



CRUISE REPORT ON RESEARCH ACTIVITY

M.V.SEAFDEC 2 Cruise No. 43-2/2013

10-31 August 2013

Oceanographic Survey at Gulf of Thailand

TD/RP/173

This report is base on preliminary data

For readers who may need data in the report, please contact to:

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1. Cruise Summary

Vessel name : M.V.SEAFDEC 2
Cruise No : M.V.SEAFDEC 2 No. 43-2/2013
Period : 10-31 August 2013 (22 days)
Area of Operation : Gulf of Thailand
Port of Call : SEAFDEC/TD, Samut Prakarn, Thailand
Activities : Collecting physical and chemical oceanographic data using iCTD, Carocel water sampler, MSS90, and ADCP

2. List of ship personnel

No.	Name	Position
1	Mr. Tossaporn Sukhapindha	Captain
2	Mr. Nanthawat Phungsuk	Chief Engineer
3	Mr. Suren Pruksarat	Second Officer
4	Mr. Vudhirat Vudthipanyo	Second Officer
5	Mr. Padung Ngowlimhua	Second Engineer
6	Mr. Boontarin Wora-in	Third Engineer
7	Mr. Thana rungjoy	Boatswain
8	Mr. Pradit Kui-prasert	Steersman
9	Mr. Jaroon Po-U	Steersman
10	Mr. Kittinai Sukdit	Fitter
11	Mr. Plew Shodok	Oiler
12	Mr. Dum Tanyachareon	Oiler
13	Mr. Watchara Panasri	Oiler
14	Mr. Saichol Kornnoom	Cook
15	Mr. Marut SangPhuek	Ship's Boy

3. List of scientists

No.	Name	Position	Organization
1	Dr.Natinee Sukramongkol	Fishery Oceanographer	SEAFDEC/TD
2	Ms.Kanokwan Thobphuk (10-21 Aug. 2013)	Audio-Visual Assistant	SEAFDEC/TD
3	Mr.Jingsong Guo	Associate Professor	FIO
4	Mr.Zhixiao Jiang	Associate Professor	FIO
5	Mr.Qi Shu	Research Assistant	FIO
6	Mr.Dapeng Qu	Research Assistant	FIO
7	Ms.Ying Feng	Research Assistant	FIO
8	Ms.Nuttida Chanthasiri	Graduated Student	CU
9	Ms.Pornpana Pechsri	Research Assistant	MCRC/Chumphon

10	Mr.Jeamsak Suvisut	Research Assistant	MCRC/Chumphon
11	Ms.Khanitta Tongbaiyai	Research Assistant	MCRC/Chumphon
12	Ms.Sirisuk Petchamnan	Research Assistant	MCRC/Phuket
13	Mr.Komsun Thongtaem	Research Assistant	MCRC/Phuket
14	Ms.Pontipa Luadnakrob	Graduated Student	BUU
15	Ms.Siraporn Tong-u-dom	Graduated Student	BUU

4. Research activities

Date	Time	Activities	Position
10 Aug 2013	1710-1735	Oceanographic survey at st. A01	L 12°23.89'N, λ100° 08.00'E
		iCTD, water sampling, and MSS90 operated at sea depth 25.3 m	
		ADCP for 20 min. at sub-surface water	
11 Aug 2013	0600-0615	Oceanographic survey at st. A02	L12° 24.02' N, λ100° 30.33' E
		iCTD, water sampling, and MSS90 operated at sea depth 28.0 m	
		ADCP for 20 min. at sub-surface water	
	0907-0912	Oceanographic survey at st. A03	L12° 23.89' N, λ101° 00.49' E
		iCTD, water sampling, and MSS90 operated at sea depth 28.8 m	
		ADCP for 20 min. at sub-surface water	
	1207-1220	Oceanographic survey at st. A04	L12° 23.89' N, λ101° 30.41' E
		iCTD, water sampling, and MSS90 operated at sea depth 30.0 m	
		ADCP for 20 min. at sub-surface water	
	1513-1526	Oceanographic survey at st. A05	L12° 23.87' N, λ102° 00.35' E
		iCTD, water sampling, and MSS90 operated at sea depth 17.0 m	
		ADCP for 20 min. at sub-surface water	
	1752-1805	Oceanographic survey at st. B05	L11° 59.75' N, λ102° 00.35' E
		iCTD, water sampling, and MSS90 operated at sea depth 38.8 m	
		ADCP for 20 min. at sub-surface water	
12 Aug 2013	0557-0615	Oceanographic survey at st. B04	L12° 00.08' N, λ101° 30.38' E
		iCTD, water sampling, and MSS90 operated at sea depth 45.7 m	
		ADCP for 20 min. at sub-surface water	
	0916-0932	Oceanographic survey at st. B03	L11° 59.93' N, λ101° 00.18' E
		iCTD, water sampling, and MSS90 operated at sea depth 38.2 m	
		ADCP for 20 min. at sub-surface	

		water	
	1228-1245	Oceanographic survey at st. B02	L11° 59.91' N, λ100° 30.29' E
		iCTD, water sampling, and MSS90 operated at sea depth 35.0 m	
		ADCP for 20 min. at sub-surface water	
	1454-1510	Oceanographic survey at st. B01	L11° 59.97' N, λ100° 07.49' E
		iCTD, water sampling, and MSS90 operated at sea depth 34.4 m	
		ADCP for 20 min. at sub-surface water	
	1819-1838	Oceanographic survey at st. C01	L11° 29.87' N, λ100° 00.29' E
		iCTD, water sampling, and MSS90 operated at sea depth 41.4 m	
		ADCP for 20 min. at sub-surface water	
13 Aug 2013	0604-0622	Oceanographic survey at st. C02	L11° 30.05' N, λ100° 30.29' E
		iCTD, water sampling, and MSS90 operated at sea depth 50.1 m	
		ADCP for 20 min. at sub-surface water	
	0914-0930	Oceanographic survey at st. C03	L11° 29.93' N, λ101° 00.38' E
		iCTD, water sampling, and MSS90 operated at sea depth 54.1 m	
		ADCP for 20 min. at sub-surface water	
	1214-1235	Oceanographic survey at st. C04	L11° 29.93' N, λ101° 30.49' E
		iCTD, water sampling, and MSS90 operated at sea depth 61.0 m	
		ADCP for 20 min. at sub-surface water	
	1520-1538	Oceanographic survey at st. C05	L11° 29.92' N, λ102° 00.33' E
		iCTD, water sampling, and MSS90 operated at sea depth 57.7 m	
		ADCP for 20 min. at sub-surface water	
14 Aug 2013	0605-0623	Oceanographic survey at st. D07	L10° 59.99' N, λ101° 15.38' E
		iCTD, water sampling, and MSS90 operated at sea depth 62.5 m	
		ADCP for 20 min. at sub-surface water	
	0836-0850	Oceanographic survey at st. D06	L11° 00.10' N, λ101° 00.38' E
		iCTD, water sampling, and MSS90 operated at sea depth 59.5 m	
		ADCP for 20 min. at sub-surface water	
	1057-1115	Oceanographic survey at st. D05	L10° 59.93' N, λ100° 45.32' E
		iCTD, water sampling, and MSS90 operated at sea depth 59.9 m	
		ADCP for 20 min. at sub-surface	

