



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Pacific Islands Fisheries Science Center
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PROJECT REPORT¹

VESSEL: *Oscar Elton Sette*, Project SE-14-07

PROJECT PERIOD: September 25–October 27, 2014

AREA OF OPERATION: The operating area included transit northwest along the main Hawaiian Islands and Papahānaumokuākea Marine National Monument from Ford Island, Pearl Harbor, to Midway Atoll with marine debris operations at Maro Reef, Lisianski Island, Pearl and Hermes Atoll, and Midway Atoll (Figure 1).

TYPE OF OPERATION: The NOAA Ship *Oscar Elton Sette* (*OES*) was engaged as support for the, NOAA Pacific Island Fisheries Science Center (PIFSC) Coral Reef Ecosystem Division (CRED) marine debris project of the National Marine Fisheries Service (NMFS). The ship supported in-water and shoreline marine debris surveys and removal operations at Maro Reef, Lisianski Island, Pearl and Hermes Atoll, and Midway Atoll. The marine debris (primarily derelict fishing gear) collected during survey and removal operations was stored onboard until the vessel returned to Ford Island, Pearl Harbor.

¹ PIFSC Cruise Report CR-14-004
Issued 22 December 2014



ITINERARY:

- 25 September **Pearl Harbor:** Embarked scientist Tamoko Acoba, Naomi Blinick, Michael Burns, Joao Garriques, Justin Goggins, Andrew Gray, Rachel Knapstein, Kyle Koyanagi, Frances Lichowski, Mark Manuel, James Morioka, Alexander Nordschow, Kevin O'Brien, Dianna Parker, Kerry Reardon, Russell Reardon, Aviv Suan, Rhonda Suka, and Jesse Tootell. Following fueling operations the *OES* departed Ford Island, Pearl Harbor, at 1300 en route to Maro Reef.
- 26-28 September **Transit:** During the first days of transit the following activities occurred: the welcome aboard ship briefing, ship fire and abandon ship drills, prepping of small boats and equipment. Chief Scientist Mark Manuel gave a power point presentation to the ship's command and deck crew discussing the history of the marine debris project and proposed operations for SE-14-07.
- 29 September **Maro Reef:** Arrived at Maro Reef for the first day of marine debris operations. Ideal weather conditions allowed for launching all four (4) marine debris small boats out of the northwest. Swim surveys were conducted in the southwest interior reefs. A total of 0.22 km² of reticulated reefs were surveyed resulting in the removal of 47 net clusters weighing a total of 1860 kg.
- Severe bleaching of Pocillopora and Montipora colonies were observed in all survey areas.
- 30 September **Maro Reef:** A large north swell forced launching of all marine debris small boats from the south. The marine debris team continued to conduct swim surveys in the southern interior reefs. A total of 0.21 km² of reticulated reefs were surveyed resulting in the removal of 49 net clusters weighing a total of 2130 kg.
- Severe bleaching of Pocillopora and Montipora colonies were observed in all survey areas.
- The project was placed under heavy water restrictions as a result of a malfunctioning evaporator/water maker.
- 1 October **Maro Reef:** All marine debris small boats were launched from the south and the team continued to conduct swim surveys in the northern patch reefs. A total of 0.11 km² of reticulated reefs were surveyed resulting in the removal of 45 net clusters weighing a total of 2865 kg.
- Severe bleaching of Pocillopora and Montipora colonies were observed in all survey areas.

- 2 October **Maro Reef:** All marine debris small boats were launched from the south and the team continued to conduct swim surveys in the northern patch reefs. A total of 0.09 km² of reticulated reefs were surveyed resulting in the removal of 43 net clusters weighing a total of 2900 kg.
- Severe bleaching of Pocillopora and Montipora colonies were observed in all survey areas.
- 3 October **Maro Reef:** All marine debris small boats were launched from the south and the team continued to conduct swim surveys in the northern patch reefs. A total of 0.15 km² of reticulated reefs were surveyed resulting in the removal of 44 net clusters weighing a total of 1630 kg.
- Severe bleaching of Pocillopora and Montipora colonies were observed in all survey areas.
- 4 October **Maro Reef:** All marine debris small boats were launched from the south and the team continued to conduct swim surveys in the southern interior reefs. A total of 0.16 km² of reticulated reefs were surveyed resulting in the removal of 28 net clusters weighing a total of 2670 kg (Figures 8 & 9). Departed Maro Reef at 1700 en route to Midway Atoll.
- Severe bleaching of Pocillopora and Montipora colonies were observed in all survey areas.
- 5 October **Transit:** Based on severe water restrictions, the command made the decision to acquire water from USFWS at Midway Atoll. This resulted in the cancellation of Laysan Island shoreline removal operations.
- 6 October **Midway Atoll:** Arrived at Midway Atoll by 1000. USFWS personnel provided the command, crew, and scientist with the Midway Atoll cultural/historical briefing. Three marine debris small boats were launched by 1230 to conduct previously established standing stock surveys (NOAA Marine Debris Program sampling protocols). The marine debris team successfully completed each survey on the northern shoreline of each island (Sand, Spit and Eastern). The team also conducted survey and removal efforts along 300-m shoreline segments as part of an accumulation rate study established in 2013.
- 7 October **Midway Atoll:** Three marine debris small boats were launched and the team continued shoreline survey and removal efforts on Spit and Eastern Island. The team surveyed and removed debris from five (5) 300-m segments on both islands (Figure 12). All debris was brought back to the main pier where it was weighed, sorted, and counted. Departed Midway Atoll at 1700 en route to Pearl and Hermes Atoll.

