

# Sustained Utilization of SEAFDEC Vessels through Collaborative Research Surveys: Marine Resources Survey of the Gulf of Thailand using the M.V. SEAFDEC 2

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Cognizant of the state of depletion and to some extent, collapse of the fishery resources particularly in coastal areas, concerned ASEAN Member States (AMSs) have increasingly placed focus on the under-utilized marine fishery resources in the offshore areas of their respective Exclusive Economic Zones (EEZs). Many AMSs are therefore making considerations to exploit these offshore fishery resources to reduce fishing pressure on their respective coastal resources and give the coastal fishery resources respite for recovery and rebuilding (Garcia *et al.*, 2018). The same concern was addressed by the AMSs during the June 2011 ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2029 “Fish for the People 2020: Adaptation to a Changing Environment” that led to the adoption of the “Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020,” which include among others, the advocacy to: “Investigate the potential of under-utilized fisheries resources and promote their exploitation in a precautionary manner based upon analysis of the best available scientific information.” Responding to such needs and requirements, the Southeast Asian Fisheries Development Center (SEAFDEC) through its Training Department (SEAFDEC/TD) has been working closely with the AMSs for the conduct of marine fishery resources surveys and studies on the marine environment of specific offshore areas, such as the Gulf of Thailand, Andaman Sea, and South China Sea, utilizing the SEAFDEC research vessels, the M.V. SEAFDEC and the M.V. SEAFDEC 2, that aim to collect information on the status of marine fishery resources and oceanographic conditions, as well as build the capacity of human resources in the aspects of fisheries and oceanographic surveys, onboard navigation practices, and marine engineering. The most recent of such surveys facilitated by SEAFDEC/TD, was the two-month “Collaborative Research Survey on Marine Fishery Resources and Marine Environment in the Gulf of Thailand” from 17 August to 18 October 2018 which made use of the M.V. SEAFDEC 2.

From 1993 to the present, SEAFDEC has helped the AMSs in the assessment of their respective fishery resources through collaborative research surveys in their respective EEZs utilizing the SEAFDEC research vessels (**Figure 1**). Specifically, the M.V. SEAFDEC (1178-GT purse seine research vessel) has been utilized for the conduct of regional collaborative surveys in the waters of the Southeast Asian countries, while the M.V. SEAFDEC 2 (211-GT research vessel) which started its operations in 2004, has been focusing on the assessment of the fishery resources through research surveys of the coastal and offshore areas of the AMSs (Sayan and Chanrachkij, 2019).



Figure 1. SEAFDEC research vessels: the M.V. SEAFDEC (above), and the M.V. SEAFDEC 2 (right)



The information compiled from the collaborative research surveys had been analyzed, the results of which had been disseminated to the region in the forms of proceedings and technical reports (**Figure 2**) that served as basis for the development of guidelines and standard operating procedures for scientific surveys and responsible fishing operations. Moreover, the collaborative surveys have also enhanced the research and training capabilities of the participating countries while the technical cooperation among the AMSs has been strengthened towards the effective management of fisheries and the environment.

## Collaborative Research Surveys on Marine Fishery Resources and Marine Environment: Gulf of Thailand

From 1995 to 2013, SEAFDEC/TD had carried out major collaborative marine fishery resources research surveys in the Gulf of Thailand using the M.V. SEAFDEC and the M.V. SEAFDEC 2. These included the surveys in 2005-2006 to monitor the fishery resources in Central Gulf of Thailand with

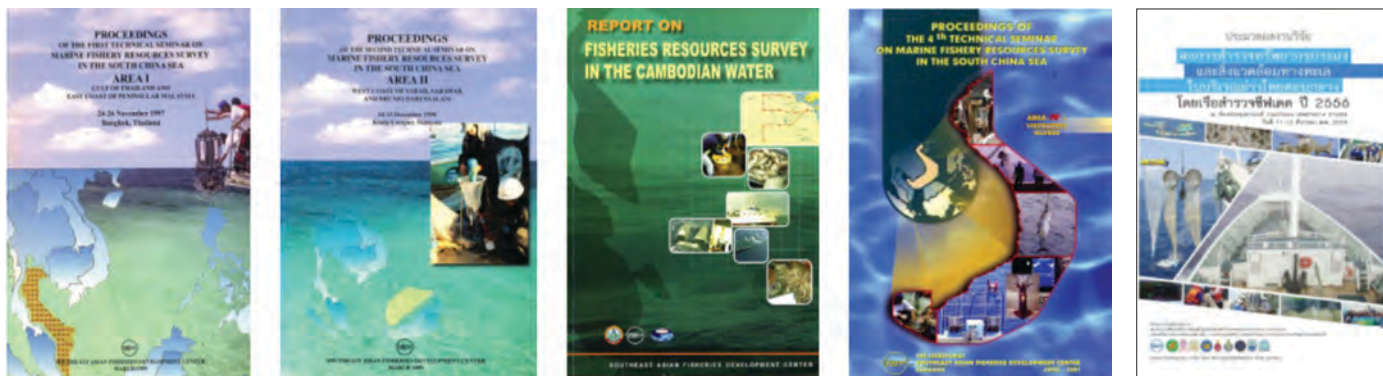


Figure 2. Some of the publications on the results of the collaborative research surveys conducted by SEAFDEC/TD since 1996

SEAFDEC/TD providing technical support to the Department of Fisheries (DOF) of Thailand including the use of the M.V. SEAFDEC 2. The survey results were reported in the DOF publication “National Report on Fishery Resources in the Middle Gulf of Thailand Surveyed by Otter Board Trawl during 2004-2005” (in Thai).