		water	
	1304-1325	Oceanographic survey at st. D04	L10° 59.97' N, λ100° 30.31' E
		iCTD, water sampling, and MSS90 operated at sea depth 55.6 m	
		ADCP for 20 min. at sub-surface water	
	1459-1522	Oceanographic survey at st. D03	L11° 00.01' N, λ100° 15.30' E
		iCTD, water sampling, and MSS90 operated at sea depth 54.3 m	
		ADCP for 20 min. at sub-surface water	
	1655-1715	Oceanographic survey at st. D02	L10° 59.92' N, λ100° 00.29' E
		iCTD, water sampling, and MSS90 operated at sea depth 52.4 m	
		ADCP for 20 min. at sub-surface water	
15 Aug 2013	0559-0618	Oceanographic survey at st. D01	L10° 59.96' N, λ099° 45.40' E
		iCTD, water sampling, and MSS90 operated at sea depth 48.4 m	
		ADCP for 20 min. at sub-surface water	
	0753-0812	Oceanographic survey at st. E01	L10° 44.88' N, λ099° 45.36' E
		iCTD, water sampling, and MSS90 operated at sea depth 50.8 m	
	0935-0915	Oceanographic survey at st. E02	L10° 44.97' N, λ100° 00.32' E
		iCTD, water sampling, and MSS90 operated at sea depth 55.4 m	
		ADCP for 20 min. at sub-surface water	
	1120-1140	Oceanographic survey at st. E03	L10° 44.93' N, λ100° 15.38' E
		iCTD, water sampling, and MSS90 operated at sea depth 53.9-58.4 m	
		ADCP for 20 min. at sub-surface water	
	1305-1327	Oceanographic survey at st. E04	L10° 44.92' N, λ100° 30.31' E
		iCTD, water sampling, and MSS90 operated at sea depth 59.5 m	
		ADCP for 20 min. at sub-surface water	
	1448-1512	Oceanographic survey at st. E05	L10° 44.96' N, λ100° 45.31' E
		iCTD, water sampling, and MSS90 operated at sea depth 62.0 m	
		ADCP for 20 min. at sub-surface water	
	1630-1653	Oceanographic survey at st. E06	L10° 44.87' N, λ101° 00.36' E
		iCTD, water sampling, and MSS90 operated at sea depth 65.8-66.7 m	
		ADCP for 20 min. at sub-surface water	

16 Aug 2013	1630-1653	Oceanographic survey at st. E07	L10° 44.91' N, λ101° 09.36' E
		iCTD, water sampling, and MSS90 operated at sea depth 62.3-63.1 m	
		ADCP for 20 min. at sub-surface water	
	0757-0817	Oceanographic survey at st. F08	L10° 29.87' N, λ101° 09.28' E
		iCTD, water sampling, and MSS90 operated at sea depth 62.0-67.8 m	
		ADCP for 20 min. at sub-surface water	
	0915-0935	Oceanographic survey at st. F07	L10° 29.99' N, λ101° 00.25' E
		iCTD, water sampling, and MSS90 operated at sea depth 65.9-66.2 m	
		ADCP for 20 min. at sub-surface water	
	1105-1123	Oceanographic survey at st. F06	L10° 29.98' N, λ100° 45.27' E
		iCTD, water sampling, and MSS90 operated at sea depth 62.7 m	
		ADCP for 20 min. at sub-surface water	
	1255-1318	Oceanographic survey at st. F05	L10° 29.99' N, λ100° 30.32' E
		iCTD, water sampling, and MSS90 operated at sea depth 61.6-63.0 m	
		ADCP for 20 min. at sub-surface water	
	1445-1505	Oceanographic survey at st. F04	L10° 29.94' N, λ100° 15.33' E
		iCTD, water sampling, and MSS90 operated at sea depth 55.8 m	
		ADCP for 20 min. at sub-surface water	
	1632-1655	Oceanographic survey at st. F03	L10° 29.91' N, 100° 00.27' E
		iCTD, water sampling, and MSS90 operated at sea depth 53.6 m	
		ADCP for 20 min. at sub-surface water	
	1823-1831	Oceanographic survey at st. F02	L10° 29.92' N, 099° 45.37' E
		iCTD, water sampling, and MSS90 operated at sea depth 50.9 m	
		ADCP for 20 min. at sub-surface water	
17 Aug 2013	0607-0630	Oceanographic survey at st. F01	L10° 29.93' N, 099° 30.29' E
		iCTD, water sampling, and MSS90 operated at sea depth 41.7 m	
		ADCP for 20 min. at sub-surface water	
	0800-0822	Oceanographic survey at st. G01	L10° 14.82' N, 099° 30.32' E
		iCTD, water sampling, and MSS90 operated at sea depth 39.5 m	
		ADCP for 20 min. at sub-surface water	

	0946-1004	Oceanographic survey at st. G02	L10° 14.95' N, 099° 45.36' E
		iCTD, water sampling, and MSS90 operated at sea depth 45.3 m	
		ADCP for 20 min. at sub-surface water	
	1132-1150	Oceanographic survey at st. G03	L10° 14.94' N, 100° 00.35' E
		iCTD, water sampling, and MSS90 operated at sea depth 52.0 m	
		ADCP for 20 min. at sub-surface water	
	1322-1345	Oceanographic survey at st. G04	L10° 15.03' N, 100° 15.27' E
		iCTD, water sampling, and MSS90 operated at sea depth 55.2 m	
		ADCP for 20 min. at sub-surface water	
	1511-1535	Oceanographic survey at st. G05	L10° 14.90' N, 100° 30.25' E
		iCTD, water sampling, and MSS90 operated at sea depth 64.7 m	
		ADCP for 20 min. at sub-surface water	
	1659-1723	Oceanographic survey at st. G06	L10° 14.93' N, 100° 45.32' E
		iCTD, water sampling, and MSS90 operated at sea depth 60.4 m	
		ADCP for 20 min. at sub-surface water	
18 Aug 2013	0600-0618	Oceanographic survey at st. G07	L10° 14.98' N, 101° 00.26' E
		iCTD, water sampling, and MSS90 operated at sea depth 64.4 m	
		ADCP for 20 min. at sub-surface water	
	0715-0738	Oceanographic survey at st. G08	L10° 14.94' N, 101° 09.37' E
		iCTD, water sampling, and MSS90 operated at sea depth 67.6 m	
		ADCP for 20 min. at sub-surface water	
	0908-0933	Oceanographic survey at st. H08	L09° 59.93' N, 101° 09.30' E
		iCTD, water sampling, and MSS90 operated at sea depth 65.1 m	
		ADCP for 20 min. at sub-surface water	
	1041-1102	Oceanographic survey at st. H07	L09° 59.99' N, 101° 00.23' E
		iCTD, water sampling, and MSS90 operated at sea depth 62.5 m	
		ADCP for 20 min. at sub-surface water	
	1231-1254	Oceanographic survey at st. H06	L09° 59.92' N, 100° 45.32' E
		iCTD, water sampling, and MSS90 operated at sea depth 60.6 m	
		ADCP for 20 min. at sub-surface water	