8 October

Pearl and Hermes Atoll: Arrived at Pearl and Hermes Atoll by 0700. All marine debris small boats were launched out of the southeast and the team conducted free-dive towed-diver survey and removal efforts along the eastern backreefs. After a half day of towed-diver operations, two small boats conducted swim surveys in the eastern portion of the “maze” and towed-diver surveys along the eastern sand margin. A total of 0.82 km² of reticulated reefs and sand margins were surveyed resulting in the removal of 20 net clusters weighing a total of 1570 kg.

One small boat team disentangled two (2) green sea turtles from two separate derelict nets (Figure 7). One turtle had its entire carapace and two forward flippers entangled in a trawl seine net. The other was trapped under the weight of a large mass of miscellaneous rope. Both turtles appeared unharmed and swam away on their own. These entanglements were reported to the PIFSC Protected Species Division authorities.

A total of 12 Crown-of-Thorns Sea star (COTS) legs were collected to examine whether the genes from the COTS within the maze are adapting differently than COTS from the rest of the archipelago (Figure 7).

9 October

Pearl and Hermes Atoll: All marine debris small boats were launched from the southeast and the team continued to conduct swim surveys in the north and northwest portion of the maze. A total of 0.35 km² of reticulated reefs were surveyed resulting in the removal of 35 net clusters weighing 1620 kg.

One small boat team located an overturned derelict vessel (~ 18 ft) that could potentially be associated to the 2011 Japan tsunami (Figure 7). The hull of the vessel was compromised, so the team was unable to tow the vessel to a secured location. Identifiable markings were passed onto the NOAA MDP Pacific Regional Coordinator for record and tracking purposes. The same team located an extremely large tree trunk stuck on a patch reef. The tree was approximately 30 ft long with a four (4) ft diameter. The tree was too large to remove safely and had completely destroyed the reef structure if it was stuck on.

A total of 18 COTS legs and four (4) complete specimens were collected to examine whether the genes from the COTS within the maze are adapting differently than COTS from the rest of the archipelago (Figure 7).

10 October

Pearl and Hermes Atoll: All marine debris small boats were launched from the southeast and the team continued to conduct swim surveys in the southern portion of the maze. A total of 0.32 km² of reticulated reefs were surveyed resulting in the removal of 38 net clusters weighing a total of 2625 kg.

One small boat team tried to relocate the vessel found the day before; in turn, however, the team found two different derelict vessels. These particular vessels hulls were in fair condition allowing for the small boat team to tow each vessel to the *OES*. Both vessels were brought on board and identifiable markings were again passed on to the NOAA MDP Pacific Regional Coordinator. The total weight of both vessels was approximately 1224 kg (Figure 7).

11 October **Pearl and Hermes Atoll:** All marine debris small boats were launched from the southeast and the team continued to conduct swim surveys in the southern portion of the maze. A total of 0.46 km² of reticulated reefs were surveyed resulting in the removal of 38 net clusters weighing 2290 kg. Forecasted southeast winds and the potential of a weather day resulted in the team deciding to depart Pearl and Hermes Atoll at 1700 en route to Lisianski Island.

One COTS leg was collected to examine whether the genes from the COTS within the maze are adapting differently than COTS from the rest of the archipelago (Figure 7).

12 October **Lisianski Island:** Arrived Lisianski Island by 0700. All marine debris small boats were launched from the west. The team conducted shoreline survey efforts resulting in the removal of 3095 kg of derelict fishing gear. Departed Lisianski Island at 1700 en route to Pearl and Hermes Atoll.

13 October **Pearl and Hermes Atoll:** Arrived at Pearl and Hermes Atoll by 0700. Three marine debris small boats were launched out of the southeast. Two small boat teams conducted shoreline survey and removal efforts on Grass Island and Seal and Kittery Island. The third small boat team conducted swim surveys in the southern portion of the maze. A total of 0.06 km² of reticulated reefs were surveyed resulting in the removal of 9 net clusters. The total weight of derelict fishing gear removed was 2890 kg.

14 October **Pearl and Hermes Atoll:** All marine debris small boats were launched from the southeast. One small boat team conducted towed-diver surveys along the west sand margin, while two others conducted swim surveys in the southern portion of the maze. A total of 0.27 km² of reticulated reefs and sand margins were surveyed resulting in the removal of 22 net clusters weighing a total of 2550 kg.

One of the teams working in the southern portion of the maze disentangled another green sea turtle from a derelict fishing net.

The last small boat team conducted an exploratory drive through the northern back reefs and maze to locate an extremely large net that was previously found in September 2013 (Figure 7). The team successfully relocated the net, but did not have the resources to remove it.

