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CRUISE REPORT[1]

VESSEL: *Oscar Elton Sette*, Cruise 10-03 (SE-79)

CRUISE PERIOD: March 20 – April 12, 2010

AREA OF OPERATION: Commonwealth of the Northern Mariana Islands (CNMI), Guam, and Micronesia.

TYPE OF OPERATION: Oceanographic operations consisted of conductivity-temperature-depth (CTD) casts down to 1000 m depth at predetermined stations along the transect lines (Fig. 1), mostly at every 0.25º. Water samples were collected at each full degree for nutrients, chlorophyll-*a* and chloropigments. Discrete chlorophyll-*a* samples were filtered at sea and chloropigment samples were stored in liquid nitrogen for later laboratory HPLC analysis. Bioacoustic backscatter, currents, and sea surface temperature and salinity were continuously monitored during the entire cruise. Zooplanktonic organisms were sampled typically at every 1º, using an Isaacs-Kidd Midwater Trawl (IKMT).

ITINERARY:

20 March	Start of cruise at 1000. Embarked Réka Domokos, Evan Howell, Amy Comer, Andrey Suntsov, Phoebe Woodworth, Eric Cruz, Bridget Ferriss, Rachel Allee, Brett Dennis-Duke, Kelli Stingle, Paula Olson, and Allan Ligon. Travelled south on Meridional Transect #1 (Fig. 1).
20–21 March	Conducted survey operations along Meridional Transect #1 (Fig. 1).
21–23 March	Conducted survey operations along Zonal Transect #1 (Fig. 1).
23–30 March	Conducted survey operations along Meridional Transect #2 (Fig. 1).
30 March–1 April	Conducted survey operations along Zonal Transect #2 (Fig. 1).

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1–4 April Conducted survey operations along Meridional Transect #3 (Fig. 1).

4 April Transited east along 13ºN to Guam. Disembarked Eric Cruz at Hagatna Harbor. Transited back west to return to Meridional Transect #3.

4–7 April Continued survey operations along Meridional Transect #3 (Fig. 1).

7–8 April Conducted survey operations along Zonal Transect #3 (Fig. 1).

8–12 April Conducted survey operations along Meridional Transect #4 (Fig. 1).

12 April Transited to Apra Harbor, Guam. End of cruise (0800). Disembarked Réka Domokos, Evan Howell, Amy Comer, Andrey Suntsov, Phoebe Woodworth, Bridget Ferriss, Rachel Allee, Brett Dennis-Duke, Kelli Stingle, Paula Olson, and Allan Ligon.

MISSIONS AND RESULTS:

The mission of this cruise was to perform oceanographic and bioacoustic surveys in waters of CNMI and Guam, and Micronesia.

This operation involved five distinct steps outlined below. The original schedule was to complete the mission during March 18-April 14. This would have allowed 28 sea days to perform the necessary operations. However, due to mechanical problems (the water system was not operational), the ship could not sail until March 20. In addition, because the calibration o f the EK60 system could not be completed during SE 10-02 or SE 10-03, the last two days of the cruise, April 13 and 14, were given to SE 10-04 in exchange for days at the end of SE 10-04 to be used for the calibration. As the calibration of the EK60 during the end of SE 10-04 was also cancelled, SE 10-03 lost 4 sea days in total, resulting in a 24 total available sea days. In addition, because we were unable to use the trawl winches, no Cobb trawl operations could be conducted during the entire cruise, which would have provided micronekton samples for composition and distribution studies, plus an ability to groundtruth the bioacoustic data.

A. Describe the physical environment of the waters belonging to Micronesia, Guam, and CNMI through routine CTD casts and continuous acoustic Doppler current profiler (ADCP) and thermosalinograph (TSG) measurements.

ADCP and TSG measurements were successfully collected for the duration of the cruise. In-situ temperature, salinity, dissolved oxygen, chloropigments, and light level measurements were taken by CTD casts down to 1000 m at 74 stations (74 casts) along Meridional Transects #2, #3, and #4, and at one station along Zonal Transect #2 (Fig. 1 and Table 1.) Stations were spaced at every 0.25 º along each of the transects.

