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Abstract

The ichthyoplankton catch data and hydrographic data collected on SO 1/87 in January–February 1987 on board FRV Soela are presented in this report. Our objective was to assess methods of estimating the abundance of southern bluefin tuna (*Thunnus maccoyii*) larvae on the spawning grounds in the eastern Indian Ocean. Sampling was designed to investigate the scale and intensity of patchiness, the extent to which tuna larvae go below the mixed layer, and their diel vertical distribution patterns in the mixed layer.

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Introduction

It is a general phenomenon that ichthyoplankton in the ocean are patchily distributed over a wide range of time and space scales (Haury et al. 1978). The schooling habit of the spawning adults imposes the primary pattern (Smith 1973; Smith and Hewitt 1985), which is subsequently modified by physical and biological processes in the ocean. These aggregated distribution patterns of fish larvae create statistical problems when estimating abundance.

Patchiness is a major source of sampling error. Computer models and field trials have shown that the size and distribution of patches greatly affect the magnitude of sampling error (Wiebe and Holland 1968; Wiebe 1971, 1972) through the interaction of the size of the sampling unit and the scale of patchiness. Assessment of the adequacy of sampling methods and designs is therefore a necessary prerequisite of any survey to estimate abundance.

Apart from ecological considerations, knowledge of the vertical distribution of ichthyoplankton is also critical for the correct assessment of their abundance. Sampling only part of the depth range of larvae will produce underestimates of abundance. Sampling far below the depth range is wasteful of time and resources. It also reduces sample size, so the resulting estimates of abundance will be more affected by the spatial distribution patterns of the larvae (Andrew and Mapstone 1987). As tuna larvae usually occur in low densities (Wade 1951; Strasburg 1960; Klawe 1963; Richards 1969; Richards and Simmons 1971; Conand and Richards 1982), sampling the correct depth range is critical.

The statistical problems of estimating the abundance of tuna larvae have not been investigated fully. Strasburg (1960) recognised that tuna larvae in the central Pacific Ocean are contagiously distributed and that little reliability could be placed on abundance estimates based on widely separated tows. There is also little information on the depth distribution of tuna larvae, although there is some evidence that tuna larvae occur mainly near the surface and are probably limited to the depth of the mixed layer (Strasburg 1960, Klawe 1963). Reports on the diel vertical movements of tuna larvae within the mixed layer are not conclusive either because few larvae were caught (Matsumoto 1958, Yukinawa 1987) or because differences in net avoidance between day and night were not resolved (Wade 1951, Richards and Simmons 1971).

Methods of estimating tuna larvae abundance were assessed on a cruise during January–February 1987 on board FRV *Soela* on the southern bluefin tuna (*Thunnus maccoyii*) spawning grounds in the eastern Indian Ocean. Our methods of estimating ichthyoplankton abundance were compared with those of the Fishery Agency of Japan (Davis et al. 1989). We investigated both the scale and intensity of patchiness in the horizontal distribution of larvae of southern bluefin tuna and other tuna species. We determined the minimum sampling depth to maximize catches and still cover the entire depth range of tuna larvae, and examined their diel vertical distribution patterns. This report presents a detailed listing of the ichthyoplankton catch data and hydrographic data collected during this cruise.

Methods

Description of nets

We used two types of nets: an Ocean Instruments 70 cm opening-closing bongo net and a 70 cm diameter ring net. The bongo net, rigged with a 22 kg Scripps cable depressor, was modified to take an electronically operated opening/closing system consisting of a Yeo-Kal Submersible Data Logger with standard depth and temperature sensors. The data logger also received signals from a General Oceanics electronic flowmeter mounted inside the net and had additional circuitry to drive solenoids that opened and closed the nets. The conventional messenger-release mechanism was replaced with solenoids mounted directly on the rims of the bongo net. Signals to and from the net were multiplexed to the ship via an armoured cable and displayed on deck using the graphic interface of an Apple Macintosh computer.

The ring net had a 70 cm diameter aluminium collar equivalent to one side of an Ocean Instruments 70 cm bongo net. A two-wire bridle mounted laterally on the collar, back from the mouth, enabled the net to be towed with little obstruction from the bridle. A 22 kg Scripps depressor was connected to the net by a second bridle mounted in the same way as the first. An electronic pressure sensor mounted on the bridle enabled the net to be guided by real-time depth data when deployed in oblique tows from the stern. When deployed at the surface, the ring net was towed from a boom on the port side amidships, clear of the wake of the vessel. It was towed approximately 0.5 m under the surface, oscillating between 0 and 2 m.

Both the bongo and ring nets were fitted with blue cylindrical-conical nets made of plain weave Estal monofilament with a mesh aperture of 0.5 mm and open area ratio of 5:1. All nets were fitted with a mechanical General Oceanics flowmeter, calibrated before sampling and mounted within the aluminium collar. All nets were towed at speeds of 1.0–1.3 m s^{-1}.

Treatment of samples

Samples were preserved in 95% ethanol, which was replaced within 12 hours of initial preservation. Tuna larvae were sorted from plankton samples in a rotatable sorting ring under a dissecting microscope with dark-field illumination, and identified to species using, in the main, the criteria of Nishikawa (1985). Plankton volume was measured by the displacement volume and settled volume methods (Smith and Richardson 1977).

Ichthyoplankton sampling strategy

Sampling was carried out in the southern part of the North Australia Basin, which has a bottom depth of approximately 5000 m. Two sites (1 and 2) were selected after trial plankton tows located significant numbers of *T. maccoyii* larvae (Fig. 1). To track the mixed layer (40–50 m), each site was marked by a satellite-tracked buoy with a parachute drogued at 20 m depth . Site 1 was selected on 14 January and marked with Buoy no. 6127 and Site 2 was selected on 28 January and marked with Buoy no. 6128.

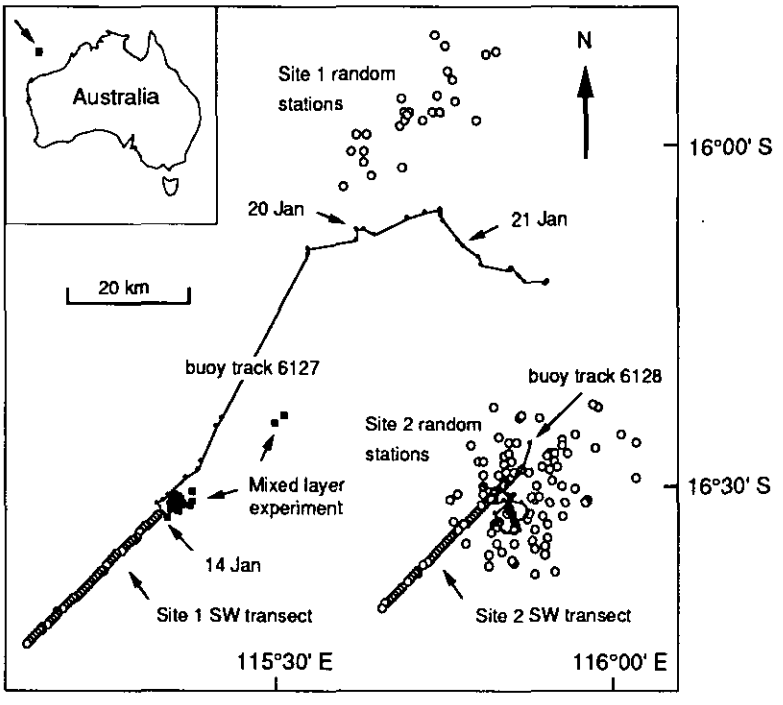

Figure 1. Ichthyoplankton station positions on SO1/87. The drift of Buoys no. 6127 and 6128 are marked by small solid squares connected by lines. Samples taken with the bongo net to determine whether tuna larvae were limited by depth to the mixed layer are indicated by larger solid squares. The positions of stations along each transect have been corrected for satellite position updates that occurred during sampling.

Mixed-layer experiment

To determine whether the maximum depth distribution of tuna larvae was restricted to the mixed layer, a series of tows were made at Site 1 on 16–17 January 1987 between 13:21 and 03:21 h GMT at Stations 128–140 (mixed-layer experiment in Table 1). The opening/closing bongo was deployed in single oblique tows. It was either opened a short distance below the mixed layer and fished to the surface, or opened at twice the depth of the mixed layer and closed before it reached the mixed layer. A surface tow with the 70 cm ring net was made concurrently with each oblique tow. The depth of the mixed layer was already known from CTD profiles taken at the drogue buoy. The positioning, opening and closing of the net were guided by temperature and depth readouts from the SDL mounted on the net. Oblique tows were nominally of 20 minutes' duration and surface tows of 10 minutes' duration.

Diel vertical distribution within the mixed layer

The diel vertical distribution of tuna larvae within the mixed layer was investigated at Sites 1 and 2 by random sampling with paired surface and oblique tows. Two 70 cm ring nets were deployed concurrently, one as a surface tow for 10 minutes and the other as a double oblique tow for a nominal 20 minutes. At Site 1 the oblique tow was fished from the surface down through the upper layer of the pycnocline to a depth of 50 m and back again. At Site 2 the net was only fished down to 40 m. Daytime sampling was done from 08:00–16:30 h WST (24:00–08:30 h GMT) and night-time sampling from 19:30–04:30 h WST (11:30–21:30 h GMT), to avoid transitional dawn and dusk periods.

Station positions were randomly assigned at the beginning of each day and night sampling period by a computer-generated bearing and distance from the buoy. Sometimes the exact position of the buoy was not known, but was estimated from its pattern of drift and its last known position from direct sighting or satellite relay. At Site 1, 16 day and 10 night tows were made on 21–22 January 1987 at stations randomly placed in a 10 km radius circle relative to Buoy no. 6127 (listed as *Site 1, random* in Table 1). Sampling had been delayed by a tropical cyclone and the position of the buoy was not known when the stations were assigned, but was estimated from its pattern of drift and last known position relayed from the satellite on 20 January. Unfortunately the drift pattern of the buoy had changed so that stations were assigned north of the actual position of the buoy (Fig. 1). At Site 2, 22 day and 22 night tows were made at random positions in a 20 km radius circle relative to Buoy no. 6128 (listed as *Site 2, random* in Table 1).

Scale and intensity of patchiness in horizontal distribution

Fine- to coarse-scale (hundreds of meters to kilometers) patchiness in the distribution of tuna larvae was investigated at each Site by a combination of contiguous transect sampling with surface tows and random sampling relative to a drifter, using double oblique tows. Contiguous transect sampling involved deploying 50 five-minute surface tows made in a south-west direction starting near each buoy. Sampling was virtually continuous. As the vessel steamed at 1.3 m s^{-1}, two nets were operated alternately. While one net was towed the other was washed down. The delay between deployment of consecutive tows was, on average, 160 seconds. These transects (Stations 76–126 at Site 1 and 195–245 at Site 2) consisted of 50 samples each of 390 m mean towed distance separated, on average, by a gap of 208 m (listed as *Site 1, transect* and *Site 2, transect* in Table 1).

The variability in catches of tuna larvae and intensity of patchiness was determined from the random oblique tows made at each site during the investigation of diel vertical distribution (listed as *Site 1, random* and *Site 2, random* in Table 1). At Site 2, a further 22 oblique tows of ten minutes' duration were made to examine the interactions of tow duration and patchiness on the variability of catches (also listed as *Site 2, random* in Table 1). The sequence and position of the 10-minute oblique tows were randomly assigned together with the 20-minute oblique tows, so that all Site 2 random stations (Stations 247–345) were randomly stratified by day/night and 10/20 minutes' tow duration.

Comparison of CSIRO and Japanese methods of ichthyoplankton sampling

The FRV *Soela* and the FRV *Shoyo Maru* met on 27 January 1987 at 15°S, 116°E. The two vessels, approximately 250 m apart, steamed at 2 knots. Concurrent surface (10 minutes) and oblique tows (20 minutes) were made by both vessels at six Stations (181–186) in daylight between 1300 and 1700 h local time; the start of tows on each vessel was co-ordinated by radio and visual communication. Sampling was preceded by four paired surface and oblique tows (Stations 177–180) taken at the one station position to investigate intra-station ichthyoplankton variability.

Hydrographic sampling

Surface temperature and salinity were continuously measured by a thermosalinograph (Grundy Environmental Systems Inc. Model no. 6620) using water pumped from approximately 2 m depth. Thermosalinograph readings made at the start of each station are listed in Table 1.

Hydrographic casts were made throughout the cruise. During random sampling at each site, hydrographic casts were made at dawn and dusk when ichthyoplankton sampling was not carried out. These casts were usually made near ichthyoplankton stations. Hydrographic casts were made before and/or after each set of ichthyoplankton sampling, again at dawn or dusk. Additional hydrographic casts were made on an opportunistic basis. Discrete water samples were collected with a General Oceanics rosette equipped with 1.8 l Niskin sampling bottles and a NBIS Mk. IIIB CTD. There are no archived CTD profiles of any of the hydrographic stations. It was discovered after the cruise that the underwater unit housing the sensors had been knocked during road transit from Hobart to Port Hedland. As a result the CTD calibration changed constantly throughout the cruise, such that no correction could be applied to the raw data.

Salinity and dissolved oxygen were measured by the methods of Major et al. (1972). Nutrient samples were collected in acid-washed high-density polyethylene bottles and stored at -20°C until analysis. Inorganic nutrients were determined using a Tecator 5020 flow injection analyser with a Tecator 5023 spectrophotometer and a Hewlett Packard 7123A chart recorder. A more detailed description of the methods is given in Clementson et al. (1989). Total nitrogen and phosphorus were determined by the methods of Sólorzano and Sharp (1980) and Koroleff (1976) respectively. The concentrations of organic nitrogen and organic phosphorus were calculated by subtracting the inorganic concentrations from the total concentrations of nitrogen and phosphorus determined and correcting for recovery.

Explanation of tables

There are three tables in this report. Table 1 presents the station data where hydrographic casts or quantitative ichthyoplankton tows were made. Stations are not listed if no samples were collected because of equipment failure, or if a sample was taken without measuring the volume filtered during the search for tuna larvae (Stations 1–66 in particular). The times, latitudes and longitudes mark the start of activities at each station. To convert the time of each station to local time (WST), 8 hours should be added to GMT time. Station positions were determined by a Magnavox Transit Satellite Navigator which, in ideal conditions, has an accuracy of 0.05'. Sea conditions, ship's motion and the period between satellite position updates would have greatly reduced the accuracy of station positions. These have been recorded to 0.01' in Table 1; they far exceed the accuracy of the Satellite Navigator. However, for the 100 stations sampled along the surface transects, it was necessary to record positions to 0.01' to retain the spatial resolution between contiguous stations which were, on average, 390 m long and separated by a distance of 208 m. In Table 1, the latitudes and longitudes at stations sampled along the surface transect at both sites are not corrected for satellite position updates that were given during the period of sampling. In Fig. 1 the station positions for both transects have been adjusted for irregularities caused by position updates.