During the recovery of the last marine debris small boat, a partner scientist fell off the Jacob's ladder in between the *OES* and small boat. The coxswain and crew aboard the small boat responded quickly and accordingly to safely pull the individual from the water and into the small boat without injury. A safety stand-down occurred directly following the incident and all appropriate paperwork was filed.

15 October **Rest Day:** Following the man-overboard incident the day before, the Chief Scientist called a rest day based on potential fatigue.

16 October **Pearl and Hermes Atoll:** All marine debris small boats were launched from the southeast. Two small boat teams retrieved nets that were located the day before, so no area was surveyed. The five (5) net clusters removed weighed a total of 1337 kg.

The other two small boats began working on the extremely large net located in the northern portion of the maze. Both teams began cutting off approximately $\frac{1}{4}$ of the total net, however they did not completely separate that piece from the remaining net.

17 October **Pearl and Hermes Atoll:** All marine debris small boats were launched from the southeast. Two small boat teams conducted swim surveys in the middle portion of the maze. A total of 0.15 km^2 of reticulated reefs were surveyed resulting in the removal of 15 net clusters weighing a total of 525 kg. One of these teams also conducted shoreline efforts on Southeast Island resulting in the removal of 336 kg of derelict nets.

The other two small boats continued cutting and preparing the extremely large net for a tow. The *OES* deployed SE-4 (16' Northwind) to tow $\frac{1}{4}$ of the large net back to the ship (~ 12 km). The net weighed approximately 3039 kg. Forecasted southeast winds and the potential of a weather day prompted the team to depart Pearl and Hermes Atoll at 1700 en route to Midway Atoll.

18 October **Midway Atoll:** Arrived at Midway Atoll by 0700. All marine debris small boats were launched by 0900 to conduct shoreline survey and removal efforts on Eastern Island. The team surveyed and removed most debris from six (6) 300-m segments (Figure 12). All debris was brought back to the main pier where it was weighed, sorted, and counted.

19 October **Midway Atoll:** Two marine debris small boats were launched to

continue shoreline survey and removal efforts on Eastern Island. The two teams were able to remove the remaining debris from segments surveyed the day before as well as survey an additional 300-m segment. The remaining marine debris personnel began sorting and counting all debris removed from the day before. All debris was brought back to the main pier where it was weighed, sorted, and counted. All scientists were back on board by 1300. Departed Midway Atoll at 1530 en route to Pearl and Hermes Atoll.

20 October

Pearl and Hermes Atoll: Arrived at Pearl and Hermes Atoll by 0700. All marine debris small boats were launched out of the west due to minimal southeast winds and north swell. One small boat team conducted towed-diver surveys along the southwest back reefs near Seal and Kittery Island. A total of 0.11 km² of reticulated reefs were surveyed resulting in the removal of 6 net clusters weighing a total of 165 kg.

The other three small boats continued to cut another portion of the extremely large net and prepared it for a tow by SE-4. Another ¼ of the net was cut free, prepared, and towed safely back to the ship. The net weighed approximately 2494 kg.

21 October

Pearl and Hermes Atoll: All marine debris small boats were launched out of the west. One small boat team conducted shoreline survey and removal efforts on North Island. This team also looked for floating derelict nets on the transit back to the ship. A total of 267 kg were removed from North Island and 178 kg were removed from the reticulated reefs of the northern maze (Figures 10 & 11).

The other three small boats continued to cut the remaining large net into two separate pieces and prepared it for a tow by SE-4. Another ¼ of the net was cut free, prepared and towed safely back to the ship. The last remaining piece was towed with one of the marine debris small boats. This tow was transferred to SE-4 when the team made it out of the protected waters of the atoll. Both pieces together weighed approximately 4898 kg. The total weight of the entire large net was estimated at 10431 kg. Departed Pearl and Hermes Atoll en route to Ford Island, Pearl Harbor.

22-26 October

Transit: Tropical storm Ana prompted the *OES* to head due south to avoid any disturbances produced by the storm. This eliminated the potential to conduct shoreline surveys and removal efforts at Laysan Island. During transit back to Pearl Harbor scientist conducted quality control of all data collected during the project, cleaned small boats and equipment, and cleaned both wet lab and e-lab workspaces.

27 October

Pearl Harbor: Arrive Ford Island, Pearl Harbor at 0900 and disembarked scientist Tamoko Acoba, Naomi Blinick, Michael Burns, Joao Garriques, Justin Goggins, Andrew Gray, Rachel Knapstein, Kyle Koyanagi, Frances Lichowski, Mark Manuel, James Morioka, Alexander Nordschow, Kevin O'Brien, Dianna Parker, Kerry Reardon, Russell Reardon, Aviv Suan, Rhonda Suka, and Jesse Tootell. End of project.

