 0.09 | 0.2 |
| P   | 1357 | 16.5 | 35.35  | 25.90  | 2.4 | 1.8  | 0.20 | 0.06 | 0.2 |
| Q   | 1400 | 16.6 | 35.15  | 25.72  | 0.7 | 1.6  | 0.44 | 0.08 |     |
| S   | 1229 | 17.2 | 35.43  | 25.80  | 0.6 | 0.8  | 0.16 | 0.05 | 0.3 |
| U   | 1007 | 16.8 | 35.38  | 25.85  |     | 1.1  | 0.32 |      | 0.1 |
| V   | 1014 | 16.9 | 35.38  | 25.83  | 0.6 | 1.2  | 0.20 | 0.07 | 0.2 |
| X   | 1123 | 18.0 | 35.41  | 25.59  | 0.2 | 1.1  | 0.24 | 0.04 |     |
| W   | 1055 | 16.8 | 35.39  | 25.86  | 1.4 | 1.5  | 0.23 | 0.10 | 0.4 |

SUMMARY OF SURFACE DATA FOR SURVEY 20 / 8 / 80  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 20    | 16.9   | 0.5   | 16.4  | 18.0  |
| SALINITY    | 20    | 35.390 | 0.034 | 35.31 | 35.44 |
| NITRATE     | 19    | 0.9    | 0.8   | 0.2   | 2.8   |
| SILICATE    | 20    | 1.3    | 0.4   | 0.6   | 1.9   |
| PHOSPHATE   | 20    | 0.25   | 0.10  | 0.06  | 0.52  |
| NITRITE     | 19    | 0.06   | 0.03  | 0.02  | 0.13  |
| D.O.P.      | 18    | 0.3    | 0.2   | 0.1   | 0.9   |

Present Conditions: Sky 6/8 to 7/8 cloud, rain starting about 1350 h; moderate NW breeze becoming fresh by 1100 h, strong by 1230 h; sea moderate becoming rough by 1100 h; moderate swell.

Previous Conditions: Overcast, occasional showers, light winds, slight seas; moderate swell 1 to 2 days previous; overcast, rain, strong W breeze, rough seas 3 days previous.

Water Quality: Water grey-green, moderately turbid inshore, deep blue and clear offshore; front clearly visible just offshore from 3-Mile Reef, with blue water outside, green water inside.

## COASTAL SURVEY ON 25 / 9 / 80

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0836 | 17.2 | 35.44  | 25.81  | 0.9 | 0.9  | 0.24 | 0.04 | 0.2 |
| 9   | 0836 | 17.0 | 35.45  | 25.86  | 0.3 | 1.0  | 0.22 | 0.09 | 0.2 |
| B   | 0852 | 17.2 | 35.41  | 25.78  | 0.2 | 1.1  | 0.02 | 0.02 | 0.3 |
| C   | 0858 | 17.2 | 35.47  | 25.83  | 0.6 | 1.2  | 0.22 | 0.09 | 0.3 |
| D   | 0914 | 17.5 | 35.51  | 25.79  | 0.4 | 1.7  | 0.04 | 0.02 | 0.4 |
| E   | 0935 | 17.4 | 35.50  | 25.80  | 0.6 | 1.1  | 0.08 | 0.03 | 0.2 |
| 22  | 0935 | 17.3 | 35.51  | 25.83  | 0.6 | 1.2  | 0.06 | 0.17 | 0.3 |
| F   | 0946 | 17.7 | 35.48  | 25.71  | 0.2 | 3.0  | 0.07 | 0.01 | 0.2 |
| G   | 1026 | 17.5 | 35.42  | 25.72  | 0.4 | 1.6  | 0.09 | 0.03 | 0.3 |
| H   | 1038 | 17.3 | 35.45  | 25.79  | 0.3 | 1.2  | 0.09 | 0.02 | 0.2 |
| 10  | 1038 | 17.1 | 35.45  | 25.84  | 0.4 | 1.3  | 0.05 | 0.02 | 0.3 |
| I   | 1050 | 17.3 | 35.43  | 25.77  | 0.4 | 2.4  | 0.11 | 0.01 | 0.2 |
| J   | 1100 | 17.3 | 35.48  | 25.81  | 0.8 | 1.4  | 0.15 | 0.04 |     |
| L   | 1104 | 17.2 | 35.47  | 25.83  | 0.5 | 2.2  | 0.07 | 0.02 | 0.3 |
| M   | 1106 | 17.2 | 35.47  | 25.83  | 0.3 | 1.0  | 0.10 | 0.02 | 0.2 |
| N   | 1111 | 17.2 | 35.51  | 25.86  | 2.1 | 1.6  | 0.12 | 0.08 | 0.3 |
| O   | 1116 | 17.5 | 35.50  | 25.78  | 1.4 | 1.0  | 0.04 | 0.02 |     |
| P   | 1120 | 17.5 | 35.48  | 25.76  | 1.6 | 1.4  | 0.06 | 0.20 | 0.2 |
| Q   | 1123 | 17.6 | 35.46  | 25.72  | 1.4 | 1.8  | 0.11 | 0.04 | 0.7 |
| S   | 1031 | 17.2 | 35.39  | 25.77  | 0.4 | 1.0  | 0.07 | 0.04 | 0.3 |
| U   | 0844 | 17.1 | 35.49  | 25.87  | 0.6 | 1.0  | 0.40 | 0.07 | 0.2 |
| V   | 0848 | 17.1 | 35.45  | 25.84  | 0.3 | 1.0  | 0.29 | 0.03 | 0.1 |
| X   | 0942 | 17.6 | 35.49  | 25.75  | 0.2 | 3.8  | 0.07 | 0.00 | 0.2 |
| W   | 0920 | 17.4 | 35.50  | 25.80  | 0.3 |      |      | 0.02 |     |

SUMMARY OF SURFACE DATA FOR SURVEY 25 / 9 / 80  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 20    | 17.3   | 0.2   | 17.1  | 17.7  |
| SALINITY    | 20    | 35.467 | 0.035 | 35.39 | 35.51 |
| NITRATE     | 20    | 0.6    | 0.5   | 0.2   | 2.1   |
| SILICATE    | 19    | 1.5    | 0.8   | 0.9   | 3.8   |
| PHOSPHATE   | 19    | 0.12   | 0.10  | 0.02  | 0.40  |
| NITRITE     | 20    | 0.04   | 0.04  | 0.00  | 0.20  |
| D.O.P.      | 17    | 0.2    | 0.1   | 0.1   | 0.4   |

Present Conditions: Sky clear; light SE breeze; seas slight; swell moderate near Ocean Reef and offshore, and low swell inside Marmion Reef.

Previous Conditions: Sky mostly clear with occasional cloud, light to moderate SW breeze 1 day previous; overcast, showers, moderate to strong N breeze shifting NW then W 2 to 3 days previous.

Water Quality: Water inshore moderately turbid and blue-green except grey-green near Stn Q; offshore water mid blue and slightly turbid; windrows of Sargassum in area of stations A and U.



## COASTAL SURVEY ON 6 / 11 / 80

| STN | TIME | TEMP | SALNTY | SIGMAT | NO3 | SI02 | PO4  | NO2  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0845 | 19.3 | 35.27  | 25.15  | 0.3 | 3.5  | 0.97 | 0.21 | 0.2 |
| 9   | 0845 | 19.2 | 35.36  | 25.25  | 0.2 | 1.2  | 0.67 | 0.20 | 0.4 |
| B   | 0910 | 19.3 | 35.27  | 25.15  | 0.2 | 2.4  | 0.61 | 0.19 | 0.4 |
| C   | 0915 | 19.1 | 35.27  | 25.20  | 0.2 | 2.6  | 1.40 | 0.05 | 0.2 |
| D   | 0925 | 19.0 | 35.40  | 25.33  | 0.2 | 2.0  | 0.84 | 0.12 | 0.1 |
| E   | 0932 | 19.1 | 35.50  | 25.38  | 0.7 | 1.8  | 0.90 | 0.06 | 0.4 |
| 22  | 0932 | 18.5 | 35.58  | 25.59  | 0.2 | 2.2  | 0.57 | 0.02 | 0.2 |
| F   | 0946 | 19.0 | 35.47  | 25.38  | 0.2 | 2.1  | 0.75 | 0.03 | 0.2 |
| G   | 1025 | 19.2 | 35.27  | 25.18  |     | 0.9  | 0.69 |      |     |
| H   | 1030 | 19.2 | 35.28  | 25.19  | 0.2 | 2.0  | 0.80 | 0.02 | 0.2 |
| 10  | 1030 | 18.8 | 35.35  | 25.34  | 0.3 | 1.7  | 1.06 | 0.03 | 1.2 |
| I   | 1041 | 19.5 | 35.24  | 25.08  | 0.3 | 1.8  | 0.77 | 0.01 | 0.3 |
| J   | 1105 | 19.5 | 35.24  | 25.08  | 0.3 | 1.4  | 0.97 | 0.04 | 0.9 |
| L   | 1110 | 19.6 | 35.23  | 25.04  | 0.4 | 1.9  | 1.19 | 0.03 | 1.1 |
| M   | 1112 | 19.5 | 35.23  | 25.07  | 0.3 | 2.1  | 0.91 | 0.03 | 0.5 |
| N   | 1120 | 19.0 | 35.39  | 25.32  | 0.7 | 2.0  | 1.43 | 0.27 | 3.3 |
| O   | 1125 | 19.5 | 35.25  | 25.08  | 0.4 | 2.8  | 1.07 | 0.03 | 2.0 |
| P   | 1134 | 19.6 | 35.23  | 25.04  | 0.5 | 2.1  | 1.01 | 0.02 | 1.5 |
| Q   | 1132 | 20.9 | 35.05  | 24.56  | 1.4 | 3.3  | 1.42 | 0.15 | 2.7 |
| S   | 1020 | 19.2 | 35.35  | 25.24  | 0.3 | 1.5  | 0.76 | 0.05 | 0.2 |
| U   | 0900 | 19.2 | 35.32  | 25.22  | 0.3 | 1.8  | 0.86 | 0.02 | 0.4 |
| V   | 0905 | 19.2 | 35.27  | 25.18  | 0.2 | 2.2  | 0.88 | 0.07 | 0.1 |
| X   | 0940 | 19.9 | 35.44  | 25.13  | 0.4 | 1.5  | 0.64 | 0.02 | 2.7 |
| W   | 0926 | 19.0 | 35.43  | 25.35  | 0.4 | 2.5  | 0.68 | 0.07 | 0.3 |

SUMMARY OF SURFACE DATA FOR SURVEY 6 / 11 / 80  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 20    | 19.3   | 0.3   | 19.0  | 19.9  |
| SALINITY    | 20    | 35.318 | 0.089 | 35.23 | 35.50 |
| NITRATE     | 19    | 0.3    | 0.1   | 0.2   | 0.7   |
| SILICATE    | 20    | 2.0    | 0.6   | 0.9   | 3.5   |
| PHOSPHATE   | 20    | 0.91   | 0.23  | 0.61  | 1.43  |
| NITRITE     | 19    | 0.07   | 0.07  | 0.01  | 0.27  |
| D.O.P.      | 19    | 0.8    | 0.9   | 0.1   | 3.3   |

Present Conditions: Sky clear, light S breeze, smooth sea, low swell, N-NE set.

