



## **SEAHORSE BIOLOGY AND FISHERIES IN PHU QUOC ISLAND, VIET NAM** ***FIELD RESEARCH REPORT***

### **OVERVIEW**

In order to address the CITES recommendations in support of sustainable seahorse efforts, Allison Stocks, Project Seahorse MSc student based at The University of British Columbia (Vancouver, Canada), conducted a detailed assessment of seahorse biology and fisheries at Phu Quoc Island. The aim of this work is contribute to several of the action items arising from the national consultative training workshops for CITES Authorities and scientific experts in Viet Nam in Nha Trang, from 29-31 May, 2013.

Although CITES Viet Nam is responsible for coordinating the completion of these action points, they have invited Project Seahorse to assist as time and resources allow.

The objective of this research was to **conduct a detailed assessment of Phu Quoc Island seahorse populations, involving:**

- 1) Collection of new information about seahorse biology and ecology (i.e. habitats) underwater.
- 2) Assessment of fishing pressure on seahorses via port sampling and fisher interviews.
- 3) Comparative analysis of underwater and fisheries data to determine the vulnerability and sustainability of seahorse populations.
- 4) Knowledge sharing with stakeholders.

The **outputs** from these objectives, and **deviations:**

- 1) Completed 27 dives to collect new information about seahorse biology and ecology. A detailed tagging study was determined to not be feasible due to a low number of seahorse sightings and high cost of diving.
- 2) Port sampling and fisher interviews were completed on a regular basis to garner information on fishing pressure. This information will be distilled into a report on the seahorse fisheries.
- 3) Analysis of underwater and fisheries data to determine the vulnerability and sustainability of seahorse populations is currently underway.
- 4) Knowledge sharing with stakeholders has begun, and will continue as data is analyzed.

## II. RESEARCH

### Underwater Methods

We conducted underwater surveys in the seagrass beds located on the eastern and northeastern sides of Phu Quoc Island, specifically in areas with evidence of the presence of seahorses. This evidence came from the results of the rapid assessment conducted by Dr. Tse-Lynn Loh during February and March 2014, with additional information provided by local experts, fishers, divers, and conservation groups.

We employed both roving diver surveys and transect surveys to locate seahorses. We recorded exact locations of study areas with a handheld GPS unit. When seahorses were found, we noted the species, habitat association (position in the water column, substrate preference, holdfast, depth, range), sex, reproductive status (presence or absence of a brood pouch), and measured body size of seahorses using calipers.

### Underwater Results Summary

Twenty-seven (27) dives were conducted over the course of 12 days, during which 17 seahorses were found: twelve *H. spinosissimus*, three *H. kuda*, and two *H. trimaculatus*. Seahorses used urchins, seagrass, and small rocks as holdfasts. We did not find seahorses in high enough numbers to justify a tagging study – despite high diving effort. Furthermore, seahorses are found in areas that are heavily fished by trawl boats, making study locations dangerous and highly disturbed. It quickly became clear that more information, especially from a management perspective, could be found using fisheries-dependent methods.

See detailed information from the underwater surveys in the Appendix, including survey sites, biological information of seahorses found, and GPS locations where seahorses were spotted.

### Fisheries Methods

We conducted fisheries dependent surveys at ports in villages across Phu Quoc Island and the An Thoi Islands. The primary source of life history data from fisheries was obtained via port sampling. With willing fishers, I measured their recent seahorse catches, both live and dried, and determined species, size, sex, and reproductive status of seahorses. Additionally, I dissected 37 freshly caught dead seahorses in order to determine brood size. My research assistant and I conducted interviews with fishers to determine whether they find seahorses, and if so, the location of their fishing, how often they catch seahorses, fishing effort, gear type, capture method (intentional or bycatch), etc. We also investigated whether fishers and community members perceive changes in catch per unit effort and fishing practices over time.

### Landings Summary

With the help of my research assistants, I gathered information on over 1500 seahorses from April 2014 to July 2014. I encountered three species of seahorse: *H. trimaculatus*, *H. spinosissimus*, and *H. kuda*. Seahorses were caught primarily by compressor divers, trawl boats and crab nets, but also by several other types of gear. Certain areas of the island were more productive for seahorse fishing,

and the majority of seahorses were landed at An Thoi, Ham Ninh, Bai Bon, and Da Chong ports. I am currently analyzing data to assess recruitment to the fishery, size at maturity, distribution of species, gear selectivity, relationships between seahorse measurements, and more.

See detailed information on the landing surveys schedule in the Appendix.

### **Interview Summary**

We conducted interviews with 85 fishers, and with five local seahorse buyers. Almost all interview participants were cooperative and honest about the nature of seahorse fishing. The vast majority of fishers and buyers reported a massive decline in seahorse catch over the last ten years, since the fishery became highly productive. When asked about the sustainability of seahorse fishing, most fishers were not concerned by the decline in seahorse catch due to rising prices, which helps maintain the feasibility of seahorse fishing.

### **III. OUTREACH & OUTPUTS**

During the course of my research, I gave one presentation, “Supporting Vietnam’s efforts towards seahorse conservation” at the Research Institute for Marine Fisheries (RIMF) in Hai Phong on April 2, 2013. There were around 20 attendees from RIMF. I received a great deal of feedback and offers to provide assistance and information.

I met several times with the staff and Director of the Phu Quoc Marine Protected Area. These were straightforward and successful meetings, and the MPA staff members were always keen to provide information and help when needed.

During my field season, I published a blog on the Mitacs website:

<http://www.mitacs.ca/b/2014/07/postcard-vietnam-ubc-student-investigates-impact-fishing-wild-seahorses>

The data from this field season are currently being analyzed and will contribute to implementing the CITES Appendix II listing of seahorses.

### **V. CONCLUSIONS, LIMITATIONS & FUTURE POSSIBILITIES**

The waters surrounding Phu Quoc Island are undoubtedly some of the most abundant seahorse fishing grounds in Vietnam. Seahorses are caught by a multitude of gears and landed at nearly every port surrounding the island. Compressor divers and trawl boats tend to catch the most seahorses, but they are also caught by squid fishers, purse seines, and in crab nets. I encountered three species of seahorse during the four-month research period (in order of highest catch to lowest): *H. spinosissimus*, *H. trimaculatus*, and *H. kuda*.