There were several problems with the CTD initially. Specifically, there were Problems with the CTD reporting modulo errors, resulting in a noisy data signal. Troubleshooting resulted in the replacement of a pump and several data cables, resulting in a cleaner signal recorded by the CTD. Additionally, the conducting wire was reterminated during the troubleshooting phase. This initially resulted in a cleaner signal and a decrease in the modulo error counts reported. However, there were still errors associated with the SBE32 carousel throughout the cruise, causing sporadic misfires of Niskin bottles (est. 1% of time). As there was no replacement carousel on board, we could not rectify this problem throughout the cruise.

The first 4 CTD casts were unsuccessful. After extensive troubleshooting, the fifth cast, in the same location as the first 4 (southeast corner of the survey area), was successful as far as the sensors went; however, the bottles did not fire. The first successful CTD cast, with bottle samples, was conducted at 11°N, one degree north from the southwest corner of the survey area.

B. 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 57 acoustic transects were conducted to collect bioacoustics data for the assessment of the density, distribution, and composition of micronekton in the study region (Table 3). These transects were spaced approximately 1º from each other along each Meridional and Zonal transects (Fig. 1), ~2 per day and ~2 per night. Vessel speed was reduced to about 4 knots and direction set to along seas to reduce excessive bubble noise in the acoustics data. However, due to our inability to collect micronekton samples, bioacoustics data could only be used to make relative density comparisons between areas, which is still highly suspect, as backscatter depends on type or organisms, preventing density comparison if the composition of the sound scatterers is not known. Furthermore, as all calibration attempts failed (during SE 10-02, SE-10-3, and SE 10-04), all bioacoustics data contained unknown bias, preventing any quantitative analyses. It will be necessary to calibrate the system within the next few months and update the calibration settings before processing the acoustics data.

In addition to the calibration issues, the 200 kHz channel was not working properly, limiting the available data to 3 frequencies (38, 70, and 120 kHz). Furthermore, the 70 kHz data were periodically contaminated in the upper 50 m by noise coming from the ship, the source of which could not be determined.

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

Water samples for nutrients, chloropigment determinations, and chlorophyll-*a* measurements were collected at 10 predetermined depths every 1º along the transects. Stations with water samples for chloropigment determinations were only spaced at every 0.5º.

Using a bench-top fluorometer, chlorophyll-*a* measurements were calculated from casts with water samples. Water samples for nutrients and chloropigment determinations will be analyzed at the laboratory after the completion of the cruise.

D. Conduct trawl operations targeting the depths of high sonic scattering layers to better our understanding of echosounder signals collected by the EK60 echosounder or, in case of no Cobb trawling capabilities, to gain information on zooplankton composition and distribution in the area.

Because the Cobb trawl winches were inoperable during the entire cruise, no micronekton samples could be collected, which would have been imperative to groundtruth the bioacoustics data. Instead of micronekton samples, zooplankton samples were collected during the night using an IKMT. Samples from only the shallow acoustics scattering layer were collected, as the winch used for these operations was not strong enough to recover the net deployed to the depth of the deep sonic scattering layer. Samples were collected approximately at every 1º along Meridional Transects #2, #3, and #4, two tows each night (Table 2). Samples were pre-sorted and preserved in formaldehyde for more complete laboratory analyses.

During two tows, an attempt was made to reach the deep sonic scattering layer. One thousand meters of cable was let out to test the capabilities of the winch, which resulted in 407 and 405 m maximum depths for the net. As the deep sonic scattering layer started at 400–450 m, more cable would have been needed to be let out in order to reach that layer. However, as the winch was struggling with retrieving the net from the 400 m depth, no further attempt was made to sample the deep sonic scattering layer.

E. In case the calibration attempt fails during SE 10-02, conduct calibrations of the Simrad EK60 echosounder by the placement of a metallic calibration sphere at various locations underneath the ship's hull.