MISSIONS AND RESULTS:

- A. The NOAA ship *Oscar Elton Sette* will be engaged as support for the NOAA Pacific Island Fisheries Science Center (PIFSC) Coral Reef Ecosystem Division (CRED) marine debris project of the National Marine Fisheries Service (NMFS). The ship will support in-water and shoreline marine debris surveys and removal operations at French Frigate Shoals, Maro Reef, Laysan Island, Lisianski Island, Pearl and Hermes Atoll, and Midway Atoll.
1. Identified four (4) and removed two (2) derelict boats from the lagoon at Pearl and Hermes Atoll that were potentially lost during the 2011 Japan tsunami event (Figure 2).
 2. Successfully disentangled three (3) green sea turtles from derelict nets at Pearl and Hermes Atoll (Figure 3).
 3. Relocated and removed an extremely large net that was first found in September 2013. The net weighed in at 10.4 metric tons and required more than four operational days of cutting and preparation before being tow back to the OES (Figure 4).
 4. In 21 operational days the team surveyed 3.92 km² of shorelines and shallow coral reef environments resulting in the removal of more than 51 metric tons of derelict fishing gear and plastics from the islands and atolls visited (Tables 1 & 2, Figures 5 & 6).
- B. Arms from the corallivorous crown-of-thorns sea star (COTS), *Acanthaster planci*, will be fortuitously collected in the maze, lagoon, and backreef of Pearl and Hermes Atoll during marine debris operations. The collected tissue will be used to examine the population structure of this sea star within the atoll. Previous work on their population structure (Timmers et al., 2012) found the COTS population within the maze to be genetically distinct from the rest of the archipelago.

The team successfully collected 4 complete COTS specimens and 35 legs for genetic processing.

**SCIENTIFIC
PERSONNEL:**

Mark Manuel, CRED Operations Manager, Joint Institute for Marine and Atmospheric Research (JIMAR), University of Hawaii (UH)

Kevin O'Brien, CRED Marine Ecosystem Research Specialist, JIMAR, UH

Kerry Reardon, CRED Marine Ecosystem Coordinator, JIMAR, UH

Russell Reardon, CRED Marine Ecosystem Coordinator, JIMAR, UH

Joao Garriques, CRED Marine Ecosystem Specialist, JIMAR, UH

James Morioka, CRED Field Logistics Specialist, JIMAR, UH

Tomoko Acoba, GIS Specialist, JIMAR, UH

Jesse Tootell, CRED Marine Ecosystem Specialist, JIMAR, UH

Andrew Gray, CRED Marine Ecosystem Specialist, JIMAR, UH

Frances Lichowski, CRED Seabed Mapping Specialist, JIMAR, UH

Rhonda Suka, CRED Optical Mapping Specialist, JIMAR, UH

Aviv Suan, CRED Marine Debris Field Technician, JIMAR, UH

Alexander Nordschow, CRED Marine Debris Field Technician, JIMAR, UH

Rachel Knapstein, CRED Marine Debris Field Technician, JIMAR, UH

Naomi Blinick, CRED Marine Debris Field Technician, JIMAR, UH

Justin Goggins, CRED Marine Debris Field Technician, JIMAR, UH

Michael Burns, CRED Marine Debris Field Technician, JIMAR, UH

Kyle Koyanagi, Pacific Islands Regional Marine Debris Coordinator, NOAA Marine Debris Program (MDP)

Dianna Parker, Legislative and Communications Specialist, NOAA MDP

Submitted by: 
Mark Manuel
Chief Scientist

Approved by: 
 Ned Cyr
Acting Science Director
Pacific Islands Fisheries Science Center

ATTACHEMENTS

Table 1. NOAA Ship *Oscar Elton Sette* project SE-14-07 marine debris daily survey area and weights.

Marine Debris Area Surveyed & Weight Totals						
SE-14-07						
Location	Date	In-water Area Surveyed (km²)	Shoreline Area Surveyed (km²)	Land (kg)	Water (kg)	Daily Totals (kg)
Maro Reef	9/29/2014	0.2237	0.0000	0	1860	1860
Maro Reef	9/30/2014	0.2204	0.0000	0	2130	2130
Maro Reef	10/1/2014	0.1139	0.0000	0	2865	2865
Maro Reef	10/2/2014	0.0872	0.0000	0	2900	2900
Maro Reef	10/3/2014	0.1472	0.0000	0	2070	2070
Maro Reef	10/4/2014	0.1607	0.0000	0	2670	2670
Midway	10/6/2014	0.0000	0.0329	575	0	575
Midway	10/7/2014	0.0000	0.0268	3263	0	3263
Pearl & Hermes	10/8/2014	0.8172	0.0000	0	1570	1570
Pearl & Hermes	10/9/2014	0.3517	0.0000	0	1620	1620
Pearl & Hermes	10/10/2014	0.3213	0.0000	0	3849	3849
Pearl & Hermes	10/11/2014	0.4649	0.0000	0	2290	2290
Lisianski	10/12/2014	0.0000	0.0933	0	3095	3095
Pearl & Hermes	10/13/2014	0.0564	0.1871	2120	770	2890
Pearl & Hermes	10/14/2014	0.2657	0.0000	101	2454	2555
Pearl & Hermes	10/16/2014	0.0000	0.0000	0	1337	1337
Pearl & Hermes	10/17/2014	0.1517	0.0000	336	3564	3900
Midway	10/18/2014	0.0000	0.0291	660	325	985
Midway	10/19/2014	0.0000	0.0042	1200	0	1200
Pearl & Hermes	10/20/2014	0.1060	0.0000	0	2659	2659
Pearl & Hermes	10/21/2014	0.0000	0.0597	267	5076	5343
SE-14-07 Totals		3.4881	0.4330	8522	43104	51626
Total Weight Removed (kg)						51626

Table 2. Shoreline survey results by abundance and debris type.