Unfortunately, we were unable to conduct an underwater population study, which may have revealed valuable and novel information about seahorse life history. The area surrounding Phu Quoc is so heavily fished that it would have been difficult to maintain a consistent research area. Luckily, fisheries-dependent research was very successful. Generally, fishers were extremely helpful and

willing to share information about their seahorse catches and fishing. This made studying the seahorse fisheries fairly straightforward. However, from about mid-June onward, monsoon rains made travel around the island very difficult and limited the amount of fishing that occurred.

In order to maintain the livelihood of the many people that benefit from seahorse fisheries and to protect these valuable species, it is important that effective management is developed and enforced.

Monitoring seahorse catch in certain key areas on a monthly or yearly basis could provide some measure of whether catches are stable or in decline. **Regular port monitoring to determine what are the trends in CPUE for different seahorse species is the only way to know if existing management measures are helping seahorses, or if further work is needed to secure seahorse populations in Phu Quoc.** Understanding trends in CPUE will require regular monitoring of seahorses. Project Seahorse suggests monitoring seahorses three (3) times a year, at several landing sites across Phu Quoc. These ports should cover all gears that catch seahorses. Whatever approach is employed, sampling should always take place at the same ports, at the same times of year, and using the same methods. Only then can the data be used to understand trends in CPUE. Project Seahorse has a protocol for sampling seahorse landings which would aid in designing an effective port sampling plan for Phu Quoc and elsewhere in Viet Nam (available at <http://iseahorse.org/?q=trends-landings>).

Educating local fishers about the destructive nature of trawl fishing could also be beneficial – not only for seahorses but many other affected species. Enforcing the MPA by fostering local support and encouraging engagement would also have positive impacts for the ecosystems.

## VI. ACKNOWLEDGEMENT & APPRECIATION

I am greatly indebted to the Research Institute of Marine Fisheries in Hai Phong, for their knowledge, hospitality, and continued assistance. This would not have been possible without their collaboration. I would also like to thank the staff of the Phu Quoc MPA for providing me with valuable information about Phu Quoc, as well as the opportunity to assist on research and monitoring efforts around the island.

I also appreciate the help of Dr Ha at Vietnam National University and Mr. Tung of CITES VN for their support and assistance with the project, and for showing me around Hanoi. Thank you also to Dr. Ut from Can Tho University, for conducting the first seahorse studies on Phu Quoc, for introducing me to many Vietnamese graduate students, and for a day of fun on the island.

Finally, to the two people who helped me the most during my four months in Vietnam: Do Thanh An and Nguyen Nhut Thanh, my research assistants, who provided never-ending translations not only of words but of an entire culture. Thank you for your patience, kindness, and hard work. I am forever grateful for the time both of you spent with me on the project.

**APPENDICES**

- I. SCHEDULE OF ACTIVITIES**
- II. RESEARCH**
- III. CONTACTS**

**I. SCHEDULE OF ACTIVITIES**

Initials: AS = Allison Stocks, DTA = Do Thanh An, Nguyen Nhut Thanh = NNT

What	When	Where	Who	Summary
Introductory meeting	March 31, 2014	CITES office, Ha Noi	AS, Nguyen M Ha, Do Quang Tung	Met to discuss the project.
Presentation of research proposal	April 2, 2014	RIMF, Hai Phong	AS, RIMF staff	Presented outline of research activities to RIMF staff.
Introductory meeting	April 3, 2014	RIMF, Hai Phong	AS, Nguyen Khac Bat	Met to discuss the project.
Introductory meeting	April 8, 2014	MPA office, An Thoi, Phu Quoc Island	AS, An, Deputy Director of MPA	Met to discuss the project.
Introductory meeting	April 9, 2014	Duong Dong, Phu Quoc Island	AS, DTA, Flipper Diving staff, Searama, Vietnam Explorer	Met with dive shops, discussed dive locations and compared prices
Introductory meeting	April 10, 2014	Duong Dong, PQI	AS, DTA, Director of MPA	Met to discuss the project.
Port sampling	April 10, 2014	Da Chong port, PQI	AS, DTA, 9 boats of compressor divers	Measured seahorses, collected effort data
Underwater surveys	April 12, 2014	Da Chong port, PQI	AS, DTA, NTT	Searched for seahorses, collected data
Port sampling	April 12, 2014	Da Chong port, PQI	AS, DTA, 2 luoi dung boats	Measured seahorses, collected effort data
Interview	April 13, 2014	Ham Ninh, PQI	AS, DTA, squid fisher	Garnered information on seahorse fishing
Underwater surveys	April 14, 2014	Da Chong port, PQI	AS, DTA, NTT	Searched for seahorses, collected data
Port sampling	April 14, 2014	Da Chong port, PQI	AS, DTA, 4 boats of compressor divers	Measured seahorses, collected effort data
Interview	April 15, 2014	Ham Ninh, PQI	AS, DTA, crab fisher	Garnered information on seahorse fishing
Underwater surveys	April 16, 2014	North of Ham Ninh, PQI	AS, DTA, NTT	Searched for seahorses, collected data
Port sampling	April 16, 2014	Ham Ninh, PQI	AS, DTA, 1 boat of compressor divers	Measured seahorses, collected effort data

