No. 0505.2/๓๓๓๙

Department of Fisheries
Kaset Klang, Chatuchak
Bangkok, Thailand 10900

๑๙ August B.E. 2558 (2015)

Dear Mr. John Scanlon

Subject : Report on Thailand's actions addressing problems of *Hippocampus* spp.

During its 26th meeting, the CITES Animal Committee has advised recommendations to address problems regarding the export from Thailand of *Hippocampus kelloggi*, *H. spinosissimus* and *H. kuda* and implementation of Article IV, paragraphs 2 (a), 3 or 6 (a) of the convention. For the past two years, the Department of Fisheries has undertaken necessary actions as reported below:

1. A detailed study on of the *Hippocampus* species has been carried out providing better understanding on the *Hippocampus* species habitat and situation (Annex 1 and 2).

- Seahorses are found in all water depth range up to the maximum depth of 50 meters and mostly in the depth of 20 - 40 meters. In addition, there is evidence that seahorses found in Thailand are affected by trawl fisheries.
- *H. kuda* are found at the shallow water up to five meters around mangrove estuaries and sea grass beds.
- *H. spinosissimus* are found in all depths, but mainly found in the depth of 20 - 30 meters. They are also found at the depth of 50 meters as well as *H. trimaculatus.*
- *H. kelloggi* are found in deeper water than the other two species; thus, they are more affected by trawl fisheries.
- Measurements of the smallest maturity size for male were as follows: *H. spinosissimus* = 10.6 cm., *H. trimaculatus* = 11.0 cm., *H. comes* = 16.7 cm. and *H. kelloggi* = 18.0 cm.

2. Location and hot spots of seahorses are shown in Annex 3. Maps of seahorses habitat, showing different areas such as coral reef, sea bottom, mangrove, marine national park, are also illustrated.

3. The result of total biomass of seahorses in Thai waters was 9.656 tons (Annex 4).

4. The country has implemented adequate conservation and management measures as follows:

- The Marine Protected Area (MPA) covers 25.23% of the total marine area or 316,118.24 km^2 including Marine National Parks, seasonal closures in the Gulf of Thailand and Andaman Sea and coastal prohibited areas, etc. The studied sites cover the areas of fisheries management measures notified by the Department of Fisheries. Moreover, coastal prohibited area for trawlers and push nets has been expanded from 3,000 to 5,400 m in 10 provinces, namely Trang, Krabi, Prachuap Kiri Khan, Rayong, Narathiwat, Pattani,

/Satun, ...

Satun, Nakhon Sri Thammarat, Chumphon and Chanthaburi (Annex 5).

- The Department of Fisheries has installed artificial reefs within the area of 3 km from shoreline to serve as breeding and nursing grounds of aquatic faunas (Annex 6). These artificial reefs also prevent trawl fishing vessels in these area. When the accidental fishing is minimized, the seahorse habitat is protected. The spawning ground and habitat of seahorse are also conserved from the artificial reef installation.
- Another measure is the ban of seahorse trading. The seahorse which the length is smaller than 10 cm is not allowed.

5. In order to monitor and update the fisheries stock of seahorses, surveys and data collection from landing sites will be conducted every 3 years by fisheries biologists from 5 Marine Fisheries Research and Development Centers (Annex 7). In regards to export sector, the Scientific Authority and Management Authority are working on identifying additional measures, according to control utilization of seahorses for trade.

In conclusion, based on the studies and existing measures mentioned above, Thailand has established adaptive and sufficient management program to prevent the catch of non-target seahorses by fishing vessels and the trade of the three species of *Hippocampus* spp. And to ensure that trade will not become detrimental to the survival of the species in the wild and complies with Article IV, paragraphs 2 (a), 3 or 6 (a) of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Yours sincerely,

(Dr. Joompol Sanguansin)

Director - General

Enclosure : as stated

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PROGRESS REPORT SUBMISSION FORM

Please type or print in English

RESEARCH PROJECT TITLE:

Implementing CITES for Seahorses in Thailand

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4. Progress report no.: 1

For research duration: Starting: 19/02/2013 (D M Y) Ending: 15/07/2013 (D M Y)

5. Research site (s):

Bangkok, Samut Prakan, Nakhon Si Thammarat, Chumphon, Prachuap Khiri Khan, Chonburi, Ranong, Phang-nga, Phuket, Krabi, Trang, Satun

6. Checklist for progress report submission.

These sections are to follow this submission form.

- [√] List of collaborating Thai researchers and/or Thai Institutions
- [√] Objective of research
- [√] Research methodology
- [√] Research results obtained during this period
- [√] Problems and actions to be taken
- [√] Research plan for the next period

I do hereby certify that all of the above given information is true.

…… …..

(Dr. Amanda Vincent)

August 29, 2013

……

(Date)

List of collaborating Thai researchers and/or Thai Institutions:

Primary collaborating Thai researchers and institutions:
Praulai Nootmorn, Director Marine Fisheries Research and Technological Development Institute, Marine Fisheries Research and Development Bureau, Department of Fisheries
Ratanawalee Phoonsawat, CITES SA, Department of Fisheries
Yoo-ee Getpech, CITES MA, Department of Fisheries
Patrichart Laksanawimol, PhD Candidate, Department of Marine Science, Faculty of Fisheries, Kasetsart University

Additional collaborating Thai researchers and/or Thai Institutions:
- Andaman Sea Fisheries Research and Development Center of Phuket – field logistics, port logistics and seahorse buyers in Phuket
- Chumphon Provincial Marine Fisheries Station - logistics for port interviews in Chumphon and a collaborative day in January
- Phang-nga Provincial Marine Fisheries Station - provided staff and logistical support for research in Koh Kloei, Tablameau, Koh Mook and Koh Lanta, including collaborative research days in Koh Mook and Koh Lanta.
- Phuket Aquarium - Aquarium seahorse breeding situation introduction
- Ranong Marine Fisheries Station - background information on seahorse bycatch, habitat, trawlers, and DoF port surveys in Ranong province
- Samut Prakan Provincial Marine Fisheries Station - logistics for port interviews and seahorse buyers in Prachuap Khiri Khan and a collaborative day in January
- Satun Provincial Marine Fisheries Station - logistics for port sampling and interviews in Kantang, Satun and Koh Sarai, including a collaborative day of research on Koh Sarai in June.
- Siam Ocean World - Aquarium seahorse breeding situation introduction
- Suchai Worachananant, Professor, Department of Marine Science, Faculty of Fisheries, Kasetsart University

Funders:

Field research and staff were co-funded by: Guylian Chocolates, Belgium; John G. Shedd Aquarium, Chicago; People's Trust for Endangered Species; Ocean Park Conservation Foundation Hong Kong; Bottom Billion Fieldwork Fund; FBR Capital Investments; Riverbanks Zoo and Garden Conservation Support Fund; SciFund Challenge; The Explorer's Club Exploration Fund; Studying Abroad Scholarship, Taiwan Ministry of Education

The preparation and execution of the Thai workshop was co-funded by the EU support through the CITES Secretariat and the People's Trust for Endangered Species.

Report pre-amble:

This report to NRCT for the research project entitled "Implementing CITES for Seahorses in Thailand" is intended to summarize the activities and results for the first six months of the two year project. ***It is being submitted by Project Seahorse, but represents the collaborative efforts of Project Seahorse and the Thai Department of Fisheries.***

There were four main research activities in support of our collaboration:

- Research activity A: Trade research
- Research activity B: Rapid assessment protocol (RAP) of Thai seahorse populations
- Research activity C: Seahorse life history research
- Research activity D: Seahorse population status under human pressure

For clarities sake, we have broken the report into three sections based on these activities – we report on each of activities A and B separately, but combine activities C and D into one section as they are highly complementary.

We are also including a report on our recent workshop: Building Thailand's capacity to undertake Non-Detriment Findings for seahorses. This workshop was co-organized by Project Seahorse and the Thai Department of Fisheries, and was held Burapha University, Bangsaen from 10-12 June 2013.

Research activity A: Trade research

Objectives of research as stated in proposal to NRCT:
The objective of trade research is to generate and share new knowledge about seahorse biology, fisheries and trade that might affect implementation of the CITES Appendix II listing for Thai species**.**

Research Methodology:
Project Seahorse and the Thai Department of Fisheries (DoF) collaborated on a survey of trade in seahorses in Thailand in support of Thailand's efforts to implement CITES for *Hippocampus*. The goal of the study was to assess the current fisheries and trade status of seahorses in Thailand.

Two researchers, representing the two partner organizations, conducted 195 semi-structured interviews at different levels of the trade in nine provinces of Thailand to gather information on species, volumes, values and trade routes. When possible, the body size of seahorses encountered in trade was also recorded.

The surveys covered the coasts of the Andaman Sea and Gulf of Thailand, including both urban and fishing regions – locations for interviews were based on previous studies (Perry et al., 2010, Phoonsawat et al. 2012), and information gathered from respondents.

Respondents were located from 1) existing connections, which came from previous studies conducted by DoF and/or Kasetsart University, and 2) through snowball sampling in which one respondent indicates other potential respondents. Respondents included fishers, divers, buyers, wholesalers, retailers, exporters, government officials, and other experts in nine provinces in Thailand (Table 1).

Trade levels
Respondents were categorized according to their role in, or involvement with, the seahorse trade – designated, for example, as fishers, traders, scientists, etc. Fishers and traders were further categorized into different trade "levels". For example, fishers who catch seahorses directly are

defined as “level 1”, collectors that buy directly from fishers are “level 2”, and so on. Note that one person can occupy more than one level.

Volume estimates

Reports from individual respondents on landings for discrete time periods (i.e., per week, trip, month, or year) were roughly scaled to annual estimates after accounting for apparent seasonal variation in catches. In this report catch per unit effort (CPUE) is the number of seahorses caught by a single fishing vessel in a one year period. Within each region, catch estimates for individual trawlers can then be multiplied by the assumed number of trawl vessels of each type operating in each region, to obtain a rough estimate of total seahorse trawl landings.

Value estimates

Researchers standardized seahorse price into baht/g based on the conversions 1 individual = 16.67g for *H. kelloggi* and 2.78g for other species. The price was then converted into USD using the average rate of conversion during the survey period (1 baht = 0.033USD). Historic values are corrected by annual core consumer price index (CPI) to 2012 for temporal comparison.

Results to date:

Respondents: Researchers interviewed 195 respondents in support of Activity A (Table 1). The roles of respondents included: fishers (trawlers: n = 58, artisanal fishers: n = 33, others: n = 7), local buyers (n = 23), retailers (traditional Chinese medicine (TCM) stores: n = 23, aquarium: n = 15, souvenir stores: n = 10, sellers on Internet: n = 5), wholesalers (n = 1), exporters (n = 1), local residents (n = 11), government officers (n = 4), NGO officers (n = 2) and experts on culturing seahorses (n = 2).

Table 1. Number of respondents interviewed during trade surveys in Thailand, categorized by occupation and location.

Province	Fishers and gleaners	Traders	Others
Bangkok	0	32	1
Samut Prakan	2	2	1
Phuket	20	15	4
Trang	7	7	2
Nakhon si Thammarat	10	4	4
Chumphon	14	5	4
Prachuap Khiri Khan	21	6	2
Chonburi	8	5	1
Trat	16	2	0
TOTAL	98	78	19

Total interviews: 195

Species

At least four seahorse species were found to occur in the Thai seahorse trade: *Hippocampus kelloggi, H. kuda, H. spinosissimus* and *H. trimaculatus. Hippocampus trimaculatus* was widely distributed across the survey area and was the most commonly encountered species (n = 341)

(Figure 1). *Hippocampus spinosissimus* was also found in both the Andaman Sea and Gulf of Thailand, and made up about one quarter of seahorses in surveyed catches (n = 135). *Hippocampus kelloggi* were found in Southern Thailand, especially on the Andaman side (n = 54). Although all of the *H. kuda* found in this survey were on the Andaman Sea (n = 9), other studies showed that there could be many more in the Gulf of Thailand.

On average, *H. kuda, H. trimaculatus, and H. spinosissimus* had individual dry weights of 2.78g (n = 123), while *H. kelloggi* weighed in at 16.7g per dry seahorse (n = 3).

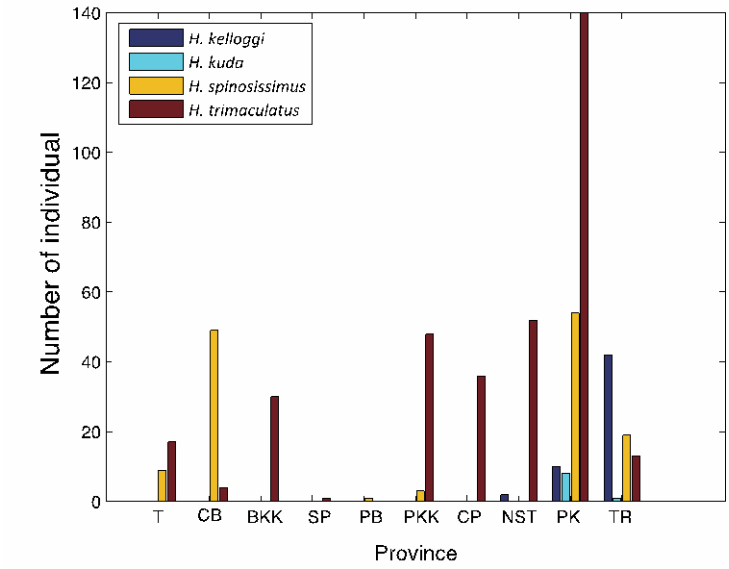

Figure 1. Numbers of individual seahorses by species observed in each province. The provinces are ordered by geography in a clock-wise pattern, starting in the north-east of Thailand (Trat Province). T: Trat, CB: Chonburi, BKK: Bangkok, SP: Samut Prakan, PB: Phetchaburi, PKK: Prachuap Khiri Khan, CP: Chumphon, NST: Nakhon si Tamarat, PK: Phuket, TR: Trang.

Fisheries

Trawlers were estimated to catch 92% seahorses in trade. Trawlers captured seahorses incidentally in both the Gulf of Thailand and the Andaman Sea, and reported fishing in Thai as well as international waters. Some artisanal fisheries such as gillnet, shrimp net, and crab trap fisheries, also reported catching seahorses as bycatch but in relatively smaller proportions.

In general, seahorses caught by trawl boats were reportedly collected by the crew and sold for pocket money. The crew reported splitting the money equally among them. In addition to selling the seahorses, some fishers in west Gulf of Thailand (n = 4 of 58 trawlers) reported keeping the smaller seahorses for themselves to make into medicinal wine for curing backache. Artisanal fishers reported selling captured seahorses (n = 18 of 33), keeping dead seahorses for medical use or/and to make into key rings (n = 12 of 33), or returning live seahorses to the sea (n = 8 of 33).

None of the fishers we interviewed reported collecting live seahorses. Indeed, retailers in Bangkok reported that they only buy live seahorses when customers ordered them, as the

survival rate of live wild seahorses in captivity is low (n = 4 of 15 aquarium respondents). According to some live seahorse retailers (n = 2 of 15), seahorses were obtained as bycatch when targeting other aquarium fishes. Our results therefore suggest that the catch and supply of seahorses for the aquarium trade was irregular.

Trade routes

Fishers reported selling dried seahorses to primary buyers in ports. Most primary buyers we interviewed lived around the ports so they could visit whenever trawlers landed their catches (n = 16 of 23); some even maintained a grocery store beside the port as a trading venue for fishers (n = 7 of 23). The primary buyers bought seahorses as well as other marine products, such as shells, sea cucumbers, and lobsters. A few of the fishers we interviewed that worked near Thailand's borders reported selling to traders from other countries for a better price (n = 5 of 98).

The primary buyers we surveyed (n = 23) reported that while they are loyal to their higher-level buyers, it seemed as though more and more people were enquiring about seahorses for sale. Primary buyers reported that their higher-level buyers travelled among coastal cities to gather their stock from primary buyers (n = 23 of 23), although some received their commodity by post as well (n = 3 of 23).

The primary buyers reported that their higher-level traders send the vast majority of their purchased seahorses to Bangkok, from where they are distributed to retailers in other regions of Thailand for sale as traditional Chinese medicine (TCM) (n = 10 of 23). Some respondents also indicated that dry seahorses are exported to China, Hong Kong SAR, Taiwan, and Malaysia as traditional Chinese medicine (n = 14 of 63 dry seahorse traders).

As curios, dry seahorses were made into key-chain or crafts and sold in some souvenir stores, especially in Phuket. Seahorses were sold live as aquarium pets as well. Although demand for live seahorse was reportedly high, aquarium stores were reluctant to keep them as survival rates of wild seahorses in captivity were low. We only encountered live seahorses for sale in Bangkok, where some retailers mentioned that seahorses from Southern Thailand, especially Andaman Sea, were more colorful and therefore preferred (n = 4 of 15 retailers); but that they were easier to obtain from the Gulf of Thailand (specifically Chonburi) (n = 4 of 15).

Figure 2. Potential trade route for dry seahorses in Thailand as deduced from trade interviews. The arrows showed the direction of trade flows. Red lines represent domestic trade routes, while blue lines indicate international trade routes. Survey locations are indicated as solid circles, whereas open circles represent place we did not survey but that were named by our respondents.

Catch volumes

The vast majority of the trawl fishers interviewed reported having caught seahorses in 2012 (n = 51 of 58). The average annual catch per unit volume of trawlers (CPUE) was 420 seahorses (standard error = 95, all errors in this report are standard errors). More seahorses were reportedly caught annually per trawler in the eastern Gulf of Thailand (749±356, n = 13) than the Andaman Sea (445±50, n = 14), while only 256±65 seahorses were reportedly caught annually per trawler in the central and southern Gulf of Thailand (n = 28) (Table 2).

Most of the interviewed fishers from crabs gillnet boats also reported catching seahorses (n = 18 of 21), but in relatively smaller numbers compared to trawlers. The average annual CPUE of crabs gillnets in Thailand was estimated to be 59±33 seahorses (Table 3).

At present time, an uncertainty about total boat numbers and/or underreported annual catch in Thailand is limiting our ability to scale up from estimated CPUE to total catch. One interesting point was that crew members tended to report a higher volume of seahorse catches than their captains (average CPUE reported by crew was 631±156 (n = 8) versus that reported by captains 378±105 (n = 47), respectively). As mentioned earlier, seahorses caught by trawl boats were reportedly collected by the crew and sold for pocket money – the captains did not tend to deal with the seahorse bycatch. Therefore CPUE estimates from the crew are probably closer to the truth; however most of our respondents were necessarily captains due to language barriers with the typically Burmese or Cambodian crew. As a result we can infer that our CPUE of seahorses by the Thai trawl fleet is significantly underestimated.

Many of the fishers and buyers we interviewed reported declining seahorse catch rates over time (n = 43 of 57 respondents mentioned the trend of seahorse catch) – they estimated decline rates from 6% to 80% (median = 30%) over the past 2~40 years (median = 10 years). Only two respondents reported that availability was increasing over time, while twelve others reported catches as stable.

Trade volumes

We only obtained information on export volumes from one individual. Our respondent said they had exported their allowed quota, as decreed by CITES Thailand, in only half of the year. In previous years, before there was a quota, the respondent reported exporting about two metric tons seahorses annually (170~180 kg per month). If this is representative of the average export volume of Thailand's permitted exporters, of which there are reportedly eight (according to Thai CITES MA), then Thailand may have exported about 16,320 kg dry seahorses (or 5.8 million individuals) per year before quota regulation. This estimate, although only based on a sample size of 1, is consistent with Thailand's average annual seahorse exports as reported to CITES (annual average of 5.8 million seahorses from 2004 to 2010).

We had a hard time estimating the domestic consumption of seahorses in Thailand as TCM retailers in Bangkok were reluctant to share their sales figures. We estimated the annual sales volume for a TCM store in Thailand across all regions at 0.55±0.35 kg $year^{-1}$ (n = 8) – but this will underestimate domestic consumption as Bangkok sales are likely much higher than those from other regions – and Bangkok has the majority of the TCM shops.

Table 2. Estimated annual CPUE of seahorses by Thai trawlers (CPUE = annual average number of seahorses caught by a trawler).

Province	*Median catch/ trawler*	*Mean catch/ trawler*	*Standard error*	*Number of Respondents*
Trat	*378*	*516*	*57*	*7*
Chonburi	*240*	*569*	*908*	*5*
Samut Prakan	*4*	*4*	-	*1*
Petchburi	*117*	*119*	*44*	*3*
Prachuap Khiri khan	*368*	*547*	*102*	*7*
Chumphon	*130*	*293*	*116*	*9*
Nakhon si Tamarat	*35*	*86*	*155*	*9*
Phuket	*360*	*416*	*106*	*12*
Trang	*411*	*411*	*51*	*2*

Table 3. Estimated annual CPUE of seahorses by Thai crab gillnet boats (CPUE = annual average number of seahorses caught by a gillnet vessel).

Province	*Median catch/ boat*	*Mean catch/ boat*	*Standard error*	*Number of Respondents*
Trat	8	11	4	7
Chonburi	1000	1000	-	1
Petchburi	90	90	-	1
Prachuap Khiri khan	5	6	2	3
Chumphon	6	6	4	2
Phuket	3	10	7	5
Trang	50	50	40	2

Live seahorse export has been prohibited from Thailand since 1979, and indeed our interviews suggest that the live seahorses found in trade were for domestic use. We interviewed one live seahorse fisher in Chonburi, who reported that he had been catching seahorses for aquarium stores in Bangkok and the aquarium in Bangsaen Institue of Marine Science (BIMS, Burapha University) until two years ago. The diver mentioned that eight years ago he caught an estimated 1000 seahorses per year. Five of the 13 surveyed aquarium sellers in Bangkok were selling seahorses at the time of interview. Although the supply of live seahorses was irregular, we estimated about 2,106 seahorses to be sold annually based on the number of major marine aquarium shops in Bangkok (n = 6) and the average reported sales of each interviewed retailer (0~1,438 individual per year, mean = 351).

Values of dried seahorses traded in Thailand

The price of seahorses was based on size across all levels of the trade. For example, it was reported that upper traders paid more for a bag of larger seahorses than smaller ones, even if the

bags were of equal total weight. We found the reported prices (g^{-1}) varied among trade levels in both selling and buying price – whereas fishers sold seahorses for an average of 0.52 USD/g, the average selling prices across other levels of the trade was 0.82 USD/g. The prices varied among regions as well (Figure 5).

The retail price of live seahorses in Bangkok varied according to their species, color, and availability. The price of a colorful seahorse could be as high as 33 USD, while the others sold for 7~10 USD per individual (n = 3 of 8). On average, fishers received 4~5 USD for per live seahorse (n = 2), and retailers sold each seahorse for 9 USD (n = 8).

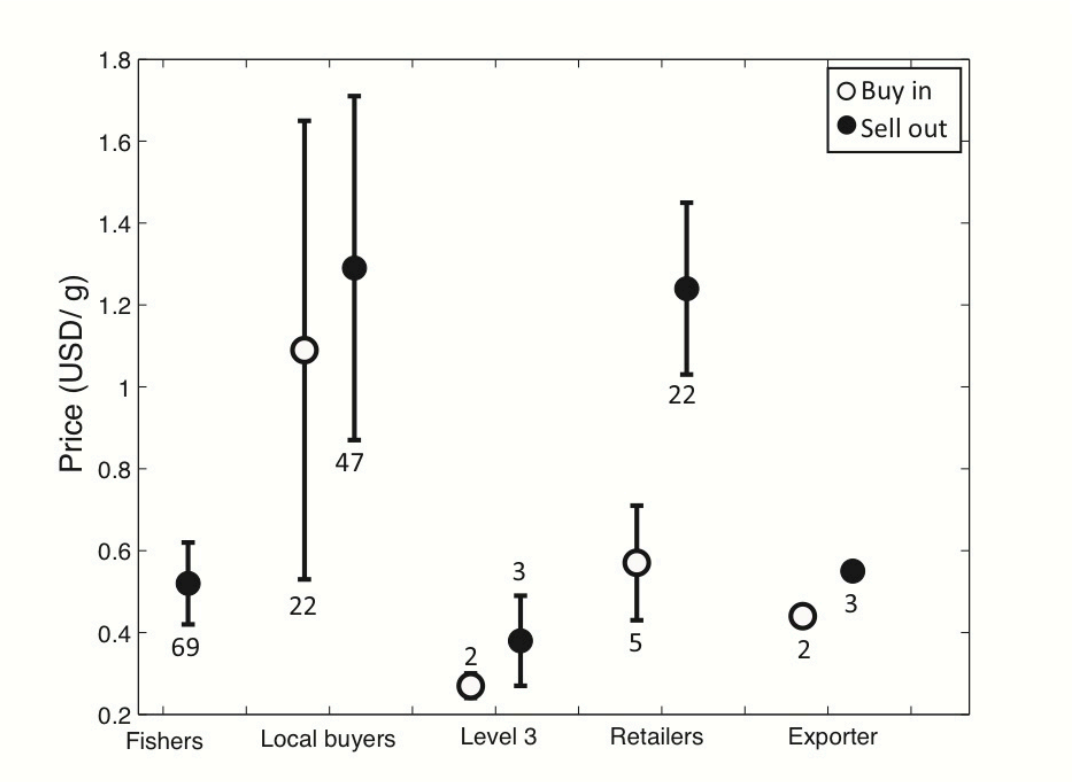

Figure 4. Reported price of dried seahorses (USD per gram dried seahorse) by trade level. Retailers that sold seahorses as souvenirs were excluded from this analysis. Values are means with standard errors, and the numbers reported on the plot represent the number of prices reported by trade level. Respondents sometimes reported more than one price, according to different size classes of seahorses.

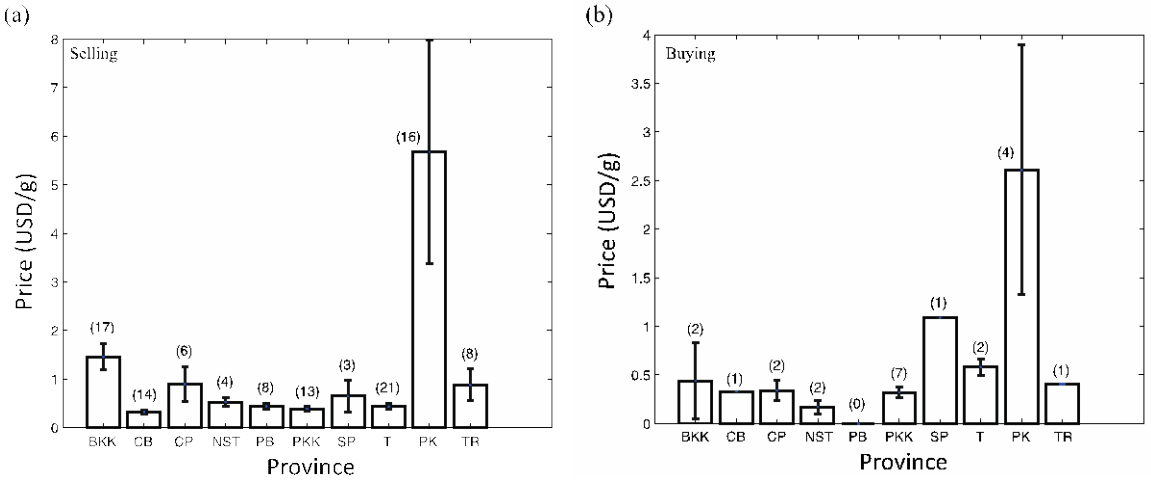

Figure 5. Reported (a) selling price and (b) buying price of dried seahorses across trade levels in each province of Thailand. The numbers in brackets indicate the number of responds that contributed to the mean. Error bars are standard errors.

Problems and actions taken:

Our trade research in support of Activity A managed to obtain novel information from a good number of fishers and primary buyers in Thailand. However we were unable to interview a sufficient number of upper level traders, especially exporters and wholesalers. There are a number of valid reasons for this, but we are seeking ways to overcome them as these data are essential for completing the picture of seahorse trade in Thailand. Without these data we cannot sufficiently support Thailand to meet the CITES recommendations and evaluate the sustainability of its exports. We are exploring the possibility of working with a researcher based at Kasetsart University to fill this important data gap with further interviews at upper levels of the trade.

Next steps:

As mentioned above, our next steps are to find additional funding in order to build on our current trade research by conducting more interviews at upper levels of the trade. We also need to work with DoF partners to figure out the number of different vessels in different ports so that we can scale up from our CPUE to total annual catches volumes in Thailand.

Research activity B: Rapid assessment protocol (RAP) of Thai seahorse populations

Objectives of research as stated in proposal to NRCT:

We need to conduct rapid in-water surveys to obtain essential information on seahorse distribution, density, sex ratio, size distribution and habitat preferences throughout Thailand. We will then (i) map seahorse distribution, identifying high density areas, to support CITES recommendation e, and ii) prepare a status report for seahorse populations, their locations, and types of habitats they depend on in support of CITES recommendation

Research Methodology:

From February to April 2013, our team surveyed 14 coastal and estuarine habitats in the provinces of Phang-Nga, Phuket, Trang, Satun, Krabi and Ranong through the use of underwater visual census (UVC). To perform UVC, researchers swam randomly laid transects (underwater tape measures 50 meters long) in as many locations along the coast in coral reef, seagrass and mangrove estuaries as time allows. We surveyed a minimum total area of 1000 m^2 and a maximum total area of 2000 m^2, per site.

Survey sites were selected based on published and anecdotal evidence with respect to the presence of seahorses and/or their habitats (coral reefs, seagrasses, mangroves). Regular consultations with provincial officers of the Thai Department of Fisheries (DoF) provided important information in this respect. We supplemented their information by consulting published literature and local researchers.

Our field research was supported by three in-country research assistants: Wansiri Rongrongmuang, PADI Dive Instructor, and Wuttipong Tangthirawanitt and Thanapoom Vichaidist, graduate students at Kasetsart University. Our assistants provided us with essential support with respect to language and culture, and in exchange were trained in field methods in support of marine conservation.

When seahorses were encountered underwater, researchers noted their abundance, habitat association, sex, reproductive status and body size.

Results to date:

We encountered very few seahorses despite a very good sampling effort in the shallow waters of the Andaman coast. We observed a total of eight seahorses from three species across a total survey area of 17,250 m^2 (31 in-water survey days), at five of the 14 survey sites (see Figure 6 and Table 4). In summary, four *Hippocampus kuda* were found in mangroves and seagrass beds, one *H. mohnikei* were encountered in seagrass and three *H. comes* in coral reefs. Two *H. kuda* were pregnant males, both of which were found in the mangroves in Trang Province. All other seahorses were female.

To complement the in-water surveys, we consulted fourteen members of the adjacent local communities, including fishers and boaters, about their experiences with seahorses. All fourteen reported a decline in seahorse populations over the past 10-20 years. This suggests that seahorses may indeed be rare in many areas along the Andaman Coast – as our in-water surveys suggest. The putative reasons given for observed declines were previous bottom trawling in the area that damaged benthic habitat, downstream pollution from shrimp farms, and poaching.

Table 4. Results to date for research activity B: Rapid assessment protocol (RAP) of Thai seahorse populations

Province	Site	Dates	Habitat	Survey area (m^2)	No. seahorses	Species	Sex
Phuket	Koh Loen	02-Mar-13	Coral reef	1000	1	*H. comes*	Female
Phuket	Koh Mai Thon	03-Mar-13	Coral reef	1500	0		
Phuket	Ao Modong	04-Mar-13	Seagrass	1000	0		
Trang	Sikao	07-Mar-13	Mangrove	1500	3	*H. kuda*	Male - 2, Female – 1
Trang	Palian	08-Mar-13	Mangrove	1200	0		
Satun	Thammalang	09-Mar-13	Mangrove	200	0		
Satun	Ko Kamin	09-Mar-13	Coral reef	200	0		
Trang	Trang river	11-Mar-13	Seagrass	300	0		
Phuket	Ko Hae	14-Mar-13	Coral reef	280	0		
Phang-nga	Ko Khai Nai	15-Mar-13	Coral reef	600	0		
Phang-nga	Dwarf Reef (Koh Khai Nai)	16-17 Mar-13	Coral reef	1100	2	*H. comes*	Female - 2
Phuket	Sarasin	18-19 Mar-13	Seagrass	1400	0		
Phang-nga	Kuraburi	20-23 Apr-13	Seagrass	2000	0		
Phang-nga	Kuraburi / Koh Phra Thong	20-23-Apr-13	Seagrass	2000	1	*H. mohnikei*	Female
Ranong	Kapoe	24- 27 Apr-13	Mangrove	2000	0		
Krabi	Koh Pu / Koh Jum	29 Apr - 2 May-13	Seagrass	2000	1	*H. kuda*	Female
Krabi	Koh Lanta	5-7-May-13	Mangrove / Seagrass	1300	0		

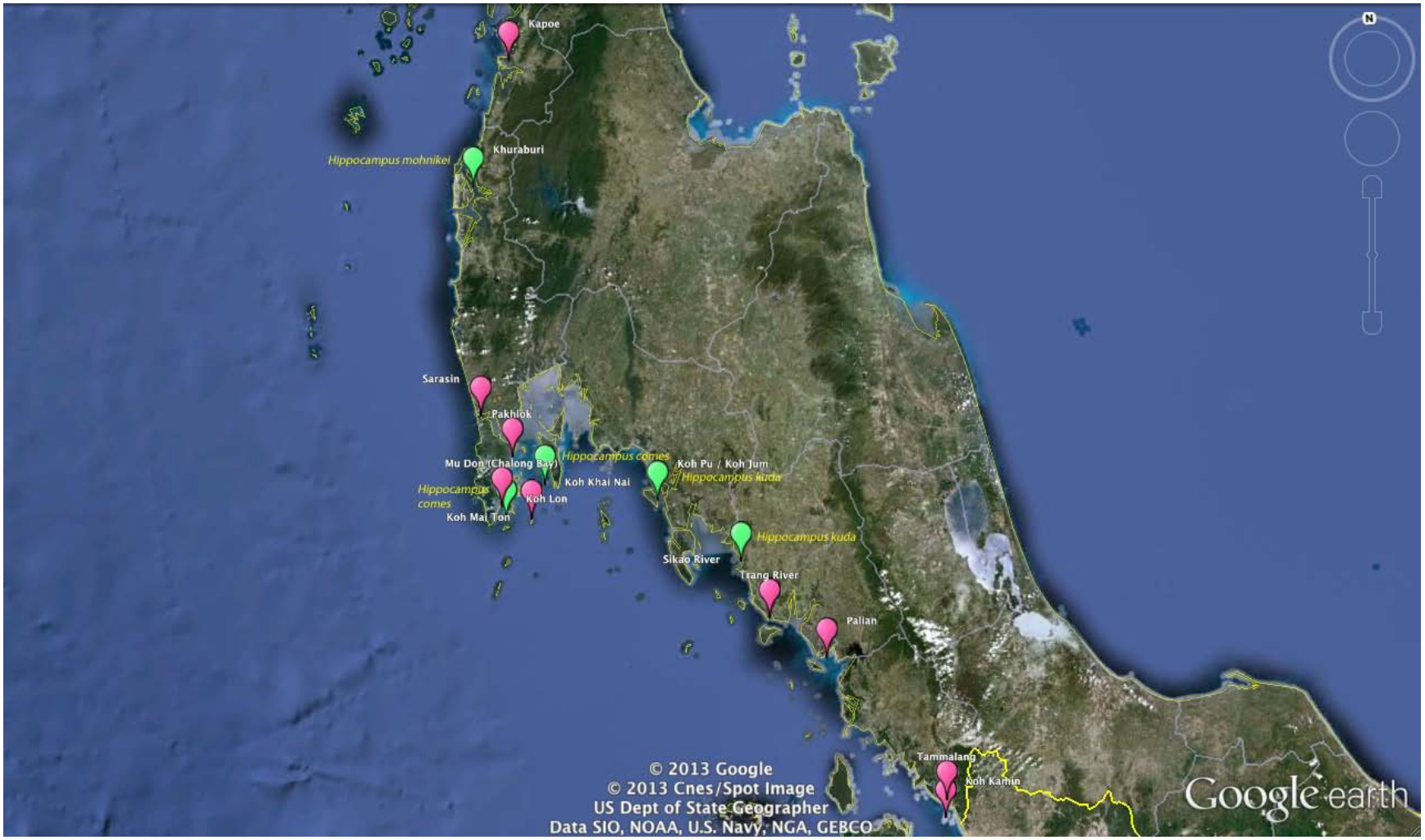

Figure 6. Sampling locations for Research activity B: Rapid assessment protocol (RAP) of Thai seahorse populations. Green pins indicate survey sites where seahorses were encountered.

Problems and actions taken:
Some of the "problems" we have encountered thus far in our RAP of Thai seahorse populations are turning into opportunities to advance the practice of surveying less abundant marine species in support of marine management and conservation.

We initially set out to estimate seahorse population abundance along the coasts of Thailand. Doing so required a random sampling design using fixed-area transects – a commonly employed approach for sampling commonly encountered animals. It was apparent during the first few weeks of our surveys that this approach will not work for seahorses, which are typically found in low densities, have patchy distributions, and are highly camouflaged. Our power analyses revealed that systematic sampling using fixed-area transects would require very high levels of effort to record seahorses in sufficient quantities for population estimation, which would be prohibitively costly and time-consuming.

We instead need to take a new and pragmatic approach to obtain the information needed to support Thailand to implement CITES for seahorses. We have moved away from sampling for abundance, and are now focused on finding seahorse hot-spots – areas of high seahorse density. Mapping these hotspots onto the distribution of Thailand's MPAs and other spatial management will allow us to understand what protection such measures provide for Thai seahorses, and what additional area restrictions are needed in support of seahorse management and conservation.

We will find seahorse hotspots by focusing our in-water surveys on areas with strong anecdotal evidence of existing seahorse populations, as well as obtaining critical information provided by Thailand's recreational divers through our new citizen science initiative, iSeahorse (www.iseahorse.org).

It has also become apparent that the contribution of our research would be greatly improved if we could search for seahorses in Thailand's Marine National Parks (MPAs). Thailand has established numerous initiatives to help its near-shore environments, including many MPAs. However, the effectiveness of such measures for mitigating pressures on Thai seahorses remains unknown. Documenting the seahorse populations inside these MPAs would help determine what coverage such measures provide for Thai seahorses. We have not yet been able to survey inside MPA boundaries as our research permit does not include activities within National Parks, but we are in dialogue with DoF with respect to obtaining this permission before we return to Thailand in September to complete the surveys.

Next steps:
We will return to Thailand during the third quarter of 2013 to complete our assessment of seahorse distribution along the Gulf of Thailand – employing our refined approach as described above. The surveys will be carried out with the support of provincial DoF officers and Parichart Laksanawimol, PhD student at Kasetsart University who has extensive research experience with seahorses in the Gulf of Thailand.

While in Thailand, we will publicize iSeahorse – the citizen science site for seahorses – across both the Gulf and Andaman coasts, and encourage local divers to use the iSeahorse survey protocol to seek out and document seahorse populations in Thailand.

Upon completion of our field surveys, we will provide DoF with a map of seahorse hot spots which can be mapped onto Thailand's MPAs and other spatial management to analyse what coverage such measures provide for each of the species. The results from this mapping exercise can be applied to assess the sustainability of seahorse trade from Thailand, and will feed into an adaptive management framework for seahorses.

Research activities C and D: Seahorse life history research and Population status under human pressure

Objectives of research as stated in proposal to NRCT:

C. Life history research – The objective of the life history research is to determine critical parameters needed to model seahorse population responses to exploitation pressures – and thus to improve management measures.

D. Population status under human pressure – The objective of this research is to determine how seahorse populations are faring under different human pressures (e.g. trawling and other fishing pressures). Building population models that examine the outcomes of management modification for particular species in full support of the CITES recommendations requires an understanding of: i) the extent of human pressure acting on the marine environment in Thailand; ii) seahorse population response to human pressures; iii) seahorse life history responses to human pressures; and iv) seahorse habitat responses to human pressures.

Research Methodology:

We chose the Andaman coast of Thailand as the focal area for research activities C and D to complement existing research on seahorses in Thailand. Research carried out by Parichart Laksanawimol, PhD student at Kasetsart University, has generated novel information on *H. kuda* and *H. spinosissimus* in the eastern Gulf of Thailand. However information on *H. kelloggi* in Thailand, or indeed elsewhere in its range, is nonexistent. We therefore decided to prioritize this species for our research – and enumerator surveys conducted by the Thai Department of Fisheries (DoF) indicated the majority of *H. kelloggi* are caught on the Andaman coast. In addition to information on *H. kelloggi*, we will be able to gather new information on the two other seahorse species – *H. kuda* and *H. spinosissimus*, which may reveal important geographical patterns in their life history and ecology (when compared to the Gulf).

C. Life history research

Information on the life history of Thai seahorses will be obtained from both underwater and fisheries sampling. Our activities thus far have focused on the latter of these approaches, with underwater sampling set to start in January 2014.

By sampling at landing sites, we have documented fishers' seahorse catches. This research approach is used to gather information on seahorse biology, ecology, and seasonality of seahorses in Thailand. By interviewing fishers we have collected information on species, size, sex, reproductive status and distribution of seahorses, before they were returned to the fishers to handle as they would normally (i.e. retain or discard). Between May and June, 2013, we interviewed 80 fishers at ports and in fishing villages in Phuket, Phang-nga, Krabi, Trang, and Satun provinces.

D. Population status under human pressure

Research started in late May to understand the extent of human pressure acting on the marine environment in Thailand, and how seahorses are faring under this pressure. The information needed for this research was collected during the same interviews used to sample for life history information, Activity C. Fishers from both commercial and small-scale fisheries participated in semi-structured interviews and participatory mapping to answer general questions about their behavior, fishing grounds, and areas of high seahorse bycatch. The interviews are designed to highlight fishers' decisions about location, frequency, gear type and duration of fishing, while mapping allows for spatial representation of fishing pressure and effort in the coastal seascape. Additionally during port sampling information was gathered on methods of extraction (e.g. target/incidental), catch per unit effort, and seasonality of seahorse catches in Thailand.

Our field research (for activities C and D) was supported by three in-country research assistants: Wansiri Rongrongmuang, Chantharas Kanchanakool – a seasoned interpreter with a science background, and Chaturong Kongkaew – a graduate student at Prince of Songkla University Hat Yai. Their local knowledge has been invaluable to overcoming cultural and language barriers. In exchange, our assistants were trained in seahorse taxonomy, biology, ecology, threats and conservation, port sampling, participatory mapping techniques, and research ethics protocols.

Research results to date:

C. Life history

We have measured and characterized the life history of 92 seahorses as of 1 July 2013. The vast majority of these seahorses have been sampled from trawl catches (N = 76), with 15 seahorses sampled from gillnets and one from a compressor diving fisher. Five of the seven species found in Thailand are represented in the catches, with the majority of individuals from *H. spinosissimus*, *H. kelloggi* and *H. trimaculatus* (Table 5).

Table 5. Preliminary analysis of life history data from five *Hippocampus* species sampled at landing sites along the Andaman Coast. Initial results include the total number of individuals, average size in centimeters, smallest pregnant male, total number of pregnant males, and sex ratio.

Species	*H. comes*	*H. kelloggi*	*H. kuda*	*H. spinosissimus*	*H. trimaculatus*	All species
No. of individuals	**6**	**22**	**2**	**46**	**16**	**92**
Average size (cm)	**14.2**	**19.8**	**15.8**	**13.1**	**12.2**	**14.7**
Smallest pregnant male (cm)	**16.7**	**18.0**	**N/A**	**11.0**	**10.6**	**----------**
Total no. pregnant males	**2**	**6**	**0**	**8**	**1**	**17**
M:F ratio	**1 : 1**	**1 : 1.4**	**0 : 2**	**1 : 1.5**	**1 : 1.6**	**1 : 1.5**

D. Population status under human pressure

We have experienced a great deal of co-operation and interest from the fishers we have interviewed for this research. Of the 80 fishers that have participated in the semi-structured interviews and participatory mapping, 22 worked on trawlers; 15 on purse seiners; and the rest used a variety of small-scale fishing gears such as crab, fish, and shrimp gillnets.

Preliminary results include the following observations:

1) Trawlers have the highest rates of seahorse bycatch – but crab gillnets, two-inch fish gillnets, and 3-layer shrimp trammel nets each consistently catch small amounts of seahorses.
2) Although there is some spatial segregation of small-scale and commercial fishing gear in each province, there are also clear areas of spatial overlap.
3) Several locations in Thailand including the areas close to the Surin and Similan Islands, the Racha Islands south of Phuket, and the deep waters near Adang-Rawi have been identified as areas with high rates of seahorse bycatch. Indeed it seems that some boats may choose to fish these areas in the hopes of catching *H. kelloggi*.
4) *Hippocampus trimaculatus* have been sampled most often from catches in areas south of Koh Lanta, while *H. spinosissimus* have been sampled from a high diversity of gears along the entire Andaman Coast.
5) *Hippocampus histrix, H. kuda,* and *H. mohnikei* have only been sampled in low numbers thus far.

Problems and actions taken:

C. Life history

We are making good progress sampling life history parameters from fishers' catches along the Andaman coast, with research progressing as planned.

The next step is to sample seahorses underwater in representative sites along the Andaman coast. Comparing the life history traits of seahorses that are captured to those found underwater will allow us to deduce the selectivity and therefore potential impact of fisheries on wild seahorse populations in Thailand. We have, however, yet to identify suitable research sites for this work. We expected to determine these sites based on the results of the RAP (Activity B) – but as reported we found few seahorses.

To remedy this situation we will seek out seahorse hotspots (area of high seahorse density) by gathering sightings data from Thailand's recreational divers through our new citizen science initiative, iSeahorse (please refer to report for Activity B). Additionally, we are in dialogue with our DoF collaborators about the possibility of surveying in National Parks, which may have substantial numbers of seahorses. If so, this would provide us with valuable life history data, as well as reveal the effectiveness of such measures for mitigating pressures on Thai seahorses.

D. Population status under human pressure
We are making good progress with our stakeholder interviews and participatory mapping, with research progressing as planned.

Research Plan for the Next Period:
C. Life history
Port sampling for life history characteristics will continue until early August 2013. From September through December 2013 we will perform analyses to generate preliminary life history estimates including size specific survival, individual growth, size at first maturity, sex ratio and sex specific differences in vital rates. We will apply established formulas to the data gathered from port sampling (*i.e.* Von Bertalanffy Growth Curve, logistic regression, length-based analyses, *etc.*) to deduce these estimates.

A draft report on our results and their management implications will be prepared by March 2014, in time for Thailand to report on its progress against the recommendation to the CITES Secretariat. January – April 2014 will provide another opportunity to gather life history data through underwater visual census. The life history results from port sampling and underwater visual census will then be incorporated into a population viability model to evaluate seahorse life history responses to human pressure (please refer to Activity D).