Table 2 presents the ichthyoplankton tow and catch data. There is a separate entry for each tow and net type used at a station. For catch data from the mixed-layer experiment (Stations 128–139), A and B were added to the station number to denote port and starboard sides of the bongo net. At each of these stations there are three entries: one for the surface tow and two for the bongo net except when equipment failed. At Station 131, side B of the bongo failed to close at 33 m and continued to fish to the surface, whereas side A closed as planned. As there was a flowmeter in side B only, there was no record of volume filtered in side A. The unidentified tuna at Stations 193–204 were larvae too small to have developed the pigment pattern needed to identify them to species, but the majority would have been *T. maccoyii*, based on the species composition of the identified larvae at these stations.

Table 3 presents the physical and chemical data determined from hydrographic casts. Temperature, measured by reversing thermometers, was usually taken at three depths at each hydrographic station unless thermometers failed to reverse. All hydrographic data indicate that the water mass present is composed of low-salinity tropical water, except for the data from Stations 67 and 75, which clearly indicate an intrusion of South East Indian central water, which is low in nutrients and high in salinity.

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Table 1. Station data where hydrographic sampling and quantitative ichthyoplankton tows were made on SO 1/87. Stations 1-66 were unmetered tows either testing gear or searching for tuna larvae. Explanation of study components: transect - contiguous transect sampling using surface tows made at site 1 and 2; mixed layer exp. - experiment to determine whether tuna larvae were restricted in depth to the mixed layer; random - stations assigned at random relative to buoys 6127 and 6128 marking sites 1 and 2, respectively; Shoyo Maru - a series of tows taken at stations concurrently sampled by the Fishery Agency of Japan Research Vessel *Shoyo maru* in order to document and calibrate Japanese sampling methods; shelf transect - hydrographic transect starting in the North Australian Basin and extending onto the North West Shelf. Direction from which wind and swell were coming recorded in degrees true, wind force measured on the Beaufort scale (0-12).

Station number	Date 1987	Time GMT	Latitude	Longitude	Study	Activity	Day or night	Surface temp. (°C)	Surface salinity (ppt)	Wind direc-tion	Wind force	Swell direc-tion	Swell height (m)	Cloud cover (0-8)
67	14 Jan	1020	16°41.45' S	115°08.38' E	search for site 1	hydrographic cast	N	28.75	34.85	200	3	200	1.5	6
68	14 Jan	2155	16°40.92' S	115°08.03' E	search for site 1	hydrographic cast	D	28.40	34.87	230	4	200	1.5	6
73	15 Jan	1006	16°34.84' S	115°12.61' E	search for site 1	hydrographic cast	N	28.66	34.85	230	4	230	1.0	6
75	15 Jan	2205	16°32.81' S	115°15.83' E	site 1	hydrographic cast	D	28.42	34.86	240	2	240	1.5	4
76	16 Jan	0215	16°33.39' S	115°19.57' E	site 1, transect	surface tow	D	28.50	34.86	230	3	230	0.5	4
77	16 Jan	0224	16°33.56' S	115°19.37' E	site 1, transect	surface tow	D	28.50	34.86	230	3	230	0.5	4
78	16 Jan	0232	16°33.73' S	115°19.16' E	site 1, transect	surface tow	D	28.50	34.86	230	3	230	0.5	4
79	16 Jan	0240	16°33.87' S	115°18.96' E	site 1, transect	surface tow	D	28.50	34.86	230	3	230	0.5	4
80	16 Jan	0248	16°34.03' S	115°18.77' E	site 1, transect	surface tow	D	28.50	34.86	230	3	230	0.5	4
81	16 Jan	0255	16°33.70' S	115°18.64' E	site 1, transect	surface tow	D	28.50	34.86	230	3	230	0.5	4
82	16 Jan	0302	16°33.84' S	115°18.48' E	site 1, transect	surface tow	D	28.55	34.86	230	3	230	0.5	4
83	16 Jan	0309	16°34.01' S	115°18.30' E	site 1, transect	surface tow	D	28.55	34.86	230	3	230	0.5	4
84	16 Jan	0319	16°34.19' S	115°18.10' E	site 1, transect	surface tow	D	28.55	34.87	230	3	230	0.5	4
85	16 Jan	0326	16°34.35' S	115°17.93' E	site 1, transect	surface tow	D	28.55	34.87	230	3	230	0.5	4
86	16 Jan	0333	16°34.51' S	115°17.76' E	site 1, transect	surface tow	D	28.55	34.87	230	3	230	0.5	4
87	16 Jan	0341	16°34.65' S	115°17.60' E	site 1, transect	surface tow	D	28.55	34.87	230	3	230	0.5	4
88	16 Jan	0348	16°34.81' S	115°17.00' E	site 1, transect	surface tow	D	28.55	34.88	230	3	230	0.5	4
89	16 Jan	0356	16°34.97' S	115°16.83' E	site 1, transect	surface tow	D	28.55	34.88	230	3	230	0.5	4
90	16 Jan	0403	16°35.16' S	115°16.62' E	site 1, transect	surface tow	D	28.60	34.88	230	3	230	0.5	4

Table 1. Continued.

Station number	Date 1987	Time GMT	Latitude	Longitude	Study	Activity	Day or night	Surface temp. (°C)	Surface salinity (ppt)	Wind direc-tion	Wind force	Swell direc-tion	Swell height (m)	Cloud cover (0-8)
91	16 Jan	0412	16°35.36' S	115°16.40' E	site 1, transect	surface tow	D	28.60	34.88	230	3	230	0.5	4
92	16 Jan	0419	16°35.59' S	115°16.16' E	site 1, transect	surface tow	D	28.60	34.88	230	3	230	0.5	4
93	16 Jan	0425	16°35.83' S	115°15.90' E	site 1, transect	surface tow	D	28.65	34.88	230	3	230	0.5	4
94	16 Jan	0436	16°35.84' S	115°15.68' E	site 1, transect	surface tow	D	28.65	34.88	230	3	230	0.5	4
95	16 Jan	0445	16°36.62' S	115°14.89' E	site 1, transect	surface tow	D	28.65	34.88	240	4	230	0.5	5
96	16 Jan	0453	16°36.88' S	115°14.62' E	site 1, transect	surface tow	D	28.65	34.88	240	4	230	0.5	5
97	16 Jan	0500	16°37.07' S	115°14.43' E	site 1, transect	surface tow	D	28.70	34.88	240	4	230	0.5	5
98	16 Jan	0507	16°37.29' S	115°14.19' E	site 1, transect	surface tow	D	28.70	34.88	240	4	230	0.5	5
99	16 Jan	0515	16°37.50' S	115°13.98' E	site 1, transect	surface tow	D	28.70	34.87	240	4	230	0.5	5
100	16 Jan	0522	16°37.71' S	115°13.75' E	site 1, transect	surface tow	D	28.70	34.86	240	4	230	0.5	5
101	16 Jan	0530	16°37.92' S	115°13.52' E	site 1, transect	surface tow	D	28.70	34.87	240	4	230	0.5	5
102	16 Jan	0537	16°38.16' S	115°13.20' E	site 1, transect	surface tow	D	28.70	34.86	240	4	230	0.5	5
103	16 Jan	0544	16°38.33' S	115°13.09' E	site 1, transect	surface tow	D	28.70	34.86	240	4	230	0.5	5
104	16 Jan	0531	16°38.51' S	115°12.73' E	site 1, transect	surface tow	D	28.70	34.87	240	4	230	0.5	5
105	16 Jan	0558	16°38.75' S	115°12.48' E	site 1, transect	surface tow	D	28.70	34.87	240	4	230	0.5	5
106	16 Jan	0605	16°38.95' S	115°12.27' E	site 1, transect	surface tow	D	28.70	34.87	240	4	230	0.5	5
107	16 Jan	0612	16°39.16' S	115°12.04' E	site 1, transect	surface tow	D	28.70	34.87	240	4	230	0.5	5
108	16 Jan	0619	16°39.37' S	115°11.83' E	site 1, transect	surface tow	D	28.70	34.87	240	4	230	0.5	5
109	16 Jan	0627	16°39.58' S	115°11.60' E	site 1, transect	surface tow	D	28.70	34.87	240	4	230	0.5	5
110	16 Jan	0635	16°39.80' S	115°11.37' E	site 1, transect	surface tow	D	28.70	34.87	240	4	230	0.5	5
111	16 Jan	0642	16°40.01' S	115°11.16' E	site 1, transect	surface tow	D	28.70	34.87	240	4	230	0.5	5
112	16 Jan	0650	16°40.24' S	115°10.91' E	site 1, transect	surface tow	D	28.70	34.87	240	4	230	0.5	5
113	16 Jan	0658	16°40.46' S	115°10.67' E	site 1, transect	surface tow	D	28.70	34.87	240	4	230	0.5	5
114	16 Jan	0705	16°40.68' S	115°10.44' E	site 1, transect	surface tow	D	28.70	34.87	240	4	230	0.5	5
115	16 Jan	0712	16°40.88' S	115°10.24' E	site 1, transect	surface tow	D	28.70	34.87	240	4	230	0.5	5

Table 1. Continued.

Station number	Date 1987	Time GMT	Latitude	Longitude	Study	Activity	Day or night	Surface temp. (°C)	Surface salinity (ppt)	Wind direction	Wind force	Swell direction	Swell height (m)	Cloud cover (0-8)
116	16 Jan	0719	16°41.07' S	115°10.04' E	site 1, transect	surface tow	D	28.70	34.87	240	4	230	0.5	5
117	16 Jan	0727	16°41.40' S	115°09.58' E	site 1, transect	surface tow	D	28.75	34.87	240	4	230	0.5	5
118	16 Jan	0734	16°41.60' S	115°09.37' E	site 1, transect	surface tow	D	28.75	34.87	240	4	230	0.5	5
119	16 Jan	0742	16°41.80' S	11°509.16' E	site 1, transect	surface tow	D	28.75	34.87	240	4	230	0.5	5
120	16 Jan	0749	16°42.02' S	115°08.93' E	site 1, transect	surface tow	D	28.75	34.87	240	4	230	0.5	5
121	16 Jan	0756	16°42.21' S	115°08.73' E	site 1, transect	surface tow	D	28.75	34.87	240	4	230	0.5	5
122	16 Jan	0803	16°42.41' S	115°08.52' E	site 1, transect	surface tow	D	28.75	34.87	240	4	230	0.5	5
123	16 Jan	0810	16°42.61' S	115°08.30' E	site 1, transect	surface tow	D	28.80	34.87	240	4	230	0.5	5
124	16 Jan	0817	16°42.81' S	115°08.10' E	site 1, transect	surface tow	D	28.75	34.87	240	4	230	0.5	5
125	16 Jan	0824	16°42.99' S	115°07.89' E	site 1, transect	surface tow	D	28.75	34.87	240	4	230	0.5	5
126	16 Jan	0830	16°43.18' S	115°07.71' E	site 1, transect	surface tow	D	28.75	34.86	240	4	230	0.5	5
127	16 Jan	1000	16°42.70' S	115°08.31' E	site 1	hydrographic cast	D	28.67	34.87	240	4	220	1.0	5
128	16 Jan	1321	16°32.60' S	115°20.62' E	mixed layer exp.	surface and oblique tow	N	28.58	34.85	230	4	230	1.0	5
129	16 Jan	1423	16°32.64' S	115°20.63' E	mixed layer exp.	surface and oblique tow	N	28.55	34.86	230	4	230	1.0	5
130	16 Jan	1527	16°32.67' S	115°20.53' E	mixed layer exp.	surface and oblique tow	N	28.50	34.86	230	4	230	1.0	4
131	16 Jan	1624	16°32.43' S	115°20.60' E	mixed layer exp.	surface and oblique tow	N	28.50	34.86	230	4	230	1.0	4
132	16 Jan	1724	16°32.75' S	115°20.50' E	mixed layer exp.	surface and oblique tow	N	28.50	34.86	230	4	230	1.0	4
133	16 Jan	1827	16°32.95' S	115°20.48' E	mixed layer exp.	surface and oblique tow	N	28.50	34.86	230	4	230	1.5	4
134	16 Jan	1921	16°32.81' S	115°20.53' E	mixed layer exp.	surface and oblique tow	N	28.50	34.86	230	5	230	1.5	7
135	16 Jan	2014	16°32.81' S	115°20.50' E	mixed layer exp.	surface and oblique tow	N	28.45	34.86	230	5	230	1.5	7
136	16 Jan	2120	16°32.73' S	115°20.54' E	mixed layer exp.	surface and oblique tow	N	28.40	34.86	230	5	230	1.5	7
137	16 Jan	2155	16°32.28' S	115°20.74' E	mixed layer exp.	hydrographic cast	N	28.40	34.87	230	5	230	1.5	7
138	17 Jan	0144	16°26.26' S	115°33.06' E	mixed layer exp.	surface and oblique tow	D	28.10	34.77	230	5	230	1.5	7
139	17 Jan	0235	16°26.42' S	115°33.29' E	mixed layer exp.	surface and oblique tow	D	28.15	34.79	230	5	230	1.5	7
140	17 Jan	0321	16°26.16' S	115°33.14' E	mixed layer exp.	surface and oblique tow	D	28.20	34.80	230	5	230	1.5	8

Table 1. Continued.

Station number	Date 1987	Time GMT	Latitude	Longitude	Study	Activity	Day or night	Surface temp. (°C)	Surface salinity (ppt)	Wind direc-tion	Wind force	Swell direc-tion	Swell height (m)	Cloud cover (0-8)
141	20 Jan	2140	16°00.07' S	115°44.09' E	site 1, random	hydrographic cast	N	27.45	34.69	260	5	260	3.0	7
142	21 Jan	0114	16°02.81' S	115°38.81' E	site 1, random	surface and oblique tow	D	27.50	34.80	250	5	230	1.0	4
143	21 Jan	0225	16°03.71' S	115°36.14' E	site 1, random	surface and oblique tow	D	27.55	34.81	250	5	230	1.0	4
144	21 Jan	0310	16°01.62' S	115°38.00' E	site 1, random	surface and oblique tow	D	27.55	34.80	250	5	230	1.0	4
145	21 Jan	0459	16°00.77' S	115°36.85' E	site 1, random	surface and oblique tow	D	27.62	34.81	250	5	230	1.0	4
146	21 Jan	0537	16°00.76' S	115°38.03' E	site 1, random	surface and oblique tow	D	27.60	34.80	250	5	230	1.0	4
147	21 Jan	0619	15°59.23' S	115°38.31' E	site 1, random	surface and oblique tow	D	27.60	34.80	250	5	230	1.0	4
148	21 Jan	0703	15°59.27' S	115°37.32' E	site 1, random	surface and oblique tow	D	27.65	34.81	250	5	230	1.0	4
149	21 Jan	0806	16°02.13' S	115°41.50' E	site 1, random	surface and oblique tow	D	27.60	34.75	250	5	230	1.0	4
150	21 Jan	1018	15°58.06' S	115°43.25' E	site 1, random	hydrographic cast	N	27.58	34.72	250	4	230	1.5	4
151	21 Jan	1128	15°58.06' S	115°43.25' E	site 1, random	surface and oblique tow	N	27.58	34.74	250	4	230	1.0	4
152	21 Jan	1218	15°57.38' S	115°42.00' E	site 1, random	surface and oblique tow	N	27.60	34.89	250	4	230	1.0	1
153	21 Jan	1353	15°58.50' S	115°41.27' E	site 1, random	surface and oblique tow	N	27.58	34.79	250	4	230	1.0	2
154	21 Jan	1441	15°57.31' S	115°44.86' E	site 1, random	surface and oblique tow	N	27.58	34.79	250	4	230	1.0	2
155	21 Jan	1556	15°56.18' S	115°41.37' E	site 1, random	surface and oblique tow	N	27.57	34.82	250	4	230	1.0	2
156	21 Jan	1645	15°58.10' S	115°41.78' E	site 1, random	surface and oblique tow	N	27.55	34.80	250	4	230	1.0	2
157	21 Jan	1731	15°55.80' S	115°44.57' E	site 1, random	surface and oblique tow	N	27.54	34.79	250	4	230	1.0	2
158	21 Jan	1825	15°57.24' S	115°44.23' E	site 1, random	surface and oblique tow	N	27.50	34.79	250	4	230	1.0	2
159	21 Jan	1928	15°57.24' S	115°41.61' E	site 1, random	surface and oblique tow	N	27.50	34.80	250	4	230	1.0	2
160	21 Jan	2006	15°57.47' S	115°41.88' E	site 1, random	surface and oblique tow	N	27.51	34.80	250	4	230	1.0	2
161	21 Jan	2155	15°56.39' S	115°46.21' E	site 1, random	hydrographic cast	N	27.50	34.78	250	4	230	1.0	2
162	22 Jan	0021	15°56.39' S	115°46.21' E	site 1, random	surface and oblique tow	D	27.45	34.76	250	4	230	1.0	4
163	22 Jan	0124	15°50.52' S	115°44.44' E	site 1, random	surface and oblique tow	D	27.52	34.81	250	4	230	1.0	5
164	22 Jan	0209	15°51.55' S	115°45.38' E	site 1, random	surface and oblique tow	D	27.50	34.81	250	4	230	1.0	4
165	22 Jan	0343	15°53.78' S	115°45.45' E	site 1, random	surface and oblique tow	D	27.51	34.79	250	4	230	1.0	4

Table 1. Continued.

