



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
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CRUISE REPORT¹

VESSEL: NOAA Ship *Oscar Elton Sette*, Cruise SE-11-02

CRUISE PERIOD: 25 February – 25 March 2011

AREA OF OPERATION: Leg I operations were conducted in Kealahou Bay and the waters off the lee coast of the island of Maui (Fig. 1). Leg II operations were conducted in the waters of the North Pacific along the 158°W and 161°W meridians, from 22.75°N to 36°N (Fig. 2).

TYPE OF OPERATION: The Simrad EK60 echosounder calibration was conducted at Kealahou Bay. Coordinated acoustic and BotCam operations were conducted in the lee waters of Maui. Conductivity-temperature-depth (CTD) casts to a depth of 1000 m were conducted regularly along the Leg II track. Acoustic backscatter, current velocity, and surface temperature and salinity data were collected continuously throughout both legs.

ITINERARY:

- 25 February 0800 Start of cruise. Embarked Donald Kobayashi, Réka Domokos, Amy Comer, Aimee Hoover, Amy Bower, Frannie Nilsen, Johanna Wren, and Benjamin Richards. Proceeded to Kealahou Bay for acoustic calibration.
- 26 February Began acoustic calibration in Kealahou Bay. Hourly CTD casts were conducted overnight to better understand the coastal oceanography of the region.
- 27 February 0630 Calibration complete; proceeded to bottomfish survey area. Overnight, completed acoustic survey of box D.
- 28 February Bottomfish acoustic survey continued, contract vessels began bottomfishing, and UH vessel completed 15 BotCam deployments.



¹ PIFSC Cruise Report CR-11-003
Issued 25 April 2011

- 1 March Acoustic survey, contract bottomfishing, and UH vessel BotCam deployments continued. Successfully completed a BotCam deployment and recovery from the *Sette*.
- 2 – 3 March Bottomfish survey operations continued.
- 4 March Contract bottomfishing suspended because of inclement weather. UH vessel BotCam operations and acoustic survey continued. Successfully completed BotCam deployment and recovery from the *Sette*.
- 5 – 7 March Bottomfish survey operations continued, with contract bottomfishing resumed and daily BotCam operations on the *Sette*.
- 8 March Bottomfish survey operations continued.
- 2000 Bottomfish survey complete; proceeded to Kewalo Basin Harbor for personnel exchanged the following morning.
- 9 March 0800 Leg 1 completed, began Leg 2. Via small boat transfer at Kewalo Basin Harbor, disembarked Donald Kobayashi, Johanna Wren, and Benjamin Richards and embarked Phoebe Woodworth, Evan Howell, Alice Ren, Tyson Bottenus, Jessica Wemer, and Sandra Love. Proceeded to Station ALOHA (22.75°N, 158°W) where CTD and acoustic transect operations commenced.
- 2138 CTD cast at Station ALOHA. After cast was complete, proceeded north along 158°W.
- 10 – 13 March 2107 CTD cast and acoustic transect at 26°N, 158°W. After cast and transect were completed, proceeded north along 158°W conducting 1000 m CTD casts every 0.25° latitude, collecting water samples every 0.5°, and conducting 90-minute acoustic transects every whole degree of latitude.
- 13 March 1230 Operations at 31°N, 158°W canceled because of heavy weather conditions. Altered course to the west and reduced speed to avoid heavy weather to the north. CTDs and acoustic transects were planned for every quarter and half degree of longitude, respectively, but were unable to be conducted because of heavy weather.
- 14 March 0815 Adjusted course to the west-northwest for a better ride. Acoustic transects completed every 0.5° of longitude, adjusting location as necessary to avoid 0500 – 0800 and 1700 – 2000 transition times. CTD casts canceled because of heavy weather.
- 15 – 16 March 0756 All operations and northward track resumed at 31°N, 161°W. CTD casts continued as scheduled, acoustic transects conducted every 0.5° of latitude,

adjusting as necessary to avoid dawn and dusk transition times (0500–0800 and 1700–2000, respectively).

17 – 18 March 0051 Reached 35°N, 161°W. Upon completion of CTD cast and acoustic transect, steamed to 36°N, 158°W

2011 Reached 36°N, 158°W. Upon completion of CTD cast and acoustic transect, continued operations southward along 158°W collecting and filtering water samples at each CTD and collecting surface water samples from the thermosalinograph flow-through system every 0.08° of latitude.

19 March 1341 Reached 33°N, 158°W, stopped collecting surface water samples and reduced water collection and filtering to CTDs conducted at half and whole degrees of latitude.

20 – 22 March Continued operations southward along 158°W.