Previous Conditions: Clear, morning E breeze, afternoon S-SW seabreezes.

Water Quality: Inshore water blue-green and fairly clear, offshore water blue and clear.

## COASTAL SURVEY ON 22 / 12 / 80

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0909 | 20.9 | 36.10  | 25.36  | 0.2 | 1.5  | 0.75 | 0.10 | 1.2 |
| 9   | 0909 | 20.8 | 36.10  | 25.39  | 0.4 | 2.9  | 1.29 | 0.12 | 3.8 |
| B   | 0936 | 21.2 | 36.05  | 25.24  | 0.1 | 1.5  | 0.78 | 0.10 | 1.3 |
| C   | 0941 | 20.9 | 36.08  | 25.35  | 0.2 | 1.6  | 0.57 | 0.11 | 0.2 |
| D   | 0950 | 21.0 | 36.05  | 25.29  | 0.7 | 2.0  | 0.46 | 0.15 | 0.4 |
| E   | 1012 | 21.0 | 35.95  | 25.22  | 0.1 | 0.6  | 0.47 | 0.05 | 0.2 |
| 22  | 1012 | 20.8 | 35.93  | 25.26  | 0.1 | 1.0  | 0.30 | 0.07 | 0.4 |
| F   | 1030 | 20.9 | 35.91  | 25.22  | 0.1 | 1.0  | 0.33 | 0.03 | 0.3 |
| G   | 1129 | 21.4 | 36.03  | 25.17  | 0.3 | 1.4  | 0.39 | 0.10 | 0.6 |
| H   | 1136 | 21.0 | 36.04  | 25.29  | 0.1 | 1.7  | 0.27 | 0.06 | 0.9 |
| 10  | 1136 | 21.1 | 36.07  | 25.28  | 0.0 | 0.8  | 0.23 | 0.05 | 0.8 |
| I   | 1148 | 21.4 | 36.03  | 25.17  | 0.1 | 0.8  | 0.36 | 0.06 | 0.7 |
| J   | 1202 | 21.0 | 36.05  | 25.29  | 0.9 | 1.1  | 0.91 | 0.15 | 2.3 |
| L   | 1211 | 21.0 | 36.08  | 25.32  | 0.3 | 0.6  | 0.74 | 0.07 | 1.2 |
| M   | 1216 | 21.0 | 36.08  | 25.32  | 0.1 | 2.6  | 0.41 | 0.11 | 0.6 |
| N   | 1058 | 20.5 | 36.06  | 25.44  | 0.8 | 1.3  | 0.32 | 0.15 | 0.4 |
| O   | 1223 | 20.9 | 36.05  | 25.32  | 0.0 | 0.9  | 0.32 | 0.03 | 0.3 |
| P   | 1226 | 21.0 | 36.01  | 25.26  | 0.1 | 1.2  | 0.41 | 0.06 |     |
| Q   | 1231 | 21.6 | 35.85  | 24.98  | 0.2 | 2.7  | 0.40 | 0.06 |     |
| S   | 1120 | 21.4 | 36.08  | 25.21  | 0.3 | 1.0  | 0.61 | 0.09 | 0.3 |
| U   | 0920 | 20.9 | 36.08  | 25.35  | 0.3 | 1.4  | 1.05 | 0.17 | 1.9 |
| V   | 0926 | 21.2 | 36.08  | 25.26  | 0.2 | 1.2  | 0.79 | 0.12 | 0.7 |
| X   | 1025 | 20.8 | 35.92  | 25.25  | 0.1 | 1.0  | 0.36 | 0.05 | 0.3 |
| W   | 0958 | 21.0 | 36.02  | 25.27  | 0.8 | 1.7  | 0.40 | 0.09 | 0.4 |

SUMMARY OF SURFACE DATA FOR SURVEY 22 / 12 / 80  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 20    | 21.0   | 0.2   | 20.5  | 21.4  |
| SALINITY    | 20    | 36.038 | 0.054 | 35.91 | 36.10 |
| NITRATE     | 20    | 0.3    | 0.3   | 0.0   | 0.9   |
| SILICATE    | 20    | 1.3    | 0.5   | 0.6   | 2.6   |
| PHOSPHATE   | 20    | 0.54   | 0.23  | 0.27  | 1.05  |
| NITRITE     | 20    | 0.09   | 0.04  | 0.03  | 0.17  |
| D.O.P.      | 19    | 0.7    | 0.6   | 0.2   | 2.3   |

Present Conditions: Sky clear, light to moderate SW breeze.

Previous Conditions: Not recorded.

Water Quality: Inshore water in northern area light green and turbid, in southern area water clear; offshore water blue-green.

## COASTAL SURVEY ON 5 / 2 / 81

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 1015 | 21.7 | 36.54  | 25.47  | 0.6 | 0.7  | 1.35 | 0.13 | 2.7 |
| 9   | 1015 | 22.1 | 36.60  | 25.41  | 0.3 | 0.2  | 0.64 | 0.01 | 1.3 |
| B   | 1037 | 21.5 | 36.44  | 25.45  | 0.4 | 0.3  | 0.50 | 0.01 | 1.9 |
| C   | 1044 | 21.3 | 36.24  | 25.36  | 0.2 | 0.9  | 0.18 | 0.13 | 0.1 |
| D   | 1049 | 21.2 | 36.15  | 25.32  | 0.9 | 1.0  | 0.34 | 0.06 | 0.7 |
| E   | 1105 | 21.2 | 36.10  | 25.28  | 0.2 | 0.6  | 0.07 | 0.02 | 0.5 |
| 22  | 1105 | 21.3 | 36.14  | 25.28  | 0.2 | 1.0  | 0.05 | 0.11 | 1.3 |
| F   | 1123 | 21.3 | 36.11  | 25.26  | 0.2 | 0.8  | 0.22 | 0.01 | 4.8 |
| G   | 1255 | 21.8 | 36.42  | 25.36  | 0.4 | 0.3  | 0.82 | 0.09 | 3.5 |
| H   | 1235 | 22.1 | 36.42  | 25.27  | 0.1 | 0.1  | 0.25 | 0.01 | 0.3 |
| 10  | 1235 | 22.1 | 36.42  | 25.27  | 0.3 | 0.1  | 0.32 | 0.03 | 0.6 |
| I   | 1300 | 22.0 | 36.42  | 25.30  | 0.2 | 0.4  | 0.46 | 0.01 | 1.1 |
| J   | 1205 | 22.1 | 36.50  | 25.33  | 0.2 | 0.3  | 0.76 | 0.03 | 0.9 |
| L   | 1210 | 21.9 | 36.52  | 25.40  | 0.2 | 0.3  | 0.43 | 0.12 | 0.6 |
| M   | 1212 | 21.2 | 36.51  | 25.59  | 0.3 | 0.5  | 0.43 | 0.00 | 0.3 |
| N   | 1149 | 21.9 | 36.52  | 25.40  | 0.3 | 0.3  | 0.53 | 0.03 | 0.7 |
| O   | 1214 | 21.4 | 36.46  | 25.50  | 0.2 | 0.2  | 0.18 | 0.01 | 0.8 |
| P   | 1220 | 21.7 | 36.50  | 25.44  | 0.2 | 1.5  | 0.46 | 0.01 | 0.1 |
| Q   | 1224 | 22.4 | 36.45  | 25.21  | 0.3 | 1.2  | 0.64 | 0.03 | 0.5 |
| S   | 1248 | 21.9 | 36.42  | 25.33  | 0.6 | 0.3  | 0.41 | 0.01 | 2.0 |
| U   | 1025 | 21.6 | 36.54  | 25.50  | 0.6 | 0.1  | 0.96 | 0.03 | 1.6 |
| V   | 1032 | 21.5 | 36.52  | 25.51  | 0.5 | 0.3  | 0.89 | 0.05 | 1.7 |
| X   | 1115 | 21.3 | 36.12  | 25.27  | 0.7 | 0.8  | 0.23 | 0.01 | 3.8 |
| W   | 1055 | 21.0 | 36.09  | 25.33  | 0.3 | 1.0  | 0.11 | 0.03 | 0.3 |

SUMMARY OF SURFACE DATA FOR SURVEY 5 / 2 / 81  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 20    | 21.6   | 0.3   | 21.0  | 22.1  |
| SALINITY    | 20    | 36.377 | 0.170 | 36.09 | 36.54 |
| NITRATE     | 20    | 0.4    | 0.2   | 0.1   | 0.9   |
| SILICATE    | 20    | 0.5    | 0.4   | 0.1   | 1.5   |
| PHOSPHATE   | 20    | 0.48   | 0.33  | 0.07  | 1.35  |
| NITRITE     | 20    | 0.04   | 0.04  | 0.00  | 0.13  |
| D.O.P.      | 20    | 1.4    | 1.3   | 0.1   | 4.8   |

Present Conditions: Sky clear; strong E breeze; slight sea; moderate swell.

Previous Conditions: Sky clear; hot, morning E breeze, afternoon SW seabreeze.

Water Quality: Water dark blue and clear inshore and offshore.