Station number	Date 1987	Time GMT	Latitude	Longitude	Study	Activity	Day or night	Surface temp. (°C)	Surface salinity (ppt)	Wind direc-tion	Wind force	Swell direc-tion	Swell height (m)	Cloud cover (0-8)
166	22 Jan	0452	15°52.29' S	115°48.95' E	site 1, random	surface and oblique tow	D	27.70	34.79	250	4	230	1.0	4
167	22 Jan	0557	15°54.46' S	115°46.00' E	site 1, random	surface and oblique tow	D	27.73	34.79	250	4	230	1.0	4
168	22 Jan	0635	15°58.07' S	115°48.01' E	site 1, random	surface and oblique tow	D	27.70	34.76	250	4	230	1.0	4
169	22 Jan	0717	15°52.07' S	115°49.79' E	site 1, random	surface and oblique tow	D	27.73	34.78	250	4	230	1.0	4
170	22 Jan	1450	17°02.14' S	115°56.37' E	shelf transect	hydrographic cast	N	27.80	34.69	250	4	230	1.0	4
171	22 Jan	2134	17°45.50' S	116°35.00' E	shelf transect	hydrographic cast	N	27.90	34.92	250	4	230	1.0	4
172	23 Jan	0305	18°18.01' S	117°05.25' E	shelf transect	hydrographic cast	D	27.40	35.02	260	4	230	0.5	3
173	23 Jan	0940	18°50.87' S	117°33.04' E	shelf transect	hydrographic cast	D	28.00	34.90	260	3	230	0.5	5
175	26 Jan	1200	16°04.12' S	115°36.32' E	Shoyo Maru	hydrographic cast	N	27.50	34.85	310	3	270	0.5	2
177	27 Jan	0023	15°00.01' S	116°00.03' E	Shoyo Maru	surface and oblique tow	D	28.28	34.55	220	2	260	0.5	3
178	27 Jan	0052	14°59.89' S	115°59.96' E	Shoyo Maru	surface and oblique tow	D	28.18	34.55	220	2	260	0.4	3
179	27 Jan	0115	14°59.97' S	116°00.04' E	Shoyo Maru	surface and oblique tow	D	28.20	34.56	220	2	260	0.4	3
180	27 Jan	0149	15°00.16' S	115°59.96' E	Shoyo Maru	surface and oblique tow	D	28.20	34.56	220	2	260	0.5	3
181	27 Jan	0534	15°00.60' S	116°02.34' E	Shoyo Maru	surface and oblique tow	D	28.60	34.56	220	2	260	0.5	3
182	27 Jan	0607	14°59.52' S	116°03.15' E	Shoyo Maru	surface and oblique tow	D	28.80	34.56	220	2	260	0.5	4
183	27 Jan	0651	14°58.21' S	116°04.05' E	Shoyo Maru	surface and oblique tow	D	28.70	34.56	220	2	260	0.5	4
184	27 Jan	0726	14°57.68' S	116°05.55' E	Shoyo Maru	surface and oblique tow	D	28.80	34.56	220	2	260	0.5	4
185	27 Jan	0802	14°56.74' S	116°06.46' E	Shoyo Maru	surface and oblique tow	D	28.87	34.56	220	2	260	0.5	4
186	27 Jan	0835	14°55.79' S	116°07.32' E	Shoyo Maru	surface and oblique tow	D	28.80	34.54	220	2	260	0.5	4
187	28 Jan	0120	16°19.41' S	116°22.19' E	search for site 2	hydrographic cast	D	27.20	34.63	220	3	220	0.5	4
188	28 Jan	0300	16°19.14' S	116°22.04' E	search for site 2	surface and oblique tow	D	27.25	34.63	220	3	220	0.5	5
189	28 Jan	0446	16°22.54' S	116°12.55' E	search for site 2	oblique tow	D	27.81	34.75	220	3	220	0.5	5
190	28 Jan	0540	16°24.25' S	116°07.03' E	search for site 2	oblique tow	D	27.90	34.78	220	3	260	0.5	3
191	28 Jan	0633	16°26.51' S	116°01.92' E	search for site 2	oblique tow	D	27.95	34.84	220	3	260	0.5	3
192	28 Jan	0726	16°28.23' S	115°56.40' E	search for site 2	oblique tow	D	27.95	34.84	220	3	260	0.5	3

Table 1. Continued.

Station number	Date 1987	Time GMT	Latitude	Longitude	Study	Activity	Day or night	Surface temp. (°C)	Surface salinity (ppt)	Wind direc-tion	Wind force	Swell direc-tion	Swell height (m)	Cloud cover (0-8)
193	28 Jan	0820	16°30.13' S	115°50.96' E	search for site 2	oblique tow	D	27.95	34.84	220	3	260	0.5	3
194	28 Jan	1003	16°30.28' S	115°50.54' E	site 2	hydrographic cast	N	27.85	34.85	220	3	280	0.5	1
195	28 Jan	1305	16°30.47' S	115°50.73' E	site 2, transect	surface tow	N	27.70	34.83	220	3	260	0.3	3
196	28 Jan	1312	16°30.63' S	115°50.57' E	site 2, transect	surface tow	N	27.70	34.84	220	3	260	0.3	3
197	28 Jan	1322	16°29.89' S	115°50.57' E	site 2, transect	surface tow	N	27.70	34.84	220	3	260	0.3	3
198	28 Jan	1328	16°30.03' S	115°50.43' E	site 2, transect	surface tow	N	27.70	34.84	220	3	260	0.3	3
199	28 Jan	1334	16°30.20' S	115°50.25' E	site 2, transect	surface tow	N	27.70	34.83	220	3	260	0.3	3
200	28 Jan	1342	16°30.37' S	115°50.07' E	site 2, transect	surface tow	N	27.70	34.85	220	3	260	0.3	3
201	28 Jan	1350	16°30.53' S	115°49.91' E	site 2, transect	surface tow	N	27.70	34.85	220	4	260	0.3	3
202	28 Jan	1355	16°30.72' S	115°49.72' E	site 2, transect	surface tow	N	27.69	34.86	220	4	260	0.3	3
203	28 Jan	1403	16°30.90' S	115°49.53' E	site 2, transect	surface tow	N	27.68	34.86	220	4	260	0.3	3
204	28 Jan	1410	16°31.07' S	115°49.36' E	site 2, transect	surface tow	N	27.67	34.86	220	4	260	0.3	3
205	28 Jan	1417	16°31.23' S	115°49.19' E	site 2, transect	surface tow	N	27.69	34.86	220	4	260	0.3	3
206	28 Jan	1424	16°31.39' S	115°49.02' E	site 2, transect	surface tow	N	27.70	34.87	220	4	260	0.3	3
207	28 Jan	1431	16°31.54' S	115°48.86' E	site 2, transect	surface tow	N	27.70	34.88	220	4	260	0.3	3
208	28 Jan	1438	16°31.70' S	115°48.69' E	site 2, transect	surface tow	N	27.68	34.88	220	4	260	0.3	3
209	28 Jan	1444	16°31.85' S	115°48.54' E	site 2, transect	surface tow	N	27.67	34.88	220	4	260	0.3	3
210	28 Jan	1451	16°32.01' S	115°48.37' E	site 2, transect	surface tow	N	27.67	34.88	220	4	260	0.3	3
211	28 Jan	1457	16°32.17' S	115°48.19' E	site 2, transect	surface tow	N	27.65	34.88	220	4	260	0.3	3
212	28 Jan	1504	16°32.34' S	115°48.02' E	site 2, transect	surface tow	N	27.64	34.88	220	4	260	0.3	3
213	28 Jan	1512	16°32.51' S	115°47.84' E	site 2, transect	surface tow	N	27.61	34.88	220	4	260	0.3	3
214	28 Jan	1519	16°32.69' S	115°47.66' E	site 2, transect	surface tow	N	27.60	34.88	220	4	260	0.3	3
215	28 Jan	1526	16°32.84' S	115°47.50' E	site 2, transect	surface tow	N	27.59	34.88	220	4	260	0.3	3
216	28 Jan	1532	16°33.00' S	115°47.33' E	site 2, transect	surface tow	N	27.58	34.88	220	4	260	0.3	3
217	28 Jan	1540	16°33.18' S	115°47.14' E	site 2, transect	surface tow	N	27.57	34.88	220	4	260	0.3	3

Table 1. Continued.

Station number	Date 1987	Time GMT	Latitude	Longitude	Study	Activity	Day or night	Surface temp. (°C)	Surface salinity (ppt)	Wind direc-tion	Wind force	Swell direc-tion	Swell height (m)	Cloud cover (0-8)
218	28 Jan	1546	16°33.37' S	115°46.95' E	site 2, transect	surface tow	N	27.55	34.88	220	4	260	0.3	3
219	28 Jan	1554	16°33.52' S	115°46.78' E	site 2, transect	surface tow	N	27.55	34.88	220	4	260	0.3	3
220	28 Jan	1600	16°33.92' S	115°46.39' E	site 2, transect	surface tow	N	27.53	34.88	220	4	260	0.3	3
221	28 Jan	1609	16°35.11' S	115°46.18' E	site 2, transect	surface tow	N	27.51	34.88	220	4	260	0.3	3
222	28 Jan	1618	16°35.29' S	115°45.99' E	site 2, transect	surface tow	N	27.50	34.88	220	4	260	0.3	3
223	28 Jan	1625	16°35.44' S	115°45.85' E	site 2, transect	surface tow	N	27.49	34.87	220	4	260	0.3	3
224	28 Jan	1632	16°35.59' S	115°45.68' E	site 2, transect	surface tow	N	27.46	34.87	220	4	260	0.3	3
225	28 Jan	1640	16°35.77' S	115°45.50' E	site 2, transect	surface tow	N	27.45	34.86	220	4	260	0.3	3
226	28 Jan	1648	16°35.98' S	115°45.29' E	site 2, transect	surface tow	N	27.43	34.86	220	4	260	0.3	3
227	28 Jan	1655	16°36.15' S	115°45.11' E	site 2, transect	surface tow	N	27.40	34.87	220	4	260	0.3	3
228	28 Jan	1702	16°36.32' S	115°44.93' E	site 2, transect	surface tow	N	27.38	34.87	220	4	260	0.3	3
229	28 Jan	1714	16°37.21' S	115°44.00' E	site 2, transect	surface tow	N	27.37	34.87	220	4	260	0.3	3
230	28 Jan	1727	16°37.64' S	115°43.91' E	site 2, transect	surface tow	N	27.37	34.87	220	4	260	0.3	3
231	28 Jan	1731	16°37.75' S	115°43.79' E	site 2, transect	surface tow	N	27.37	34.88	220	4	260	0.3	3
232	28 Jan	1737	16°38.17' S	115°43.50' E	site 2, transect	surface tow	N	27.37	34.89	220	4	260	0.3	3
233	28 Jan	1744	16°38.33' S	115°43.34' E	site 2, transect	surface tow	N	27.37	34.89	220	4	260	0.3	3
234	28 Jan	1750	16°38.50' S	115°43.17' E	site 2, transect	surface tow	N	27.38	34.89	220	4	260	0.3	3
235	28 Jan	1758	16°38.70' S	115°42.97' E	site 2, transect	surface tow	N	27.38	34.90	220	4	260	0.3	3
236	28 Jan	1804	16°38.83' S	115°42.83' E	site 2, transect	surface tow	N	27.38	34.91	220	4	260	0.3	3
237	28 Jan	1811	16°39.01' S	115°42.64' E	site 2, transect	surface tow	N	27.43	34.92	220	4	260	0.3	3
238	28 Jan	1819	16°39.20' S	115°42.45' E	site 2, transect	surface tow	N	27.39	34.93	220	4	260	0.3	3
239	28 Jan	1826	16°39.37' S	115°42.28' E	site 2, transect	surface tow	N	27.38	34.93	220	4	260	0.3	3
240	28 Jan	1833	16°39.56' S	115°42.08' E	site 2, transect	surface tow	N	27.38	34.93	220	4	260	0.3	3
241	28 Jan	1840	16°39.74' S	115°41.89' E	site 2, transect	surface tow	N	27.39	34.94	220	4	260	0.3	3
242	28 Jan	1847	16°39.92' S	115°41.70' E	site 2, transect	surface tow	N	27.40	34.94	220	4	260	0.3	3

Table 1. Continued.