ITEMS	EASTERN ISLAND	SPIT ISLAND	SAND ISLAND	TOTAL
PLASTIC_FRAGMENTS_HARD	5160	1741	535	7436
BOTTLE_CAPS	2919	509	320	3748
BOUYS_FLOATS_HARD	1525	394	64	1983
BEVERAGE_BOTTLES	1140	300	29	1469
OYSTER_SPACERS	1012	255	105	1372
BOUYS_FLOATS_FOAM	717	153	31	901
OTHER_CONTAINERS	454	113	62	629
PLASTIC_FRAGMENTS_FOAM	432	121	22	575
ROPE_NET_SML	467	51	0	518
LIGHTERS	389	73	15	477
SLIPPERS	205	120	20	345
PERSONAL_CARE_PRODUCTS	259	59	24	342
OTHER_PLASTIC	203	29	36	268
EEL_CONES	138	56	32	226
CLOTHING_SHOES	212	8	2	222
NONNYLON_ROPE_NET_SML	75	85	50	210
ROPE_NET_MED	89	8	0	97
PLASTIC_TOYS	62	16	4	82
RUBBER_FRAGMENTS	11	32	2	45
OTHER_RUBBER	42	0	0	42
NONNYLON_ROPE_NET_MED	10	11	7	28
ROPE_NET_LRG	19	5	0	24
NONNYLON_ROPE_NET_LRG	10	6	1	17
PLASTIC_FRAGMENTS_FILM	11	2	2	15
CUPS_DISHES	10	3	1	14
PLASTIC_UTENSILS	9	2	3	14
TIRES	3	5	0	8
LURES_LINE	3	3	0	6
OTHER_FABRIC	4	0	2	6
FABRIC_PIECES	2	1	0	3
ALUMINUM_FLOAT	1	0	0	1
METAL_AIRPLANE_COMPONENT	1	0	0	1
RUDDER	1	0	0	1
LRG_PLASTIC_TOTE	1	0	0	1
PROPANE_TANK	0	1	0	1
BAGS	0	0	0	0
RUBBER_GLOVES	0	0	0	0
TOTAL	15596	4162	1369	21127

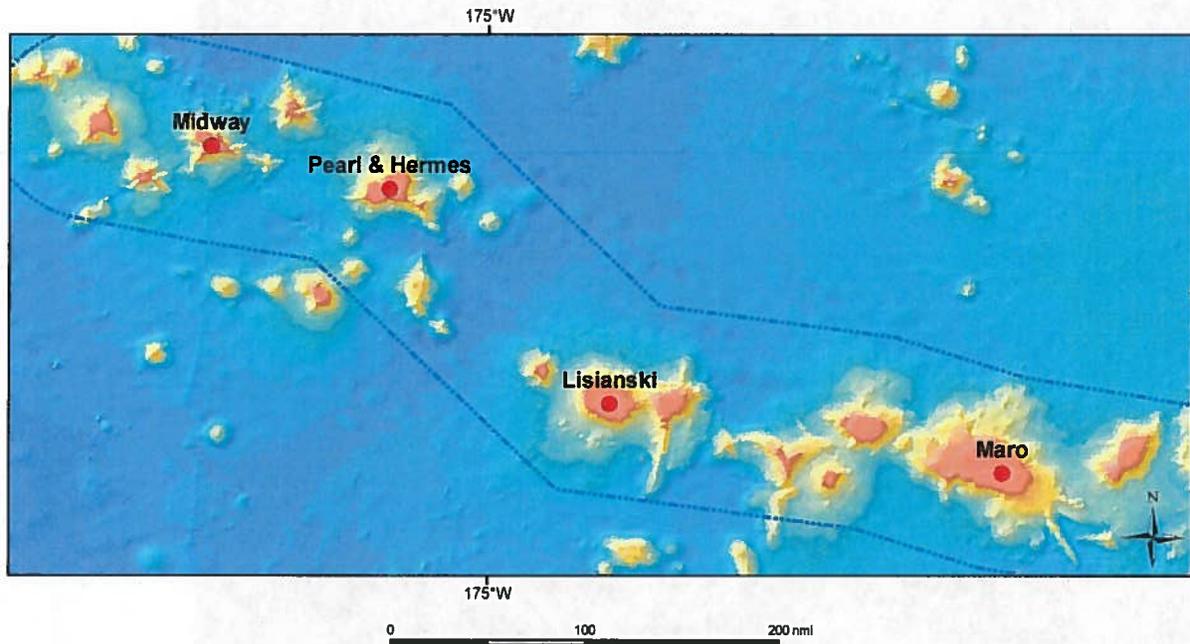


Figure 1. Project operational area for NOAA Ship *Oscar Elton Sette* project SE-14-07.