COASTAL SURVEY ON 26 / 3 / 81

| STN | TIME | TEMP | SALNTY | SIGMAT | NO3 | SI02 | P04  | NO2  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0944 | 21.5 | 36.28  | 25.33  | 0.2 | 2.4  | 0.30 | 0.14 | 0.1 |
| 9   | 0944 | 21.4 | 36.28  | 25.36  | 0.3 | 2.3  | 0.10 | 0.14 | 0.3 |
| B   | 1006 | 21.6 | 36.28  | 25.30  | 0.6 | 4.0  | 0.76 | 0.12 | 2.0 |
| C   | 1014 | 21.5 | 36.27  | 25.32  | 0.5 | 2.7  | 0.61 | 0.10 | 2.1 |
| D   | 1023 | 21.6 | 36.07  | 25.14  | 0.4 | 2.6  | 0.20 | 0.06 | 0.1 |
| E   | 1045 | 21.7 | 35.92  | 25.00  | 0.2 | 2.7  | 0.05 | 0.14 | 0.5 |
| 22  | 1045 | 21.8 | 36.01  | 25.04  | 0.3 | 2.6  | 0.05 | 0.18 | 0.4 |
| F   | 1103 | 22.0 | 35.93  | 24.93  | 0.3 | 2.5  | 0.05 | 0.08 | 0.2 |
| G   | 1156 | 22.2 | 36.29  | 25.14  | 0.3 | 2.2  | 0.30 | 0.16 | 0.1 |
| H   | 1215 | 22.3 | 36.57  | 25.33  | 0.2 | 2.0  | 0.51 | 0.12 | 0.1 |
| 10  | 1215 | 22.2 | 36.55  | 25.34  | 0.1 | 2.2  | 0.51 | 0.19 |     |
| I   | 1250 | 22.4 | 36.46  | 25.22  | 0.5 | 2.3  | 0.46 | 0.12 | 0.1 |
| J   | 1303 | 22.4 | 36.39  | 25.16  | 0.3 | 2.4  | 0.41 | 0.15 | 0.1 |
| L   | 1306 | 22.4 | 36.36  | 25.14  | 0.5 | 3.4  | 0.41 | 0.13 | 0.2 |
| M   | 1311 | 22.1 | 36.35  | 25.22  | 0.2 | 1.4  | 0.36 | 0.09 | 0.1 |
| N   | 1317 | 22.5 | 36.37  | 25.12  | 0.7 | 2.4  | 0.46 | 0.15 | 0.1 |
| O   | 1321 | 22.6 | 36.36  | 25.08  | 0.2 | 2.2  | 0.36 | 0.12 | 0.2 |
| P   | 1325 | 22.5 | 36.34  | 25.10  | 0.3 | 7.3  | 0.30 | 0.12 | 0.1 |
| Q   | 1328 | 23.1 | 36.23  | 24.84  | 0.5 | 3.6  | 0.41 | 0.14 | 0.2 |
| S   | 1149 | 22.2 | 36.02  | 24.94  | 0.3 | 2.6  | 0.15 | 0.11 | 0.3 |
| U   | 0955 | 21.5 | 36.30  | 25.35  | 0.3 | 2.4  | 0.30 | 0.11 | 0.3 |
| V   | 1000 | 21.4 | 36.26  | 25.34  | 0.7 | 2.6  | 0.30 | 0.15 | 0.2 |
| X   | 1056 | 21.9 | 35.93  | 24.95  | 0.2 | 2.5  | 0.10 | 0.11 | 1.3 |
| W   | 1038 | 21.8 | 36.01  | 25.04  | 0.6 | 2.7  | 0.46 | 0.12 | 2.2 |

SUMMARY OF SURFACE DATA FOR SURVEY 26 / 3 / 81  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN   | MAX   |
|-------------|-------|--------|-------|-------|-------|
| TEMPERATURE | 20    | 22.0   | 0.4   | 21.4  | 22.6  |
| SALINITY    | 20    | 36.238 | 0.190 | 35.92 | 36.57 |
| NITRATE     | 20    | 0.4    | 0.2   | 0.2   | 0.7   |
| SILICATE    | 20    | 2.7    | 1.2   | 1.4   | 7.3   |
| PHOSPHATE   | 20    | 0.34   | 0.18  | 0.05  | 0.76  |
| NITRITE     | 20    | 0.12   | 0.03  | 0.06  | 0.16  |
| D.O.P.      | 20    | 0.5    | 0.8   | 0.1   | 2.2   |

Present Conditions: Sky clear, light NE breeze; slight seas;  
low swell; S-SW surface set.

Previous Conditions: Clear skies, moderate E breezes at night  
and mornings and calm afternoons past 3 to  
4 days.

Water Quality: Water inshore blue-green and clear,  
offshore deep blue and clear;  
Trichodesmium bloom in early stages at Stn  
F; dense Trichodesmium bloom in windrow  
running N-S about 100 m outside Marmion  
Reef opposite Trigg.

## COASTAL SURVEY ON 6 / 5 / 81

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0900 | 20.2 | 35.816 | 25.33  | 0.2 | 1.5  | 0.44 | 0.03 | 0.4 |
| 9   | 0900 | 20.1 | 35.814 | 25.36  | 0.2 | 1.8  | 0.44 | 0.02 | 0.8 |
| B   | 0926 | 20.3 | 35.803 | 25.30  | 0.1 | 2.5  | 0.49 | 0.06 | 0.8 |
| C   | 0933 | 20.3 | 35.766 | 25.27  | 1.3 | 1.8  | 0.53 | 0.09 | 0.1 |
| D   | 0938 | 20.9 | 35.706 | 25.06  | 0.8 | 2.1  | 0.37 | 0.09 | 0.8 |
| E   | 0950 | 21.5 | 35.774 | 24.95  | 0.6 | 2.2  | 0.73 | 0.01 | 1.3 |
| 22  | 0950 | 21.2 | 35.772 | 25.03  | 0.5 | 1.7  | 0.62 | 0.02 | 0.5 |
| F   | 1004 | 21.5 | 35.792 | 24.96  | 0.4 | 2.0  | 0.44 | 0.06 | 0.6 |
| G   | 1104 | 20.5 | 35.819 | 25.25  | 0.5 | 1.3  | 0.38 | 0.02 | 0.6 |
| H   | 1111 | 20.7 | 35.804 | 25.19  | 0.2 | 1.8  | 0.62 | 0.02 | 1.5 |
| 10  | 1111 | 20.6 | 35.808 | 25.22  | 0.2 | 1.2  | 0.38 | 0.04 |     |
| I   | 1120 | 20.5 | 35.801 | 25.24  | 0.7 |      | 0.42 | 0.04 | 1.9 |
| J   | 1132 | 20.2 | 35.785 | 25.31  | 0.3 |      | 0.40 | 0.01 | 0.5 |
| L   | 1136 | 20.2 | 35.807 | 25.33  |     | 7.5  | 0.40 |      | 1.0 |
| M   | 1142 | 20.1 | 35.815 | 25.36  | 0.2 | 5.3  | 0.42 | 0.02 | 1.4 |
| N   | 1148 | 20.6 | 35.777 | 25.20  | 1.6 | 2.1  | 0.57 | 0.08 | 0.3 |
| O   | 1153 | 20.2 | 35.796 | 25.32  | 1.5 | 3.5  | 0.51 | 0.07 | 0.9 |
| P   | 1156 | 19.6 | 35.736 | 25.43  | 0.1 | 3.1  | 0.44 |      | 0.7 |
| Q   | 1200 | 19.2 | 35.517 | 25.37  | 0.5 | 4.2  | 0.90 | 0.02 | 2.2 |
| S   | 1100 | 20.8 | 35.756 | 25.13  | 1.4 | 2.6  | 0.73 | 0.08 | 4.5 |
| U   | 0915 | 20.3 | 35.781 | 25.28  | 0.5 | 2.5  | 1.43 | 0.04 | 4.2 |
| V   | 0921 | 20.4 | 35.764 | 25.24  | 1.5 | 1.8  | 0.42 | 0.08 | 1.1 |
| X   | 1000 | 21.5 | 35.780 | 24.95  | 0.6 |      | 0.40 | 0.11 | 0.6 |
| W   | 0943 | 21.2 | 35.730 | 25.00  | 0.4 | 2.0  | 0.33 | 0.04 |     |
| PA  | 1205 | 20.2 | 35.812 | 25.33  | 0.4 |      |      | 0.03 |     |
| PU  | 1209 | 20.1 | 35.804 | 25.35  | 0.5 |      |      | 0.02 |     |
| A   | 1215 | 20.4 | 35.792 | 25.26  |     | 1.8  | 0.64 |      | 2.0 |
| 9   | 1215 | 20.2 | 35.814 | 25.33  |     | 2.6  | 0.57 |      | 0.8 |

SUMMARY OF SURFACE DATA FOR SURVEY 6 / 5 / 81  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN    | MAX    |
|-------------|-------|--------|-------|--------|--------|
| TEMPERATURE | 21    | 20.6   | 0.5   | 19.6   | 21.5   |
| SALINITY    | 21    | 35.781 | 0.030 | 35.706 | 35.819 |
| NITRATE     | 19    | 0.7    | 0.5   | 0.1    | 1.6    |
| SILICATE    | 18    | 2.6    | 1.5   | 1.3    | 7.5    |
| PHOSPHATE   | 21    | 0.53   | 0.24  | 0.33   | 1.43   |
| NITRITE     | 18    | 0.05   | 0.03  | 0.01   | 0.11   |
| D.O.P.      | 20    | 1.3    | 1.2   | 0.1    | 4.5    |

Present Conditions: Sky clear; moderate E breeze, fresher offshore; sea slight inshore, moderate sea offshore; low swell inshore, moderate swell offshore; northerly set.

Previous Conditions: Clear skies, light to moderate SE to E breezes.

Water Quality: Water inshore green, slightly turbid with an abundance of visible particulates; offshore water dark green, slightly turbid with visible particulates, except station S where water blue and clear.