	1421-1442	Oceanographic survey at st. H05	L09° 59.99' N, 100° 30.35' E
		iCTD, water sampling, and MSS90 operated at sea depth 58.3 m	
		ADCP for 20 min. at sub-surface water	
	1607-1628	Oceanographic survey at st. H04	L09° 59.95' N, 100° 15.26' E
		iCTD, water sampling, and MSS90 operated at sea depth 53.9 m	
		ADCP for 20 min. at sub-surface water	
	1752-1815	Oceanographic survey at st. H03	L09° 59.93' N, 100° 00.26' E
		iCTD, water sampling, and MSS90 operated at sea depth 43.0 m	
		ADCP for 20 min. at sub-surface water	
19 Aug 2013	0558-0627	Oceanographic survey at st. H02	L09° 59.91' N, 099° 45.20' E
		iCTD, water sampling, and MSS90 operated at sea depth 35.8 m	
		ADCP for 20 min. at sub-surface water	
	0756-0820	Oceanographic survey at st. H01	L09° 59.95' N, 099° 30.26' E
		iCTD, water sampling, and MSS90 operated at sea depth 28.0 m	
		ADCP for 20 min. at sub-surface water	
	0916-0936	Oceanographic survey at st. Z01	L09° 53.06' N, 099° 36.55' E
		iCTD operated at sea depth 26.6 m	
		ADCP for 20 min. at sub-surface water	
	1037-1057	Oceanographic survey at st. Z02	L09° 44.95' N, 099° 43.75' E
		iCTD operated at sea depth 19.2 m	
		ADCP for 20 min. at sub-surface water	
	1210-1230	Oceanographic survey at st. Z03	L09° 35.60' N, 099° 51.20' E
		iCTD operated at sea depth 12.1 m	
		ADCP for 20 min. at sub-surface water	
20-21 Aug 2013		Anchored at Koh Samui Island, Suratthani Province -Refreshment and refilled provisions	
22-25 Aug 2013		Mooring station at L 09° 56.50'N, λ 100° 15.50'E; sea depth 40.0m - Time series recorded every hour using Logger version CTD Profiler from 22 to 25 Aug. 2013 - Deploy an ADCP at sub-surface water from 22 to 25 Aug. 2013 -MSS90 deploy every hour for 25 hours during 23-24 Aug. 2013	
26 Aug 2013	0559-0616	Oceanographic survey at st. I01	L09° 44.91' N, 100° 15.36' E
		iCTD operated at sea depth 26.3 m	
		ADCP for 20 min. at sub-surface water	
	0747-0805	Oceanographic survey at st. I02	L09° 44.95' N, 100° 30.38' E
		iCTD operated at sea depth 56.1 m	

		ADCP for 20 min. at sub-surface water	
	0929-0947	Oceanographic survey at st. I03	L09° 44.95' N, 100° 45.42' E
		iCTD operated at sea depth 58.7 m	
		ADCP for 20 min. at sub-surface water	
	1113-1134	Oceanographic survey at st. I04	L09° 44.94' N, 101° 00.35' E
		iCTD operated at sea depth 61.8 m	
		ADCP for 20 min. at sub-surface water	
	1225-1247	Oceanographic survey at st. I05	L09° 44.91' N, 101° 09.25' E
		iCTD operated at sea depth 67.2 m	
		ADCP for 20 min. at sub-surface water	
	1414-1435	Oceanographic survey at st. J05	L09° 29.96' N, 101° 09.29' E
		iCTD operated at sea depth 66.4 m	
		ADCP for 20 min. at sub-surface water	
	1525-1546	Oceanographic survey at st. J04	L09° 29.88' N, 101° 00.32' E
		iCTD operated at sea depth 61.3 m	
		ADCP for 20 min. at sub-surface water	
	1710-1731	Oceanographic survey at st. J03	L09° 29.91' N, 100° 45.32' E
		iCTD operated at sea depth 52.3 m	
		ADCP for 20 min. at sub-surface water	
27 Aug 2013	0603-0622	Oceanographic survey at st. J02	L09° 29.98' N, 100° 30.28' E
		iCTD operated at sea depth 43.3 m	
		ADCP for 20 min. at sub-surface water	
	0749-0822	Oceanographic survey at st. J01	L09° 29.93' N, 100° 15.24' E
		iCTD operated at sea depth 28.5 m	
		ADCP for 20 min. at sub-surface water	
	1102-1122	Oceanographic survey at st. K01	L08° 59.87' N, 100° 09.29' E
		iCTD operated at sea depth 25.0 m	
		ADCP for 20 min. at sub-surface water	
	1321-1342	Oceanographic survey at st. K02	L08° 59.93' N, 100° 30.26' E
		iCTD operated at sea depth 34.1 m	
		ADCP for 20 min. at sub-surface water	
	1625-1645	Oceanographic survey at st. K03	L08° 59.93' N, 101° 00.38' E
		iCTD operated at sea depth 50.9 m	
		ADCP for 20 min. at sub-surface water	
	1737-1758	Oceanographic survey at st. K04	L08° 59.90' N, 101° 09.35' E
		iCTD operated at sea depth 59.6 m	
		ADCP for 20 min. at sub-surface water	

28 Aug 2013	0559-0608	Oceanographic survey at st. L04	L08° 29.98' E, 101° 33.27' E
		iCTD operated at sea depth 60.2 m	
		ADCP for 20 min. at sub-surface water	
	0839-0900	Oceanographic survey at st. L03	L08° 29.95' N, 101° 09.25' E
		iCTD operated at sea depth 54.9 m	
		ADCP for 20 min. at sub-surface water	
	1113-1137	Oceanographic survey at st. L02	L08° 29.91' N, 100° 45.28' E
		iCTD operated at sea depth 31.5 m	
		ADCP for 20 min. at sub-surface water	
	1253-1315	Oceanographic survey at st. L01	L08° 29.96' N, 100° 30.28' E
		iCTD operated at sea depth 28.1 m	
		ADCP for 20 min. at sub-surface water	
	1614-1634	Oceanographic survey at st. M01	L07° 59.87' N, 100° 40.32' E
		iCTD operated at sea depth 26.7 m	
		ADCP for 20 min. at sub-surface water	
	1752-1812	Oceanographic survey at st. M02	L07° 59.95' N, 100° 54.35' E
		iCTD operated at sea depth 32.5 m	
		ADCP for 20 min. at sub-surface water	
29 Aug 2013	0552-0610	Oceanographic survey at st. M03	L07° 59.96' N, 101° 21.25' E
		iCTD operated at sea depth 53.2 m	
		ADCP for 20 min. at sub-surface water	
	0829-0850	Oceanographic survey at st. M04	L07° 59.94' N, 101° 45.35' E
		iCTD operated at sea depth 65.3 m	
		ADCP for 20 min. at sub-surface water	
	1145-1152	Oceanographic survey at st. N04	L07° 29.92' N, 101° 54.32' E
		iCTD operated at sea depth 52.0 m	
		ADCP for 20 min. at sub-surface water	
	1420-1440	Oceanographic survey at st. N03	L07° 29.89' N; 101° 30.34' E
		iCTD operated at sea depth 48.9 m	
		ADCP for 20 min. at sub-surface water	
	1653-1715	Oceanographic survey at st. N02	L07° 29.94' N, 101° 06.25' E
		iCTD operated at sea depth 39.4 m	
		ADCP for 20 min. at sub-surface water	
	1926-1948	Oceanographic survey at st. N01	L07° 29.95' N, 100° 42.25' E
		iCTD operated at sea depth 24.5 m	
		ADCP for 20 min. at sub-surface water	
30-31 Aug 2013		Proceeded to SEAFDEC/TD	

5. Oceanographic survey

5.1 Physical and chemical oceanography

There were 82 oceanographic stations completed during 10-29 August 2013 (Figure 1). Physical and chemical characteristic of water including conductivity, temperature, fluorescence, dissolved oxygen, and PAR was measuring using SeaBird 911 CTD and compact CTD data logger (JFE Advantech) (Figure 2). The SeaBird 911 CTD and compact CTD were deployed the same time from the sea surface to approximately 5 meter above the sea bottom. During retrieving the CTD, the Carousel Water Sample comprised with the Niskin Bottles which is a part of SeaBird 911 CTD system were used for collecting water samples at sub-surface water (3 meter), mid-water column, and bottom (5 meter above bottom) as shown in table1.