D. Population status under human pressure
To understand the extent of human pressure acting on the marine environment in Thailand, and how seahorses are faring under this pressure, population viability models will be created based on the information collected during the rapid assessment (Activity B), life history sampling (Activity C), and participatory mapping (Activity D).

First, participatory mapping data from fisher interviews will be analyzed to determine the extent of human pressure acting on the marine environment in Thailand. From September – December 2013, analysis will be performed to create maps detailing small scale and commercial fishing effort by province, gear type, and seahorse species. This effort will be used as a proxy for the extent of human pressure acting on the marine environment. The results of the mapping will allow for spatial visualization of areas that obtain *Hippocampus* species as bycatch, supporting Thai CITES Authorities to consider spatial or temporal restrictions on fishing activities as recommended by CITES.

To determine how seahorses are faring under human pressure requires the use of population viability models. These models will incorporate newly obtained life history metrics and human (fishing) pressure estimates to examine the outcome of management modifications for a particular species. Results from this model allow for a species-specific assessment of population trajectory, extinction risk and the influence of direct and indirect exploitation on population demographics. This last phase of the project ties together our previous research activities (A, B and C) to support Thailand to make CITES non-detriment findings in support of sustainable trade.

Workshop: Building Thailand's capacity to under-take Non-Detriment Findings for seahorses

Objectives of workshop as stated in proposal to NRCT:
After completion of research objectives A and B, we had planned to co-organize a workshop in Thailand, with our colleagues at the Department of Fisheries, focused on implementing CITES for seahorses. The workshop aimed to bring together Thai stakeholders, including CITES Authorities, Department of Marine and Coastal Resources (DMCR), Department of National Parks (DNP), and colleagues from universities and non-governmental organizations, to:
• share and elicit available knowledge on seahorse biology, fisheries, trade, conservation and management;
• discuss techniques in marine science research (e.g. mark-recapture, hotspot mapping, population viability models;
• provide a platform to facilitate ownership and input into design of a step-by-step framework for developing an adaptive management programme and undertaking NDFs;
• design programmes to monitor catch landings (and effort) as a proxy for population assessments, taking into account different gear types and means of extraction.

Workshop report:
We are pleased to report that we indeed met or objective and had a productive meeting at Burapha University, Bangsaen from 10-12 June 2013. Both Project Seahorse and DoF colleagues learned much and had great enthusiasm for the process and experience.

Many DoF colleagues attended – including senior officials, CITES Management and Scientific Authority staff, researchers, enforcement officers, and CITES staff at the airport – along with colleagues from the Thai Department of National Parks, Department of Marine and Coastal Resources, university researchers, and a citizen group (please refer to Appendix 1 – participants list). It was an honour to have Mr. Yongyuth Taksin of DoF represent the DG for part of the meeting. Simultaneous interpretation made a big difference in communication.

We spent the first day reviewing all available knowledge of Thai seahorses, their habitats, and their catches and trade --- along with Thai fisheries and spatial management practices in general. The quality of information and energy of the speakers was excellent (please refer to Appendix 2 - workshop agenda).

The second day was dedicated to working through a draft framework for making NDFs for seahorses (developed by Project Seahorse, Figure 8). We broke into three groups, each focusing on one of the three species under CITES Review of Significant Trade, and enjoyed animated and interesting discussion. The result was a draft NDF for each species and helpful amendments to the NDF framework; this (and the ID tools, also developed by Project Seahorse, Figure 9) will now be revised by Project Seahorse and sent to Thailand for them to refine their NDFs.

Using the draft NDF framework, Thailand was not able to make a defensible NDF for its wild exports of *Hippocampus kelloggi, H. kuda* and *H. spinosissimus*. Workshop participants determined that all three species in Thailand are at some risk (medium, high or unknown) from fishing mortality or habitat damage / loss (Table 6). Thailand has established numerous initiatives to help manage its near-shore fisheries, including spatial and temporal restrictions. However, the effectiveness of such measures for mitigating pressures on Thai seahorses remains unknown. Moreover, some pressures, such as posed by unregulated small-scale crab trap fisheries have still not been addressed.

Table 6. Summaries of pressures and management evaluations for each species are as follows:

Species	Pressures	Management
H. kelloggi	Habitats, trawl fisheries	Uncertain – do not know if are in MPAs, do not know if covered by trawl bans, and if so whether such bans are effective
H. kuda	Habitats, small-scale trap and gill-net fisheries	Uncertain – do not know if are in MPAs, and no management of small-scale fisheries
H. spinosissimus	Habitats, trawl fisheries and small-scale trap fisheries	Uncertain – do not know if are in MPAs, do not know if trawl bans are effective, no management of small-scale fisheries

Participants agreed there is a need for more research and management action before NDFs can be made for the three species. Participants also recognized the need to collect information on *H. trimaculatus* as Thailand's trade in this species is currently under Review of Significant Trade. Thailand may also be asked to justify NDFs for *H. histrix,* for which the Party is mistakenly currently not recognized as a range state.

The third day revolved around a brainstorm session on how best to address remaining CITES recommendations. We considered what existing information could be compiled to round out the seahorse story, what more needed to be done, what might be the trigger points for a change in adaptive management, and what such changes might be. The latter was largely left for further consideration. The Director of the Marine Fisheries Research and Tech Development Institute proposed an annual Thai review process for seahorses, with an array of agencies and institutions represented.

A comprehensive list of action points were agreed, relating to research and management action in support of sustainable trade. Completing the agreed actions will support Thailand to meet most of the recommendations set down by the CITES Animals Committee. CITES Thailand is responsible for coordinating the completion of the action points, but invite Project Seahorse to assist as time and resources allow.

Figure 8. Translated draft framework for making NDFs for seahorses.

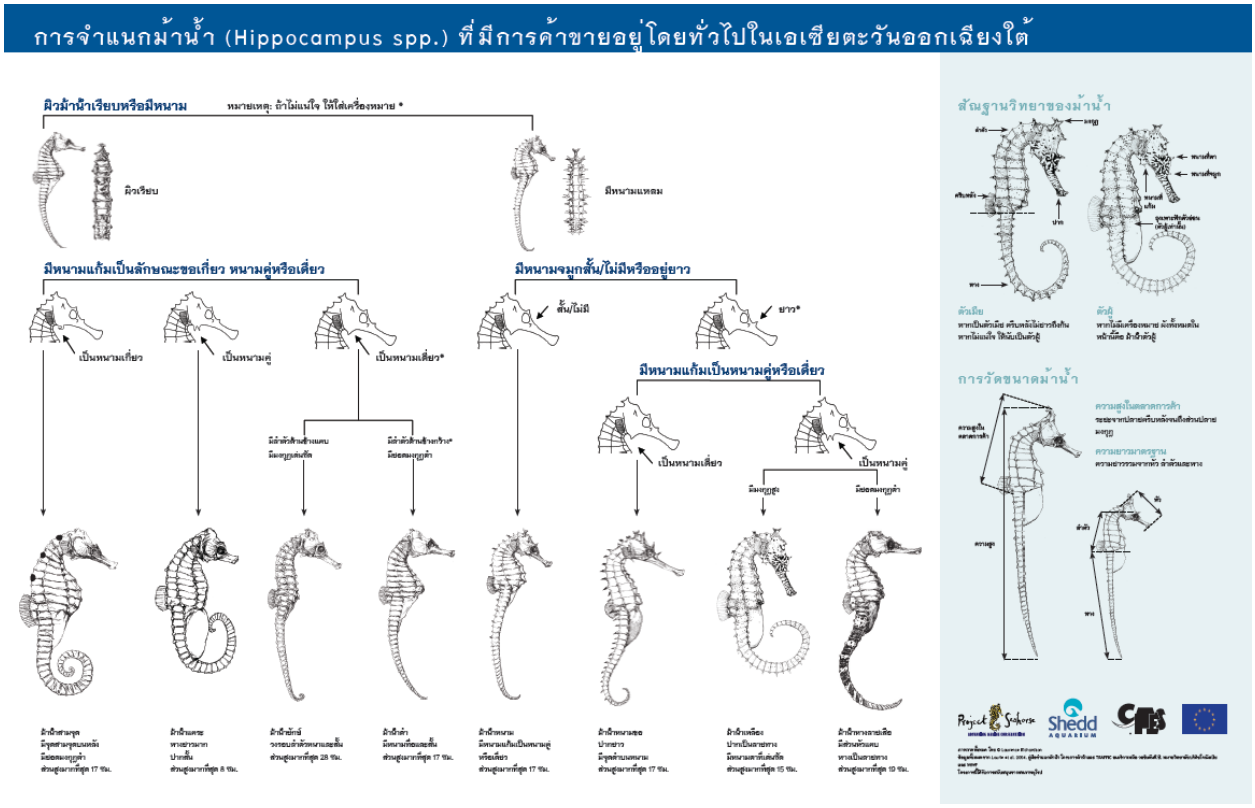

Figure 9. Translated ID guide for seahorses most commonly found in trade in SE Asia.

Appendix 1 – Participants list

Name	Affiliation
Department of Fisheries	
Mr. Manoch Roongratri	Director, Marine Fisheries Research and Development Bureau
Mr. Yangyuth Taksin	Senior Specialist of Marine Fishery Development and Research Office
Ms.Praulai Nootmorn	Director of Marine Fishery Technology Development and Research Institute
Ms.Ratanawalee Poonsawat	Marine Fishery Development and Research Centre in the upper Gulf of Thailand (Samutprakarn)
Mr.Tasanapol Krachangdara	Marine Fishery Development and Research Office in Andaman (Phuket)
Mr.Montri Sumonta	Marine Fishery Station, Ranong
Mrs. Tiwarat Sinanan	Marine Fishery Development and Research Centre in the Western Gulf of Thailand (Samutprakarn)
Mr.Nantachai Boonjorn	Marine Fishery Development and Research Centre in the central Gulf of Thailand (Chumporn)
Ms.Suwantana Tosapornpitakkul	Marine Fishery Development and Research Centre in the lower Gulf of Thailand (Songkla)
Mr. Suriya Chongyota	Director of Fisheries Licensing and Management Measures
Mr. San Sringam	Director of Marine Fishery Management Section
Mrs. Yoo-ee Getpech	Head of Fisheries Resources Conservation and Convention Group, Fisheries Licensing and Management Measures Section
Mr. Ekkawit Wongsrisung	Fisheries Licensing and Management Measures Section
Mr. Weera Jitsuwan	Marine fisheries suspension and prevention Section
Mr. Weera Ratanajinda	Head of Marine Fishery Management Section in the upper Gulf of Thailand (Samutprakarn)
Mr. Worawoot Soocharern	CITES-DoF Officer, Suvannabhurm Airport
Mr. Kittipat Rochanarat	CITES-DoF Officer, Suvannabhurm Airport
Mr. Anggoon Rattanaprom	Head of Marine Fishery Management Centre on Eastern Gulf of Thailand
Department of Marine and Coastal Resources	
Mr. Ronnakorn Boonprakob	Phuket Marine Biological Centre, DMCR
Department of National Parks	
Mr. Wannasak Rungrojwanich	National Parks Office, DNP, Wildlife and Plants Conservation
Kasetsart University	
Dr. Suchai Varachananan	Marine Science, Fishery Faculty
Dr. Pasinee Varachananan	Marine Science, Fishery Faculty
Ms. Parichart Laksanawimol	Marine Science, Fishery Faculty
Sahaob Dockaew	Marine Science, Fishery Faculty
Prince of Songkla University	
Ekkalak Rattanachart	Seaweed and Seagrass Research Unit, Department of Biology
Save our Sea	
Nagnnoy Yossundara	President
Somyod Yossundara	Vice-President
Project Seahorse	
Dr. Amanda Vincent	Director
Dr. Sarah Foster	Programme Manager
Lindsay Aylesworth	PhD Student
Radda Larpun	Workshop Coordinator
Sampan Panjarat	Interpreter
Wansiri Rongrungmeang	Interpreter

Appendix 2 – Workshop agenda

TRAINING PROGRAMME

Building Thailand's capacity to under-take
Non Detriment Findings for seahorses
June 10 – 12, 2013
Venue: Tao-Thong Hotel, Burapha University, Bangsan, Chonburi

Time	Activities
9 June 2013	
	Arrival of participants and guests
10 June 2013	
08:00 – 08:30	Registration
08:30 – 09:00	**Opening Ceremony** • **Statement** from Mr. Youngyuth Taksin, Senior Specialist, DoF • **Background Report** by Mr. Praulai Nootmorn, Marine Fishery Technology Research and Development Institute, DoF • **Statement from Project Seahorse Director** by Dr. Amanda Vincent
09.00 – 10:00	**Introduction to course** • **Course goals and objectives:** Dr. Sarah Foster, Project Seahorse • **Course program, Expectation & need:** Ms. Praulai Nootmorn , Marine Fishery Technology Research and Development Institute, DoF
10:00 – 10:30	*Coffee Break*
10:30 – 12.30	**Session 1: Sharing available knowledge on seahorses (will be presented by experts and open discussion afterward)** • **Seahorse taxonomy and biology**: Mr. Sahapob Dokkeaw, Faculty of Fishery, Kasertsart University • **Conservation status of TH seahorses** (global – IUCN – and national): Ms. Parichart Laksanawimol, Kasetsart University • **Reviewing information in support of NDF framework**: Dr. Sarah Foster, Project Seahorse
12:30 – 13:30	*Lunch Break*
13:30 – 15:30	• **Habitats**: *Coral reef & mangroves Forest*: Mr. Ronnakorn Boonprakob, DMCR *Sea Grasses*: Mr. Ekkalak Rattanachart, Prince of Songkla University • **Threats:** *Seahorse catch and utilization* By Mr. Montri Sumontra, Marine Fishery Station, Ranong, DoF *Seahorses and CITES*: Mr.Suriya Jongyotha, Director of *Fisheries* Registration and Licensing Management Measures Section *Seahorse trade in Thailand*: Mrs. Yoo-ee Getpech, DoF; Dr. Amanda Vincent, Project Seahorse; Ms. Parichart Laksanawimol, Kasetsart University • **Reviewing information in support of NDF framework**: Dr. Sarah

	Foster, Project Seahorse
15.30 – 15.45	*Coffee Break*
15.45 – 17.00	• **Conservation/management** *Fishing control areas, marine protected areas in Thailand and Exclusive Economic Zone: EEZ) and Seahorse export controls*; Panel discussion • Mr.Manop Changkij, Director of Fishery Management office, DoF • Mr.San Sringam, Director of Marine fishery inspection section, Fishery management Office • Mr. Wannasak Rungrojwanich, DNP **Reviewing information in support of NDF framework**: Dr. Sarah Foster, Project Seahorse
18:30 – 19:30	*Dinner*
11 June 2013	
08.30 – 08.45	Review and Orientation
08:45 – 10:00	**Session 2: Presenting draft framework for making NDFs for seahorses**: Sarah Foster (presentation with lots of discussion)
10:00 – 10:20	*Coffee Break*
10.30– 12:00	**Revising and adapting the framework for making NDFs for seahorses**: led by Sarah Foster but mostly discussion
12:00 – 13:00	*Lunch*
13:00 – 14:30	**Session 3: Next steps for seahorses in Thailand:** led by TH CITES Authority and Project Seahorse (but mostly discussion) Setting priorities in support of adaptive management and making NDFs for seahorses in Thailand – figuring out the pragmatic way forward.
14:30 – 15:00	*Coffee break*
15:00 – 17:00	**Session 4: Designing programmes to monitor catch landings and effort data** • *Existing monitor catch landing of DoF*: Mr. Nantachai Boonjorn, Fishery and resources condition Survey and Analyst group, Research and development unit in the Central Gulf of Thailand Centre (Chumporn), DoF • *Monitoring techniques in seahorse catch landing in other countries:* Dr. Sarah Foster, Project Seahorse ***Discussion***: devising a monitoring plan for Thailand
18:30 – 19:30	*Dinner*
12 June 2013	
08.00 – 12.00	**Open session to follow up on issues, ideas, discussions that have arisen in previous days**
10:00 – 10:30	*Coffee Break*
10:30 – 12:00	**Session 4: Introducing the emerging iSeahorse citizen science programme (created by Project Seahorse) and explain how it engages volunteers to monitor wild seahorse populations and fisheries** By Project Seahorse
12:00 – 13:00	*Lunch Break*
13:00 – 14:00	**Course conclusion and evaluation**
14.00 – 14.30	**Closing ceremony & Certificate delivery:** Mr.Manoch Roongratri, Director of Marine Fisheries Research and Development Bureau

Project I.D.
0002/1306

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Website : www.nrct.net, www.nrct-foreignresearcher.org
E-mail : webmaster@nrct-foreignresearcher.org

PROGRESS REPORT SUBMISSION FORM

Please type or print in English

RESEARCH PROJECT TITLE:

Implementing CITES for Seahorses in Thailand

1. Name:

Principle Investigator – Dr. Amanda Vincent
Research team:

a) Ting Chun-Kuo
b) Tse-Lynn Loh
c) Lindsay Aylesworth
d) Sarah Foster

2. Foreign researcher registration no.:

Principle Investigator – Dr. Amanda Vincent – 37/56
Research team:

a) Ting Chun-Kuo – 40/56
b) Tse-Lynn Loh - 39/56
c) Lindsay Aylesworth - 41/56
d) Sarah Foster – 38/56

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4. Progress report no.: 2

For research duration: Starting: 16/07/2013 (D M Y) Ending: 15/03/2014 (D M Y)

5. Research site (s):

Bangkok, Samut Prakan, Nakhon Si Thammarat, Surat Thani, Chumphon, Prachuap Khiri Khan, Chonburi, Ranong, Phang-nga, Phuket, Krabi, Trang, Satun

6. Checklist for progress report submission.

These sections are to follow this submission form.

- [√] List of collaborating Thai researchers and/or Thai Institutions
- [√] Objective of research
- [√] Research methodology
- [√] Research results obtained during this period
- [√] Problems and actions to be taken
- [√] Research plan for the next period

I do hereby certify that all of the above given information is true.

…… ……..
(Foreign researcher's signature)

……March 26, 2014……
(Date)

List of collaborating Thai researchers and/or Thai Institutions:

Primary collaborating Thai researchers and institutions:
Praulai Nootmorn, Director Marine Fisheries Research and Technological Development Institute, Marine Fisheries Research and Development Bureau, Department of Fisheries
Ratanawalee Phoonsawat, CITES SA, Department of Fisheries
Yoo-ee Getpech, CITES MA, Department of Fisheries
Patrichart Laksanawimol, PhD Candidate, Department of Marine Science, Faculty of Fisheries, Kasetsart University

Additional collaborating Thai researchers and/or Thai Institutions:
- Andaman Sea Fisheries Research and Development Center of Phuket – field logistics, port logistics and seahorse buyers in Phuket
- Chumphon Provincial Marine Fisheries Station - logistics for port interviews in Chumphon and a collaborative day in January
- Phang-nga Provincial Marine Fisheries Station - provided staff and logistical support for research in Koh Kloei, Tablameau, Koh Mook and Koh Lanta, including collaborative research days in Koh Mook and Koh Lanta.
- Phuket Aquarium - Aquarium seahorse breeding situation introduction
- Samut Prakan Provincial Marine Fisheries Station - logistics for port interviews and seahorse buyers in Prachuap Khiri Khan and a collaborative day in January
- Satun Provincial Marine Fisheries Station - logistics for port sampling and interviews in Kantang, Satun and Koh Sarai, including a collaborative day of research on Koh Sarai in June.
- Siam Ocean World - Aquarium seahorse breeding situation introduction
- Department of Fisheries Geospatial Analysis Department – capacity building for seahorse observation maps and temporary access to national park shapefiles and Thai bathymetry data.
- New Heaven Reef Conservation Program (Koh Tao) and Dive Tribe Thailand (Pattaya) –iSeahorse collaborators.

Funders:
Field research and staff were co-funded by: Guylian Chocolates, Belgium; John G. Shedd Aquarium, Chicago; People's Trust for Endangered Species; Ocean Park Conservation Foundation Hong Kong; Bottom Billion Fieldwork Fund; FBR Capital Investments; Riverbanks Zoo and Garden Conservation Support Fund; SciFund Challenge; The Explorer's Club Exploration Fund

Report pre-amble:
This report to NRCT for the research project entitled "Implementing CITES for Seahorses in Thailand" is intended to summarize the activities and results for roughly the second six months of the two year project. It is being submitted by Project Seahorse, but represents the collaborative efforts of Project Seahorse and the Thai Department of Fisheries.

There were four main research activities in support of our collaboration:
- Research activity A: Trade research
- Research activity B: Rapid assessment protocol (RAP) of Thai seahorse populations
- Research activity C: Seahorse life history research
- Research activity D: Seahorse population status under human pressure

For clarities sake, we have broken the report into three sections based on these activities – we report on each of activities A and B separately, but combine activities C and D into one section as they are highly complementary.

Second report to NRCT on Research activity A: Trade research

a collaboration between Project Seahorse (The University of British Columbia)
and the Thai Department of Fisheries

Objectives of research as stated in proposal to NRCT:
The objective of trade research is to generate and share new knowledge about seahorse biology, fisheries and trade that might affect implementation of the CITES Appendix II listing for Thai species**.**

Update on activity:

As reported in our 6 months progress report to NRCT (submitted August 2013), our trade research in support of Activity A managed to obtain novel information from a good number of fishers and primary buyers in Thailand. However we were unable to interview a sufficient number of upper level traders, especially exporters and wholesalers. It is important we obtain these data to complete the picture of seahorse trade in Thailand.

To resolve the issue, Project Seahorse found additional funding and contracted Dr. Parichart Laksanawimol, Thai seahorse expert based at Chandrakasem Rajabhat University, to fill this important data gap with further interviews at upper levels of the trade.

Dr. Laksanawimol will execute surveys of upper level traders, wholesalers and exporters of seahorses in Bangkok and surrounding regions. She will gather information on seahorse biology, volumes, values (at different trade levels), uses (domestic and international), trade structure, trade routes, and seasonality of the trade in Thailand. She will also probe temporal trends and geographic differences in these parameters. Information will come from (a) interviewing a wide array of participants in trade, and (b) measuring seahorses in trade.

Dr. Laksanawimol will submit her final report to Project Seahorse mid-April 2014. The results of her research will then be combined with those already obtained during earlier trade surveys to complete our analysis and report to CITES Thailand. We also expect to publish the complete results of the trade research in a primary journal.

Second report to NRCT on Research activity B: Rapid assessment protocol (RAP)

a collaboration between Project Seahorse (The University of British Columbia)
and the Thai Department of Fisheries

Objectives of research as stated in proposal to NRCT:
We need to conduct rapid in-water surveys to obtain essential information on seahorse distribution, density, sex ratio, size distribution and habitat preferences throughout Thailand. We will then (i) map seahorse distribution, identifying high density areas, to support CITES recommendation e, and ii) prepare a status report for seahorse populations, their locations, and types of habitats they depend on in support of CITES recommendations.

Introduction

Seahorses (*Hippocampus* spp.) are featured heavily in global wildlife trade both as dried (traditional medicines or curios) and live (aquaria) specimens (Vincent et al. 2011). This trade provides valuable cash flow to low-income communities, especially subsistence fishers in developing countries (Vincent 1996, Vincent et al. 2007). The seahorse trade for traditional medicine is particularly significant in Southeast Asia (Choo and Liew 2005, Giles et al. 2006, Perry et al. 2010, Vincent et al. 2011), with tens of millions of dried seahorse exported annually (Vincent et al. 2011). The main source of dried seahorses is trawl bycatch (Baum and Vincent 2005, Giles et al. 2006, Perry et al. 2010), while live animals are specifically targeted for capture (Rosa et al. 2006, Perry et al. 2010).

Since seahorses are slow-moving, have limited home-ranges, exhibit mate-fidelity and have low fecundity relative to other fish species, they are prone to overfishing (Foster and Vincent 2004), and the current harvest rates of seahorses are of great concern (Vincent et al. 2011). In addition, seahorses are sensitive to habitat degradation caused by trawling on soft-bottom environments, dynamiting of coral reefs, and other destructive capture methods (Duarte 2002, Marcus et al. 2007), further impeding population recovery. However, the geographic range, population size and habitat preferences for many species are still unknown, making it difficult to assess population impacts and manage trade. At present, there are 14 recognized seahorse species in Southeast Asia (Lourie et al. 2004), and six of these are listed as "Data Deficient" on the IUCN Red List.

All seahorses are listed on CITES Appendix II, requiring the 175 signatory nations (Parties) to cooperate on seahorse conservation. CITES official data indicate that Thailand is the principal source of seahorses for trade, exporting an average of five million individuals per year (UNEP-WCMC, 2013). A lack of basic information on distribution, habitat and abundance means that the sustainability of this exploitation cannot be assessed. Given the scale of its exports – and Thailand's challenges in regulating them – the CITES Animals Committee has deemed Thailand's trade in several seahorse species to be of "Urgent Concern", and suggested action that might help Thailand fully implement the Convention for three species of seahorses. One of these recommendations was to "undertake studies to provide evidence on variation in the spatial and temporal abundance of the three species of *Hippocampus* to enable areas of high seahorse density to be identified…, as the basis for considering area restrictions on nonselective fishing gear that obtains *Hippocampus* species as bycatch".

The aim of this project was to support Thailand to meet this recommendation by documenting seahorse distribution, variation in spatial abundance and habitat preferences in Thailand, to enable areas of high seahorse density, or hotspots, to be identified as the basis for considering spatial management opportunities. Mapping these hotspots onto the distribution of Thailand's MPAs and other spatial management will allow us to understand what protection such measures provide for Thai seahorses, and what additional area restrictions are needed in support of seahorse management and conservation. The results from this mapping exercise will also inform priority areas for further monitoring and conservation action.

Our initial efforts towards this aim were carried out from February to April 2013, and involved searching for seahorses along the Andaman coast of Thailand using random belts transects. Only eight seahorses were sighted at 14 sites in spite of a huge survey effort; we surveyed a minimum total area of 1000 m^2 and a maximum total area of 2000 m^2, per site (Project Seahorse and DoF, 2013). It became apparent that surveys restricted to areas defined by transects were not conducive to finding seahorses, which are typically found in low densities or rare, have patchy distributions, and are highly camouflaged. We instead needed a survey method that is flexible enough to increase the chances of spotting seahorses underwater, yet rigorous enough for spatial and temporal comparisons. As such, a novel methodology was developed for the citizen science program iSeahorse, as part of a comprehensive monitoring toolkit for wild populations of seahorses, iSeahorse Trends.

With this new survey methodology, our focus turned once again to finding seahorse hotspots. Mapping these hotspots onto the distribution of Thailand's MPAs and other spatial management will allow us to understand what protection such measures provide for Thai seahorses, and what additional area restrictions are needed in support of seahorse management and conservation. The results from this mapping exercise can be applied to assess the sustainability of seahorse trade from Thailand, and will feed into an adaptive management framework for seahorses. The objectives of our second field season, carried out from September to October 2013 and primarily focused in the Gulf of Thailand and around Phuket, were to:

- Identify and ground-truth seahorse hotspots in Thailand
- Characterize seahorse populations at hotspots

Materials and Methods

Finding seahorse hotspots

Prior to heading to the field we made a concerted effort to extract seahorse sightings from all available sources of information including but not limited to internet resources, popular media, survey reports and published articles. An appeal to report seahorse sightings and localities around Thailand was also made through mass emails, list-servs, social media (Facebook and Twitter) and direct contact with scuba divers and local dive shops. The appeal for sightings was also translated and posted on Thai online forums where local scuba divers interact.

Field Surveys - hotspot identification and ground-truthing

Seahorse surveys were based on methods developed for the iSeahorse Trends toolkit for underwater surveys. Survey sites were selected based on information gathered through email and social media outreach, and from anecdotal information obtained on site visits. Instead of searching a fixed transect area, a random swim, or survey "run", was conducted for each scuba dive or snorkeling session. Surveyors searched for seahorses during a run and recorded distance traveled and total active search time. When seahorses were encountered, characteristics such as sex, reproductive state, torso length

and habitat type were recorded. Only seahorses found outside of national parks were handled to obtain measurements. One to three runs were conducted at each survey site, and 250-300ml of seawater was collected at survey depth at each site for water quality analysis. From September to October 2013, a total of 44 sites were surveyed at the following locations- Ko Tao (Surat Thani), Ban Tong Tom (Chumphon), Laem Por (Surat Thani), Khanom (Nakhon Si Thammarat), Ao Nang (Krabi), Thung Walen (Chumphon), Ao Por (Phuket), Pattaya (Chonburi), Samaesan (Chonburi) and Ko Kood (Trat) (Figure B1). The survey team primarily consisted of the principal investigator (T-L Loh) and experienced field assistants. At Ko Tao, the team was assisted by staff of the New Heaven Conservation Reef Program, who teaches and runs seahorse monitoring surveys. A senior aquarist from Shedd Aquarium assisted with fieldwork at Ko Tao, Ban Tong Tom, Laem Por, Khanom and Ao Nang, and dive guides helped with finding seahorses on surveys conducted at Ao Nang, Pattaya and Ko Kood.

Informal interviews

With the help of local research assistants, we spoke with 35 people, including fishers, boat captains and crew, dive guides, villagers and officers from the Rayong office of the Department of Fisheries to try and determine where seahorse populations could be found. When applicable, we also requested examinations of dried seahorse collections to assess the species caught in the area, the average sizes of seahorses caught and the relative proportions of each species in the collection. Questions varied by person but usually included asking about catch or sighting per unit effort, fishing grounds, seasonal sightings of seahorses and estimations of changes to seahorse populations over the last decade.

Results

Finding seahorse hotspots

From the information gathered through email blasts and social media outreach, the following locations were identified as locations where seahorses were frequently spotted by divers- Pattaya and the surrounding area, the local islands off Ao Nang, the local islands off Phuket and Ko Tao. Respondents also suggested areas of interest such as a homestay in Chumphon province, Tong Tom Yai Homestay, which attracts visitors to view the seahorses living under the homestay building.

Field Surveys - hotspot identification and ground-truthing

From the surveys, seahorses were found at six of the ten survey locations- Ko Tao, Ao Nang, Pattaya, Samaesan and Ko Kood, and 15 of the 44 survey sites (Figure B1). Further details by site are found in Table B1.

Figure B1. Map of seahorse survey sites. Seahorses were observed at sites labeled green, and none were observed at sites labeled red. The numbers on the labels correspond to site numbers in Table B1.

Table B1. Summary of field surveys to identify and ground-truth potential seahorse hotspots. The average individual search time was multiplied by the number of surveyors for each run. Sites where surveyors snorkeled are highlighted in blue.

No.	Location	Site	No. of runs	No. of seahorses	Species	Dist. traveled/m	Search time/min	Habitat type	Depth range/m
1	Ko Tao	Mango Bay	3	1	*H. kuda*	255, 280, 230	180, 125, 148	Coral rubble, sand, silt	11-27
2		Ao Leuk	5	0	-	250, 250, 242, 242, 242	128, 180, 76, 114, 76	Sand	5-14
3		Hin Wong	3	0	-	142, 285, 280	108, 136, 196	Coral pinnacle, rock, sand	8-27
4		Twins	3	0	-	198, 198, 300	104, 128, 152	Coral rubble, sand	5-20
5	Ban Tong Tom	Tong Tom Yai Bay	1	0	-	200	200	Silt, sand, gorgonians	2-3
6	Laem Por	Phum Riang Bay	1	0	-	200	69	Sand with seaweed	3
7		Ko Sed	1	0	-	300	90	Sand with sponges	3
8		Mussel farm	1	0	-	150	120	Mussel poles on mud	3
9	Khanom	Ao Thong Node	1	0	-	500	330	Rock, patchy coral	2-3
10		Ko Tha Rai	3	0	-	70, 200, 200	330	Seagrass	0-2
11	Ao Nang	Ko Mae Urai	1	7	*H. comes, H. kuda*	250	148	Coral reef	9-17
12		Ko Yawasam	1	1	*H. comes*	320	152	Coral reef	4-15
13		Ko Ha	1	0	-	250	256	Coral reef	10-15
14		Ko Kom	1	2	*H. comes*	330	192	Coral reef	8-10

15		Ko See	1	0	-	310	216	Coral reef	6-8
16		Ko Tang Ming	1	1	*H. comes*	280	144	Sand, rock	4-13
17		Ko Tup	1	0	-	400	156	Sand, silt, shallow reef	3.5-14
18	Thung Walen	Ko Lak Ngam	1	0	-	280	78	Pinnacle	20
19		Ko Ngam Noi	1	0	-	380	56	Sand, pinnacle	13-22
20		Ko Keh	1	0	-	200	60	Sand, patchy coral, rock	2-3
21	Ao Por	Ao Por 1	2	0	-	100, 150	96, 26	Seagrass, silt	1.5-2.5
22		Ao Por 2	2	1	*H. comes*	100, 250	92, 34	Sand, rock, patchy coral	1.5-8.5
23	Pattaya	Ko Pai	1	11	*H. spinosissimus*	150	87	Sand, some bivalves	7-11.5
24		Ko Sak	1	2	*H. spinosissimus*	50	150	Artificial reef (concrete)	7-11
25		Khram Wreck	1	0	-	170	69	Shipwreck with sand/shell bottom	27-28
26		Ko Sak East	1	1	*H. spinosissimus*	250	183	Sand	5-11
27		Ko Klung Bedan	1	3	*H. spinosissimus*	300	171	Sand, rubble, shell	4-11
28		Ko Rin	1	0	-	100	159	Patchy coral, rock, sand	2.5-13
29		North Rock	1	0	-	300	156	Coral reef	4-19
30		Ko Lan	2	16	*H.*	65, 120	119, 99	Artificial reef	12-16.5

					spinosissimus			(concrete)	
31	Samaesan	Hardeep Wreck	1	0	-	200	32	Shipwreck, sand bottom	24-27
32		Ko Chan	1	1	*H. spinosissimus*	400	66	Silt	10-24
33		Ko Chan N	1	1	*H. spinosissimus*	550	58	Sand	5-22
34	Ko Kood	Ban Bao	6	2	*H. spinosissimus*	350, 350, 350, 250, 250, 250	65, 65, 65, 34, 34, 34	Sand	1.5-7.5
35		Hat Khlong Chao	1	0	-	80	69	Silt	18-20
36		Khlong Chao shallow	3	0	-	300, 300, 300	38, 38, 38	Sand	3-7.5
37		Ao Ta Kien	1	1	*H. spinosissimus*	150	186	Rubble	9-13
38		Ao Lang Aurn	1	0	-	300	123	Sand, patchy coral	7.5-9
39		Ko Maisi	1	0	-	200	117	Sand, small rocks	4-8
40		Ko Raed	1	0	-	100	168	Fish cages, shallow reef, sand	2-5
41		Artificial reef	1	0	-	80	69	Artificial reef (concrete)	17
42		Ao Khluai	1	0	-	400	261	Sand, rubble	10
43		Ao Jak	1	0	-	150	165	Sand, silt	4-8
44		Ao Yoi	1	0	-	200	135	Sand, silt	3-9

Three seahorse species were recorded in this survey series- *H. comes*, *H. kuda* and *H. spinosissimus*. *Hippocampus comes* was only found on coral reefs along the Andaman coast, at Phuket and Ao Nang, *H. spinosissimus* was only recorded within the Gulf of Thailand, on sand, silt and rubble, and *H. kuda* can be found along both coasts in reef and sandy habitats. The mean torso length of adult *H. spinosissimus* was 47.8 ± 3.3 (SE) mm (n=28), and 11.7 ± 0.4mm for juveniles (n=8). Individuals of *H. comes* and *H. kuda* were all found within the Hat Noppharathara National Park, except for one *H. comes* at Phuket, which had a height of 120mm. One of the ten *H. comes* observed was a juvenile, and no juveniles were recorded for *H. kuda* (n=3). Of the adult seahorses, the female to male sex ratio for *H. comes*, *H. kuda* and *H. spinosissimus* was 4:5, 2:1 and 21:7 respectively. Ten of the 13 male seahorses encountered were pregnant, and many pregnant males were found in close proximity to a female seahorse.

Informal interviews

From informal interviews, seahorses can also be found at Ban Tong Tom, Laem Por and Khanom, despite not encountering any in our surveys. Dried individuals of *H. trimaculatus* were common in dried seahorse stockpiles at Laem Por and Ko Kood, with a few individuals of *H. spinosissimus* (usually ~10%). According to a boat captain at Bang Saray, Chumphon Province (n=1), the trawling boats frequently catch *H. trimaculatus* at 30-40m around Ko Rin, off Pattaya. The boats that land at Samaesan pier trawl from Prachuap Khiri Khan to Samaesan, and a boat captain (n=1) estimated catching 20-30 seahorses every two weeks from an average trawl depth of 25m. Villagers at Ban Tong Tom (n=6) and Laem Por (n=12) reported catching individuals of *H. kuda* prior to our arrival on site. Small-scale fishers (n=2) reported that they used to release seahorses if accidentally caught in fishing gear such as gill nets, but as the price of seahorses has increased, some fishers now keep seahorses from bycatch to sell to brokers. Most of the interviewees (n=32/35) thought that seahorse populations in their area had declined over the past ten years. The owner of a gift shop at Fossil Beach, Ao Nang, said that she does not sell many souvenirs made from seahorses these days are seahorses are hard to find now. Overall, reported estimates of seahorse declines range from 50-90% (n=32), with only three of the 35 respondents (all fishers) indicating that there were no population declines over the past decade.

A few respondents reported that trawling takes place within the 3 km trawling exclusion zone. Small-scale fishers, villagers and dive professionals from Ban Tong Tom (n=1), Thung Walen (n=2), Ao Nang (n=1), Laem Por, Khanom (n=1) and Ban Laem Prathap, Khanom (n=1) reported that bottom trawling occurs within 1 km of the shore, with trawl boats coming from other provinces. Aside from removing fish stocks, interviewees were concerned that bottom trawling would damage the shallow habitats. The dive guides from Chumphon Cabana at Thung Walen (n=2) mentioned that trawl nets can be found in protected areas such as within the Mu Ko Chumphon National Park. On the topic of enforcement, interviewees perceived that there are not enough officers in the area to arrest the crew of boats trawling within the exclusion zone, and that trained volunteers are needed as well. Besides seahorses, respondents from Ban Laem Prathap (n=3) and Ko Kood (n=2) indicated that populations of other fish species have declined. In Ban Laem Prathap, the three villagers interviewed reported switching from fishing to agriculture and tourism, and on Ko Kood, the two trawler fishers interviewed now catch small fish for animal feed instead of food fish for human consumption.

Discussion

The results of this study contribute to our understanding of seahorse distributions along the coasts of Thailand. From the results of our surveys and interviews, two species of interest in trade- *H. kuda* and

H. spinosissimus, can be found along both the Andaman coast and in the Gulf of Thailand. *Hippocampus trimaculatus* was never encountered in-water during surveys, but appeared to be frequently netted as bycatch by trawlers operating in waters deeper than 25m. The tiger tail seahorse, *H. comes*, was only observed along the Andaman, at Ao Nang and off Phuket. The survey sites Ko Lak Ngam and Ko Ngam Noi off Thung Walen, and off Khanom and Ao Nang were within National Parks, however, seahorses were only found off Ao Nang. The waters around Ko Tao are now part of a newly designated marine protected area administered by the local community, with zoning regulations and restricted fishing.

In line with our survey findings from February to April 2013, *H. comes* appears to be associated with reef habitats, while *H. kuda* can be found in a variety of habitats including coral reefs, mangroves and sandy bottoms. From our surveys, *H. spinosissimus* is not usually associated with coral areas, and is found more frequently in sandy, silty, or rubble habitats. At sites off Pattaya, *H. spinosissimus* commonly uses pencil urchins as a holdfast.

The highest abundance of seahorses was found at an artificial reef off Ko Lan, Pattaya, with a total of 16 seahorses, or 8.6 seahorses/100m surveyed. Seahorses were also common at Ko Pai, Pattaya (7.3 seahorses/100m) and Ko Mae Urai, Ao Nang (2.8 seahorses/100m). The outer islands off Pattaya including Ko Pai are part of a marine protected area regulated by the Thai Royal Navy. Ko Lan and Ko Sak are considered part of the inner islands near Pattaya, which are not within a marine protected area, however, they fall within the commercial fishing exclusion zone that covers the entire coastline of Thailand. Ko Lan is also heavily visited by tourists year-round, which may deter fishing activity in the area. It was heartening to note that most of the male seahorses found were pregnant, especially at Ko Lan, indicating that this site may be an important source of seahorse recruits.

While Thailand has several measures already in place to regulate fishing pressure and designate no-take zones, it is clear from our conversations with local community members that enforcement of these regulations may be an issue. Several people reported incidences of illegal trawling activity within 3km of the shoreline, which intersects with shallow seahorse habitats. We also do not know the impacts of trawling deeper waters on populations of species such as *H. trimaculatus* and *H. kelloggi*. Information from these surveys and informal interviews need to be integrated with data from fisher interviews and port sampling for a fuller understanding of seahorse distribution and threats in Thailand.

The identification of a few seahorse hotspots in Thailand is useful, but there is still a need to improve the spatial analysis of seahorse presence in Thailand, starting with the proportion of potential habitat occupied by seahorses. This may be addressed by an occupancy study to determine how often seahorses occupy different habitat types will be carried out by Project Seahorse and DoF in 2014 along both the Andaman and Gulf coasts. iSeahorse, the citizen science site for seahorses (www.iSeahorse.org), can also provide valuable information on seahorse distribution, especially from visitors to National Parks. Additional independent trawl surveys can help to determine seahorse location and species composition in deep offshore areas as well.

In the meantime, decision makers in Thailand could consider protecting known seahorse hotspots such as Pattaya from future fishing efforts. This could be achieved by establishing and maintaining relationships with local stakeholders such as conservation groups and dive shops to collaboratively manage the seahorse areas. These community groups can then act as local monitors or enforcement agents to continue collecting data on seahorse populations, and ensure the longevity of the populations in the area.

Second report to NRCT on research activities C and D: Seahorse life history research and Population status under human pressure

a collaboration between Project Seahorse (The University of British Columbia)
and the Thai Department of Fisheries

Objectives of research as stated in proposal to NRCT:

C. Life history research – The objective of the life history research is to determine critical parameters needed to model seahorse population responses to exploitation pressures – and thus to improve management measures.

D. Population status under human pressure – The objective of this research is to determine how seahorse populations are faring under different human pressures (e.g. trawling and other fishing pressures). Building population models that examine the outcomes of management modification for particular species in full support of the CITES recommendations requires an understanding of: i) the extent of human pressure acting on the marine environment in Thailand; ii) seahorse population response to human pressures; iii) seahorse life history responses to human pressures; and iv) seahorse habitat responses to human pressures.

Research Methodology:

We originally chose the Andaman coast of Thailand as the focal area for research activities C and D to complement existing research on seahorses in Thailand. Research carried out by Parichart Laksanawimol, PhD student at Kasetsart University, has generated novel information on *H. kuda* and *H. spinosissimus* in the eastern Gulf of Thailand. However information on *H. kelloggi* in Thailand, or indeed elsewhere in its range, is nonexistent. We therefore decided to prioritize this species for our research – and enumerator surveys conducted by the Thai Department of Fisheries (DoF) indicated the majority of *H. kelloggi* are caught on the Andaman coast. In addition to information on *H. kelloggi*, we will be able to gather new information on the two other seahorse species – *H. kuda* and *H. spinosissimus*, which may reveal important geographical patterns in their life history and ecology (when compared to the Gulf).

However, our first round of research activities in Thailand found few wild seahorse populations along the Andaman coast (see report on activity B). As a result we have added several research sites along the central and northern Gulf Coasts to our sampling for life history research (activity C). These new sites are based off the results of the Gulf rapid assessment research (activity B), and reports of repeated sightings of H. *kuda* and H. *spinosissimus* from divers on www.iSeahorse.org – a citizen science venture for seahorses. Including these sites should help to ensure we have sufficient sample sizes to generate life history estimates.

C. Life history research

Information on the life history of Thai seahorses will be obtained from both underwater and fisheries sampling. Our activities thus far have focused on the latter of these approaches, with underwater sampling set to start in February 2014 on the Andaman Coast and May 2014 in the central and northern Gulf of Thailand.

By sampling at landing sites from May-August 2013, we documented fishers' seahorse catches. This research approach is used to gather information on seahorse biology, ecology, and seasonality of seahorses in Thailand. By interviewing fishers we have collected information on species, size, sex, reproductive status and distribution of seahorses, before they were returned to the fishers to handle as they would normally (i.e. retain or discard).

Initial life history analysis was performed by generating the following descriptive information per species - the total number of individuals, average height, smallest pregnant male as determined by the presence of a fully developed brood pouch on the male's tail, total number of pregnant males, total number of juveniles, and sex ratio.

D. Population status under human pressure

Research started in late May 2013 to understand the extent of human pressure acting on the marine environment in Thailand, and how seahorses are faring under this pressure. The information needed for this research was collected during the same interviews used to sample for life history information, Activity C. Fishers from both commercial and small-scale fisheries participated in semi-structured interviews and participatory mapping to answer general questions about their behavior, fishing grounds, and areas of high seahorse bycatch. The interviews are designed to highlight fishers' decisions about location, frequency, gear type and duration of fishing, while mapping allows for spatial representation of fishing pressure and effort in the coastal seascape. Additionally during port sampling information was gathered on methods of extraction (e.g. target/incidental), catch per unit effort, and seasonality of seahorse catches in Thailand.

To date our participatory mapping with fishers has yielded two types of maps. The first identifies spatial extent of fishing effort by commercial and small-scale fishers on the Andaman Coast. Fishers were asked to map their fishing grounds on a computer tablet. Information on depth of fishing activities, and geographical reference points were recorded for each fishing ground to edit maps for accuracy based on these constraints. The second set of maps, identify reported areas of seahorse occurrence as reported by fishers (interviewed during activity C) and divers (as part of activity B). Some fishers identified seahorses by species or provided dried specimens; others identified seahorses as either smooth or spiny but generally reported size or depth ranges. These general descriptions of seahorses were included in species maps based on morphological characteristics, and / or known size or depth ranges for *H. kelloggi, H. kuda* and *H. spinosissimus*.

To date maps have been made with raw-data only, meaning that spatial extent of fishing grounds and location of seahorse occurrences have yet to be edited by depth or geographical reference points. Therefore the results of these maps should be interpreted with caution. These maps were created in ArcGIS 9.1.

Research results to date:

C. Life history

Between May and August 2013, we interviewed 175 fishers at ports and in fishing villages in Phuket, Phang-nga, Krabi, Ranong, Trang, and Satun provinces. During this time we recorded species information from a total of 256 individual seahorses, but were only able to measure 231 individuals for life history characteristics. The vast majority of these seahorses (n = 189) were sampled from trawl catches, with 36 seahorses sampled from gillnets, five from purse seiners, and one from a compressor

diving fisher. Six of the seven species found in Thailand are represented in these fisheries catches, with the majority of individuals from *H. spinosissimus*, *H. kelloggi* and *H. trimaculatus* (Table C1).