Underwater surveys	April 17, 2014	South of Ham Ninh, PQI	AS, DTA	Searched for seahorses, collected data
Port sampling	April 17, 2014	Ham Ninh, PQI	AS, DTA, 1 boat of compressor divers	Measured seahorses, collected effort data
Underwater surveys	April 18, 2014	Southeastern pagoda	AS, DTA, NTT	Searched for seahorses, collected data
Interviews	April 19, 2014	Rach Tram, PQI	DTA, 5 net fishers	Garnered information on seahorse fishing
Interviews	April 20, 2014	Ganh Dau, PQI	AS, DTA, 2 net fishers	Garnered information on seahorse fishing
Port sampling	April 21, 2014	Da Chong port, PQI	AS, DTA, 13 boats of compressor divers	Measured seahorses, collected effort data
Port sampling	April 22, 2014	Duong Dong port, PQI	AS, DTA, 1 boat of compressor divers	Measured seahorses, collected effort data
Port sampling	April 23, 2014	Hon Thom Islet	AS, DTA, crab fishers	Measured seahorses, collected effort data
Interviews	April 23, 2014	Hon Thom Islet	AS, DTA, crab fishers	Garnered information on seahorse fishing
Port sampling	April 23, 2014	Hon Roi Islet	AS, DTA, compressor diver	Measured seahorses, collected effort data
Interviews	April 23, 2014	Hon Roi Islet	AS, DTA, compressor diver	Garnered information on seahorse fishing
Port sampling	April 24, 2014	Hon Thom Islet	AS, DTA, 3 trawl boats	Measured seahorses, collected effort data
Interviews	April 24, 2014	Hon Thom Islet	AS, DTA, 3 trawl boats	Garnered information on seahorse fishing
Interviews	April 24, 2014	Hon Thom Islet	AS, DTA, 4 banh long fishing boats, 1 trawl boat	Garnered information on seahorse fishing
Port sampling	April 24, 2014	Hon Roi Islet	AS, DTA, 3 compressor diver boats	Measured seahorses, collected effort data
Port sampling	April 25, 2014	Hon Thom Islet	AS, DTA, 6 boats	Measured seahorses, collected effort data
Port sampling	April 26, 2014	Ham Ninh, PQI	AS, DTA, 6 boats of compressor divers	Measured seahorses, collected effort data
Meeting	April 27, 2014	Duong Dong, PQI	AS, DTA, MPA staff	Discussed Reef Check
Port sampling	April 28, 2014	Ham Ninh, PQI	AS, DTA, 8 boats	Measured seahorses, collected effort data
Underwater surveys	April 29, 2014	Ham Ninh, PQI	AS, DTA	Searched for seahorses, collected data
Port sampling	April 29, 2014	Ham Ninh, PQI	AS, DTA, 2 boats	Measured seahorses, collected effort data
Interview	April 29, 2014	Ham Ninh, PQI	AS, DTA, 1 trawl boat	Garnered information on seahorse fishing
Port sampling	April 30,	Da Chong Port,	AS, DTA, 7 boats	Measured seahorses,

	2014	PQI		collected effort data
Port sampling	May 1, 2014	Ham Ninh, PQI	AS, DTA, 5 boats	Measured seahorses, collected effort data
Interview	May 1, 2014	Da Bac, PQI	AS, DTA, 1 trawl boat	Garnered information on seahorse fishing
Interview	May 2, 2014	Rach Tram, PQI	AS, DTA, 2 trawl boats	Garnered information on seahorse fishing
Arrival and orientation of new research assistant	May 7, 2014	Duong Dong, PQI	AS, NNT	
Port sampling	May 9, 2014	Ham Ninh, PQI	AS, NNT, 6 boats	Measured seahorses, collected effort data
Port sampling	May 10, 2014	Da Chong Port, PQI	AS, NNT, 11 boats	Measured seahorses, collected effort data
Interview	May 12, 2014	Cay Sao, Bai Bon, PQI	AS, NNT, 3 fishers	Garnered information on seahorse fishing
Underwater surveys	May 13, 2014	An Thoi Islands	AS, MPA staff	Reef Check
Underwater surveys	May 14, 2014	An Thoi Islands	AS, MPA staff	Reef Check
Port sampling	May 15, 2014	Ham Ninh, PQI	AS, NNT, 4 boats	Measured seahorses, collected effort data
Underwater surveys	May 16, 2014	Ganh Dao, PQI	AS, MPA staff	Reef Check
Underwater surveys	May 17, 2014	Hon Mot, PQI	AS, MPA staff	Reef Check
Underwater surveys	May 18, 2014	Da Chong & Bai Bon, PQI	AS, MPA staff	Reef Check
Meeting	May 19, 2014	Duong Dong, PQI	AS, NNT, Dr Ut	Discussed past seahorse research, met CTU Masters students
Underwater surveys	May 20, 2014	Cay Sao & Da Bac, PQI	AS, MPA staff	Reef Check
Underwater surveys	May 21, 2014	Bai Vong & Ham Ninh, PQI	AS, MPA staff	Reef Check
Port sampling	May 21, 2014	Ham Ninh, PQI	AS, NNT, 7 boats	Measured seahorses, collected effort data
Port sampling	May 26, 2014	Da Chong Port, PQI	AS, NNT, 9 boats	Measured seahorses, collected effort data
Interview	May 26, 2014	Da Chong Port, PQI	AS, NNT, one fisher	Garnered information on seahorse fishing
Interview	May 27, 2014	Hon Roi, PQI	AS, NNT, two fishers	Garnered information on seahorse fishing
Port sampling	May 28, 2014	Hon Thom Islet	AS, NNT, 2 boats	Measured seahorses, collected effort data
Interview	May 28, 2014	Hon Thom Islet	AS, NNT, 4 boats, one buyer	Garnered information on seahorse fishing

Interview	May 28, 2014	Hon Roi Islet	AS, NNT, one fisher	Garnered information on seahorse fishing
Port sampling	May 29, 2014	Hon Thom Islet	AS, NNT, 3 boats	Measured seahorses, collected effort data
Interview	May 29, 2014	Hon Thom Islet	AS, NNT, 4 boats	Garnered information on seahorse fishing
Port sampling	May 29, 2014	Ham Ninh, PQI	AS, NNT, 8 boats	Measured seahorses, collected effort data
Port sampling	May 30, 2014	Ham Ninh (main port), PQI	AS, NNT, 5 boats	Measured seahorses, collected effort data
Interview	May 30, 2014	Ham Ninh (main port), PQI	AS, NNT, one fisher	Garnered information on seahorse fishing
Port sampling	June 1, 2014	An Thoi, PQI	AS, NNT, 1 boat	Measured seahorses, collected effort data
Interview	June 1, 2014	An Thoi, PQI	AS, NNT, one boat, one buyer	Garnered information on seahorse fishing
Port sampling	June 2, 2014	Ham Ninh, PQI	AS, NNT, 3 boats	Measured seahorses, collected effort data
Interview	June 2, 2014	An Thoi, PQI	AS, NNT, 2 boats	Garnered information on seahorse fishing
Interview	June 2, 2014	Ham Ninh, PQI	AS, NNT, one fisher	Garnered information on seahorse fishing
Interview	June 3, 2014	Cau Sau, Vinh Dam PQI	AS, NNT, four fishers	Garnered information on seahorse fishing
Port sampling	June 4, 2014	Ham Ninh (main port), PQI	AS, NNT, 0 boats	No boats went out last night
Port sampling	June 4, 2014	Bai Bon, PQI	AS, NNT, 6 boats	Measured seahorses, collected effort data
Interview	June 4, 2014	Bai Bon, PQI	AS, NNT, one fisher	Garnered information on seahorse fishing
Port sampling	June 5, 2014	Da Chong, PQI	AS, NNT, 4 boats	Measured seahorses, collected effort data
Interview	June 5, 2014	Da Chong, Xa Luc, PQI	AS, NNT, 5 fishers	Garnered information on seahorse fishing
Interview	June 5, 2014	Bai Thom, PQI	AS, NNT, buyer	Garnered information on seahorse fishing
Port sampling	June 6 AM, 2014	Da Chong, PQI	AS, NNT, 15 boats	Measured seahorses, collected effort data
Port sampling	June 6, 2014	An Thoi, PQI	AS, NNT, 0 boats	No boats went out last night
Interview	June 6, 2014	An Thoi, PQI	AS, NNT, one fisher	Garnered information on seahorse fishing
Port sampling	June 18, 2014	Duong Dong, PQI	AS, NNT	Explored port, no boats were fishing seahorses in this area at the time
Port sampling	June 19,	An Thoi, PQI	AS, NNT, 2 boats	Measured seahorses,