Station number	Date 1987	Time GMT	Latitude	Longitude	Study	Activity	Day or night	Surface temp. (°C)	Surface salinity (ppt)	Wind direc-tion	Wind force	Swell direc-tion	Swell height (m)	Cloud cover (0-8)
243	28 Jan	1854	16°40.09' S	115°41.53' E	site 2, transect	surface tow	N	27.40	34.94	220	4	260	0.3	3
244	28 Jan	1901	16°40.98' S	115°40.75' E	site 2, transect	surface tow	N	27.40	34.94	220	4	260	0.3	3
245	28 Jan	1909	16°41.16' S	115°40.57' E	site 2, transect	surface tow	N	27.40	34.94	220	4	260	0.3	3
246	29 Jan	2137	16°31.65' S	115°57.17' E	site 2, random	hydrographic cast	N	27.50	34.85	260	4	260	0.8	3
247	29 Jan	0043	16°32.49' S	115°52.88' E	site 2, random	oblique tow	D	27.50	34.82	240	5	260	1.0	4
248	29 Jan	0107	16°31.49' S	115°54.51' E	site 2, random	oblique tow	D	27.50	34.82	240	5	260	1.0	3
249	29 Jan	0133	16°31.29' S	115°53.29' E	site 2, random	surface and oblique tow	D	27.50	34.82	240	5	260	1.0	3
250	29 Jan	0236	16°31.27' S	115°57.93' E	site 2, random	surface and oblique tow	D	27.52	34.84	240	5	260	1.0	3
251	29 Jan	0336	16°28.80' S	115°51.34' E	site 2, random	surface and oblique tow	D	27.55	34.84	240	5	240	1.0	3
252	29 Jan	0437	16°27.20' S	115°51.02' E	site 2, random	surface and oblique tow	D	27.60	34.84	240	5	260	1.0	3
253	29 Jan	0523	16°25.82' S	115°50.10' E	site 2, random	oblique tow	D	27.70	34.87	240	5	260	1.0	3
254	29 Jan	0602	16°23.93' S	115°53.62' E	site 2, random	oblique tow	D	27.80	34.88	240	5	260	1.0	3
255	29 Jan	1005	16°27.91' S	115°54.62' E	site 2, random	hydrographic cast	N	27.69	34.86	240	4	260	0.5	3
256	29 Jan	1204	16°27.91' S	115°55.00' E	site 2, random	oblique tow	N	27.65	34.82	240	4	260	0.5	3
257	29 Jan	1237	16°27.12' S	115°56.07' E	site 2, random	oblique tow	N	27.65	34.85	240	4	260	0.5	3
258	29 Jan	1312	16°26.70' S	115°58.59' E	site 2, random	surface and oblique tow	N	27.63	34.87	240	4	260	0.5	3
259	29 Jan	1404	16°25.40' S	115°56.73' E	site 2, random	surface and oblique tow	N	27.61	34.86	240	4	260	0.5	2
260	29 Jan	1449	16°25.38' S	116°00.84' E	site 2, random	oblique tow	N	27.62	34.88	240	4	260	0.5	2
261	29 Jan	1527	16°23.02' S	115°59.00' E	site 2, random	surface and oblique tow	N	27.30	34.70	240	4	260	0.5	2
262	29 Jan	1654	16°30.25' S	115°56.81' E	site 2, random	oblique tow	N	27.60	34.86	240	4	260	0.5	2
263	29 Jan	1741	16°29.28' S	116°02.29' E	site 2, random	surface and oblique tow	N	27.55	34.83	240	4	260	0.5	2
264	29 Jan	1825	16°26.25' S	116°02.17' E	site 2, random	oblique tow	N	27.60	34.86	240	4	260	0.5	2
265	29 Jan	1924	16°22.79' S	115°58.34' E	site 2, random	surface and oblique tow	N	27.40	34.64	240	4	260	0.5	2
266	29 Jan	2149	16°25.20' S	116°05.80' E	site 2, random	hydrographic cast	N	27.60	34.85	240	4	260	0.5	3
267	30 Jan	0229	16°35.15' S	115°51.42' E	site 2, random	oblique tow	D	27.50	34.82	250	5	250	1.0	6

Table 1. Continued.

Station number	Date 1987	Time GMT	Latitude	Longitude	Study	Activity	Day or night	Surface temp. (°C)	Surface salinity (ppt)	Wind direc-tion	Wind force	Swell direc-tion	Swell height (m)	Cloud cover (0-8)
268	30 Jan	0256	16°34.91' S	115°53.05' E	site 2, random	surface and oblique tow	D	27.56	34.83	250	5	250	1.0	6
269	30 Jan	0332	16°34.57' S	115°54.43' E	site 2, random	surface and oblique tow	D	27.57	34.84	250	5	250	1.0	6
270	30 Jan	0437	16°36.18' S	115°54.16' E	site 2, random	oblique tow	D	27.60	34.83	250	5	250	1.0	6
271	30 Jan	0523	16°32.64' S	115°53.86' E	site 2, random	surface and oblique tow	D	27.60	34.85	250	5	250	1.0	6
272	30 Jan	0617	16°32.42' S	115°50.65' E	site 2, random	oblique tow	D	27.60	34.84	250	5	250	1.0	6
273	30 Jan	0654	16°31.56' S	115°55.94' E	site 2, random	surface and oblique tow	D	27.60	34.84	250	5	250	1.0	6
274	30 Jan	0801	16°27.49' S	115°50.43' E	site 2, random	oblique tow	D	27.69	34.84	250	5	250	1.0	6
275	30 Jan	1045	16°37.02' S	115°49.32' E	site 2, random	hydrographic cast	N	27.55	34.85	250	5	250	0.8	5
276	30 Jan	1235	16°37.02' S	115°49.14' E	site 2, random	oblique tow	N	27.50	34.82	250	5	250	1.0	6
277	30 Jan	1307	16°37.72' S	115°53.14' E	site 2, random	surface and oblique tow	N	27.50	34.83	250	5	250	1.0	6
278	30 Jan	1346	16°35.27' S	115°54.11' E	site 2, random	surface and oblique tow	N	27.55	34.85	250	5	250	1.0	6
279	30 Jan	1429	16°32.79' S	115°55.80' E	site 2, random	oblique tow	N	27.55	34.87	250	5	250	1.0	4
280	30 Jan	1520	16°32.93' S	115°52.61' E	site 2, random	surface and oblique tow	N	27.50	34.83	250	6	250	1.5	4
281	30 Jan	1612	16°29.01' S	115°52.88' E	site 2, random	oblique tow	N	27.45	34.83	250	6	250	1.5	4
282	30 Jan	1641	16°28.38' S	115°53.93' E	site 2, random	surface and oblique tow	N	27.45	34.82	250	6	250	1.5	5
283	30 Jan	1832	16°33.26' S	115°46.00' E	site 2, random	oblique tow	N	27.45	34.86	250	6	250	1.5	6
284	30 Jan	1907	16°34.25' S	115°49.37' E	site 2, random	oblique tow	N	27.50	34.86	250	6	250	1.5	6
285	30 Jan	2002	16°31.50' S	115°57.71' E	site 2, random	surface and oblique tow	N	27.50	34.85	250	6	250	1.5	6
286	30 Jan	2137	16°36.03' S	115°58.12' E	site 2, random	hydrographic cast	N	27.50	34.83	250	6	250	1.5	7
287	31 Jan	0036	16°30.14' S	115°53.55' E	site 2, random	oblique tow	D	27.42	34.84	250	4	250	1.5	6
288	31 Jan	0100	16°30.94' S	115°53.64' E	site 2, random	surface and oblique tow	D	27.45	34.85	250	4	250	1.5	6
289	31 Jan	0205	16°33.69' S	115°51.47' E	site 2, random	surface and oblique tow	D	27.46	34.83	250	5	250	1.5	4
290	31 Jan	0305	16°35.04' S	115°49.81' E	site 2, random	oblique tow	D	27.45	34.82	250	5	250	1.5	4
291	31 Jan	0329	16°35.96' S	115°50.32' E	site 2, random	surface and oblique tow	D	27.48	34.82	250	5	250	1.5	5
292	31 Jan	0446	16°31.32' S	115°45.69' E	site 2, random	oblique tow	D	27.60	34.89	250	5	250	1.5	5

Table 1. Continued.

Station number	Date 1987	Time GMT	Latitude	Longitude	Study	Activity	Day or night	Surface temp. (°C)	Surface salinity (ppt)	Wind direc-tion	Wind force	Swell direc-tion	Swell height (m)	Cloud cover (0-8)
293	31 Jan	0509	16°30.87' S	115°46.36' E	site 2, random	oblique tow	D	27.60	34.88	250	5	250	1.5	5
294	31 Jan	0545	16°26.46' S	115°47.60' E	site 2, random	oblique tow	D	27.60	34.86	250	5	250	1.5	5
295	31 Jan	0622	16°26.30' S	115°51.02' E	site 2, random	surface and oblique tow	D	27.46	34.79	250	5	250	1.5	6
296	31 Jan	0701	16°26.22' S	115°51.58' E	site 2, random	surface and oblique tow	D	27.45	34.79	250	5	250	1.5	6
297	31 Jan	1107	16°32.40' S	115°51.20' E	site 2, random	hydrographic cast	N	27.55	34.84	250	5	250	1.5	6
298	31 Jan	1207	16°32.25' S	115°50.98' E	site 2, random	oblique tow	N	27.55	34.85	230	5	230	1.5	6
299	31 Jan	1239	16°33.75' S	115°49.80' E	site 2, random	oblique tow	N	27.55	34.84	230	5	230	1.0	6
300	31 Jan	1310	16°30.92' S	115°48.74' E	site 2, random	surface and oblique tow	N	27.50	34.83	230	6	230	1.5	6
301	31 Jan	1426	16°35.23' S	115°47.01' E	site 2, random	surface and oblique tow	N	27.50	34.87	230	6	230	2.0	6
302	31 Jan	1506	16°35.01' S	115°45.93' E	site 2, random	oblique tow	N	27.50	34.88	230	6	230	1.5	6
303	31 Jan	1605	16°36.73' S	115°51.37' E	site 2, random	surface and oblique tow	N	27.50	34.85	230	5	230	1.5	6
304	31 Jan	1643	16°36.48' S	115°51.08' E	site 2, random	oblique tow	N	27.50	34.84	230	5	230	1.5	6
305	31 Jan	1709	16°35.64' S	115°53.16' E	site 2, random	oblique tow	N	27.50	34.85	230	5	230	1.5	7
306	31 Jan	1802	16°37.84' S	115°53.21' E	site 2, random	surface and oblique tow	N	27.50	34.85	260	5	230	1.5	7
307	31 Jan	1857	16°37.51' S	115°55.02' E	site 2, random	surface and oblique tow	N	27.50	34.85	260	5	230	1.5	7
308	31 Jan	2150	16°31.50' S	115°51.10' E	site 2, random	hydrographic cast	N	27.35	34.81	260	5	230	1.5	5
309	1 Feb	0055	16°28.96' S	115°50.75' E	site 2, random	surface and oblique tow	D	27.30	34.78	230	4	230	2.0	7
310	1 Feb	0258	16°30.02' S	115°48.73' E	site 2, random	oblique tow	D	27.45	34.84	230	4	230	2.0	6
311	1 Feb	0316	16°30.02' S	115°50.71' E	site 2, random	oblique tow	D	27.45	34.83	230	4	230	2.0	6
312	1 Feb	0447	16°24.00' S	115°51.81' E	site 2, random	surface and oblique tow	D	27.18	34.68	230	4	230	2.0	6
313	1 Feb	0535	16°27.19' S	115°54.50' E	site 2, random	oblique tow	D	27.20	34.72	230	4	230	2.0	6
314	1 Feb	0556	16°27.43' S	115°54.41' E	site 2, random	surface and oblique tow	D	27.20	34.72	230	4	230	2.0	7
315	1 Feb	0626	16°26.04' S	115°55.66' E	site 2, random	surface and oblique tow	D	27.23	34.74	230	4	230	2.0	7
316	1 Feb	0723	16°30.02' S	115°55.71' E	site 2, random	oblique tow	D	27.40	34.82	230	4	230	2.0	7
317	1 Feb	0805	16°33.87' S	115°53.17' E	site 2, random	oblique tow	D	27.49	34.84	230	4	230	2.0	7
318	1 Feb	0824	16°33.40' S	115°54.24' E	site 2, random	surface and oblique tow	D	27.49	34.84	230	4	230	2.0	7
319	1 Feb	1120	16°31.00' S	115°53.00' E	site 2, random	hydrographic cast	N	27.35	34.81	230	5	230	1.0	8

Table 1. Continued.

Station number	Date 1987	Time GMT	Latitude	Longitude	Study	Activity	Day or night	Surface temp. (°C)	Surface salinity (ppt)	Wind direction	Wind force	Swell direction	Swell height (m)	Cloud cover (0-8)
320	1 Feb	1228	16°31.01' S	115°52.97' E	site 2, random	oblique tow	N	27.35	34.82	230	5	230	1.0	8
321	1 Feb	1331	16°27.97' S	115°51.23' E	site 2, random	surface and oblique tow	N	27.25	34.76	230	5	230	1.5	8
322	1 Feb	1406	16°27.25' S	115°51.01' E	site 2, random	oblique tow	N	27.20	34.74	230	5	230	2.0	8
323	1 Feb	1441	16°27.48' S	115°54.31' E	site 2, random	oblique tow	N	27.29	34.78	230	5	230	2.0	8
324	1 Feb	1527	16°28.73' S	115°54.68' E	site 2, random	oblique tow	N	27.30	34.80	230	5	230	2.0	8
325	1 Feb	1641	16°29.03' S	115°50.07' E	site 2, random	surface and oblique tow	N	27.25	34.78	230	5	230	2.0	8
326	1 Feb	1742	16°32.02' S	115°50.97' E	site 2, random	surface and oblique tow	N	27.39	34.82	230	5	230	2.0	8
327	1 Feb	1846	16°27.86' S	115°48.23' E	site 2, random	surface and oblique tow	N	27.15	34.74	230	5	230	2.0	8
328	1 Feb	1933	16°23.04' S	115°49.50' E	site 2, random	oblique tow	N	27.05	34.68	230	5	230	2.0	8
329	1 Feb	2000	16°23.68' S	115°52.01' E	site 2, random	surface and oblique tow	N	27.00	34.67	230	5	230	2.0	8
330	1 Feb	2208	16°29.00' S	115°52.00' E	site 2, random	hydrographic cast	D	27.20	34.79	230	5	230	2.0	8
331	2 Feb	0119	16°28.60' S	115°52.00' E	site 2, random	surface and oblique tow	D	27.20	34.78	250	5	250	2.0	8
332	2 Feb	0215	16°28.33' S	115°55.26' E	site 2, random	surface and oblique tow	D	27.25	34.80	250	5	250	2.0	8
333	2 Feb	0311	16°27.25' S	115°55.03' E	site 2, random	surface and oblique tow	D	27.20	34.78	230	6	230	2.0	8
334	2 Feb	0343	16°26.42' S	115°55.82' E	site 2, random	oblique tow	D	27.19	34.75	250	6	250	2.0	8
335	2 Feb	0542	16°27.98' S	115°48.73' E	site 2, random	oblique tow	D	27.40	34.77	250	6	250	2.0	8
336	2 Feb	0706	16°29.56' S	115°54.82' E	site 2, random	oblique tow	D	27.40	34.79	250	6	250	2.0	8
337	2 Feb	0805	16°28.11' S	115°50.38' E	site 2, random	oblique tow	D	27.20	34.75	250	6	250	2.0	8
338	2 Feb	0833	16°26.08' S	115°51.01' E	site 2, random	surface and oblique tow	D	27.20	34.75	250	6	250	2.0	8
339	2 Feb	1030	16°33.29' S	115°50.12' E	site 2, random	hydrographic cast	N	27.30	34.83	250	6	250	2.5	8
340	2 Feb	1215	16°33.95' S	115°51.49' E	site 2, random	oblique tow	N	27.30	34.75	250	6	250	2.5	8
341	2 Feb	1301	16°33.29' S	115°50.12' E	site 2, random	surface and oblique tow	N	27.25	34.83	250	6	250	2.5	8
342	2 Feb	1351	16°33.52' S	115°49.47' E	site 2, random	oblique tow	N	27.25	34.82	250	6	250	2.5	8
343	2 Feb	1434	16°36.01' S	115°49.04' E	site 2, random	surface and oblique tow	N	27.25	34.83	250	6	250	2.0	8
344	2 Feb	1531	16°29.18' S	115°48.74' E	site 2, random	oblique tow	N	27.20	34.81	250	6	250	2.0	8
345	2 Feb	1625	16°26.80' S	115°47.35' E	site 2, random	oblique tow	N	27.20	34.78	250	7	250	2.0	8

Table 2. Ichthyoplankton tow and catch data on SO1/87. A and B postfix on station number denotes port and starboard sides of bongo net. Displacement volumes of 0 represent volumes less than 1 ml; -- represents data missing or not recorded; *T. ala./alba.* - *Thunnus alalunga and T. albacares* that cannot be differentiated from each other; unid. tuna - unidentified tuna including larvae damaged or too small to identify to species; other species - include fish larvae other than scombrids and istiophorids. All numbers of larvae are raw counts unadjusted for volume filtered.