23 March Continued operations southward along 158°W.

1400 Operations at 26.25°N, 158°W canceled because of heavy weather.

1508 Acoustic transect performed at 26.08°N, 158.01°W.

1742 Reached 26°N, 158°W. After CTD cast, science operations complete.

24 March Cleaned all personal bunks, science working areas, and movie room.

25 March 0800 Returned to Ford Island, Pearl Harbor. Disembarked Réka Domokos, Amy Comer, Aimee Hoover, Amy Bower, Frannie Nilsen, Tyson Bottenus, Jessica Wemer, Sandra Lover, Phoebe Woodworth, Evan Howell, and Alice Ren. End of cruise.

MISSIONS AND RESULTS:

- A. Estimate bottomfish abundance using the Simrad EK60 echosounder system and BotCam.

A total of 9.5 days and 9 nights of nearly continuous acoustic survey were completed on Leg I of the cruise in the survey box D off the Maui triangle area. This included 5 days of daytime acoustic survey over a BotCam unit deployed on the seafloor. Five evenings were also dedicated to acoustic surveys in conjunction with targeted fishing operations from the ship. Approximately 17 day and night replicates over the survey grid using a combination of north/south and east/west passes over the centroids of all subgrids within the survey grid were completed. Additionally, partner fishing vessels during Leg I completed 111 daytime fishing stations and 43 nighttime fishing stations. The UH

contract vessel completed 98 standardized BotCam drops throughout the survey grid (Fig. 1).

- B. Describe the physical environment of the North Pacific tuna and swordfish fishing grounds through routine CTD casts and continuous acoustic Doppler current profiler (ADCP) and thermosalinograph (TSG) measurements.

A total of 74 fully successful CTD casts were conducted, all to a depth of 1000 m. During all casts, profiles of temperature, conductivity, and dissolved oxygen were collected on redundant sensors, and profiles of fluorescence were collected by both an open WetLabs and pumped Seapoint fluorometer. Fifteen CTD casts were cancelled because of heavy weather, 14 while diverting to the north and west to avoid heavy weather and one near the end of the southward transect. However, through combining both northward transects and the one southward transect, CTD casts were conducted at all predetermined stations (Fig. 3).

ADCP data were successfully collected throughout the cruise.

The TSG intake was often air-bound in heavy seas and had to be secured for 65% of the time underway on Leg II (61% of the time before science operations were complete). While operational, the pump housing experienced heating while the ship was transiting, which led to increased temperatures that will likely render the data unusable (Fig. 4). The TSG flow-through system did allow for surface water to be sampled every 0.08° of latitude in the vicinity of the chlorophyll front (33° – 36°N, 158°). These samples were filtered and the chlorophyll content measured.

- C. Assess the influence of the physical dynamics on the density, distribution, and composition of micronekton in the region by monitoring the biological backscatter using the Simrad EK60 echosounder system. Characterize the micronekton faunal composition and densities as the forage base for larger pelagic nekton.

A total of 41 acoustic transects were conducted to collect bioacoustic data on micronekton during the Leg II (Table 1, Fig. 5). The 200 kHz frequency was inoperable, limiting echosounder data collection to 38, 70, and 120 kHz frequencies. During CTDs and some of the acoustic transects, interference was generated by the ship but the source could not be located. The interference was limited to the upper 50 m in the 70 kHz channel and did not appear to compromise the acoustic data at other frequencies.

- D. Assess the influence of the physical dynamics on the biological productivity in the region through CTD-mounted fluorometer measurements and extracted chlorophyll and accessory pigment determinations.

Two CTD-mounted fluorometers measured chlorophyll profiles to a depth of 1000 m during all 74 CTD casts: a pumped Seapoint fluorometer and an open WetLabs fluorometer. Water samples were collected at 10 depths during 47 CTDs for total chlorophyll, chlorophyll-*a*, nutrient, and HLPC analysis (Table 2). Additionally, surface

water samples were collected for total chlorophyll and chlorophyll-*a* analysis at 35 locations (Table 3).

All chlorophyll analyses were carried out on a bench-top fluorometer while underway. Water samples for nutrient analysis and filtered content for HPLC analysis were stored in the ship's scientific freezer for post-cruise analysis. The scientific freezer experienced several episodes of warming during the final week of the cruise, reaching 5°C briefly. Each time, the freezer was cooled below -20°C in a matter of hours. No chlorophyll samples appear to have been compromised, and the samples for HPLC analysis were stored in liquid nitrogen and should have been unaffected by increased temperatures. The nutrient samples are currently being processed, but did not appear to have been compromised.

- E. Conduct stern trawl operations targeting the depths of the high sonic scattering layers to better our understanding of echosounder signals collected by the EK60 echosounder.

The stern trawl system was not operational during the cruise, eliminating the possibility of completing this mission.