	2014			collected effort data
Port sampling	June 20, 2014	Cau Sau, PQI	AS, NNT, 1 boat	Measured seahorses, collected effort data
Interview	June 20, 2014	Cau Sau, PQI	AS, NNT, 3 boats	Garnered information on seahorse fishing
Port sampling	June 20, 2014	An Thoi, PQI	AS, NNT, 4 boats	Measured seahorses, collected effort data
Port sampling	June 21, 2014	Ham Ninh, PQI	AS, NNT, 4 boats	Measured seahorses, collected effort data
Port sampling	June 22 AM, 2014	Ham Ninh (main port), PQI	AS, NNT, 6 boats	Measured seahorses, collected effort data
Port sampling	June 22, 2014	Bai Bon, PQI	AS, NNT, 2 boats	Measured seahorses, collected effort data
Interview	June 22, 2014	Bai Bon, PQI	AS, NNT, 2 boats	Garnered information on seahorse fishing
Port sampling	June 23, 2014	Da Chong, PQI	AS, NNT, 0 boats	No boats went out during the day
Interview	June 23, 2014	Bai No, PQI	AS, NNT, 2 boats, one buyer	Garnered information on seahorse fishing
Port sampling	June 24, 2014	Da Chong, PQI	AS, NNT, 0 boats	No boats went out last night
Interview	June 24, 2014	Bai Thom, Da Chong	AS, NNT, 3 fishers	Garnered information on seahorse fishing
Interview	June 25, 2014	Ganh Dau, PQI	AS, NNT, 3 fishers, one buyer	Garnered information on seahorse fishing
Port sampling	June 26, 2014	Hon Thom Islet	AS, NNT, 2 boats	Measured seahorses, collected effort data
Interview	June 27, 2014	Hon Thom Islet	AS, NNT, 4 boats	Garnered information on seahorse fishing
Port sampling	June 28, 2014	Hon Thom Islet	AS, NNT, 4 boats	Measured seahorses, collected effort data
Interview	June 28, 2014	Hon Thom Islet	AS, NNT, 2 boats	Garnered information on seahorse fishing
Port sampling	June 28, 2014	Ham Ninh, PQI	AS, NNT, 4 boats	Measured seahorses, collected effort data
Port sampling	June 29, 2014	Ham Ninh (main port), PQI	AS, NNT, 0 boats	No boats went out last night
Port sampling	June 29, 2014	Da Chong, PQI	AS, NNT, 2 boats	Measured seahorses, collected effort data
Interview	June 29, 2014	Da Chong, PQI	AS, NNT, 1 boat	Garnered information on seahorse fishing
Port sampling	June 30, 2014	Da Chong, PQI	AS, NNT, 13 boats	Measured seahorses, collected effort data
Port sampling	July 2, 2014	An Thoi, PQI	AS, NNT, 2 boats	Measured seahorses, collected effort data
Port sampling	July 3,	Ham Ninh, PQI	AS, NNT, 7 boats	Measured seahorses,

	2014			collected effort data
Interview	July 3, 2014	Ham Ninh, PQI	AS, NNT, 1 boat	Garnered information on seahorse fishing
Dissections	July 3, 2014	Purchased in Hon Thom	AS, NNT	Dissected seven seahorses
Port sampling	July 3, 2014	An Thoi, PQI	AS, NNT, 3 boats	Measured seahorses, collected effort data
Port sampling	July 4 AM, 2014	Ham Ninh (main port), PQI	AS, NNT, 9 boats	Measured seahorses, collected effort data
Port sampling	July 6, 2014	Da Chong, PQI	AS, NNT, 4 boats	Measured seahorses, collected effort data
Port sapling	July 6, 2014	Xa Luc, PQI	AS, NNT, 4 boats	Measured seahorses, collected effort data
Interview	July 6, 2014	Bai No, PQI	AS, NNT, 2 fishers	Garnered information on seahorse fishing
Port sampling	July 7 AM, 2014	Da Chong, PQI	AS, NNT, 26 boats	Measured seahorses, collected effort data
Port sampling	July 7, 2014	Xa Luc, PQI	AS, NNT, 4 boats	Measured seahorses, collected effort data
Dissections	July 7, 2014	Da Chong, PQI	AS, NNT	Dissected three seahorses
Port sampling	July 8 AM, 2014	Da Chong, PQI	AS, NNT, 7 boats	Measured seahorses, collected effort data
Dissections	July 8, 2014	Da Chong, PQI	AS, NNT	Dissected two seahorses
Port sampling	July 8, 2014	Bai Bon, PQI	AS, NNT, 3 boats	Measured seahorses, collected effort data
Port sampling	July 9, 2014	Ham Ninh, PQI	AS, NNT, 4 boats	Measured seahorses, collected effort data
Interview	July 9, 2014	Ham Ninh, PQI	AS, NNT, 2 fishers	Garnered information on seahorse fishing
Port sampling	July 10, 2014	Ham Ninh, PQI	AS, NNT, 7 boats	Measured seahorses, collected effort data
Dissections	July 10, 2014	Ham Ninh, PQI	AS, NNT	Dissected two seahorses
Port sampling	July 11 AM, 2014	Ham Ninh (main port), PQI	AS, NNT, 5 boats	Measured seahorses, collected effort data
Dissections	July 11, 2014	Ham Ninh, PQI	AS, NNT	Dissected one seahorse
Port sampling	July 11, 2014	An Thoi, PQI	AS, NNT, 2 boats	Measured seahorses, collected effort data
Port sampling	July 14, 2014	Da Chong, PQI	AS, NNT, 3 boats	Measured seahorses, collected effort data