Station number	Date 1987	Time GMT	Depth strata (m)	Tow dur. (min.)	Vol. filtered (m^3)	Settled vol. (ml)	Displ. vol. (ml)	*T. macc-oyii*	*T. obesus*	*T. ala-lunga*	*T. alba-cares*	*T. ala./ alba.*	*K. pela-mis*	*A. solan-dri*	Istio-phor-idae	Unid. tuna	Other species
76	16 Jan	0215	0-2	5	145	5	2	12	0	1	0	3	0	0	0	8	6
77	16 Jan	0224	0-2	5	157	1	0	3	0	0	0	1	0	0	0	3	3
78	16 Jan	0232	0-2	5	127	3	1	14	0	2	0	1	0	0	0	4	4
79	16 Jan	0240	0-2	5	145	1	0	11	0	0	0	0	0	0	0	3	5
80	16 Jan	0248	0-2	5	125	3	1	0	0	0	0	0	0	0	0	1	1
81	16 Jan	0255	0-2	5	120	1	0	0	0	0	0	0	0	0	0	0	2
82	16 Jan	0302	0-2	5	136	1	0	1	0	0	0	0	0	0	0	0	4
83	16 Jan	0309	0-2	5	183	1	0	0	0	0	0	0	0	0	0	0	5
84	16 Jan	0319	0-2	5	135	1	0	0	0	0	0	0	0	0	0	0	1
85	16 Jan	0326	0-2	5	127	1	0	0	0	0	0	0	0	0	0	0	4
86	16 Jan	0333	0-2	5	131	2	1	0	0	0	0	0	0	0	0	0	6
87	16 Jan	0341	0-2	5	135	1	0	0	0	0	0	0	0	0	0	0	3
88	16 Jan	0348	0-2	5	134	2	1	0	0	0	0	0	0	0	0	0	1
89	16 Jan	0356	0-2	5	142	1	0	0	0	0	0	0	0	0	0	0	2
90	16 Jan	0403	0-2	5	158	1	0	0	0	0	0	0	0	0	0	0	3
91	16 Jan	0412	0-2	5	152	1	0	0	0	0	0	0	0	0	0	0	9
92	16 Jan	0419	0-2	5	178	1	0	0	0	0	0	0	0	0	0	0	2
93	16 Jan	0425	0-2	5	184	2	1	0	0	0	0	0	0	0	0	0	1
94	16 Jan	0436	0-2	5	160	3	1	0	0	0	0	0	0	0	0	0	3
95	16 Jan	0445	0-2	5	162	3	1	0	0	0	0	0	0	0	0	0	5
96	16 Jan	0453	0-2	5	145	3	1	0	0	0	0	0	0	0	0	0	2
97	16 Jan	0500	0-2	5	159	5	2	0	0	0	0	0	0	0	0	0	12

Table 2. Continued.

Station number	Date	Time GMT	Depth strata (m)	Tow dur. (min.)	Vol. filtered (m^3)	Settled vol. (ml)	Displ. vol. (ml)	*T. macc-oyii*	*T. obesus*	*T. ala-lunga*	*T. alba-cares*	*T. ala./ alba.*	*K. pela-mis*	*A. solan-dri*	Istio-phor-idae	Unid. tuna	Other species
98	16 Jan	0507	0-2	5	168	3	1	0	0	0	0	0	0	0	0	0	3
99	16 Jan	0515	0-2	5	151	1	0	0	0	0	0	0	0	0	0	0	2
100	16 Jan	0522	0-2	5	168	1	0	0	0	0	0	0	0	0	0	0	13
101	16 Jan	0530	0-2	5	164	1	0	0	0	0	0	0	0	0	0	0	6
102	16 Jan	0537	0-2	5	148	1	0	3	0	1	0	0	0	0	0	0	4
103	16 Jan	0544	0-2	5	170	1	0	1	0	0	0	0	0	0	0	0	5
104	16 Jan	0531	0-2	5	155	5	1	0	0	0	0	2	0	0	0	0	4
105	16 Jan	0558	0-2	5	168	5	1	1	0	0	0	0	0	0	0	0	10
106	16 Jan	0605	0-2	5	171	10	2	0	0	0	0	0	0	0	1	2	11
107	16 Jan	0612	0-2	5	166	5	1	5	0	0	1	0	0	0	0	2	9
108	16 Jan	0619	0-2	5	186	5	1	8	0	0	0	0	0	0	0	0	13
109	16 Jan	0627	0-2	5	190	5	1	6	0	1	0	0	0	0	0	0	15
110	16 Jan	0635	0-2	5	153	5	1	1	0	0	0	0	0	0	0	1	12
111	16 Jan	0642	0-2	5	174	5	1	4	0	0	0	0	0	0	0	1	6
112	16 Jan	0650	0-2	5	177	5	1	2	0	0	1	0	0	0	0	6	13
113	16 Jan	0658	0-2	5	172	5	1	7	0	1	0	0	0	0	0	0	8
114	16 Jan	0705	0-2	5	159	5	1	9	0	0	0	1	0	0	0	0	6
115	16 Jan	0712	0-2	5	163	5	1	6	0	1	0	0	0	0	0	0	6
116	16 Jan	0719	0-2	5	192	5	1	0	0	0	0	0	0	0	1	0	8
117	16 Jan	0727	0-2	5	167	5	1	10	0	0	0	0	0	0	0	0	15
118	16 Jan	0734	0-2	5	167	5	1	21	0	0	0	0	0	0	0	0	8
119	16 Jan	0742	0-2	5	187	5	1	30	0	1	0	0	0	0	0	0	10
120	16 Jan	0749	0-2	5	164	5	1	2	0	0	0	0	0	0	0	0	3
121	16 Jan	0756	0-2	5	167	5	1	18	0	1	0	0	0	0	0	0	8
122	16 Jan	0803	0-2	5	170	5	1	16	0	1	0	1	0	0	0	0	16

Table 2. Continued.

Station number	Date	Time GMT	Depth strata (m)	Tow dur. (min.)	Vol. filtered (m^3)	Settled vol. (ml)	Displ. vol. (ml)	*T. macc-oyii*	*T. obesus*	*T. ala-lunga*	*T. alba-cares*	*T. ala./ alba.*	*K. pela-mis*	*A. solan-dri*	Istio-phor-idae	Unid. tuna	Other species
123	16 Jan	0810	0-2	5	170	5	1	23	0	0	1	0	0	0	1	0	14
124	16 Jan	0817	0-2	5	156	5	1	19	0	0	0	0	0	0	1	0	14
125	16 Jan	0824	0-2	5	158	5	1	36	0	4	0	0	0	0	0	0	7
126	16 Jan	0830	0-2	5	156	10	1	14	0	1	0	0	0	0	0	3	6
128	16 Jan	1321	0-2	10	310	80	21	8	0	0	0	0	1	0	0	1	6
128A	16 Jan	1321	35-0	20	593	80	21	0	0	0	0	0	0	0	0	0	16
128B	16 Jan	1321	35-0	20	593	80	21	0	0	0	0	0	0	0	0	0	11
129	16 Jan	1423	0-2	10	268	30	9	4	0	0	0	0	0	0	0	0	6
130	16 Jan	1527	0-2	10	529	40	9	6	0	0	0	0	4	0	0	0	13
131	16 Jan	1624	0-2	10	357	40	15	4	0	0	0	0	3	0	0	1	14
131A	16 Jan	1624	79-33	20	–	40	15	0	0	0	0	0	0	0	0	0	184
131B	16 Jan	1624	79-0	20	799	40	15	3	0	0	0	0	2	0	0	0	386
132	16 Jan	1724	0-2	10	339	40	16	8	0	0	0	0	3	0	0	4	20
132A	16 Jan	1724	34-0	21	806	40	16	0	0	1	0	0	3	0	0	0	37
132B	16 Jan	1724	34-0	21	806	40	16	4	0	0	0	0	4	0	1	1	34
133	16 Jan	1827	0-2	10	300	50	15	2	0	0	0	0	0	0	0	0	8
133B	16 Jan	1827	70-33	17	530	50	15	0	0	0	0	0	0	0	0	0	101
134	16 Jan	1921	0-2	10	279	35	6	5	0	0	0	1	4	0	0	4	8
134A	16 Jan	1921	72-34	20	851	35	6	0	0	0	0	0	0	0	0	0	267
134B	16 Jan	1921	72-34	20	851	35	6	0	0	0	0	0	0	0	0	0	263
135	16 Jan	2014	0-2	10	295	40	18	1	0	1	0	0	0	0	0	1	7
135A	16 Jan	2014	72-34	20	791	40	18	0	0	0	0	0	0	0	0	0	243
135B	16 Jan	2014	72-34	20	791	40	18	0	0	0	0	0	0	0	0	0	203
136	16 Jan	2120	0-2	10	320	90	27	4	0	0	0	0	2	1	0	2	21
138	17 Jan	0144	0-2	10	264	20	2	32	0	6	0	0	0	0	0	0	19

Table 2. Continued.

Station number	Date	Time GMT	Depth strata (m)	Tow dur. (min.)	Vol. filtered (m^3)	Settled vol. (ml)	Displ. vol. (ml)	*T. macc-oyii*	*T. obesus*	*T. ala-lunga*	*T. alba-cares*	*T. ala./ alba.*	*K. pela-mis*	*A. solan-dri*	Istio-phor-idae	Unid. tuna	Other species
138A	17 Jan	0144	78-34	20	608	20	2	0	0	0	0	0	0	0	0	0	67
138B	17 Jan	0144	78-34	20	608	20	2	0	0	0	0	0	0	0	0	0	24
139	17 Jan	0235	0-2	10	271	45	13	34	0	5	0	0	0	0	0	3	32
139A	17 Jan	0235	37-0	20	617	45	13	8	0	1	0	1	2	1	0	1	101
139B	17 Jan	0235	37-0	20	617	45	13	4	0	1	0	0	1	0	0	2	91
142	21 Jan	0114	0-2	10	308	–	–	28	0	1	0	0	0	0	0	0	9
142	21 Jan	0114	0-50	21	676	–	–	5	0	0	0	0	1	0	0	1	71
143	21 Jan	0225	0-2	10	311	–	–	79	0	3	0	0	0	0	0	2	10
143	21 Jan	0225	0-50	22	718	–	–	29	0	2	0	0	1	0	0	0	42
144	21 Jan	0310	0-2	10	285	–	–	1	0	1	0	0	0	0	2	0	7
144	21 Jan	0310	0-50	23	673	–	–	1	0	0	0	0	1	0	0	0	102
145	21 Jan	0459	0-2	10	409	–	–	1	0	1	0	0	0	0	0	0	17
145	21 Jan	0459	0-50	22	829	–	–	3	0	3	0	0	3	0	0	0	103
146	21 Jan	0537	0-2	10	325	–	–	0	0	0	0	0	0	0	0	0	5
146	21 Jan	0537	0-50	22	761	–	–	3	0	0	0	0	1	0	0	0	165
147	21 Jan	0619	0-2	10	298	–	–	15	0	5	0	2	0	0	0	0	9
147	21 Jan	0619	0-50	22	712	–	–	10	0	0	0	0	4	0	0	2	124
148	21 Jan	0703	0-2	10	317	–	–	39	0	6	0	0	0	0	0	0	7
148	21 Jan	0703	0-50	21	749	–	–	8	0	2	0	0	4	0	0	0	96
149	21 Jan	0806	0-2	10	311	–	–	5	0	4	1	0	0	0	0	6	15
149	21 Jan	0806	0-50	21	680	–	–	1	0	0	0	0	4	0	0	3	96
151	21 Jan	1128	0-2	10	273	–	–	6	0	1	0	0	2	0	0	2	82
151	21 Jan	1128	0-50	20	534	–	–	4	0	1	0	0	4	0	1	3	214
152	21 Jan	1218	0-2	10	274	–	–	4	0	0	0	0	1	0	0	1	68
152	21 Jan	1218	0-50	21	534	–	–	4	0	0	0	0	2	0	0	0	308

Table 2. Continued.

Station number	Date	Time GMT	Depth strata (m)	Tow dur. (min.)	Vol. filtered (m^3)	Settled vol. (ml)	Displ. vol. (ml)	*T. macc-oyii*	*T. obesus*	*T. ala-lunga*	*T. alba-cares*	*T. ala./ alba.*	*K. pela-mis*	*A. solan-dri*	Istio-phor-idae	Unid. tuna	Other species
153	21 Jan	1353	0-2	10	347	110	35	3	0	1	0	0	3	0	0	0	26
153	21 Jan	1353	0-50	22	703	110	35	6	0	0	0	0	1	0	0	0	310
154	21 Jan	1441	0-2	10	304	170	43	5	0	0	0	0	1	0	0	1	58
154	21 Jan	1441	0-50	24	715	170	43	3	0	0	0	0	5	0	0	2	361
155	21 Jan	1556	0-2	10	347	60	20	30	0	0	0	0	0	0	0	0	77
155	21 Jan	1556	0-50	19	618	60	20	95	0	1	0	0	2	0	0	5	330
156	21 Jan	1645	0-2	10	392	80	23	2	0	1	0	0	1	0	0	0	55
156	21 Jan	1645	0-50	21	702	80	23	5	0	0	0	1	2	0	1	0	168
157	21 Jan	1731	0-2	10	313	40	11	14	0	2	0	0	0	0	0	1	59
157	21 Jan	1731	0-50	20	674	40	11	24	0	8	0	0	2	0	0	6	293
158	21 Jan	1825	0-2	10	342	35	9	27	0	3	0	0	2	0	0	3	58
158	21 Jan	1825	0-50	21	675	35	9	78	0	1	0	0	2	0	0	9	328
159	21 Jan	1928	0-2	10	332	55	20	3	0	0	0	0	0	0	0	0	49
159	21 Jan	1928	0-50	21	680	55	20	21	0	0	0	0	0	0	0	2	338
160	21 Jan	2006	0-2	10	336	40	12	5	0	0	0	0	0	0	0	0	65
160	21 Jan	2006	0-50	21	720	40	12	17	0	2	0	1	2	0	0	2	368
162	22 Jan	0021	0-2	10	255	20	5	2	0	17	8	5	0	0	2	213	55
162	22 Jan	0021	0-50	21	646	20	5	1	0	1	0	0	0	0	0	16	147
163	22 Jan	0124	0-2	10	437	20	5	59	0	4	3	8	0	0	0	14	18
163	22 Jan	0124	0-50	20	559	20	5	4	0	1	0	0	3	0	0	3	100
164	22 Jan	0209	0-2	10	237	10	2	10	0	0	0	1	0	0	0	1	8
164	22 Jan	0209	0-50	21	715	10	2	6	0	0	0	0	3	0	0	2	69
165	22 Jan	0343	0-2	10	264	5	2	0	0	0	0	0	0	0	0	0	9
165	22 Jan	0343	0-50	22	624	5	2	6	0	1	0	0	0	0	0	1	195

Table 2. Continued.