SCIENTIFIC PERSONNEL:

Donald Kobayashi, Chief Scientist (Leg I), Pacific Islands Fisheries Science Center (PIFSC), National Marine Fisheries Service (NMFS)

Phoebe Woodworth, Chief Scientist (Leg II), PIFSC, NMFS

Réka Domokos, Research Oceanographer, PIFSC, NMFS

Amy Comer, Research Associate, University of Hawaii (UH), Joint Institute for Marine and Atmospheric Research (JIMAR)

Aimee Hoover, Cooperating Scientist, UH, JIMAR

Amy Bower, Cooperating Scientist, UH, JIMAR

Frannie Nilsen, Cooperating Scientist, UH, JIMAR

Johanna Wren, Cooperating Scientist, UH

Benjamin Richards, Research Fishery Biologist, PIFSC, NMFS

Evan Howell, Research Oceanographer, PIFSC, NMFS

Alice Ren, Cooperating Scientist, Department of Justice

Tyson Bottenus, Cooperating Scientist, UH, JIMAR

Jessica Wemer, Cooperating Scientist, UH, JIMAR

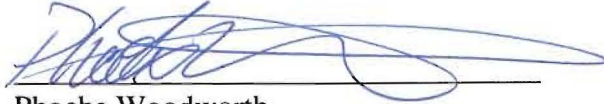
Sandra Love, Cooperating Scientist, UH, JIMAR

Submitted by:



Donald Kobayashi
Chief Scientist, Leg I

Submitted by:

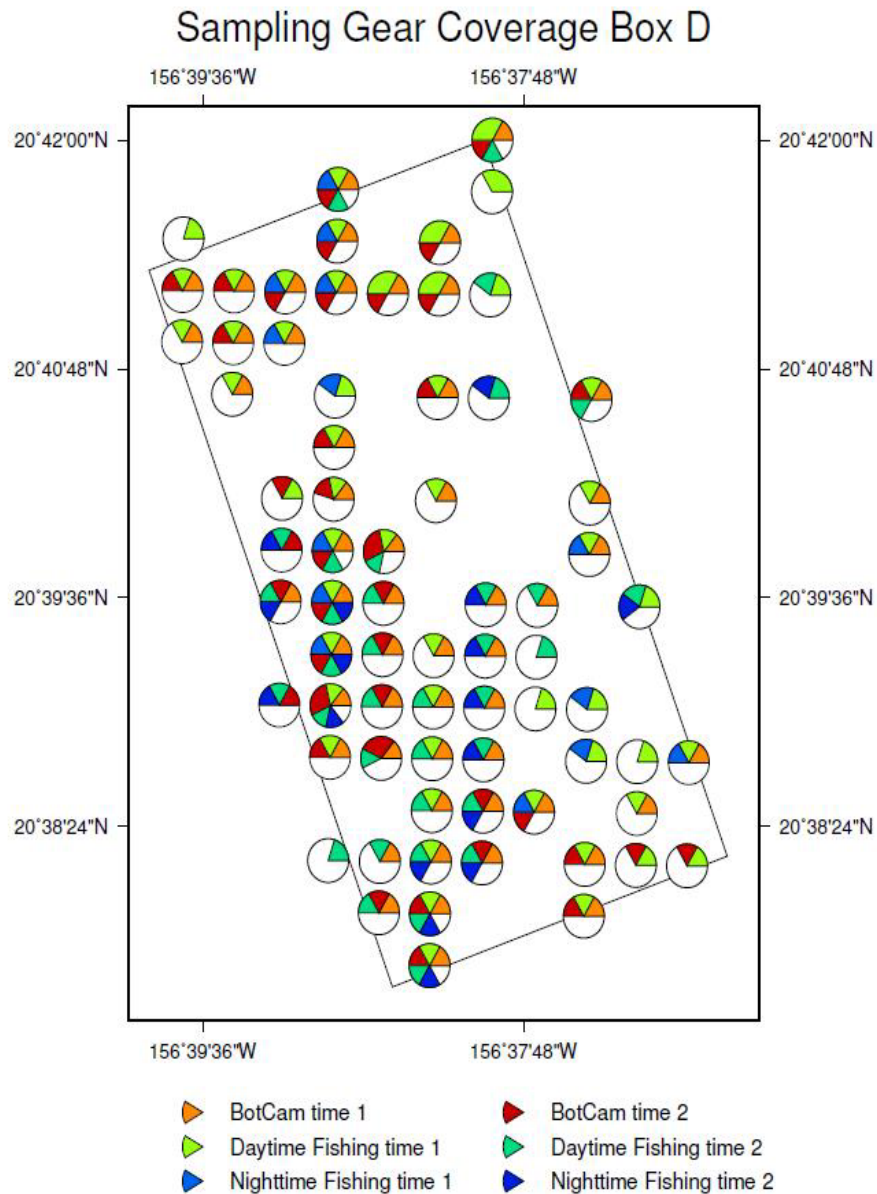


Phoebe Woodworth
Chief Scientist, Leg II

Approved by:



for Samuel G. Pooley
Science Director
Pacific Islands Fisheries Science Center



GM 2011 Mar 09 11:38:28 Map created by Johanna Wren

Fig. 1. Bottomfish fishing and BotCam survey summary for Leg I of SE-11-02. The two time periods represent an arbitrary breakpoint occurring in the middle of Leg I. Acoustic survey from *Sette* was completed with 17 replicates of the entire grid.