Port sampling	July 14, 2014	Xa Luc, PQI	AS, NNT, 1 boat	Measured seahorses, collected effort data
Dissections	July 14, 2014	Da Chong, PQI	AS, NNT	Dissected two seahorses
Port sampling	July 14, 2014	Bai No, PQI	AS, NNT, 2 boats	Measured seahorses, collected effort data
Interview	July 14, 2014	Bai No, PQI	AS, NNT, one fisher	Garnered information on seahorse fishing
Port sampling	July 15, 2014	Da Chong, PQI	AS, NNT, 7 boats	Measured seahorses, collected effort data
Dissections	July 15, 2014	Da Chong, PQI	AS, NNT	Dissected six seahorses
Port sampling	July 15, 2014	Bai Bon, PQI	AS, NNT, 4 boats	Measured seahorses, collected effort data
Port sampling	July 16 AM, 2014	Ham Ninh (main port), PQI	AS, NNT, 8 boats	Measured seahorses, collected effort data
Dissections	July 16, 2014	Ham Ninh, PQI	AS, NNT	Dissected four seahorses
Port sampling	July 16, 2014	Ham Ninh, PQI	AS, NNT, 10 boats	Measured seahorses, collected effort data
Port sampling	July 17, 2014	An Thoi, PQI	AS, NNT, 3 boats	Collected effort data
Dissections	July 17, 2014	Ham Ninh, PQI	AS, NNT	Dissected two seahorses
Underwater sponge survey	July 18, 2014	An Thoi Islands	AS, Huong	Assisted with sponge sample collection
Port sampling	July 18, 2014	Ham Ninh, PQI	AS, NNT, 1 boat	Collected effort data
Dissections	July 18, 2014	Ham Ninh, PQI	AS, NNT	Dissected three seahorses
Final Meeting	July 18, 2014	Duong Dong, PQI	AS, NNT, MPA Staff	Discussed the project, gave thank you gifts
Dissections	July 19, 2014	Ham Ninh, PQI	AS	Dissected four seahorses
General Meetings	July 29, 2014	Hai Phong	AS, RIMF staff	Discussed field season with RIMF staff
Final Meeting	July 31, 2014	Hai Phong	AS, Dr Bat	Discussed the project, gave thank you gift

## II. RESEARCH

### Underwater Survey Sites

Date	Site No.	Name	Latitude	Longitude	Surveyors	Dist. Traveled (m)	Search time (min)	Habitat type	Avg depth (m)	Temp (°C)
4-12	1	Lo Reef	10.36936758	104.1013707	AS, NTT, DTA	-	73	S, SG	5.5	31.1
4-12	2	Lo Reef	10.3651566	104.0935296	AS, NTT	-	84	S, SG	4.1	31.4
4-12	3	Da Chong	10.34529492	104.0802622	AS, NTT	-	29	S, SG	1.6	32.5
4-14	4	Hon Mot	10.42305149	104.0562373	AS, NTT, DTA	300	24	S, M	5.6	30.9
4-14	5	Hon Mot	10.40892036	104.0611995	AS, NTT, DTA	200	22	CR	1.8	31.0
4-14	6	Da Chong	10.36630995	104.1041245	AS, NTT	350	31	S	5.7	31.1
4-14	7	Da Chong	10.36239166	104.0939354	AS, NTT, DTA	-	74	S, SG	3.5	31.4
4-16	8	Da Bac	10.198275	104.071065	AS, NTT, DTA	-	95	S, Sh	2.8	31.3
4-16	9	Da Bac	10.20149047	104.0733946	AS, NTT, DTA	600	55	S, Sh	3.0	31.5
4-16	10	Da Bac	10.17374201	104.0727002	AS, NTT, DTA	700	80	S, Sh, SG	3.6	31.3
4-17	11	Vong Beach	10.11434457	104.0627593	AS, DTA	-	68	S, Sh	4.8	31.0
4-17	12	Cay Gia Beach	10.36239166	104.0939354	AS, DTA	1000	105	S, Sh	4.5	31.5
4-18	13	Pagoda Shore	10.09073024	104.0251173	NTT, DTA	200	45	S, R	1.0	-
4-29	14	Pagoda offshore	10.08566723	104.0756594	AS, DTA	-	106	S, Sh	5.2	32.5
4-29	15	Pagoda offshore	10.08763338	104.0748934	AS, DTA	1000	87	S, Sh	5.3	32.8
5-13	16	An Thoi islands	9.918464357	104.0200566	AS	400	42	CR	3.0	32.1
5-13	17	An Thoi islands	9.928218881	104.0204865	AS	350	36	CR	3.5	32.2
5-14	18	Hon Thom	9.956525657	104.0111442	AS	400	36	CR	3.4	32.2
5-14	19	Hon Roi	9.974682117	104.0165864	AS	500	38	CR	3.3	32.3
5-16	20	Ganh Dao	10.36600912	103.8332019	AS	300	52	CR	3.6	32.3
5-17	21	Hon Mot	10.40064197	104.0603677	AS	500	72	SG	0.7	32.5
5-18	22	Da Chong	10.34895438	104.0805976	AS, Tha	500	59	SG	1.3	32.3
5-18	23	Bai Bon	10.32321255	104.0831065	AS, Tha	350	47	SG	0.3	32.4
5-20	24	Cay Sao	10.24413918	104.0890695	AS, Tha, Long	350	49	S, SG	1.0	32.2
5-20	25	Da Bac	10.20720659	104.0702721	Tha, Long	200	60	S, SG	1.8	32.8
5-21	26	Bai Vong	10.15248676	104.0472916	AS, Tha	700	79	S, SG	0.75	32.3
5-21	27	Ham Ninh	10.17559181	104.0610104	AS, Tha	600	60	S, SG	1.9	32.1

Surveyor abbreviations: AS = Allison Stocks, NTT = Nguyen Tri Thanh, DTA = Do Thanh An  
 Habitat abbreviations: S = sand, SG = seagrass, CR = coral reef, R = rocks, M = mud, Sh = shells