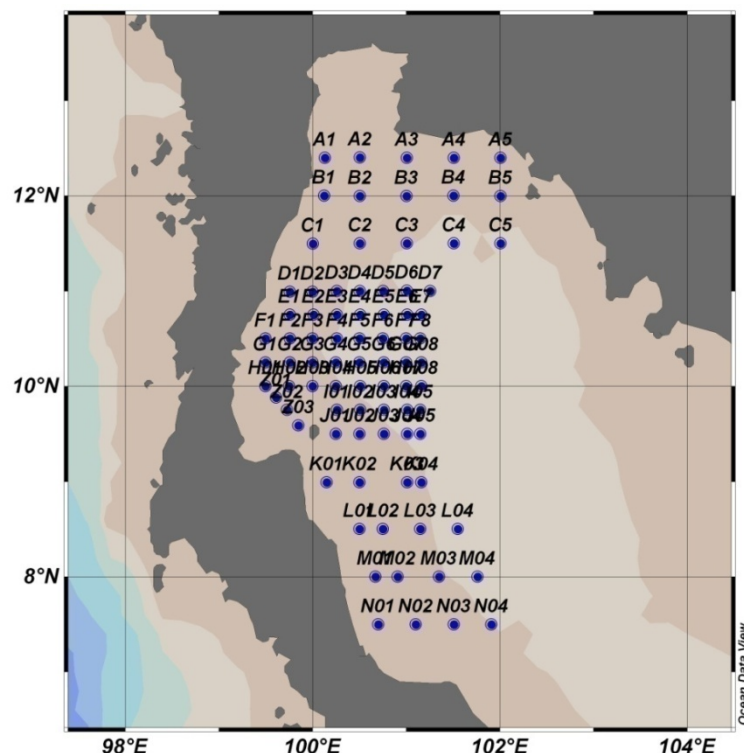


Figure 1 Survey station map.

The in situ microstructure scan (MSS90) was deployed after the CTD deployment to measure the sea water turbulences (Figure 3). Water sampling from Niskin bottles were collected 250 ml each water depth for nutrients analysis and 1000 ml for chlorophyll concentration measurement (Figure 4). Water samples was filtered through Whatman GFC filter paper and stored in -24 °C freezer (Figure 4). During the oceanographic survey at each station, the Acoustic Doppler Current Profiler (ADCP) was deployed at sub-surface water (1 meter) for 20 minutes at stern deck (Figure 5).

Thermosalinograph with Fluorometer (TSG-Fluorometer) were operated along the cruise track of M.V. SEAFDEC 2 to measure the temperature and chlorophyll a. The system was designed to pump water from approximately 5 meter below the sea surface continuously. The data were average every 6 second.

Additional survey station had been added from the original plane for 3 stations (st.Z01, Z02, Z03) for compact CTD data logger and ADCP data collection only. Operating summary had shown in table 1.

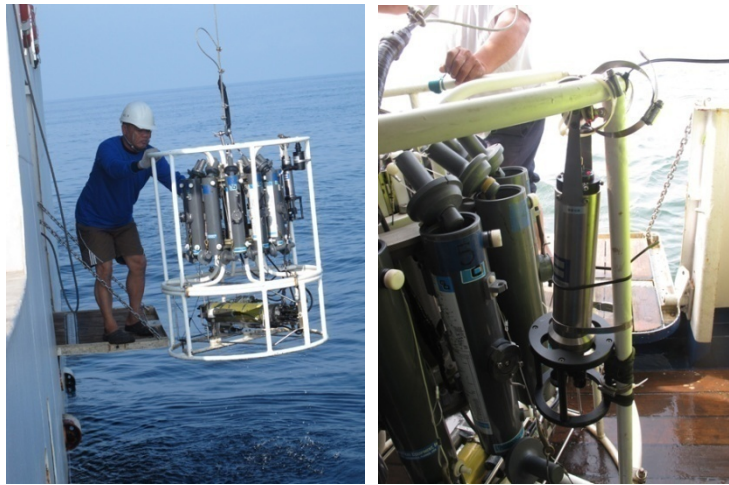


Figure 2. SeaBird 911 CTD unit with carousel water sampling and compact CTD data logger.



Figure 3. The in situ microstructure scan (MSS90).



Figure 4. Water sampling and water filtering.

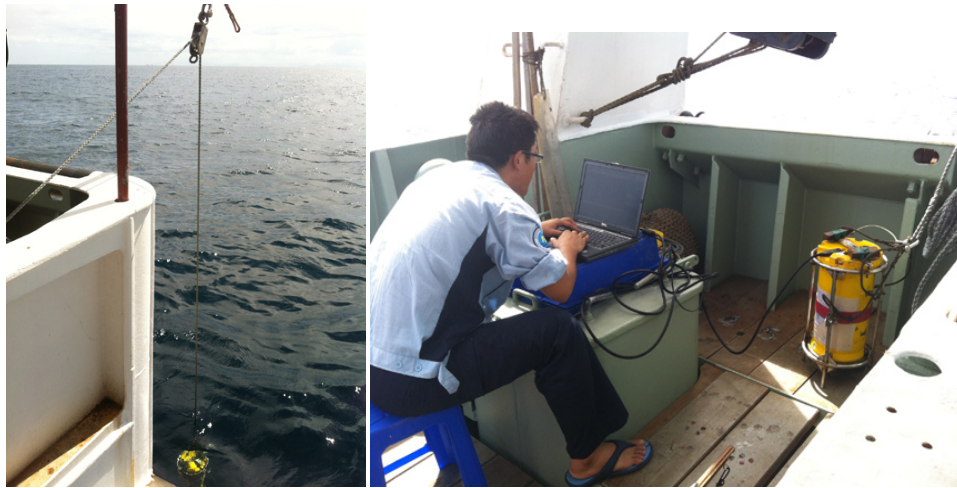


Figure 5. Acoustic Doppler Current Profiler (ADCP) deployed at sub-surface water.

Mooring survey station was conducted during 22-25 August 2013; compact CTD data logger was operated every hour for 72 hours as well as the MSS90 was operated every hour for 25 hours, and ADCP was deployed for 72 hours (Figure 6).



Figure 6. Compact CTD data logger and MSS90 deploy at mooring station.

5.2 Preliminary analysis of oceanographic parameter

All 82 oceanographic stations were conducted during day time with air temperature recorded between 27 and 32 °C. Sea depth varies between 12 m (Z03) and 68 m (F08). Sea surface temperature was between 28.5 and 30.0 °C. The water column at the upper-Gulf of Thailand are well mixed (transect A to J), however, thermocline layer was found between 40 and 50 m depth at transect K to N. Rapid changes of salinity, dissolved oxygen, and pH with increasing depth also found at the thermocline layer. The profiles of temperature (°C), salinity (PSU), dissolved oxygen (ml/l), fluorescence (microg/l), and pH from the oceanographic stations were plotted and shown in figure 7. Data from each station had shown the similar pattern except the dissolved oxygen and pH data.

Horizontal and vertical plot along the survey track of temperature (°C), salinity (PSU), and dissolved oxygen (ml/l) were shown in figure 8 and 9. High salinity and low water temperature were observed at the station off coast of Nakhon Srithammarat to Songkla province (K03, K04, L03, L04, M03, M04, N03, and N04). Dissolved oxygen concentration (ml/l) found fluctuated between 3.0 and 4.5 ml/l at the Central Gulf area while the low

dissolved oxygen concentration at the sea bottom found at west coast off Chumporn Province and outer station off coast of Songkla province at 2.75-3.0 ml/l. Vertical plot along the cruise track reveal the South China Sea water mass with low temperature (26.5-27.0 °C) and high salinity (33.5-34.0 PSU) mixed over at sea depth between 40-60 m at the outer of the Gulf of Thailand (Figure 9).