## COASTAL SURVEY ON 4 / 6 / 81

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0903 | 16.3 | 35.460 | 26.03  | 2.5 | 8.4  | 0.56 | 0.20 | 0.5 |
| 9   | 0903 | 16.1 | 35.450 | 26.07  | 2.1 | 7.3  | 0.58 | 0.19 | 0.4 |
| B   | 0931 | 16.5 | 35.403 | 25.94  | 1.8 | 2.3  | 0.58 | 0.19 | 0.6 |
| C   | 0937 | 16.6 | 35.459 | 25.96  | 1.8 | 2.0  | 0.51 | 0.11 | 0.8 |
| D   | 0942 | 17.5 | 35.480 | 25.76  | 1.8 | 2.1  | 0.78 | 0.12 | 3.8 |
| E   | 0955 | 18.6 | 35.506 | 25.51  | 0.8 | 3.2  | 0.51 | 0.10 | 0.9 |
| 22  | 0955 | 17.6 | 35.460 | 25.72  | 1.5 | 1.8  | 0.47 | 0.19 | 0.4 |
| F   | 1010 | 19.0 | 35.497 | 25.40  | 0.4 | 3.1  | 0.58 | 0.04 | 1.0 |
| G   | 1052 | 17.3 | 35.516 | 25.84  | 1.1 | 2.6  | 0.51 | 0.09 | 1.1 |
| H   | 1105 | 17.2 | 35.530 | 25.87  | 1.3 | 2.1  | 1.02 | 0.11 | 4.6 |
| 10  | 1105 | 17.1 | 35.520 | 25.89  | 1.5 | 2.0  | 0.33 | 0.09 | 3.5 |
| I   | 1115 | 17.5 | 35.523 | 25.80  | 0.7 | 1.8  | 0.33 | 0.09 | 1.1 |
| J   | 1141 | 17.5 | 35.537 | 25.81  | 1.3 | 2.8  | 0.49 | 0.12 | 0.5 |
| L   | 1146 | 17.2 | 35.492 | 25.85  | 1.5 | 2.5  | 0.47 | 0.15 | 1.2 |
| M   | 1152 | 17.3 | 35.483 | 25.81  | 1.8 |      | 0.47 | 0.14 | 0.6 |
| N   | 1201 | 17.2 | 35.484 | 25.84  | 2.4 | 3.5  | 1.93 | 0.20 | 1.0 |
| O   | 1206 | 17.3 | 35.478 | 25.81  | 2.8 | 4.5  | 1.02 | 0.18 | 3.2 |
| P   | 1212 | 17.3 | 35.496 | 25.82  | 2.3 | 1.9  | 0.96 | 0.14 |     |
| Q   | 1215 | 16.9 | 35.347 | 25.81  | 1.5 | 2.9  | 0.76 | 0.15 | 1.0 |
| S   | 1058 | 17.3 | 35.522 | 25.84  | 1.4 | 3.4  | 0.71 | 0.22 | 2.6 |
| U   | 0916 | 16.2 | 35.405 | 26.01  | 2.5 | 7.2  | 0.69 | 0.24 | 0.6 |
| V   | 0925 | 16.6 | 35.441 | 25.95  | 1.6 | 2.4  | 0.51 | 0.17 | 0.5 |
| X   | 1005 | 18.8 | 35.500 | 25.46  | 0.6 |      | 0.36 | 0.16 | 1.7 |
| W   | 0948 | 17.6 | 35.494 | 25.75  | 1.8 | 2.6  | 0.51 | 0.15 | 0.5 |
| PA  | 1220 | 17.2 | 35.491 | 25.84  | 1.5 | 1.8  | 0.33 | 0.08 | 0.6 |
| PU  | 1224 | 16.9 | 35.483 | 25.91  | 1.7 | 7.5  | 0.42 | 0.10 | 0.7 |
| A   | 1228 | 16.2 | 35.323 | 25.95  | 1.9 | 1.7  | 0.38 | 0.31 | 0.8 |

SUMMARY OF SURFACE DATA FOR SURVEY 4 / 6 / 81  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN    | MAX    |
|-------------|-------|--------|-------|--------|--------|
| TEMPERATURE | 21    | 17.3   | 0.8   | 16.2   | 19.0   |
| SALINITY    | 21    | 35.478 | 0.051 | 35.323 | 35.537 |
| NITRATE     | 21    | 1.6    | 0.7   | 0.4    | 2.8    |
| SILICATE    | 19    | 3.2    | 1.8   | 1.7    | 8.4    |
| PHOSPHATE   | 21    | 0.66   | 0.35  | 0.33   | 1.93   |
| NITRITE     | 21    | 0.15   | 0.06  | 0.04   | 0.31   |
| D.O.P.      | 20    | 1.4    | 1.2   | 0.5    | 4.6    |

Present Conditions: Sky 1/8 to 3/8 cloud but mostly sunny;  
light E breeze becoming moderate by 1000  
h; slight seas; moderate swell inshore,  
moderate to heavy offshore; southerly set.

Previous Conditions: Storm 2 days ago with strong W winds  
becoming SW, then decreasing yesterday.

Water Quality: Inshore water dark green and turbid in  
northern area, brownish-green and turbid  
inside Marmion Reef; fine particulates  
visible in all inshore areas; offshore  
water dark green and slightly turbid;  
occasional rafts and windrows of detached  
seagrass in northern inshore areas.

## COASTAL SURVEY ON 16 / 7 / 81

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0858 | 17.5 | 35.465 | 25.75  | 1.3 | 2.0  | 0.48 | 0.04 | 0.6 |
| 9   | 0858 | 17.2 | 35.472 | 25.83  | 1.1 | 2.1  | 0.31 | 0.10 | 5.9 |
| B   | 0925 | 17.6 | 35.456 | 25.72  | 1.3 | 2.2  | 0.31 | 0.06 | 2.9 |
| C   | 0934 | 17.5 | 35.464 | 25.75  | 1.1 | 2.6  | 0.37 | 0.05 | 0.7 |
| D   | 0941 | 17.6 | 35.480 | 25.74  | 1.7 | 2.3  | 0.34 | 0.04 | 1.3 |
| E   | 0953 | 19.3 | 35.446 | 25.29  | 0.3 | 2.9  | 0.31 | 0.01 | 6.9 |
| 22  | 0953 | 18.8 | 35.446 | 25.41  | 0.4 | 2.9  | 0.66 | 0.02 | 0.4 |
| F   | 1012 | 20.0 | 35.420 | 25.08  | 0.2 | 5.9  | 0.24 | 0.02 | 0.4 |
| G   | 1049 | 18.0 | 35.496 | 25.65  | 0.9 | 3.0  | 0.30 | 0.03 | 0.4 |
| H   | 1112 | 17.8 | 35.485 | 25.69  | 1.0 | 3.4  | 0.47 | 0.07 | 1.1 |
| 10  | 1112 | 17.2 | 35.452 | 25.81  | 1.1 | 3.5  | 0.34 | 0.07 | 0.9 |
| I   | 1119 | 17.5 | 35.493 | 25.77  | 1.0 | 2.2  | 0.85 | 0.05 | 0.6 |
| J   | 1136 | 18.1 | 35.471 | 25.61  | 1.6 | 2.9  | 0.35 | 0.07 | 0.3 |
| L   | 1152 | 17.5 | 35.474 | 25.76  | 2.6 | 4.7  |      | 0.08 | 3.7 |
| M   | 1156 | 17.6 | 35.475 | 25.74  | 1.8 | 2.0  | 0.53 | 0.06 | 0.4 |
| N   | 1210 | 18.0 | 35.483 | 25.64  | 2.2 | 2.6  | 0.50 | 0.08 | 0.7 |
| O   | 1213 | 17.8 | 35.476 | 25.69  | 2.2 | 2.7  | 0.97 | 0.08 | 3.0 |
| P   | 1216 | 17.4 | 35.476 | 25.78  | 1.4 | 2.4  | 1.00 | 0.05 | 3.3 |
| Q   | 1220 | 17.1 | 35.265 | 25.69  | 0.5 | 4.5  | 1.35 | 0.05 | 0.6 |
| S   | 1100 | 18.3 | 35.490 | 25.57  | 0.7 | 2.3  | 0.27 | 0.01 | 0.4 |
| U   | 0913 | 17.5 | 35.455 | 25.74  | 1.4 | 2.4  | 0.80 | 0.06 | 2.5 |
| V   | 0920 | 17.5 | 35.466 | 25.75  | 1.2 | 2.6  | 0.38 | 0.05 | 7.8 |
| X   | 1004 | 19.8 | 35.426 | 25.14  | 0.5 | 3.5  | 0.38 | 0.01 | 1.9 |
| W   | 0947 | 18.3 | 35.473 | 25.56  | 2.2 | 2.8  | 0.36 | 0.07 | 0.4 |
| PA  | 1228 | 17.4 | 35.455 | 25.77  | 1.0 | 3.9  | 0.83 | 0.05 | 1.0 |
| PU  | 1236 | 17.6 | 35.461 | 25.72  | 0.7 | 3.1  | 0.84 | 0.04 | 1.1 |
| A   | 1250 |      | 35.464 |        | 1.0 | 2.2  | 0.34 | 0.05 | 0.5 |

SUMMARY OF SURFACE DATA FOR SURVEY 16 / 7 / 81  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN    | MAX    |
|-------------|-------|--------|-------|--------|--------|
| TEMPERATURE | 20    | 18.0   | 0.8   | 17.4   | 20.0   |
| SALINITY    | 21    | 35.468 | 0.020 | 35.420 | 35.496 |
| NITRATE     | 21    | 1.3    | 0.6   | 0.2    | 2.6    |
| SILICATE    | 21    | 2.8    | 0.9   | 2.0    | 5.9    |
| PHOSPHATE   | 20    | 0.48   | 0.23  | 0.24   | 1.00   |
| NITRITE     | 21    | 0.05   | 0.02  | 0.01   | 0.08   |
| D.O.P.      | 21    | 1.9    | 2.1   | 0.3    | 7.8    |

Present Conditions: 7/8 to 8/8 cloud; fresh N-NW breeze;  
moderate seas; moderate swell.

Previous Conditions: Cloudy, moderate W-SW breezes in northern  
area.

Water Quality: Inshore water blue-green, slightly turbid  
inside Marmion Reef; offshore water dark  
blue, clear.

## COASTAL SURVEY ON 1 / 9 / 81

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0915 | 15.7 | 35.045 | 25.85  | 0.2 | 1.1  | 0.46 | 0.17 | 0.2 |
| 9   | 0915 | 15.9 | 35.044 | 25.81  | 0.2 | 0.4  | 0.28 | 0.17 | 0.4 |
| B   | 0930 | 16.0 | 35.176 | 25.88  | 0.9 | 1.9  | 0.33 | 0.39 | 0.5 |
| C   | 0936 | 15.9 | 35.075 | 25.83  | 1.0 | 1.8  | 1.53 | 0.21 | 3.0 |
| D   | 0941 | 16.4 | 35.258 | 25.85  |     | 1.6  | 0.38 |      | 0.4 |
| E   | 0954 | 17.1 | 35.358 | 25.77  | 0.1 | 1.0  | 0.23 | 0.17 | 0.3 |
| 22  | 0954 | 16.9 | 35.352 | 25.81  | 0.2 | 1.2  | 0.59 | 0.13 | 0.3 |
| F   | 1008 | 17.2 | 35.424 | 25.79  | 0.7 | 4.4  | 0.69 | 0.12 | 4.8 |
| G   | 1056 | 16.7 | 35.197 | 25.74  | 0.2 | 1.4  | 0.22 | 0.17 | 0.7 |
| H   | 1101 | 16.4 | 35.042 | 25.69  | 0.2 | 0.6  | 0.28 | 0.17 | 0.3 |
| 10  | 1101 | 16.2 | 35.046 | 25.74  | 0.1 | 1.3  | 0.43 | 0.23 | 0.3 |
| I   | 1108 | 16.5 | 35.056 | 25.68  | 0.2 | 1.6  | 0.37 | 0.18 | 0.2 |
| J   | 1116 | 16.0 | 34.934 | 25.70  | 0.1 | 0.8  | 0.24 | 0.18 | 0.3 |
| L   | 1127 | 15.9 | 34.949 | 25.73  | 0.7 | 0.9  | 0.79 | 0.12 | 3.1 |
| M   | 1132 | 15.9 | 34.970 | 25.75  | 0.3 | 1.2  | 0.37 | 0.13 | 0.4 |
| N   | 1136 | 15.9 | 35.051 | 25.81  | 0.7 | 0.9  | 0.30 | 0.17 | 0.2 |
| O   | 1140 | 15.9 | 34.978 | 25.75  | 0.1 | 0.8  | 0.41 | 0.17 | 0.4 |
| P   | 1143 | 15.8 | 34.891 | 25.71  | 1.0 | 2.1  | 0.22 | 0.22 | 0.3 |
| Q   | 1148 | 16.7 | 34.733 | 25.38  | 1.9 | 2.8  | 0.74 | 0.24 | 0.6 |
| S   | 1053 | 16.7 | 35.191 | 25.73  | 0.1 | 1.6  | 0.38 | 0.13 | 2.7 |
| U   | 0923 | 16.0 | 35.096 | 25.82  | 0.2 | 1.7  | 0.75 | 0.52 | 0.2 |
| V   | 0927 | 16.0 | 35.101 | 25.83  | 0.7 | 2.0  | 0.60 | 0.20 | 0.4 |
| X   | 1003 | 17.1 | 35.388 | 25.79  | 0.1 | 1.3  | 0.19 | 0.17 | 0.3 |
| W   | 0949 | 16.7 | 35.302 | 25.82  | 0.5 | 1.2  | 0.37 | 0.23 | 0.2 |
| PA  | 1154 | 16.0 | 34.936 | 25.70  | 0.7 | 2.5  | 0.70 | 0.18 | 2.7 |
| PU  | 1157 | 16.2 | 35.089 | 25.77  | 0.1 | 2.2  | 0.25 | 0.14 | 0.4 |
| A   | 1203 | 16.2 | 35.036 | 25.73  | 0.6 | 1.7  | 0.69 | 0.12 | 0.3 |