Table C1. Initial analysis of life history data from six *Hippocampus* species sampled at landing sites along the Andaman Coast. Results include the total number of sampled individuals, average height of individuals in centimeters, previously estimated size at first maturity, height of smallest pregnant male, total number of pregnant males, number of juveniles and sampled sex ratio. *For *Hippocampus trimaculatus,* an additional 25 individuals were observed and identified to the species level, but we were unable to record additional life history information.

Species	***H. comes***	***H. histrix***	***H. kelloggi***	***H. kuda***	***H. spinosissimus***	***H. trimaculatus***
No. of individuals	6	2	65	2	67	89*
Average height (cm)	14.2	11.3	17.5	15.8	12.9	11.9
Estimated sizes at first maturity (previous studies)	8.1[1]	7.9[1]	15.0[1]	14.0[1]	10.0[2]	9.1[2]
Smallest pregnant male (cm, this study)	16.7	10.2	15.2	N/A	11.2	7.5
Total no. pregnant males	2	1	17	0	13	20
No. of juveniles	0	0	8	0	7	16
M: F ratio	1: 1	1:1	1:1.3	0: 2	1: 1.0	1:1.2

[1] Foster & Vincent 2004
[2] Lawson et al, Project Seahorse, unpublished data

Sex ratios were close to one to one for all species except for *H. kuda*, where both sampled individuals were female. We found the largest number of juveniles for *H. trimaculatus* but did not observe juveniles in our port sampling for *H. comes, H. histrix,* or *H. kuda.* The smallest pregnant males observed in this study were comparable in size to previously estimated sizes at first maturity for *H. kelloggi*, *H. spinosissimus* and *H. trimaculatus*. We still need to model population size at maturity with our samples to make a proper comparison to past research. Unfortunately, we can not yet model maturity for *H. comes*, *H. histrix* or *H. kuda* due to small samples sizes.

D. Population status under human pressure

We experienced a great deal of co-operation and interest from the fishers during interviews for this portion of our research. We conducted interviews in Krabi, Phuket, Phang-nga, Ranong, Satun and Trang provinces. Of the 175 fishers that have participated in the semi-structured interviews and participatory mapping: 44 worked on trawlers; 29 on purse seiners; and the rest (102) used a variety of small-scale fishing gears such as gillnets and cages (Table D1). Note that some fishers reported using more than one gear type and therefore totals by gear type do not equal the total number of fishers interviewed.

Table D1: The number of fishers interviewed by province and their reported types of fishing gear.

Gear Type	Trawl	Purse Seine	Gillnets	Cage	Other	Total Fishers Interviewed
Province	---	---	---	---	---	---
Krabi	0	5	13	12	0	**23**
Phang-nga	12	7	33	3	6	**52**
Phuket	13	10	11	5	8	**40**
Ranong	0	0	0	2	0	**2**
Satun	9	7	15	2	0	**33**
Trang	10	0	14	6	2	**25**
Total	**44**	**29**	**86**	**30**	**16**	**175**

Fishing Effort Maps

Interpreting the maps: The fishing effort map in Figure D1 is a *draft map* only. They have been edited for accuracy according to depth, but have not been crosschecked against fisher reported landmarks or travel times from shore. And critically, they have yet to be validated with the fishers themselves. The maps reflect the cumulative fishing effort reported by 73 commercial fishers and 102 small-scale fishers. **Additional editing of the maps must occur before they can be considered final.**

Small-scale fishers*:* Small-scale fishers (n=102) reported few areas along the coast that are fished only by small-scale fishers. The majority of these reported areas are in Phang-nga Bay and around several of the islands south of Koh Lanta. Small-scale fishers reported using the following gears: fish, crab, shrimp and stingray gillnets, crab cages, squid cages and squid light luring boats. Respondents also suggested that some small-scale fishers travel to nearby islands in Burma and Langkawi, Malaysia, to take advantage of fish stocks in these waters. Small-scale fishers reported fishing in waters as shallow as 1-2 m and as deep as 80 m (reported for crab cages); the shapefiles of small scale fishing effort have been edited to reflect these depths.

Commercial fishers: Commercial fishers (n=73) reported covering a large area of the Andaman Coast with their effort, including some international waters. It appears as though most of the areas reported to receive only commercial fishing effort are located quite far from the coast. Commercial fishers reported using purse seines, drop nets and trawls (both pair and otter). Several boats also reported fishing in waters off the coast of Indonesia or in international waters. Commercial fishers reported fishing as shallow as 10 m and as deep as 130 m; the shapefiles of commercial fishing effort have been edited to reflect these depths.

Small scale and commercial overlap: A large proportion of Thai waters on the Andaman Coast are reportedly fished by both small scale and commercial fishers. These areas of overlap extend all the way from Ranong to Satun and appear to include coastal and offshore waters. Consequently, these areas of spatial overlap may experience the highest levels of fishing effort. The depth ranges of these areas of overlap have yet to be assessed, but are not deeper than 80 m.

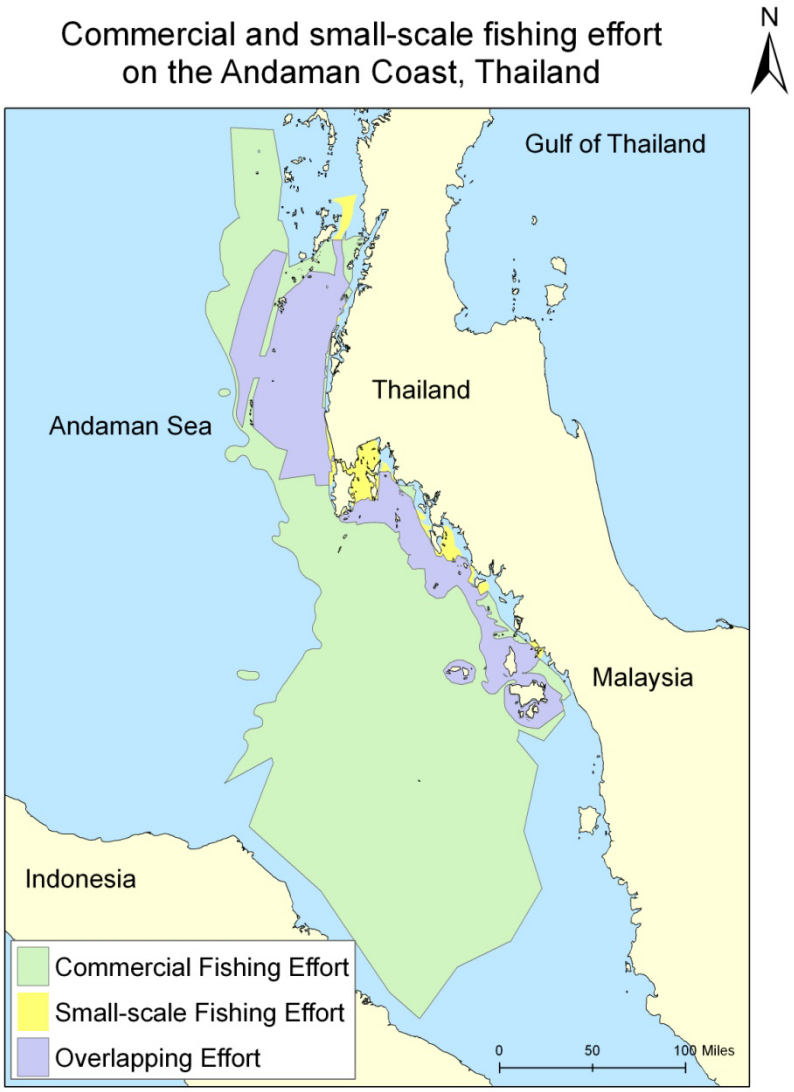

Figure D1. **DRAFT** map of reported distribution of fishing effort of commercial and small-scale fishers along the Andaman Coast of Thailand.

Seahorse Observation Maps

Interpreting the maps: The seahorse observation maps in Figures D2 through D5 are *draft maps* only. Seahorse locations on these maps were reported by fishers (interviewed during activity C) and divers (as part of activity B). Some fishers and divers identified seahorses by species or provided dried specimens, however others only identified seahorses as either smooth or spiny. All spiny seahorse reports were interpreted to mean *H. spinosissimus*, and all 'smooth' seahorses were interpreted to be *H. kelloggi*, *H. kuda* or *H. trimaculatus* based on reported morphological characteristics. The current maps have yet to be edited for accuracy according to reported and known species depth preferences. **These maps are not distribution maps for each species**, locations without observations do not necessarily reflect areas without seahorses due to biases from fishing, sampling or interview efforts. **Additional editing, including validation with stakeholders, must occur before maps can be considered final.**

Hippocampus kelloggi: The majority of reports of *H. kelloggi* come from fishers (N = 182) (note some fishers reported *H. kelloggi* from more than one location and therefore sample size of reports is larger than number of fishers interviewed). The one diver observation came from the shallow waters off Kata Beach in Phuket. A photograph accompanied this observation and Dr. Parichart Laksanawimol confirmed the sighting. Fisher observations of *H. kelloggi* appear to be evenly reported along the Andaman Coast. Most of these observations were reported by trawlers (N = 147) and gillnet fishers (N = 35) to be from very deep waters (>40 m). *H. kelloggi* was reported more frequently than *H. kuda*, but less frequently than *H. spinosissimus* and *H.trimaculatus* along the Andaman Coast.

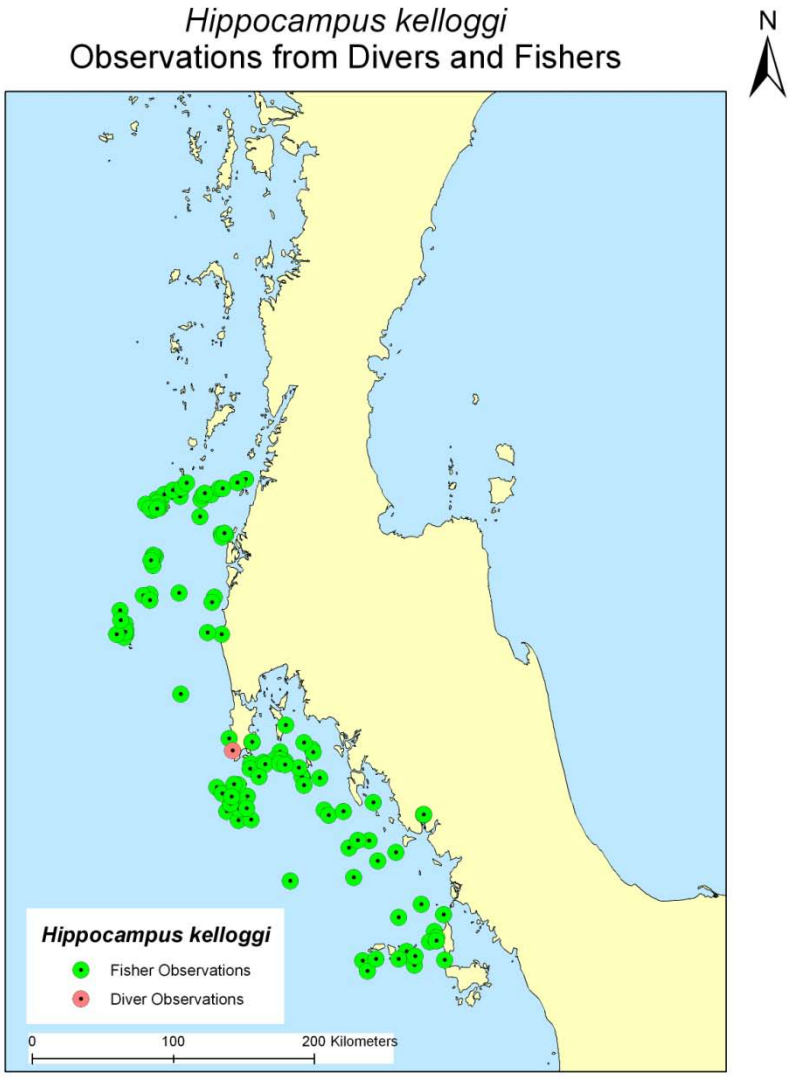

Figure D2. **DRAFT** map showing *Hippocampus kelloggi* observations from divers and fishers along the Andaman Coast of Thailand.

***Hippocampus kuda*:** Reports of *H. kuda* were for both the Andaman Coast and Gulf of Thailand. This is because the maps reflect reports by fishers (on the Andaman Coast, activity C) and by divers (on both the Andaman and Gulf Coasts, activity B). Fisher (N = 57) and diver (N=10) reports suggested that *H. kuda* is evenly distributed throughout the Andaman Coast. The only report from the Gulf of Thailand was from Koh Tao (N=2).

Diver observations of *H. kuda* were mostly from estuary areas. However several of the observations (Kata Beach and Koh Tao) were in shallow sandy bays. From diver reports, *H. kuda* was occasionally observed in habitat where other seahorse species were observed (*H. mohnikei*, *H. trimaculatus*, and *H. spinosissimus).* Few fisher observations specifically identified *H. kuda* but rather identified a smooth seahorse species, within known depth and size ranges of *H. kuda* and therefore were included in the map. *Hippocampus kuda* was the least reported seahorse by fishers along the Andaman Coast.

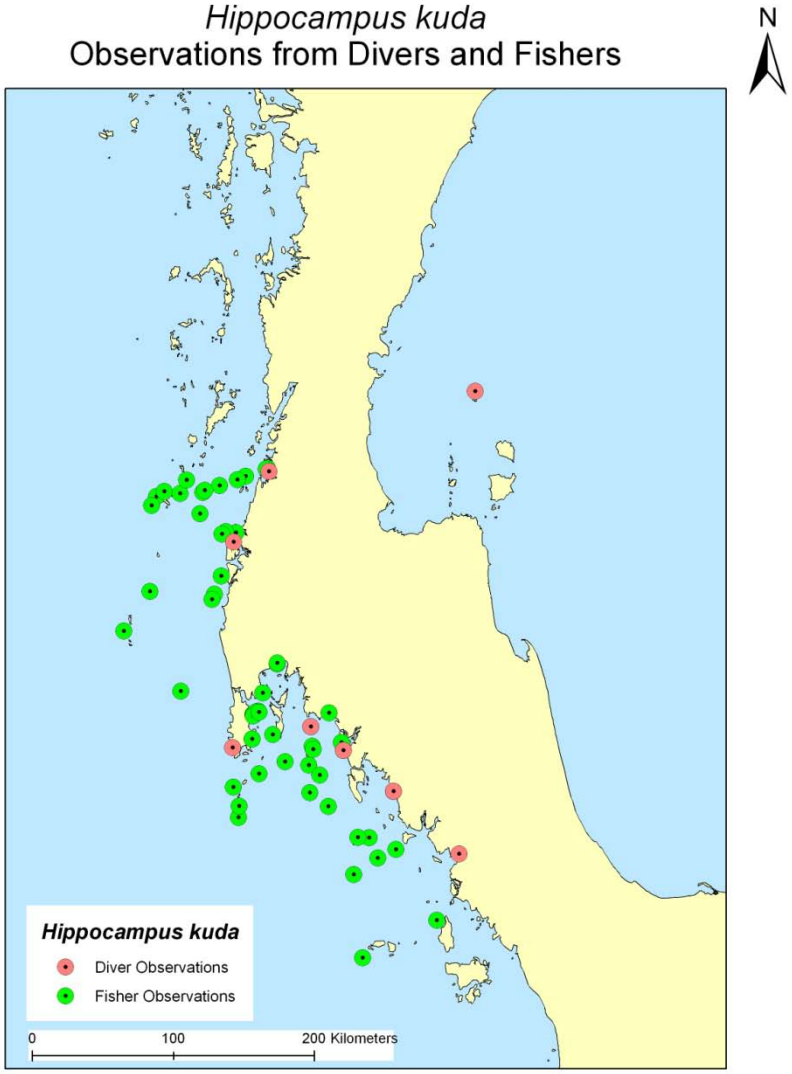

Figure D3. **DRAFT** map showing *Hippocampus kuda* observations from divers and fishers along the Andaman Coast of Thailand.

***Hippocampus spinosissimus*:** The most diver observations of *Hippocampus spinosissimus* (N =33 out of 42) came from the rapid assessment surveys (activity B) around the islands off Pattaya. Along the Andaman Coast, several sightings of juvenile *H. spinosissimus* were observed in the shallow sandy bay off Kata Beach. Fisher observations (N= 271) of *Hippocampus spinosissimus* appear to be evenly distributed along the Andaman Coast.
H. spinosissimus was the second most reported seahorses by fishers along the Andaman Coast.

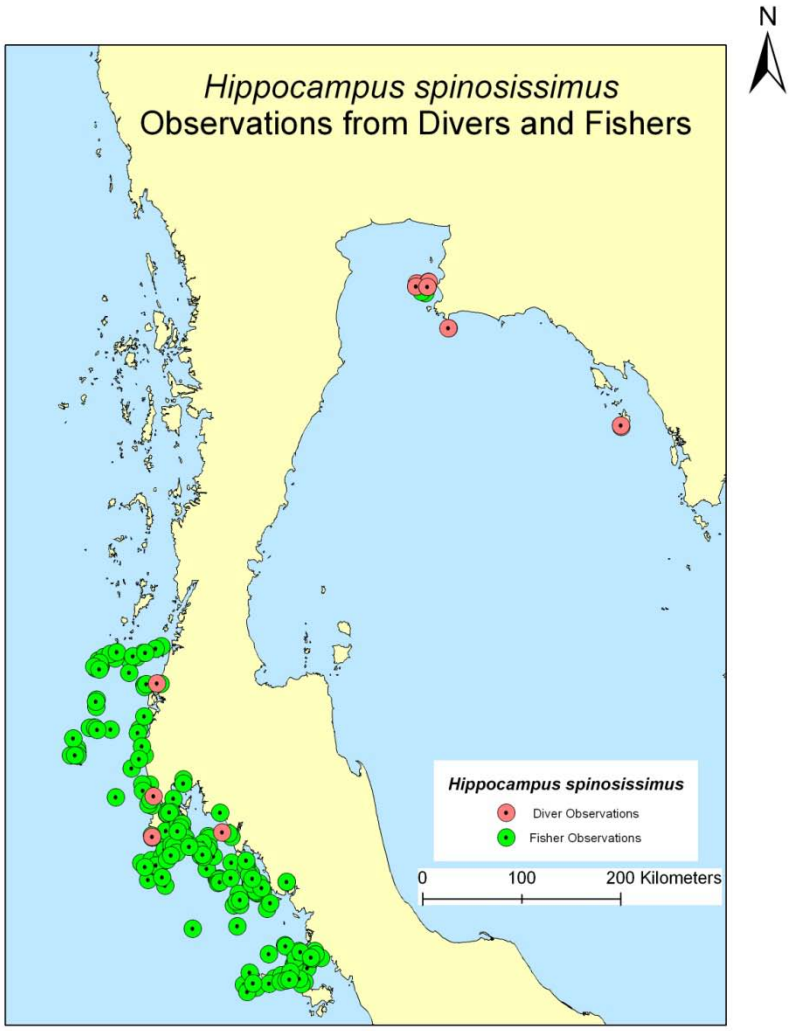

Figure D4. **DRAFT** map showing *Hippocampus spinosissimus* observations from divers and fishers along the Andaman Coast of Thailand.

***Hippocampus trimaculatus*:** Reports of *H. trimaculatus* appear to be evenly distributed along the Andaman Coast. The majority of observations of *H. trimaculatus* were reported from fishers (N=277). Diver observations (N = 13) on the Andaman coast are from sandy bays or rocky reefs. *H. trimaculatus* was the most reported seahorse species by fishers along the Andaman Coast.

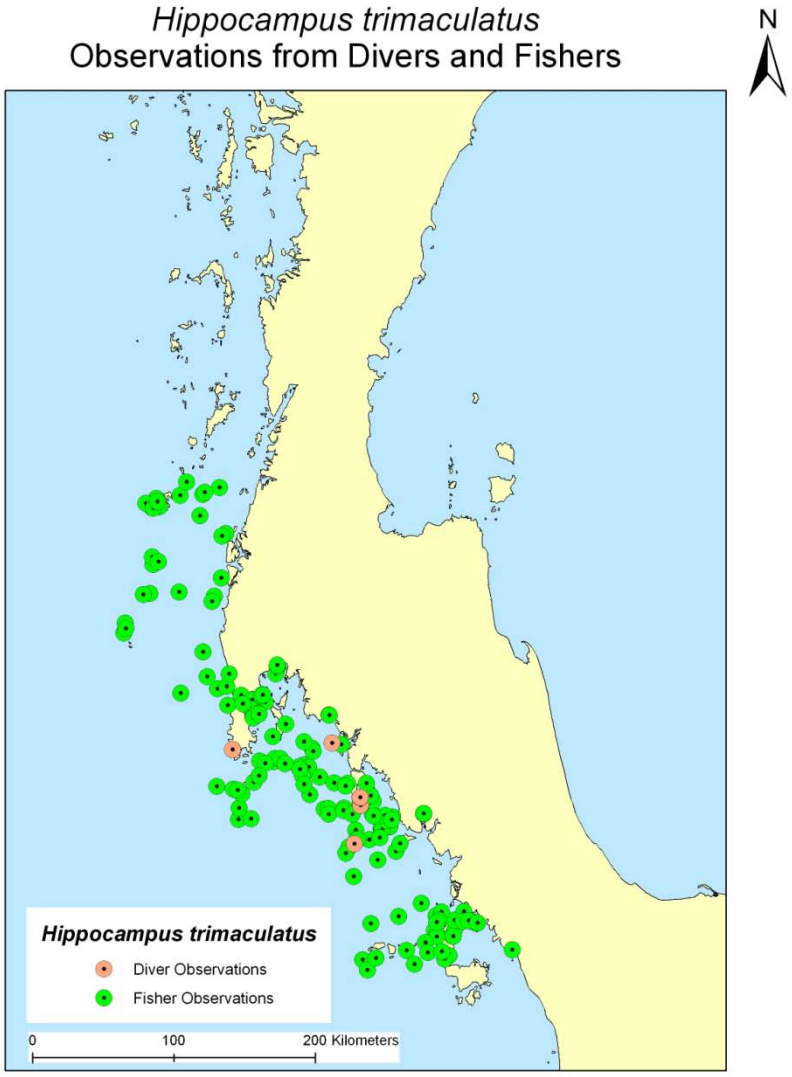

Figure D5. **DRAFT** map showing *Hippocampus trimaculatus* observations from divers and fishers along the Andaman Coast of Thailand.

Problems and Actions Taken:

C. Life History

We have yet to identify suitable research sites for the underwater portion of our life history work. We expected to determine these sites based on the results of the RAP (Activity B) – but as reported we found few seahorses.

To remedy this situation we are targeting areas of seahorse occurrence based on reports from fisher interviews and sightings data from Thailand's recreational divers through our new citizen science initiative, www.iSeahorse.org (see maps above). This will target our efforts to areas with a higher probability of finding seahorses.

D. Population status under human pressure

We require access to the Thai bathymetry data, National Park shapefiles, and habitat data from our colleagues at the Department of Fisheries (DoF) to fully edit current data and maps. This is proving challenging due to restrictions on data sharing.

As a first step to overcoming this problem, in February a collaborative effort between Project Seahorse and the Thailand Department of Fisheries was undertaken to create maps reflecting current management measures that may affect seahorses. Working alongside the DoF Geospatial Department, current fisheries management measures such as trawl exclusion zones, seasonal closures, and National Parks areas were added onto the draft maps of seahorse presence. Several maps showing bathymetric data and seahorse observations were also created. Additionally the Department of Fisheries added in sightings from their deep-water trawl surveys to create more comprehensive maps. Once finalized these maps will assist Project Seahorse and DoF to evaluate seahorse population status under human pressure through the identification of areas where current management measures are providing adequate protection to seahorse populations.

The issue now is how to update the seahorse observation maps with new data as our access to bathymetric, National Park and habitat data was only temporary. We do hope a data sharing agreement can be reached that is suitable for all Parties.

Research Plan for the Next Period:

C. Life history

The next step is to sample seahorses underwater in representative sites along the Andaman and Gulf coasts. Comparing the life history traits of seahorses that are captured to those found underwater will allow us to deduce the selectivity and therefore potential impact of fisheries on wild seahorse populations in Thailand. If sample sizes remain low, we will explore the use of additional new datasets from outside Thailand (*e.g.* Malaysia) that if combined with our data, may be used to generate life history estimates.

We will strategically samples seahorses underwater for life history at sites identified by fishers and divers (seahorse observation maps, activity D). From this stakeholder-generated list, sites in National Parks, deeper than 25 m, and more than 5 km from shore were excluded based on permit requirements and accessibility. Eight sites from the remaining list were chosen for each coast because they met at least one of the following criteria:

- Recommended by both fishers and divers
- High frequency of reports by either fishers or divers
- Reports consistently from the site over the last 6 months
- Reports from key informants with years of knowledge & experience in the area

Additionally these research sites will be focused in areas with sandy soft bottom habitats. We chose to focus on this habitat for four reasons:

- Seahorses were reported most often by fishers on the Andaman Coast from sandy soft bottom habitats.
- Results from the Thai RAP (especially Gulf of Thailand) observed seahorses in sandy soft bottom habitats.

- Several reports from divers (some of which are on i-Seahorse) indicate that *H.kuda, H. spinosissimus* and *H. trimaculatus* have all been observed in sandy soft bottom habitats on both the Andaman and Gulf Coasts.
- Efforts from the rapid assessment on the Andaman Coast in 2013 did not focus on sandy soft bottom habitats, which may have contributed to the low numbers recorded.

Our strategic approach to future sampling will enable us to re-evaluate the results of the rapid assessment (activity B) and support the creation of a seahorse distribution map (activity D).

We will continue analysis on the port sampling data by seeking to generate size at maturity, size specific survival and individual growth rates. We will also seek to increase samples through collaboration with Dr. Parichart Laksanawimol. Additionally we may use simulations or bootstrap current data to generate more robust estimates for survival, growth and maturity.

D. Population status under human pressure
There are many research activities planned for activity D in the next period.

In order to better understand *the extent of human pressure acting on the marine environment* in Thailand, we will perform the following activities:

- Continue to edit the existing fisher effort maps for spatial accuracy by geographical references, travel time to fishing grounds, and habitat.
- Determine spatial seahorse bycatch areas based on fishers mapping data and seahorse observations.
- Return to interview locations and validate fisher effort and seahorse bycatch maps.

In order to gain a better understanding of *seahorse population response to human pressures,* we will perform the following activities:

- Additional interviews at four key locations along the Andaman Coast – eastern Phang-nga Bay, near Ao Nang, near Sikao and near Koh Sukorn.
- Create a seahorse distribution map based on fisher interviews from 2013 and seahorse observation maps for the Andaman Coast. Approximately one month will be dedicated to validation of distribution maps with fishers.
- Raise awareness among divers in National Parks about iSeahorse to generate information on seahorse populations inside Thailand's national parks.
- Work with the DoF Geospatial Department to finalize spatial management maps to determine which seahorse populations are protected from human pressures.

In order to gain a better understanding of *seahorse life history responses to human pressures,* we will perform the following activities:

- Gather underwater life history data from seahorses at eight sites in the Andaman Coast and eight sites in the central and northern Gulf of Thailand.
- Continued analysis on port sampling data to generate length at maturity, size specific survival and individual growth rates.
- Work with Dr. Patrichart Laksanawimol to explore collaborations for seahorse life history with port sampling data.

In order to gain a better understanding of *seahorse habitat responses to human pressures,* we will perform the following activities:

- Identify the habitat in areas of known seahorse bycatch reported by fishers.
- Additional capacity building with the DoF Geospatial Analysis department to gain access to habitat shapefiles.
- Overlay habitat shapefiles with fisher effort and seahorse observations to identify additional seahorse habitat areas.
- Overlay current spatial management measures with habitat data, and fisher and seahorse observation maps to determine which seahorse habitats are currently protected.

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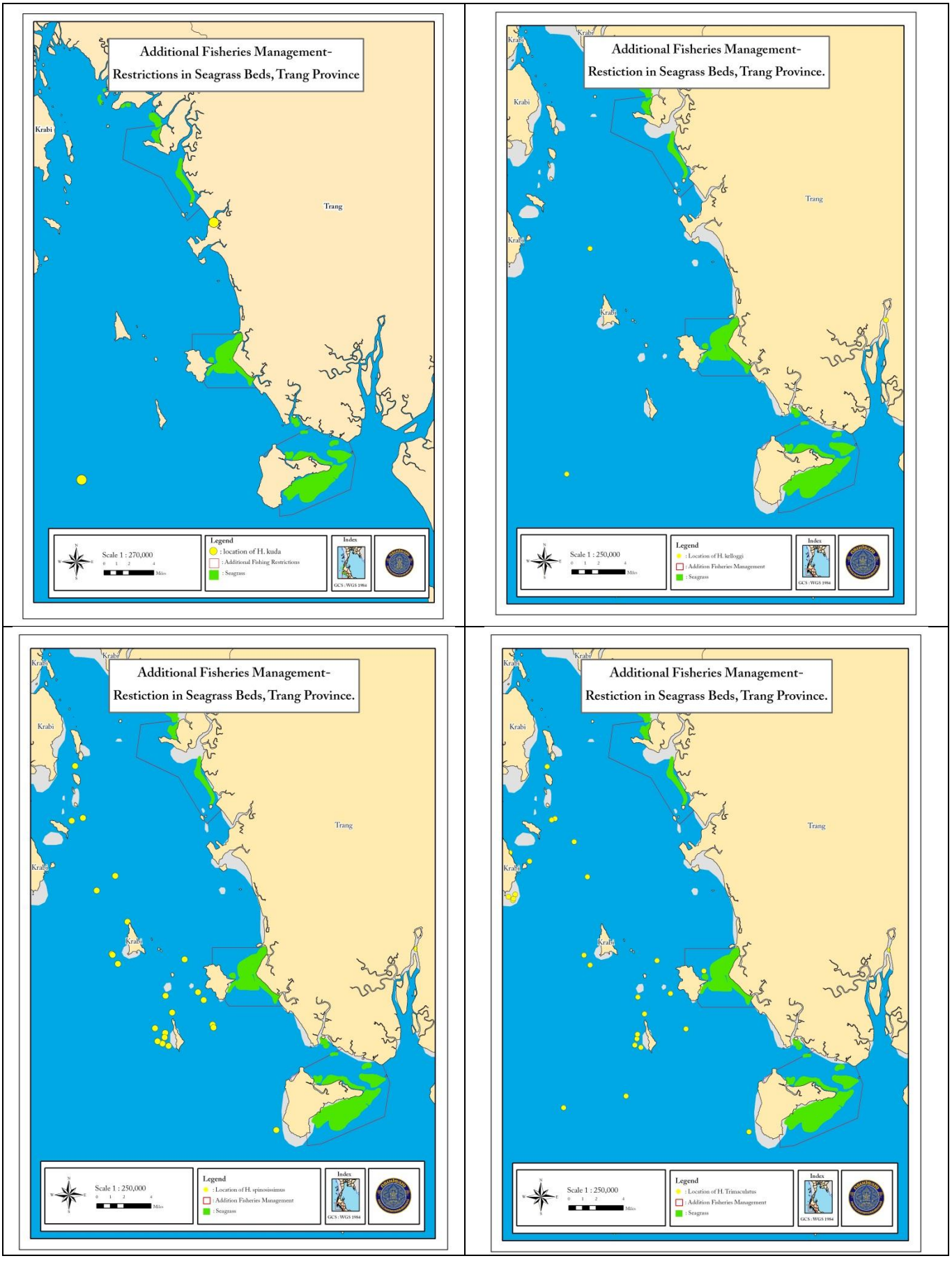
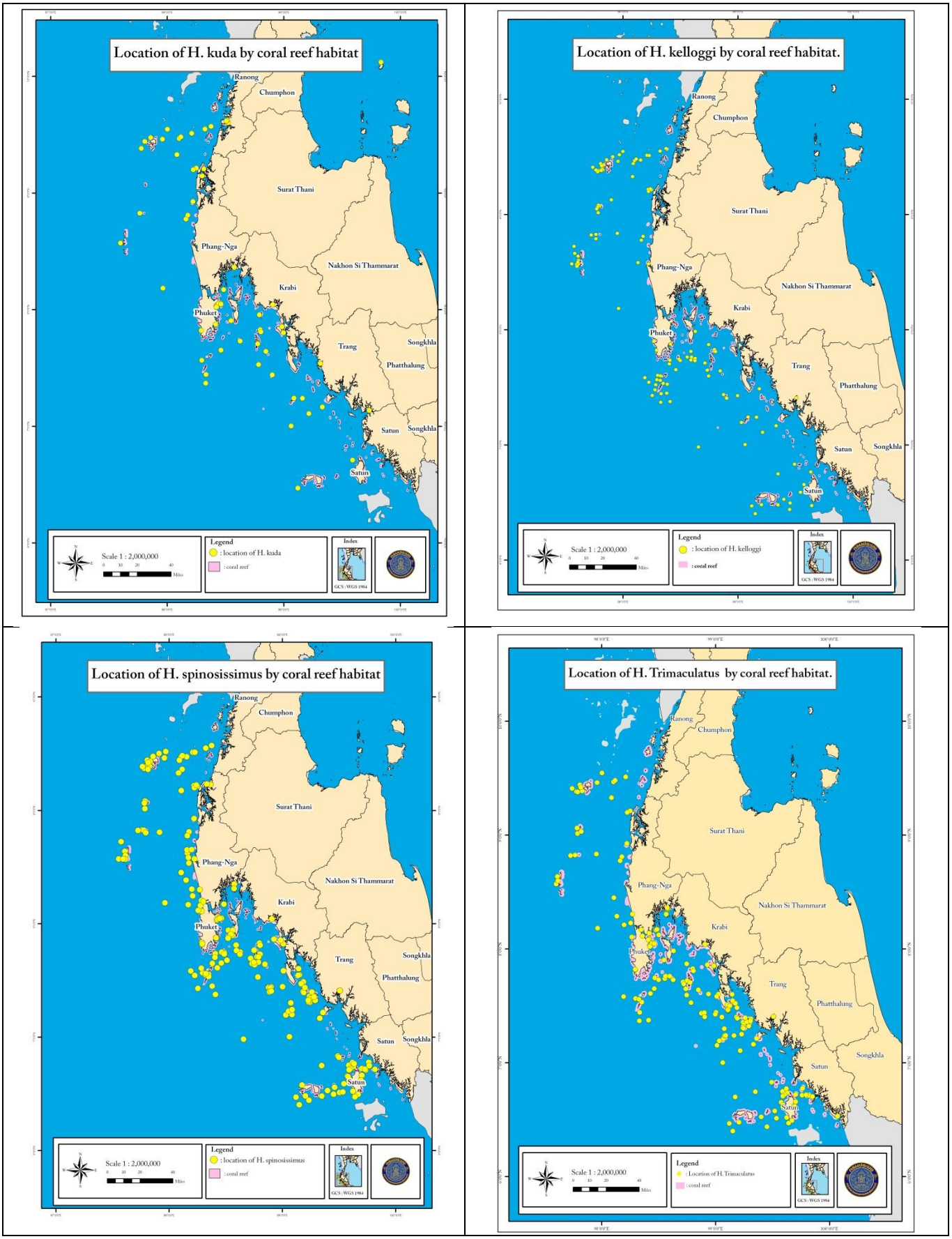
Annex 3

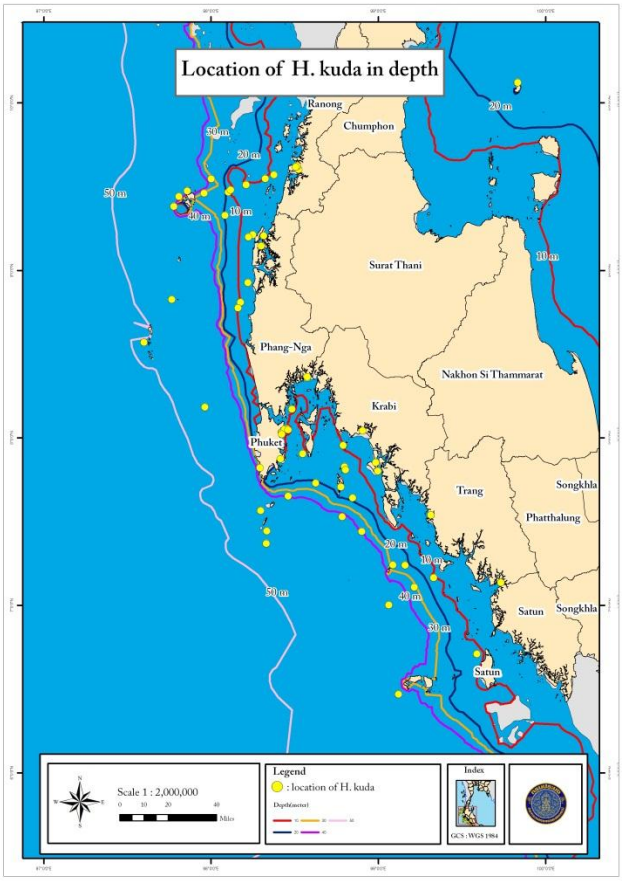
Additional Fisheries Management Restrictions in seagrass beds, Trang province.