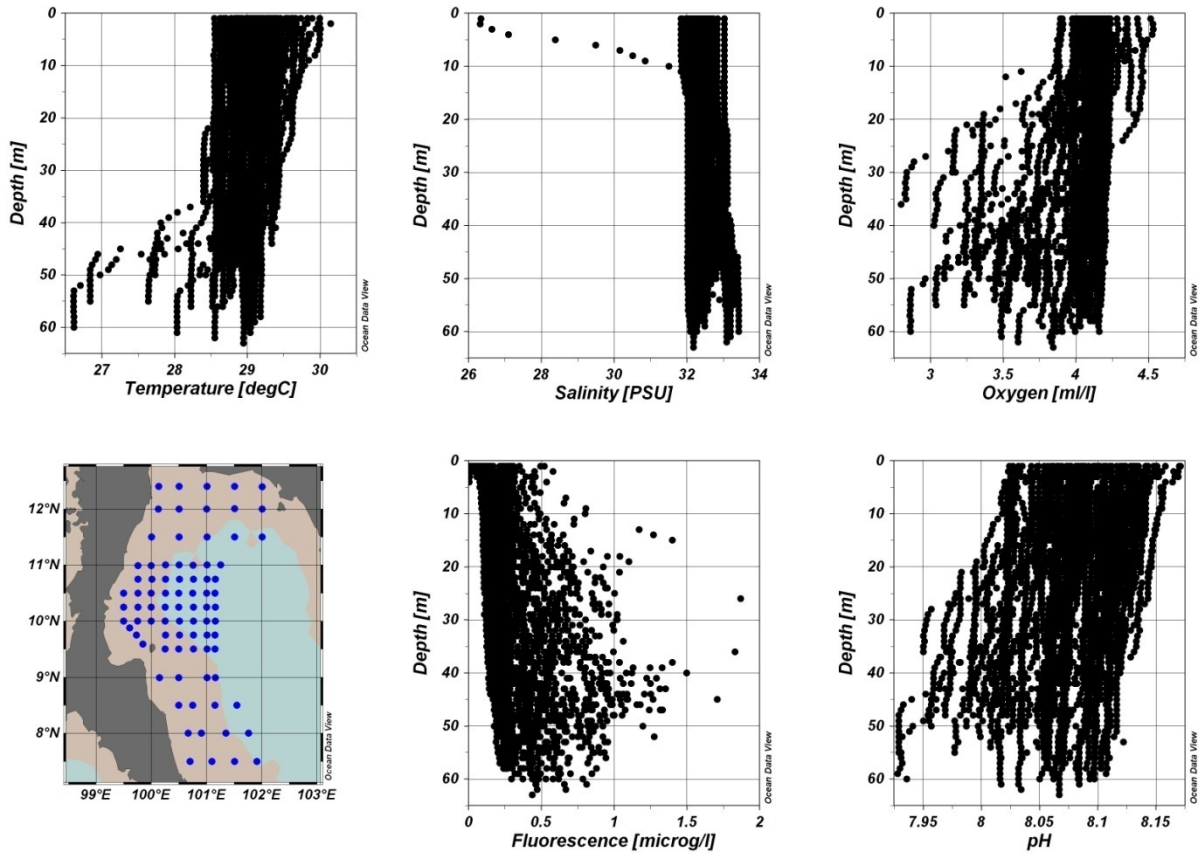


Figure 7. Temperature (°C), salinity (PSU), dissolved oxygen (ml/l), fluorescence (microg/l), and pH.

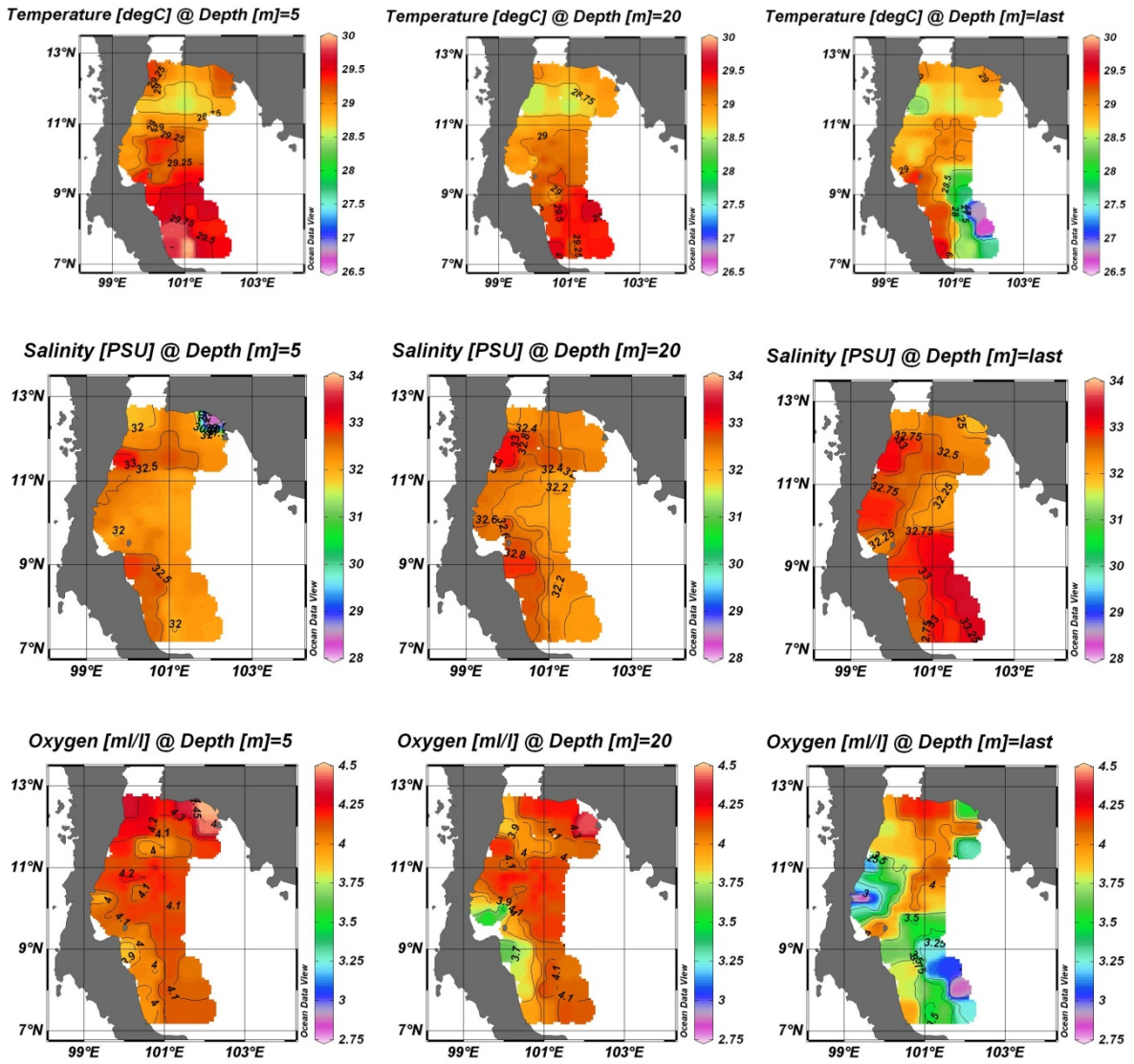


Figure 8. Horizontal plot along the survey track of temperature ($^{\circ}\text{C}$), salinity (PSU), and dissolved oxygen (ml/l) at surface layer (5m), 20 m, and bottom, respectively.