Although SEAFDEC/TD had undertaken a number of fishery resources and environmental surveys in the Gulf of Thailand during the past several years, these were mostly focused in the EEZ of Thailand. One of these surveys was the fisheries and environmental research survey within the EEZ of Thailand using the M.V. SEAFDEC from 14 March to 12 April 2013. Conducted by SEAFDEC/TD with support from the Petroleum Authority of Thailand (PTT) Exploration and Production Public Company Limited, the survey was a collaborative effort among relevant agencies and academic institutions in Thailand, *i.e.* Department of Fisheries, Department of Coastal and Marine Resources, Pollution Control Department, Burapa University, Chulalongkorn University, Kasetsart University, Ramkhamhaeng University, and Walailuk University.

When the results of the aforesaid survey were presented during the Seminar “Results of Fisheries and Environmental

Research Survey in the Gulf of Thailand” organized in early 2018, it was recommended that the oceanographic study in the Gulf of Thailand (Figure 3) should be continued, specifically focusing on the water stratification and influence from the South China Sea into the Gulf of Thailand, both spatial and temporal conditions. In addition, the Standard Operational Procedures for Data Collection for the M.V. SEAFDEC 2 (SEAFDEC, 2004) should be updated and used as reference for future surveys. Another very important recommendation during the 2018 Seminar was the expansion of the survey area to include the waters of Cambodia and Viet Nam, to take into consideration the transboundary nature of the marine aquatic species in the Gulf of Thailand, and the importance of studying the hydrography and oceanography of the habitats of particular straddling marine aquatic species, *e.g.* Indo-Pacific mackerel which spawns in the eastern part of the Gulf of Thailand but the broodstock is believed to straddle within the waters of Cambodia, Thailand, and Viet Nam.

Thus, with support from the Government of Japan through the Japanese Trust Fund (JTF), the Collaborative Survey on Marine Fisheries Resources and Marine Environment in the Gulf of Thailand was carried out under the JTF Project



Figure 3. Map of Gulf of Thailand bounded by Thailand, Cambodia, Viet Nam, and Malaysia

Source: Google map



Figure 4. One hundred and ten (110) stations proposed for the 2018 collaborative survey, covering the EEZs of Cambodia, Thailand, and Viet Nam

“Offshore Fisheries Resources Exploration in Southeast Asia.” With SEAFDEC/TD at the helm, the survey was planned to be carried out in the Gulf of Thailand (**Figure 4**) with the collaboration of the Fisheries Administration of Cambodia, Department of Fisheries of Thailand, and the Directorate of Fisheries of Viet Nam through its Research Institute for Marine Fisheries Research, from 17 August to 18 October 2018. Baseline data on marine fishery resources and marine environmental situation as well as the status of the marine fishery resources in the Gulf of Thailand, were then compiled to be used as scientific reference during the said collaborative survey.

## 2018 Collaborative Survey: the Processes

A collaborative survey, especially using the SEAFDEC vessels, starts with a survey plan developed through a series of Technical Consultation Meetings with the concerned national agencies of participating countries and SEAFDEC/TD. In the case of the 2018 Collaborative Survey, series meetings were organized with representatives from the three (3) participating countries in attendance, *i.e.* from the Research Institute for Marine Fisheries Research (RIMF) of the Directorate of Fisheries (D-FISH) of Viet Nam, Fisheries Administration (FiA) of Cambodia, and from the Department of Fisheries (DOF) of Thailand together with representatives from relevant national academic institutions and agencies in Thailand.

In order to finalize the survey plan for the 2018 Collaborative Survey, the Regional Technical Meeting on the Collaborative Research Survey on Marine Fisheries Resources and Marine Environment in the Gulf of Thailand (Cambodia, Thailand, and Viet Nam Waters) was organized by SEAFDEC/TD in July 2018, where the survey and cruise period was confirmed

as well as the area to be covered and the number of survey stations, *i.e.* 24 stations in Cambodian waters, 62 in the waters of Thailand, and 24 in the waters of Viet Nam (**Figure 5**).

Prior to the start of the actual survey, SEAFDEC/TD organized the Pre-Survey Meeting to finalize the list of survey device/equipment to be carried onboard (**Figure 6**), the list of researchers and scientists who would go onboard, the sampling operations and data collection activities onboard, and the shipboard research activities to be conducted. The detailed survey plan also includes provisions of hygienic supplies for crew and scientists, and safety measures onboard the research vessel. Moreover, the Cruise Order of the M.V. SEAFDEC 2 No. 51-1/2018 was also finalized as agreed upon by the participating countries.