SUMMARY OF SURFACE DATA FOR SURVEY 1 / 9 / 81  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN    | MAX    |
|-------------|-------|--------|-------|--------|--------|
| TEMPERATURE | 21    | 16.3   | 0.5   | 15.7   | 17.2   |
| SALINITY    | 21    | 35.120 | 0.154 | 34.891 | 35.424 |
| NITRATE     | 20    | 0.4    | 0.3   | 0.1    | 1.0    |
| SILICATE    | 21    | 1.5    | 0.8   | 0.6    | 4.4    |
| PHOSPHATE   | 21    | 0.47   | 0.31  | 0.19   | 1.53   |
| NITRITE     | 20    | 0.20   | 0.10  | 0.12   | 0.52   |
| D.O.P.      | 21    | 0.9    | 1.3   | 0.2    | 4.8    |

Present Conditions: Sky clear; light SW breeze becoming moderate by 1130 h; calm sea becoming slight by 1130 h; low swell inshore, moderate swell offshore.

Previous Conditions: Clear skies, light winds.

Water Quality: Water inshore green and slightly turbid; offshore dark blue-green and clear with visible fine particulates.



## COASTAL SURVEY ON 20 / 10 / 81

| STN | TIME | TEMP | SALNTY | SIGMAT | NO3 | SI02 | P04  | NO2  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0845 | 17.8 | 35.054 | 25.36  | 0.5 | 1.8  | 0.64 | 0.07 | 0.9 |
| 9   | 0845 | 18.0 | 35.130 | 25.37  | 0.4 | 1.5  | 1.08 | 0.41 | 4.4 |
| B   | 0900 | 18.0 | 35.159 | 25.39  | 0.5 | 1.5  | 0.68 | 0.11 | 0.2 |
| C   | 0905 | 17.8 | 35.156 | 25.44  | 0.4 | 1.7  | 1.17 | 0.14 | 0.2 |
| D   | 0912 | 17.9 | 35.236 | 25.48  | 0.6 | 1.7  | 0.95 | 0.09 | 0.9 |
| E   | 0924 | 17.9 | 35.293 | 25.52  | 0.8 | 1.7  | 0.81 | 0.12 | 0.3 |
| 22  | 0924 | 17.8 | 35.282 | 25.54  | 0.2 | 1.3  | 0.64 | 0.09 | 0.3 |
| F   | 0937 | 18.1 | 35.353 | 25.52  | 0.1 | 1.4  | 0.58 | 0.08 | 0.3 |
| G   | 1029 | 18.3 | 35.057 | 25.24  | 0.4 | 1.6  | 1.36 | 0.07 | 3.3 |
| H   | 1045 | 18.4 | 35.072 | 25.23  | 0.6 | 1.7  | 0.86 | 0.07 | 0.5 |
| 10  | 1045 | 18.1 | 35.117 | 25.34  | 0.2 | 1.7  | 0.80 | 0.09 | 3.6 |
| I   | 1106 | 18.8 | 35.093 | 25.14  | 0.3 | 1.3  | 0.75 | 0.10 | 0.3 |
| J   | 1119 | 18.4 | 35.117 | 25.26  | 0.3 | 1.2  | 0.64 | 0.06 | 0.5 |
| L   | 1123 | 18.5 | 34.982 | 25.14  | 0.2 | 1.9  | 0.63 | 0.07 | 0.7 |
| M   | 1125 | 18.5 | 35.028 | 25.17  |     | 1.4  | 1.29 | 0.11 | 3.0 |
| N   | 1131 | 18.2 | 35.180 | 25.36  | 0.6 | 1.1  | 0.78 | 0.18 | 1.4 |
| O   | 1135 | 18.4 | 35.039 | 25.20  | 0.3 | 1.5  | 0.69 | 0.06 | 0.5 |
| P   | 1139 | 18.3 | 35.000 | 25.20  | 0.6 | 1.8  | 0.69 | 0.07 | 0.3 |
| Q   | 1144 | 18.7 | 35.004 | 25.10  | 0.2 | 1.6  | 0.64 | 0.06 | 0.7 |
| S   | 1037 | 18.5 | 35.122 | 25.24  | 0.2 | 1.3  | 0.63 | 0.11 | 0.5 |
| U   | 0851 | 17.7 | 35.102 | 25.42  | 0.3 | 1.6  | 0.69 | 0.14 | 0.5 |
| V   | 0855 | 17.8 | 35.142 | 25.43  | 0.3 | 2.3  | 0.95 | 0.14 | 0.5 |
| X   | 0933 | 18.0 | 35.332 | 25.53  | 0.4 | 1.4  | 0.84 | 0.05 | 0.4 |
| W   | 0918 | 17.9 | 35.275 | 25.51  | 0.9 | 1.7  | 0.58 | 0.13 | 0.3 |
| PA  | 1150 | 18.7 | 35.067 | 25.15  | 0.2 | 1.6  | 0.68 | 0.10 | 4.0 |
| PU  | 1156 | 18.6 | 35.056 | 25.17  | 0.3 | 1.6  | 1.19 | 0.10 | 4.4 |
| A   | 1208 | 18.5 | 35.040 | 25.18  | 0.2 | 1.5  | 0.61 | 0.07 | 0.3 |
| 9   | 1208 | 18.2 | 35.169 | 25.35  | 0.4 | 1.6  | 1.22 | 0.14 | 2.2 |

SUMMARY OF SURFACE DATA FOR SURVEY 20 / 10 / 81  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN    | MAX    |
|-------------|-------|--------|-------|--------|--------|
| TEMPERATURE | 21    | 18.2   | 0.3   | 17.7   | 18.8   |
| SALINITY    | 21    | 35.135 | 0.109 | 34.982 | 35.353 |
| NITRATE     | 20    | 0.4    | 0.2   | 0.1    | 0.9    |
| SILICATE    | 21    | 1.6    | 0.3   | 1.1    | 2.3    |
| PHOSPHATE   | 21    | 0.80   | 0.23  | 0.58   | 1.36   |
| NITRITE     | 21    | 0.10   | 0.03  | 0.05   | 0.18   |
| D.O.P.      | 21    | 0.8    | 0.8   | 0.2    | 3.3    |

Present Conditions: Sky clear; moderate SW breeze at 0830 h becoming calm by 0930 h, then fresh SW breeze starting about 1130 h; slight seas; moderate swell.

Previous Conditions: Clear and warm, light E breeze at night and early SW seabreeze previous day; clear, warm, calm 2 days previous.

Water Quality: Water inshore green and moderately turbid; water offshore blue-green and moderately clear.

## COASTAL SURVEY ON 8 / 12 / 81

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0842 | 20.7 | 35.668 | 25.09  | 0.2 | 1.3  | 0.88 | 0.08 | 0.0 |
| 9   | 0842 | 21.0 | 35.674 | 25.01  | 0.5 | 1.2  | 0.72 | 0.07 | 0.6 |
| B   | 0857 | 20.5 | 35.722 | 25.18  | 0.6 | 1.9  | 1.16 | 0.12 | 2.9 |
| C   | 0903 | 20.6 | 35.638 | 25.09  | 0.4 | 1.1  | 1.00 | 0.10 | 0.3 |
| D   | 0910 | 20.5 | 35.658 | 25.13  | 2.4 | 1.5  | 1.12 | 0.12 | 2.7 |
| E   | 0919 | 20.4 | 35.654 | 25.16  | 0.7 | 2.0  | 0.65 | 0.10 | 0.3 |
| 22  | 0919 | 20.3 | 35.651 | 25.18  | 1.3 | 1.7  | 1.06 | 0.07 | 2.9 |
| F   | 0935 | 20.3 | 35.643 | 25.17  | 0.1 | 1.5  | 0.64 | 0.18 | 0.3 |
| G   | 1046 | 20.9 | 35.514 | 24.91  | 0.2 | 1.9  | 0.72 | 0.08 | 0.4 |
| H   | 1053 | 21.0 | 35.541 | 24.91  | 0.3 | 1.9  | 1.00 | 0.09 | 0.3 |
| 10  | 1053 | 21.0 | 35.573 | 24.93  | 0.1 | 2.5  | 0.98 | 0.30 | 0.1 |
| I   | 1103 | 21.0 | 35.522 | 24.89  | 0.8 | 1.7  | 1.08 | 0.10 | 0.4 |
| J   | 1112 | 21.4 | 35.546 | 24.80  | 0.3 | 0.3  | 0.83 | 0.10 | 0.4 |
| L   | 1117 | 21.4 | 35.492 | 24.76  | 0.2 | 0.8  | 1.02 | 0.34 | 0.4 |
| M   | 1119 | 21.6 | 35.458 | 24.68  | 0.5 | 0.9  | 1.29 | 0.06 | 0.7 |
| N   | 1123 | 21.0 | 35.610 | 24.96  | 1.9 | 1.3  | 2.44 | 0.14 | 2.3 |
| O   | 1128 | 21.3 | 35.522 | 24.81  | 0.2 | 2.3  | 0.81 | 0.07 | 0.1 |
| P   | 1132 | 21.4 | 35.494 | 24.76  | 0.5 | 1.1  | 0.88 | 0.09 | 0.4 |
| Q   | 1135 | 21.7 | 35.474 | 24.66  | 0.8 | 2.5  | 2.31 | 0.12 | 3.7 |
| S   | 1040 | 21.1 | 35.597 | 24.92  | 0.3 | 1.5  | 1.19 | 0.07 | 0.9 |
| U   | 0847 | 20.6 | 35.639 | 25.09  | 0.3 | 1.3  | 0.92 | 0.12 | 0.2 |
| V   | 0853 | 20.5 | 35.663 | 25.14  | 0.3 | 1.0  | 0.75 | 0.11 | 0.1 |
| X   | 0930 | 20.2 | 35.643 | 25.20  | 0.4 | 1.5  | 0.75 | 0.12 | 0.3 |
| W   | 0914 | 20.5 | 35.662 | 25.13  | 0.1 | 1.3  | 0.81 | 0.62 | 0.3 |
| PA  | 1140 | 21.2 | 35.565 | 24.87  | 0.5 | 0.6  | 0.80 | 0.09 | 0.1 |
| PU  | 1144 | 21.2 | 35.616 | 24.91  | 0.3 | 0.8  | 0.59 | 0.07 | 0.2 |
| A   | 1148 | 21.2 | 35.671 | 24.95  | 0.2 | 3.5  | 2.60 | 0.06 | 3.4 |
| 9   | 1148 | 20.9 | 35.671 | 25.03  | 0.1 | 1.2  | 0.94 | 0.09 | 0.4 |