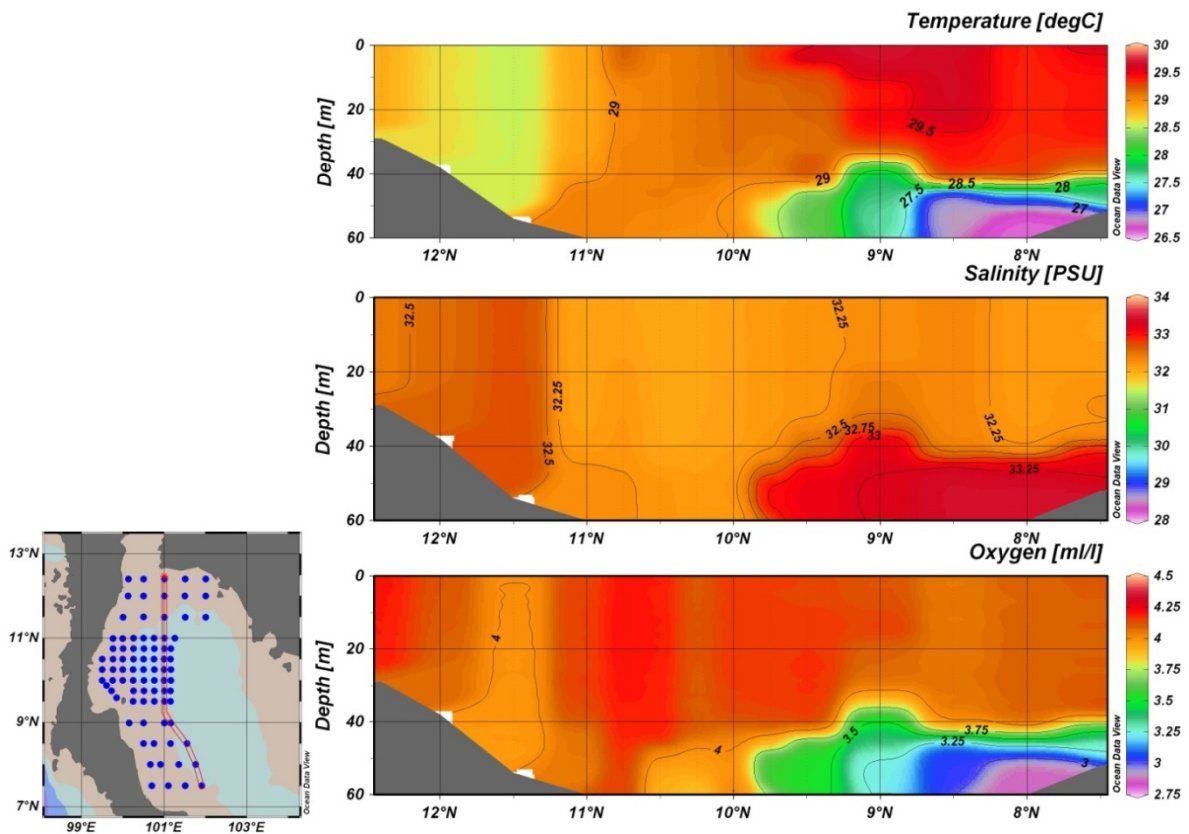


Figure 9. Vertical plot along the survey track of temperature ($^{\circ}\text{C}$), salinity (PSU), and dissolved oxygen (ml/l).

6. Cruise comments and suggestions

6.1 The data sharing policy still unclear among the scientists onboard as all the raw data retrieved during M.V.SEAFFDEC 2 cruise 43-2/2013 were un-shared except the SeaBird 911 CTD raw data were duplicated into 3 copies and distributed to MCRC for 2 copies and 1 copy for SEAFFDEC/TD.

6.2 MCRC must send senior scientist as a chief scientist onboard during the survey since there were foreign scientists onboard and need English speaking for communication and executive decisions during the cruise.