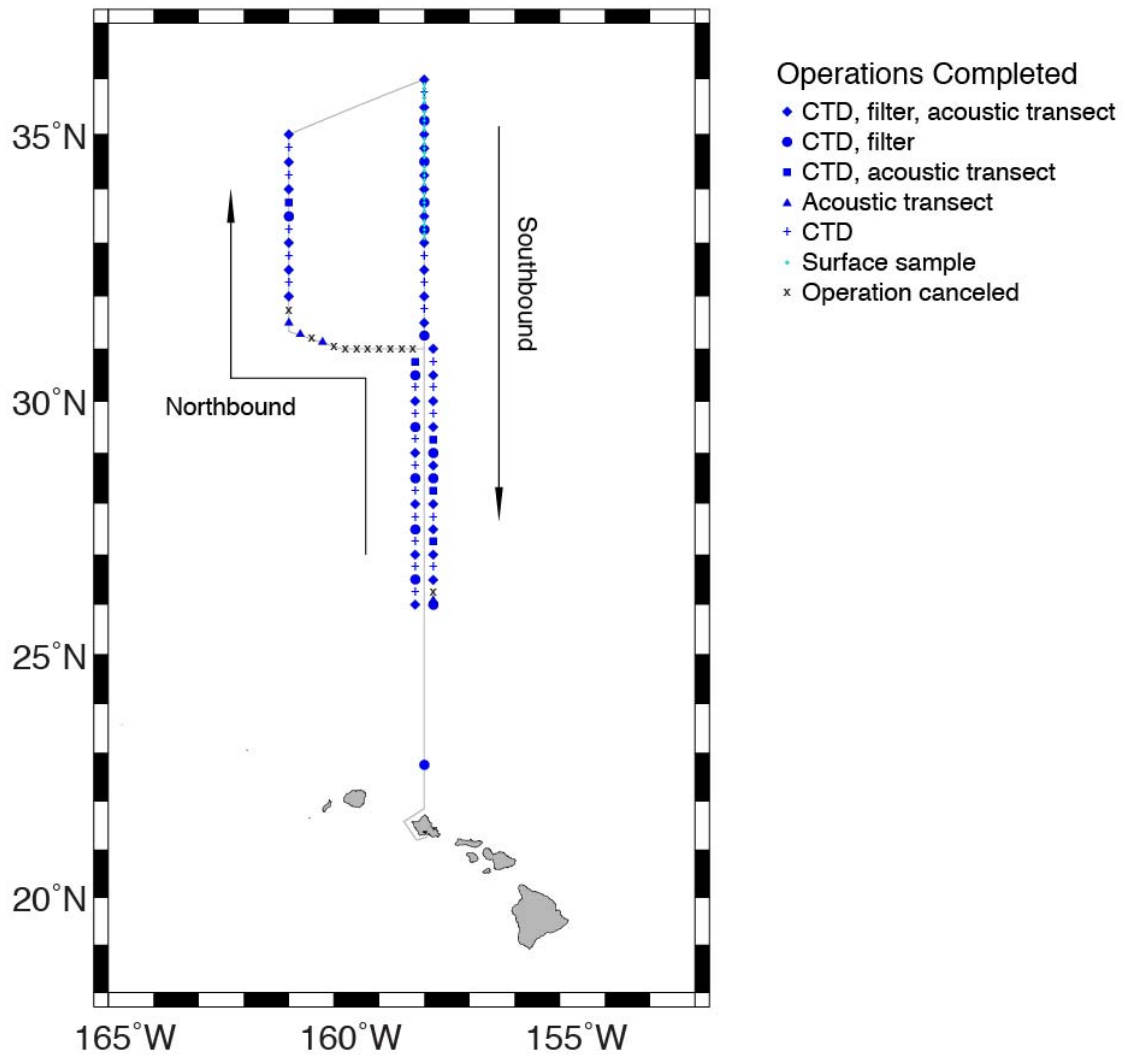


Fig. 2: Operations during SE-11-02, Leg II.