### Underwater Seahorse Sightings

Site No.	Total seahorses	Species	Holdfast	Sex	Pregnant	Height (mm)	Torso (mm)	Depth
1	2	<i>H. spinosissimus</i>	Seagrass	M	Yes	100	65	5.8
		<i>H. trimaculatus</i>	Plants	F			20	6.0
2	3	<i>H. spinosissimus</i>	Seagrass	M	Yes	92	50	4.7
		<i>H. spinosissimus</i>	Seagrass	M	Yes	105	39	4.5
		<i>H. spinosissimus</i>	Sponge	M	Yes	102	38	4.8
3	0							
4	0							
5	0							
6	0							
7	3	<i>H. spinosissimus</i>	Urchin	F	No	76	24	3.8
		<i>H. spinosissimus</i>	Urchin	M		65	27	3.8
		<i>H. spinosissimus</i>	Urchin	J		44	20	3.9
8	0							
9	0							
10	0							
11	0							
12	1	<i>H. spinosissimus</i>	Urchin	J		70	30	5.2
13	1	<i>H. kuda</i>	Rock	F		99	34	-
14	4	<i>H. kuda</i>	Rock	F		120	49	5.9
		<i>H. spinosissimus</i>	Urchin	J		68	26	5.8
		<i>H. trimaculatus</i>	Shells	M	Yes	117	40	5.8
		<i>H. spinosissimus</i>	Urchin	M	No	75	29	5.9
15	2	<i>H. spinosissimus</i>	Shells	J		74	30	6.2
		<i>H. spinosissimus</i>	Sponge	M	Yes	109	39	6.1
16	0							
17	0							
18	0							
19	0							
20	0							
21	0							
22	0							
23	0							
24	1	<i>H. kuda</i>	Seagrass					
25	0							
26	0							
27	0							

N10 27.182 E103 47.329 (Lat/Lon hddd°mm.mmm' WGS 84)

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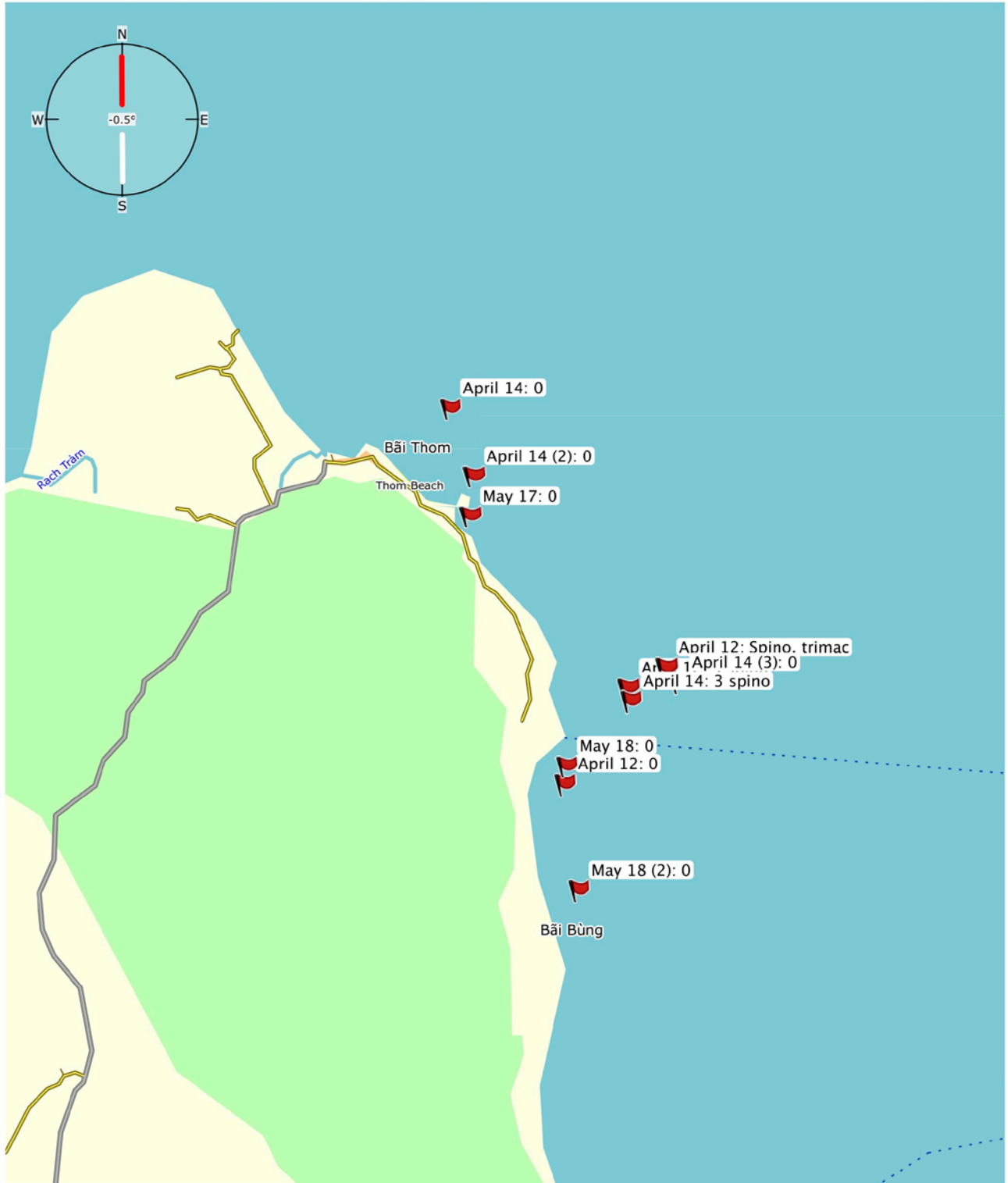
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N10 30.425 E103 57.779 (Lat/Lon hddd°mm.mmm' WGS 84)