As calibration attempts failed during SE 10-02, the calibration of the EK60 bioacoustic system was scheduled for the first few days of the cruise to be conducted at Apra Harbor. However, upon arrival, it was evident that Apra Harbor was not a suitable location for calibration. The harbor was large enough for wind-chops to build up, making the calibration impossible. In addition, most of the harbor was too shallow for calibration operations, with high tidal currents at the few deeper spots. Furthermore, material left from the second World War on the bottom of the harbor would have jeopardized anchoring safely within the

harbor. Failing to conduct calibration of the EK60 within a few months of data collection rendered all acoustic data collected questionable in accuracy, preventing any quantitative analyses of the data.

SCIENTIFIC PERSONNEL:

Réka Domokos, Chief Scientist, Pacific Islands Fisheries Science Center (PIFSC), National Marine Fisheries Service (NMFS)
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Submitted by: _____
Réka Domokos
Chief Scientist

Approved by: _____
Samuel G. Pooley
Science Director
Pacific Islands Fisheries Science Center

Attachments

Table 1.--List of CTD cast dates, time, location, and maximum depth.

CAST	DATE (GMT)		LAT*	LON*	Depth (m)
1	3/22/2010	19:53:33	10°N	146°40'E	1000m
2	3/23/2010	02:25:11	10°N	146°40'E	1000m
3	3/23/2010	03:26:23	10°N	146°40'E	1000m
4	3/23/2010	07:08:54	10°N	146°40'E	1000m
5	3/23/2010	08:51:53	10°N	146°40'E	1000m
6	3/23/2010	20:09:07	10°30N	146°40'E	1000m
7	3/24/2010	05:57:12	11°N	146°40'E	1000m
8	3/24/2010	20:10:44	11°30N	146°40'E	1000m
9	3/24/2010	22:55:52	11°45N	146°40'E	1000m
10	3/25/2010	01:33:42	12°N	146°40'E	1000m
11	3/25/2010	08:24:52	12°15N	146°40'E	1000m
12	3/25/2010	20:06:05	12º30N	146°40'E	1000m
13	3/25/2010	22:54:50	12º45N	146°40'E	1000m
14	3/26/2010	01:27:25	13ºN	146°40'E	1000m
15	3/26/2010	08:24:03	13º15N	146°40'E	1000m
16	3/26/2010	20:07:38	13º30N	146°40'E	1000m
17	3/26/2010	22:53:21	13º45N	146°40'E	1000m
18	3/27/2010	01:22:40	14°N	146°40'E	1000m
19	3/27/2010	08:24:42	14º15N	146°40'E	1000m
20	3/27/2010	20:01:36	14º30N	146°40'E	1000m
21	3/27/2010	22:49:20	14º45N	146°40'E	1000m
22	3/28/2010	01:20:39	15ºN	146°40'E	1000m
23	3/28/2010	08:27:47	15º15N	146°40'E	1000m
24	3/28/2010	19:49:51	15º30N	146°40'E	1000m
25	3/28/2010	22:36:00	15º45N	146°40'E	1000m
26	3/29/2010	01:06:38	16ºN	146°40'E	1000m
27	3/29/2010	08:30:22	16º15N	146°40'E	1000m
28	3/29/2010	19:54:46	16º30N	146°40'E	1000m
29	3/29/2010	22:46:06	16º45N	146°40'E	1000m
30	3/30/2010	01:40:57	17ºN	146°40'E	1000m
31	3/30/2010	09:54:46	17ºN	145º50'E	1000m
32	3/30/2010	22:00:25	16º45'N	143º48'E	1000m
33	3/31/2010	07:31:23	16º30'N	143º48'E	1000m
34	3/31/2010	20:09:15	16º15'N	143º48'E	1000m
35	4/1/2010	02:11:35	16ºN	143º48'E	1000m
36	4/1/2010	08:18:42	15.45ºN	143º48'E	1000m
37	4/1/2010	19:58:00	15º30'N	143º48'E	1000m