Station number	Date	Time GMT	Depth strata (m)	Tow dur. (min.)	Vol. filtered (m^3)	Settled vol. (ml)	Displ. vol. (ml)	*T. macc-oyii*	*T. obesus*	*T. ala-lunga*	*T. alba-cares*	*T. ala./ alba.*	*K. pela-mis*	*A. solan-dri*	Istio-phor-idae	Unid. tuna	Other species
166	22 Jan	0452	0-2	10	395	3	1	0	0	0	0	0	0	0	0	1	29
166	22 Jan	0452	0-50	23	820	3	1	1	0	0	0	0	2	0	2	3	81
167	22 Jan	0557	0-2	10	309	2	0	6	0	2	1	0	0	0	0	4	3
167	22 Jan	0557	0-50	21	679	2	0	4	0	7	0	1	0	0	0	1	193
168	22 Jan	0635	0-2	10	298	6	2	0	0	1	0	0	0	0	0	33	15
168	22 Jan	0635	0-50	20	670	6	2	1	0	0	0	1	1	0	0	12	98
169	22 Jan	0717	0-2	10	305	6	2	8	0	6	0	0	0	0	0	1	13
169	22 Jan	0717	0-50	22	707	6	2	3	0	2	0	1	1	0	0	4	251
177	27 Jan	0023	0-2	10	309	–	–	11	0	8	0	19	0	0	1	15	15
177	27 Jan	0023	0-30	15	440	–	–	5	0	1	0	2	0	0	1	2	85
178	27 Jan	0052	0-2	10	320	–	–	0	0	0	0	1	0	0	0	1	14
178	27 Jan	0052	0-40	15	475	–	–	5	0	2	0	1	3	0	0	3	137
179	27 Jan	0115	0-2	10	358	–	–	1	0	0	0	1	0	0	0	1	12
179	27 Jan	0115	0-40	20	724	–	–	8	0	6	1	1	3	0	0	2	306
180	27 Jan	0149	0-2	10	287	–	–	1	0	1	0	0	0	0	0	2	14
180	27 Jan	0149	0-40	17	499	–	–	5	0	6	0	2	0	0	0	3	189
181	27 Jan	0534	0-2	10	253	1	10	0	0	5	0	3	0	0	3	4	4
181	27 Jan	0534	0-40	21	510	1	10	1	0	0	0	1	1	0	1	1	98
182	27 Jan	0607	0-2	10	305	1	12	4	0	8	0	2	0	0	0	33	16
182	27 Jan	0607	0-40	21	522	1	12	0	0	0	0	1	0	0	0	13	117
183	27 Jan	0651	0-2	10	314	1	17	0	0	7	0	10	0	0	1	9	30
183	27 Jan	0651	0-40	21	561	1	17	0	0	5	0	3	0	0	0	7	171
184	27 Jan	0726	0-2	10	278	1	17	2	0	9	0	7	0	0	3	1	3
184	27 Jan	0726	0-40	20	538	1	17	2	0	2	0	2	0	0	0	5	153
185	27 Jan	0802	0-2	10	259	1	15	7	0	11	0	20	0	0	2	26	17

Table 2. Continued.

Station number	Date	Time GMT	Depth strata (m)	Tow dur. (min.)	Vol. filtered (m^3)	Settled vol. (ml)	Displ. vol. (ml)	*T. macc-oyii*	*T. obesus*	*T. ala-lunga*	*T. alba-cares*	*T. ala./ alba.*	*K. pela-mis*	*A. solan-dri*	Istio-phor-idae	Unid. tuna	Other species
185	27 Jan	0802	0-40	20	565	1	15	0	0	0	0	1	0	0	0	3	274
186	27 Jan	0835	0-40	21	540	15	6	2	0	2	0	1	0	0	0	0	146
186	27 Jan	0835	0-2	10	250	15	6	3	0	29	0	15	0	0	5	15	0
193	28 Jan	0820	0-40	21	574	-	-	1882	0	0	0	15	0	0	0	1239	258
195	28 Jan	1305	0-2	5	100	20	2	1761	0	0	0	0	0	0	0	440	0
196	28 Jan	1312	0-2	5	135	25	8	1220	0	0	0	0	0	0	0	1684	6
197	28 Jan	1322	0-2	5	124	25	6	1808	0	0	0	0	0	0	0	570	6
198	28 Jan	1328	0-2	5	143	25	12	1202	0	0	0	0	0	0	0	1155	5
199	28 Jan	1334	0-2	5	127	20	4	936	0	7	0	0	0	0	0	554	6
200	28 Jan	1342	0-2	5	131	30	9	305	0	0	0	0	0	0	0	619	5
201	28 Jan	1350	0-2	5	114	20	5	117	0	0	0	0	0	0	0	318	2
202	28 Jan	1355	0-2	5	144	25	10	24	0	0	0	0	0	0	0	161	7
203	28 Jan	1403	0-2	5	120	25	8	15	0	0	0	0	0	0	0	77	5
204	28 Jan	1410	0-2	5	143	25	7	6	0	0	0	0	0	0	0	34	3
205	28 Jan	1417	0-2	5	129	25	3	3	0	0	0	0	0	0	0	7	11
206	28 Jan	1424	0-2	5	122	25	4	0	0	0	0	0	0	0	0	1	2
207	28 Jan	1431	0-2	5	132	25	5	0	0	0	0	0	0	0	0	0	6
208	28 Jan	1438	0-2	5	125	30	11	0	0	0	0	0	0	0	0	1	4
209	28 Jan	1444	0-2	5	136	30	10	1	0	0	0	0	0	0	0	0	2
210	28 Jan	1451	0-2	5	138	30	11	1	0	0	0	0	0	0	0	2	8
211	28 Jan	1457	0-2	5	126	20	6	3	0	0	0	0	0	0	0	0	1
212	28 Jan	1504	0-2	5	140	30	10	2	0	0	0	0	0	0	0	0	4
213	28 Jan	1512	0-2	5	141	30	14	0	0	0	0	0	0	0	0	0	3
214	28 Jan	1519	0-2	5	137	25	10	1	0	1	0	0	1	0	0	1	3

Table 2. Continued.

Station number	Date	Time GMT	Depth strata (m)	Tow dur. (min.)	Vol. filtered (m^3)	Settled vol. (ml)	Displ. vol. (ml)	*T. macc-oyii*	*T. obesus*	*T. ala-lunga*	*T. alba-cares*	*T. ala./ alba.*	*K. pela-mis*	*A. solan-dri*	Istio-phor-idae	Unid. tuna	Other species
215	28 Jan	1526	0-2	5	131	40	18	3	0	0	0	0	0	0	0	2	7
216	28 Jan	1532	0-2	5	149	30	9	0	0	0	0	0	2	0	0	1	6
217	28 Jan	1540	0-2	5	148	55	18	4	0	0	0	0	1	0	0	3	7
218	28 Jan	1546	0-2	5	141	35	10	2	0	0	0	0	0	0	0	3	9
219	28 Jan	1554	0-2	5	124	30	11	0	0	1	0	2	1	0	0	3	0
220	28 Jan	1600	0-2	5	131	30	8	1	0	0	0	1	1	0	0	4	11
221	28 Jan	1609	0-2	5	135	30	10	1	0	2	0	0	0	0	0	7	13
222	28 Jan	1618	0-2	5	157	30	10	1	0	0	0	0	1	0	0	6	11
223	28 Jan	1625	0-2	5	133	30	11	1	0	1	0	0	0	0	0	3	15
224	28 Jan	1632	0-2	5	152	35	10	3	0	2	0	0	1	0	0	1	18
225	28 Jan	1640	0-2	5	143	30	10	2	0	1	0	0	0	0	0	1	22
226	28 Jan	1648	0-2	5	146	30	8	2	0	1	0	0	1	0	0	1	22
227	28 Jan	1655	0-2	5	152	760	439	0	0	0	0	0	0	0	0	0	8
228	28 Jan	1702	0-2	5	184	655	407	0	0	0	0	0	0	0	0	0	7
229	28 Jan	1714	0-2	5	166	25	9	5	0	0	0	0	0	0	0	2	37
230	28 Jan	1727	0-2	5	172	40	13	10	0	0	0	0	0	0	0	0	37
231	28 Jan	1731	0-2	5	140	40	12	11	0	1	0	0	0	0	0	1	28
232	28 Jan	1737	0-2	5	133	30	8	10	0	1	0	0	1	0	0	0	57
233	28 Jan	1744	0-2	5	147	45	13	17	0	0	0	0	0	0	0	0	37
234	28 Jan	1750	0-2	5	146	40	9	30	0	1	0	4	0	0	1	3	40
235	28 Jan	1758	0-2	5	133	35	11	26	0	2	0	4	0	0	0	3	30
237	28 Jan	1811	0-2	5	162	30	10	69	0	0	2	12	0	0	1	12	51
238	28 Jan	1819	0-2	5	146	35	10	47	0	7	0	0	0	0	0	36	39
239	28 Jan	1826	0-2	5	140	40	12	45	0	5	0	11	0	0	0	23	63
240	28 Jan	1833	0-2	5	141	35	10	44	0	1	0	14	1	0	0	15	47

Table 2. Continued.

Station number	Date	Time GMT	Depth strata (m)	Tow dur. (min.)	Vol. filtered (m^3)	Settled vol. (ml)	Displ. vol. (ml)	*T. macc-oyii*	*T. obesus*	*T. ala-lunga*	*T. alba-cares*	*T. ala./ alba.*	*K. pela-mis*	*A. solan-dri*	Istio-phor-idae	Unid. tuna	Other species
241	28 Jan	1840	0-2	5	144	40	12	27	0	1	0	6	0	0	0	31	37
242	28 Jan	1847	0-2	5	147	35	15	24	0	1	2	3	2	0	0	7	23
243	28 Jan	1854	0-2	5	142	40	14	22	0	1	0	4	4	0	0	33	48
244	28 Jan	1901	0-2	5	142	50	17	19	0	0	0	3	2	0	0	22	33
245	28 Jan	1909	0-2	5	141	35	14	23	0	0	0	7	0	0	0	20	30
247	29 Jan	0043	0-40	10	311	60	18	24	0	0	0	0	0	0	0	1	148
248	29 Jan	0107	0-40	10	336	40	11	21	0	0	0	0	0	0	0	7	97
249	29 Jan	0133	0-40	20	520	5	2	30	0	0	0	1	0	0	0	4	169
249	29 Jan	0133	0-2	10	194	5	2	81	0	1	0	1	0	0	0	3	1
250	29 Jan	0236	0-2	10	308	10	4	3	0	0	0	0	0	0	0	0	9
250	29 Jan	0236	0-40	21	711	10	4	10	0	1	0	1	0	0	0	3	140
251	29 Jan	0336	0-40	20	710	10	1	43	0	0	0	8	0	0	0	0	201
251	29 Jan	0336	0-2	10	309	10	1	5	0	0	0	1	0	0	0	1	0
252	29 Jan	0437	0-2	10	306	5	1	34	0	0	0	0	0	0	0	3	10
252	29 Jan	0437	0-40	20	583	5	1	411	0	1	0	0	1	0	0	2	87
253	29 Jan	0523	0-40	10	336	45	14	240	0	1	0	0	1	1	0	0	58
254	29 Jan	0602	0-40	10	327	55	26	16	0	0	0	0	0	0	0	3	44
256	29 Jan	1204	0-40	9	240	50	12	15	0	0	1	0	0	0	0	0	83
257	29 Jan	1237	0-40	11	331	60	15	16	0	1	0	0	1	0	0	0	214
258	29 Jan	1312	0-2	10	318	250	143	0	0	0	1	0	0	0	0	6	13
258	29 Jan	1312	0-40	20	661	250	143	33	0	1	0	1	1	0	0	0	206
259	29 Jan	1404	0-40	21	490	40	16	56	0	3	0	0	4	0	0	4	211
259	29 Jan	1404	0-2	10	275	40	16	17	0	0	1	0	0	0	0	0	0
260	29 Jan	1449	0-40	10	256	70	20	8	0	0	0	1	1	0	0	1	91
261	29 Jan	1527	0-40	18	501	120	27	4	0	5	1	2	1	0	0	2	250

Table 2. Continued.

Station number	Date	Time GMT	Depth strata (m)	Tow dur. (min.)	Vol. filtered (m^3)	Settled vol. (ml)	Displ. vol. (ml)	*T. macc-oyii*	*T. obesus*	*T. ala-lunga*	*T. alba-cares*	*T. ala./ alba.*	*K. pela-mis*	*A. solan-dri*	Istio-phor-idae	Unid. tuna	Other species
261	29 Jan	1527	0-2	10	299	120	27	4	0	5	0	0	1	0	0	1	54
262	29 Jan	1654	0-40	10	347	60	14	7	0	1	0	0	3	1	0	2	113
263	29 Jan	1741	0-40	20	709	75	17	10	0	0	0	0	2	2	0	66	217
263	29 Jan	1741	0-2	10	310	75	17	23	0	0	0	0	0	0	0	0	71
264	29 Jan	1825	0-40	10	310	70	16	3	0	2	0	0	0	0	0	0	132
265	29 Jan	1924	0-2	10	324	55	11	1	0	2	0	0	1	0	0	1	63
265	29 Jan	1924	0-40	21	663	55	11	2	0	1	2	0	1	0	0	0	378
267	30 Jan	0229	0-40	11	356	25	3	896	0	4	0	0	0	0	0	0	208
268	30 Jan	0256	0-40	20	577	10	1	46	0	0	1	0	0	0	0	5	140
268	30 Jan	0256	0-2	10	262	10	1	192	0	2	1	1	0	0	0	4	11
269	30 Jan	0332	0-40	20	645	15	4	3	0	2	0	0	0	0	0	0	177
269	30 Jan	0332	0-2	10	310	15	4	5	0	1	0	0	0	0	0	0	11
270	30 Jan	0437	0-40	10	307	40	6	10	0	0	0	1	0	0	0	0	42
271	30 Jan	0523	0-40	20	695	10	2	18	0	3	1	2	0	0	0	0	119
271	30 Jan	0523	0-2	10	318	10	2	4	0	0	0	0	0	0	0	0	5
272	30 Jan	0617	0-40	10	310	35	6	306	0	0	1	1	0	0	0	0	66
273	30 Jan	0654	0-40	20	631	10	1	16	0	7	0	3	1	0	0	11	312
273	30 Jan	0654	0-2	10	280	10	1	9	0	25	1	4	0	0	2	14	25
274	30 Jan	0801	0-40	10	360	35	12	172	0	5	0	2	0	0	0	2	110
276	30 Jan	1235	0-40	11	337	40	16	156	0	0	0	2	0	0	0	42	0
277	30 Jan	1307	0-2	10	371	50	21	308	0	0	0	0	0	0	0	4	113
277	30 Jan	1307	0-40	20	703	50	21	386	0	0	0	0	2	0	0	12	407
278	30 Jan	1346	0-40	21	596	65	27	14	0	2	1	0	0	0	0	0	311
278	30 Jan	1346	0-2	10	348	65	27	2	0	0	0	0	0	0	0	0	57

Table 2. Continued.