Figure 2. Two derelict vessels recovered from Pearl and Hermes Atoll that were potentially lost during the 2011 Japan tsunami event.

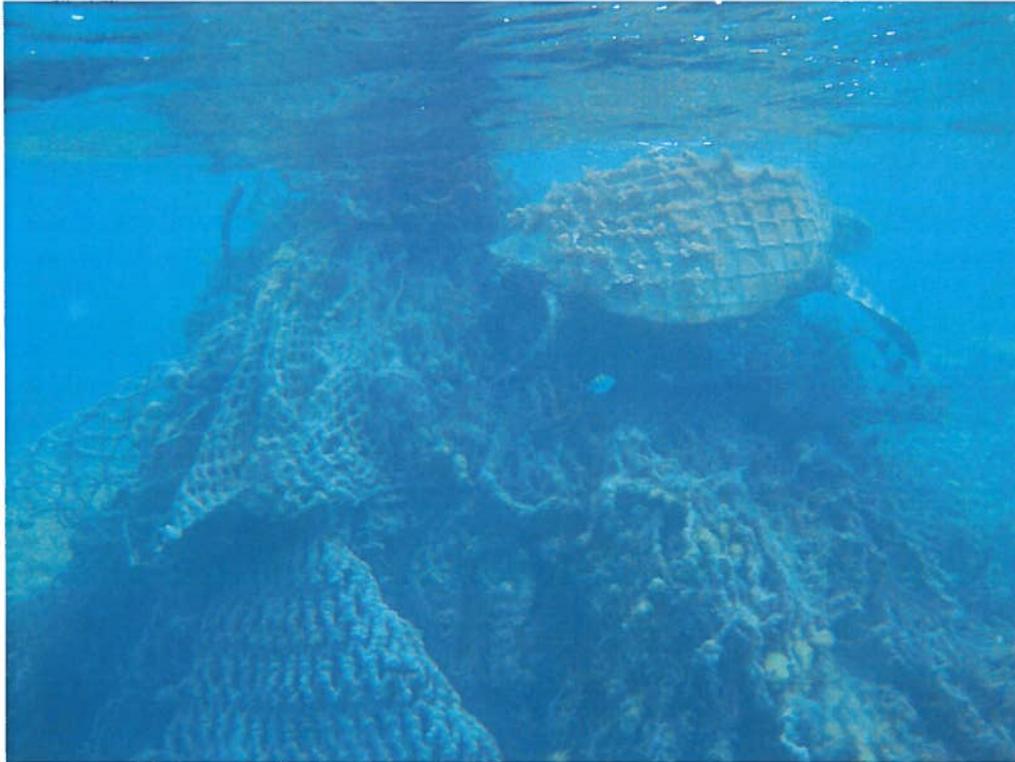


Figure 3. One of three entangled green sea turtles found and rescued at Pearl and Hermes Atoll.



Figure 4. Marine debris member standing on a massive net located in the maze at Pearl and Hermes Atoll.



Figure 5. Pile of derelict nets aboard the NOAA Ship *Oscar Elton Sette*.



Figure 6. Marine debris personnel sorting and counting various plastics collected from Midway Atoll's shorelines.