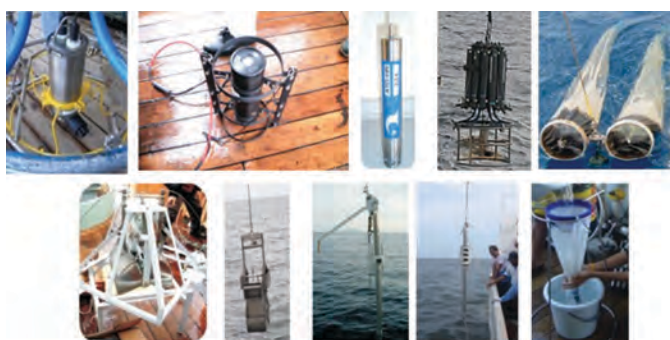


Figure 6. Major equipment carried onboard the M.V. SEAFDEC 2 for the collaborative survey (*clockwise from left*): (Top left) CTD, portable CTD, rosette sampler, bongo net, neuston net, gravity core, Smith-McIntyre grab, box core, and Van Don water sampler

Furthermore, the Pre-Survey Meeting also finalized the operations and activities to be undertaken onboard the M.V. SEAFDEC 2 during the collaborative survey, as shown in **Box 1**.

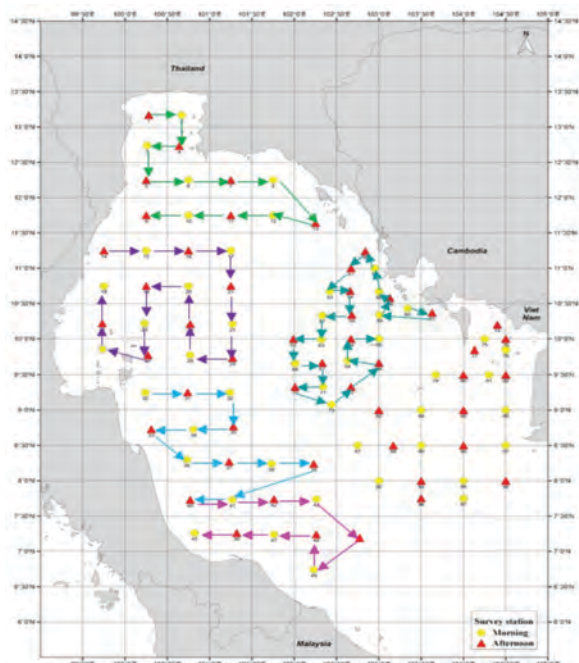


Figure 5. Map of the 2018 Collaborative Survey in the Gulf of Thailand using the M.V. SEAFDEC 2

### Box 1. Detailed operations for the 2018 Collaborative Survey

**Demersal fishery resources survey** - using bottom trawl, to collect updated data on the status of the demersal fishery resources in the Gulf of Thailand, and specifically to determine the catch per unit effort (CPUE) of bottom trawls

**Oceanographic survey** - using CTD device, to collect relevant oceanographic parameters, *e.g.* conductivity, temperature, depth) in the various areas of the Gulf of Thailand

**Microplastic and marine Debris survey** - through ocular observation, to determine the microplastic and debris situation in the waters and environment of the Gulf of Thailand

**Other surveys** - includes activities to determine the radiation dose and assess the radiation risk in marine biota, as well as investigate the source of aerosol in the Gulf of Thailand, to be used as information to improve the weather predictions in the region

## The Actual Survey

As planned, the collaborative survey from 17 August to 18 October 2018 using the M.V. SEAFDEC 2 was supposed to be carried out in six (6) legs. However, because of time and other constraints, the planned survey of the waters of

**Table 1.** Schedule of the survey operations in the Gulf of Thailand

Leg	Station Nos.	Areas surveyed	Date surveyed
Leg 1	No. 1 - No. 13	Upper Gulf of Thailand	17-26 August 2018
Leg 2	No. 14 - No. 29	Eastern Gulf of Thailand	27 August-7 September 2018
Leg 3	No. 30 - No. 41	Central Gulf of Thailand	8-16 September 2018
Leg 4	No. 41 - No. 49	Southern Gulf of Thailand	17-25 September 2018
Leg 5	No. 50 - No. 73	Waters of Cambodia	26 September-16 October 2018
Leg 6		Western waters of Viet Nam	Survey operations in Viet Nam waters were cancelled for some administrative and technical reasons



**Figure 7.** Survey and research activities carried out onboard the M.V. SEAFDEC 2 Cruise No.56-1/2018 - Collaborative Research Survey on the Marine Fisheries Resources and Marine Environment Survey in the Gulf of Thailand