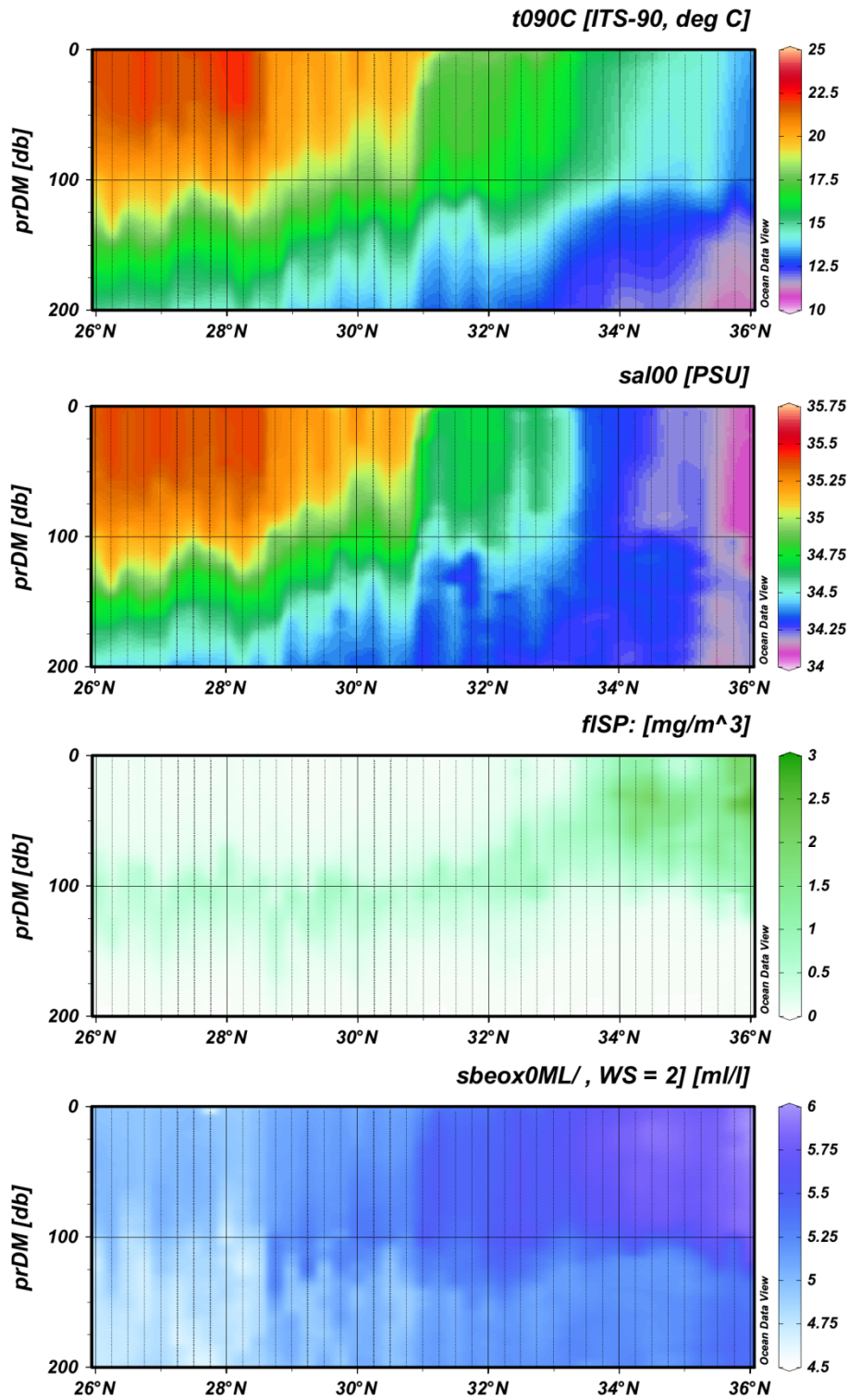


Fig. 3: From top, temperature ($^{\circ}C$), salinity, fluorescence ($mg\ chlorophyll\ m^{-3}$), and dissolved oxygen ($ml\ l^{-1}$) measured from CTD casts between 26° - $36^{\circ}N$, $158^{\circ}W$. The transition zone temperature front is located near $31^{\circ}N$ and the chlorophyll front near $33^{\circ}N$.