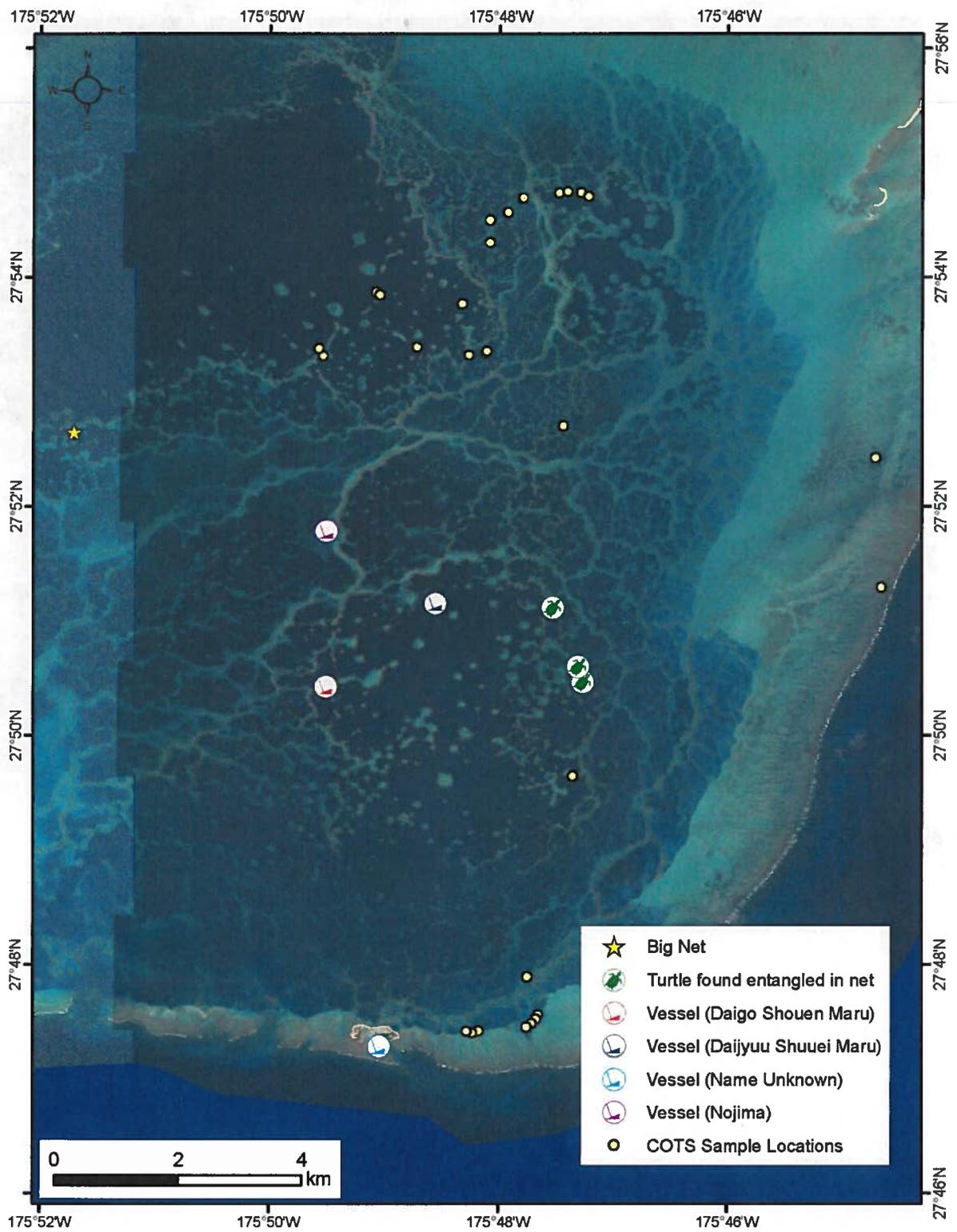


Figure 7. Points of interest for SE-14-07 at Pearl and Hermes Atoll.