7. Appendix1 Partial details of survey and environmental

OS no.	St.	Date	Start	Finish	Position	Bottom depth (m)	CTD file name	Water sampling (depth, m)	ADCP	MSS90	Wind	Air		Sea Surf.		Air		Current			Weather condition	Stage of sea			
												Temp. (°C)	Temp. (°C)	Temp. (°C)	Temp. (°C)	Temp. (°C)	Temp. (°C)	Dir(deg)	Dir(deg)	5M (Kts)			15M (Kts)	25M (Kts)	Dir(Deg)
1	A01	10 August 2013	17:10	17:35	12° 23.89' N 100° 08.00' E	25.3	s2c43a001	/	/	/	/	10.0	180	30.1	29.3	1010.5	92	0.1	0.43	-	-	-	Cloudy	Moderate	
2	A02	11 August 2013	06:00	06:15	12° 24.02' N 100° 30.33' E	28.0	s2c43a002	/	/	/	/	10.0	200	28.2	29.1	1012.5	92	0.5	0.11	-	-	-	Cloudy	Slight	
3	A03	11 August 2013	09:07	09:12	12° 23.89' N 101° 30.41' E	28.8	s2c43a003	/	/	/	/	12.0	180	28.1	28.9	1013.0	92	0.5	0.22	-	-	-	Cloudy	Slight	
4	A04	11 August 2013	12:07	12:20	12° 23.89' N 101° 30.41' E	30.0	s2c43a004	/	/	/	/	8.0	180	29.0	29.0	1013.5	85	0.6	0.95	-	-	-	Cloudy	Slight	
5	A05	11 August 2013	15:13	15:26	12° 23.87' N 102° 00.35' E	17.0	s2c43a005	x	/	/	/	10.0	200	30.1	29.7	1011.5	85	0.4	0.21	-	-	-	Cloudy	Slight	
6	B05	11 August 2013	17:52	18:05	11° 59.75' N 102° 00.35' E	38.8	s2c43a006	/	/	/	/	8.0	190	29.3	29.3	1011.0	92	0.2	0.42	-	-	-	Cloudy	Slight	
7	B04	12 August 2013	06:57	06:15	12° 00.08' N 101° 30.38' E	45.7	s2c43a007	/	/	/	/	8.0	250	27.8	28.8	1011.5	92	0.1	0.31	-	-	-	Rain	Slight	
8	B03	12 August 2013	09:16	09:32	11° 59.95' N 101° 30.18' E	38.2	s2c43a008	/	/	/	/	12.0	250	27.8	28.7	1012.5	92	0.1	0.19	-	-	-	Rain	Slight	
9	B02	12 August 2013	12:28	12:45	11° 59.91' N 100° 30.29' E	35.0	s2c43a009	/	/	/	/	8.0	250	29.8	28.8	1011.5	92	0.4	0.18	-	-	-	Cloudy	Slight	
10	B01	12 August 2013	14:54	15:10	11° 59.97' N 100° 07.49' E	34.4	s2c43a010	/	/	/	/	10.0	180	30.6	29.7	1009.0	78	0.3	0.32	-	-	-	Cloudy	Slight	
11	C01	12 August 2013	18:19	18:38	11° 29.87' N 100° 00.29' E	41.4	s2c43a011	/	/	/	/	14.1	180	29.6	28.7	1009.0	93	0.4	0.05	-	-	-	Cloudy	Slight	
12	C02	13 August 2013	06:04	06:22	11° 30.05' N 100° 30.29' E	50.1	s2c43a012	/	/	/	/	10.0	240	27.9	28.7	1010.5	92	0.9	0.17	0.09	0.8	240	Cloudy	Moderate	
13	C03	13 August 2013	09:14	09:30	11° 29.95' N 101° 00.38' E	54.1	s2c43a013	/	/	/	/	14.0	220	27.9	28.6	1012.5	92	0.6	0.55	0.5	0.5	0.93	Rain	Moderate	
14	C04	13 August 2013	12:14	12:35	11° 29.95' N 101° 30.49' E	61.0	s2c43a014	/	/	/	/	12.0	200	27.9	28.6	1011.5	92	0.6	1.29	0.6	1.10	0.4	11.5	Cloudy	Moderate
15	C05	13 August 2013	15:20	15:38	11° 29.92' N 102° 00.33' E	57.7	s2c43a015	/	/	/	/	14.0	240	28.8	27.8	1008.0	92	0.3	0.97	0.3	0.35	0.3	0.14	Cloudy	Moderate
16	D07	14 August 2013	06:05	06:23	10° 59.99' N 101° 15.38' E	62.5	s2c43a016	/	/	/	/	14.0	200	29.2	28.9	1010.0	92	0.4	0.32	0.6	0.350	0.3	0.29	Cloudy	Moderate
17	D06	14 August 2013	08:36	08:50	11° 00.10' N 101° 00.38' E	59.5	s2c43a017	/	/	/	/	8.0	230	27.7	28.9	1011.5	92	0.7	0.15	0.7	0.12	0.4	0.08	Cloudy	Slight
18	D05	14 August 2013	10:57	11:15	10° 59.95' N 100° 45.32' E	59.9	s2c43a018	/	/	/	/	16.0	250	28.5	28.9	1010.5	92	0.2	0.13	0.1	0.40	0.1	0.356	Cloudy	Moderate
19	D04	14 August 2013	13:04	13:25	10° 59.97' N 100° 30.31' E	55.6	s2c43a019	/	/	/	/	14.0	250	29.9	28.8	1012.0	92	0.4	0.56	0.4	0.52	0.2	0.04	Cloudy	Moderate
20	D03	14 August 2013	14:59	15:22	10° 59.97' N 100° 15.30' E	54.3	s2c43a020	/	/	/	/	12.0	220	29.2	28.9	1010.0	85	0.2	0.57	0.4	0.12	0.3	0.296	Cloudy	Moderate
21	D02	14 August 2013	16:55	17:15	10° 59.92' N 100° 02.29' E	52.4	s2c43a021	/	/	/	/	14.0	200	29.6	29.1	1010.0	92	0.4	0.32	0.6	0.350	0.3	0.29	Cloudy	Moderate
22	D01	15 August 2013	05:59	06:18	10° 59.96' N 100° 45.40' E	48.4	s2c43a022	/	/	/	/	8.0	230	27.6	28.8	1013.5	92	0.7	0.15	0.7	0.12	0.4	0.08	Cloudy	Slight
23	E01	15 August 2013	07:53	08:12	10° 44.88' N 100° 45.36' E	50.8	s2c43a023	/	/	/	/	10.0	230	27.7	28.9	1015.0	85	0.7	0.71	0.7	0.34	0.6	0.12	Cloudy	Slight
24	E02	15 August 2013	09:35	09:15	10° 44.97' N 100° 00.32' E	55.4	s2c43a024	/	/	/	/	16.0	250	28.5	28.9	1012.5	92	0.2	0.13	0.1	0.40	0.1	0.146	Cloudy	Moderate
25	E03	15 August 2013	11:20	11:40	10° 44.95' N 100° 15.38' E	53.9-58.4	s2c43a025	/	/	/	/	12.0	230	28.9	29.0	1015.5	92	0.5	0.32	0.3	0.32	0.5	0.344	Cloudy	Slight
26	E04	15 August 2013	13:05	13:27	10° 44.92' N 100° 30.31' E	59.5	s2c43a026	/	/	/	/	12.0	230	29.2	29.1	1014.5	92	0.3	0.30	0.5	0.316	0.2	0.321	Cloudy	Slight
27	E05	15 August 2013	14:48	15:12	10° 44.96' N 100° 45.31' E	62.0	s2c43a027	/	/	/	/	10.0	220	30.0	29.1	1013.5	92	0.4	0.32	0.4	0.06	0.2	0.333	Cloudy	Slight
28	E06	15 August 2013	16:30	16:53	10° 44.87' N 101° 00.36' E	65.8-66.7	s2c43a028	/	/	/	/	10.0	220	30.4	29.1	1013.0	93	0.4	0.58	0.3	0.67	0.5	0.92	Cloudy	Slight
29	F07	16 August 2013	06:03	06:25	10° 44.91' N 101° 09.36' E	62.3-63.1	s2c43a029	/	/	/	/	6.0	270	27.9	29.1	1014.5	92	0.4	0.76	0.4	0.68	0.3	0.81	Cloudy	Slight
30	F08	16 August 2013	07:57	08:17	10° 29.87' N 101° 09.28' E	62.0-67.8	s2c43a030	/	/	/	/	10.0	270	27.1	29.1	1015.0	92	0.2	0.39	0.2	0.46	0.2	0.22	Rain	Slight
31	F07	16 August 2013	09:15	09:35	10° 29.99' N 101° 00.25' E	65.9-66.2	s2c43a031	/	/	/	/	10.0	270	28.2	29.0	1015.0	92	0.3	0.01	0.1	0.39	0.4	0.16	Cloudy	Slight
32	F06	16 August 2013	11:05	11:23	10° 29.98' N 100° 45.27' E	62.7	s2c43a032	/	/	/	/	10.0	270	30.1	29.4	1014.5	92	0.3	0.19	0.4	0.12	0.5	0.17	Cloudy	Slight
33	F05	16 August 2013	12:55	13:18	10° 29.99' N 100° 30.32' E	61.6-65.0	s2c43a033	/	/	/	/	10.0	270	29.7	29.4	1014.0	92	0.5	0.75	0.5	0.24	0.6	0.00	Cloudy	Slight
34	F04	16 August 2013	14:45	15:05	10° 29.94' N 100° 15.33' E	55.8	s2c43a034	/	/	/	/	10.0	270	30.1	29.6	1012.0	85	0.6	0.34	0.8	0.319	0.6	0.344	Cloudy	Slight
35	F03	16 August 2013	16:32	16:55	10° 29.91' N 100° 00.27' E	53.6	s2c43a035	/	/	/	/	10.0	270	30.3	29.6	1012.0	85	0.5	0.40	0.7	0.336	0.6	0.333	Cloudy	Slight
36	F02	16 August 2013	18:23	18:31	10° 29.92' N 100° 45.37' E	50.9	s2c43a036	/	/	/	/	14.0	240	29.4	29.2	1012.5	92	0.3	0.35	0.3	0.335	0.5	0.333	Cloudy	Slight
37	F01	17 August 2013	06:07	06:30	10° 29.95' N 100° 30.29' E	41.7	s2c43a037	/	/	/	/	8.0	250	27.6	28.9	1014.0	92	0.3	0.25	0.4	0.358	0.3	0.04	Cloudy	Slight
38	G01	17 August 2013	08:00	08:22	10° 14.82' N 100° 30.32' E	39.5	s2c43a038	/	/	/	/	10.0	250	26.9	28.9	1014.5	92	0.2	0.55	0.3	0.326	-	-	Cloudy	Slight
39	G02	17 August 2013	09:46	10:04	10° 14.95' N 100° 45.36' E	45.3	s2c43a039	/	/	/	/	10.0	270	28.2	29.0	1014.5	92	0.4	0.04	0.4	0.349	0.5	0.313	Cloudy	Slight
40	G04	17 August 2013	11:32	11:50	10° 14.94' N 100° 00.35' E	52.0	s2c43a040	/	/	/	/	10.0	270	28.9	28.2	1014.5	92	0.4	0.30	0.3	0.06	0.2	0.01	Partly cloudy	Slight
41	G04	17 August 2013	13:22	13:45	10° 15.03' N 100° 15.27' E	55.2	s2c43a041	/	/	/	/	10.0	270	29.6	29.3	1014.0	92	0.8	0.30	0.8	0.304	1.0	0.327	Partly cloudy	Slight
42	G05	17 August 2013	15:11	15:35	10° 14.90' N 100° 30.25' E	64.7	s2c43a042	/	/	/	/	10.0	240	30.5	29.2	1012.0	92	0.7	0.329	0.7	0.340	0.5	0.328	Partly cloudy	Slight
43	G06	17 August 2013	16:59	17:23	10° 14.95' N 100° 45.32' E	60.4	s2c43a043	/	/	/	/	10.0	270	30.4	29.3	1011.5	85	0.2	0.44	0.3	0.212	0.4	0.229	Partly cloudy	Slight
44	G07	18 August 2013	06:00	06:18	10° 14.98' N 101° 00.26' E	64.4	s2c43a044	/	/	/	/	14.0	260	28.5	29.1	1013.0	92	0.2	0.74	0.1	0.202	0.1	0.247	Partly cloudy	Slight
45	G08	18 August 2013	07:15	07:38	10° 14.94' N 101° 09.37' E	67.6	s2c43a045	/	/	/	/	12.0	260	29.1	29.0	1014.0	92	0.3	0.14	0.4	0.409	0.3	0.088	Cloudy	Moderate
46	H08	18 August 2013	09:08	09:33	09°																				

Appendix1 (Cont.)