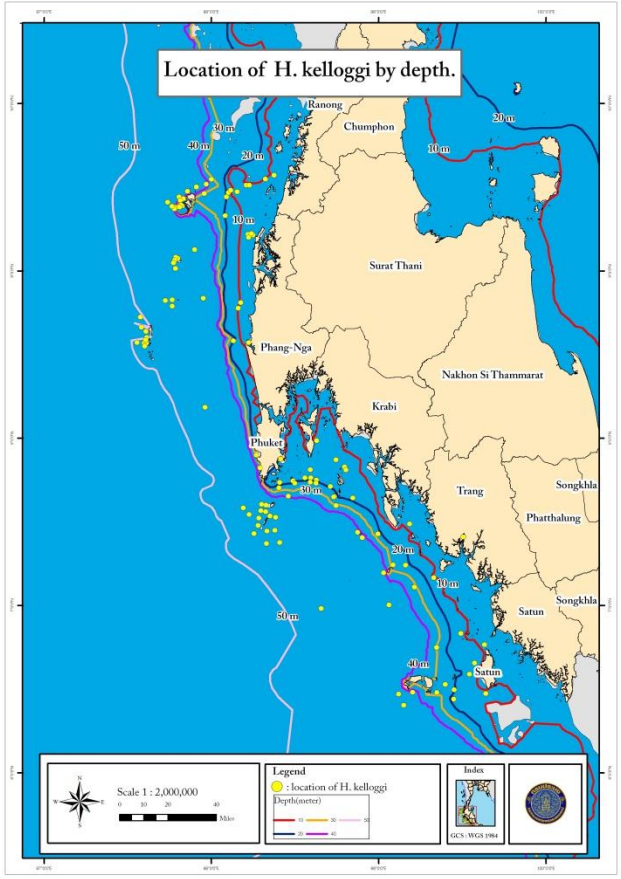


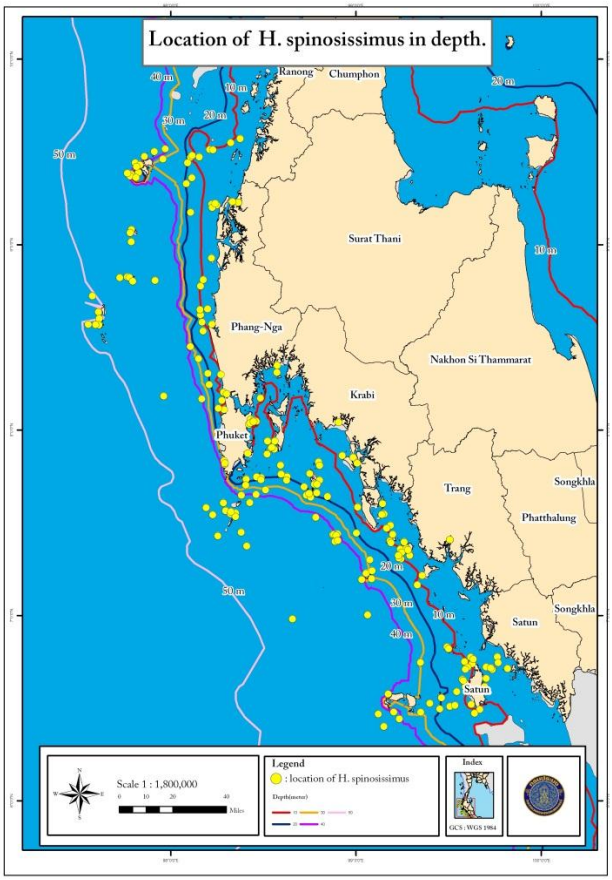
Coral Reef Habitat

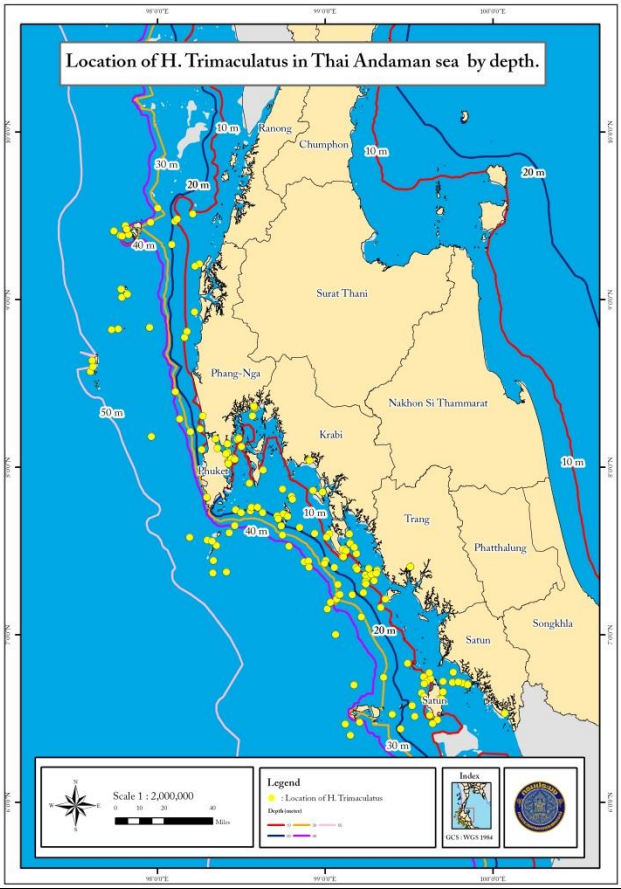


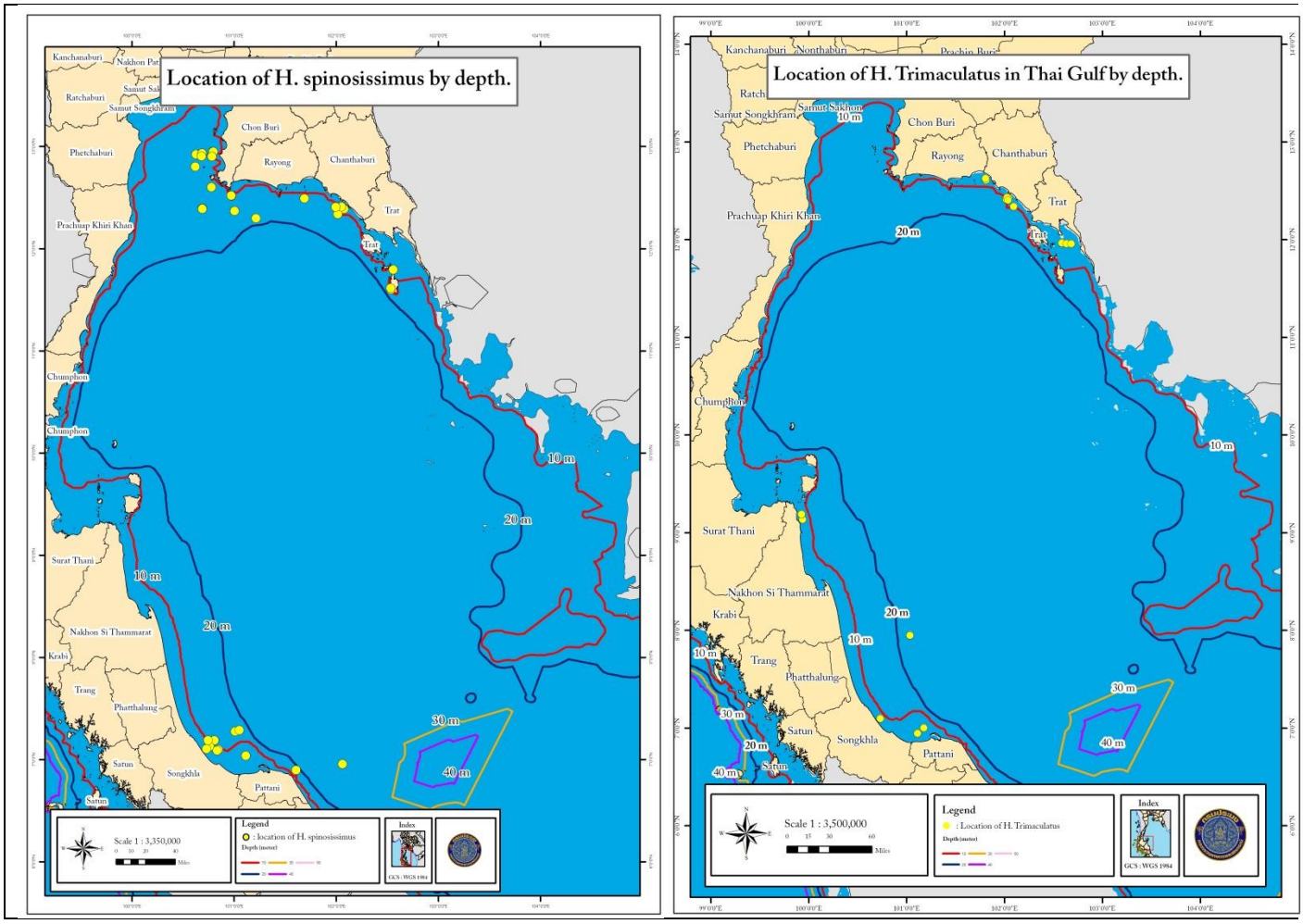
Location of seahorses by depth

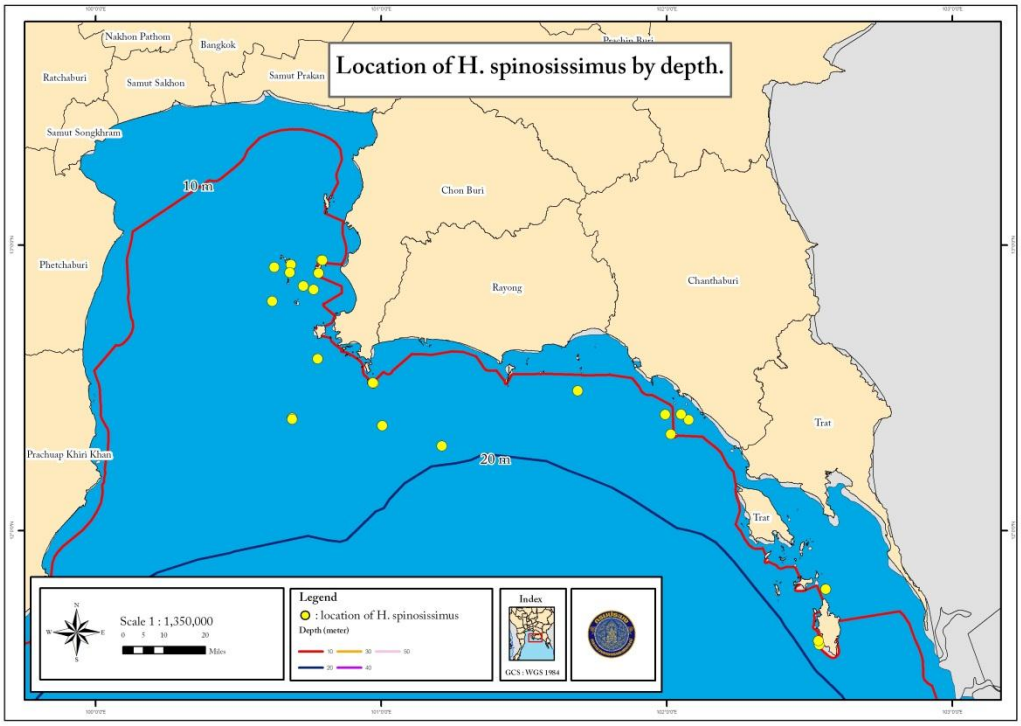




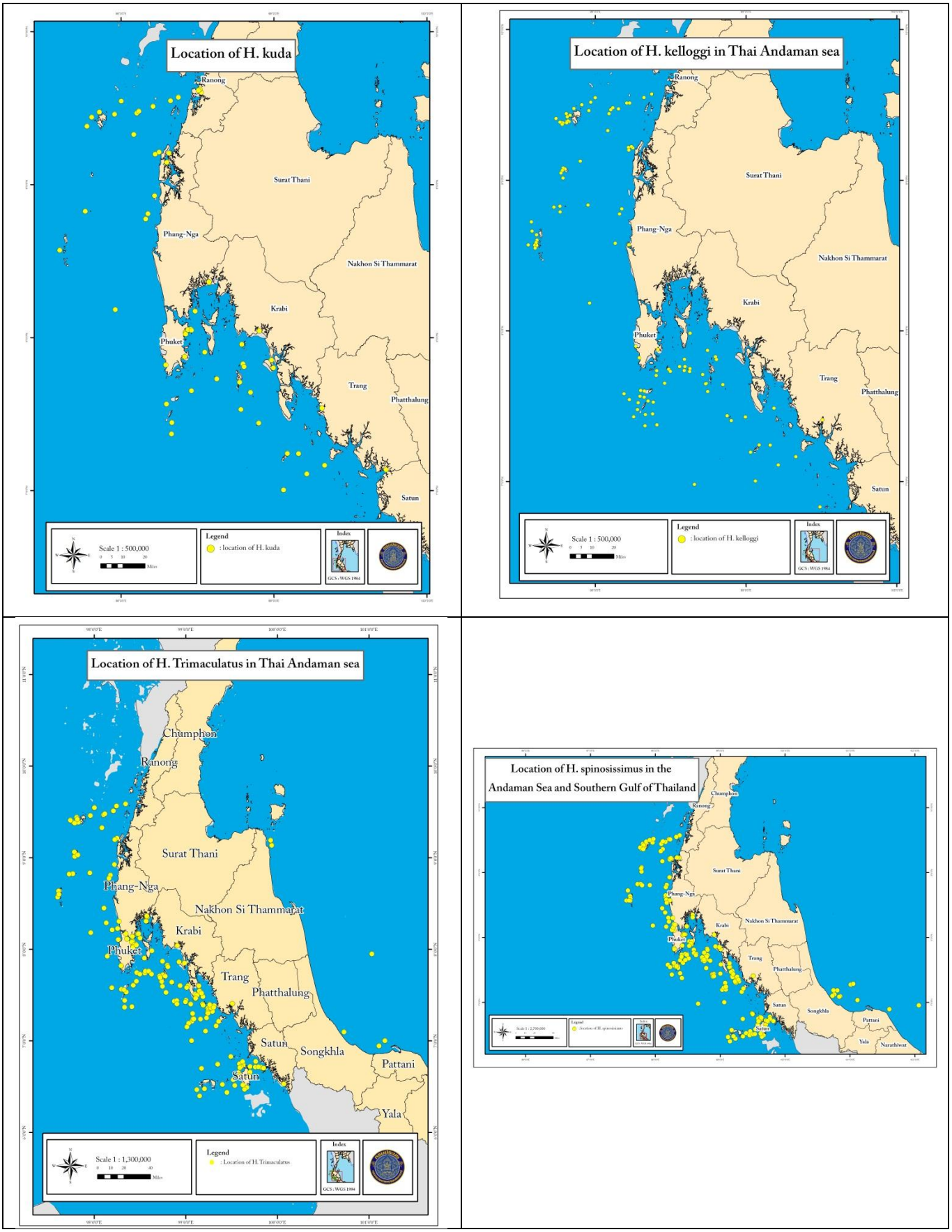


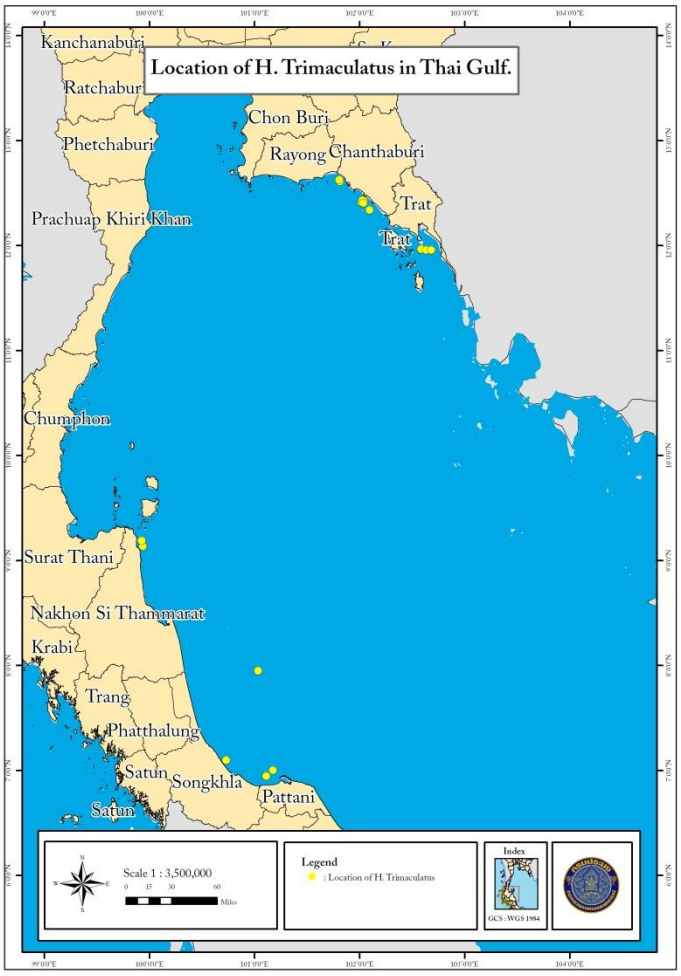


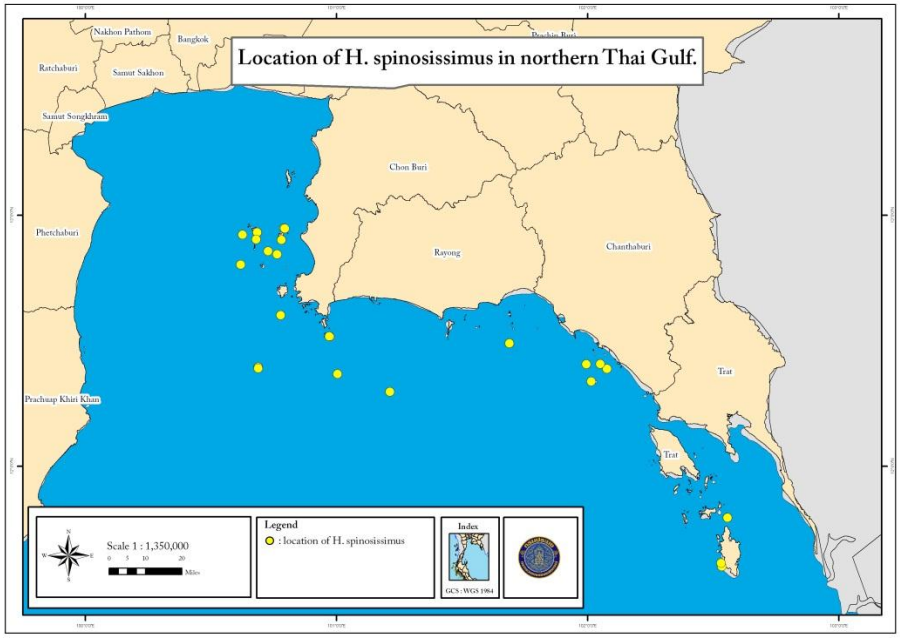

Location of H. spinosissimus by depth.
Location of H. Trimaculatus in Thai Gulf by depth.
Kanchanaburi
Nakhon Pathom
Ratchaburi
Samut Sakhon
Samut Songkhram
Chon Buri
Phetchaburi
Rayong
Chanthaburi
Trat
Prachuap Khiri Khan
Chumphon
Surat Thani
Nakhon Si Thammarat
Krabi
Trang
Phatthalung
Satun
Songkhla
Pattani
10 m
20 m
30 m
40 m
Scale 1 : 3,350,000
Scale 1 : 3,500,000
Legend
: location of H. spinosissimus
: Location of H. Trimaculatus
Depth (meter)
Index
GCS : WGS 1984


Location of H. spinosissimus by depth.
Nakhon Pathom
Bangkok
Samut Prakan
Ratchaburi
Samut Sakhon
Samut Songkhram
Chon Buri
Phetchaburi
Rayong
Chanthaburi
Trat
Prachuap Khiri Khan
10 m
20 m
Scale 1 : 1,350,000
Legend
: location of H. spinosissimus
Depth (meter)
Index
GCS : WGS 1984

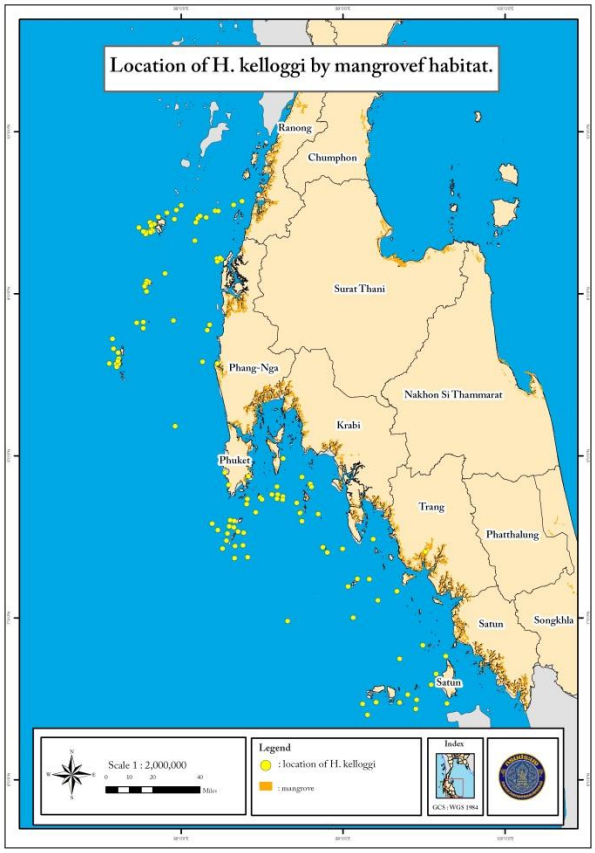
Location of seahorses in Thai Andaman Sea and Gulf of Thailand

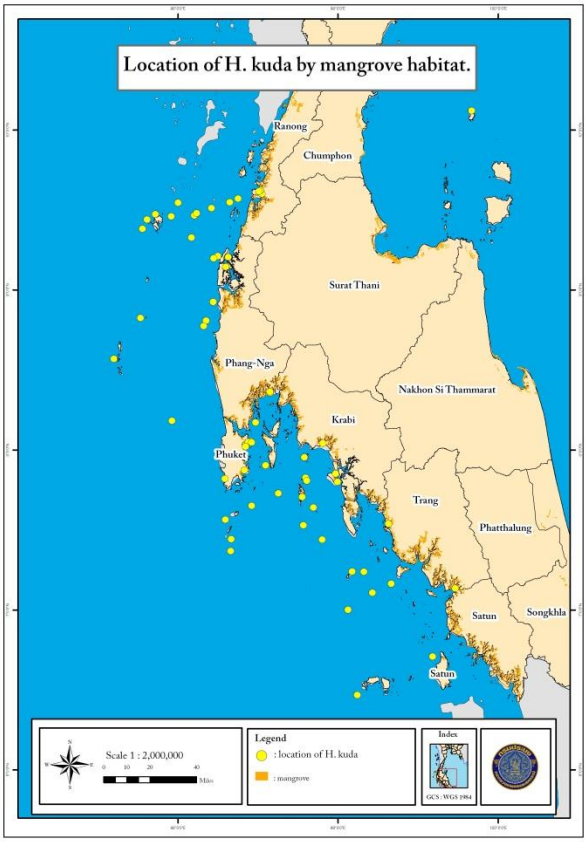


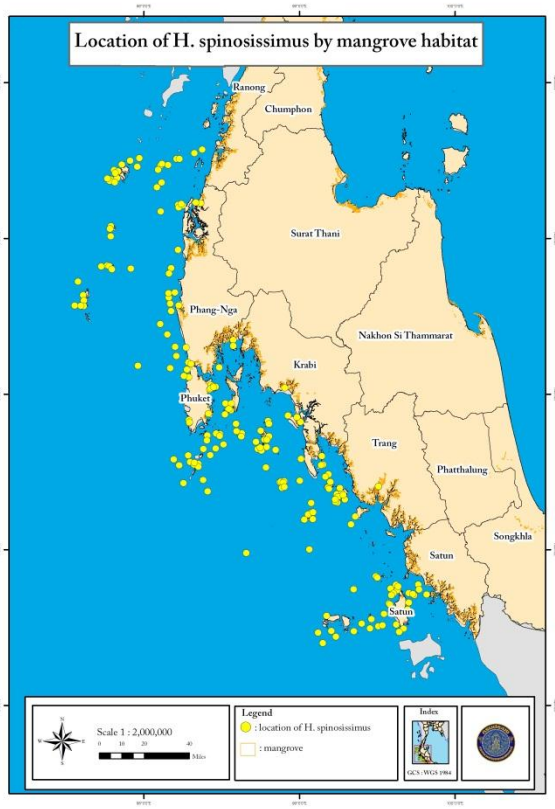

Location of H. Trimaculatus in Thai Gulf.
Kanchanaburi
Ratchaburi
Phetchaburi
Chon Buri
Rayong
Chanthaburi
Trat
Prachuap Khiri Khan
Chumphon
Surat Thani
Nakhon Si Thammarat
Krabi
Trang
Phatthalung
Satun
Songkhla
Pattani
Scale 1 : 3,500,000
Legend
: Location of H. Trimaculatus
Index
GCS : WGS 1984

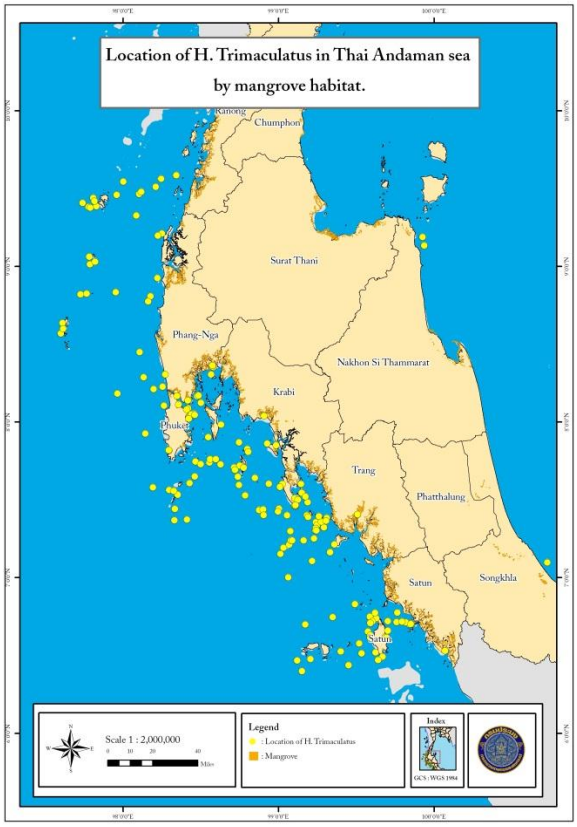

Location of H. spinosissimus in northern Thai Gulf.
Nakhon Pathom
Bangkok
Ratchaburi
Samut Sakhon
Samut Songkhram
Chon Buri
Phetchaburi
Rayong
Chanthaburi
Trat
Prachuap Khiri Khan
Scale 1 : 1,350,000
Legend
: location of H. spinosissimus
Index
GCS : WGS 1984

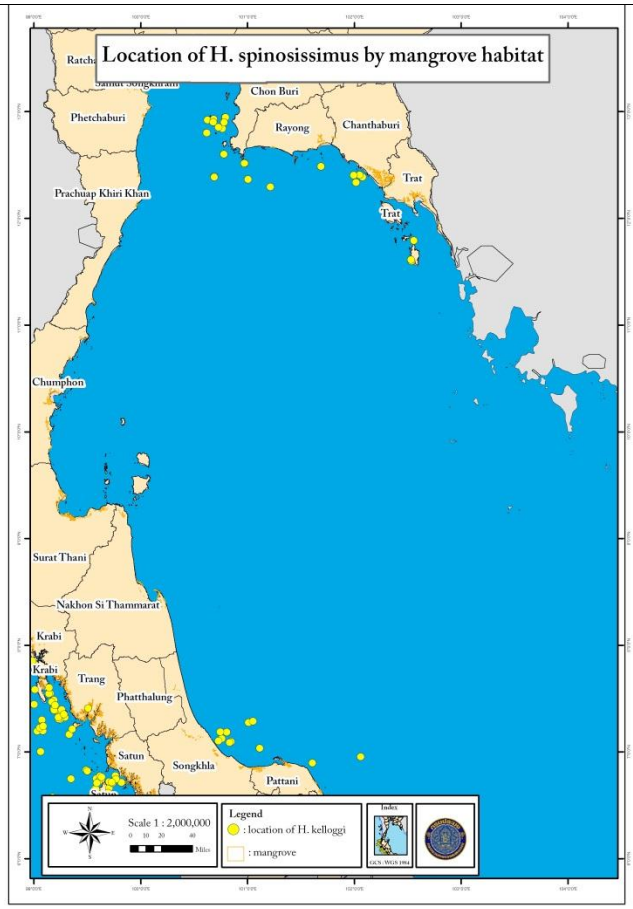
Location of seahorses in mangrove habitats

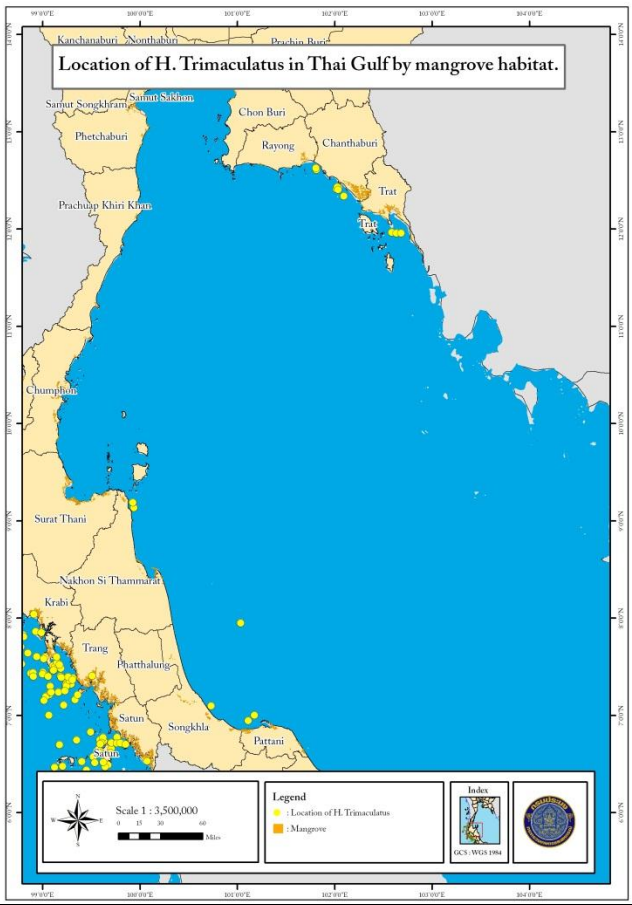




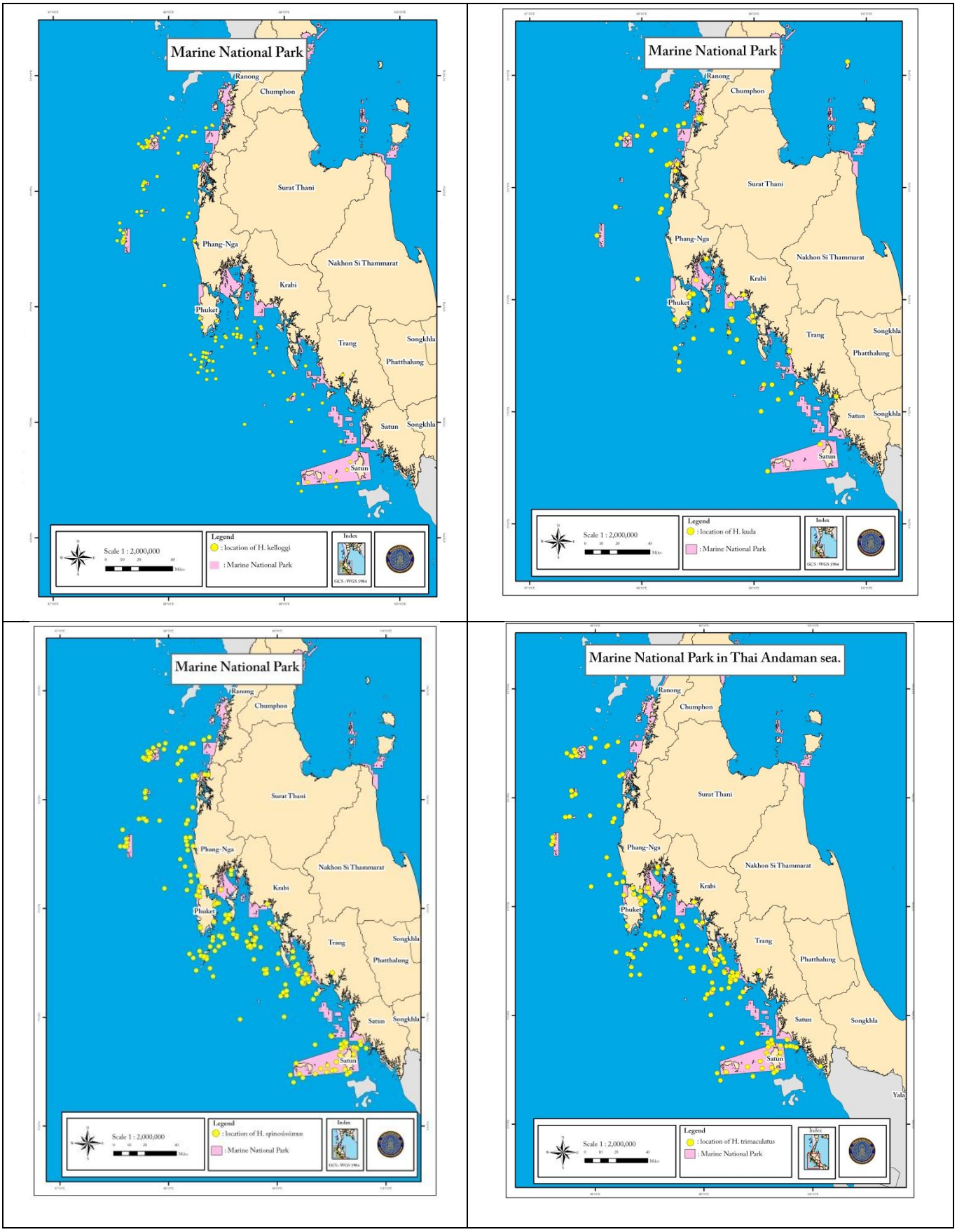


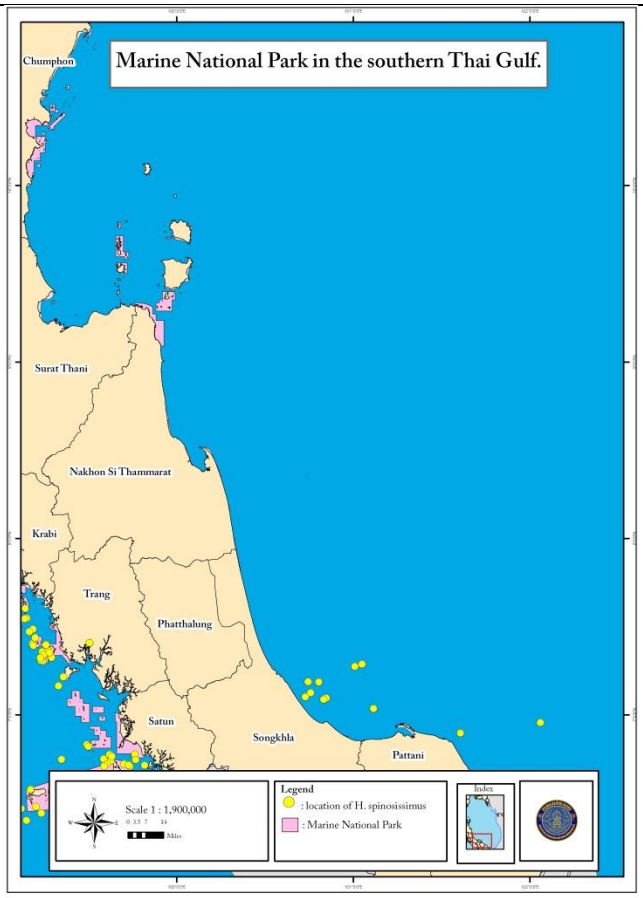


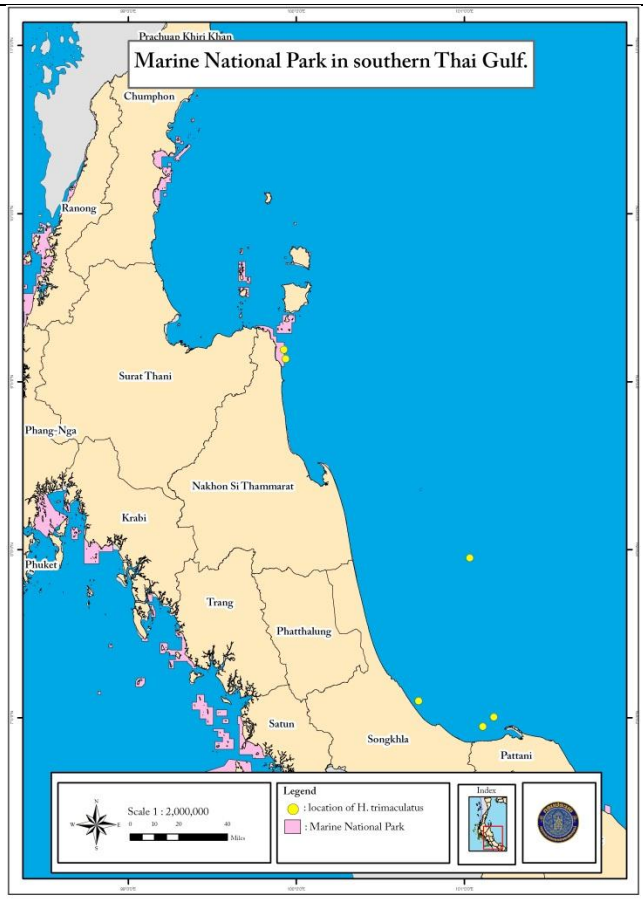

Location of H. spinosissimus by mangrove habitat
Chon Buri
Rayong
Chanthaburi
Phetchaburi
Trat
Prachuap Khiri Khan
Chumphon
Surat Thani
Nakhon Si Thammarat
Krabi
Trang
Phatthalung
Satun
Songkhla
Pattani
Scale 1 : 2,000,000
Legend
: location of H. kelloggi
: mangrove
Index
GCS : WGS 1984

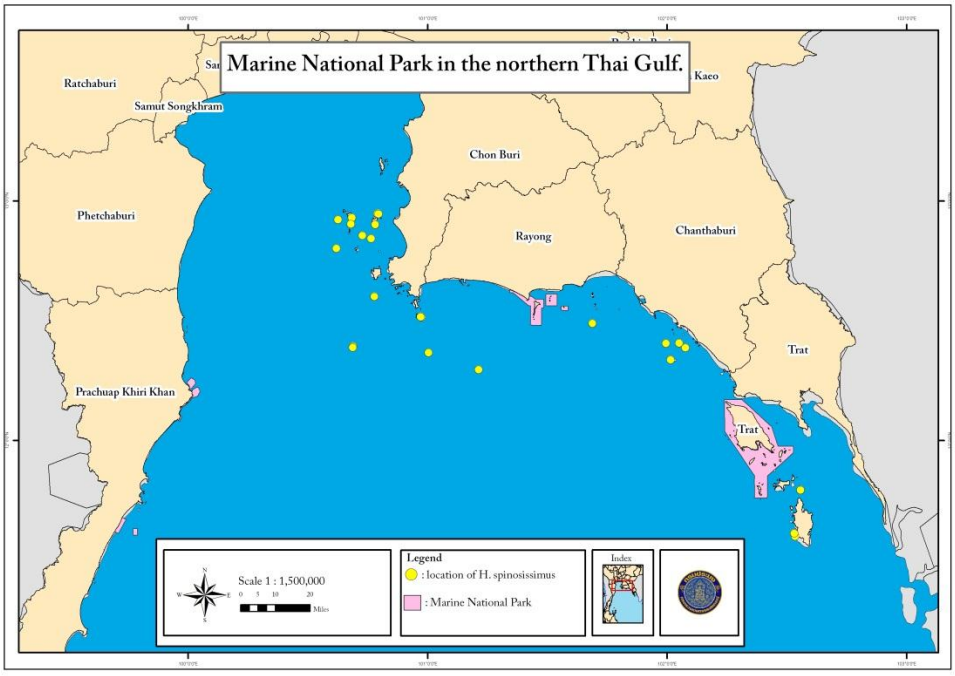

Location of H. Trimaculatus in Thai Gulf by mangrove habitat.
Kanchanaburi
Nonthaburi
Samut Songkhram
Samut Sakhon
Chon Buri
Rayong
Chanthaburi
Phetchaburi
Trat
Prachuap Khiri Khan
Chumphon
Surat Thani
Nakhon Si Thammarat
Krabi
Trang
Phatthalung
Satun
Songkhla
Pattani
Scale 1 : 3,500,000
Legend
: Location of H. Trimaculatus
: Mangrove
Index
GCS : WGS 1984

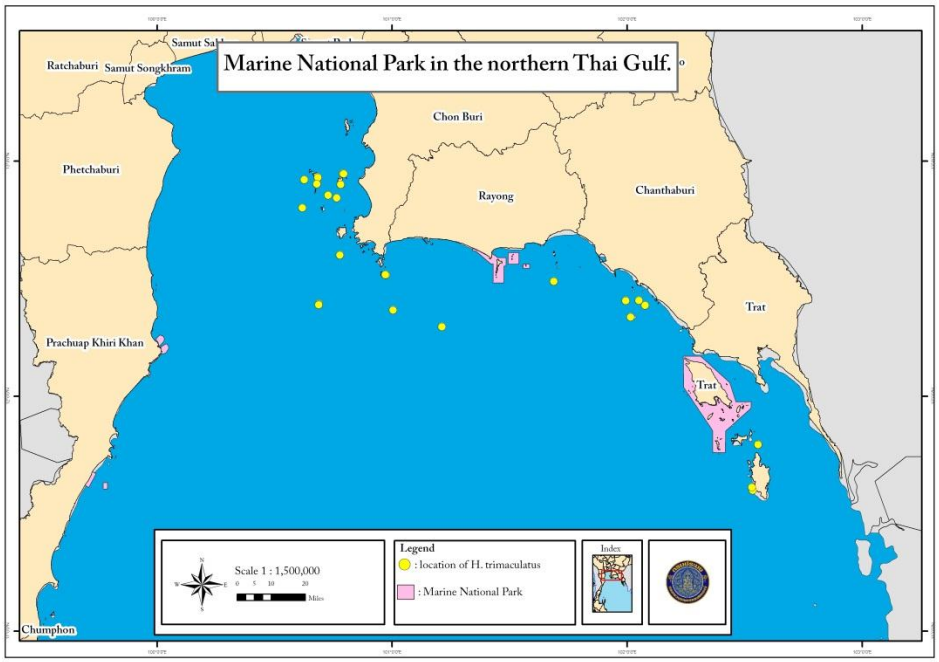
Marine National Parks in Thai Andaman Sea and Gulf of Thailand



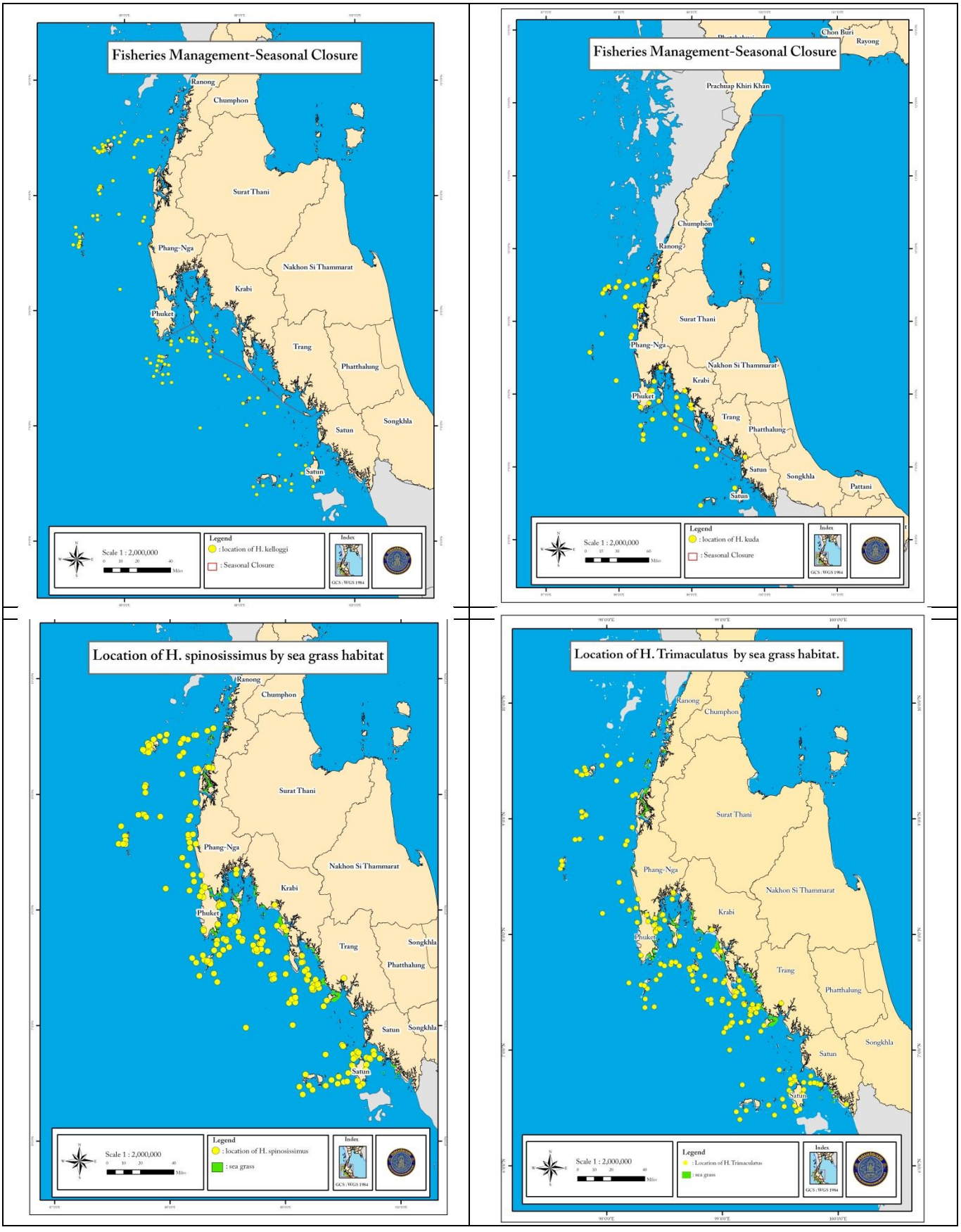

Marine National Park in the southern Thai Gulf.
Chumphon
Surat Thani
Nakhon Si Thammarat
Krabi
Trang
Phatthalung
Satun
Songkhla
Pattani
Scale 1 : 1,900,000
Legend
: location of H. spinosissimus
: Marine National Park
Index


Prachuap Khiri Khan
Marine National Park in southern Thai Gulf.
Chumphon
Ranong
Surat Thani
Phang-Nga
Nakhon Si Thammarat
Krabi
Phuket
Trang
Phatthalung
Satun
Songkhla
Pattani
Scale 1 : 2,000,000
Legend
: location of H. trimaculatus
: Marine National Park
Index

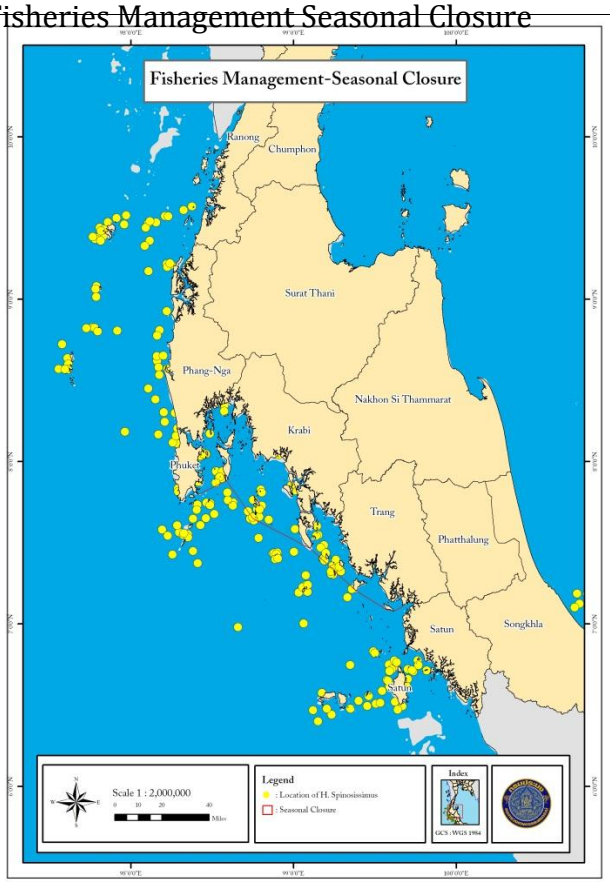

Marine National Park in the northern Thai Gulf.
Ratchaburi
Samut Songkhram
Kaeo
Chon Buri
Phetchaburi
Rayong
Chanthaburi
Trat
Prachuap Khiri Khan
Trat
Scale 1 : 1,500,000
0 5 10 20
Miles
Legend
: location of H. spinosissimus
: Marine National Park
Index

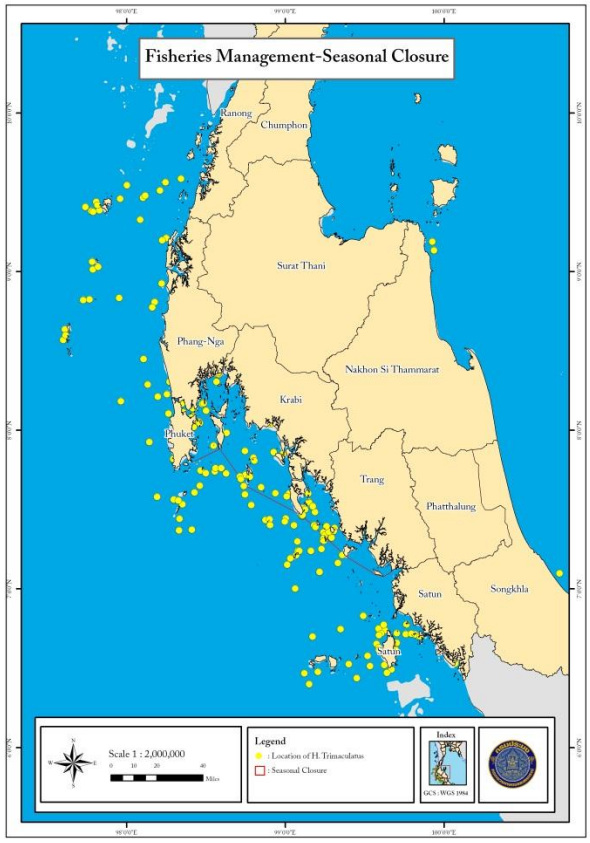

Marine National Park in the northern Thai Gulf.
Ratchaburi
Samut Songkhram
Chon Buri
Phetchaburi
Rayong
Chanthaburi
Trat
Prachuap Khiri Khan
Trat
Chumphon
Scale 1 : 1,500,000
0 5 10 20
Miles
Legend
: location of H. trimaculatus
: Marine National Park
Index

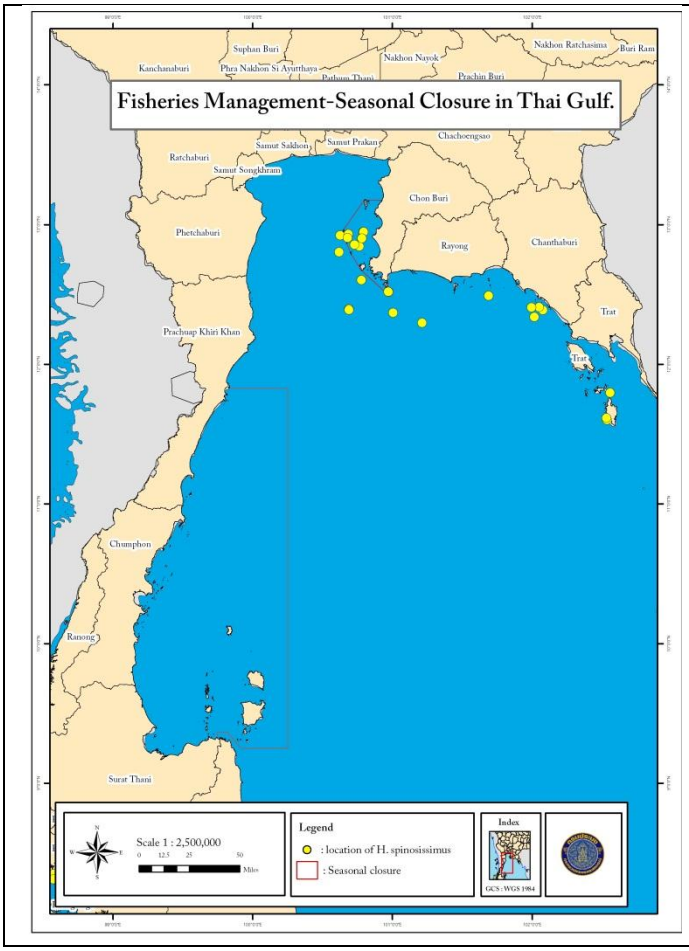
Location of seahorses in seagrass habitats.