Station number	Date	Time GMT	Depth strata (m)	Tow dur. (min.)	Vol. filtered (m^3)	Settled vol. (ml)	Displ. vol. (ml)	*T. macc-oyii*	*T. obesus*	*T. ala-lunga*	*T. alba-cares*	*T. ala./ alba.*	*K. pela-mis*	*A. solan-dri*	Istio-phor-idae	Unid. tuna	Other species
279	30 Jan	1429	0-40	10	419	70	27	1	0	4	0	0	1	0	0	0	84
280	30 Jan	1520	0-40	20	652	40	15	238	0	0	0	0	1	0	1	16	0
280	30 Jan	1520	0-2	10	365	40	15	95	0	0	0	0	0	0	0	1	99
281	30 Jan	1612	0-40	10	329	105	31	7	0	0	0	0	1	0	0	2	84
282	30 Jan	1641	0-40	20	611	80	41	20	0	5	0	0	0	0	0	2	238
282	30 Jan	1641	0-2	10	295	80	41	5	0	0	0	0	0	0	0	2	0
283	30 Jan	1832	0-40	10	310	35	18	4	0	0	0	0	1	0	0	0	243
284	30 Jan	1907	0-40	10	352	50	13	322	0	0	0	0	0	4	0	0	0
285	30 Jan	2002	0-40	20	569	50	14	6	0	0	0	0	1	0	0	4	259
285	30 Jan	2002	0-2	10	267	50	14	0	0	3	1	0	0	0	0	4	104
287	31 Jan	0036	0-40	9	306	50	12	0	0	0	0	0	0	0	0	1	28
288	31 Jan	0100	0-40	20	585	15	3	13	0	3	2	0	1	1	0	8	160
288	31 Jan	0100	0-2	10	271	15	3	27	0	26	1	0	0	0	0	3	53
289	31 Jan	0205	0-40	20	624	10	6	378	0	1	0	0	0	0	0	5	144
289	31 Jan	0205	0-2	10	302	10	6	246	0	2	0	0	0	0	0	0	18
290	31 Jan	0305	0-40	10	330	30	10	366	0	1	0	0	0	0	0	5	86
291	31 Jan	0329	0-40	20	589	15	3	943	0	4	0	0	0	0	0	4	155
291	31 Jan	0329	0-2	10	293	15	3	107	0	2	0	0	0	0	0	4	2
292	31 Jan	0446	0-40	10	324	25	5	3	0	0	0	0	1	0	0	0	40
293	31 Jan	0509	0-40	10	328	25	4	3	0	0	0	0	0	0	1	0	78
294	31 Jan	0545	0-40	10	333	30	5	182	0	0	0	2	2	1	0	2	91
295	31 Jan	0622	0-40	20	640	15	2	18	0	2	1	0	1	0	0	0	0
295	31 Jan	0622	0-2	10	301	15	2	48	1	39	4	0	0	0	1	10	34
296	31 Jan	0701	0-40	20	718	20	4	10	0	1	3	0	0	0	0	0	218
296	31 Jan	0701	0-2	10	340	20	4	91	0	44	1	0	0	0	2	12	29

Table 2. Continued.

Station number	Date	Time GMT	Depth strata (m)	Tow dur. (min.)	Vol. filtered (m^3)	Settled vol. (ml)	Displ. vol. (ml)	*T. macc-oyii*	*T. obesus*	*T. ala-lunga*	*T. alba-cares*	*T. ala./ alba.*	*K. pela-mis*	*A. solan-dri*	Istio-phor-idae	Unid. tuna	Other species
298	31 Jan	1207	0-40	10	323	55	12	62	0	3	1	0	0	0	0	2	1
299	31 Jan	1239	0-40	10	320	40	10	162	0	2	2	0	2	0	0	5	78
300	31 Jan	1310	0-2	10	304	30	10	178	0	1	0	0	1	0	0	4	84
300	31 Jan	1310	0-40	20	666	30	10	496	0	2	5	0	0	0	0	0	274
301	31 Jan	1426	0-40	21	651	35	11	11	0	4	0	0	2	0	0	1	398
301	31 Jan	1426	0-2	10	409	35	11	2	0	0	0	0	0	0	0	0	67
302	31 Jan	1506	0-40	11	290	70	35	1	0	0	0	2	1	0	0	2	64
303	31 Jan	1605	0-2	10	392	75	39	121	0	0	0	0	2	0	0	3	75
303	31 Jan	1605	0-40	21	699	75	39	262	0	0	0	0	0	0	1	5	202
304	31 Jan	1643	0-40	10	307	85	27	47	0	0	0	0	0	0	0	1	60
305	31 Jan	1709	0-40	10	330	110	32	0	0	2	1	0	3	0	0	0	82
306	31 Jan	1802	0-40	21	612	65	16	50	0	1	0	0	1	0	0	1	206
306	31 Jan	1802	0-2	10	280	65	16	30	0	1	0	0	1	0	0	0	53
307	31 Jan	1857	0-40	21	633	70	14	7	0	4	1	0	1	0	0	2	189
307	31 Jan	1857	0-2	10	300	70	14	2	0	0	0	0	1	0	0	0	77
309	1 Feb	0055	0-40	20	538	10	2	5	0	0	0	1	0	0	0	3	120
309	1 Feb	0055	0-2	10	241	10	2	35	0	15	2	1	0	0	0	5	120
310	1 Feb	0258	0-40	10	335	25	6	97	0	2	0	0	1	0	0	0	46
311	1 Feb	0316	0-40	10	341	30	4	90	0	1	0	0	0	0	0	4	91
312	1 Feb	0447	0-40	20	603	10	1	1	0	2	0	2	0	0	0	2	130
312	1 Feb	0447	0-2	10	290	10	1	29	0	27	2	0	0	0	5	3	55
313	1 Feb	0535	0-40	10	359	40	10	0	0	3	0	0	2	0	0	1	194
314	1 Feb	0556	0-40	20	674	20	8	0	0	2	0	0	5	0	0	1	332
314	1 Feb	0556	0-2	10	373	20	8	0	0	10	0	0	0	0	0	3	76
315	1 Feb	0626	0-40	20	631	20	3	3	0	2	0	2	0	0	0	0	258

Table 2. Continued.

Station number	Date	Time GMT	Depth strata (m)	Tow dur. (min.)	Vol. filtered (m^3)	Settled vol. (ml)	Displ. vol. (ml)	*T. macc-oyii*	*T. obesus*	*T. ala-lunga*	*T. /albo-cares*	*T. ala./ alba.*	*K. pela-mis*	*A. solan-dri*	Istio-phor-idae	Unid. tuna	Other species
315	1 Feb	0626	0-2	10	327	20	3	1	0	9	2	0	0	0	0	0	36
316	1 Feb	0723	0-40	10	301	35	12	0	0	0	0	0	0	0	0	0	44
317	1 Feb	0805	0-40	10	295	40	10	1	0	0	0	0	0	0	0	0	117
318	1 Feb	0824	0-40	20	646	35	14	0	0	4	0	0	1	0	0	3	151
318	1 Feb	0824	0-2	10	342	35	14	16	0	33	0	0	0	0	1	3	198
320	1 Feb	1228	0-40	10	283	50	23	4	0	2	0	2	0	0	0	1	98
321	1 Feb	1331	0-40	20	643	70	22	12	0	7	1	4	3	0	0	0	280
321	1 Feb	1331	0-2	10	321	70	22	9	0	1	0	2	0	0	0	0	140
322	1 Feb	1406	0-40	10	303	65	27	0	0	1	0	0	0	1	0	1	141
323	1 Feb	1441	0-40	11	352	75	29	0	0	0	0	2	1	0	0	1	116
324	1 Feb	1527	0-40	10	323	70	20	1	0	2	0	0	0	0	0	0	73
325	1 Feb	1641	0-2	10	282	50	12	18	0	3	0	0	1	0	1	1	100
325	1 Feb	1641	0-40	20	655	50	12	33	0	3	0	0	5	0	1	0	270
326	1 Feb	1742	0-40	19	631	60	19	105	0	5	2	0	0	0	0	8	385
326	1 Feb	1742	0-2	10	277	60	19	40	2	0	0	0	0	0	0	0	62
327	1 Feb	1846	0-40	20	601	370	184	19	0	0	0	1	3	0	0	3	243
327	1 Feb	1846	0-2	10	291	370	184	4	0	0	0	0	0	0	0	1	17
328	1 Feb	1933	0-40	10	282	65	21	1	0	0	0	0	0	0	0	1	95
329	1 Feb	2000	0-40	20	630	50	20	6	0	4	0	0	1	0	0	1	287
329	1 Feb	2000	0-2	10	313	50	20	3	0	5	0	2	0	0	0	2	83
331	2 Feb	0119	0-40	20	710	20	5	1	0	4	0	2	0	0	0	0	133
331	2 Feb	0119	0-2	10	340	20	5	3	0	17	2	0	0	0	1	3	0
332	2 Feb	0215	0-40	20	647	25	7	3	0	0	0	0	1	0	0	1	90
332	2 Feb	0215	0-2	10	333	25	7	21	0	8	0	4	0	0	2	3	42
333	2 Feb	0311	0-40	20	677	5	1	1	0	0	0	0	0	0	0	0	90

Table 2. Continued.

Station number	Date	Time GMT	Depth strata (m)	Tow dur. (min.)	Vol. filtered (m^3)	Settled vol. (ml)	Displ. vol. (ml)	*T. macc-oyii*	*T. obesus*	*T. ala-lunga*	*T. alba-cares*	*T. ala./ alba.*	*K. pela-mis*	*A. solan-dri*	Istio-phor-idae	Unid. tuna	Other species
333	2 Feb	0311	0-2	10	361	5	1	0	0	3	0	0	0	0	0	0	27
334	2 Feb	0343	0-40	10	345	40	12	0	0	2	0	0	0	0	0	0	60
335	2 Feb	0542	0-40	10	358	40	9	3	0	2	0	0	0	0	0	0	124
336	2 Feb	0706	0-40	10	336	50	11	0	0	0	0	0	1	0	0	0	65
337	2 Feb	0805	0-40	10	351	20	5	2	0	0	0	0	2	0	0	0	105
338	2 Feb	0833	0-40	20	664	110	30	2	0	3	1	0	0	0	0	1	173
338	2 Feb	0833	0-2	10	369	110	30	5	0	11	0	0	0	0	0	0	114
340	2 Feb	1215	0-40	10	390	80	32	81	0	0	0	0	0	1	0	2	184
341	2 Feb	1301	0-40	20	639	50	20	141	1	2	2	0	0	0	0	3	114
341	2 Feb	1301	0-2	10	300	50	20	87	0	2	0	0	0	0	0	1	45
342	2 Feb	1351	0-40	12	352	80	31	89	0	1	2	0	0	0	0	5	49
343	2 Feb	1434	0-2	10	362	35	12	27	0	0	0	0	0	0	0	1	17
343	2 Feb	1434	0-40	21	661	35	12	159	0	3	1	0	0	0	0	6	100
344	2 Feb	1531	0-40	20	658	255	127	19	0	0	0	0	1	0	0	11	99

Table 3. Physical and chemical parameters of hydrographic casts made on SO 1/87. Total N measured as nitrate and total P measured as phosphate; organic N and organic P were determined by subtracting the inorganic fraction from the total nitrogen and total phosphorus. NR - no result; SL - sample lost: NA - not analysed

Station number	Depth (m)	Salinity (ppt)	Temperature (°C)	Dissolved O_2 (µM)	Nitrate (µM)	Nitrite (µM)	Organic N (µM)	Total N (µM)	Phosphate (µM)	Organic P (µM)	Total P (µM)
67	3.1	34.879		209.5	0.00	0.00	3.80	3.80	0.38	0.09	0.47
"	26.4	34.617	26.05	227.0	0.00	0.00	3.70	3.70	0.37	0.07	0.44
"	61.1	34.900		223.3	0.00	0.00	4.31	4.31	0.40	0.09	0.49
"	133.5	35.144		160.8	8.88	0.00	3.54	12.42	0.55	0.14	0.69
"	184.1	35.628		195.8	4.04	0.00	3.82	7.86	0.48	0.12	0.60
"	208.0	35.166	16.88	145.5	15.08	0.00	2.82	17.90	0.83	0.05	0.88
"	346.5	34.983		225.8	13.53	0.00	0.72	14.25	0.76	0.07	0.83
"	488.3	34.673	8.61	177.3	35.44	0.00	0.00	35.44	1.41	0.09	1.50
68	3.6	34.905	28.27	208.0	0.00	0.00	4.32	4.32	0.24	0.00	0.24
"	32.8	34.775		216.3	0.00	0.00	5.24	5.24	0.21	0.00	0.21
"	49.4	34.861	25.14	221.5	0.00	0.00	4.91	4.91	0.21	0.01	0.22
"	101.6	35.023		188.5	3.62	0.00	3.99	7.61	0.33	0.03	0.36
"	154.7	35.508	19.89	188.8	4.10	0.00	3.21	7.31	0.35	0.00	0.35
73	2.4	34.886		205.0	0.00	0.00	4.81	4.81	0.37	0.10	0.47
"	24.7	34.837		211.3	0.00	0.00	6.00	6.00	0.36	0.06	0.42
"	39.2	34.835		225.8	0.00	0.00	4.86	4.86	0.36	0.07	0.43
"	79.5	34.849		224.0	0.00	0.00	5.29	5.29	0.40	0.01	0.41
"	150.9	35.225		171.8	6.15	0.00	3.59	9.74	0.51	0.01	0.52
75	1.7	34.893	28.28	201.8	0.00	0.00	3.82	3.82	0.00	0.00	0.00
"	26.1	34.841		213.8	0.00	0.00	4.90	4.90	0.00	0.62	0.62

Table 3. Continued.