SUMMARY OF SURFACE DATA FOR SURVEY 8 / 12 / 81  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN    | MAX    |
|-------------|-------|--------|-------|--------|--------|
| TEMPERATURE | 21    | 20.9   | 0.4   | 20.2   | 21.6   |
| SALINITY    | 21    | 35.598 | 0.076 | 35.458 | 35.722 |
| NITRATE     | 21    | 0.5    | 0.6   | 0.1    | 2.4    |
| SILICATE    | 21    | 1.5    | 0.7   | 0.3    | 3.5    |
| PHOSPHATE   | 21    | 1.07   | 0.51  | 0.64   | 2.60   |
| NITRITE     | 21    | 0.14   | 0.13  | 0.06   | 0.62   |
| D.O.P.      | 21    | 0.8    | 1.0   | 0.0    | 3.4    |

Present Conditions: Sky 1/8 cloud at 0845 h becoming 3/8 cloud by 1045 h; light to moderate E breeze; slight seas; low swell.

Previous Conditions: Partly cloudy, warm, light winds.

Water Quality: Water inshore blue-green, moderately clear in northern area; green, moderately clear in southern area; water offshore blue-green and clear; Trichodesmium bloom in early stages near Stn F.

## COASTAL SURVEY ON 27 / 1 / 82

| STN | TIME | TEMP | SALNTY | SIGMAT | NO3 | SI02 | P04  | NO2  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0900 | 21.9 | 36.053 | 25.05  | 0.1 | 2.3  | 1.16 | 0.16 | 1.2 |
| 9   | 0900 | 22.2 | 36.058 | 24.97  | 0.2 | 7.6  | 0.79 | 0.04 | 0.8 |
| B   | 0915 | 21.8 | 36.047 | 25.07  | 0.2 | 3.7  | 1.61 | 0.09 | 0.8 |
| C   | 0924 | 22.0 |        |        | 0.4 | 2.5  | 1.47 | 0.05 | 1.0 |
| D   | 0929 | 22.0 | 36.038 | 25.01  | 0.2 | 2.5  | 1.57 | 0.18 | 0.1 |
| E   | 0941 | 21.6 | 35.954 | 25.06  | 0.3 | 3.1  | 1.20 | 0.10 | 4.6 |
| 22  | 0941 | 21.4 | 35.942 | 25.10  | 0.2 | 1.7  | 0.40 | 0.11 | 0.8 |
| F   | 0956 | 22.0 | 35.934 | 24.93  | 0.1 | 2.5  | 0.61 | 0.06 | 0.7 |
| G   | 1035 | 22.3 | 35.967 | 24.87  | 0.5 | 2.5  | 2.18 | 0.10 | 7.0 |
| H   | 1047 | 22.3 | 35.983 | 24.88  | 0.1 | 2.9  | 0.83 | 0.10 | 6.3 |
| 10  | 1047 | 22.0 | 35.972 | 24.96  | 0.1 | 1.7  | 1.02 | 0.11 | 0.5 |
| I   | 1053 | 22.3 | 35.970 | 24.87  | 0.1 | 2.9  | 1.02 | 0.12 | 0.5 |
| J   | 1103 | 22.5 | 36.007 | 24.84  | 0.2 | 2.4  | 1.30 | 0.11 | 9.2 |
| L   | 1107 | 22.5 | 36.009 | 24.84  | 0.2 | 3.7  | 0.95 | 0.10 | 3.4 |
| M   | 1109 | 22.5 | 36.009 | 24.84  | 0.1 | 2.7  | 1.65 | 0.11 | 0.9 |
| N   | 1115 | 22.5 | 36.069 | 24.89  |     | 2.4  | 1.21 | 0.18 | 0.8 |
| O   | 1120 | 22.7 | 36.017 | 24.79  | 0.1 | 3.0  | 1.06 | 0.05 | 0.4 |
| P   | 1123 | 22.6 | 35.975 | 24.79  | 0.1 | 3.0  | 1.57 | 0.09 | 3.0 |
| Q   | 1127 | 23.0 | 35.947 | 24.65  | 0.1 | 6.1  | 1.16 | 0.12 | 0.8 |
| S   | 1041 | 22.2 | 35.950 | 24.88  | 0.3 | 2.8  | 1.07 | 0.11 | 4.9 |
| U   | 0907 | 22.0 | 36.023 | 25.00  | 0.5 | 3.0  | 1.79 | 0.10 | 5.3 |
| V   | 0910 | 21.9 | 36.054 | 25.05  | 0.1 | 2.9  | 1.06 | 0.18 | 1.7 |
| X   | 0951 | 21.9 | 35.926 | 24.95  | 0.1 | 1.0  | 0.29 | 0.10 | 1.3 |
| W   | 0935 | 21.9 | 35.974 | 24.99  | 0.8 | 1.3  | 0.46 | 0.12 | 7.3 |
| PA  | 1131 | 22.7 | 36.001 | 24.78  | 0.3 | 2.8  | 1.92 | 0.04 | 1.1 |
| PU  | 1138 | 22.5 | 36.038 | 24.97  | 0.6 | 5.0  | 2.14 | 0.11 | 4.2 |
| A   | 1150 | 22.5 | 36.052 | 24.88  | 0.2 | 3.1  | 1.36 | 0.05 | 0.7 |
| 9   | 1150 | 22.2 | 36.050 | 24.96  | 0.2 | 2.7  | 1.07 | 0.12 | 1.3 |

SUMMARY OF SURFACE DATA FOR SURVEY 27 / 1 / 82  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN    | MAX    |
|-------------|-------|--------|-------|--------|--------|
| TEMPERATURE | 21    | 22.2   | 0.3   | 21.6   | 22.7   |
| SALINITY    | 20    | 36.001 | 0.043 | 35.926 | 36.069 |
| NITRATE     | 20    | 0.2    | 0.2   | 0.1    | 0.8    |
| SILICATE    | 21    | 2.7    | 0.6   | 1.0    | 3.7    |
| PHOSPHATE   | 21    | 1.21   | 0.45  | 0.29   | 2.18   |
| NITRITE     | 21    | 0.11   | 0.04  | 0.05   | 0.18   |
| D.O.P.      | 21    | 2.9    | 2.8   | 0.1    | 9.2    |

Present Conditions: Sky clear; fresh NE breeze becoming light by 0940 h, light to moderate SW seabreeze starting at 1045 h; slight seas; low swell; SW set at first changing abruptly to NW when seabreeze started.

Previous Conditions: Clear, hot, E breezes at night, SW seabreezes in afternoons previous 2 days; very high rainfall one week previous.

Water Quality: Water green and slightly turbid inshore, deep blue and clear offshore.

COASTAL SURVEY ON 17 / 2 / 82

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0855 | 20.9 | 35.841 | 25.16  | 0.2 | 2.1  | 0.45 | 0.10 | 0.5 |
| 9   | 0855 | 20.9 | 35.830 | 25.15  | 0.1 | 1.2  | 0.78 | 0.36 | 2.6 |
| C   | 0908 | 21.0 | 35.881 | 25.17  | 0.1 | 1.2  | 0.45 | 0.34 | 0.1 |
| D   | 0913 | 20.7 | 35.837 | 25.21  | 0.1 | 1.6  | 0.35 | 0.36 | 0.0 |
| E   | 0925 | 20.4 | 35.808 | 25.27  | 0.2 | 1.8  | 0.67 | 0.38 | 2.1 |
| 22  | 0925 | 20.0 | 35.780 | 25.36  | 0.2 | 1.7  | 0.21 | 0.08 | 0.3 |
| F   | 0941 | 20.1 | 35.794 | 25.34  | 0.1 | 2.4  | 0.17 | 0.12 | 0.2 |
| U   | 0905 | 20.9 | 35.823 | 25.15  | 0.2 | 1.4  | 0.66 | 0.09 | 0.3 |
| X   | 0936 | 20.3 | 35.798 | 25.29  | 0.1 | 1.8  | 0.17 | 0.08 | 0.2 |
| W   | 0919 | 20.5 | 35.812 | 25.25  | 0.4 | 1.7  | 0.28 | 0.28 | 0.1 |
| A   | 1030 | 21.1 | 35.843 | 25.11  | 0.2 | 1.3  | 0.34 | 0.06 | 0.1 |
| 9   | 1030 | 20.9 | 35.835 | 25.16  | 0.1 | 0.9  | 0.48 | 0.20 | 0.1 |

SUMMARY OF SURFACE DATA FOR SURVEY 17 / 2 / 82  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN    | MAX    |
|-------------|-------|--------|-------|--------|--------|
| TEMPERATURE | 9     | 20.7   | 0.3   | 20.1   | 21.1   |
| SALINITY    | 9     | 35.826 | 0.027 | 35.794 | 35.881 |
| NITRATE     | 9     | 0.2    | 0.1   | 0.1    | 0.4    |
| SILICATE    | 9     | 1.7    | 0.4   | 1.2    | 2.4    |
| PHOSPHATE   | 9     | 0.39   | 0.18  | 0.17   | 0.67   |
| NITRITE     | 9     | 0.20   | 0.14  | 0.06   | 0.38   |
| D.O.P.      | 9     | 0.4    | 0.7   | 0.0    | 2.1    |

Present Conditions: Sky clear; fresh S-SE breeze swinging S-SW by 0930 h; slight to moderate seas; low swell inshore, low to moderate swell offshore.

Previous Conditions: Clear, light S-SE breezes at night, SW seabreezes in afternoons.