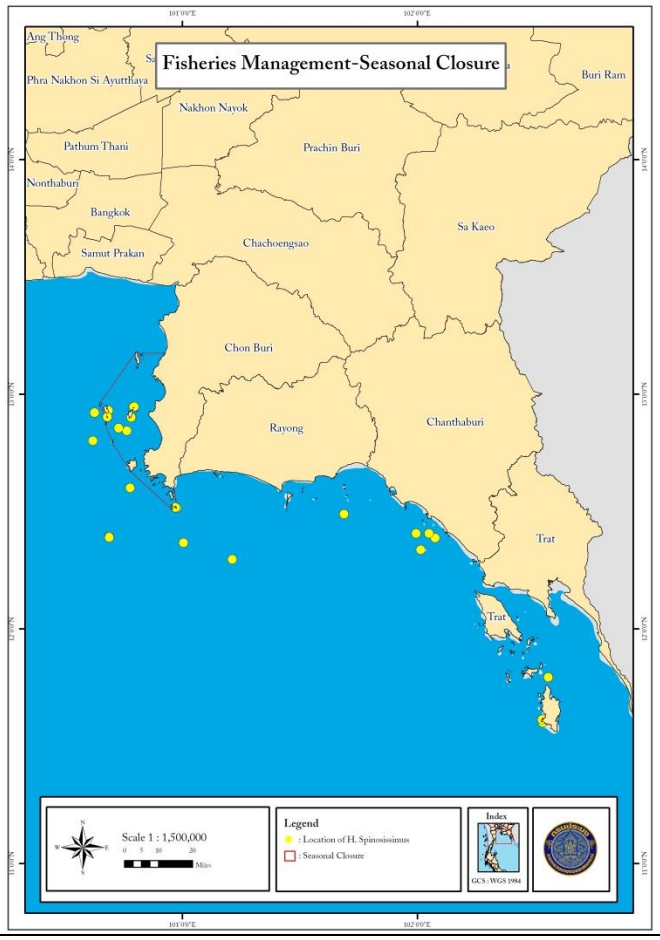


Fisheries Management Seasonal Closure

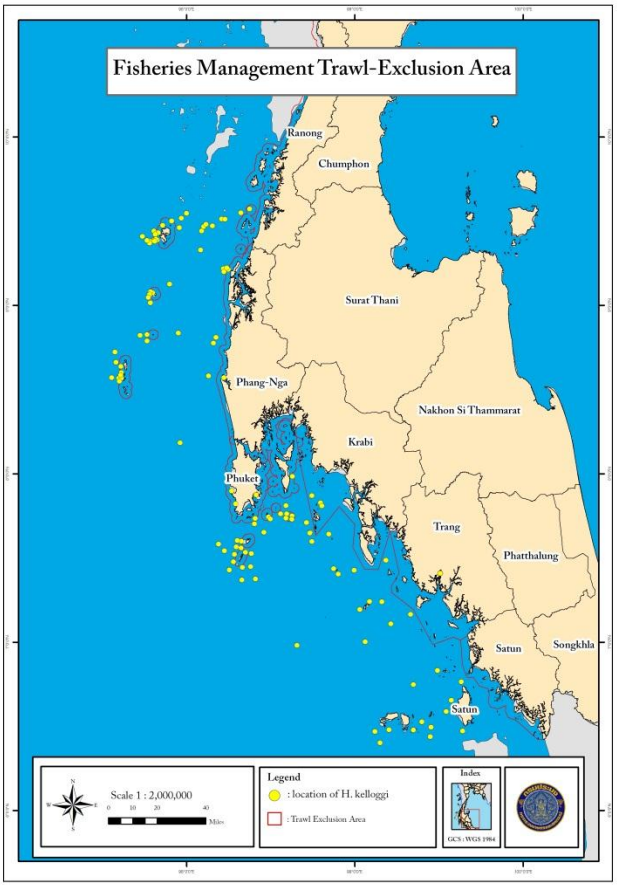


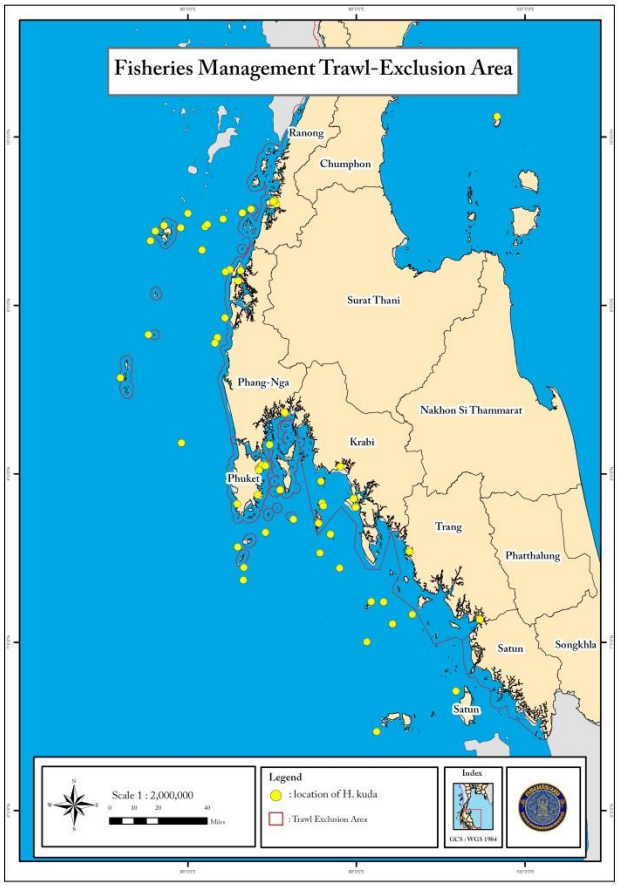


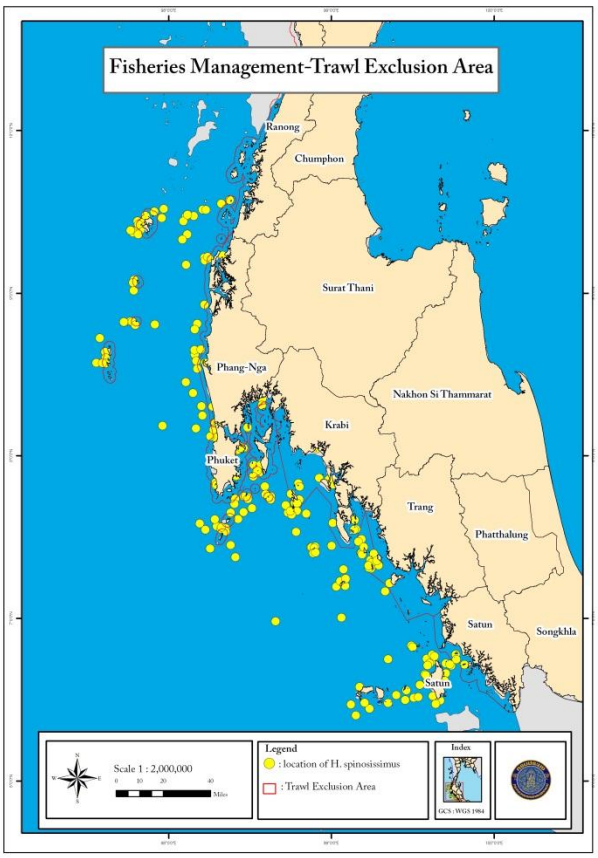

Fisheries Management-Seasonal Closure in Thai Gulf.
Suphan Buri
Nakhon Ratchasima
Buri Ram
Kanchanaburi
Phra Nakhon Si Ayutthaya
Nakhon Nayok
Pathum Thani
Prachin Buri
Samut Sakhon
Samut Prakan
Chachoengsao
Ratchaburi
Samut Songkhram
Chon Buri
Phetchaburi
Rayong
Chanthaburi
Trat
Prachuap Khiri Khan
Chumphon
Ranong
Surat Thani
Scale 1 : 2,500,000
0 12.5 25 50
Miles
Legend
: location of H. spinosissimus
: Seasonal closure
Index
GCS : WGS 1984

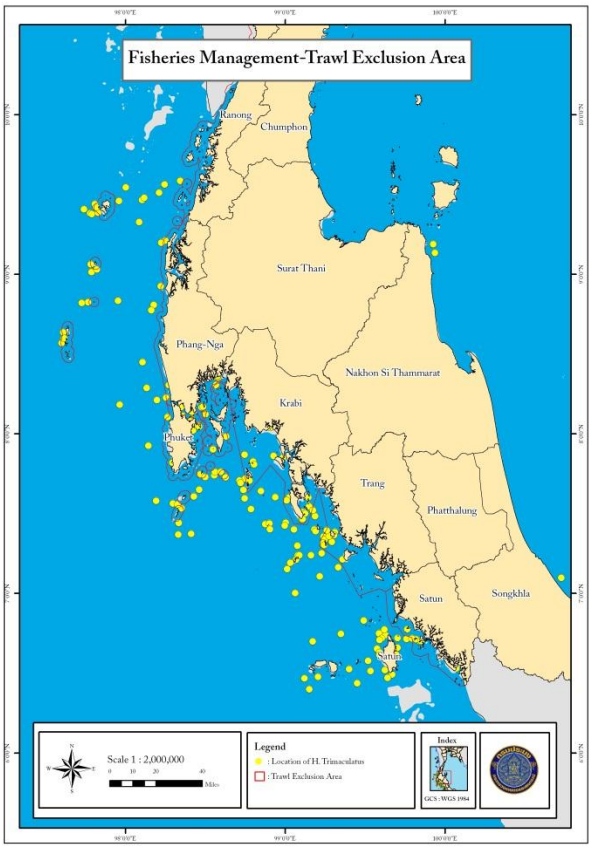

Fisheries Management-Seasonal Closure
Ang Thong
Phra Nakhon Si Ayutthaya
Buri Ram
Nakhon Nayok
Pathum Thani
Prachin Buri
Nonthaburi
Bangkok
Sa Kaeo
Samut Prakan
Chachoengsao
Chon Buri
Rayong
Chanthaburi
Trat
Scale 1 : 1,500,000
0 5 10 20
Miles
Legend
: Location of H. Spinosissimus
: Seasonal Closure
Index
GCS : WGS 1984

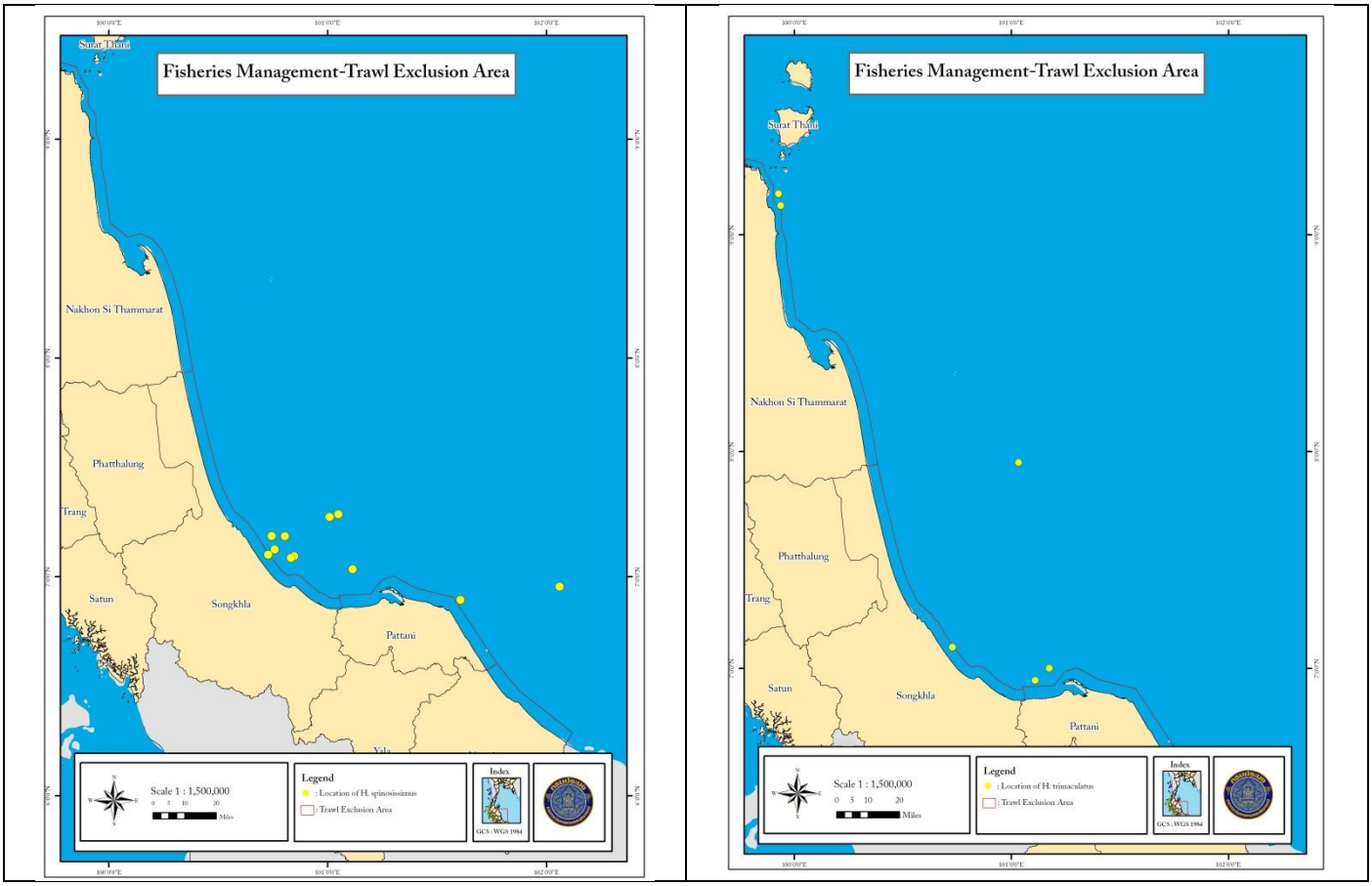
Fisheries Management of trawl exclusion area.

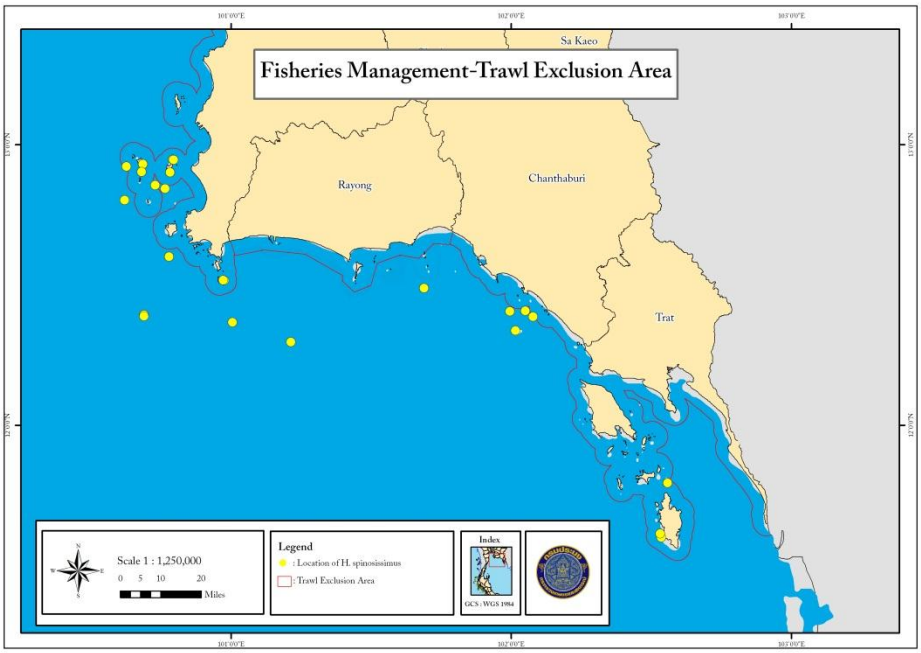


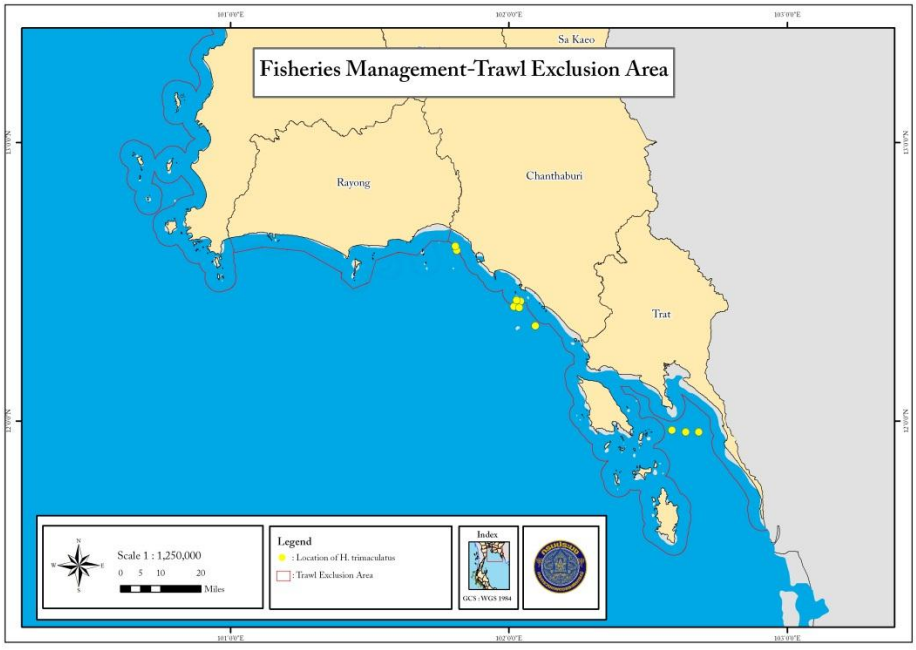







Fisheries Management-Trawl Exclusion Area
Surat Thani
Nakhon Si Thammarat
Phatthalung
Trang
Satun
Songkhla
Pattani
Yala
Scale 1 : 1,500,000
0 5 10 20
Miles
Legend
: Location of H. spinosissimus
: Trawl Exclusion Area
Index
GCS : WGS 1984
Fisheries Management-Trawl Exclusion Area
Surat Thani
Nakhon Si Thammarat
Phatthalung
Trang
Satun
Songkhla
Pattani
Scale 1 : 1,500,000
0 5 10 20
Miles
Legend
: Location of H. trimaculatus
: Trawl Exclusion Area
Index
GCS : WGS 1984


Fisheries Management-Trawl Exclusion Area
Sa Kaeo
Rayong
Chanthaburi
Trat
Scale 1 : 1,250,000
0 5 10 20
Miles
Legend
: Location of H. spinosissimus
: Trawl Exclusion Area
Index
GCS : WGS 1984


Fisheries Management-Trawl Exclusion Area
Sa Kaeo
Rayong
Chanthaburi
Trat
Scale 1 : 1,250,000
0 5 10 20
Miles
Legend
: Location of H. trimaculatus
: Trawl Exclusion Area
Index
GCS : WGS 1984

Annex 3.

These maps are showing the survey of seahorses were distributed in Thai waters, including Andaman Sea and Gulf of Thailand and fisheries management as follow;

- Additional Fisheries Management Restrictions in seagrass beds, Trang province
- Coral Reef Habitat
- Location of seahorses by depth
- Location of seahorses in Andaman Sea and Gulf of Thailand
- Location of seahorses in mangrove habitats
- Marine National Parks in Andaman Sea and Gulf of Thailand
- Location of seahorses in seagrass habitats
- Fisheries Management Seasonal Closure
- Fisheries Management of trawl exclusion area

Additional Fisheries Management Restrictions in seagrass beds, Trang province

The seahorse survey around additional Fisheries Management Restrictions in seagrass beds, Trang province where found 4 species i.e. *Hippocampus kuda, H. kelloggi, H. spinosissimus* and *H. trimaculatus*. The last two species were high abundance around Koh Mook.

Coral reef habitat

The seahorses survey conducted around coral reef of Andaman Sea where showing in these maps. There are 4 species of seahorses i.e. *Hippocampus kuda, H. kelloggi, H. spinosissimus* and *H. trimaculata*. The last two species were high abundance in coral reef habitat.

Location of seahorses by depth

There are *H. spinosissimus* distributed along the coast line of Chonburi, Trat and Pattani Province in the depth range 10 – 20 m and *H. trimaculatus* distributed off coast line of Chonburi and Trat Province to 20 m of the depth range.

Location of seahorses in Andaman Sea and Gulf of Thailand

These maps are showing the overlay of 4 species i.e. *Hippocampus kuda, H. kelloggi, H. spinosissimus* and *H. trimaculatus* in Andaman Sea and Gulf of Thailand. The last two species were high abundance around this area.

Location of seahorses in mangrove habitat

The seahorse survey around mangrove habitat were found 4 species i.e. *Hippocampus kuda, H. kelloggi, H. spinosissimus* and *H. trimaculatus*. The last two species were high abundance around mangrove habitat.

Marine National Parks in Andaman Sea and Gulf of Thailand

The seahorse survey around marine national parks, including the Marine Protected Area (MPA), national marine parks, seasonal closure in the Gulf of Thailand and Andaman Sea were found 4 species i.e. *Hippocampus kuda, H. kelloggi, H. spinosissimus* and *H. trimaculatus*. The last two species were high abundance around these area.

Location of seahorses in seagrass habitat

These maps are showing the overlay of 4 species i.e. *Hippocampus kuda, H. kelloggi, H. spinosissimus* and *H. trimaculatus*. The last two species were high abundance around seagrass habitat.

Fisheries Management Seasonal Closure and Fisheries Management of trawl exclusion area.

The seahorse survey are covered fisheries management seasonal closure and fisheries management of trawl exclusion areas which expanded closed area form 3 km to 3,000 – 5,400 m for trawls net in 10 provinces were found 4 species i.e. *Hippocampus kuda, H. kelloggi, H. spinosissimus* and *H. trimaculatus*. The last two species were high abundance around these area.

Sea horse in Thai Waters

Ratanawalee Phoonsawat, Nantachai boonjorn, Thiwarat Sinanan, Opas Chamason, Nipa Kulanujaree, Thumawadee Jaiyen, Suwanthana Thodsapornpithakkul, Tassapon Kjandara, Montee Sumontra, Sontraya Boonsuk and Praulai Nootmorn

Marine Fisheries Research and Development Bureau
Department of Fisheries
Ministry of Agriculture and Cooperatives

In order to collect the information on current status of sea horse fisheries in Thailand, five main landing sites have been selected. Project timeframe was set up to 1 year in 2010. Before the project will start, the study term has organized consultation meeting for establishment of study frame work and survey method between fisheries scientist who take responsible for the data collection. Outcome of the consultation meeting are as follow:

Developing and publishing standard method of sea horse classification (annex 1) in taxonomic level and field sheet on identification of sea horse species (annex 2), as a manual for fisheries scientists who in charge with this project.

The survey and data collection managed by fisheries scientists and enumerators from the 5 marine fisheries research and development centers under Marine Fisheries Research and Development Bureau:

1. Upper Gulf Marine Fisheries Research and Development Center
2. Central Gulf Marine Fisheries Research and Development Center
3. Southern Marine Fisheries Research and Development Center
4. Eastern Gulf Marine Fisheries Research and Development Center
5. Andaman Sea Marine Fisheries Research and Development Center

Fisheries scientists and enumerators assigned to collect the data and cooperate with the fishermen. The monitoring data of sea house in CPUE was collected by standard otter board trawl from five research vessels to investigate the status of sea horse. The research vessel operated 4 times in January, March, May and July 2010 (station in Table 1 and Fig. 1).

Table 1. Survey station for research vessel

	Area	Station number
Gulf of Thailand	Area 1	42 44 57
	Area 2	18 20 28 30 38 40
	Area 3	2 5 7 9 11
	Area 4	14 16 24 26 34 36 47 49
	Area 5	58 60 62 73 75 87 89 101 103
	Area 6	117 119 136 138 156 158 177 179 181
	Area 7	201 221 243 245 268 270
	Area 8	294 296 319 321 345 347 371 373
	Area 9	395 397 399 420 422 424 445 447 466
Andaman Sea	Area 1	1 3 4 7 8
	Area 2	11 12 16 21
	Area 3	14 17 23 27 29
	Area 4	30 32 34 36 37 38 39 43

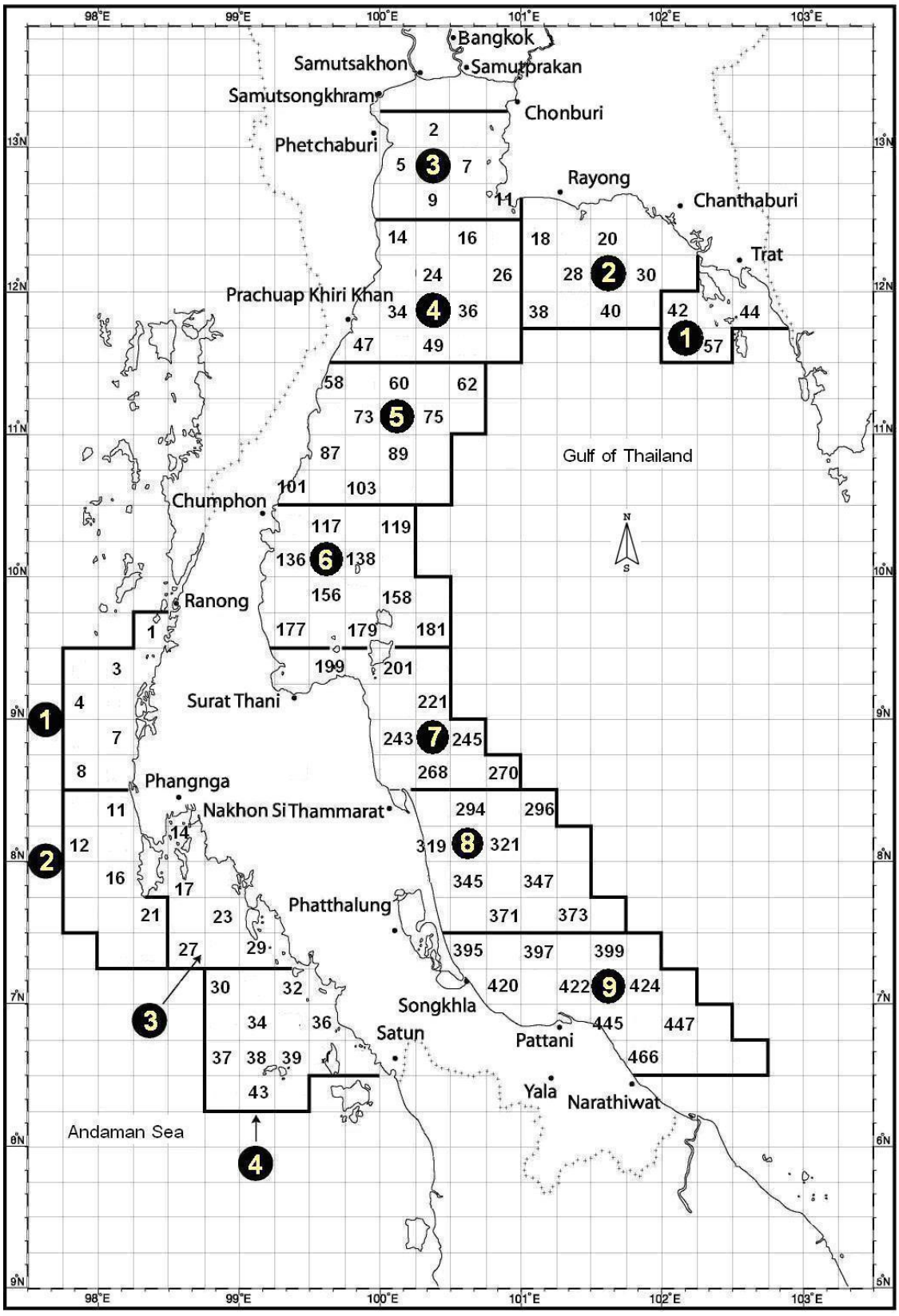


Fig. 1 Survey station by research vessels in the Gulf of Thailand and the Andaman Sea, 2010.

Biomass estimation by swept area method

Let Cw be the catch in weight of a haul. Then Cw/t is the catch in weight per hour, when t is the time spent hauling (in hours). Let a be the area swept. Then a/t is the area swept per hour. For the estimation of the biomass we use the catch per unit area (CPUA), It is estimated by dividing the catch by swept area (in kilometers). (Sparre and S. V. Venema, 1992)

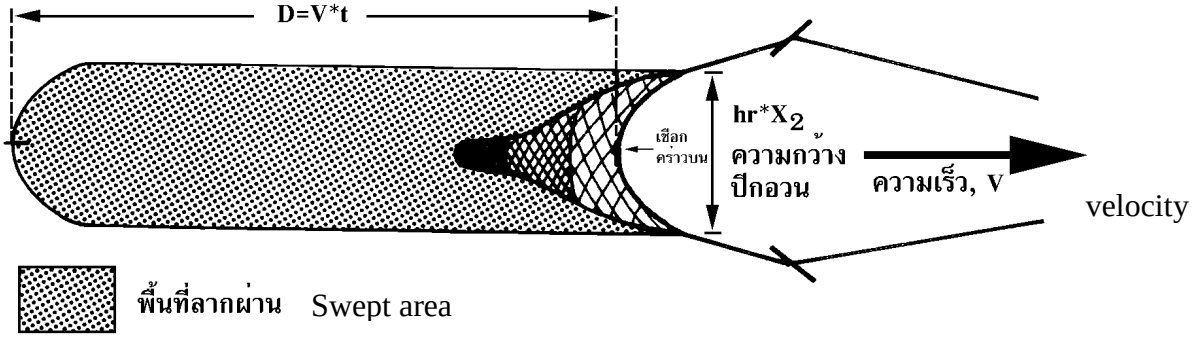
$$\text{Biomass} = \text{CPUA}^* A/X$$

where

CPUA	is the catch per unit area (kg/km^2)
A	is area of survey per one hour (km^2)
X	is retaintion coeffient

CPUA is the catch per unit area equal to Cw /a (kg/km^2)
The swept area (a) can be estimate from

a = D * h, D = V *t



where

V	is velocity of the trawl over the ground when trawling (2.5 knot or 2.5 nautical mile/hour = 4.63 kilometer/hour)
h	is the length of head-rope of trawl net (39 meter = 0.039 kilometer)
t	is the time spent trawling (1 hour)

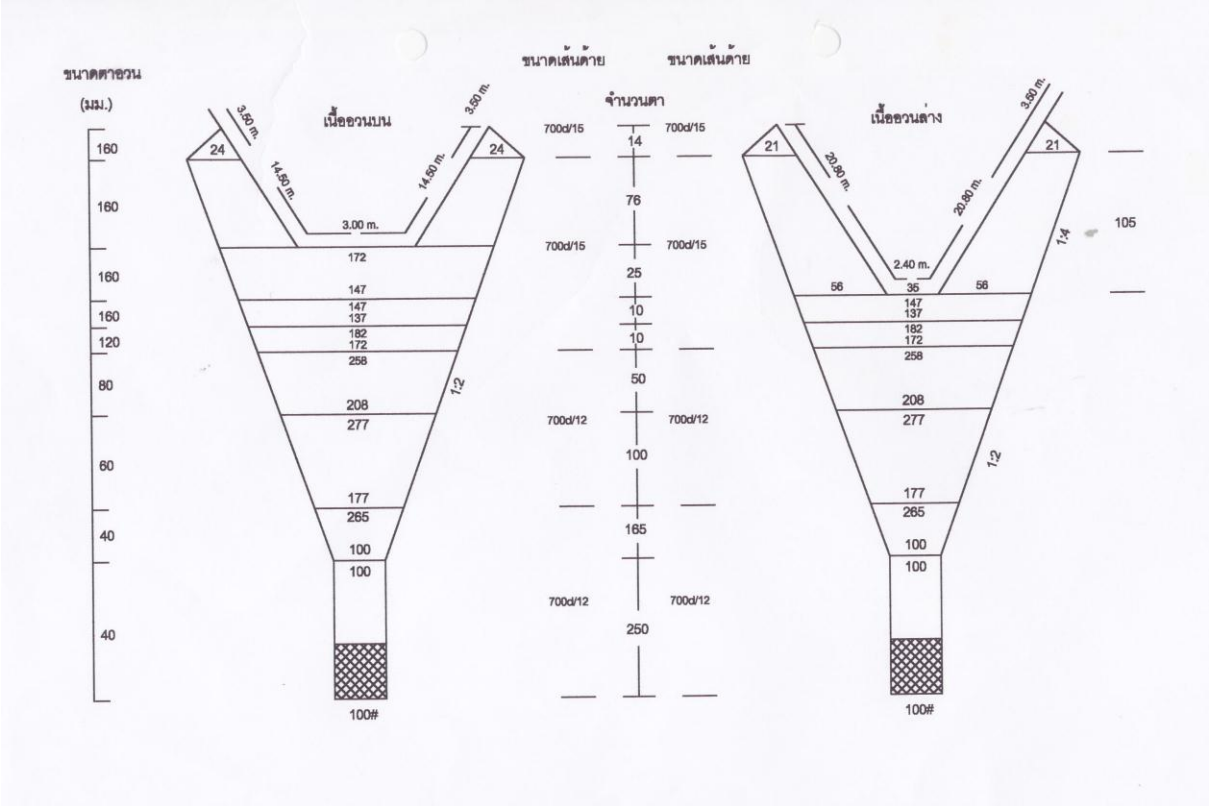


Fig. 2 Trawl net for research vessel.

Cw is the catch in weight of a haul (kg).

A is area of survey per one hour equal to 1 grid of research survey (15 *15 nautical miles) 15 nautical miles equal to 27.78 km. Then 1 grid is equal to 27.78 * 27.78 = 771.73 km^2

X is retaintion coeffient. It is difficult to estimate which proportion of the fish that is present in the area swept by trawl gear is actually retained by the gear, in other words it is difficult to give a precise estimate of X. Underwater television recording show that the reaction of fish to trawls varies markedly between species. The value of X is usually chosen between 0.5 and 1.0. For trawlers in Southeast Asia as value of X = 0.5 is commonly used in survey work (Isarankura,1971; Seager, Martosubroto and Pauly,1980). Then in this paper we use 0.5

Result

Gulf of Thailand found 3 species of sea horses (Tables 2 and 3 and Fig. 3) as follow:

1. *Hippocampus kelloggi* found1 sea horse:length 140.00 mm weight 5.78 g. This species found only in the water depth range >10-20 m.

2. *H. spinosissimus* found 52 sea horses length: 52.00 – 211.00 mm. average length 141.09 mn. Average weight 8.08 g total weight 420.40 g. This species found only in the water depth range >10-70 m.

3. *H. trimaculatus* found 20 sea horses: length 107.00 – 178.00 mm. average length 133.95 mm. Average weight 6.28 g total weight 125.67 g. This species found only in the water depth range >10-70 m.

Andaman sea found 3 species of sea horse (Tables 2 and 3 and Fig. 3) as follow:

1. *H. kelloggi* found 1sea horses: length 238.00 mm.Average weight 24.08 g.
2. *H. spinosissimus* found 9 sea horses: length 109.00 – 202.00 mm. average length 155.00 mn. Average weight 9.03 g.
3. *H. trimaculatus* found 4 female sea horses length 102.00 – 153.00 mm. average length 134.00 mm. Average weight 5.46 g total weight 21.85 g.

Table 2 Sea horse found in the Gulf of Thailand (GOT) and Andaman Sea (AS) survey by research vessel.

Area	species	Number	Length (mm)	Avg.Length (mn.)	Avg.weight (g)	Total weight of Sea horse (g)
GOT	*Hippocampus kelloggi*	1	140-140	140.00	5.78	5.78
	H. spinosissimus	52	52-211	141.09	8.08	420.40
	H. trimaculatus	20	107-178	133.95	6.28	125.67
AS	*H. kelloggi*	1	238-238	238.00	24.08	24.08
	H. spinosissimus	9	109-202	155.00	9.03	81.25
	H. trimaculatus	4	102-153	134.00	5.46	21.85

Table 3 Distribution of sea horse by depth during survey in 2010 in the Gulf of Thailand and Andaman Sea

Depth (m)	Specie	Number	Length (mm.)	Avg. length (mm.)	Weight (g)	Avg. Weight (g)	Total weight (g)
>10-20	*Hippocampus kelloggi*	1	140-140	140.00	5.78-5.78	5.78	5.78
	H. spinosissimus	39	52-211	145.89	0.33-19.79	8.37	326.62
	H. trimaculatus	18	107-175	131.00	3.51-10.52	5.82	104.77
>20-30	*H. spinosissimus*	7	113-202	163.29	3.50-19.95	10.23	71.06
	H. trimaculatus	3	102-150	127.67	2.42-7.41	5.01	15.02
>30-40	*H. spinosissimus*	12	100-175	130.83	3.33-12.00	7.83	93.96
	H. trimaculatus	1	178-178	178.00	12.95-12.95	12.95	12.95
>40-50	*H. spinosissimus*	3	108-112	109.67	2.72-3.54	3.16	9.47
	H. trimaculatus	1	143-143	143.00	7.95-7.95	7.95	7.95
>60-70	*H. kelloggi*	1	238-238	238.00	24.08-24.08	24.08	24.08
	H. trimaculatus	1	153-153	153.00	6.83-6.83	6.83	6.83
Total		87					679.03

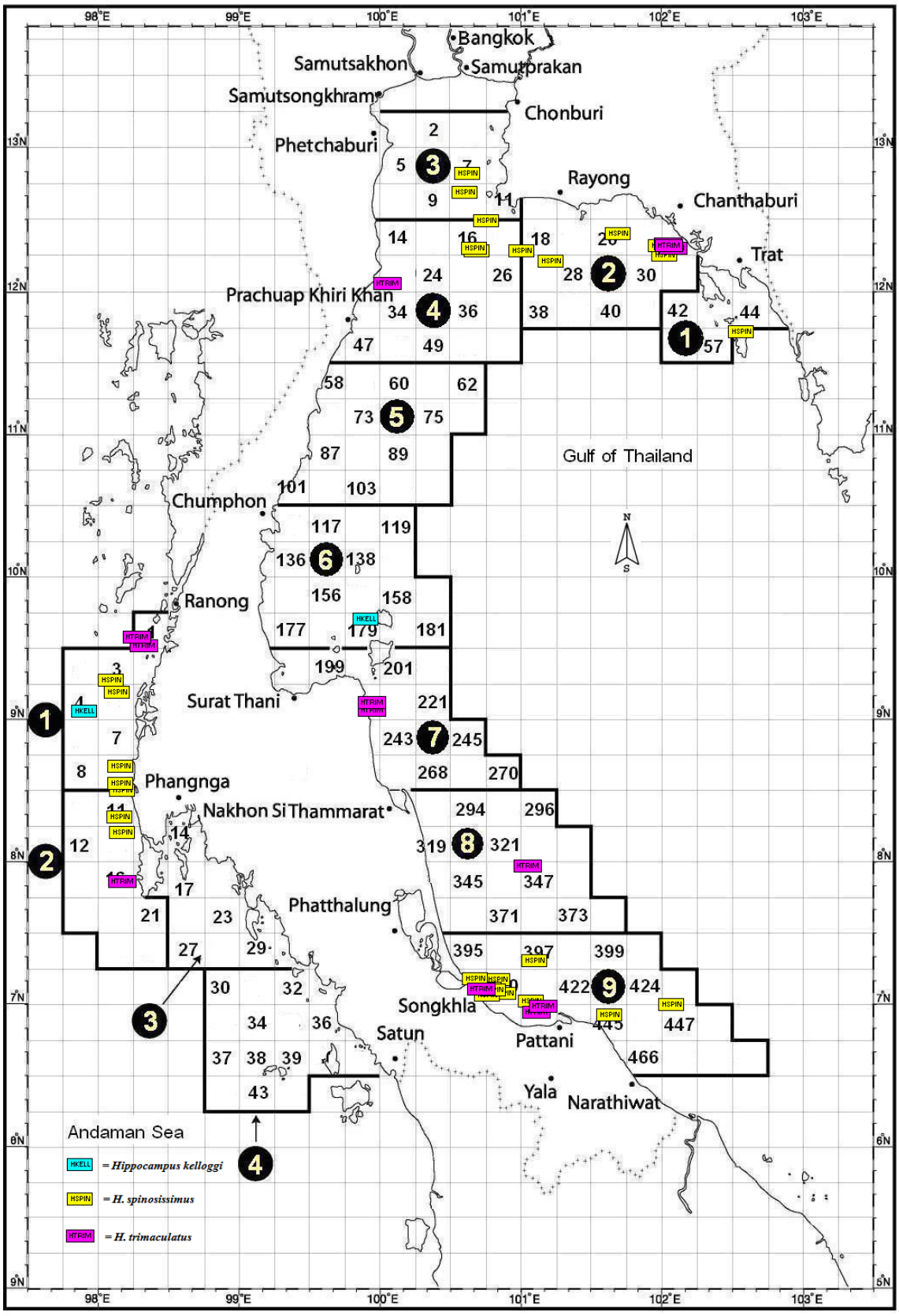


Fig 3. Survey station that found sea horse in the Gulf of Thailand and Andaman sea by research vessel in 2010.

During this project, enumerators had collected data from 3 landing sites along the Gulf of Thailand and 2 landing sites along the Andaman Sea. Enumerators have collected data from trawl fisheries (pair trawlers, otter board trawlers), crab gill nets, collapsible crab trap and squid trap. The major fishing gear catch sea horse is trawler (pair trawlers, otter board trawlers) approximately 99.97 % follow by crab gill nets (0.03%), collapsible crab trap (0.001%) and squid trap (0.0002%). In general, it could be implied that sea horse in Thailand can catch by trawl and gill net fisheries (Table 4).

Table 4. Percent composition of sea horse caught by each type of fishing gear in 2010.

Gear	Percent by weight					
	H. trimaculatus	*H. kuda*	*H. kelloggi*	*H. spinosissimus*	*H. histrixs*	total
Trawl	30.60	0.05	50.08	19.19	0.08	100
Crab gill net	38.73			61.27		100
collapsible crab trap		47.37		52.63		100
Squid trap				100.00		100

Data from enumerator showed the sea horse were collected in the Gulf of Thailand were 149.97 kg in dried weight (Table 5) whereas in the Andaman Sea were 1,547.27 kg in dried weight (Table 6). Composition of sea horse in the Gulf of Thailand 74.86 % is *Hippocampus trimaculatus* followed by *H. spinosissimus* 24.25 % but for the Andaman Sea is *H. kelloggi* 53.08 % followed by *H. trimaculatus* 28.01%. Fig. 4 showed species composition of sea horse in Thai Waters.

Table 5. Sea horse was collected by enumerator in 3 landing sites in the Gulf of Thailand.

Species	Number	Dried weight (kg)	Percent by weight
Hippocampus trimaculatus	35,374	112.27	74.86
H. kuda	48	0.18	0.12
H. kelloggi	136	1.12	0.75
H. spinosissimus	12,554	36.37	24.25
H. histrixs	5	0.03	0.02
Total	48,117	149.97	100.00

Table 6. Sea horse was collected by enumerator in 3 landing sites in the Andaman Sea.

Species	Number	Dried weight (kg)	Percent by weight
H. trimaculatus	181,971	433.36	28.01
H. kuda	116	0.76	0.05
H. kelloggi	103,670	821.30	53.08
H. spinosissimus	62,799	290.54	18.78
H. histrixs	483	1.31	0.08

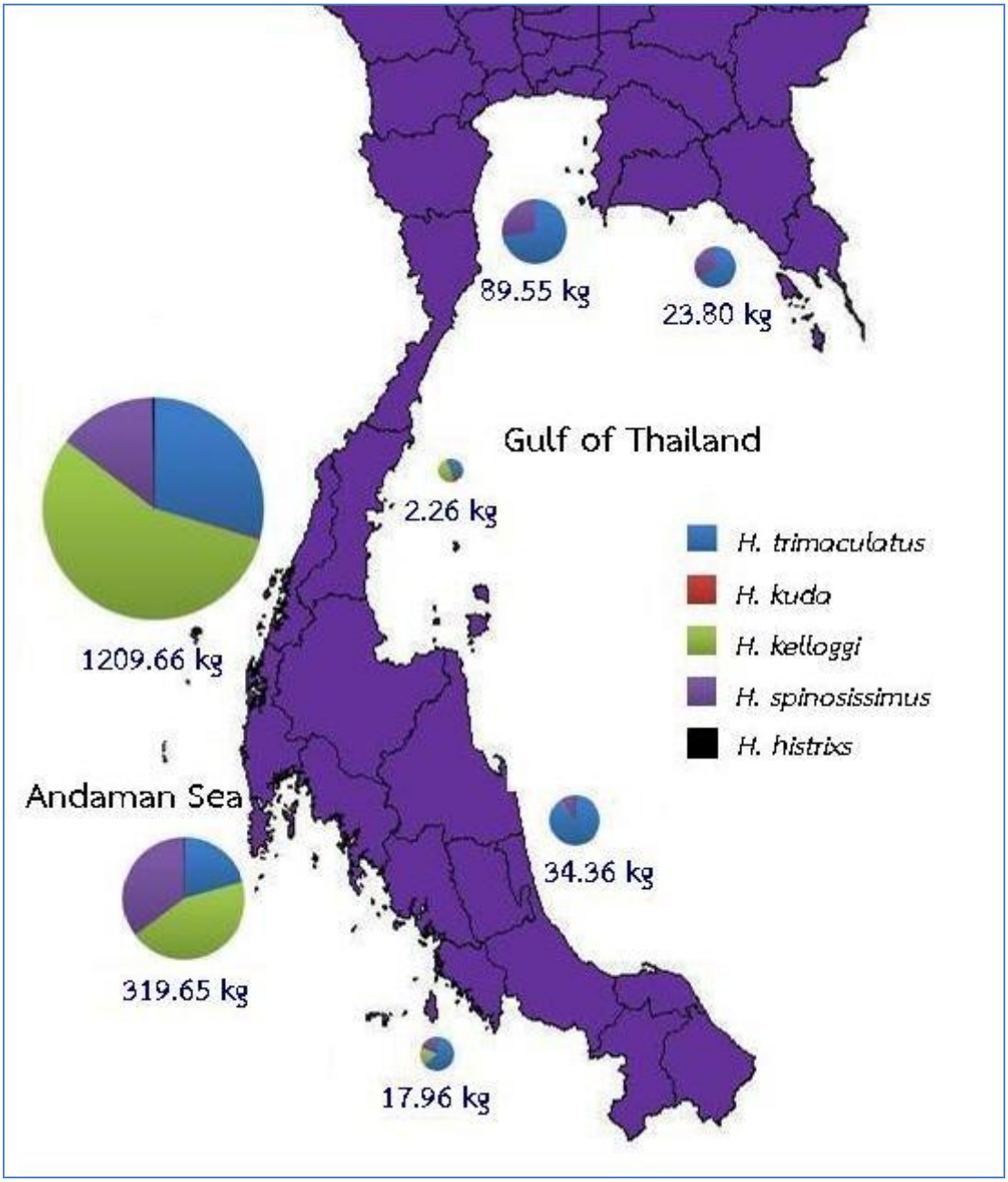


Fig.5 Sea horse composition in Thai water collected by enumerators.

Biomass of sea horse in The Gulf of Thailand and Andaman Sea use swept area by research vessel

The individual catch of sea horse in the gulf of Thailand and Andaman Sea are in Tables 7 and 8. The result of biomass showed in Table 9. The calculate biomass separated into 3 sub areas by the habitat of sea horse were upper Gulf, central and southern Gulf and Andaman sea. Total biomass in the Gulf of Thailand was 9.063 tonnes. The biomass of the Andaman sea was 5.935 tonnes. Total biomass in Thai water was 9.656 tonnes (Table 9).

Table 7. Catch of sea horse in the Gulf of Thailand in 2009- 2010 by research vessel.