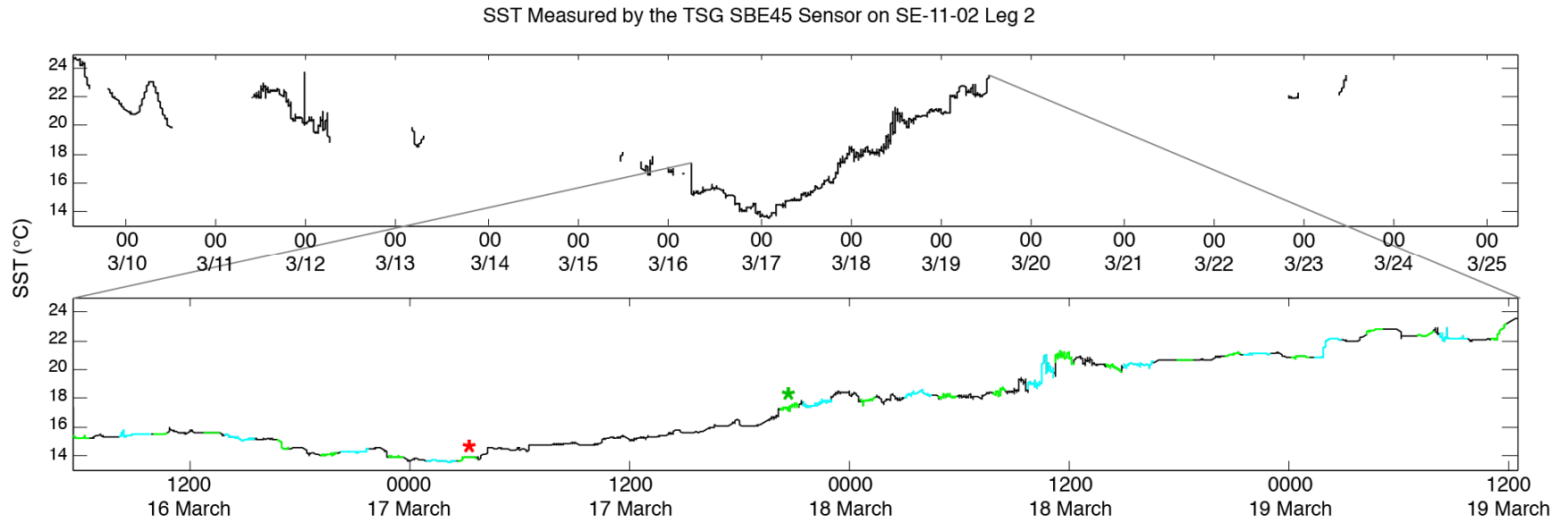


Fig. 4: Sea surface temperature as measured by the TSG SBE45 sensor for the entire second leg (top) and the longest continuous segment (bottom). Gaps in top panel indicate when TSG was secured during rough seas. Blue segments in lower panel indicate acoustic transects, green indicate CTDs. TSG pump housing heated during transit, influencing SST measurement. Note erroneous 3.58°C SST increase while steaming between 35°N, 161°W (*) and 36°N, 158°W (*) when CTD measurements indicated that SST decreased 1.64°C.

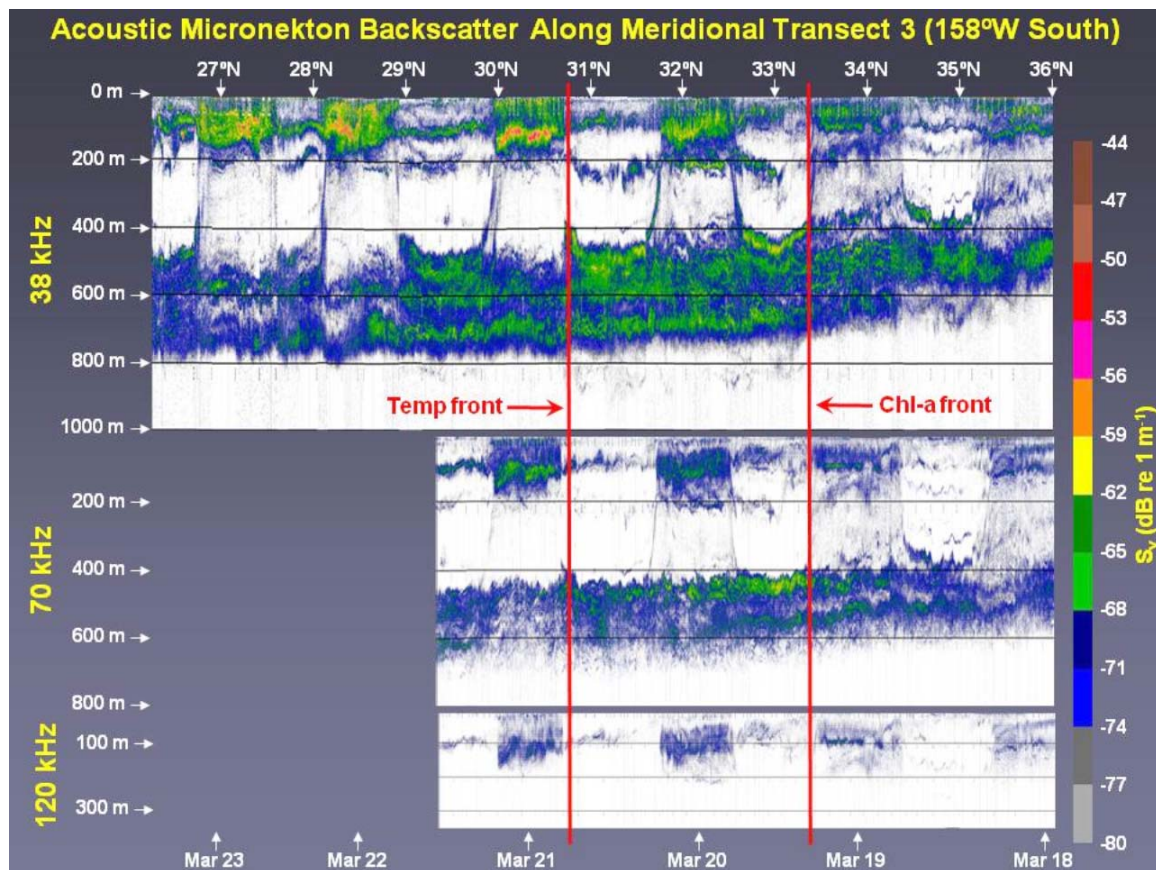


Fig. 5: Acoustic data collected at the 38, 70, and 120 kHz frequencies along the southward transect of 158°W, from 36° - 26°N. The shoaling of the deep scattering layer in the vicinity and north of the chlorophyll front can be seen in the 38 and 70 kHz data. Figure by Amy Comer and Réka Domokos.