Water Quality: Water inshore blue-green, moderately clear, and dark blue, clear offshore; small planktonic organisms visible in water at all stations.

## COASTAL SURVEY ON 18 / 3 / 82

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0858 | 21.1 | 36.183 | 25.37  | 0.1 | 1.5  | 0.97 | 0.10 |     |
| 9   | 0858 | 20.7 | 36.183 | 25.48  | 0.2 | 1.4  | 0.61 | 0.13 | 0.2 |
| B   | 0920 | 20.9 | 36.123 | 25.38  | 0.3 | 1.5  | 0.42 | 0.07 | 0.1 |
| C   | 0927 | 20.9 | 36.173 | 25.42  | 0.2 | 1.7  | 2.02 | 0.06 | 0.1 |
| D   | 0931 | 20.8 | 36.095 | 25.38  | 0.6 | 1.5  | 0.67 | 0.06 | 2.7 |
| E   | 0943 | 20.9 | 35.984 | 25.27  | 0.2 | 1.6  | 0.22 | 0.03 | 1.7 |
| 22  | 0943 | 20.9 | 35.984 | 25.27  | 0.2 | 1.3  | 0.14 | 0.03 | 0.2 |
| F   | 0957 | 21.0 | 35.998 | 25.26  | 0.2 | 1.1  | 0.22 | 0.03 | 0.3 |
| G   | 1048 | 21.1 | 36.126 | 25.33  | 0.3 | 1.4  | 0.24 | 0.29 | 0.1 |
| H   | 1100 | 21.3 | 36.109 | 25.26  | 0.2 | 1.5  | 0.36 | 0.04 | 0.1 |
| 10  | 1100 | 21.2 | 36.122 | 25.29  | 0.3 | 1.6  | 0.82 | 0.04 |     |
| I   | 1107 | 21.4 | 36.082 | 25.21  | 0.2 | 1.4  | 0.34 | 0.16 | 0.0 |
| J   | 1120 | 21.4 | 36.175 | 25.28  | 0.5 | 2.0  | 0.88 | 0.03 | 0.7 |
| L   | 1126 | 21.2 | 36.175 | 25.34  | 0.1 | 2.6  | 0.56 | 0.06 | 0.2 |
| M   | 1128 | 21.4 | 36.186 | 25.29  | 0.3 | 3.2  | 0.97 | 0.06 | 0.3 |
| N   | 1138 | 21.7 | 36.231 | 25.24  | 0.4 | 1.7  | 0.96 | 0.13 | 0.1 |
| O   | 1145 | 21.5 | 36.193 | 25.27  | 0.6 | 1.9  | 0.47 | 0.10 | 0.4 |
| P   | 1148 | 21.6 | 36.189 | 25.24  | 0.2 | 2.5  | 0.60 | 0.05 | 0.4 |
| Q   | 1152 | 21.8 | 36.038 | 25.06  | 0.3 | 3.8  | 0.67 | 0.05 | 0.4 |
| S   | 1054 | 21.1 | 36.064 | 25.28  | 0.3 | 1.1  | 0.32 | 0.07 | 0.2 |
| U   | 0913 | 20.9 | 36.173 | 25.42  | 0.2 | 1.3  | 0.70 | 0.11 | 0.1 |
| V   | 0916 | 21.0 | 36.168 | 25.38  | 0.1 | 1.3  | 0.68 | 0.18 | 0.2 |
| X   | 0952 | 20.9 | 35.987 | 25.27  | 0.1 | 1.2  | 0.21 | 0.04 | 0.1 |
| W   | 0937 | 21.0 | 36.031 | 25.28  | 0.9 | 1.9  | 0.26 | 0.13 | 0.2 |
| PA  | 1158 | 21.9 | 36.211 | 25.17  | 0.2 | 1.6  | 0.66 | 0.04 | 0.4 |
| PU  | 1201 | 21.6 | 36.192 | 25.24  | 0.4 | 1.8  | 0.61 | 0.09 | 0.1 |
| MA  | 1115 | 21.2 | 36.096 | 25.28  | 0.1 | 1.8  | 0.38 | 0.04 | 0.6 |
| A   | 1205 | 21.6 | 36.179 | 25.23  | 0.7 | 1.2  | 1.13 | 0.11 | 3.5 |
| 9   | 1205 | 21.4 | 36.187 | 25.29  | 0.2 | 2.2  | 0.73 | 0.04 | 0.2 |

## SUMMARY OF SURFACE DATA FOR SURVEY 18 / 3 / 82

(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN    | MAX    |
|-------------|-------|--------|-------|--------|--------|
| TEMPERATURE | 21    | 21.2   | 0.3   | 20.8   | 21.7   |
| SALINITY    | 21    | 36.125 | 0.075 | 35.984 | 36.231 |
| NITRATE     | 21    | 0.3    | 0.2   | 0.1    | 0.9    |
| SILICATE    | 21    | 1.7    | 0.5   | 1.1    | 3.2    |
| PHOSPHATE   | 21    | 0.63   | 0.43  | 0.21   | 2.02   |
| NITRITE     | 21    | 0.09   | 0.06  | 0.03   | 0.29   |
| D.O.P.      | 20    | 0.6    | 1.0   | 0.0    | 3.5    |

Present Conditions: Sky 3/8 cloud reducing to 1/8 cloud by 1100 h; fresh E breeze; slight seas inshore, moderate seas offshore; low swell.

Previous Conditions: Strong offshore breezes previous 4 to 5 days.

Water Quality: Inshore waters dark blue-green, clear with senescent plankton visible; offshore water dark blue, clear.

## COASTAL SURVEY ON 20 / 4 / 82

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02 | D0P |
|-----|------|------|--------|--------|-----|------|------|-----|-----|
| A   | 0900 | 20.3 | 36.098 | 25.52  | 0.2 | 3.2  | 0.39 |     | 0.3 |
| 9   | 0900 | 20.1 | 36.129 | 25.60  | 0.1 | 2.1  | 0.33 |     | 0.4 |
| B   | 0929 | 20.3 | 36.024 | 25.46  | 0.2 | 1.6  | 0.31 |     | 0.4 |
| C   | 0938 | 20.3 | 36.056 | 25.49  | 0.3 | 1.4  |      |     | 0.3 |
| D   | 0947 | 20.3 | 36.102 | 25.52  | 0.2 | 2.0  | 0.34 |     | 0.5 |
| E   | 1009 | 20.6 | 35.930 | 25.31  | 0.2 | 2.8  | 0.34 |     | 1.1 |
| 22  | 1009 | 20.3 | 36.033 | 25.47  | 0.2 | 3.2  | 0.28 |     | 0.3 |
| F   | 1025 | 20.6 | 35.914 | 25.30  | 0.2 | 1.7  | 0.30 |     | 1.4 |
| G   | 1126 | 21.0 | 35.813 | 25.11  | 0.1 | 2.1  | 0.28 |     | 0.3 |
| H   | 1135 | 20.9 | 35.833 | 25.16  | 0.2 | 1.9  | 0.26 |     | 0.3 |
| 10  | 1135 | 20.4 | 36.158 | 25.54  |     | 3.2  |      |     |     |
| I   | 1150 | 20.9 | 35.849 | 25.17  | 0.1 | 2.0  | 0.25 |     | 0.4 |
| J   | 1205 | 20.7 | 35.934 | 25.29  | 0.4 | 1.9  | 0.42 |     | 0.7 |
| L   | 1212 | 20.7 | 35.969 | 25.31  | 0.1 | 5.8  | 0.31 |     | 0.3 |
| M   | 1215 | 20.6 | 35.980 | 25.35  | 0.2 | 2.9  | 0.21 |     | 0.6 |
| N   | 1225 | 20.6 | 36.029 | 25.39  |     | 2.7  | 0.55 |     | 0.2 |
| O   | 1231 | 20.7 | 35.973 | 25.32  | 0.2 | 1.6  | 0.29 |     | 2.3 |
| P   | 1237 | 20.7 | 36.021 | 25.35  | 0.2 | 1.7  | 0.43 |     | 0.3 |
| Q   | 1241 | 21.3 | 35.894 | 25.09  | 0.3 | 2.4  | 0.43 |     |     |
| S   | 1120 | 21.0 | 35.817 | 25.12  | 0.2 | 2.1  | 0.33 |     | 0.3 |
| U   | 0918 | 20.2 | 36.052 | 25.51  | 0.2 | 1.3  | 0.63 |     | 1.1 |
| V   | 0924 | 20.3 | 36.000 | 25.45  | 0.5 | 3.3  | 0.34 |     | 0.2 |
| X   | 1017 | 20.5 | 35.920 | 25.33  | 0.1 | 2.6  | 0.37 |     | 0.2 |
| W   | 1000 | 20.4 | 35.966 | 25.39  | 0.3 | 1.7  | 0.31 |     | 0.4 |
| PA  | 1248 | 20.5 | 36.048 | 25.43  | 0.2 | 2.0  | 0.33 |     | 0.5 |
| PU  | 1256 | 20.3 | 36.062 | 25.49  | 0.6 | 1.0  | 0.67 |     | 1.3 |
| MA  | 1200 | 20.8 | 35.881 | 25.22  | 0.2 | 2.7  | 0.32 |     | 0.1 |
| A   | 1305 | 20.6 | 36.064 | 25.41  | 0.1 | 1.3  | 0.46 |     | 0.3 |
| 9   | 1305 | 20.2 | 36.110 | 25.56  | 0.2 |      | 0.54 |     | 0.2 |

SUMMARY OF SURFACE DATA FOR SURVEY 20 / 4 / 82  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN    | MAX    |
|-------------|-------|--------|-------|--------|--------|
| TEMPERATURE | 21    | 20.6   | 0.2   | 20.2   | 21.0   |
| SALINITY    | 21    | 35.969 | 0.089 | 35.813 | 36.102 |
| NITRATE     | 20    | 0.2    | 0.1   | 0.1    | 0.5    |
| SILICATE    | 21    | 2.3    | 1.0   | 1.3    | 5.8    |
| PHOSPHATE   | 20    | 0.36   | 0.10  | 0.21   | 0.63   |
| D.O.P.      | 21    | 0.6    | 0.5   | 0.2    | 2.3    |

Present Conditions: 7/8 cloud at first, clearing to 1/8 cloud by 1000 h; winds calm at first becoming light SW breeze by 1000 h; seas smooth becoming slight by 1130 h; low swell.

Previous Conditions: Clear, calm, low swell.

Water Quality: Water inshore dark green, clear; water offshore blue-green and very clear; windrow of detached seagrass near Stn D running NNE.