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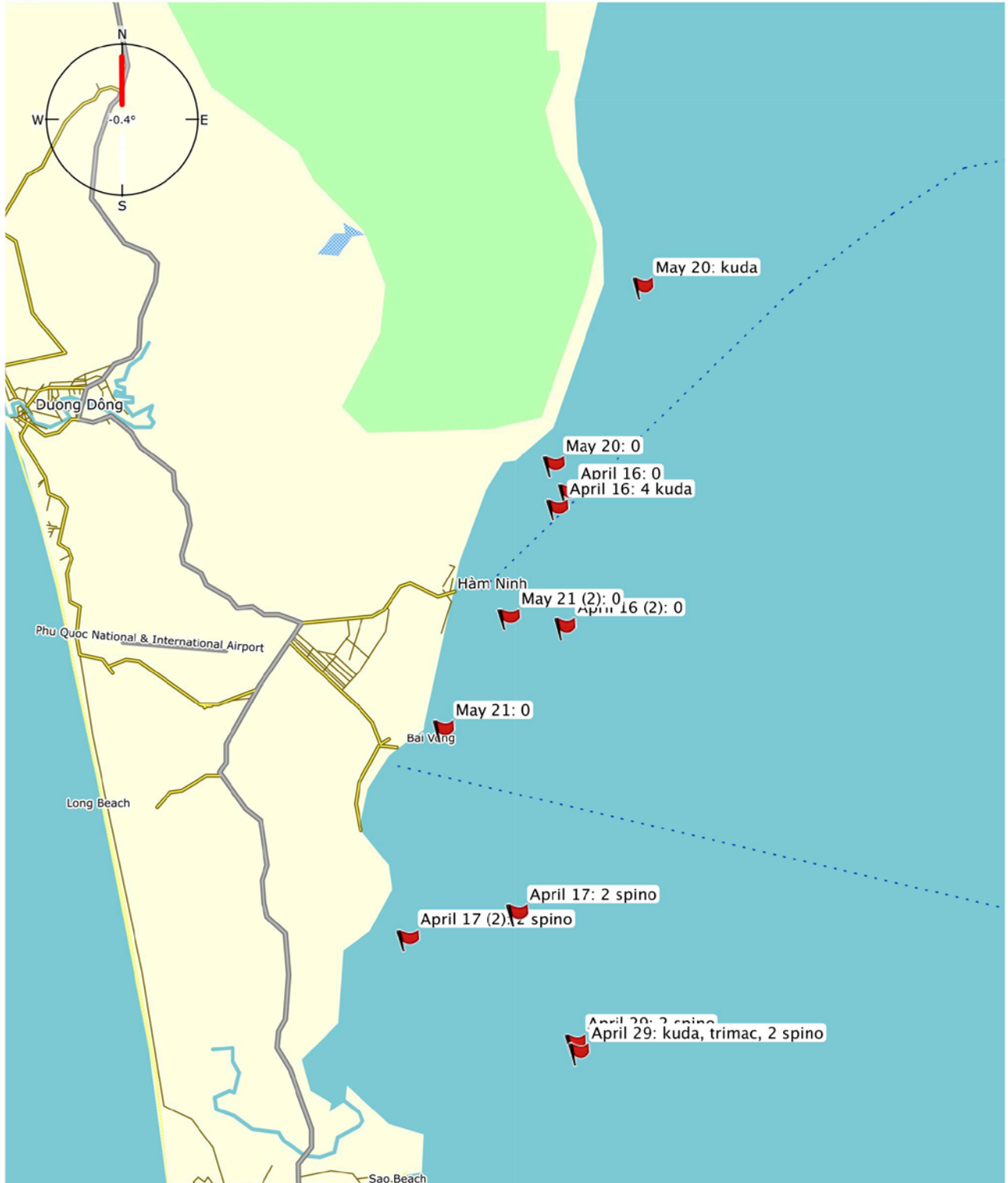


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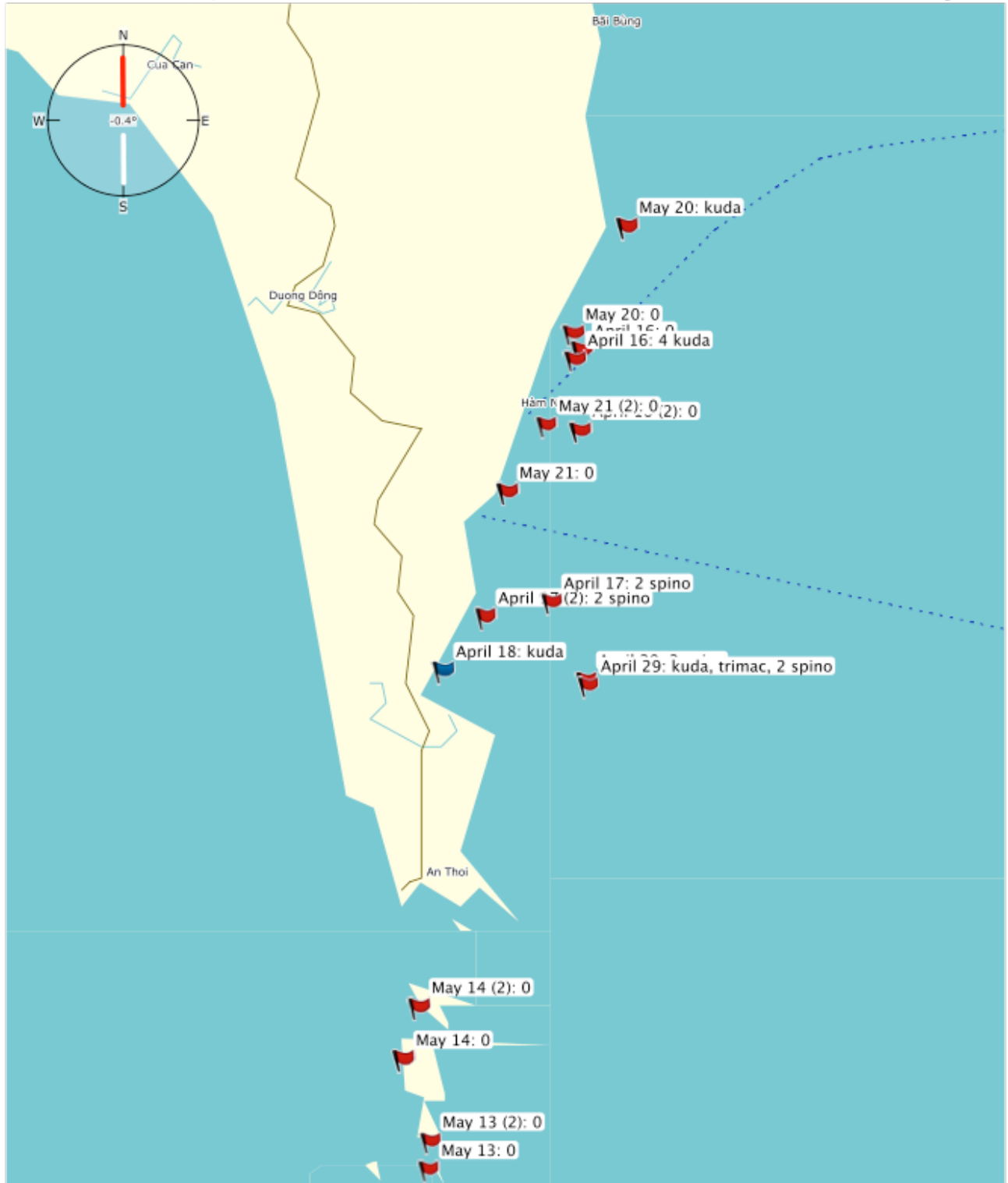
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0 5 10 15 km

N9 54.793 E104 13.243



### Fisheries Survey Sites



Surveys occurred at marked locations – Hon Thom, Hon Roi, An Thoi, Bai Vong, Ham Ninh, Bai Bon, Da Chong, Rach Tram, Ganh Dau, and Duong Dong.