Table 1: Date, time, and location of 90-minute acoustic transects conducted during Leg II of SE-11-02.

Acoustic Transect	Date and Time (HST)	Latitude (°N)	Longitude (°W)
1	10 March 2208	26.01	158.01
2	11 March 1027	27.01	158.01
3	11 March 2159	28.00	158.01
4	12 March 1029	29.01	158.00
5	12 March 2304	30.01	158.00
6	13 March 0923	30.75	158.00
7	13 March 1236	31.00	158.01
8	14 March 1328	31.11	160.25
9	14 March 2014	31.31	160.75
10	15 March 0047	31.53	161.00
11	15 March 0914	32.00	161.00
12	15 March 1541	32.44	161.00
13	16 March 0004	33.00	161.00
14	16 March 0803	33.66	161.00
15	16 March 1353	34.01	161.01
16	16 March 2010	34.51	161.01
17	17 March 0051	34.94	161.00
18	17 March 2126	36.06	158.00
19	18 March 0300	35.56	157.96
20	18 March 0943	35.07	158.00
21	18 March 1454	34.74	158.00
22	18 March 2128	34.24	158.00
23	19 March 0117	34.01	157.99
24	19 March 0808	33.50	157.99
25	19 March 1438	33.00	157.98
26	19 March 2049	32.49	158.00
27	20 March 0123	32.07	158.00
28	20 March 0859	31.50	158.00
29	20 March 1400	31.07	158.00
30	20 March 2214	30.51	158.02
31	21 March 0317	30.08	158.00
32	21 March 1011	29.58	158.00
33	21 March 1356	29.32	158.00
34	21 March 2143	28.76	158.01
35	22 March 0307	28.33	158.00
36	22 March 0835	27.99	158.00
37	22 March 1450	27.50	158.00
38	22 March 2154	27.27	158.02
39	23 March 0303	27.01	158.01
40	23 March 1017	26.52	158.00
41	23 March 1508	26.08	158.01

Table 2: Date, time, and location of 1000 m CTD casts conducted during Leg II of SE-11-02. The Samples Collected column lists the analyses water samples were collect for during the cast. Redundant sensors collected conductivity, temperature, dissolved oxygen, and fluorescence data during each cast.

Cast	Date and Time (HST)	Latitude (°N)	Longitude (°W)	Samples Collected
1	9 March 2138	22.75	158.00	HPLC ¹ , Nutr, Chl
2	10 March 2107	26.01	158.00	HPLC, Nutr, Chl
3	11 March 0058	26.25	158.00	
4	11 March 0347	26.50	158.00	Chl
5	11 March 0642	26.75	158.00	
6	11 March 0918	27.00	158.00	HPLC, Nutr, Chl
7	11 March 1308	27.25	158.00	
8	11 March 1544	27.51	158.00	Chl
9	11 March 1825	27.75	158.00	
10	11 March 2052	28.00	158.00	HPLC, Nutr, Chl
11	12 March 0114	28.25	158.00	
12	12 March 0348	28.50	158.00	Chl
13	12 March 0636	28.75	158.00	
14	12 March 0917	29.00	158.00	HPLC, Nutr, Chl
15	12 March 1333	29.25	158.00	
16	12 March 1626	29.50	158.00	Chl
17	12 March 1911	29.75	158.00	
18	12 March 2143	30.00	158.00	HPLC, Nutr, Chl
19	13 March 0234	30.25	158.00	
20	13 March 0518	30.51	158.00	Chl
21	13 March 0821	30.75	158.01	
22	15 March 0756	32.00	161.00	HPLC, Nutr, Chl
23	15 March 1315	32.25	161.00	
24	15 March 1723	32.50	161.01	HPLC, Nutr, Chl
25	15 March 2008	32.75	161.00	
26	15 March 2249	33.00	161.00	HPLC, Nutr, Chl
27	16 March 0255	33.25	161.00	
28	16 March 0536	33.50	161.00	HPLC, Nutr, Chl
29	16 March 0959	33.75	161.00	
30	16 March 1244	34.00	161.00	HPLC, Nutr, Chl
31	16 March 1642	34.25	161.00	
32	16 March 1908	34.50	161.00	HPLC, Nutr, Chl
33	16 March 2250	34.75	161.00	
34	17 March 0236	35.03	160.99	HPLC, Nutr, Chl
35	17 March 2011	36.00	158.00	HPLC, Nutr, Chl
36	18 March 0036	35.75	158.00	Chl ²
37	18 March 0452	35.50	158.00	HPLC, Nutr, Chl
38	18 March 0748	35.25	158.00	HPLC, Nutr, Chl ²
39	18 March 1114	35.00	158.00	HPLC, Nutr, Chl
40	18 March 1358	34.75	158.00	HPLC, Nutr, Chl ²
41	18 March 1748	34.50	158.00	HPLC, Nutr, Chl
42	18 March 2028	34.25	158.00	HPLC, Nutr, Chl ²