Area	Group	research Center	year	Month	Station	Habitat	Lattitude start UTM	Longitude start UTM	Lattitude end UTM	Longitude end UTM	depth (m.)	Species	Weight (g)	height (mm.)	total length (mm.)	Sex	Total catch per haul (kg.)
GOT	Upper gulf	RY	2009	11	18	18	12.3388	101.22708	12.29582	101.2126	30	Hspin	3.5	99	113	F	11.49
GOT	Upper gulf	RY	2010	1	44	44	11.76732	102.51912	11.79363	102.55777	20	Hspin	11.91	174	193	F	70.45
GOT	Upper gulf	RY	2010	1	44	44	11.76732	102.51912	11.79363	102.55777	20	Hspin	7.9	151	174	M	70.45
GOT	Upper gulf	RY	2010	1	44	44	11.76732	102.51912	11.79363	102.55777	20	Hspin	8.61	150	179	M	70.45
GOT	Upper gulf	RY	2010	1	44	44	11.76732	102.51912	11.79363	102.55777	20	Hspin	4.22	160.5	135	M	70.45
GOT	Upper gulf	RY	2010	1	44	44	11.76732	102.51912	11.79363	102.55777	20	Hspin	5.89	125	153.5	M	70.45
GOT	Upper gulf	RY	2010	1	44	44	11.76732		11.79363	102.55777	20	Hspin	3.82	102.5	123.5	M	70.45
GOT	Upper gulf	RY	2010	1	44	44	11.76732	102.51912	11.79363	102.55777	20	Hspin	0.58	71	76.5	F	70.45
GOT	Upper gulf	RY	2010	1	44	44	11.76732	102.51912	11.79363	102.55777	20	Hspin	0.87	66.5	77	F	70.45
GOT	Upper gulf	RY	2010	1	44	44	11.76732	102.51912	11.79363	102.55777	20	Hspin	2.71	111.5	133.5	M	70.45
GOT	Upper gulf	RY	2010	1	Chantaburi1	Chantaburi1	12.43	102.041	12.387	102.077	12	Hspin	11.34	142	168	M	6.53
GOT	Upper gulf	RY	2010	1	Chantaburi1	Chantaburi1	12.43	102.041	12.387	102.077	12	Htrim	5.95	121.5	138	F	6.53
GOT	Upper gulf	RY	2010	3	Chantaburi3	Chantaburi3	12.36	101.97	12.337	102.015	19	Hspin	0.33	44	52	F	28.823
GOT	Upper gulf	RY	2010	5	Chantaburi3	Chantaburi3	12.383	101.969	12.367	101.004	17	Hspin	4.1	104	123.5	M	67.786
GOT	Upper gulf	RY	2010	5	Chantaburi3	Chantaburi3	12.383	101.969	12.367	101.004	17	Hspin	3.65	99	117.5	F	67.786
GOT	Upper gulf	RY	2010	5	Chantaburi1	Chantaburi1	12.434	102.027	12.419	102.042	12	Htrim	9.42	147.5	175	M	6.141
GOT	Upper gulf	RY	2010	5	20	20	12.46713	101.72738	12.48863	101.68848	20	Hspin	4.77	111.5	130	F	31.791
GOT	Upper gulf	RY	2010	5	20	20	12.46713	101.72738	12.48863	101.68848	20	Hspin	14.64	154	186	M	31.791
GOT	Upper gulf	RY	2010	5	20	20	12.46713	101.72738	12.48863	101.68848	20	Hspin	14.66	152.5	183.4	M	31.791
GOT	Upper gulf	RY	2010	8	Chantaburi3	Chantaburi3	12.407	102.036	12.407	102.05	15	Hspin	10.92	150	189	M	5.97

Table 7. (cont.)

Area	Group	research Center	year	Month	Station	Habitat	Lattitude start UTM	Longitude start UTM	Lattitude end UTM	Longitude end UTM	depth (m.)	Species	Weight (g)	height (mm.)	total length (mm.)	Sex	Total catch per haul (kg.)
GOT	Upper gulf	RY	2010	8	Chantaburi3	Chantaburi3	12.407	102.036	12.407	102.05	15	Hspin	5.55	118.5	140.5	F	5.97
GOT	Upper gulf	RY	2010	8	Chantaburi3	Chantaburi3	12.407	102.036	12.407	102.05	15	Htrim	6.21	142	170	F	5.97
GOT	Upper gulf	RY	2010	8	Chantaburi2	Chantaburi2	12.406	102.014	12.406	101.995	15	Hspin	4.99	100	115	F	4.235
GOT	Upper gulf	RY	2010	8	Chantaburi2	Chantaburi2	12.406	102.014	12.406	101.995	15	Hspin	7.22	109	131	M	4.235
GOT	Upper gulf	Hum	2010	3	016	RBM	12 22 93	100 37 48	12 22 95	100 41 19	31	Hspin	12	-	175	M	8.011
GOT	Upper gulf	Hum	2010	3	016	RBM	12 22 93	100 37 48	12 22 95	100 41 19	31	Hspin	12	-	175	M	8.011
GOT	Upper gulf	Hum	2010	3	016	RBM	12 22 93	100 37 48	12 22 95	100 41 19	31	Hspin	8	-	120	M	8.011
GOT	Upper gulf	Hum	2010	3	011	RBM	12 35 72	100 48 59	12 35 63	100 45 99	35	Hspin	10	-	130	M	6.24
GOT	Upper gulf	Hum	2010	3	011	RBM	12 35 72	100 48 59	12 35 63	100 45 99	35	Hspin	8	-	100	M	6.24
GOT	Upper gulf	Hum	2010	3	011	RBM	12 35 72	100 48 59	12 35 63	100 45 99	35	Hspin	8	-	122	M	6.24
GOT	Upper gulf	Hum	2010	3	011	RBM	12 35 72	100 48 59	12 35 63	100 45 99	35	Hspin	8	-	133	M	6.24
GOT	Upper gulf	Hum	2010	3	7	RBM	12 50 80	100 37 32	12 47 67	100 36 67	19	Hspin	8	-	115	M	3.705
GOT	Upper gulf	Hum	2010	5	16	RBM	12 23 17	100 37 41	12 23 20	100 40 77	35	Hspin	3.33	9.6	111	M	9.995
GOT	Upper gulf	Hum	2010	5	7	RBM	12 51 05	100 37 33	12 55 18	100 37 32	18	Hspin	6.12	12.2	138	M	9.967
GOT	Upper gulf	Hum	2010	5	E10	Coastal	12 12 44	100 03 41	12 08 62	100 03 31	31	Htrim	12.95	16	178	F	12.513

Table 7. (cont.)

Area	Group	research Center	year	Month	Station	Habitat	Lattitude start UTM	Longitude start UTM	Lattitude end UTM	Longitude end UTM	depth (m.)	Species	Weight (g)	height (mm.)	total length (mm.)	Sex	Total catch per haul (kg.)
GOT	central and southern gulf	CM	2010	5	179	RBM					11	Hkell	5.78	122	140	F	142.798
GOT	central and southern gulf	SM	2010	4	397	RBM	7.273667	101.0095	7.306667	101.04	20	Hspin	14.89	170	196	F	15.173
GOT	central and southern gulf	SM	2010	4	PT3	Coastal	7.034833	101.1145	7.024667	101.07317	15	Hspin	19.19	174	206	F	17.105
GOT	central and southern gulf	SM	2010	4	PT3	Coastal	7.034833	101.1145	7.024667	101.07317	15	Hspin	19.79	175	211	F	17.105
GOT	central and southern gulf	SM	2010	4	PT3	Coastal	7.034833	101.1145	7.024667	101.07317	15	Hspin	19.3	169	203	F	17.105
GOT	central and southern gulf	SM	2010	4	PT2	Coastal	6.946667	101.10983	0	0	12	Htrim	8.27	133	161	F	7.752
GOT	central and southern gulf	SM	2010	4	420	RBM	7.185667	100.8055	7.175833	100.83533	20	Hspin	10.22	127	155	F	13.962
GOT	central and southern gulf	SM	2010	4	SK3	Coastal	7.185667	100.8055	7.175833	100.83533	20	Hspin	10.22	127	155	F	13.962
GOT	central and southern gulf	SM	2010	4	420	RBM	7.185667	100.8055	7.175833	100.83533	20	Hspin	8.07	118	140	F	13.962
GOT	central and southern gulf	SM	2010	4	SK3	Coastal	7.185667	100.8055	7.175833	100.83533	20	Hspin	8.07	118	140	F	13.962
GOT	central and southern gulf	SM	2010	4	420	RBM	7.185667	100.8055	7.175833	100.83533	20	Hspin	8.77	127	146	F	13.962
GOT	central and southern gulf	SM	2010	4	SK3	Coastal	7.185667	100.8055	7.175833	100.83533	20	Hspin	8.77	127	146	F	13.962
GOT	central and southern gulf	SM	2010	4	SK2	Coastal	7.124833	100.75867	7.118333	100.773	15	Hspin	12.74	145	171	F	13.068
GOT	central and southern gulf	SM	2010	4	SK1	Coastal	7.098833	100.72867	7.112	100.71583	13	Htrim	10.52	141	162	M	7.872
GOT	central and southern gulf	SM	2010	5	SC1	Coastal	9.135667	99.9375	9.097333	99.943333	13	Htrim	5.18	109	115	M	14.036
GOT	central and southern gulf	SM	2010	5	SC1	Coastal	9.135667	99.9375	9.097333	99.943333	13	Htrim	3.51	95	107	M	14.036
GOT	central and southern gulf	SM	2010	5	SC1	Coastal	9.135667	99.9375	9.097333	99.943333	13	Htrim	4.88	115	121	F	14.036

Table 7. (cont.)

Area	Group	research Center	year	Month	Station	Habitat	Lattitude start UTM	Longitude start UTM	Lattitude end UTM	Longitude end UTM	depth (m.)	Species	Weight (g)	height (mm.)	total length (mm.)	Sex	Total catch per haul (kg.)
GOT	central and southern gulf	SM	2010	5	SC1	Coastal	9.135667	99.9375	9.097333	99.943333	13	Htrim	4.53	101	110	F	14.036
GOT	central and southern gulf	SM	2010	5	SC1	Coastal	9.135667	99.9375	9.097333	99.943333	13	Htrim	5.35	101	124	F	14.036
GOT	central and southern gulf	SM	2010	5	SC1	Coastal	9.135667	99.9375	9.097333	99.943333	13	Htrim	4.31	109	125	F	14.036
GOT	central and southern gulf	SM	2010	5	SC2	Coastal	9.190333	99.926667	9.147667	99.939167	12	Htrim	5.78	115	120	F	7.888
GOT	central and southern gulf	SM	2010	5	SC2	Coastal	9.190333	99.926667	9.147667	99.939167	12	Htrim	4.53	102	121	F	7.888
GOT	central and southern gulf	SM	2010	5	SC2	Coastal	9.190333	99.926667	9.147667	99.939167	12	Htrim	6.13	109	129	F	7.888
GOT	central and southern gulf	SM	2010	5	SC2	Coastal	9.190333	99.926667	9.147667	99.939167	12	Htrim	4.93	95	115	F	7.888
GOT	central and southern gulf	SM	2010	5	SC2	Coastal	9.190333	99.926667	9.147667	99.939167	12	Htrim	5.79	105	124	M	7.888
GOT	central and southern gulf	SM	2010	5	SC2	Coastal	9.190333	99.926667	9.147667	99.939167	12	Htrim	5.25	111	124	M	7.888
GOT	central and southern gulf	SM	2010	5	347	RBM	7.950167	101.03267	7.986333	101.0465	42	Htrim	7.95	128	143	F	10.12
GOT	central and southern gulf	SM	2010	6	447	RBM	6.954667	102.06033	6.998	102.067	48	Hspin	3.54	94	108	F	7.415
GOT	central and southern gulf	SM	2010	6	445	RBM	6.895167	101.607	6.9275	101.62783	31	Hspin	6.09	102	112	F	8.616
GOT	central and southern gulf	SM	2010	6	445	RBM	6.895167	101.607	6.9275	101.62783	31	Hspin	5.92	112	129	F	8.616
GOT	central and southern gulf	SM	2010	6	445	RBM	6.895167	101.607	6.9275	101.62783	31	Hspin	5.4	107	119	F	8.616
GOT	central and southern gulf	SM	2010	6	PT3	Coastal	7.002	101.17517	6.990333	101.156	13	Htrim	4.23	98	117	F	8.642
GOT	central and southern gulf	SM	2010	6	SK1	Coastal	7.186833	100.74433	7.185	100.67517	14	Hspin	3.46	103	116	M	5.687
GOT	central and southern gulf	SM	2010	7	397	RBM	7.2865	101.04967	7.3085	101.0975	16	Hspin	3.74	90	125	F	68.618

Table 7. (cont.)

Area	Group	research Center	year	Month	Station	Habitat	Lattitude start UTM	Longitude start UTM	Lattitude end UTM	Longitude end UTM	depth (m.)	Species	Weight (g)	height (mm.)	total length (mm.)	Sex	Total catch per haul (kg.)
GOT	central and southern gulf	SM	2010	7	420	RBM	7.0945	100.84733	7.0755	100.87483	15	Hspin	8.03	107	129	F	33.384
GOT	central and southern gulf	SM	2010	7	SK3	Coastal	7.0945	100.84733	7.0755	100.87483	15	Hspin	8.03	107	129	F	33.384
GOT	central and southern gulf	SM	2010	7	SK1	Coastal	7.101167	100.72867	7.0655	100.75783	11	Hspin	9.49	130	143	M	10.269
GOT	central and southern gulf	SM	2010	7	SK2	Coastal	7.086667	100.83283	7.103667	100.80317	15	Hspin	11.04	131	145	M	18.985
												total (kg)	total (g)	Percent	Percent of total		Total catch (kg)
Gulf of Thailand												0.55185	551.85	100	0.032		1711.708
Upper Gulf												0.25016	250.16	45.33	0.024		1036.062
Central and Southern gulf												0.30169	301.69	54.67	0.045		675.646

Remark : GOT= Gulf of Thailand, RY = Eastern Gulf Marine Fisheries Research and Development Center, Hum = Upper Gulf Marine Fisheries Research and Development Center, CM = Central Gulf Marine Fisheries Research and Development Center, SM = Southern Marine Fisheries Research and Development Center

Table 8. Catch of sea horse in the Andaman Sea during 2009- 2010 by research vessel.

Area	Group	research Center	year	Month	Station	Habitat	Lattitude start UTM	Longitude start UTM	Lattitude end UTM	Longitude end UTM	depth (m.)	Species	Weight (g)	height (mm.)	total length (mm.)	Sex	Total catch (kg.)
Andaman	AS	AP	2010	3	1/2	COASTAL+RBM	9.587617	98.341367	9.550417	98.320117	21	Htrim	7.4128	86	150	M	17.252
Andaman	AS	AP	2010	3	1/3	COASTAL	9.565083	98.244167	9.611783	98.271067	24	Htrim	5.1887	72	131	M	12.1
Andaman	AS	AP	2010	3	1/3	COASTAL	9.565083	98.244167	9.611783	98.271067	24	Htrim	2.4201	55	102	F	12.1
Andaman	AS	AP	2010	3	3	RBM	9.360517	98.114883	9.3085	98.087183	28	Hspin	3.5836	72	126	F	24.06
Andaman	AS	AP	2010	3	5/3	COASTAL	9.173733	98.107783	9.2225	98.132717	34	Hspin	7.2233	80	144	F	52.315
Andaman	AS	AP	2010	3	9/2	COASTAL	8.621383	98.16045	8.569533	98.157017	24	Hspin	14.7355	100	183	M	157.98
Andaman	AS	AP	2010	3	11	RBM	8.38355	98.150517	8.3336	98.148767	43	Hspin	2.7216	55	109	F	46.978
Andaman	AS	AP	2010	3	9/1	COASTAL	8.581833	98.169617	8.524433	98.1708	29	Hspin	10.1067	106	195	M	94.087
Andaman	AS	AP	2010	3	9/1	COASTAL	8.581833	98.169617	8.524433	98.1708	30	Hspin	19.9452	113	202	M	94.087
Andaman	AS	AP	2010	3	13/3	COASTAL	8.166967	98.16825	8.22165	98.16745	45	Hspin	3.2081	53	112	F	58.438
Andaman	AS	AP	2010	3	16	RBM	7.926133	98.143233	7.875117	98.171917	77	Htrim	6.8292	91	153	M	71.957
Andaman	AS	AP	2010	11	4	RBM	9.125583	97.900867	9.085417	97.898917	65	Hkell	24.08	195	238	F	24.923
Andaman	AS	AP	2010	11	9/2	COASTAL	8.648867	98.15865	8.694167	98.157267	26	Hspin	10.53	134	163	F	24.916
Andaman	AS	AP	2010	11	9/2	COASTAL	8.648867	98.15865	8.694167	98.157267	26	Hspin	9.2	134	161	F	24.916
												total (kg)	total (g)	Percent	Percent of total		Total catch (kg)
Andaman Sea												0.127	127.1848	100	0.018		716.109

Remark: AS = Andaman sea, AP = Andaman Sea Marine Fisheries Research and Development Center

Table 9. Biomass of sea horse in the Gulf of Thailand and Andaman Sea by swept area

Area	cw kg	no. tows with seahorses	mean catch per tow (g)	v km/hr	t hour	h km	a km^2	CPUA kg/km^2	CPUA kg/grid	no. grids in area	% grids with seahorses	Biomass of seahorses (kg)
Upper Gulf	0.25016	14	17.87	4.63	1	0.039	0.181	0.0989565	76.3676836			
Central and Southern gulf	0.30169	17	17.75	4.63	1	0.039	0.181	0.0982803	75.8458423			
Gulf of Thailand	0.55185	31	17.80	4.63				0.0985857	76.0815126	469	0.254	9,063.286
Andaman	0.12718	11	11.56	4.63	1	0.039	0.181	0.06403	49.4153996	44	0.273	593.577
Total biomass												9,656.864

Current management policy

Department of Fisheries of Thailand has implemented various notifications through the Fisheries Act of 1947, revised in 1953 and 1985. However, there are no existing management policies which concerning to sea horse. But the important regulations to manage sea horse that caught by main fishing gear as trawler are as follows:

- The Department of Fisheries of Thailand has established the notification to prohibit fishing by trawlers and push netters within a distance of 3,000 m from the shoreline and within a perimeter of 400 m of any stationary gear (Annex 3).
- The number of new entry trawler is limited and push net is banned.
- A conservation area in the Gulf of Thailand about 26,000 km^2 is declared to protect fish during their spawning and breeding seasons from February 15 to May 15 each year. This notification prohibits all types and sizes of trawlers except beam trawlers, all type of purse seiner and encircling gill netters with less than 4.7 cm mesh size in area along the coastline of Prachuap Khirikhan Chumphon and Surat Thani as well as Khanom District in Nakhon Sri Thamarat. And this regulation was extended to the Andaman Sea by declearation of 1,800 km^2 in Phangnga and Krabi (Annex 4).

Thailand has MPA to protect fishing by any type of fishing gears

MPA	Total number	number/area (km2)
Aquatic sanctuaries	56	166.57
Non-hunting area	1	447.49
Nation Marine Park	21	5,685.23
Mangrove swamps	23	2,527.51
Coral reefs areas	420	160.50
Sea grass bed	5	33.66
Area for fisheries	9	52,240.90
Protection of Underwater Archaeological Sites	1	27.00
Environmental protection area	6	12,190.21
Total IUCN Marine protected areas		**73,479.07**
total sea area in Thai water		**316,118.24**
% IUCN MPA		**23.24**
Wetlands of international importance	9	4,226.60
Biosphere reserves	1	246.08
ASEAN Heritage Parks and Reserves	3	1,804.97
Total Marine protected areas		**79,756.72**
total sea area in Thai water		**316,118.24**
% MPA		**25.23**

Reference

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Annex 3

Notification of the Ministry of Agriculture and Cooperatives
Re: Determination of Areas in which Fishing Appliances, i.e., Trawls and Push Nets used with Motor Vessels, are Prohibited

Whereas it is known that the coastal area is habitat of young aquatic animals and a place where they spawn and fishermen have used manpower and small mobile fishing appliances and stationary gear in their fishing for long times. At present, however, there appear many persons using trawls attached with bags with motor vessels in their fishing causing a large numbers of larval aquatic animals, mostly of economical value, and eggs of aquatic animals in shallow coastal water to be caught and destroyed. Moreover, it appears that such fisherman has intruded a stationary gear area of other person and causes damage and often makes a quarrel among them. In order to conserve young aquatic animals and their eggs from being caught or destroyed, the Ministry of Agriculture deems expedient to determines area in which the using of trawls with motor vessels in fishing in shallow coastal water are prohibited;

By virtue of section 32 (2) and (4) of the Fisheries Act B.E. 2490, the Minister of Agriculture issues the Notification as follows:

Clause 1. No person shall, absolutely within the area of 3,000 meters (75 *Sen*) from the coastal water line measuring at the time of fishing and of 400 meters (10 *Sen*) surrounding a place of all kinds of stationary gear permitted for fishing in the sea or gulf or bay in any province, use a trawl with any motor vessel by any method. Exemption shall be allowed to the act of a competent official for academic purpose and obtains a written permission from the Director-General of the Department of Fisheries.

Clause 2. The Notification of the Ministry of Agriculture, Re: Determining of the Area in which Trawls and Push Nets are Prohibited, dated February 17, B.E. 2507 and Notifications of provincial governors with the approval of the Minister of Agriculture that are contrary to or inconsistent with this Notification shall be repealed from the day this Notification comes into force.

Clause 3. This Notification shall come into force when the period of thirty days from the date of its publication under section 60 of the Fisheries Act B.E. 2490 has elapsed.

Given on July 20, B.E. 2515
(Signed) **P. Kannasuth**
(Mr. Preeda Kannasuth)
Permanent Secretary to the Ministry of Agriculture
Acting Minister of Agriculture

Annex 4

Notification of the Ministry of Agriculture and Cooperatives
Re: Prohibition of Certain Kinds of Fishing Appliances in Spawning and Breeding Seasons in Prachuab Kirikhan, Chumporn and Surat Thani Provinces During Specified Period, (No. 2)

Whereas the Ministry of Agriculture and Cooperatives has issued the Notification dated September 24 B.E. 2542, prohibiting certain kinds of fishing appliances in spawning and breeding seasons in the locality of Prachuab Kirikhan, Chumporn and Surat Thani Provinces during February 15 to May 15 every year, in order to prevent brood stocks and their larvae from being caught in excessive numbers and to enhance the sustainable utilization thereof;

After the Notification comes into force, certain kind of fishing appliances are prohibited in spawning and breeding seasons and together with the fact that the recession of economy occurred, fishermen are in difficulties so they made complaints through provincial working committee on solving problems in fishing undertaking. They ask for the suspension of the Notification so that the study on social and economic impact as well as supporting measures will be made. Having considered the matter, the Ministry of Agriculture and Cooperatives deems expedient to mitigate the trouble of the fishermen as requested;

By virtue of section 32 (1) (2) (4) and (5) of the Fisheries Act B.E. 2490, which is the Act containing certain provisions that restricts rights and liberties of persons and where section 29 together with sections 31, 36, 48 and 50 paragraph two, of the Constitution of the Kingdom of Thailand allow to be done by virtue of law, the Minister of Agriculture and Cooperatives issues the Notification as follows:

Clause 1. The Notification of the Ministry of Agriculture and Cooperatives, Re: Prohibition of Certain Kinds of Fishing Appliances in Spawning and Breeding Seasons in Prachuab Kirikhan, Chumporn and Surat Thani Provinces during Specified Period, dated September 24 B.E. 2542 shall be temporarily suspended during February 15 B.E. 2543 to May 15 B.E. 2543.

Clause 2. During the suspension of the Notification under clause 1, the Notification of the Ministry of Agriculture and Cooperatives, Re: Prohibition of Certain Kinds of Fishing Appliances in Spawning and Breeding Seasons in Some Localities during Specified Period, B.E. 2527 dated November 28 B.E. 2527 shall apply *mutatis mutandis*.

Clause 3. This Notification shall come into force when the period of thirty days from the date of its publication under section 60 of the Fisheries Act B.E. 2490 has elapsed.

Given on February 10, B.E. 2543
(Signed) **Pongphol Adireksarn**
(Mr. Pongphol Adireksarn)
Minister of Agriculture and Cooperatives

Annex5

Marine Protected Area

MPA	Total number	number/area (km2)
Aquatic sanctuaries	56	166.57
Non-hunting area	1	447.49
Nation Marine Park	21	5,685.23
Mangrove swamps	23	2,527.51
Coral reefs areas	420	160.50
Sea grass bed	5	33.66
Area for fisheries	9	52,240.90
Protection of Underwater Archaeological Sites	1	27.00
Environmental protection area	6	12,190.21
Total IUCN Marine protected areas		**73,479.07**
total sea area in Thai water		**316,118.24**
% IUCN MPA		**23.24**
Wetlands of international importance	9	4,226.60
Biosphere reserves	1	246.08
ASEAN Heritage Parks and Reserves	3	1,804.97
Total Marine protected areas		**79,756.72**
total sea area in Thai water		**316,118.24**
% MPA		**25.23**

That measures the MPA , which is available to 25.23 % of the total marine area or area of 316,118.24 km2 which includes the Marine Park, fisheries management measures such as closed areas in the Gulf of Thailandand and area of trawl nets, etc. The data source for the seahorse overlapped with several measures that the Department of Fisheries has such a closed area fisheries (Seasonal closure) of closing any of the vessel nets and trawl in Area 3 mile and trawl ban was extended to 10 provinces.

The Seasonal closure in Thailand have 3 areas.

A conservation area in the Gulf of Thailand about 26,000 km^2 is declared to protect fish during their spawning and breeding seasons from February 15 to May 15 each year. This

notification prohibits all types and sizes of trawlers except beam trawlers, all type of purse seiner and encircling gill netters with less than 4.7 cm mesh size in area along the coastline of Prachuap Khirikhan Chumphon and Surat Thani as well as Khanom District in Nakhon Sri Thamarat.

And this regulation was extended to the Andaman Sea by declaration of 4,696 km^2 in Phukhet, Phangnga and Krabi.

In addition, in 2556, Thailand has announced a closed area additional 1 source is a total area of 4,940 km2, which banned trawl fishing tools. Diverging beam trawl nets and gill net in the surrounding areas. Prachuab Khiri Khan, Phetchaburi, Chachoengsao, Samut Prakan Samut Sakhon and Bangkok.

The closed area such as a sea grass, coral reef, mangroves. In addition, the Department of Fisheries to placing artificial reef from out of shore three kilometers for the field of marine larvae .

The artificial reefs are extremely serious for trawl nets into the area. That the country has conservation and management measures are adequate.

Civil society also contributes to the conservation of seahorses as Home stray at home, Thong Tom Yai in Chumphon Province have greatly helped in the conservation of seahorses.

Annex 5-1

Thailand have expanded control area for fisheries by trawl net in the 5400 m. In 10 provinces as Prachaupkirikhan, Krabi, Trang, Rayong, Pattanee, Naratiwas, Satun, Chomporn, Nakhonsritamarach, Chanthaburi

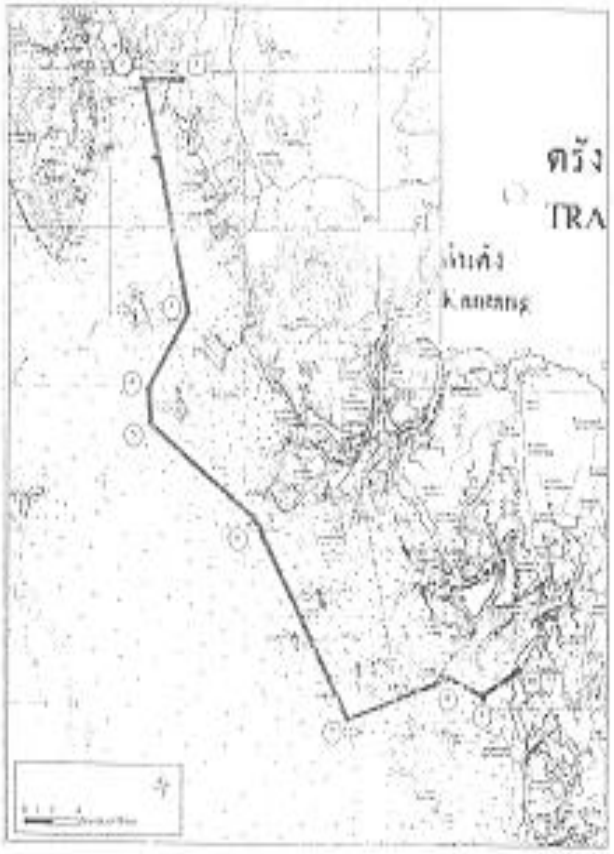
Notification of the Ministry of Agriculture and Cooperatives
Re: Determination of Areas in which Fishing Appliances, i.e., Trawls and Push Nets used with Motor Vessels, are Prohibited

Trang Province

รายละเอียดจุดพิกัดแนบท้าย
ประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุน ที่ใช้
ประกอบเรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดตรัง ลงวันที่ 9 ตุลาคม พ.ศ. 2550

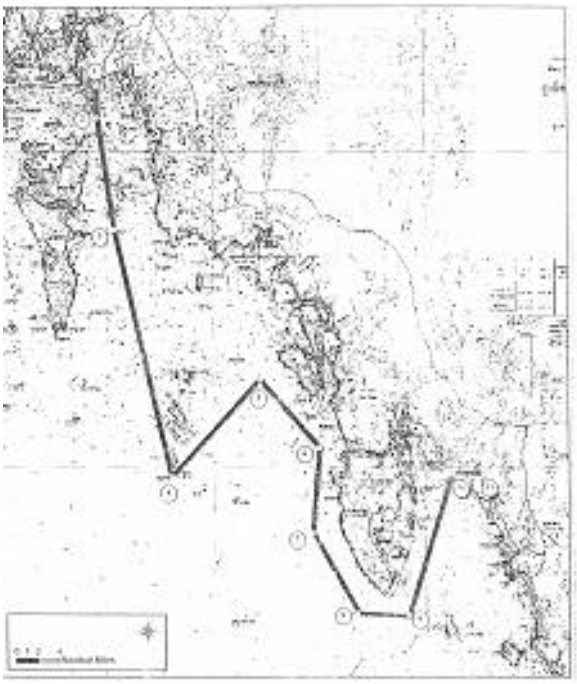
จุดที่ (1) แลต 7° 39' 34" เหนือ ลอง 99° 15' 26" ตะวันออก
จุดที่ (2) แลต 7° 39' 29" เหนือ ลอง 99° 12' 33" ตะวันออก
จุดที่ (3) แลต 7° 24' 40" เหนือ ลอง 99° 15' 51" ตะวันออก
จุดที่ (4) แลต 7° 18' 55" เหนือ ลอง 99° 12' 57" ตะวันออก
จุดที่ (5) แลต 7° 17' 42" เหนือ ลอง 99° 13' 08" ตะวันออก
จุดที่ (6) แลต 7° 11' 43" เหนือ ลอง 99° 20' 51" ตะวันออก
จุดที่ (7) แลต 6° 59' 09" เหนือ ลอง 99° 27' 45" ตะวันออก
จุดที่ (8) แลต 7° 01' 51" เหนือ ลอง 99° 35' 12" ตะวันออก
จุดที่ (9) แลต 7° 09' 42" เหนือ ลอง 99° 37' 40" ตะวันออก
จุดที่ (10) แลต 7° 02' 30" เหนือ ลอง 99° 40' 21" ตะวันออก

แผนที่แนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุน
ที่ใช้ประกอบเรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดตรัง ลงวันที่ 9 ตุลาคม พ.ศ. 2550



Krabi Province

แผนที่แนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุนที่ใช้ประกอบ
เรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดกระบี่ ลงวันที่ 9 ตุลาคม พ.ศ. 2550



รายละเอียดจุดพิกัดแนบท้าย
ประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุน
ที่ใช้ประกอบเรือยนต์ทำการประมง
ในที่จับสัตว์น้ำบางแห่งของจังหวัดกระบี่
ลงวันที่ 9 ตุลาคม พ.ศ. 2550

จุดที่ (1) แลต 8° 16′ 17″ เหนือ
ลอง 98° 39′ 04″ ตะวันออก
จุดที่ (2) แลต 8° 13′ 19″ เหนือ
ลอง 98° 39′ 04″ ตะวันออก
จุดที่ (3) แลต 8° 02′ 42″ เหนือ
ลอง 98° 40′ 43″ ตะวันออก
จุดที่ (4) แลต 7° 38′ 00″ เหนือ
ลอง 98° 46′ 06″ ตะวันออก
จุดที่ (5) แลต 7° 48′ 20″ เหนือ
ลอง 98° 54′ 25″ ตะวันออก
จุดที่ (11) แลต 7° 39′ 34″ เหนือ
ลอง 99° 15′ 26″ ตะวันออก
จุดที่ (6) แลต 7° 41′ 55″ เหนือ
ลอง 99° 00′ 00″ ตะวันออก
จุดที่ (7) แลต 7° 33′ 43″ เหนือ
ลอง 98° 59′ 14″ ตะวันออก
จุดที่ (8) แลต 7° 26′ 10″ เหนือ
ลอง 99° 03′ 22″ ตะวันออก
จุดที่ (9) แลต 7° 25′ 53″ เหนือ
ลอง 99° 08′ 19″ ตะวันออก
จุดที่ (10) แลต 7° 39′ 29″ เหนือ
ลอง 99° 12′ 30″ ตะวันออก

Prachaupkirikhan Province

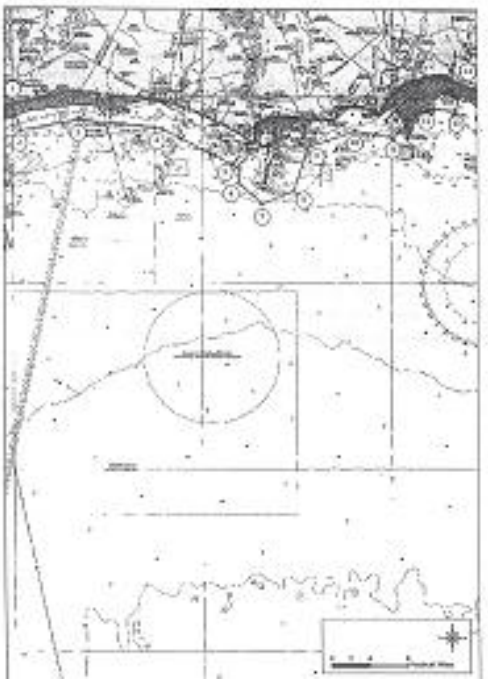
รายละเอียดจุดพิกัดแนบท้าย
ประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุนที่ใช้
ประกอบเรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่งของ
จังหวัดประจวบคีรีขันธ์
ลงวันที่ 9 ตุลาคม พ.ศ. 2550

จุดที่ (1) แลต 12° 35′ 54″ เหนือ
ลอง 99° 57′ 32″ ตะวันออก
จุดที่ (2) แลต 12° 35′ 53″ เหนือ
ลอง 100° 00′ 29″ ตะวันออก
จุดที่ (3) แลต 12° 11′ 16″ เหนือ
ลอง 100° 04′ 28″ ตะวันออก
จุดที่ (4) แลต 11° 54′ 32″ เหนือ
ลอง 99° 52′ 50″ ตะวันออก
จุดที่ (5) แลต 11° 44′ 22″ เหนือ
ลอง 99° 51′ 58″ ตะวันออก
จุดที่ (6) แลต 11° 33′ 02″ เหนือ
ลอง 99° 42′ 56″ ตะวันออก
จุดที่ (7) แลต 11° 09′ 48″ เหนือ
ลอง 99° 37′ 27″ ตะวันออก
จุดที่ (8) แลต 11° 05′ 00″ เหนือ
ลอง 99° 32′ 22″ ตะวันออก
จุดที่ (9) แลต 11° 04′ 33″ เหนือ
ลอง 99° 36′ 53″ตะวันออก
จุดที่ (10) แลต 10° 59′ 10″ เหนือ
ลอง 99° 32′ 12″ ตะวันออก
จุดที่ (11) แลต 10° 59′ 10″ เหนือ
ลอง 99° 30′ 13″ ตะวันออก

แผนที่แนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุนที่ใช้ประกอบ
เรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดประจวบคีรีขันธ์ ลงวันที่ 9 ตุลาคม พ.ศ. 2550

Rayong Province

แผนที่แนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุน
ที่ใช้ประกอบเรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดระยอง
ลงวันที่ 3 มกราคม พ.ศ. 2551

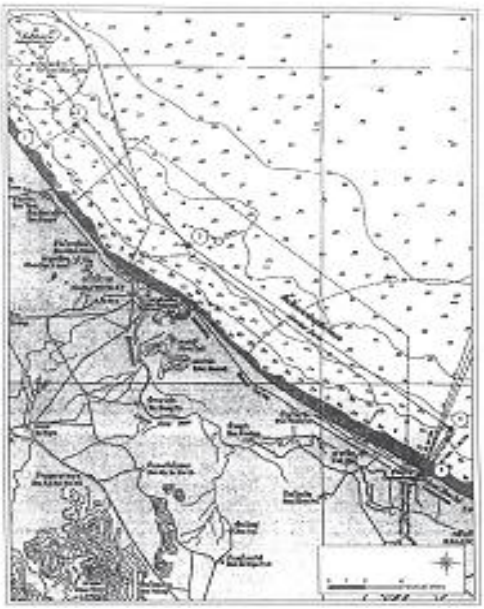


รายละเอียดจุดพิกัดแนบท้าย
ประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุนที่ใช้
ประกอบเรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดระยอง
ลงวันที่ 3 มกราคม พ.ศ. 2551

จุดที่ (1) แลด 12° 39' 20" เหนือ ลอง 100° 59' 50" ตะวันออก
จุดที่ (2) แลด 12° 36' 19" เหนือ ลอง 101° 00' 46" ตะวันออก
จุดที่ (3) แลด 12° 37' 32" เหนือ ลอง 101° 06' 59" ตะวันออก
จุดที่ (4) แลด 12° 36' 35" เหนือ ลอง 101° 15' 46" ตะวันออก
จุดที่ (5) แลด 12° 32' 20" เหนือ ลอง 101 °23' 58" ตะวันออก
จุดที่ (6) แลด 12° 30' 45" เหนือ ลอง 101° 23' 55" ตะวันออก
จุดที่ (7) แลด 12° 28' 30" เหนือ ลอง 101° 26' 22" ตะวันออก
จุดที่ (8) แลด 12° 29' 54" เหนือ ลอง 101° 29' 44" ตะวันออก
จุดที่ (9) แลด 12° 34' 40" เหนือ ลอง 101° 31' 14" ตะวันออก
จุดที่ (10) แลด 12° 36' 25" เหนือ ลอง 101° 36' 11" ตะวันออก
จุดที่ (11) แลด 12° 35' 41" เหนือ ลอง 101° 40' 09" ตะวันออก
จุดที่ (12) แลด 12° 38' 53" เหนือ ลอง 101° 43' 21" ตะวันออก
จุดที่ (13) แลด 12° 38' 38" เหนือ ลอง 101° 46' 45" ตะวันออก
จุดที่ (14) แลด 12° 41' 36" เหนือ ลอง 101° 47' 32" ตะวันออก

Naratiwas Province

แผนที่แนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุน
ที่ใช้ประกอบเรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดนราธิวาส
ลงวันที่ 3 มกราคม พ.ศ. 2551

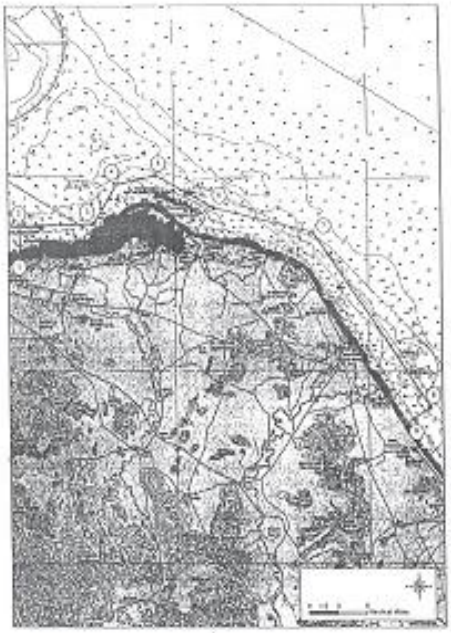


รายละเอียดจุดพิกัดแนบท้าย
ประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุนที่ใช้
ประกอบเรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดนราธิวาส ลงวันที่ 3 มกราคม พ.ศ. 2551

จุดที่ (1) แลด 6° 34' 29" เหนือ ลอง 101° 43' 41" ตะวันออก
จุดที่ (2) แลด 6° 36' 19" เหนือ ลอง 101° 46' 24" ตะวันออก
จุดที่ (3) แลด 6° 28' 47" เหนือ ลอง 101° 52' 38" ตะวันออก
จุดที่ (4) แลด 6° 17' 17" เหนือ ลอง 102° 07' 09" ตะวันออก
จุดที่ (5) แลด 6° 14' 39" เหนือ ลอง 102° 06' 31" ตะวันออก

Pattanee Province

แผนที่แนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลาก
ที่ใช้ประกอบเรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดปัตตานี ลงวันที่ 3 มกราคม พ.ศ. 2551

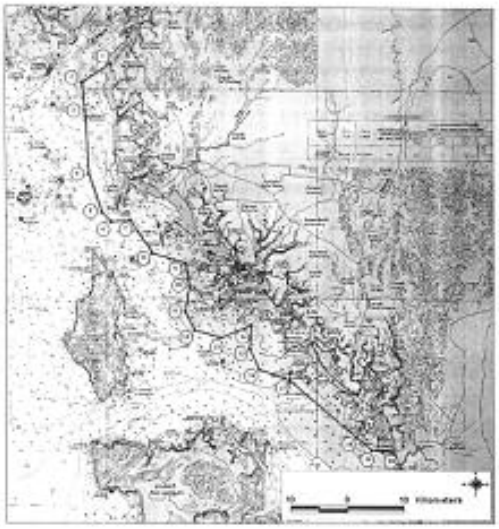


รายละเอียดจุดพิกัดแนบท้าย
ประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากที่ใช้ประกอบเรือยนต์
ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดปัตตานี
ลงวันที่ 3 มกราคม พ.ศ. 2551

จุดที่ (1) แลด 6° 51′ 20″ เหนือ
ลอง 101° 04′ 02″ ตะวันออก
จุดที่ (2) แลด 6° 54′ 58″ เหนือ
ลอง 101° 03′ 06″ ตะวันออก
จุดที่ (3) แลด 6° 55′ 18″ เหนือ
ลอง 101° 11′ 42″ ตะวันออก
จุดที่ (4) แลด 6° 59′ 18″ เหนือ
ลอง 101° 14′ 01″ ตะวันออก
จุดที่ (5) แลด 7° 00′ 15″ เหนือ
ลอง 101° 18′ 07″ ตะวันออก
จุดที่ (6) แลด 6° 56′ 59″ เหนือ
ลอง 101° 24′ 08″ ตะวันออก
จุดที่ (7) แลด 6° 54′ 25″ เหนือ
ลอง 101° 34′ 25″ ตะวันออก
จุดที่ (8) แลด 6° 36′ 19″ เหนือ
ลอง 101° 46′ 24″ ตะวันออก
จุดที่ (9) แลด 6° 34′ 29″ เหนือ
ลอง 101° 43′ 41″ ตะวันออก

Satun Province

แผนที่แนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลาก
และอวนรุนที่ใช้ประกอบเรือยนต์ทำการประมง
ในที่จับสัตว์น้ำบางแห่งของจังหวัดสตูล
ลงวันที่ 29 มกราคม พ.ศ. 2552



รายละเอียดจุดพิกัดแนบท้าย
ประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุนที่ใช้
ประกอบเรือยนต์ทำการประมง ในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดสตูล
ลงวันที่ 29 มกราคม พ.ศ. 2552

จุดที่ (1) แลด 7° 02′ 30″ เหนือ
ลอง 99° 40′ 21″ ตะวันออก
จุดที่ (2) แลด 7° 00′ 42″ เหนือ
ลอง 99° 37′ 40″ ตะวันออก
จุดที่ (3) แลด 6° 57′ 59″ เหนือ
ลอง 99° 37′ 57″ ตะวันออก
จุดที่ (4) แลด 6° 51′ 53″ เหนือ
ลอง 99° 38′ 19″ ตะวันออก
จุดที่ (5) แลด 6° 48′ 16″ เหนือ
ลอง 99° 39′ 34″ ตะวันออก
จุดที่ (6) แลด 6° 47′ 21″ เหนือ
ลอง 99° 40′ 26″ ตะวันออก
จุดที่ (7) แลด 6° 47′ 33″ เหนือ
ลอง 99° 42′ 13″ ตะวันออก
จุดที่ (8) แลด 6° 44′ 20″ เหนือ
ลอง 99° 44′ 22″ ตะวันออก
จุดที่ (9) แลด 6° 43′ 25″ เหนือ
ลอง 99° 47′ 31″ ตะวันออก
จุดที่ (10) แลด 6° 41′ 11″ เหนือ
ลอง 99° 47′ 53″ ตะวันออก
จุดที่ (11) แลด 6° 38′ 41″ เหนือ
ลอง 99° 47′ 29″ ตะวันออก
จุดที่ (12) แลด 6° 36′ 56″ เหนือ
ลอง 99° 48′ 23″ ตะวันออก
จุดที่ (13) แลด 6° 36′ 13″ เหนือ
ลอง 99° 50′ 54″ ตะวันออก
จุดที่ (14) แลด 6° 37′ 25″ เหนือ
ลอง 99° 53′ 48″ ตะวันออก
จุดที่ (15) แลด 6° 35′ 09″ เหนือ
ลอง 99° 53′ 37″ ตะวันออก
จุดที่ (16) แลด 6° 33′ 12″ เหนือ
ลอง 99° 54′ 32″ ตะวันออก
จุดที่ (17) แลด 6° 32′ 12″ เหนือ
ลอง 99° 57′ 24″ ตะวันออก
จุดที่ (18) แลด 6° 26′ 42″ เหนือ
ลอง 100° 03′ 42″ ตะวันออก
จุดที่ (19) แลด 6° 25′ 24″ เหนือ
ลอง 100° 05′ 12″ ตะวันออก
จุดที่ (20) แลด 6° 25′ 15″ เหนือ
ลอง 100° 07′ 11″ ตะวันออก

Nakhonsritamarach Province

แผนที่แนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุน
ที่ใช้ประกอบเรือยนต์ทำการประมง
ในที่จับสัตว์น้ำบางแห่งของจังหวัดนครศรีธรรมราช
ลงวันที่ 17 กรกฎาคม พ.ศ. 2552

รายละเอียดจุดพิกัดแนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุน
ที่ใช้ประกอบเรือยนต์ทำการประมง
ในที่จับสัตว์น้ำบางแห่งของจังหวัดนครศรีธรรมราช
ลงวันที่ 17 กรกฎาคม พ.ศ. 2552