**Brood Size**

37 male seahorses that appeared pregnant were dissected, and their brood sizes were counted.

<b>Species</b>	<b>Height (mm)</b>	<b>Pouch Length</b>	<b>Pouch Width</b>	<b>Pouch Depth</b>	<b>Number of Young</b>
<i>H. trimaculatus</i>	105	17	5	6	288
<i>H. trimaculatus</i>	124	14	5	3	0
<i>H. spinosissimus</i>	108	21	6	4	259
<i>H. trimaculatus</i>	108	17	5	6	285
<i>H. spinosissimus</i>	114	24	7	5	239
<i>H. trimaculatus</i>	120	17	6	7	253
<i>H. spinosissimus</i>	112	21	7	5	0
<i>H. trimaculatus</i>	125	19	5	4	321
<i>H. spinosissimus</i>	124	26	8	4	237
<i>H. spinosissimus</i>	117	21	5	4	119
<i>H. spinosissimus</i>	122	18	9	7	277
<i>H. trimaculatus</i>	131	20	8	4	182
<i>H. kuda</i>	119	21	9	10	520
<i>H. trimaculatus</i>	114	19	6	5	345
<i>H. trimaculatus</i>	132	20	5	4	45
<i>H. kuda</i>	128	24	9	8	305
<i>H. kuda</i>	125	23	9	8	628
<i>H. spinosissimus</i>	121	17	6	5	107
<i>H. spinosissimus</i>	150	29	9	5	197
<i>H. spinosissimus</i>	122	22	6	5	380
<i>H. spinosissimus</i>	119	26	8	6	314
<i>H. spinosissimus</i>	118	19	3	4	56
<i>H. trimaculatus</i>	148	24	4	7	205
<i>H. spinosissimus</i>	113	22	8	6	9
<i>H. spinosissimus</i>	111	18	8	7	296
<i>H. spinosissimus</i>	113	23	5	5	388
<i>H. spinosissimus</i>	125	27	6	5	325
<i>H. spinosissimus</i>	120	22	8	5	337
<i>H. spinosissimus</i>	125	23	7	5	381
<i>H. spinosissimus</i>	133	23	6	5	286
<i>H. kuda</i>	145	32	10	9	694
<i>H. kuda</i>	150	35	14	13	356
<i>H. kuda</i>	127	27	9	7	382
<i>H. kuda</i>	127	21	6	7	403
<i>H. trimaculatus</i>	122	17	4	7	200
<i>H. trimaculatus</i>	125	17	6	7	251
<i>H. trimaculatus</i>	128	22	7	8	621

**III. CONTACTS**

Name	Affiliation	Phone Number	Email	Location	Notes
Nguyen Khac Bat	RIMF	0916497967	nkbat2005@gmail.com	Hai Phong	
Nguyen M Ha	CRES	0982994468	ha.nguyenba@gmail.com	Ha Noi	
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Doan Thu Ha	RIMF	0914620588	dtha@rimf.org.vn	Hai Phong	
Hoang Dinh Chieu	RIMF	0979488080	hoangdinhchiew@gmail.com	Hai Phong	Deputy Head of Dept of Marine Biodiversity and Conservation
Do Thanh An	RIMF	0934388856	dothanhanrimf@gmail.com	Hai Phong	Research assistant
Thien	RIMF	0973114401		Hai Phong	
Son	RIMF	0902024624		Hai Phong	
Nguyen Nhut Thanh	Can Tho University	01665748862	thanh.nguyennhut2014@gmail.com		Research assistant
Mr. Thang	Coastal Guard	0912114686		Da Chong	Approved research
Mr. Truong	Boat owner	01646112198		Da Chong	Rented boat for diving
Mr. Son		01265457743		Duong Dong	Taxi driver
Mr. Hoang	Coastal guard	0972396809		Ham Ninh	Approved research
Mr. Nghia	Fisher	01234849466		Ham Ninh	Rented boat for diving
Mr. Cong	Seahorse Fisher	01698662987		Ham Ninh	Rented boat for diving
Mr. Tho		01668490116		Ham Ninh	Fishing village leader
Mr. Tam	Fisher			Ham Ninh	Excellent seahorse
Mr. Cuong	MPA	0918221282		An Thoi	Director
Mr. Ngoc	MPA	0907666860		An Thoi	Speaks English
Mr. Tha	MPA	0986763820		Anthoi	Speaks English
Mr. Le	Seahorse fisher	01672539391		Da Bac	Offered to let us survey with him
Mr. Vu	Seahorse fisher	01676570645		Rach Tram	
Mr. Hai		0919859709		Hon Thom	Stayed at his house several times
Nguyen Tri Thanh	Freelance diver	0987300299		Duong Dong	Assisted with dives, rented motorbike
Mr. Cuong	RIMF	0986364684		Hai Phong	Met several times on PQ for surveys
Mr. Trung		0912114686		Kien	Fisheries official

				Giang	
Mr. Tâm	Seahorse fisher	01254636965		Đá Chồng	Trawl boat
Mr. Chín Mọi	Seahorse fisher	01277717981		Đá Chồng	Trawl boat
Mr. Tranh	Seahorse fisher	01673994744		An Thới	Trawl boat
Mr. Vũ	Seahorse fisher	0974549147		An Thới	Trawl boat
Mr. Cường	Seahorse fisher	0983712427		An Thới	Trawl boat
Mr. Lam	Seahorse buyer	0918071169		Bãi Nò	Buy seahorses across PQ
Mr. Sơn	Seahorse fisher	01265688192		An Thới	Trawl boat
Mr. Quyền Hăng	Fisher	01688763096		Bãi Bồn	Trawl boat
		01668799965		Hàm Ninh	Daughter in family where I often ate.
Quý Đức	Guest house	0917264268		Đá Chồng	
Mr. Phước		0918873484		Bãi Bồn	Helped with MPA ReefCheck, did homestay with him
Mr. Huong	RIMF	0989686087		Hai Phong	Assisted him with sponge survey