CAST	DATE (GMT)		LAT*	LON*	Depth (m)
38	4/1/2010	23:18:52	15º15'N	143°48'E	1000m
39	4/2/2010	02:13:33	15ºN	143°48'E	1000m
40	4/2/2010	08:32:05	14º45N	143°48'E	1000m
41	4/2/2010	19:54:41	14º30N	143°48'E	1000m
42	4/2/2010	22:56:03	14º15N	143°48'E	1000m
43	4/3/2010	01:33:02	14ºN	143°48'E	1000m
44	4/3/2010	08:28:25	13º45N	143°48'E	1000m
45	4/4/2010	06:01:15	13º30N	143°48'E	1000m
46	4/4/2010	08:52:16	13º15N	143°48'E	1000m
47	4/4/2010	19:47:48	13ºN	143°48'E	1000m
48	4/4/2010	22:49:32	12º45N	143°48'E	1000m
49	4/4/2010	01:15:46	12º30N	143°48'E	1000m
50	4/5/2010	8:21:49	12º15N	143°48'E	1000m
51	4/5/2010	20:01:03	12ºN	143°48'E	1000m
52	4/5/2010	22:52:28	11°45N	143°48'E	1000m
53	4/5/2010	1:28:53	11°30N	143°48'E	1000m
54	4/6/2010	8:23:46	11°15N	143°48'E	1000m
55	4/6/2010	19:53:50	11°N,	143°48'E	1000m
56	4/6/2010	22:57:35	10°45N	143°48'E	1000m
57	4/6/2010	1:32:37	10°30N	143°48'E	1000m
58	4/7/2010	8:25:35	10°15N	143°48'E	1000m
59	4/7/2010	19:48:01	10°N	143°48'E	1000m
60	4/7/2010	9:56:35	10°N	145°14'E	1000m
61	4/8/2010	19:52:58	10°15N	145°14'E	1000m
62	4/8/2010	22:43:29	10°30N	145°14'E	1000m
63	4/8/2010	4:20:51	10°45N	145°14'E	1000m
64	4/9/2010	6:57:22	11°N	145°14'E	1000m
65	4/9/2010	9:41:01	11°15N	145°14'E	1000m
66	4/9/2010	19:00:36	11°30N	145°14'E	1000m
67	4/9/2010	21:50:12	11°45N	145°14'E	1000m
68	4/9/2010	3:17:19	12°N	145°14'E	1000m
69	4/10/2010	6:29:57	12°15N	145°14'E	1000m
70	4/10/2010	8:53:11	12°30N	145°14'E	1000m
71	4/10/2010	19:54:00	12°45N	145°14'E	1000m
72	4/10/2010	22:54:03	13°N	145°14'E	1000m
73	4/11/2010	5:12:59	13°15N	145°14'E	1000m
74	4/12/2010	7:51:03	13°30N	145°14'E	1000m

Table 2.--List of IKMT trawl date and time, location, type, and the targeted maximum depth.