## COASTAL SURVEY ON 19 / 5 / 82

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0906 | 18.8 | 35.754 | 25.65  | 0.5 | 2.8  | 0.60 | 0.12 | 0.2 |
| 9   | 0906 | 18.9 | 35.750 | 25.62  | 0.4 | 2.7  | 0.50 | 0.13 | 0.3 |
| B   | 0926 | 18.5 | 35.709 | 25.69  | 0.6 | 2.5  | 0.56 | 0.39 | 0.1 |
| C   | 0934 | 19.1 | 35.704 | 25.53  | 1.3 | 2.4  | 0.37 | 0.14 | 0.3 |
| D   | 0941 | 19.4 | 35.688 | 25.45  | 1.5 | 2.7  | 0.48 | 0.13 | 0.2 |
| E   | 1000 | 20.1 | 35.637 | 25.22  | 0.4 | 2.5  | 0.28 | 0.08 | 0.3 |
| 22  | 1000 | 20.0 | 35.635 | 25.25  | 0.3 | 2.4  | 0.28 | 0.20 | 0.1 |
| F   | 1015 | 20.3 | 35.630 | 25.16  | 0.2 | 2.4  | 0.48 | 0.11 | 0.5 |
| G   | 1130 | 18.8 | 35.728 | 25.63  | 0.5 | 2.7  | 0.34 | 0.11 | 0.3 |
| H   | 1145 | 18.7 | 35.740 | 25.66  | 0.2 | 2.4  | 0.37 | 0.15 | 0.3 |
| 10  | 1145 | 18.7 | 35.744 | 25.67  | 0.8 | 2.7  | 1.02 | 0.22 |     |
| I   | 1157 | 19.0 | 35.735 | 25.58  | 0.5 | 2.4  | 0.35 | 0.15 | 0.3 |
| J   | 1210 | 19.1 | 35.714 | 25.54  | 0.1 | 2.2  | 0.34 | 0.12 | 0.4 |
| L   | 1215 | 18.8 | 35.733 | 25.63  | 0.4 | 2.2  | 0.33 | 0.03 | 0.2 |
| M   | 1219 | 18.9 | 35.731 | 25.61  | 0.0 | 2.3  | 0.30 | 0.22 | 0.6 |
| N   | 1226 | 19.3 | 35.701 | 25.48  | 2.0 | 2.4  | 0.98 | 0.14 | 0.4 |
| O   | 1230 | 18.8 | 35.720 | 25.62  | 0.2 | 2.2  | 0.49 | 0.18 | 0.1 |
| P   | 1233 | 18.2 | 35.734 | 25.79  | 0.7 | 2.9  | 0.52 | 0.10 | 0.3 |
| Q   | 1236 | 18.6 | 35.660 | 25.63  | 0.1 | 3.5  | 0.50 | 0.26 | 0.4 |
| S   | 1037 | 19.1 | 35.729 | 25.55  | 1.2 | 2.4  | 0.34 | 0.09 | 0.2 |
| U   | 0915 | 18.9 | 35.712 | 25.59  | 1.5 | 2.5  | 0.39 | 0.15 | 0.2 |
| V   | 0921 | 18.5 | 35.712 | 25.69  | 1.3 | 2.5  | 0.67 | 0.26 | 0.0 |
| X   | 1010 | 20.3 | 35.630 | 25.16  | 0.4 | 3.4  | 0.37 | 0.09 | 0.7 |
| W   | 0949 | 19.8 | 35.648 | 25.31  | 1.0 | 2.4  | 0.40 | 0.13 | 0.2 |
| PA  | 1245 | 18.2 | 35.739 | 25.79  | 0.3 | 2.2  | 0.31 | 0.09 | 0.2 |
| PU  | 1325 | 18.6 | 35.766 | 25.71  | 0.1 | 2.1  | 0.46 | 0.25 | 0.1 |
| MA  | 1204 | 19.1 | 35.725 | 25.55  | 0.6 | 3.4  | 0.48 | 0.05 | 1.4 |
| A   | 1340 | 18.5 | 35.755 | 25.73  | 0.4 | 2.5  | 0.46 |      | 0.3 |
| 9   | 1340 | 18.5 | 35.756 | 25.73  | 0.2 | 2.4  | 1.06 | 0.63 |     |

SUMMARY OF SURFACE DATA FOR SURVEY 19 / 5 / 82  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN    | MAX    |
|-------------|-------|--------|-------|--------|--------|
| TEMPERATURE | 21    | 19.1   | 0.6   | 18.2   | 20.3   |
| SALINITY    | 21    | 35.707 | 0.039 | 35.630 | 35.755 |
| NITRATE     | 21    | 0.7    | 0.6   | 0.0    | 2.0    |
| SILICATE    | 21    | 2.5    | 0.3   | 2.2    | 3.4    |
| PHOSPHATE   | 21    | 0.45   | 0.16  | 0.28   | 0.98   |
| NITRITE     | 20    | 0.14   | 0.08  | 0.03   | 0.39   |
| D.O.P.      | 21    | 0.3    | 0.2   | 0.0    | 0.7    |

Present Conditions: Sky clear; moderate SE breeze becoming E by 1145 h; moderate seas; low swell.

Previous Conditions: Clear with moderate E breezes.

Water Quality: Water inshore green, moderately turbid; water offshore dark green, moderately turbid.

## COASTAL SURVEY ON 22 / 6 / 82

| STN | TIME | TEMP | SALNTY | SIGMAT | N03 | SI02 | P04  | N02  | DOP |
|-----|------|------|--------|--------|-----|------|------|------|-----|
| A   | 0915 | 16.1 | 35.141 | 25.83  | 3.9 | 1.9  | 0.73 | 0.42 | 2.4 |
| 9   | 0915 | 15.9 | 35.141 | 25.88  | 3.9 | 1.9  | 0.87 | 0.71 | 0.7 |
| B   | 0934 | 16.7 | 35.228 | 25.76  | 2.1 | 1.9  | 0.52 | 0.63 | 0.5 |
| C   | 0940 | 16.8 | 35.264 | 25.77  | 2.7 | 2.2  | 0.72 | 0.44 | 0.4 |
| D   | 1000 | 17.2 | 35.300 | 25.70  | 3.3 | 2.2  | 0.67 | 0.35 | 0.7 |
| E   | 1018 | 18.2 | 35.337 | 25.48  | 1.5 | 2.0  | 0.82 | 0.26 | 1.0 |
| 22  | 1018 | 18.1 | 35.344 | 25.51  | 2.2 | 2.2  | 1.11 | 0.83 | 0.0 |
| F   | 1027 | 18.5 | 35.349 | 25.42  | 3.7 | 2.5  | 0.37 | 0.49 | 1.1 |
| G   | 1112 | 17.2 | 35.251 | 25.66  | 1.6 | 1.9  | 0.46 | 0.27 | 0.8 |
| H   | 1123 | 17.2 | 35.261 | 25.67  | 1.1 | 1.9  | 0.56 | 0.49 | 0.6 |
| 10  | 1123 | 17.1 | 35.264 | 25.69  | 1.2 | 1.9  | 0.43 | 0.32 | 1.1 |
| I   | 1130 | 16.9 | 35.172 | 25.67  | 1.6 | 2.3  | 0.44 | 0.26 | 0.4 |
| J   | 1143 | 17.3 | 35.364 | 25.72  | 1.8 | 2.0  | 0.41 | 0.51 | 0.6 |
| L   | 1151 | 17.2 | 35.357 | 25.74  | 1.9 | 2.1  | 0.55 | 0.28 | 1.0 |
| M   | 1155 | 17.2 | 35.357 | 25.74  | 2.1 | 2.1  | 0.56 | 0.30 | 1.3 |
| N   | 1204 | 17.5 | 35.328 | 25.65  | 3.2 | 2.3  | 0.63 | 0.29 | 0.7 |
| O   | 1208 | 17.3 | 35.332 | 25.70  | 2.7 | 2.2  | 0.49 | 0.54 | 0.7 |
| P   | 1212 | 16.9 | 35.297 | 25.77  | 1.4 | 2.3  | 0.54 | 0.41 | 0.6 |
| Q   | 1215 | 16.6 | 35.058 | 25.65  | 1.0 | 4.1  | 0.56 | 0.42 | 0.3 |
| S   | 1103 | 17.0 | 35.202 | 25.67  | 1.9 | 1.9  | 0.49 | 0.34 | 0.6 |
| U   | 0925 | 16.3 | 35.145 | 25.79  | 1.5 | 1.9  | 0.80 | 0.58 | 0.1 |
| V   | 0930 | 16.9 | 35.278 | 25.75  | 2.7 | 2.2  | 0.60 | 0.39 | 0.8 |
| X   | 1023 | 18.4 | 35.355 | 25.45  | 1.1 | 2.3  | 0.50 | 0.37 | 0.8 |
| W   | 1006 | 17.6 | 35.307 | 25.61  | 2.5 | 2.3  | 0.52 | 0.42 | 0.6 |
| PA  | 1225 | 16.2 | 35.142 | 25.81  | 2.3 | 2.2  | 1.07 | 0.45 | 0.2 |
| PU  | 1234 | 15.8 |        |        | 2.4 | 2.2  | 0.62 | 0.52 | 0.8 |
| MA  | 1137 | 16.6 | 35.202 | 25.76  | 1.4 | 2.3  | 0.49 | 0.25 | 0.5 |
| A   | 1243 | 16.4 | 35.196 | 25.81  | 1.6 | 1.9  | 0.47 | 0.44 | 0.9 |
| 9   | 1243 | 16.1 | 35.176 | 25.86  | 2.0 | 1.9  | 0.47 | 0.28 | 0.8 |

SUMMARY OF SURFACE DATA FOR SURVEY 22 / 6 / 82  
(omitting IL,MA,PA,PU,Q)

| PARAMETER   | N.OBS | MEAN   | STDEV | MIN    | MAX    |
|-------------|-------|--------|-------|--------|--------|
| TEMPERATURE | 21    | 17.2   | 0.6   | 16.1   | 18.5   |
| SALINITY    | 21    | 35.277 | 0.073 | 35.141 | 35.364 |
| NITRATE     | 21    | 2.2    | 0.8   | 1.1    | 3.9    |
| SILICATE    | 21    | 2.1    | 0.2   | 1.9    | 2.5    |
| PHOSPHATE   | 21    | 0.56   | 0.12  | 0.37   | 0.82   |
| NITRITE     | 21    | 0.40   | 0.11  | 0.26   | 0.63   |
| D.O.P.      | 21    | 0.8    | 0.5   | 0.1    | 2.4    |

Present Conditions: Sky clear; moderate N breeze; slight seas inshore, moderate seas offshore; low swell.

Previous Conditions: Clear, light winds 1 day previous; overcast, stormy winds, heavy rain 2-10 days previous.

Water Quality: Water dark green, moderately clear inshore and offshore, except turbid and dirty at Stn Q; rafts of Posidonia detritus in area of Stn F.



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