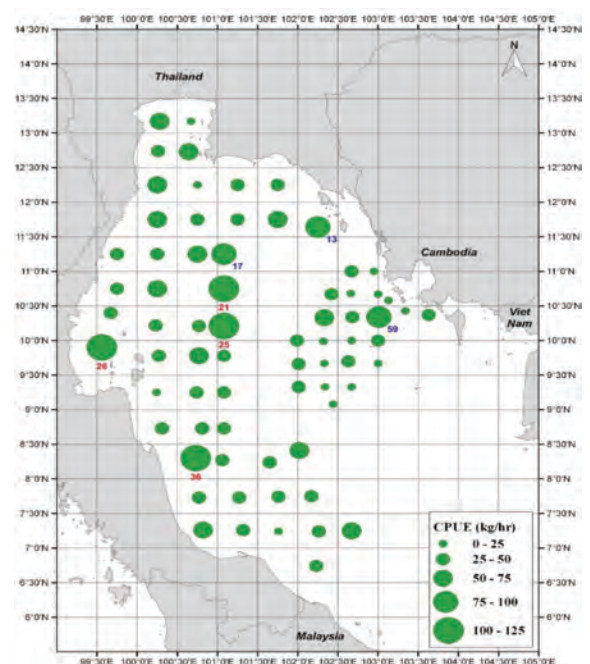
Viet Nam was cancelled, as a result, only 73 survey stations were considered, *i.e.* 49 stations in the waters of Thailand, and 24 in the waters of Cambodia (**Figure 5**). Nonetheless, the operations in two (2) stations had to be cancelled, *i.e.* Station No. 20 in Thai waters because of rough bottom conditions in the area, and Station No. 50 in Cambodian waters considering the noticeable number of squid traps that were found spread in the area. Thus, only 71 survey operations were carried out, *i.e.* 48 operations in Thai waters and 23 operations in Cambodian waters. The survey schedule of the six legs is detailed in **Table 1**, corresponding to the survey plan laid out in **Figure 5**.

## The Survey and Research Activities

The overall survey and research activities carried out during the 2018 Collaborative Survey on Marine Fisheries Resources and Marine Environment in the Gulf of Thailand are exhibited in **Figure 7**.

### Demersal Fishery Resources Survey

The demersal fishery resources survey was undertaken using bottom trawl, and was aimed at updating the status of the



**Figure 8.** Preliminary results of the demersal fishery resources survey in the Gulf of Thailand by trawling operations, indicating the CPUEs



Figure 9. Shipboard operations of the bottom trawl in the waters of Thailand and Cambodia, using the M.V. SEAFDEC 2



Figure 10. Outputs of the demersal fisheries resources survey from 71 bottom trawl fishing operations

demersal fishery resources in the Gulf of Thailand. While SEAFDEC/TD was responsible for selecting the trawl net design, the other participating agencies and institutions helped in preparing the trawl nets and fishing accessories used for the survey operations. Preliminary results of fishery resources survey revealed that the catch per unit effort (CPUE) of bottom trawl in Thai waters was 37.78 kg/hr, and in Cambodian waters at 26.27 kg/hr (Figure 8). The overall CPUE in the survey area was estimated at 43.29 kg/hr. The operation of the bottom trawl is shown in Figure 9, while the outputs of the bottom trawl operations are shown in Figure 10.

### Oceanographic Survey

The oceanographic survey comprised four main activities, namely: oceanographic data collection, water sampling, plankton and larvae sampling, and sediment sampling. Collection of oceanographic data was carried out by operating the conductivity, temperature, and depth (CTD) device and the thermosalinograph (TSG) system, as well as making use of the current indicator and weather information. The plankton and larvae sampling made use of phytoplankton and zooplankton nets, bongo net, and neuston net, while for the sediment and benthos sampling, the gravity and box core, and Smith McIntyre grab were used. Oceanographic winches, CTD winch and capstan winches were also operated during the survey activities. The data collected through the

**Box 2. Shipboard research studies that made use of the data collected from the oceanographic survey**

- Amount of mercury and arsenic in seawater
- Carbon dioxide flux and primary productivity in the Gulf of Thailand
- Nutrient and nutrient pool in seawater
- Validation of the hydrographic in-situ data in the Gulf of Thailand compared with multi-satellite model data
- Microbiome composition and function in seawater
- Relationship between chlorophyll-a concentration, primary production and ocean color from remote sensing

oceanographic survey would be used in the analysis of the shipboard research studies shown in **Box 2**.

### Oceanographic Data Collection using CTD Systems

Two CTD systems were used in the survey: (1) CTD system (SeaBird SBE-911+); and (2) Portable CTD model SD 204 (Figure 11). The CTD system SeaBird SBE-911+, which was designed for real-time data acquisition and control, includes underwater unit, deck unit, auxiliary sensor, water sampler and software. The portable CTD model SD 204 is a sensor using personal computer to display the data record. For the 2018 collaborative survey, the CTD Model SeaBird SBE-911+ was used in 62 stations (Figure 12). The operation of CTD SeaBird SBE-911+ was however canceled in Leg 2 due to

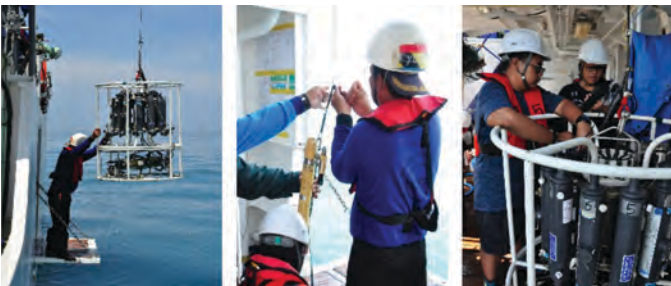


Figure 11. Collection of oceanographic data using CTD SeaBird SBE-911+ and SD-204