จุดที่ (1) แลก 8° 19' 33" เหนือ
แลง 99° 46' 01" ตะวันออก
จุดที่ (2) แลก 8° 21' 09" เหนือ
แลง 99° 46' 51" ตะวันออก
จุดที่ (3) แลก 8° 19' 53" เหนือ
แลง 99° 51' 04" ตะวันออก
จุดที่ (4) แลก 8° 18 ' 34" เหนือ
แลง 99° 52' 25" ตะวันออก
จุดที่ (5) แลก 8° 13' 32" เหนือ
แลง 99° 54' 19" ตะวันออก
จุดที่ (6) แลก 8u 09' 30" เหนือ
แลง 99° 54' 20" ตะวันออก
จุดที่ (7) แลก 8° 08' 40" เหนือ
แลง 99° 56' 21" ตะวันออก
จุดที่ (8) แลก 8° 05' 32" เหนือ
แลง 99° 56' 25" ตะวันออก
จุดที่ (9) แลก 8° 01' 55" เหนือ
แลง 99° 56' 25" ตะวันออก
จุดที่ (10) แลก 8° 57' 59" เหนือ
แลง 99° 57' 43" ตะวันออก
จุดที่ (11) แลก 8° 52' 46" เหนือ
แลง 99° 57' 59" ตะวันออก
จุดที่ (12) แลก 8° 48' 09" เหนือ
แลง 99° 58' 56" ตะวันออก
จุดที่ (13) แลก 8° 37' 12" เหนือ
แลง 100° 00' 20" ตะวันออก
จุดที่ (14) แลก 8° 33' 12" เหนือ
แลง 100° 05' 12" ตะวันออก
จุดที่ (15) แลก 8° 34' 08" เหนือ
แลง 100° 08' 25" ตะวันออก
จุดที่ (16) แลก 8u 32' 56" เหนือ
แลง 100° 11' 38" ตะวันออก
จุดที่ (17) แลก 8° 29' 55" เหนือ
แลง 100° 14' 25" ตะวันออก
จุดที่ (18) แลก 8° 22' 54" เหนือ
แลง 100° 17' 25" ตะวันออก
จุดที่ (19) แลก 8° 13' 21" เหนือ
แลง 100° 20' 08" ตะวันออก
จุดที่ (20) แลก 7° 56' 37" เหนือ
แลง 100° 23' 02" ตะวันออก
จุดที่ (21) แลก 7° 55' 55" เหนือ
แลง 100° 20' 13" ตะวันออก

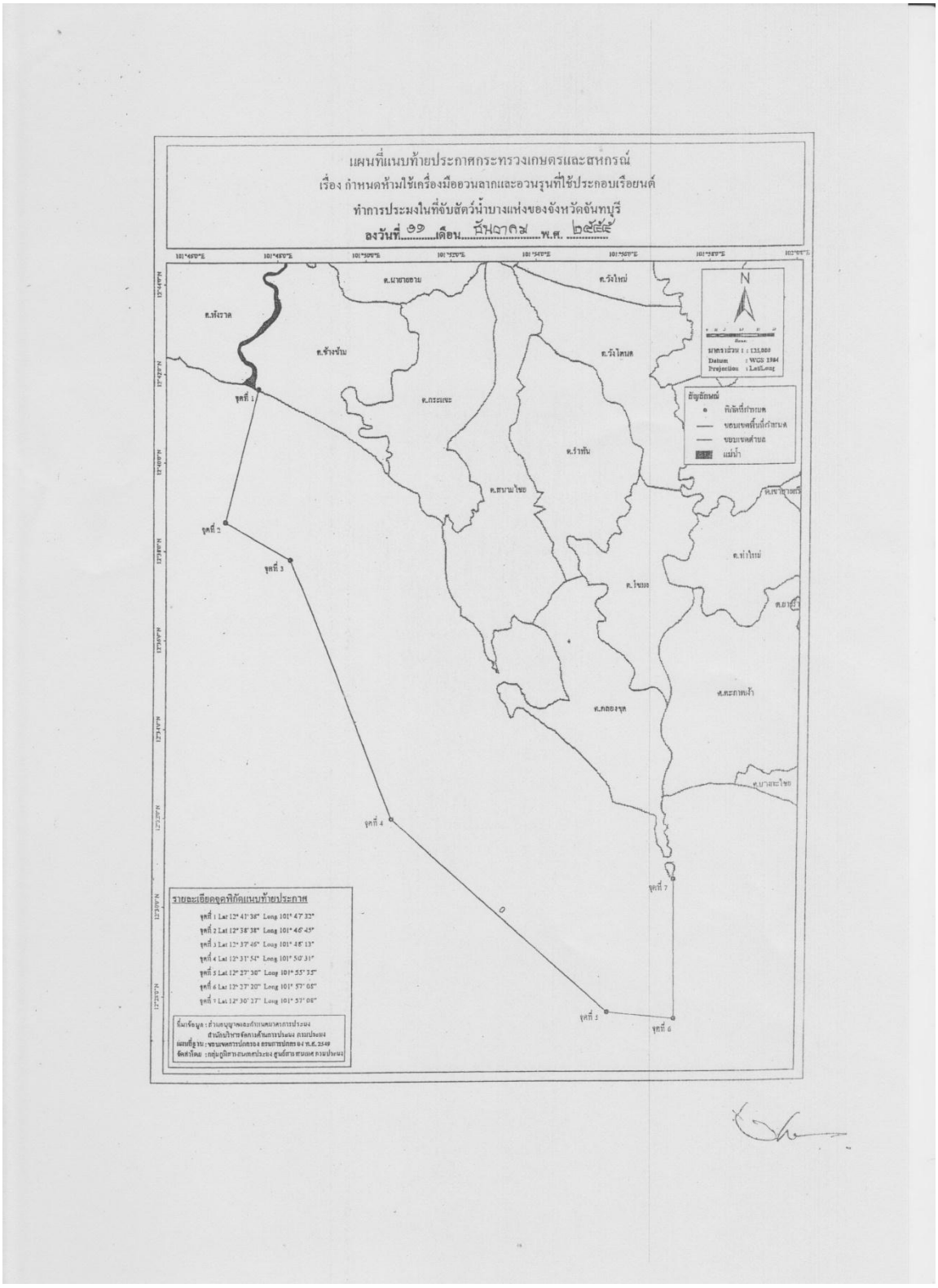
Chomporn Province

แผนที่แนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุนที่ใช้ประกอบ
เรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่งของจังหวัดชุมพร
ลงวันที่ 11 เมษายน พ.ศ. 2554

รายละเอียดจุดพิกัดแนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุน
ที่ใช้ประกอบเรือยนต์ทำการประมง
ในที่จับสัตว์น้ำบางแห่งของจังหวัดชุมพร
ลงวันที่...11....เมษายน..พ.ศ. 2554

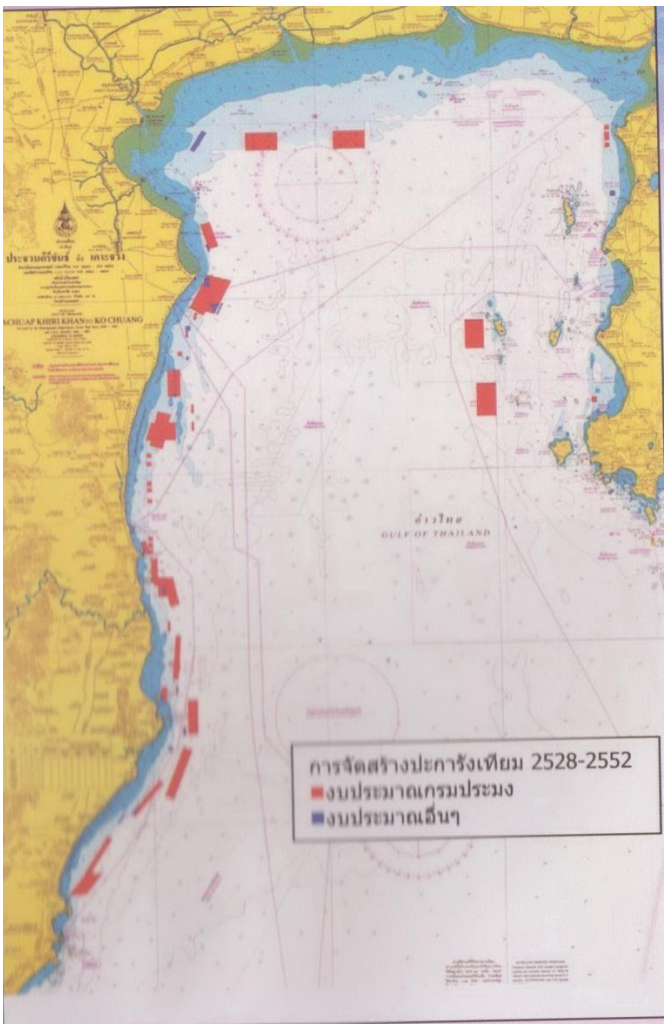
จุดที่ (1) แลก 10° 59' 10" เหนือ
แลง 99° 32' 12" ตะวันออก
จุดที่ (2) แลก 10° 57' 00" เหนือ
แลง 99° 32' 24" ตะวันออก
จุดที่ (3) แลก 10° 54' 00" เหนือ
แลง 99° 34' 00" ตะวันออก
จุดที่ (4) แลก 10° 50' 48" เหนือ
แลง 99° 35' 12" ตะวันออก
จุดที่ (5) แลก 10° 49' 12" เหนือ
แลง 99° 32' 00" ตะวันออก
จุดที่ (6) แลก 10° 48' 48" เหนือ
แลง 99° 29' 24" ตะวันออก
จุดที่ (7) แลก 10° 44' 00" เหนือ
แลง 99° 28' 00" ตะวันออก
จุดที่ (8) แลก 10° 38' 00" เหนือ
แลง 99° 24' 00" ตะวันออก
จุดที่ (9) แลก 10° 37' 00" เหนือ
แลง 99° 21' 12" ตะวันออก
จุดที่ (10) แลก 10° 33' 00" เหนือ
แลง 99° 20' 00" ตะวันออก
จุดที่ (11) แลก 10° 31' 00" เหนือ
แลง 99° 16' 00" ตะวันออก
จุดที่ (12) แลก 10° 21' 00" เหนือ
แลง 99° 16' 00" ตะวันออก
จุดที่ (13) แลก 10° 17' 36" เหนือ
แลง 99° 15' 12" ตะวันออก
จุดที่ (14) แลก 10° 14' 00" เหนือ
แลง 99° 18' 00" ตะวันออก
จุดที่ (15) แลก 10° 12' 12" เหนือ
แลง 99° 17' 36" ตะวันออก
จุดที่ (16) แลก 10° 09' 00" เหนือ
แลง 99° 13' 00" ตะวันออก
จุดที่ (17) แลก 10° 08' 48" เหนือ
แลง 99° 12' 24" ตะวันออก
จุดที่ (18) แลก 10° 03' 24" เหนือ
แลง 99° 14' 00" ตะวันออก
จุดที่ (19) แลก 10° 02' 00" เหนือ
แลง 99° 14' 00" ตะวันออก
จุดที่ (20) แลก 09° 58' 00" เหนือ
แลง 99° 12' 24" ตะวันออก
จุดที่ (21) แลก 09° 55' 24" เหนือ
แลง 99° 12' 48" ตะวันออก
จุดที่ (22) แลก 09° 50 ' 00" เหนือ
แลง 99° 13' 00" ตะวันออก
จุดที่ (23) แลก 09° 48' 24" เหนือ
แลง 99° 11' 36" ตะวันออก
จุดที่ (24) แลก 09° 47' 00" เหนือ
แลง 99° 12' 00" ตะวันออก
จุดที่ (25) แลก 09° 43 ' 00" เหนือ
แลง 99° 12' 00" ตะวันออก
จุดที่ (26) แลก 09° 43' 00" เหนือ
แลง 99° 10'00" ตะวันออก

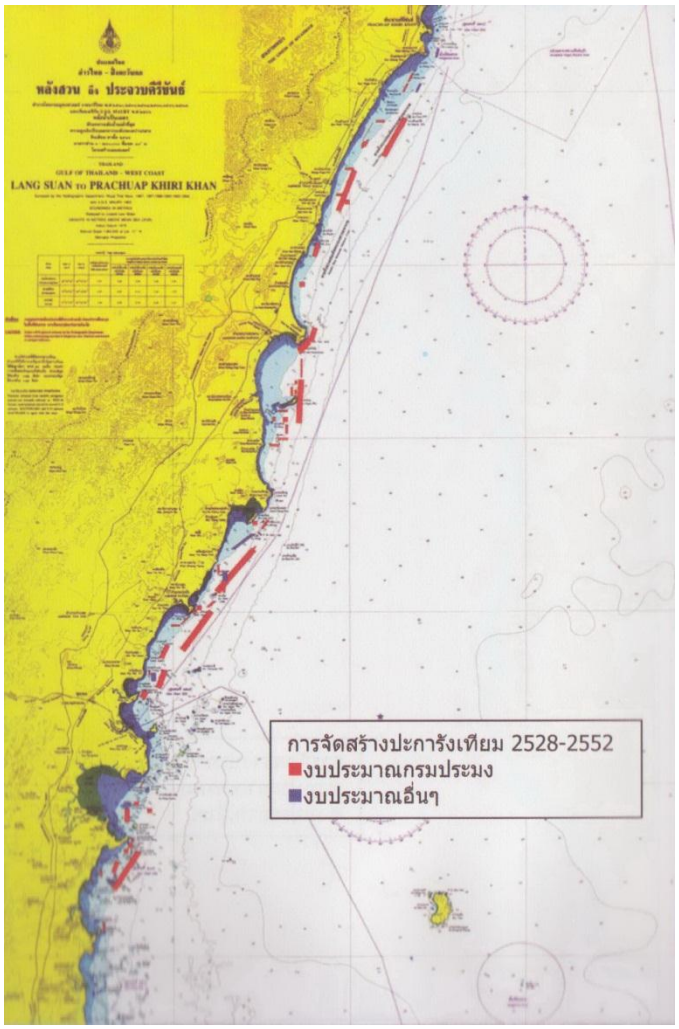
Chanthaburi Province

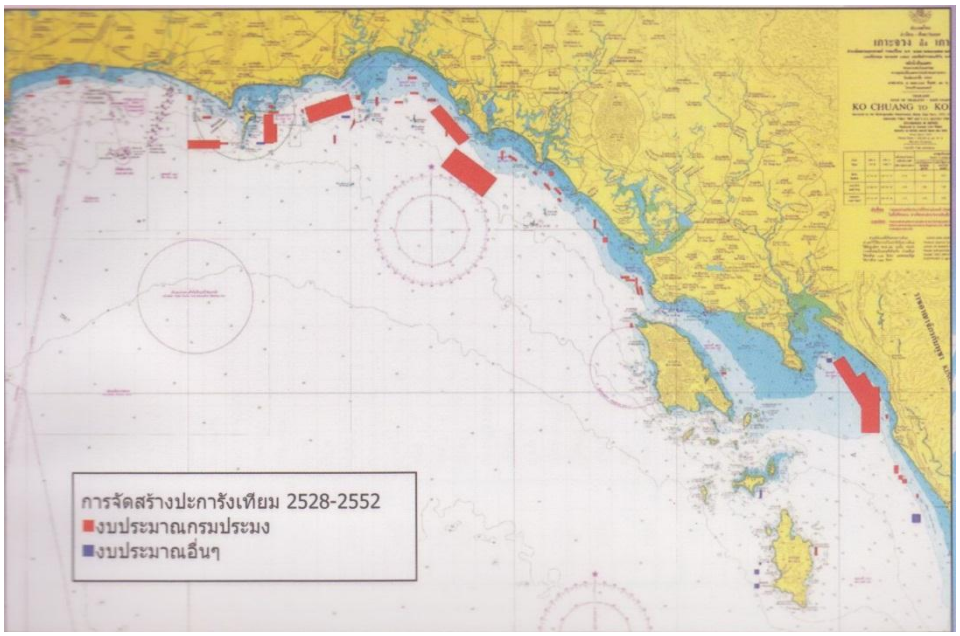


Annex 6

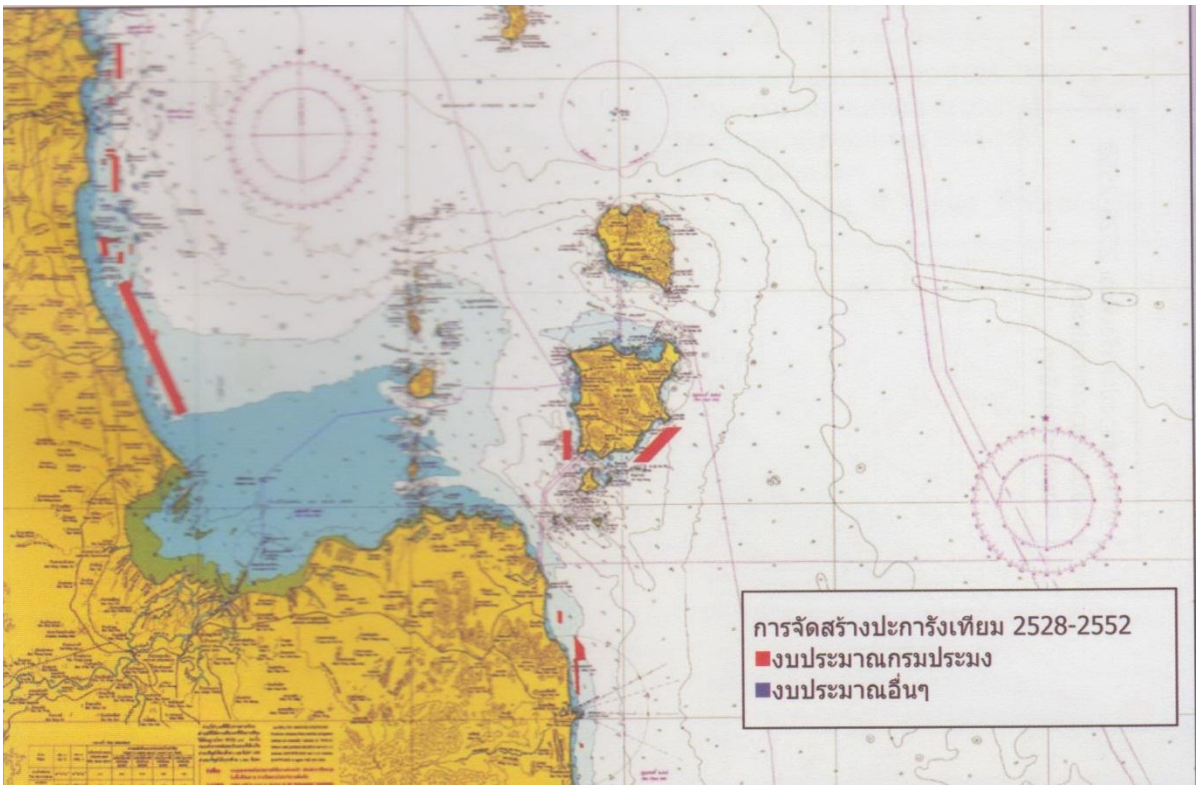
Artificial coral reef in the Gulf of Thailand.

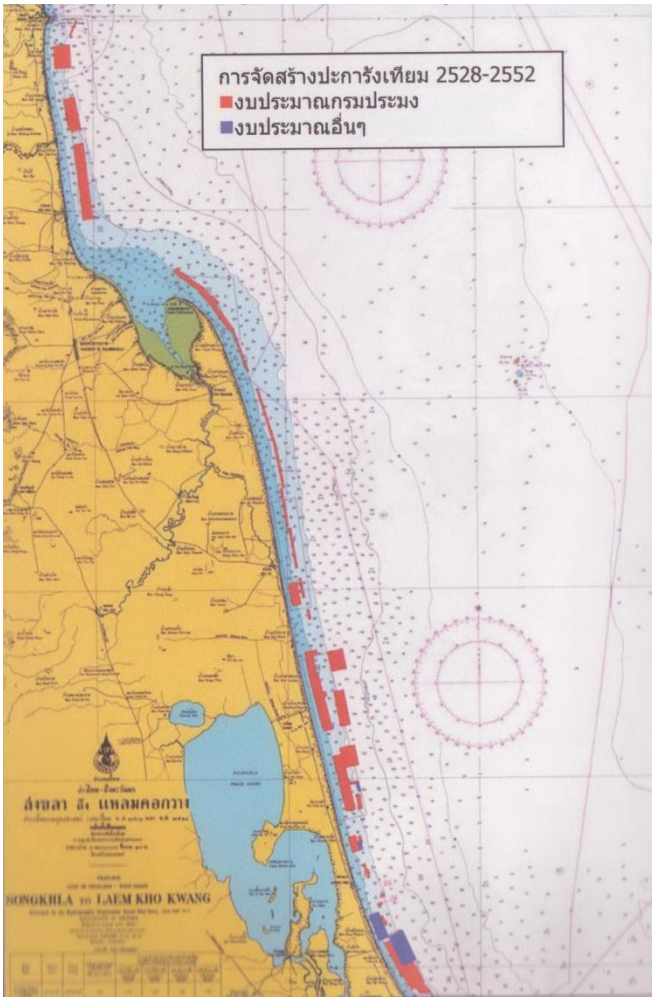




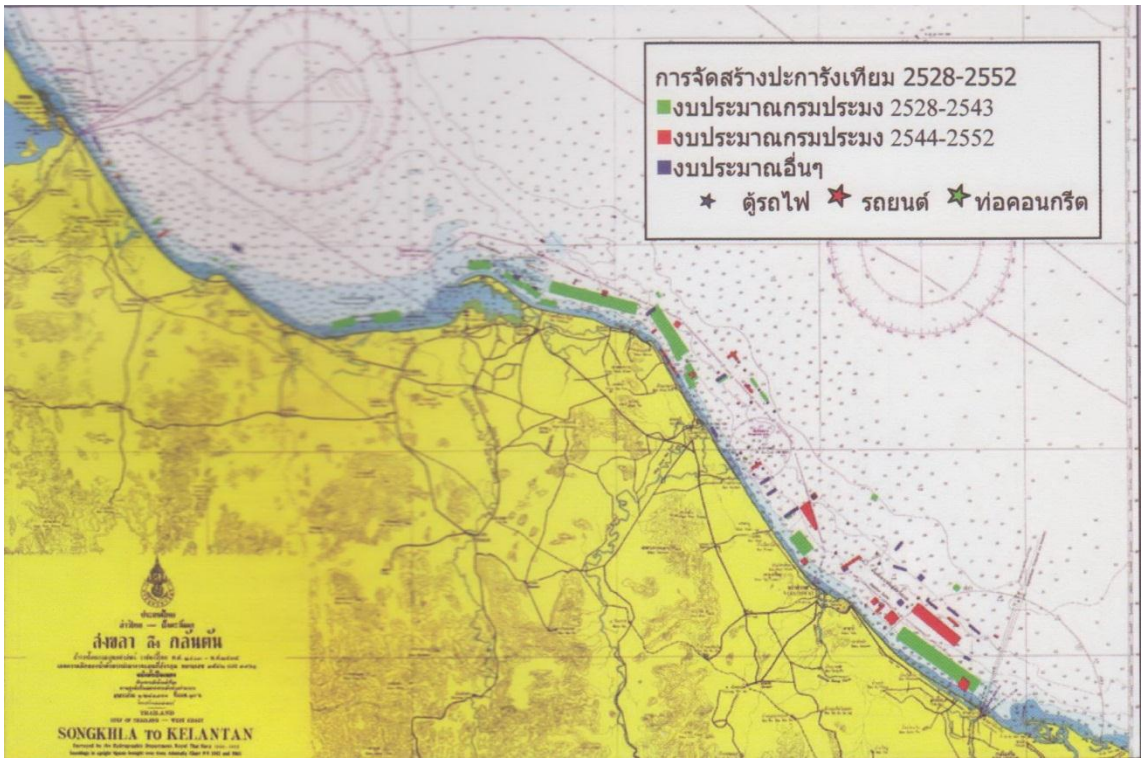


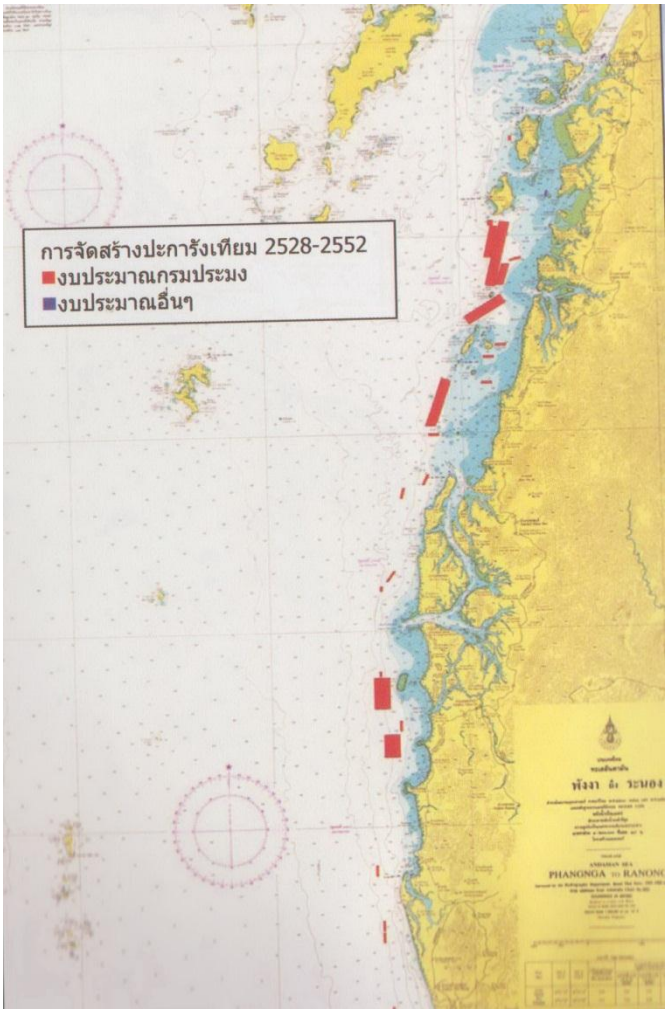
Artificial coral reef in the Gulf of Thailand.



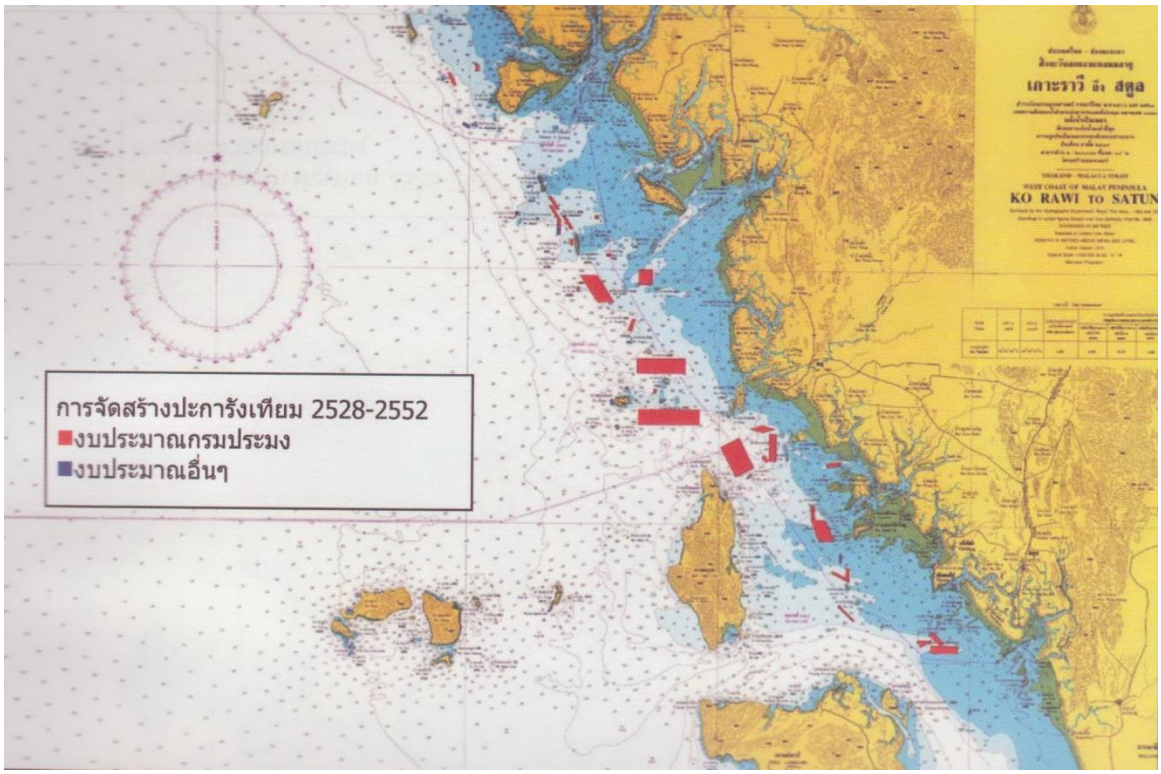


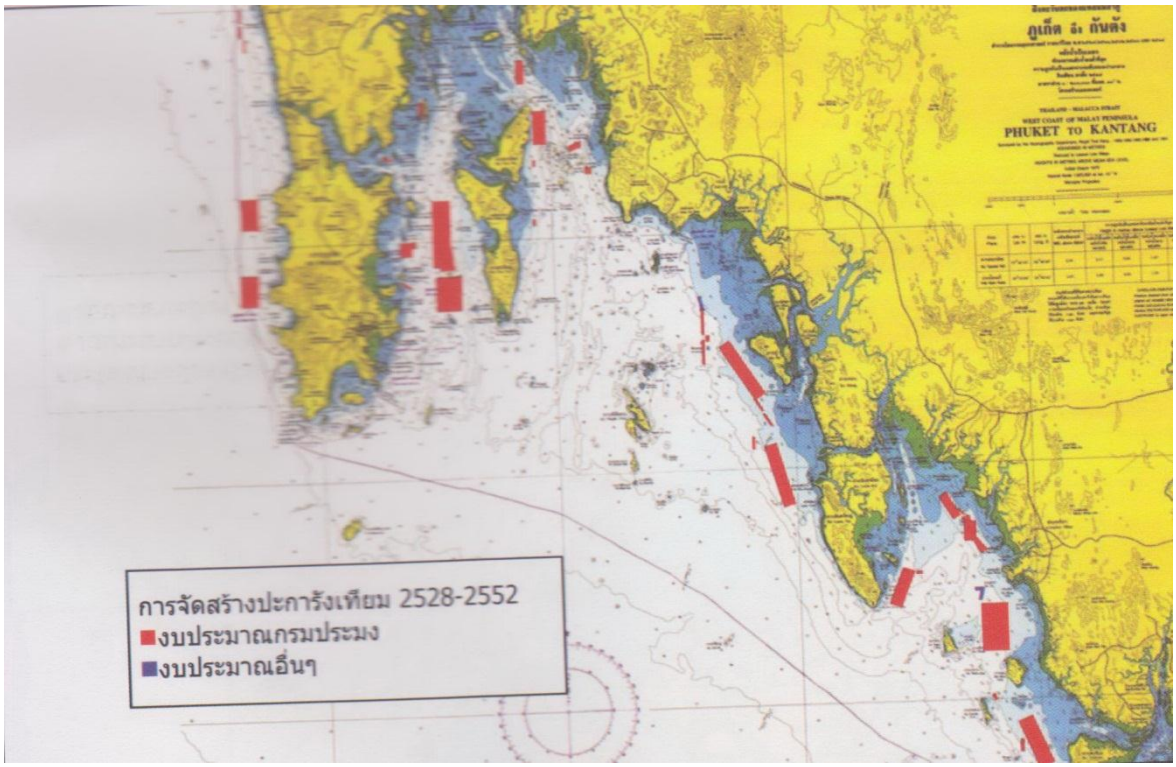
Artificial coral reef in the Gulf of Thailand.





Artificial coral reef in the Andaman Sea.





Annex 7

Monitoring System by Thai DOF

In order to monitor the current status of sea horse fisheries in Thailand, five main landing sites have been selected. The survey will organize in Rayong, Phetchburi, Chumphon, Songkhla, Phuket in every 3 year. The survey and data collection will manage by fisheries scientists from the 5 marine fisheries research and development centers under Marine Fisheries Research and Development Bureau:

1. Upper Gulf Marine Fisheries Research and Development Center
2. Central Gulf Marine Fisheries Research and Development Center
3. Southern Marine Fisheries Research and Development Center
4. Eastern Gulf Marine Fisheries Research and Development Center
5. Andaman Sea Marine Fisheries Research and Development Center

The data will collected on catch, effort, identify sea horse such as specie, sex and measure sea horse in order to study on trend of CPUE.

However, the monitoring data of sea house in CPUE was collected by standard otter board trawl from five research vessels to investigate the status of sea horse. The research vessel operated 4 times in January, March, May and July in every year. (station in Table 1 and Fig. 1).

Table 1. Survey station for research vessel

	Area	Station number
Gulf of Thailand	Area 1	42 44 57
	Area 2	18 20 28 30 38 40
	Area 3	2 5 7 9 11
	Area 4	14 16 24 26 34 36 47 49
	Area 5	58 60 62 73 75 87 89 101 103
	Area 6	117 119 136 138 156 158 177 179 181
	Area 7	201 221 243 245 268 270
	Area 8	294 296 319 321 345 347 371 373
	Area 9	395 397 399 420 422 424 445 447 466
Andaman Sea	Area 1	1 3 4 7 8
	Area 2	11 12 16 21
	Area 3	14 17 23 27 29
	Area 4	30 32 34 36 37 38 39 43

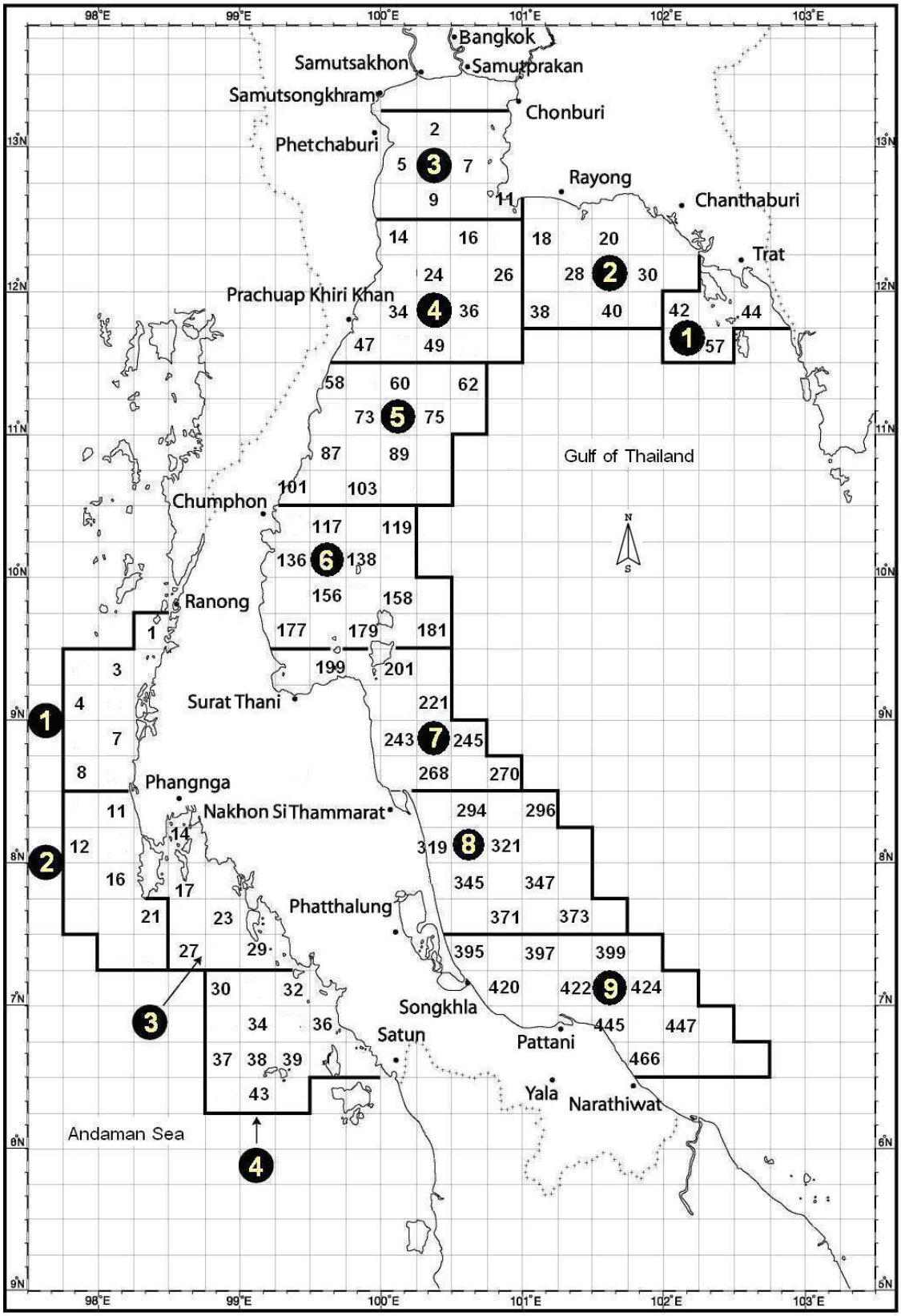


Fig. 1 Survey station by research vessels in the Gulf of Thailand and the Andaman Sea. Survey in every year.

No. 0510.2/ 1057

Department of Fisheries
Kaset Klang, Chatuchak
Bangkok 10900, Thailand

25 February B.E. 2557 (2014)

Dear Mr. David H.W. Morgan,

Subject: Clarification on *Hippocampus trimaculatus* in Thailand

Kindly refer to your letter dated 13 December 2013 regarding the Animal Committee's concern on the export of *Hippocampus trimaculatus* from Thailand.

In this connection, to provide an adequate clarification on the above – mentioned matter, we have enclosed herewith the following documents for your perusal;

1. *Hippocampus trimaculatus* evaluation to assist Scientific Authorities in making non – detriment findings;
2. the research on "Implementing CITES for seahorse in Thailand";
3. the data collected from landing sites along the Gulf of Thailand and the Andaman Sea showing percent composition of seahorse caught by type of fishing gear in 2010 and species of seahorse and;
4. the export statistic of *Hippocampus trimaculatus*.

Moreover, we call for full cooperation from traders for not exporting seahorse smaller than 10 cm. or about 4 inches in length according to CITES regulations. We also would like to ensure that the exports arriving at the airport will be rigidly inspected by qualified fisheries inspectors. In addition, to contribute in addressing the problem, the controlled areas of trawl fishing have been expanded to 5400 m. from coastline in ten provinces in Eastern and Southern Thailand. Lastly, we hope that the provided information will be useful to you and should further information be required, please contact Mrs. Yoo-ee Getpech, Tel/Fax 66 2561 4689.

Please be assured of our full cooperation.

Yours sincerely,

(Mr.Niwat Sutemechaikul)
Director - General

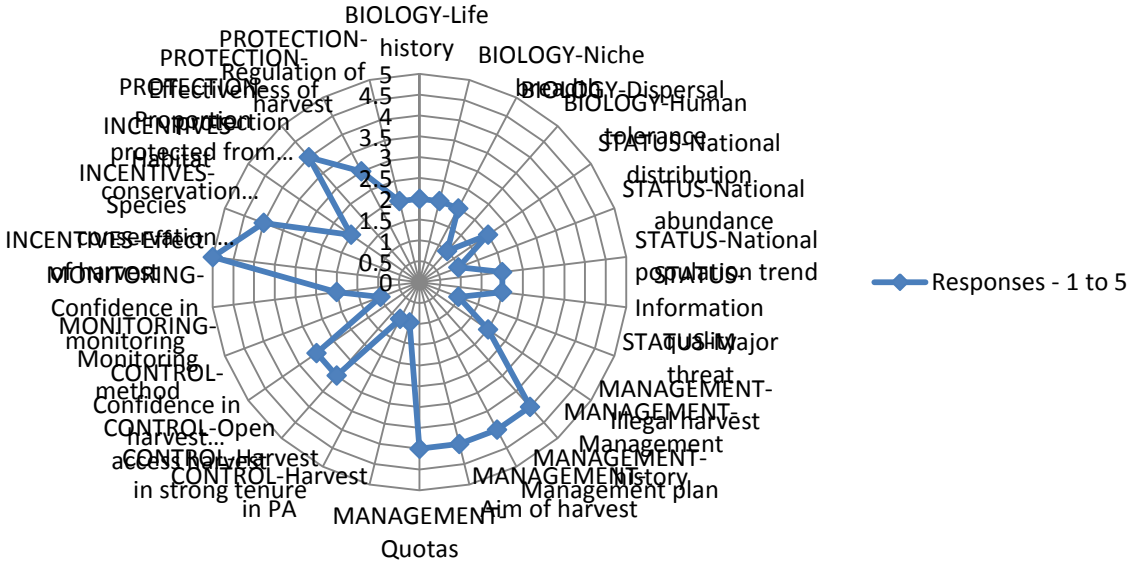
Mr. David H.W. Morgan
Chief, Scientific Support Team
International Environment House
Chemin des Animones
CH – 1219 Chatelaine Geneva,
Switzerland
Tel: +41 (22) 917 81 39/40
Fax: +41 (22) 797 34 17

Fisheries Administration and Management Bureau
Tel./Fax: 66 2561 4689

Fig.1 ***Fig.1 Hippocampus kelloggi evaluation to assist Scientific Authorities in making nondetriment findings - plot of responses to questions in Table 2.***			
questions number	Question category	Question	Responses - 1 to 5
2.1	Biology	BIOLOGY-Life history	2
2.2		BIOLOGY-Niche breadth	2
2.3		BIOLOGY-Dispersal	2
2.4		BIOLOGY-Human tolerance	1
2.5	Status	STATUS-National distribution	2
2.6		STATUS-National abundance	1
2.7		STATUS-National population trend	2
2.8		STATUS-Information quality	2
2.9		STATUS-Major threat	1
2.10	Management	MANAGEMENT-Illegal harvest	2
2.11		MANAGEMENT-Management history	4
2.12		MANAGEMENT-Management plan	4
2.13		MANAGEMENT-Aim of harvest	4
2.14		MANAGEMENT-Quotas	4
2.15	Control	CONTROL-Harvest in PA	1
2.16		CONTROL-Harvest in strong tenure	1
2.17		CONTROL-Open access harvest	3
2.18		CONTROL-Confidence in harvest management	3
2.19	Monitoring	MONITORING-Monitoring method	1
2.20		MONITORING-Confidence in monitoring	2
2.21	Incentives	INCENTIVES-Effect of harvest	5
2.22		INCENTIVES-Species conservation incentive	4
2.23		INCENTIVES-Habitat conservation incentive	2
2.24	Protection	PROTECTION-Proportion protected from harvest	4
2.25		PROTECTION-Effectiveness of protection	3
2.26		PROTECTION-Regulation of harvest	2

Hippocampus trimaculatus evaluation to assist Scientific Authorities in making nondetriment

findings - plot of responses to questions in Table 2.



Project I.D. ……

……

Office of the National Research Council of Thailand (NRCT)

Office of International Affairs

196 Phaholyothin Road

Chatuchak, Bangkok 10900, Thailand

Phone: +(66-2) 940-6369, 579-2690 Fax: +(66-2) 561-3049

Website : www.nrct.net, www.nrct-foreignresearcher.org

E-mail : webmaster@nrct-foreignresearcher.org

APPLICATION FORM FOR PERMISSION TO CONDUCT RESEARCH IN THAILAND

Please type or print in English

RESEARCH PROJECT TITLE: Implementing CITES for seahorses in Thailand

PART 1 PERSONAL INFORMATION

1.1 Name: Dr. Amanda J. Vincent Sex: [X] Female

(First) (Middle) (Last)

1.2 Permanent address: Project Seahorse, The University of British Columbia, 2202 Main Mall, Fisheries Centre, Vancouver, British Columbia

Postal code: V6T 1Z4 Country: Canada

Phone: +(604) 827- 5139

1.3 Current employer: The University of British Columbia

Address: Fisheries Centre, 2202 Main Mall, Vancouver, British Columbia

Postal code: V6T 1Z4 Country: Canada

Phone: +(604) 827- 5139 Fax: …….

E-mail: a.vincent@fisheries.ubc.ca

Job title: Director of Project Seahorse; Canada Research Chair in Marine Conservation

Job description: Dr. Amanda Vincent holds the Canada Research Chair in Marine Conservation in the Fisheries Centre at the University of British Columbia, Canada. She has a Ph.D. from the University of Cambridge. In 1996, Dr. Vincent co-founded Project Seahorse, an organisation whose goal is to advance marine conservation in general by focusing on particular case studies. As Director, she guides an international team in an integrated programme to conserve and manage seahorses, their relatives and their habitats, while respecting human needs. Dr. Vincent was the first person to study seahorses underwater, the first to document the extensive trade in these fishes and the first to initiate a seahorse conservation project.

1.4 Passport information

Nationality: Canadian.

Country of citizenship: Canada

Passport number: BA 729145

Expiration date: 05 Jan 2016

1.5 Family information:

In case of being accompanied by family, provide the following information. *Otherwise, skip to 1.6.*

Family: 1) Name: ……..

Nationality: …… Country of citizenship: ……

Passport number: … Expiration date: …

2) Name: …

Nationality: …… Country of citizenship: …

Passport number: … Expiration date: …

1.6 Highest degree earned

Degree	Major/Specialization	University	Graduation year
Ph.D	Zoology	Cambridge University	1990

1.7 If the applicant is a student, give the degree sought. Otherwise, skip to 1.8

Degree Sought	Major/Specialization	University	Expected graduation year

1.8 Previous research in Thailand (*if any, list the most two recent visits*):

Year	Length of stay	Submission of complete report

PART 2 RESEARCH PROJECT INFORMATION

2.1 Research subject : Seahorses (*Hippocampus* spp.)

- Research discipline : (More than one discipline can be ticked.)

[ ] Physical Science and Mathematics [ ] Law

[ ] Medical Science

[x] Political Science & Public Administration

[ ] Chemical and Pharmaceutical Sciences [ ] Economics

[x] Agriculture and Biology [ ] Sociology

[ ] Engineering and Industrial Research

[ ] Information Technology & Communication Science

[ ] Philosophy [ ] Education

- Research field : Biology, Ecology, Conservation, Fisheries, Trade

2.2 Research duration: From December 2012 To December 2014

2.3 Funding agency name:

This table outlines funds already received. We are seeking additional sources of funding for our work - The costs of Project Seahorse's research will not fall to DoF or Thailand.

Funding Agency	**Funding Period**	**Amount received**	**Funding Agency address**
Conservation and Research Foundation	2013	US$5,000	P.O. Box 909 Shelburne, Vermont, USA 05482-0909 Email : mwetzel@kc3ol.dynip.com.
People's Trust for Endangered Species, UK	2012	UK£25,000	15 Cloisters House, 8 Battersea Park Road, London, UK, SW8 4BG Phone: 020 7498 4533 Fax: 020 7498 4459 Email : **enquiries@ptes.org**
CITES Secretariat, Switzerland	2012	US$61,000 **only partly for Thai work	International Environment House, Chemin des Anemones, 1219 Chatelaine, Switzerland Phone: +41(22)917 8601 Fax: +41(22)797 3417 Email : **alice.abalos@cites.org**

Total research budget (to cover expenses in Thailand)

The costs of Project Seahorse's research will not fall to DoF or Thailand. This budget reflects projected in-country (Thailand) expenses that will be covered by Project Seahorse, and should not be considered final. Not reflected are additional costs that will be borne by Project Seahorse such as team member salaries, dive gear, etc.