Table 2, Cont'd.

Cast	Date and Time (HST)	Latitude (°N)	Longitude (°W)	Samples Collected
43	19 March 0007	34.00	158.00	HPLC, Nutr, Chl
44	19 March 0407	33.75	158.00	HPLC, Nutr, Chl ²
45	19 March 0656	33.50	158.00	HPLC, Nutr, Chl
46	19 March 1059	33.25	158.00	HPLC, Nutr, Chl ²
47	19 March 1341	33.00	158.00	HPLC, Nutr, Chl
48	19 March 1717	32.74	158.00	
49	19 March 1943	32.50	158.00	HPLC, Nutr, Chl
50	19 March 2329	32.25	158.00	
51	20 March 0251	32.00	158.00	HPLC, Nutr, Chl
52	20 March 0528	31.75	158.00	
53	20 March 0757	31.50	158.00	HPLC, Nutr, Chl
54	20 March 1147	31.25	158.00	HPLC ³ , Nutr ³
55	20 March 1551	31.00	157.99	HPLC, Nutr, Chl
56	20 March 1835	30.75	158.00	
57	20 March 2107	30.50	158.00	HPLC, Nutr, Chl
58	21 March 0113	30.25	158.00	
59	21 March 0457	30.00	158.00	HPLC, Nutr, Chl
60	21 March 0807	29.75	158.00	
61	21 March 1145	29.50	158.00	Chl
62	21 March 1532	29.25	158.00	
63	21 March 1802	29.00	158.00	HPLC, Nutr, Chl
64	21 March 2041	28.75	158.00	Chl ⁴
65	22 March 0043	28.50	158.00	Chl
66	22 March 0449	28.25	158.00	
67	22 March 0725	28.00	158.00	HPLC, Nutr, Chl
68	22 March 1153	27.76	158.00	
69	22 March 1754	27.50	158.00	Chl
70	22 March 2049	27.25	158.00	
71	23 March 0141	27.00	158.00	HPLC, Nutr, Chl
72	23 March 0621	26.75	158.01	
73	23 March 0914	26.50	158.00	Chl
74	23 March 1742	26.00	158.01	HPLC, Nutr, Chl

¹Samples only taken at surface, 20m, 35m, and 50m.

²Surface sample only.

³Sampling done given proximity to temperature front.

⁴Samples taken at surface, 80m, 95m, 105m, 115m, 130m, and 200m to investigate double chlorophyll peak observed during down-cast.

Table 3: Time and locations of surface water samples taken for total chlorophyll and chlorophyll-*a* analysis in the proximity of the chlorophyll front.

Surface Sample	Date and Time (HST)	Latitude (°N)	Longitude (°W)
1	17 March 2315	35.92	158.00
2	17 March 2352	35.83	158.00
3	18 March 0036	35.75	158.00
4	18 March 0215	35.67	158.00
5	18 March 0258	35.58	158.00
6	18 March 0452	35.50	158.00
7	18 March 0635	35.42	158.00
8	18 March 0708	35.33	158.00
9	18 March 0748	35.25	158.00
10	18 March 0955	35.17	158.00
11	18 March 0942	35.08	158.00
12	18 March 1114	35.00	158.00
13	18 March 1250	34.92	158.00
14	18 March 1320	34.83	158.00
15	18 March 1358	34.75	158.00
16	18 March 1635	34.67	158.00
17	18 March 1715	34.58	158.00
18	18 March 1748	34.50	158.00
19	18 March 1920	34.42	158.00
20	18 March 1950	34.33	158.00
21	18 March 2028	34.25	158.00
22	18 March 2300	34.17	158.00
23	18 March 2345	34.08	158.00
24	19 March 0007	34.00	158.00
25	19 March 0315	33.92	158.00
26	19 March 0340	33.83	158.00
27	19 March 0407	33.75	158.00
28	19 March 0545	33.67	158.00
29	19 March 0622	33.58	158.00
30	19 March 0656	33.50	158.00
31	19 March 0950	33.42	158.00
32	19 March 1020	33.33	158.00
33	19 March 1059	33.25	158.00
34	19 March 1230	33.17	158.00
35	19 March 1308	33.08	158.00