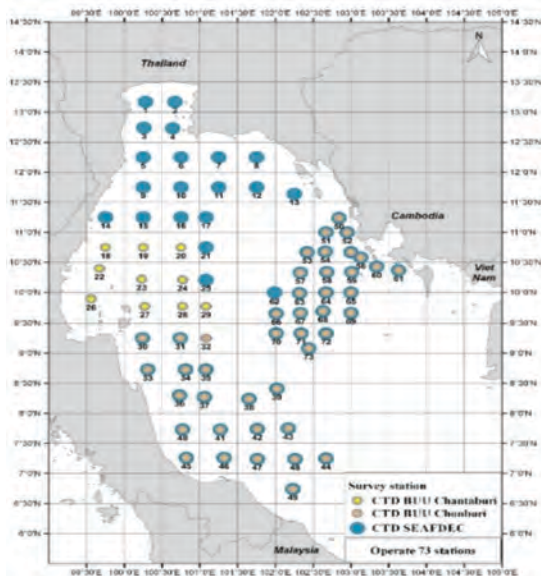


Figure 12. Survey stations for the oceanographic data collection using CTD SeaBird SBE-911+ and SD-204

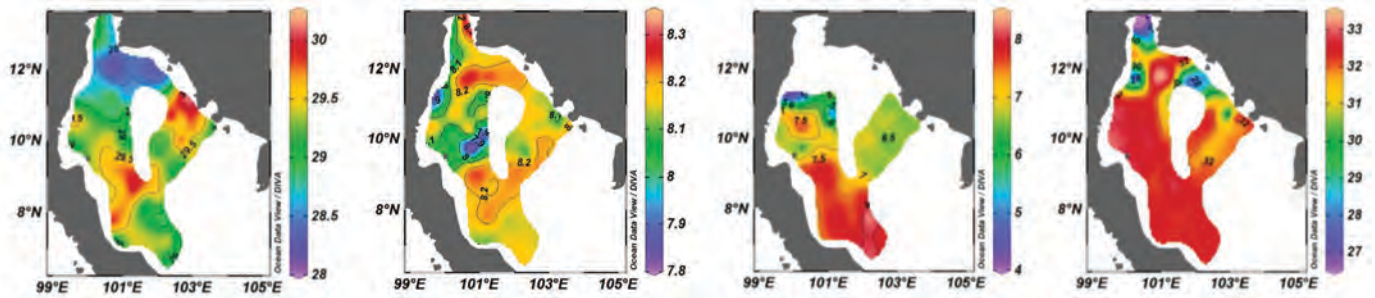


Figure 13. Analysis of the preliminary data on the sea surface oceanographic parameters collected by CTD device during the 2018 Collaborative Survey of the Gulf of Thailand

leaking cable connection, electrical short circuit, damaged and non-functioning unit. Considering that it would take seven 7 days to repair and make the damaged CTD Model SeaBird SBE-911+ ready for use in Leg No.3, the CTD model SD 204 was used instead. Meanwhile, the research activities in Station No.32 were canceled due to strong winds. Thus, temperature and salinity data were also collected from all stations from Leg 3 to Leg 5 using the CTD Model SD 204, which was also used to collect the DO profile. However, no data could be collected from Station No. 62 as the device was no longer functioning. The data collected through the CTD device could provide profiles of the chemical and physical parameters in the entire water column, which could lead to the establishment of the distribution and abundance of marine species in certain areas of the ocean. Results of the analysis of the preliminary oceanographic parameters of the sea surface of the Gulf of Thailand collected through the CTD device shown in **Figure 13**, provide the necessary inputs for the shipboard research studies shown in **Box 2**.

### Water Sampling

Four (4) models of water bottle samplers (**Figure 14**) were used during the 2018 Collaborative Survey, *i.e.* Niskin bottles, Vandon bottle, dropped bottle, and bucket sampler. The Rosette multi-bottle array which has 12 Niskin 1.7 L bottles was remotely activated in conjunction with CTD system, and the data collected were used for the different shipboard research studies. A total of 73 operations were conducted: 49 operations in Thai waters and 24 in Cambodian waters. The water samples were analyzed to serve as inputs for the different shipboard research studies (**Box 3**).



Figure 14. Bottle Samplers (left to right): Vandon Bottle, Niskin bottles, and Dropped bottle



Figure 15. Zooplankton and phytoplankton vertical sampling

### Plankton and Larvae Sampling

Phytoplankton net with 20  $\mu\text{m}$  mesh size was used for filtering phytoplankton from the seawater (40 liters) collected by 10 liters Van Dorn samplers at the surface and chlorophyll maximum layer (**Figure 15**). Zooplankton and phytoplankton were collected by vertical sampling tows using a zooplankton net with 300  $\mu\text{m}$  mesh size from 20 meters below the water surface to the surface. If the station depth is less than the specified depth, sampling collection was conducted by towing net from two meters above the bottom.