	Budget (CAD)	Budget (BAHT)
Trade research		
Field Research Assistant	$ 1,500	45,257
International Air Fare (YVR - BKK) for PS researcher (TCK)	$ 1,750	52,800
Local Travel	$ 1,750	52,800
Accommodation	$ 1,850	55,817
Food/Consumables	$ 1,720	51,895
Misc. Equipment (i.e. caliper, bags, etc.)	$ 100	3,017
Other (Cell phone, printing, etc.)	$ 300	9,051
Subtotal	**$ 8,970**	**270,639**
Rapid Assessment for Thai seahorse populations		
Field Research Assistant	$ 5,000	150,858
International Air Fare (YVR - BKK) for PS researcher (TLL)	$ 1,750	52,800
Local Travel	$ 2,200	66,377
Accommodation	$ 2,700	81,463
Food/consumables	$ 1,800	54,309
Dive Equipment (GPS, diver computer, etc.)	$ 500	15,086
Equipment Rental (boats, tanks, Etc.)	$ 7,500	226,286
Other (Cell phone, printing, etc.)	$ 400	12,069
Subtotal	**$ 21,850**	**659,248**
Life history research		
Field Research Assistant	$ 3,000	90,515
International Air Fare (YVR - BKK) for PS researcher (JML)	$ 1,750	52,800
Local Travel	$ 2,200	66,377
Accommodation	$ 2,400	72,412
Food/consumables (per/month)	$ 1,800	54,309
Dive Equipment (GPS, diver computer, etc.)	$ 600	18,103
Equipment Rental (boats, tanks, Etc.)	$ 5,000	150,858
Other (Cell phone, printing, etc.)	$ 300	9,051
Subtotal	**$ 17,050**	**514,424**
Population status		
Field Research Assistant	$ 3,500	105,600
International Air Fare (YVR - BKK) for PS researcher (LA)	$ 1,750	52,800
Local Travel	$ 2,200	66,377
Accommodation	$ 2,400	72,412
Food/consumables (per/month)	$ 1,800	54,309
Dive Equipment (GPS, diver computer, etc.)	$ 300	9,051
Equipment Rental (boats, tanks, Etc.)	$ 2,600	78,446
Other (Cell phone, printing, etc.)	$ 300	9,051
Subtotal	**$ 14,850**	**448,047**
TOTAL BUDGET	**$ 45,670**	**1,377,933**

2.4 Research results will appear as:

[X] Research report

[X] Master's thesis

[X] Doctoral dissertation

[X] Journal/conference paper

[X] Others.

The findings of this project will lead to the following outputs:

- Reports to the Thai Authorities to assist with their responsibilities under CITES. These will provide options for population management and trade regulation.
- Reports by Thailand to the CITES Animals Committee, explaining its response to the recommendations under the Significant Trade Review.
- Primary papers in refereed journals.
- An increased constituency for seahorses, in particular, and marine conservation in general.
- Dynamic interactive maps that identify and connect seahorse presence with site-specific and regional threats and conservation action.
- Professional projections to anticipate trajectories for local seahorse populations.
- Integrated analyses of population trends within and across species and regions.
- Decision tools for resource managers on how best to secure seahorse populations, particularly how to make defensible NDFs for seahorses in CITES framework.
- Policy briefings for participants and decision-makers.
- Updated global and in most cases first time national/regional IUCN Red List assessments for seahorses.

(Your complete report that has to be submitted to NRCT shall be in the same publication type that your research results will appear.)

2.5 Details of research project proposal (*provide these information as a separate document*):

- Background and rationale
- Conceptual framework
- Objective of research
- Scope of research
- Research methodology
- Research plan
- Needs to conduct research in Thailand
- Research site in Thailand
- Anticipated output
- Expected significance of the results
- Impact to Thailand
- References

Please see attached proposal named "PS-DoF research proposal 6December2012"

PART 3 RESEARCH PROJECT TO BE CONDUCTED IN THAILAND

The applicant must provide information on items asked below in detail (as a separate document, if necessary). Failure to do so may result in a delay in permission process.

3.1 Please check only one box.

[ ] The research project is an aid program that a foreign institution/government is providing to Thai institution/government. (*Verification documents must be attached.*)

[X] The research project is a joint project between a foreign institution/government and Thai institution/government. (*Verification documents must be attached.*)

[ ] The research project is Thai institution's project

[ ] None of the above.

3.2 Research equipment (s) to be brought into Thailand:

The following equipment will be brought into Thailand, in addition to lap top computers:

3.2.1 The rapid assessment protocol (RAP) will require team members to bring SCUBA diving equipment and hand held GPS units into Thailand. This will enable team members to document seahorse distribution and habitat preferences in their natural environment.

3.2.2. To allow us to estimate key life history rates such as natural mortality, growth, and movement –we plan to mark a sub-sample of seahorses with Visible Implant Florescent Elastomer (VIFE) tags, which we will bring into Thailand. VIFE is a two-part silicone based polymer, which is mixed and applied as a liquid just underneath the skin. The liquid soon cures into a pliable biocompatible solid, which is non-lethal to the animal. We plan to bring 6 ml of elastomer for our tagging purposes. This method allows us to return to the study area over longer time periods (months to years) in search of tagged animals. To allow detection of these tags, seahorses are (in situ) passed under a wand of ultraviolet light.

3.3 If the research concerns each following issue, please tick. Otherwise, skip to 3.4

X biodiversity ☐ traditional knowledge ☐ folklore

3.4 Specimen (s) or sample (s) collected in Thailand :

3.4.1. By participating in fishing trips or sampling at landing sites, we document fishers' seahorse catches. This research approach is used to gather information on seahorse biology, ecology, methods of extraction (e.g. target/incidental), catch per unit effort, and seasonality of catches in SE Asia. **We will never be responsible for catching or landing the seahorse.** Due to the stress and physical damage from being caught and sorted, the majority of seahorses are either landed, or returned to the water, dead. Even those few that are returned to the water alive have a low chance of survival. **As a result our sampling methods do not intend to cause a significant increase in mortality to any seahorse species**. ***Please note that it is our intention for all seahorse specimens collected during the course of this research to remain in Thailand with our Thai collaborators.***

3.5 Specimen (s) or sample (s) to be taken away from Thailand:

Please note that it is our intention for all seahorse specimens collected during the course of this research to remain in Thailand with our Thai collaborators.

3.6 Non-Thai researchers in the project team who will come to Thailand (They have to send NRCT-01 part I):

3.6.1. Dr. Sarah Foster

3.6.2. Dr. Tse-Lynn Loh

3.6.3. Ting Chun Kuo

3.6.4. Lindsay Aylesworth

3.6.5. Julia Lawson

3.7 Collaborating Thai researchers and institutions:

3.7.1. Praulai Nootmorn, Director Marine Fisheries Research and Technological Development Institute, Marine Fisheries Research and Development Bureau, Department of Fisheries

3.7.2. Ratanawalee Phoonsawat, CITES SA, Department of Fisheries

3.7.3. Yoo-ee Getpech, CITES MA, Department of Fisheries

3.7.4. Patrichart Laksanawimol, PhD Candidate, Department of Marine Science, Faculty of Fisheries, Kasetsart University

3.8 Roles of Thai researchers or institutions:

3.7.1. Praulai Nootmorn, Director Marine Fisheries Research and Technological Development Institute, Marine Fisheries Research and Development Bureau, Department of Fisheries – supervisor (all activities)

3.7.2. Ratanawalee Phoonsawat, CITES SA, Department of Fisheries – supervisor (all activities)

3.7.3. Yoo-ee Getpech, CITES MA, Department of Fisheries – supervisor (all activities)

3.7.4. Patrichart Laksanawimol, PhD Candidate, Department of Marine Science, Faculty of Fisheries, Kasetsart University – in-country research coordinator (all activities)

PART 4 STATEMENT OF UNDERSTANDING AND COMPLIANCE

4.1 I hereby certify that I have read and understood the "Regulation on the Permission for Foreign Researchers to Conduct Research in Thailand, B.E.2550" and all of the information that I have provided is true.

4.2 I agree that I shall strictly comply with the said regulation in all aspects.

4.3 I agree that I shall submit the progress report and/or summary report according to the schedules set by NRCT.

4.4 I agree that I shall submit the complete report within a given time and shall properly acknowledge NRCT, Thai researchers, and Thai institutions for their contributions.

4.5 I agree that I shall provide a statement of acknowledgment in all publications that are written on the findings of the research project conducted in Thailand to recognize the contributions of NRCT, Thai researchers, and Thai institutions.

4.6 I understand that failure to comply with the said regulation may result in a revoke of the permission to conduct research in Thailand, a rejection of future applications to conduct research in Thailand, or a report of such non-compliance to the funding agency and my current Employer.

…… ...

(Applicant's signature)

……January 30, 2013……..

(Date)

Data from 3 landing sites along the Gulf of Thailand and 2 landing sites along the Andaman Sea. Enumerators have collected data from trawl fisheries (pair trawlers, otter board trawlers), crab gill nets, collapsible crab trap and squid trap. The major fishing gear catch sea horse is trawler (pair trawlers, otter board trawlers) approximately 99.97 % follow by crab gill nets (0.03%), collapsible crab trap (0.001%) and squid trap (0.0002%). In general, it could be implied that sea horse in Thailand can catch by trawl and gill net fisheries.

Table 1 Percent composition of sea horse caught by each type of fishing gear in 2010.

Gear	Percent by weight					
	H. trimaculatus	*H. kuda*	*H. kelloggi*	*H. spinosissimus*	*H. histrixs*	total
Trawl	30.60	0.05	50.08	19.19	0.08	100
Crab gill net	38.73			61.27		100
collapsible crab trap		47.37		52.63		100
Squid trap				100.00		100

Data from enumerator showed the sea horse were collected in the Gulf of Thailand and the Andaman Sea. Composition of sea horse in the Gulf of Thailand 74.86 % is *Hippocampus trimaculatus* follow with *H. spinosissimus* 24.25 % but for the Andaman sea is *H. kelloggi* 53.08 % follow with *Hippocampus trimaculatus* 28.01% .

Table 2 Sea horse was collected by enumerator in 3 landing sites in the Gulf of Thailand

Species	Number	Dried weight)kg(	Percent by weight
Hippocampus trimaculatus	35,374	112.27	74.86
H. kuda	48	0.18	0.12
H. kelloggi	136	1.12	0.75
H. spinosissimus	12,554	36.37	24.25
H. histrixs	5	0.03	0.02
Total	48,117	149.97	100.00

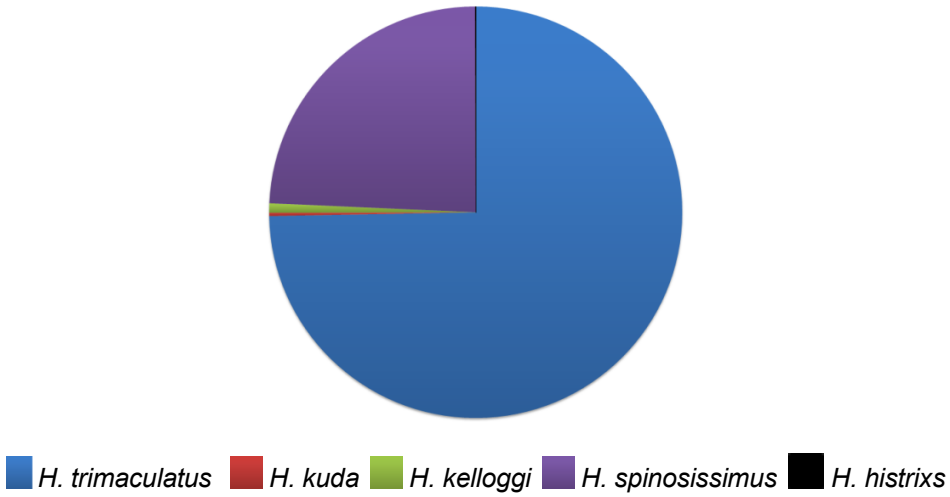


Fig 1 Percent composition by weight of sea horse in the Gulf of Thailand

Table 3 Sea horse was collected by enumerator in 3 landing sites in the Andaman Sea.

Species	Number	Dried weight) kg(	Percent by weight
H. trimaculatus	181,971	433.36	28.01
H. kuda	116	0.76	0.05
H. kelloggi	103,670	821.30	53.08
H. spinosissimus	62,799	290.54	18.78
H. histrixs	483	1.31	0.08

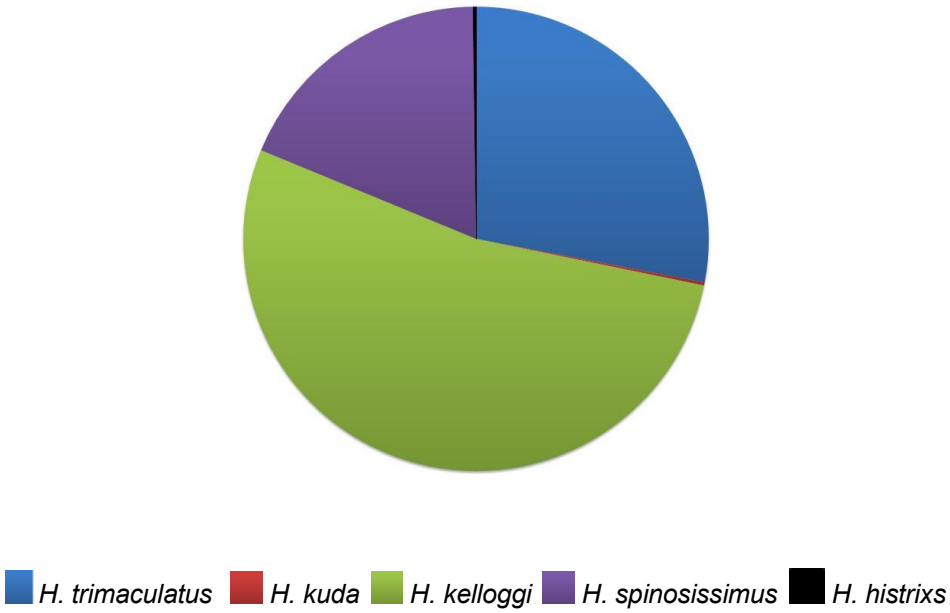


Fig 2 Percent composition by weight of sea horse in the Andaman Sea

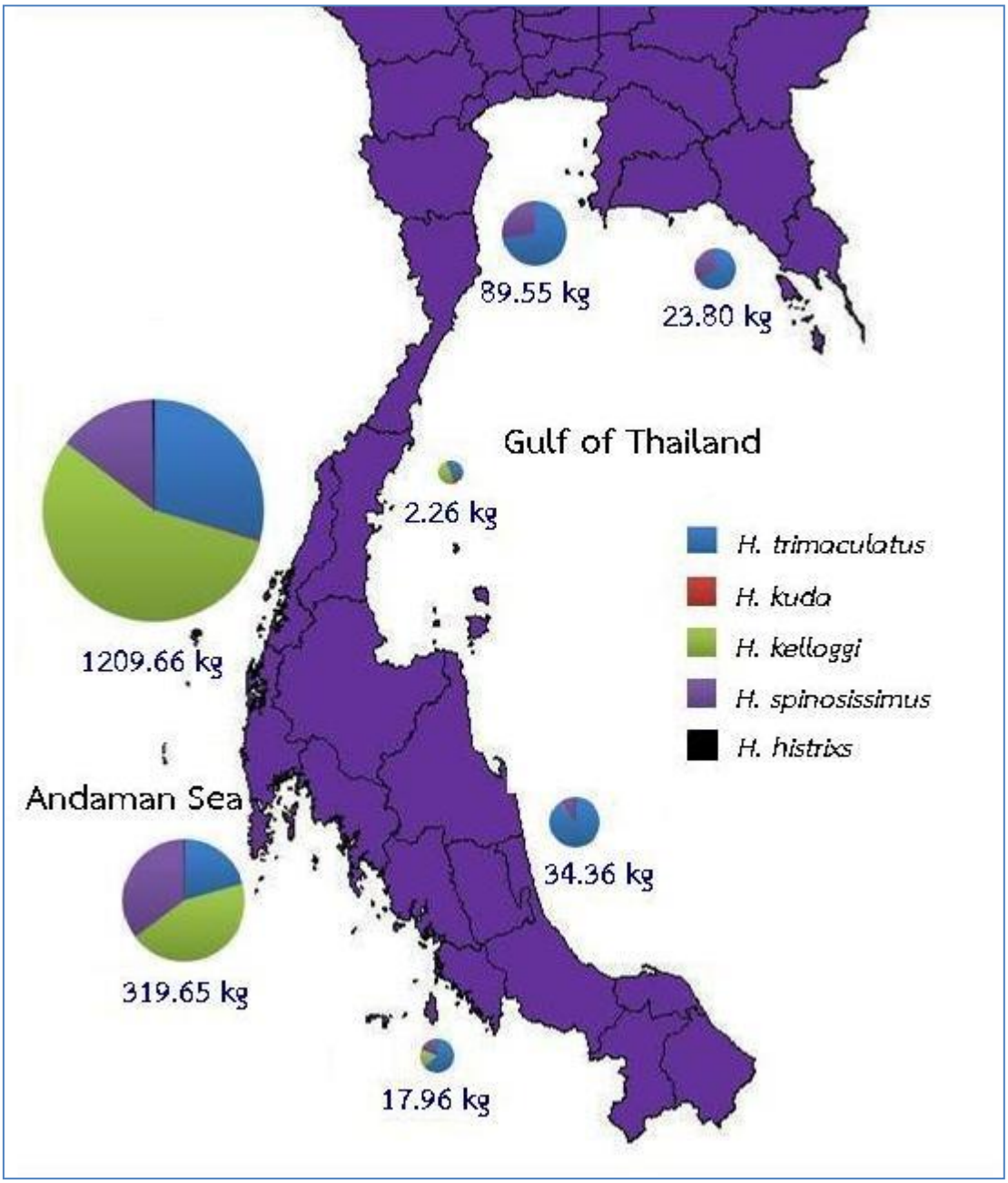


Fig.3 Sea horse composition in Thai water.

Biomass of sea horse in The Gulf of Thailand and Andaman Sea use swept area by research vessel

The individual catch of sea horse in the gulf of Thailand and Andaman Sea are in table 1 and 2. The result of the calculation of biomass are in table 9. We calculate the biomass separated into 3 sub areas by the habitat of sea horse are upper gulf, central and southern gulf and Andaman sea. Total biomass in the Gulf of Thailand was 9.063 tonnes. The biomass of the Andaman sea was 5.935 tonnes. Total biomass in Thai water was 9.656 tonnes.

Statistic of Export *Hippocampus trimaculatus*

(During 2010 - 2013)

Year	Weight (kgs.)
2010	4,157.60
2011	3,045.80
2012	257.78
2013	400.60

Thailand have expanded control area for fisheries by trawl net in the 5400 m. In 10 provinces as Prachaupkirikhan, Krabi, Trang, Rayong, Pattanee, Naratiwas, Satun, Chomporn, Nakhonsritamarach, Chanthaburi

Notification of the Ministry of Agriculture and Cooperatives
Re: Determination of Areas in which Fishing Appliances, i.e., Trawls and Push Nets used with Motor Vessels, are Prohibited

Trang Province

แผนที่แนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุน
ที่ใช้ประกอบเรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดตรัง ลงวันที่ 9 ตุลาคม พ.ศ. 2550

รายละเอียดจุดพิกัดแนบท้าย
ประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุน ที่ใช้
ประกอบเรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดตรัง ลงวันที่ 9 ตุลาคม พ.ศ. 2550

จุดที่ (1) แลด 7° 39' 34" เหนือ
ลอง 99° 15' 26" ตะวันออก
จุดที่ (2) แลด 7° 39' 29" เหนือ
ลอง 99°12' 33" ตะวันออก
จุดที่ (3) แลด 7° 24' 40" เหนือ
ลอง 99° 15' 51" ตะวันออก
จุดที่ (4) แลด 7°19' 55" เหนือ
ลอง 99° 12' 57" ตะวันออก
จุดที่ (5) แลด 7° 17' 42" เหนือ
ลอง 99° 13' 06" ตะวันออก
จุดที่ (6) แลด 7° 11' 43" เหนือ
ลอง 99° 20' 51" ตะวันออก
จุดที่ (7) แลด 6° 59' 09" เหนือ
ลอง 99° 27' 45" ตะวันออก
จุดที่ (8) แลด 7° 01' 51" เหนือ
ลอง 99° 35' 12" ตะวันออก
จุดที่ (9) แลด 7° 00' 42" เหนือ
ลอง 99° 37' 40" ตะวันออก
จุดที่ (10) แลด 7° 02' 30" เหนือ
ลอง 99° 40' 21" ตะวันออก

Krabi Province

แผนที่แนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุนที่ใช้ประกอบ
เรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดกระบี่ ลงวันที่ 9 ตุลาคม พ.ศ. 2550

รายละเอียดจุดพิกัดแนบท้าย
ประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุน
ที่ใช้ประกอบเรือยนต์ทำการประมง
ในที่จับสัตว์น้ำบางแห่งของจังหวัดกระบี่
ลงวันที่ 9 ตุลาคม พ.ศ. 2550

จุดที่ (1) แลด 8° 16′ 17″ เหนือ
ลอง 98° 39′ 04″ ตะวันออก
จุดที่ (2) แลด 8° 13′ 19″ เหนือ
ลอง 98° 39′ 04″ ตะวันออก
จุดที่ (3) แลด 8° 02′ 42″ เหนือ
ลอง 98° 40′ 43″ ตะวันออก
จุดที่ (4) แลด 7° 38′ 00″ เหนือ
ลอง 98° 46′ 06″ ตะวันออก
จุดที่ (5) แลด 7° 48′ 20″ เหนือ
ลอง 98° 54′ 25″ ตะวันออก
จุดที่ (11) แลด 7° 39′ 34″ เหนือ
ลอง 99° 15′ 26″ ตะวันออก
จุดที่ (6) แลด 7° 41′ 55″ เหนือ
ลอง 99° 00′ 00″ ตะวันออก
จุดที่ (7) แลด 7° 33′ 43″ เหนือ
ลอง 98° 59′ 14″ ตะวันออก
จุดที่ (8) แลด 7° 26′ 10″ เหนือ
ลอง 99° 03′ 22″ ตะวันออก
จุดที่ (9) แลด 7° 25′ 53″ เหนือ
ลอง 99° 08′ 19″ ตะวันออก
จุดที่ (10) แลด 7° 39′ 29″ เหนือ
ลอง 99° 12′ 33″ ตะวันออก

Prachaupkirikhan Province

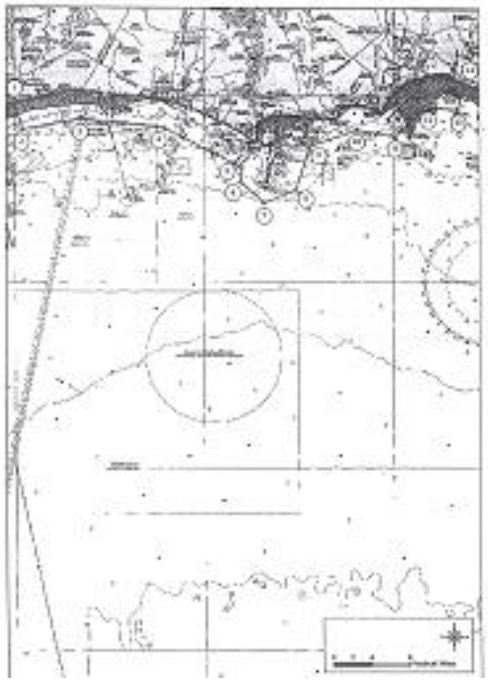
รายละเอียดจุดพิกัดแนบท้าย
ประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุนที่ใช้
ประกอบเรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่งของ
จังหวัดประจวบคีรีขันธ์
ลงวันที่ 9 ตุลาคม พ.ศ. 2550

จุดที่ (1) แลด 12° 35′ 54″ เหนือ
ลอง 99° 57′ 32″ ตะวันออก
จุดที่ (2) แลด 12° 35′ 53″ เหนือ
ลอง 100° 00′ 29″ ตะวันออก
จุดที่ (3) แลด 12° 11′ 16″ เหนือ
ลอง 100° 04′ 28″ ตะวันออก
จุดที่ (4) แลด 11° 54′ 32″ เหนือ
ลอง 99° 52′ 50″ ตะวันออก
จุดที่ (5) แลด 11° 44′ 22″ เหนือ
ลอง 99° 51′ 58″ ตะวันออก
จุดที่ (6) แลด 11° 33′ 02″ เหนือ
ลอง 99° 42′ 56″ ตะวันออก
จุดที่ (7) แลด 11° 09′ 48″ เหนือ
ลอง 99° 37′ 27″ ตะวันออก
จุดที่ (8) แลด 11° 08′ 00″ เหนือ
ลอง 99° 32′ 22″ ตะวันออก
จุดที่ (9) แลด 11° 04′ 33″ เหนือ
ลอง 99° 36′ 53″ตะวันออก
จุดที่ (10) แลด 10° 59′ 10″ เหนือ
ลอง 99° 32′ 12″ ตะวันออก
จุดที่ (11) แลด 10° 59′ 10″ เหนือ
ลอง 99° 30′ 13″ ตะวันออก

แผนที่แนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุนที่ใช้ประกอบ
เรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดประจวบคีรีขันธ์ ลงวันที่ 9 ตุลาคม พ.ศ. 2550

Rayong Province

แผนที่แนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุน
ที่ใช้ประกอบเรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดระยอง
ลงวันที่ 3 มกราคม พ.ศ. 2551

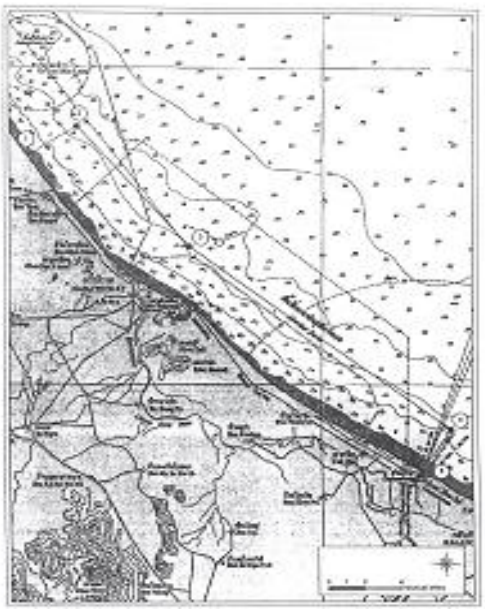


รายละเอียดจุดพิกัดแนบท้าย
ประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุนที่ใช้
ประกอบเรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดระยอง
ลงวันที่ 3 มกราคม พ.ศ. 2551

จุดที่ (1) แลต 12° 39′ 20″ เหนือ
ลอง 100° 58′ 50″ ตะวันออก
จุดที่ (2) แลต 12° 36′ 19″ เหนือ
ลอง 101° 00′ 46″ ตะวันออก
จุดที่ (3) แลต 12° 37′ 32″ เหนือ
ลอง 101° 06′ 59″ ตะวันออก
จุดที่ (4) แลต 12° 36′ 35″ เหนือ
ลอง 101° 15′ 46″ ตะวันออก
จุดที่ (5) แลต 12° 32′ 20″ เหนือ
ลอง 101 °23′ 58″ ตะวันออก
จุดที่ (6) แลต 12° 30′ 45″ เหนือ
ลอง 101° 23′ 55″ ตะวันออก
จุดที่ (7) แลต 12° 28′ 30″ เหนือ
ลอง 101° 26′ 22″ ตะวันออก
จุดที่ (8) แลต 12° 29′ 54″เหนือ
ลอง 101° 29′ 44″ ตะวันออก
จุดที่ (9) แลต 12° 34′ 40″ เหนือ
ลอง 101° 31′ 14″ ตะวันออก
จุดที่ (10) แลต 12° 36′ 25″ เหนือ
ลอง 101° 36′ 11″ ตะวันออก
จุดที่ (11) แลต 12° 35′ 41″ เหนือ
ลอง 101° 40′ 09″ ตะวันออก
จุดที่ (12) แลต 12° 38′ 53″ เหนือ
ลอง 101° 43′ 21″ ตะวันออก
จุดที่ (13) แลต 12° 38′ 38″ เหนือ
ลอง 101° 46′ 45″ ตะวันออก
จุดที่ (14) แลต 12° 41′ 38″ เหนือ
ลอง 101° 47′ 32″ ตะวันออก

Narathiwas Province

แผนที่แนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุน
ที่ใช้ประกอบเรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดนราธิวาส
ลงวันที่ 3 มกราคม พ.ศ. 2551

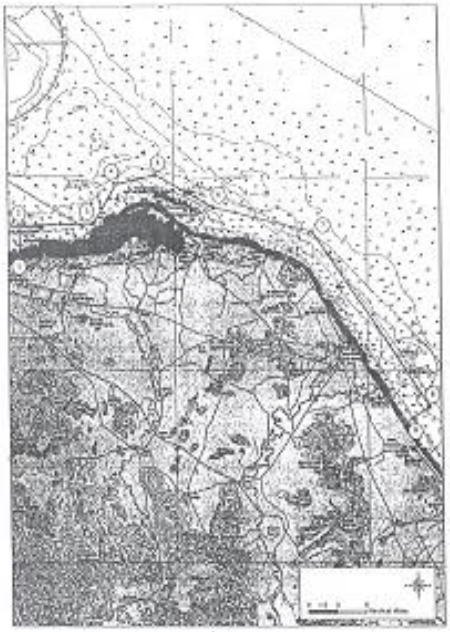


รายละเอียดจุดพิกัดแนบท้าย
ประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุนที่ใช้
ประกอบเรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดนราธิวาส ลงวันที่ 3 มกราคม พ.ศ. 2551

จุดที่ (1) แลต 6° 34′ 29″ เหนือ
ลอง 101° 43′ 41″ ตะวันออก
จุดที่ (2) แลต 6° 36′ 19″ เหนือ
ลอง 101° 46′ 24″ ตะวันออก
จุดที่ (3) แลต 6° 28′ 47″ เหนือ
ลอง 101° 52′ 38″ ตะวันออก
จุดที่ (4) แลต 6° 17′ 17″ เหนือ
ลอง 102° 07′ 09″ ตะวันออก
จุดที่ (5) แลต 6° 14′ 39″ เหนือ
ลอง 102° 06′ 31″ ตะวันออก

Pattanee Province

แผนที่แนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลาก
ที่ใช้ประกอบเรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดปัตตานี ลงวันที่ 3 มกราคม พ.ศ. 2551

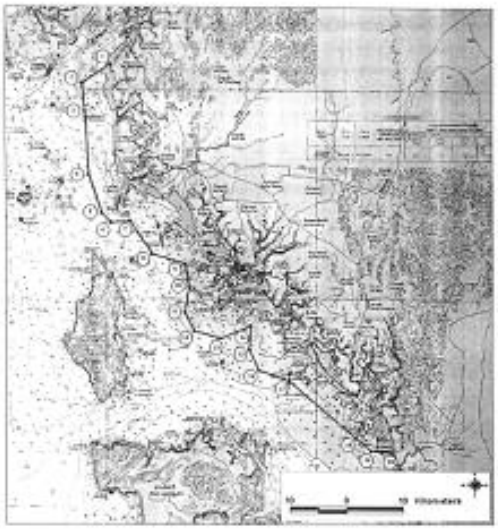


รายละเอียดจุดพิกัดแนบท้าย
ประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากที่ใช้ประกอบเรือยนต์
ทำการประมงในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดปัตตานี
ลงวันที่ 3 มกราคม พ.ศ. 2551

จุดที่ (1) แลต 6° 51′ 20″ เหนือ
ลอง 101° 04′ 02″ ตะวันออก
จุดที่ (2) แลต 6° 54′ 58″ เหนือ
ลอง 101° 03′ 06″ ตะวันออก
จุดที่ (3) แลต 6° 55′ 18″ เหนือ
ลอง 101° 11′ 42″ ตะวันออก
จุดที่ (4) แลต 6° 59′ 18″ เหนือ
ลอง 101° 14′ 01″ ตะวันออก
จุดที่ (5) แลต 7° 00′ 15″ เหนือ
ลอง 101° 18′ 07″ ตะวันออก
จุดที่ (6) แลต 6° 56′ 59″ เหนือ
ลอง 101° 24′ 08″ ตะวันออก
จุดที่ (7) แลต 6° 54′ 25″ เหนือ
ลอง 101° 34′ 25″ ตะวันออก
จุดที่ (8) แลต 6° 36′ 19″ เหนือ
ลอง 101° 46′ 24″ ตะวันออก
จุดที่ (9) แลต 6° 34′ 29″ เหนือ
ลอง 101° 43′ 41″ ตะวันออก

Satun Province

แผนที่แนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลาก
และอวนรุนที่ใช้ประกอบเรือยนต์ทำการประมง
ในที่จับสัตว์น้ำบางแห่งของจังหวัดสตูล
ลงวันที่ 29 มกราคม พ.ศ. 2552



รายละเอียดจุดพิกัดแนบท้าย
ประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุนที่ใช้
ประกอบเรือยนต์ทำการประมง ในที่จับสัตว์น้ำบางแห่ง
ของจังหวัดสตูล
ลงวันที่ 29 มกราคม พ.ศ. 2552

จุดที่ (1) แลต 7° 02′ 30″ เหนือ
ลอง 99° 40′ 21″ ตะวันออก
จุดที่ (2) แลต 7° 00′ 42″ เหนือ
ลอง 99° 37′ 40″ ตะวันออก
จุดที่ (3) แลต 6° 57′ 59″ เหนือ
ลอง 99° 37′ 57″ ตะวันออก
จุดที่ (4) แลต 6° 51′ 53″ เหนือ
ลอง 99° 38′ 19″ ตะวันออก
จุดที่ (5) แลต 6° 48′ 16″ เหนือ
ลอง 99° 39′ 34″ ตะวันออก
จุดที่ (6) แลต 6° 47′ 21″ เหนือ
ลอง 99° 40′ 26″ ตะวันออก
จุดที่ (7) แลต 6° 47′ 33″ เหนือ
ลอง 99° 42′ 13″ ตะวันออก
จุดที่ (8) แลต 6° 44′ 20″ เหนือ
ลอง 99° 44′ 22″ ตะวันออก
จุดที่ (9) แลต 6° 43′ 25″ เหนือ
ลอง 99° 47′ 31″ ตะวันออก
จุดที่ (10) แลต 6° 41′ 11″ เหนือ
ลอง 99° 47′ 53″ ตะวันออก
จุดที่ (11) แลต 6° 38′ 41″ เหนือ
ลอง 99° 47′ 29″ ตะวันออก
จุดที่ (12) แลต 6° 36′ 56″ เหนือ
ลอง 99° 48′ 23″ ตะวันออก
จุดที่ (13) แลต 6° 36′ 13″ เหนือ
ลอง 99° 50′ 54″ ตะวันออก
จุดที่ (14) แลต 6° 37′ 25″ เหนือ
ลอง 99° 53′ 48″ ตะวันออก
จุดที่ (15) แลต 6° 35′ 09″ เหนือ
ลอง 99° 53′ 37″ ตะวันออก
จุดที่ (16) แลต 6° 33′ 12″ เหนือ
ลอง 99° 54′ 32″ ตะวันออก
จุดที่ (17) แลต 6° 32′ 12″ เหนือ
ลอง 99° 57′ 24″ ตะวันออก
จุดที่ (18) แลต 6° 26′ 42″ เหนือ
ลอง 100° 03′ 42″ ตะวันออก
จุดที่ (19) แลต 6° 25′ 24″ เหนือ
ลอง 100° 05′ 12″ ตะวันออก
จุดที่ (20) แลต 6° 25′ 15″ เหนือ
ลอง 100° 07′ 11″ ตะวันออก

Nakhonsritamarach Province

แผนที่แนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุน
ที่ใช้ประกอบเรือยนต์ทำการประมง
ในที่จับสัตว์น้ำบางแห่งของจังหวัดนครศรีธรรมราช
ลงวันที่ 17 กรกฎาคม พ.ศ. 2552

รายละเอียดจุดพิกัดแนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุน
ที่ใช้ประกอบเรือยนต์ทำการประมง
ในที่จับสัตว์น้ำบางแห่งของจังหวัดนครศรีธรรมราช
ลงวันที่ 17 กรกฎาคม พ.ศ. 2552

จุดที่ (1) แรก 9° 19' 33" เหนือ
ลอง 99° 48' 01" ตะวันออก
จุดที่ (2) แรก 9° 21' 09" เหนือ
ลอง 99° 48' 51" ตะวันออก
จุดที่ (3) แรก 9° 19' 53" เหนือ
ลอง 99° 51' 04" ตะวันออก
จุดที่ (4) แรก 9° 16' 34" เหนือ
ลอง 99° 52' 25" ตะวันออก
จุดที่ (5) แรก 9° 13' 32" เหนือ
ลอง 99° 54' 19" ตะวันออก
จุดที่ (6) แรก 9บ 09' 30" เหนือ
ลอง 99° 54' 20" ตะวันออก
จุดที่ (7) แรก 9° 06' 40" เหนือ
ลอง 99° 56' 21" ตะวันออก
จุดที่ (8) แรก 9° 05' 32" เหนือ
ลอง 99° 56' 25" ตะวันออก
จุดที่ (9) แรก 9° 01' 55" เหนือ
ลอง 99° 56' 25" ตะวันออก
จุดที่ (10) แรก 8° 57' 59" เหนือ
ลอง 99° 57' 43" ตะวันออก
จุดที่ (11) แรก 8° 52' 48" เหนือ
ลอง 99° 57' 59" ตะวันออก
จุดที่ (12) แรก 8° 48' 09" เหนือ
ลอง 99° 58' 56" ตะวันออก
จุดที่ (13) แรก 8° 37' 12" เหนือ
ลอง 100° 00' 20" ตะวันออก
จุดที่ (14) แรก 8° 33' 12" เหนือ
ลอง 100° 05' 12" ตะวันออก
จุดที่ (15) แรก 8° 34' 08" เหนือ
ลอง 100° 08' 25" ตะวันออก
จุดที่ (16) แรก 8บ 32' 56" เหนือ
ลอง 100° 11' 38" ตะวันออก
จุดที่ (17) แรก 8° 29' 55" เหนือ
ลอง 100° 14' 25" ตะวันออก
จุดที่ (18) แรก 8° 22' 54" เหนือ
ลอง 100° 17' 25" ตะวันออก
จุดที่ (19) แรก 8° 13' 21" เหนือ
ลอง 100° 20' 08" ตะวันออก
จุดที่ (20) แรก 7° 56' 37" เหนือ
ลอง 100° 23' 02" ตะวันออก
จุดที่ (21) แรก 7° 55' 55" เหนือ
ลอง 100° 20' 13" ตะวันออก

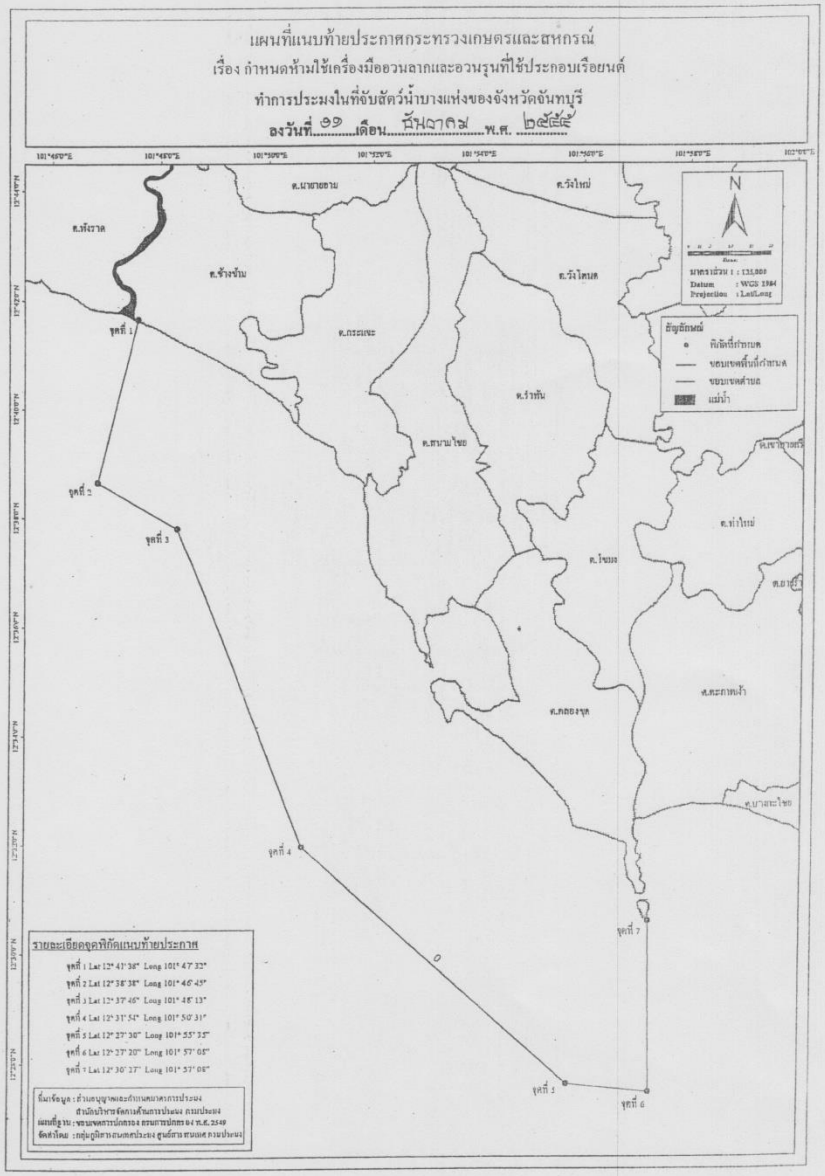
Chomporn Province

แผนที่แนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุนที่ใช้ประกอบ
เรือยนต์ทำการประมงในที่จับสัตว์น้ำบางแห่งของจังหวัดชุมพร
ลงวันที่ 11 เมษายน พ.ศ. 2554

รายละเอียดจุดพิกัดแนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุน
ที่ใช้ประกอบเรือยนต์ทำการประมง
ในที่จับสัตว์น้ำบางแห่งของจังหวัดชุมพร
ลงวันที่...11....เมษายน...พ.ศ. 2554

จุดที่ (1) แรก 10° 59' 10" เหนือ
ลอง 99° 32' 12" ตะวันออก
จุดที่ (2) แรก 10° 57' 00" เหนือ
ลอง 99° 32' 24" ตะวันออก
จุดที่ (3) แรก 10° 54' 00" เหนือ
ลอง 99° 34' 00" ตะวันออก
จุดที่ (4) แรก 10° 50' 48" เหนือ
ลอง 99° 33' 12" ตะวันออก
จุดที่ (5) แรก 10° 49' 12" เหนือ
ลอง 99° 32' 00" ตะวันออก
จุดที่ (6) แรก 10° 48' 48" เหนือ
ลอง 99° 29' 24" ตะวันออก
จุดที่ (7) แรก 10° 44' 00" เหนือ
ลอง 99° 28' 00" ตะวันออก
จุดที่ (8) แรก 10° 38' 00" เหนือ
ลอง 99° 24' 00" ตะวันออก
จุดที่ (9) แรก 10° 37' 00" เหนือ
ลอง 99° 21' 12" ตะวันออก
จุดที่ (10) แรก 10° 33' 00" เหนือ
ลอง 99° 20' 00" ตะวันออก
จุดที่ (11) แรก 10° 31' 00" เหนือ
ลอง 99° 16' 00" ตะวันออก
จุดที่ (12) แรก 10° 21' 00" เหนือ
ลอง 99° 16' 00" ตะวันออก
จุดที่ (13) แรก 10° 17' 36" เหนือ
ลอง 99° 15' 12" ตะวันออก
จุดที่ (14) แรก 10° 14' 00" เหนือ
ลอง 99° 18' 00" ตะวันออก
จุดที่ (15) แรก 10° 12' 12" เหนือ
ลอง 99° 17' 36" ตะวันออก
จุดที่ (16) แรก 10° 09' 00" เหนือ
ลอง 99° 13' 00" ตะวันออก
จุดที่ (17) แรก 10° 06' 48" เหนือ
ลอง 99° 12' 24" ตะวันออก
จุดที่ (18) แรก 10° 03' 24" เหนือ
ลอง 99° 14' 00" ตะวันออก
จุดที่ (19) แรก 10° 02' 00" เหนือ
ลอง 99° 14' 00" ตะวันออก
จุดที่ (20) แรก 09° 58' 00" เหนือ
ลอง 99° 12' 24" ตะวันออก
จุดที่ (21) แรก 09° 55' 24" เหนือ
ลอง 99° 12' 48" ตะวันออก
จุดที่ (22) แรก 09° 50' 00" เหนือ
ลอง 99° 13' 00" ตะวันออก
จุดที่ (23) แรก 09° 48' 24" เหนือ
ลอง 99° 11' 36" ตะวันออก
จุดที่ (24) แรก 09° 47' 00" เหนือ
ลอง 99° 12' 00" ตะวันออก
จุดที่ (25) แรก 09° 43' 00" เหนือ
ลอง 99° 12' 00" ตะวันออก
จุดที่ (26) แรก 09° 43' 00" เหนือ
ลอง 99° 10' 00" ตะวันออก

Chanthaburi Province


แผนที่แนบท้ายประกาศกระทรวงเกษตรและสหกรณ์
เรื่อง กำหนดห้ามใช้เครื่องมืออวนลากและอวนรุนที่ใช้ประกอบเรือยนต์
ทำการประมงในที่จับสัตว์น้ำบางแห่งของจังหวัดจันทบุรี
ลงวันที่ ๑๑ เดือน ธันวาคม พ.ศ. ๒๕๕๕
N
ต.ทังราด
ต.ช้างข้าม
ต.กระแจะ
ต.ร่ำพัน
ต.ท่าใหม่
ต.คลองขุด
จุดที่ 1
จุดที่ 2
จุดที่ 3
จุดที่ 4
จุดที่ 5
จุดที่ 6
จุดที่ 7
รายละเอียดจุดพิกัดแนบท้ายประกาศ
จุดที่ 1 Lat 12° 41' 38" Long 101° 47' 32"
จุดที่ 2 Lat 12° 38' 38" Long 101° 46' 45"
จุดที่ 3 Lat 12° 37' 46" Long 101° 48' 13"
จุดที่ 4 Lat 12° 31' 54" Long 101° 50' 31"
จุดที่ 5 Lat 12° 27' 30" Long 101° 55' 35"
จุดที่ 6 Lat 12° 27' 20" Long 101° 57' 05"
จุดที่ 7 Lat 12° 30' 27" Long 101° 57' 08"