OS no.	Si. no.	Date	Start	Finish	Position		Bottom depth (m)	CTD file name	Water sampling (depth, m)	ADCP MSS90	Wind Speed(knts)	Dir(deg)	Air Temp.		Sea Surf. Air Temp.		Current					Weather condition	Stage of sea		
					Latitude	Longitude							Temp. (°C)	Temp. (°C)	Temp. (°C)	Temp. (°C)	5M	15M	25M	5M	15M			25M	
58	102	26 August 2013	07:47	08:05	09°44.95' N	100°30.38' E	56.1	s2c43u02	3,26.51	/	/	8.0	230	28.6	29.1	1013.5	85	0.1	0.27	0.2	344	0.4	0.9	Cloudy	Slight
59	103	26 August 2013	09:29	09:47	09°44.95' N	100°45.42' E	58.7	s2c43u03	3,27.53	/	/	10.0	230	29.2	29.1	1014.0	85	0.5	3.30	0.6	348	0.3	297	Cloudy	Slight
60	104	26 August 2013	11:13	11:34	09°44.94' N	101°00.35' E	61.8	s2c43u04	3,28.56	/	/	10.0	230	30.1	29.3	1014.5	78	0.5	3.13	0.8	316	0.5	318	Cloudy	Slight
61	105	26 August 2013	12:25	12:47	09°44.91' N	101°09.25' E	67.2	s2c43u05	3,31.62	/	/	10.0	270	29.6	29.3	1013.0	85	0.8	3.29	0.8	322	0.5	316	Cloudy	Slight
62	105	26 August 2013	14:14	14:35	09°29.96' N	101°09.29' E	66.4	s2c43u05	3,31.61	/	/	10.0	280	30.2	29.5	1012.5	85	0.8	2.96	0.7	290	0.6	313	Partly cloudy	Slight
63	104	26 August 2013	15:25	15:46	09°29.88' N	101°00.32' E	61.3	s2c43u04	3,28.56	/	/	10.0	270	30.1	29.6	1012.0	78	1.0	3.04	0.6	315	0.7	312	Partly cloudy	Slight
64	103	26 August 2013	17:10	17:31	09°29.91' N	100°45.32' E	52.3	s2c43u03	3,24.47	/	/	8.0	270	30.0	30.1	1011.0	85	0.6	0.04	0.5	353	0.3	000	Cloudy	Slight
65	102	27 August 2013	06:03	06:22	09°29.98' N	100°30.28' E	43.3	s2c43u02	3,19.38	/	/	12.0	250	27.9	29.3	1013.5	92	0.4	0.13	0.4	329	0.3	015	Cloudy	Slight
66	101	27 August 2013	07:49	08:22	09°29.95' N	100°15.24' E	28.5	s2c43u01	3,12.24	/	/	8.0	250	28.7	29.2	1014.0	92	0.3	0.11	-	-	-	-	Partly cloudy	Slight
67	K01	27 August 2013	11:02	11:22	08°59.87' N	100°09.29' E	25.0	s2c43uK01	3,10.20	/	/	2.0	270	29.4	29.7	1015.0	78	0.1	2.03	-	-	-	-	Cloudy	Slight
68	K03	27 August 2013	13:21	13:42	08°59.93' N	100°30.26' E	34.1	s2c43uK02	3,15.29	/	/	4.0	270	31.1	29.9	1014.0	73	0.3	3.42	0.4	295	-	-	Cloudy	Slight
69	K03	27 August 2013	16:25	16:45	08°59.93' N	101°00.38' E	50.9	s2c43uK03	3,23.45	/	/	10.0	270	32.7	29.7	1012.0	73	0.6	0.00	0.5	009	0.4	329	Cloudy	Slight
70	K04	27 August 2013	17:37	17:58	08°59.90' N	101°09.35' E	59.6	s2c43uK04	3,28.55	/	/	8.0	300	29.7	29.6	1012.0	85	0.1	2.66	0.1	183	0.2	332	Cloudy	Slight
71	L04	28 August 2013	05:59	06:08	08°29.98' N	101°33.27' E	60.2	s2c43uL04	3,28.55	/	/	6.0	240	28.1	29.6	1013.5	92	0.3	1.04	0.1	182	0.2	097	Cloudy	Slight
72	L03	28 August 2013	08:39	09:00	08°29.95' N	101°09.25' E	54.9	s2c43uL03	3,25.50	/	/	10.0	310	29.1	29.4	1015.5	85	0.4	3.43	0.4	004	0.5	001	Cloudy	Slight
73	L02	28 August 2013	11:13	11:37	08°29.91' N	100°45.28' E	31.5	s2c43uL02	3,13.26	/	/	8.0	310	30.4	29.6	1015.0	78	0.4	3.33	0.3	353	-	-	Cloudy	Slight
74	L01	28 August 2013	12:53	13:15	08°29.96' N	100°30.28' E	28.1	s2c43uL01	3,12.23	/	/	4.0	310	31.0	29.7	1014.5	73	0.3	3.19	-	-	-	-	Cloudy	Calm
75	M01	28 August 2013	16:14	16:34	07°59.87' N	100°40.32' E	26.7	s2c43uM01	3,11.21	/	/	4.0	300	33.0	30.3	1012.0	79	0.3	1.69	-	-	-	-	Cloudy	Calm
76	M02	28 August 2013	17:52	18:12	07°59.95' N	100°54.35' E	32.5	s2c43uM02	3,14.27	/	/	2.0	140	31.0	30.3	1015.0	85	0.7	0.17	0.8	354	-	-	Cloudy	Calm
77	M03	29 August 2013	05:52	06:10	07°59.96' N	101°21.25' E	53.2	s2c43uM03	3,24.48	/	/	12.0	220	28.8	29.4	1014.5	92	0.5	0.54	0.4	356	0.4	353	Cloudy	Slight
78	M04	29 August 2013	08:29	08:50	07°59.94' N	101°45.35' E	65.3	s2c43uM04	3,30.60	/	/	12.0	230	28.7	29.3	1015.5	92	0.2	3.35	0.1	160	0.5	325	Cloudy	Slight
79	N04	29 August 2013	11:45	11:52	07°29.92' N	101°54.32' E	52.0	s2c43uN04	3,23.46	/	/	16.1	230	28.5	29.5	1016.0	92	0.4	2.55	0.2	231	0.7	257	Cloudy	Moderate
80	N03	29 August 2013	14:20	14:40	07°29.89' N	101°30.34' E	48.9	s2c43uN03	3,22.44	/	/	12.0	240	30.3	29.4	1014.0	85	0.3	3.33	0.3	347	0.6	282	Cloudy	Moderate
81	N02	29 August 2013	16:53	17:15	07°29.94' N	101°06.25' E	39.4	s2c43uN02	3,17.34	/	/	10.0	250	29.7	30.0	1014.0	78	0.8	3.28	1.1	334	-	-	Cloudy	Slight
82	N01	29 August 2013	19:26	19:48	07°29.95' N	100°42.25' E	24.5	s2c43uN01	3,10.20	/	/	6.0	250	29.4	29.7	1014.0	92	0.5	3.19	-	-	-	-	Cloudy	Slight