Larvae samples were collected using neuston net and bongo net (**Figure 16**). Bongo net has stainless frame with 55 cm diameter and mesh size of 330 and 500  $\mu\text{m}$ , and towed from sea surface to 5 m above sea bottom. Neuston net, which is used for surface horizontal towing, is rectangular shaped, 100 x 70 cm with 1,000  $\mu\text{m}$  mesh size, and attached with flow meter.

### Box 3. Shipboard research studies that made use of the data from the water sampling

- Density and diversity of phytoplankton in the Gulf of Thailand
- Relationship between chlorophyll-a concentration and ocean color from remote sensing of the Gulf of Thailand
- Inherent properties of sea water in Gulf of Thailand
- Total petroleum hydrocarbons in surface seawater
- Radiation dose and radiological risks in marine biota and seafood consumers



Figure 16. Nueston net (left) and bongo Net (right)

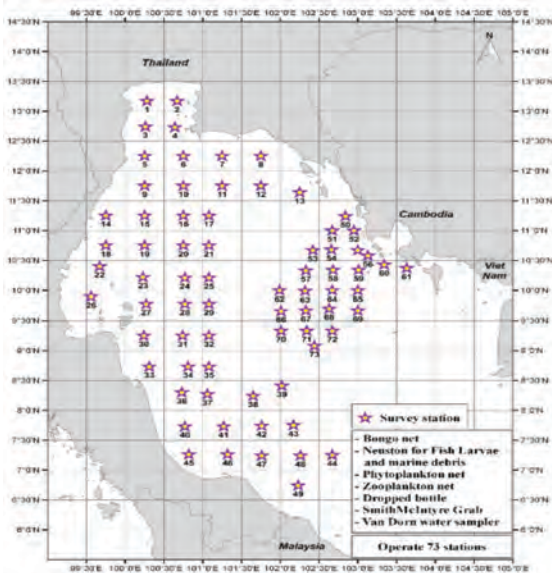


Figure 17. Survey stations for fish larvae sampling, phytoplankton and zooplankton sampling, and sediment sampling

**Box 4. Shipboard research studies that made use of the data from the larvae, zooplankton and phytoplankton sampling**

- Zooplankton diversity in the Gulf of Thailand
- Density and diversity of phytoplankton in the Gulf of Thailand
- Species and distribution of paralarvae and cephalopods in the Gulf of Thailand
- Composition and distribution of fish larvae in the Gulf of Thailand

The samples collected from 71 operations: 48 in Thai waters and 23 in Cambodian waters (Figure 17), comprising larvae, zooplankton and phytoplankton were analyzed, to be used as inputs for the shipboard research studies shown in Box 4.

**Box 5. Shipboard research studies that made use of the data from the sediment sampling**

- Sedimentary properties and sedimentation rate of sediment in the Gulf of Thailand
- Temporal distribution of mercury and trace metals in the sediment
- Diversity of benthic microcrustaceans and micromollusks in the Gulf of Thailand
- Stock of marine debris in Gulf of Thailand
- Meiofauna abundance and distribution in the surface of the sediment
- Microbiome composition and function in the sediment
- Spatial sedimentology and source area composition of sediment in the Gulf of Thailand
- Radiation dose and radiological risk in marine biota and seafood consumers
- Petroleum hydrocarbon and polycyclic aromatic hydrocarbon
- Microplastic accumulations in fish and sediment

**Sediment Sampling**

Three (3) types of sediment samplers, *i.e.* gravity core, box core, and Smith McIntyre grab, were used during the survey (Figure 18). Thirty-five (35) box core operations, thirteen (13) gravity core operations, and seventy-three (73) Smith McIntyre grab operations, were conducted. Results of the sediment analysis would be used as inputs for the shipboard research studies shown in Box 5.

**Microplastic and Marine Debris Study**

SEAFDEC/TD has been studying the accumulation of microplastics in sea water, sediments, and marine life to determine the microplastic situation in the environment, especially in the Gulf of Thailand, with the collaboration of Chulalongkorn University in Thailand. During the 2018 Collaborative Survey, microplastics were collected using the