TRAWL	DATE (GMT)		LAT*	LON*	TYPE	TARGET DEPTH
1	3/23/2010	11:15:12	10ºN	146º40' E	Shallow Oblique	200m
2	3/23/2010	15:08:59	10ºN	146º40' E	Shallow Oblique	200m
3	3/24/2010	10:27:16	11º30N	146º40' E	Shallow Oblique	200m
4	3/24/2010	15:01:32	11º30N	146º40' E	Shallow Oblique	200m
5	3/25/2010	11:08:13	12º30N	146º40' E	Shallow Oblique	200m
6	3/25/2010	14:50:16	12º30N	146º40' E	Shallow Oblique	200m
7	3/26/2010	10:52:15	13º30N	146º40' E	Shallow Oblique	200m
8	3/26/2010	14:51:26	13º30N	146º40' E	Shallow Oblique	200m
9	3/27/2010	10:53:58	14º30N	146º40' E	Shallow Oblique	200m
10	3/27/2010	14:53:22	14º30N	146º40' E	Shallow Oblique	200m
11	3/28/2010	11:04:13	15º30N	146º40' E	Shallow Oblique	200m
12	3/28/2010	14:47:36	15º30N	146º40' E	Shallow Oblique	200m
13	3/29/2010	11:04:24	16º30N	146º40' E	Shallow Oblique	200m
14	3/29/2010	14:51:28	16º30N	146º40' E	Shallow Oblique	200m
15	4/1/2010	11:30:10	15º30N	143º48' E	Shallow Oblique	200m
16	4/2/2010	11:12:15	14º30N	143º48' E	Shallow Oblique	200m
17	4/2/2010	14:54:31	14º30N	143º48' E	Shallow Oblique	200m
18	4/3/2010	11:02:05	13º30N	143º48' E	Shallow Oblique	200m
19	4/4/2010	11:19:50	13ºN	143º48’ E	Shallow Oblique	200m
20	4/4/2010	17:25:26	13ºN	143º48’ E	Shallow Oblique	200m
21	4/5/2010	10:54:58	12ºN	143º48’ E	Shallow Oblique	200m
22	4/5/2010	15:26:23	12ºN	143º48’ E	Shallow Oblique	200m
23	4/6/2010	10:57:28	11ºN	143º48’ E	Shallow Oblique	200m
24	4/6/2010	15:27:37	11ºN	143º48’ E	Shallow Oblique	200m
25	4/7/2010	10:59:08	10ºN	143º48’ E	Shallow Oblique	200m
26	4/7/2010	16:58:35	10ºN	143º48’ E	Deep Oblique	400m
27	4/8/2010	11:04:24	10ºN	145º13’ E	Shallow Oblique	200m
28	4/8/2010	16:24:33	10ºN	145º07’ E	Deep Oblique	400m
29	4/9/2010	13:02:44	11º30N	145º15’ E	Shallow Oblique	200m

TRAWL	DATE (GMT)		LAT*	LON*	TYPE	TARGET DEPTH
30	4/9/2010	16:52:25	11º30N	145º15' E	Shallow Oblique	200m
31	4/10/2010	11:02:58	12º30N	145º15' E	Shallow Oblique	200m
32	4/10/2010	15:23:31	12º30N	145º15' E	Shallow Oblique	200m
33	4/11/2010	11:02:08	13º30N	145º15' E	Shallow Oblique	200m

Table 3.--List of date, time, and location of transects during which both ADCP and EK60 data were collected continuously.

Activity		Date		Time (GMT)		Location	
Type	Number	Start	End	Start	End	Start	End
Meridional Transect	1	3/20/2010	3/21/2010	5:38:37	02:50:05	13°24N 143°49E	10°N 143°49E
Meridional Transect	2	3/23/2010	3/30/2010	16:42:39	1:40:36	10°N, 146°45E	17ºN,146°45E
Meridional Transect	3	4/1/2010	4/7/2010	0:31:10	10:58:41	16°07N 143°38E	10°N 143°49E
Meridional Transect	4	4/8/2010	4/11/2010	18:23:30	7:50:46	10°N 145°14 E	13°30N 145°14 E
Zonal Transect	1	3/21/2010	3/22/2010	2:50:13	14:22:04	10°N 143°49E	10°N 146°45E
Zonal Transect	2	3/30/2010	3/30/2010	3:02:34	22:00:04	17ºN 146º40E	17ºN 143º39E
Zonal Transect	3	4/8/2010	4/8/2010	0:34:48	9:56:05	10°N 143°48E	10°N to 145°14