Station number	Depth (m)	Salinity (ppt)	Temperature (°C)	Dissolved O_2 (µM)	Nitrate (µM)	Nitrite (µM)	Organic N (µM)	Total N (µM)	Phosphate (µM)	Organic P (µM)	Total P (µM)
75	100.6	34.991		167.0	6.32	0.00	4.75	11.07	0.44	0.13	0.57
"	176.7	35.544		191.8	3.73	0.00	2.77	6.50	0.39	0.07	0.46
"	217.2	35.183	16.42	144.0	15.07	0.00	1.57	16.64	0.83	0.01	0.84
"	273.3	35.371		202.3	9.54	0.00	1.36	10.90	0.56	0.08	0.64
"	342.7	35.195		195.3	12.97	0.00	1.02	13.99	0.72	0.13	0.85
"	470.2	34.705		178.5	30.07	0.00	0.00	30.07	1.33	0.00	1.33
127	2.7	34.901	28.53	206.8	0.00	0.00	4.08	4.08	0.00	0.00	0.00
"	31.2	34.831		221.3	0.00	0.00	4.58	4.58	0.00	0.61	0.61
"	49.4	34.782		219.5	0.00	0.00	4.58	4.58	0.00	0.61	0.61
"	100.6	35.010	21.79	178.5	4.36	0.33	3.27	7.96	0.45	0.17	0.62
"	149.2	35.203	19.66	157.5	8.71	0.00	2.18	10.89	0.51	0.14	0.65
137	3.1	34.901	28.27	204.5	0.00	0.00	1.53	1.53	0.35	0.19	0.54
"	29.0	34.884	28.11	205.0	SL	SL	SL	SL	SL	SL	SL
"	50.1	34.801		215.3	0.00	0.00	2.39	2.39	0.35	0.12	0.47
"	101.0	35.011		182.5	4.33	0.00	0.66	4.99	0.51	0.01	0.52
"	151.7	35.353	20.37	184.0	4.43	0.00	0.33	4.76	0.48	0.05	0.53
141	2.6	34.718	27.33	208.8	0.00	0.00	2.73	2.73	0.30	0.07	0.37
"	50.9	34.376		212.9	0.00	0.00	3.45	3.45	0.34	0.11	0.45
"	133.7	34.803		138.3	12.03	0.00	2.62	14.65	0.80	0.08	0.88
"	179.5	34.984		133.9	14.42	0.00	1.10	15.52	0.90	0.00	0.90
"	225.1	35.113	15.01	145.4	15.89	0.00	1.32	17.21	0.99	0.00	0.99
"	264.2	34.976		140.3	20.97	0.00	3.76	24.73	1.21	0.00	1.21
"	366.4	34.775	10.21	152.8	20.58	0.00	8.63	29.21	1.40	0.00	1.40

Table 3. Continued.

Station number	Depth (m)	Salinity (ppt)	Temperature (°C)	Dissolved O_2 (µM)	Nitrate (µM)	Nitrite (µM)	Organic N (µM)	Total N (µM)	Phosphate (µM)	Organic P (µM)	Total P (µM)
141	505.3	34.646		132.9	27.90	0.00	7.26	35.16	1.79	0.00	1.79
150	1.4	34.750		203.9	0.00	0.00	4.79	4.79	0.35	0.11	0.46
"	26.5	34.750	27.45	203.4	0.00	0.00	5.18	5.18	0.33	0.10	0.43
"	50.6	34.397		210.8	0.00	0.00	4.73	4.73	0.39	0.10	0.49
"	99.2	34.752	22.33	150.2	8.57	0.00	2.72	11.29	0.65	0.00	0.65
"	152.5	34.911	19.34	137.2	13.22	0.00	2.11	15.33	0.77	0.00	0.77
161	2.0	34.803		208.5	0.00	0.00	6.18	6.18	0.31	0.03	0.34
"	28.1	34.802	27.38	206.7	0.00	0.00	5.97	5.97	0.35	0.00	0.35
"	52.1	34.668		213.9	0.00	0.00	6.25	6.25	0.34	0.00	0.34
"	100.7	34.757	22.66	155.8	7.90	0.00	4.43	12.33	0.66	0.00	0.66
"	152.8	34.713	19.49	130.1	14.75	0.00	2.85	17.60	0.96	0.00	0.96
170	2.0	34.731		214.4	0.00	0.00	4.41	4.41	0.31	0.10	0.41
"	24.5	34.819	27.57	207.8	0.00	0.00	4.67	4.67	0.34	0.12	0.46
"	49.3	34.676		198.6	2.32	0.33	5.52	8.17	0.45	0.10	0.55
"	99.3	34.978		173.1	5.78	0.00	4.80	10.58	0.47	0.16	0.63
"	149.7	35.319	20.29	180.8	5.64	0.00	3.87	9.51	0.43	0.17	0.60
"	250.0	35.050		146.7	16.90	0.00	3.22	20.12	1.01	0.00	1.01
"	350.4	34.878		180.3	17.82	0.00	4.18	22.00	1.08	0.00	1.08
"	501.7	34.657	8.10	149.5	26.09	0.00	5.80	31.89	1.65	0.00	1.65
171	1.6	34.958		204.7	0.00	0.00	3.54	3.54	0.43	0.00	0.43
"	25.5	34.955	27.81	209.8	0.00	0.00	5.40	5.40	0.37	0.21	0.58
"	50.7	34.891		215.9	0.00	0.00	4.32	4.32	0.37	0.14	0.51

Table 3. Continued.

Station number	Depth (m)	Salinity (ppt)	Temperature (°C)	Dissolved O_2 (µM)	Nitrate (µM)	Nitrite (µM)	Organic N (µM)	Total N (µM)	Phosphate (µM)	Organic P (µM)	Total P (µM)
171	100.1	35.007		170.3	5.70	0.00	2.48	8.18	0.48	0.14	0.62
"	154.2	34.963	19.04	139.0	12.96	0.00	0.94	13.90	0.79	0.04	0.83
"	251.6	34.935		136.0	20.22	0.00	0.00	20.22	1.15	0.09	1.24
"	350.4	34.806		148.2	22.89	0.00	0.00	22.89	1.40	0.00	1.40
"	492.9	34.668	8.54	144.1	28.24	0.00	0.00	28.24	1.64	0.12	1.76
172	1.7	35.059		207.5	0.00	0.00	3.72	3.72	0.00	0.00	0.00
"	25.4	35.043	27.13	191.0	0.00	0.00	1.93	1.93	0.00	0.00	0.00
"	52.6	35.008		210.1	0.00	0.00	2.32	2.32	0.00	0.00	0.00
"	102.7	34.933		166.5	5.92	0.00	0.82	6.74	0.49	0.19	0.68
"	145.8	34.983	20.16	148.9	10.41	0.00	0.00	10.41	0.60	0.14	0.74
"	250.8	34.846		117.9	22.12	0.00	1.19	23.31	1.10	0.04	1.14
"	350.3	34.868		147.9	21.50	0.00	0.54	22.04	1.19	0.00	1.19
"	494.2	34.675	8.54	149.5	27.31	0.00	2.10	29.41	1.52	0.07	1.59
173	2.5	34.933	27.93	208.8	0.00	0.00	3.08	3.08	0.38	0.13	0.51
"	23.7	34.929		209.0	0.00	0.00	2.51	2.51	0.45	0.08	0.53
"	48.7	34.931	27.61	209.5	0.00	0.00	2.64	2.64	0.38	0.13	0.51
"	99.2	34.881		189.9	3.93	0.43	0.71	5.07	0.48	0.08	0.56
"	148.3	34.899		105.4	13.35	0.00	0.00	13.35	0.67	0.13	0.80
"	203.6	34.783	13.23	112.3	22.74	0.00	2.18	24.92	1.29	0.08	1.37
175	2.0	34.862	27.62	211.9	0.00	0.00	2.00	2.00	0.00	0.65	0.65
"	24.9	34.833		215.4	0.00	0.00	1.44	1.44	0.00	0.65	0.65
"	50.8	34.789	25.18	237.6	0.00	0.00	2.14	2.14	0.00	0.73	0.73
"	99.4	34.971		199.9	3.72	0.34	0.57	4.63	0.50	0.05	0.55

Table 3. Continued.

Station number	Depth (m)	Salinity (ppt)	Temperature (°C)	Dissolved O_2 (µM)	Nitrate (µM)	Nitrite (µM)	Organic N (µM)	Total N (µM)	Phosphate (µM)	Organic P (µM)	Total P (µM)
175	152.0	35.033	19.53	147.0	SL	SL	SL	SL	SL	SL	SL
187	2.2	34.648	27.28	217.7	0.00	0.00	0.73	0.73	0.00	0.65	0.65
"	41.5	34.482		216.5	0.00	0.00	2.00	2.00	0.00	0.61	0.61
"	94.1	34.863		199.2	2.45	0.55	0.07	3.07	0.41	0.16	0.57
"	170.5	35.037		146.3	12.61	0.00	0.00	12.61	0.62	0.29	0.91
"	260.6	34.704		110.6	24.72	0.00	0.00	24.72	1.40	0.16	1.56
"	323.1	34.893	11.70	150.8	20.86	0.00	0.00	20.86	1.06	0.07	1.13
"	398.3	34.786		178.0	21.54	0.00	0.04	21.58	1.13	0.10	1.23
"	502.4	34.649	7.98	139.4	29.25	0.00	0.00	29.25	1.31	0.58	1.89
194	2.1	34.864		210.1	0.00	0.00	3.31	3.31	0.43	0.09	0.52
"	45.7	34.481		218.0	0.00	0.00	2.48	2.48	0.40	0.09	0.49
"	102.3	34.813	21.28	148.5	9.24	trace	4.03	13.27	0.56	0.17	0.73
"	150.5	34.977		136.8	12.39	0.00	6.73	19.12	0.65	0.23	0.88
"	200.4	34.867		117.8	17.53	0.00	7.59	25.12	0.97	0.14	1.11
"	250.2	34.968	13.91	129.0	17.53	0.00	7.59	25.12	0.88	0.14	1.02
"	348.2	34.826		144.0	20.53	0.00	8.42	28.95	1.06	0.00	1.06
"	500.7	34.654	8.13	147.3	23.53	0.00	12.81	36.34	1.37	0.14	1.51
246	2.5	34.875	27.64	211.7	0.00	0.00	5.22	5.22	0.00	0.74	0.74
"	25.1	34.876		204.8	0.00	0.00	5.39	5.39	0.00	0.71	0.71
"	50.8	34.399	24.00	193.9	1.67	0.18	5.18	7.03	0.00	0.75	0.75
"	100.1	35.153		166.7	6.24	trace	4.73	10.97	0.47	0.17	0.64
"	150.2	34.981	19.80	142.5	10.70	0.00	3.22	13.92	0.59	0.23	0.82

Table 3. Continued.

Station number	Depth (m)	Salinity (ppt)	Temperature (°C)	Dissolved O_2 (µM)	Nitrate (µM)	Nitrite (µM)	Organic N (µM)	Total N (µM)	Phosphate (µM)	Organic P (µM)	Total P (µM)
255	2.2	34.894		218.0	0.00	0.00	4.26	4.26	0.00	0.00	0.00
"	24.6	34.904	27.77	219.5	0.00	0.00	4.26	4.26	0.00	0.00	0.00
"	50.2	34.694	25.34	227.2	0.00	0.00	4.45	4.45	0.00	0.67	0.67
"	100.3	34.706		146.6	10.74	0.00	2.24	12.98	0.50	0.31	0.81
"	152.3	35.012	18.93	137.0	13.05	0.00	2.19	15.24	0.65	0.27	0.92
266	1.4	34.881		207.6	0.00	0.00	4.45	4.45	0.00	0.00	0.00
"	24.9	34.905	27.77	210.1	0.00	0.00	3.09	3.09	0.00	0.00	0.00
"	49.8	34.612		215.2	0.00	0.00	4.97	4.97	0.00	0.63	0.63
"	101.2	34.768		147.4	9.51	0.00	3.34	12.85	0.53	0.18	0.71
"	151.5	34.982		143.6	11.54	0.00	NR	SL	0.56	0.18	0.74
"	254.2	34.823	13.20	117.4	22.08	0.00	0.27	22.35	1.09	0.14	1.23
"	355.4	34.878		171.5	19.20	0.00	1.86	21.06	1.03	0.10	1.13
"	494.2	34.669	8.35	151.7	25.62	0.00	2.23	27.85	1.29	0.28	1.57
275	2.9	34.885		204.0	0.00	NA	5.76	5.76	0.00	0.66	0.66
"	25.3	34.879	27.73	212.2	0.00	NA	5.63	5.63	0.00	0.62	0.62
"	52.2	34.481	23.76	192.3	2.77	NA	3.94	6.71	0.39	0.22	0.61
"	102.3	34.745		133.9	12.04	NA	3.74	15.78	0.53	0.28	0.81
"	143.9	35.141	20.57	164.1	7.45	NA	2.98	10.43	0.49	0.12	0.61
286	2.9	34.873		212.6	0.00	0.00	3.34	3.34	0.36	0.13	0.49
"	25.0	34.874	27.66	203.1	0.00	0.00	3.28	3.28	0.34	0.01	0.35
"	49.8	34.869	27.62	209.3	0.00	0.00	3.71	3.71	0.37	0.03	0.40
"	99.5	34.793		160.9	8.08	0.00	2.25	10.33	0.65	0.00	0.65

Table 3. Continued.

Station number	Depth (m)	Salinity (ppt)	Temperature (°C)	Dissolved O_2 (µM)	Nitrate (µM)	Nitrite (µM)	Organic N (µM)	Total N (µM)	Phosphate (µM)	Organic P (µM)	Total P (µM)
	"	150.2	35.176	21.03	182.8	5.96	0.00	1.42	7.38	0.50	0.03
0.53297	3.7	34.883	27.72	225.2	0.00	0.00	4.87	4.87	0.00	0.60	0.60
"	24.5	34.885		219.0	0.00	0.00	3.83	3.83	0.00	0.68	0.68
"	54.8	34.623	24.87	221.7	0.00	0.00	2.86	2.86	0.49	0.08	0.57
"	103.3	34.711		145.8	10.92	0.11	1.82	12.85	0.50	0.28	0.78
"	138.5	35.044	20.33	150.0	10.21	0.00	2.18	12.39	0.56	0.15	0.71
308	2.5	34.849		210.1	0.00	NA	4.82	4.82	0.00	0.66	0.66
"	24.7	34.846	27.54	212.8	0.00	NA	5.43	5.43	0.00	0.62	0.62
"	51.0	34.771		227.7	0.00	NA	5.90	5.90	0.41	0.05	0.46
"	103.2	34.775		142.5	10.69	NA	4.55	15.24	0.56	0.26	0.82
"	151.4	35.003		140.8	11.76	NA	4.56	16.32	0.56	0.24	0.80
"	250.0	34.915	14.19	120.9	19.86	NA	NR	SL	0.96	0.22	1.18
"	351.3	34.881		162.1	19.63	NA	7.69	27.32	1.00	0.16	1.16
"	486.5	NR	8.31	148.2	27.27	NA	5.80	33.07	1.49	0.05	1.54
319	2.8	34.863	27.54	209.8	0.00	0.00	2.97	2.97	0.00	0.64	0.64
"	24.7	34.864		207.6	0.00	0.50	3.96	4.46	0.35	0.19	0.54
"	50.0	34.573	25.02	222.7	0.00	0.00	4.29	4.29	0.36	0.18	0.54
"	99.7	34.807		159.2	8.63	0.11	2.56	11.19	0.49	0.28	0.77
"	167.9	34.976	18.78	145.5	13.63	0.00	2.21	15.84	0.67	0.21	0.88
330	3.0	34.835	27.39	233.9	0.00	0.00	3.08	3.08	0.00	0.55	0.55
"	24.5	34.830		221.0	0.00	0.00	2.90	2.90	0.43	0.14	0.57
"	50.9	34.549	25.03	239.1	0.00	0.00	1.87	1.87	0.45	0.12	0.57

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