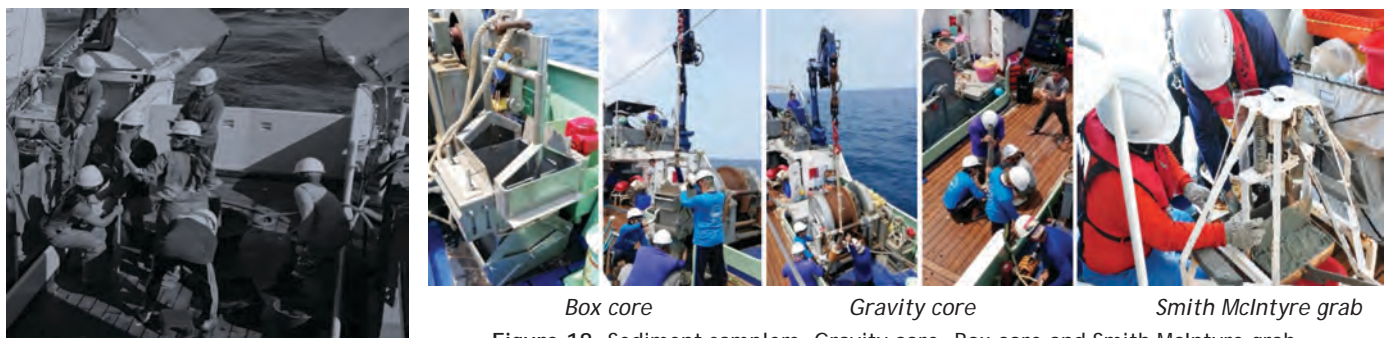


Figure 18. Sediment samplers: Gravity core, Box core and Smith McIntyre grab



Figure 19. Study on microplastic accumulation in the Gulf of Thailand (from left to right): collection by neuston net; collection by Smith McIntyre grab; and data on marine biota based on dominant and economically important fishes

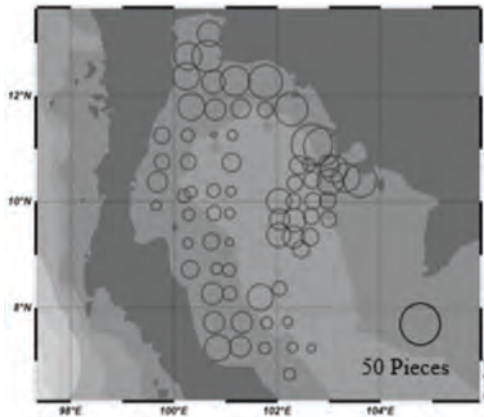


Figure 20. Initial hotspots of marine debris at sea bottom of the Gulf of Thailand

neuston net towed at the surface layer for 10 minutes, while microplastics in sediment were collected using the Smith McIntyre grab, *i.e.* one (1) kg sediment sample from each station (Figure 19). The data on marine biota (fish) showed

three (3) dominant fish species and three (3) economic fish species that were caught by trawl net (Figure 19). All samples have been sorted while the microplastic accumulations in the samples were analyzed using the Bench-top Fourier Transform Infrared Spectroscopy (FT-IR).

One of the collaborating partners of the 2018 Collaborative Research Survey, the Burapa University in Chantaburi Campus, Thailand, is the lead institute in Thailand to investigate the distribution of bottom plastic debris in the Gulf of Thailand. Thus, data on marine debris in the Gulf of Thailand was also collected during the 2018 Collaborative Research Survey. The demersal marine plastic debris samples collected during the trawl fishing operations generated 758 pieces of debris. Preliminary analysis showed the hotspot of marine debris at sea bottom around the Gulf of Thailand (Figure 20). For the drifting marine debris, especially the density and distribution of drifting marine debris in the waters of Cambodia, the technical support from Tokyo University of Marine Science and Technology (TUMSAT) was availed of (Figure 21).



Figure 21. Drifting marine debris observation was conducted in Cambodia waters with Prof. Dr. Keiichi Uchida from TUMSAT

Under the supervision of Prof. Dr. Keiichi Uchida from TUMSAT, data on marine debris *i.e.* number, size, color, type, and position were recorded through a TUMSAT visual observation mobile and tablet application (Figure 22). The estimated accumulation of marine debris in the waters of Cambodia is shown in Figure 23.



Figure 22. Data on observed drifting marine debris were recorded in TUMSAT mobile with tablet application

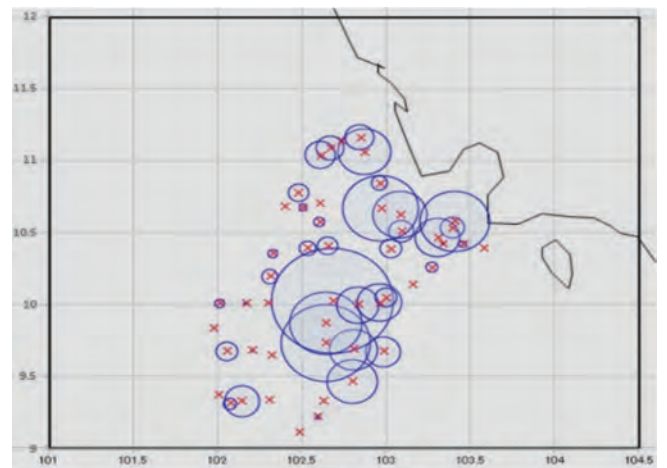


Figure 23. Accumulated drifting marine debris observed in the waters of Cambodia





Figure 24 (left to right): Biota sample, water sample, and sediment sample to study the radiation dose and assess the radiological risks in marine biota from the Gulf of Thailand and in seafood consumers



Figure 25. SEAFDEC researcher collecting information on aerosol in the Gulf of Thailand

### Other Survey Activities

Other research activities carried out onboard the M.V. SEAFDEC 2 pertain to human well-being, and deal with the estimation of radiation dose and assessment of radiological risks in marine biota from the Gulf of Thailand and in seafood consumers. Focus of such shipboard study was not only on radio activity from both natural and artificial radio nuclides in seawater and sediments but also on the national safety guideline and values for protecting local marine organisms and seafood consumers from possible radiological hazards. This would also support the establishment of national marine environmental radioactivity database and mapping to be used as reference in nuclear and radiological emergencies. Nonetheless, considering the inadequate facilities onboard the M.V. SEAFDEC 2 for analyzing the samples that comprise marine biota (fishes), water, and sediments (Figure 24), the analysis would be done by experts in appropriate laboratories in Bangkok, Thailand.