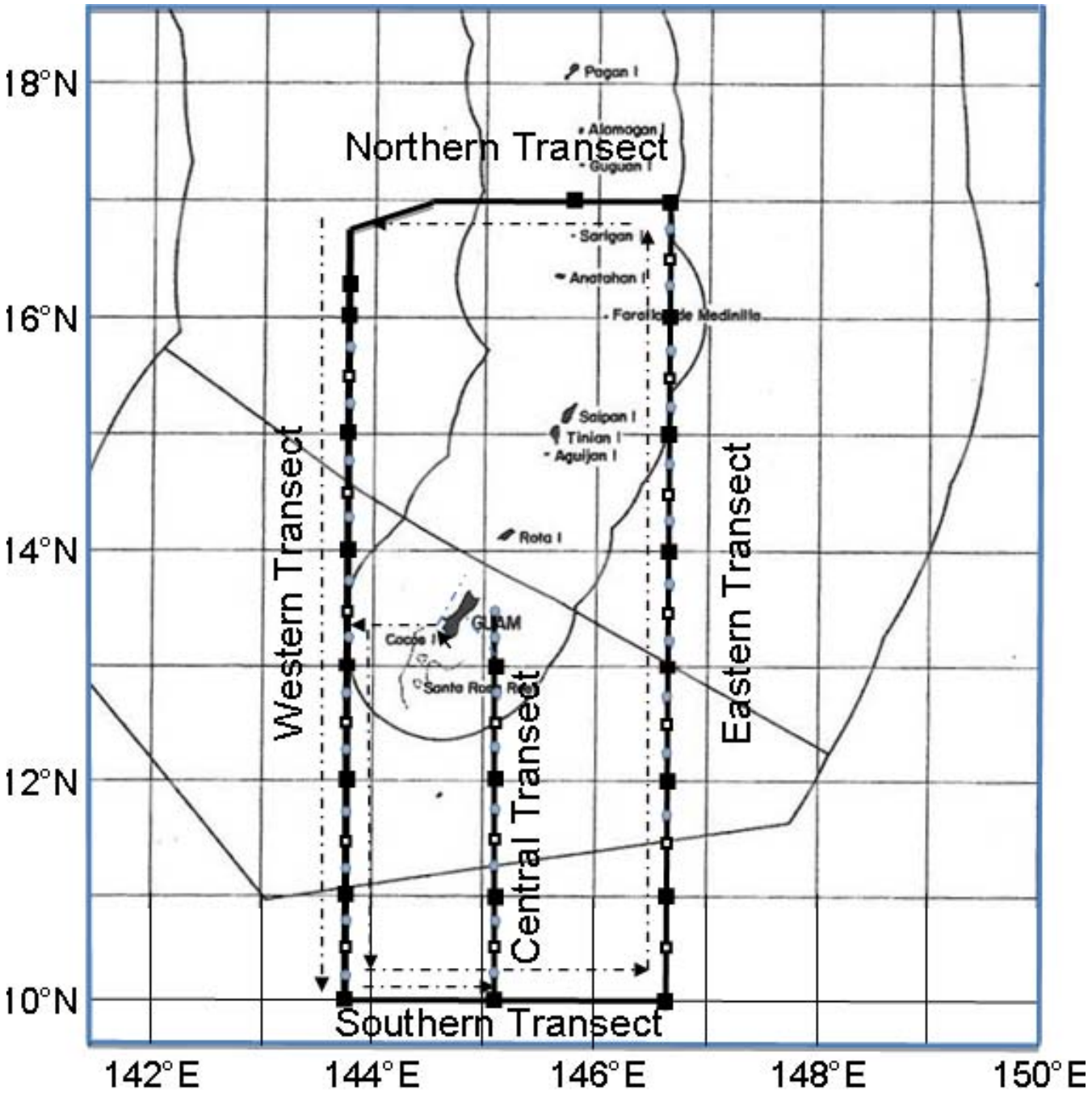

Figure 1.-- Survey transects and stations for SE 10-03. Filled and unfilled squares indicate full (nutrients, chloropigments, and chlorophyll-*a*) and bottled (chloropigment determinations only) CTD stations, with gray circles denoting CTD stations with no bottle samples. One daytime and two nighttime acoustic transects and IKMT trawls were also conducted at each full and bottled CTD stations, respectively.