In addition, study on the composition and potential source of aerosol was also carried out with the main objective of investigating the source of aerosol in the Gulf of Thailand (Figure 25). Results of the analysis would be used to support the improvement of weather predictions in the region.

### Way Forward

The initial results of the survey were presented during the Regional Technical Meeting (RTM) on the Evaluation of the Collaborative Research Survey on Marine Fisheries and Marine Environment in the Gulf of Thailand, organized at the SEAFDEC/TD from 8 to 9 January 2019, where it was agreed that monitoring and follow up of the data analysis should be continued (SEAFDEC, 2019). Nonetheless, the results had provided an initial cleaner and broader picture of the resources and the environmental conditions of the Gulf of Thailand. Meanwhile, the data and samples collected from the 2018 Collaborative Research Survey would be analyzed by responsible scientists and researchers from the participating countries, national agencies and institutes. The results would be compiled in forms of technical reports. Moreover, results of the monitoring and follow up of the data/sample analysis from the 2018 Collaborative Research Survey in the Gulf of Thailand would be presented during the first follow up meeting tentatively scheduled to be organized in July or August 2019, and during the second meeting in December 2019 or January 2020. The final results, especially from the various shipboard research studies would be presented during the Seventh Marine Science Conference hosted by Ramkhamhaeng University, Bangkok, Thailand in 2020. In this regard, SEAFDEC/TD was tasked to facilitate coordination with Ramkhamhaeng University for the arrangements related to the presentation of the results of 2018 Collaborative Research Survey.

The 2018 Collaborative Research Survey had generated an increased number of experienced researchers on marine fishery resources and marine environment in Southeast Asia, strengthened the network of fisheries and oceanographic scientists and researchers in the region, and maximized the efficiencies and benefits from the use of the SEAFDEC research vessels and equipment to support marine fishery resources and marine environment surveys in the Southeast Asian waters. During the RTM on the Evaluation of the Collaborative Research Survey on Marine Fisheries and Marine Environment in the Gulf of Thailand (SEAFDEC,

2019), the priorities revealed by the three (3) participating countries, *i.e.* Thailand, Cambodia, and Viet Nam pointed towards the conduct of capacity building on the analysis of “zooplankton, phytoplankton and paralarvae of cephalopods diversity and distribution in the Gulf of Thailand.” Based on such revelation, SEAFDEC/TD would continue to exert efforts to seek funding support for the conduct of the human resource development programs on the suggested topic for the three (3) participating countries.

For more information on the results of the 2018 Collaborative Research Survey, communication and coordination could be made through the respective Country’s National Focal Points of the Survey (**Table 2**) or through SEAFDEC/TD and the concerned institutes and academes shown in **Table 3**.

**Table 2.** National Focal Points for the Collaborative Research Survey on the Marine Fisheries Resources and Marine Environment Survey in the Gulf of Thailand using the M.V. SEAFDEC 2

Countries	Contact person	National agencies
Cambodia	Mr. Suy Serywuth	Fisheries Administration, Cambodia
Thailand	Dr. Pavarot Noranarttragoon	Department of Fisheries, Thailand
Viet Nam	Mr. Nguyen Van Minh	Directorate of Fisheries, Viet Nam

**Table 3.** Focal Points from Institutions and Academes in Thailand, for the Collaborative Research Survey on the Marine Fisheries Resources and Marine Environment Survey in the Gulf of Thailand using the M.V. SEAFDEC 2

Contact Person	Institute/Agency/University
Dr. Taweekiet Amornpiyakrit and Mr. Sukchai Arnupapboon	Southeast Asian Fisheries Development Center, Training Department
Dr. Supawat Kantireklap	Department of Marine and Coastal Resources, Thailand
Dr. Yutthana Tumnoi	Office of Atoms for Peace, Thailand
Dr. Wirote Laongmanee	Burapha University, Thailand
Dr. Supanee Leethochawalit	The Institute of Marine Science, Burapha University, Thailand
Dr. Worrawit Maneepitaksanti	Chiang Mai University, Thailand
Dr. Penjai Sompongchaiyakul	Chulalongkorn University, Thailand
Dr. Jitraporn Phaksopa	KU: Kasetsart University, Thailand
Dr. Sontaya Koolkalya	RBRU: Rambhai Barni Rajabhat University, Thailand
Dr. Tuantong Jutagate	URU: Ubon Ratchathani University, Thailand

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## About the Authors

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Mr. Suy Serywath is Director of the Marine Fisheries Research and Development Institute (MaFReDI) of the Fisheries Administration of Cambodia.

Dr. Pavarot Noranarttragoon is Head of the Fisheries Resource Assessment Group of the Department of Fisheries, Thailand.

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