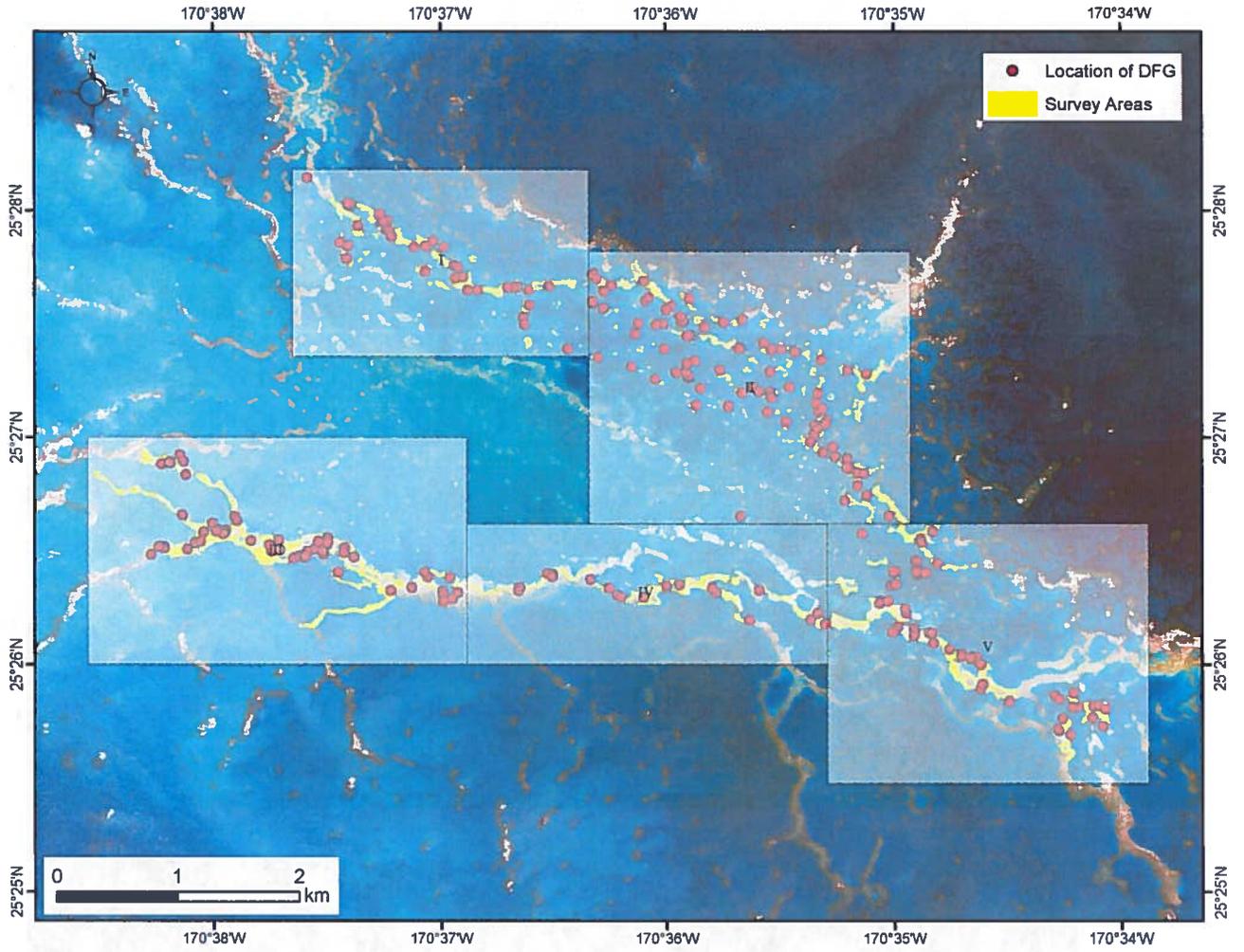


Figure 8. Maro Reef: Survey area for SE-14-07 and distribution of derelict fishing gear.

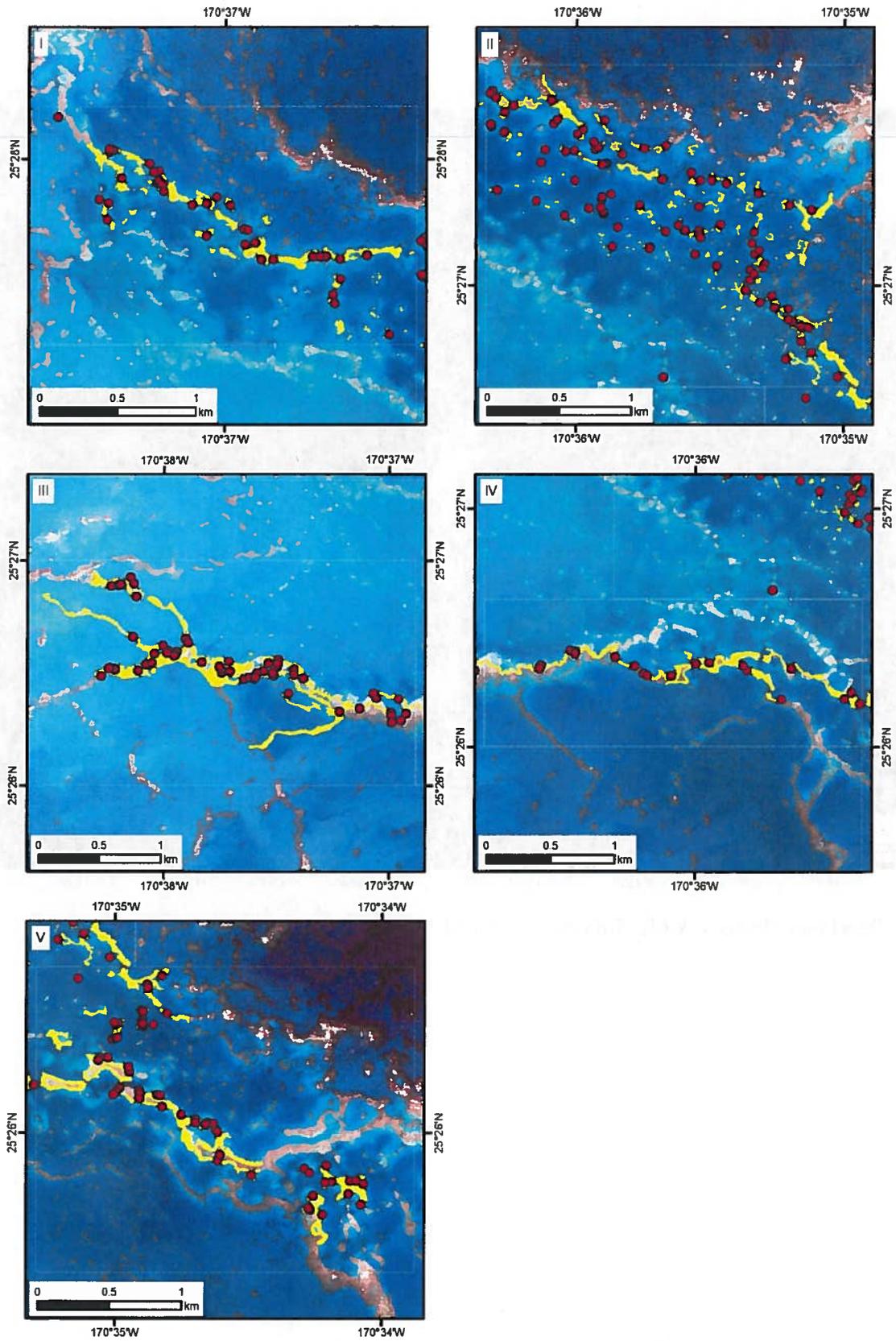


Figure 9. Maro Reef: Magnification of sections I, II, III, IV, and V in Figure 8.

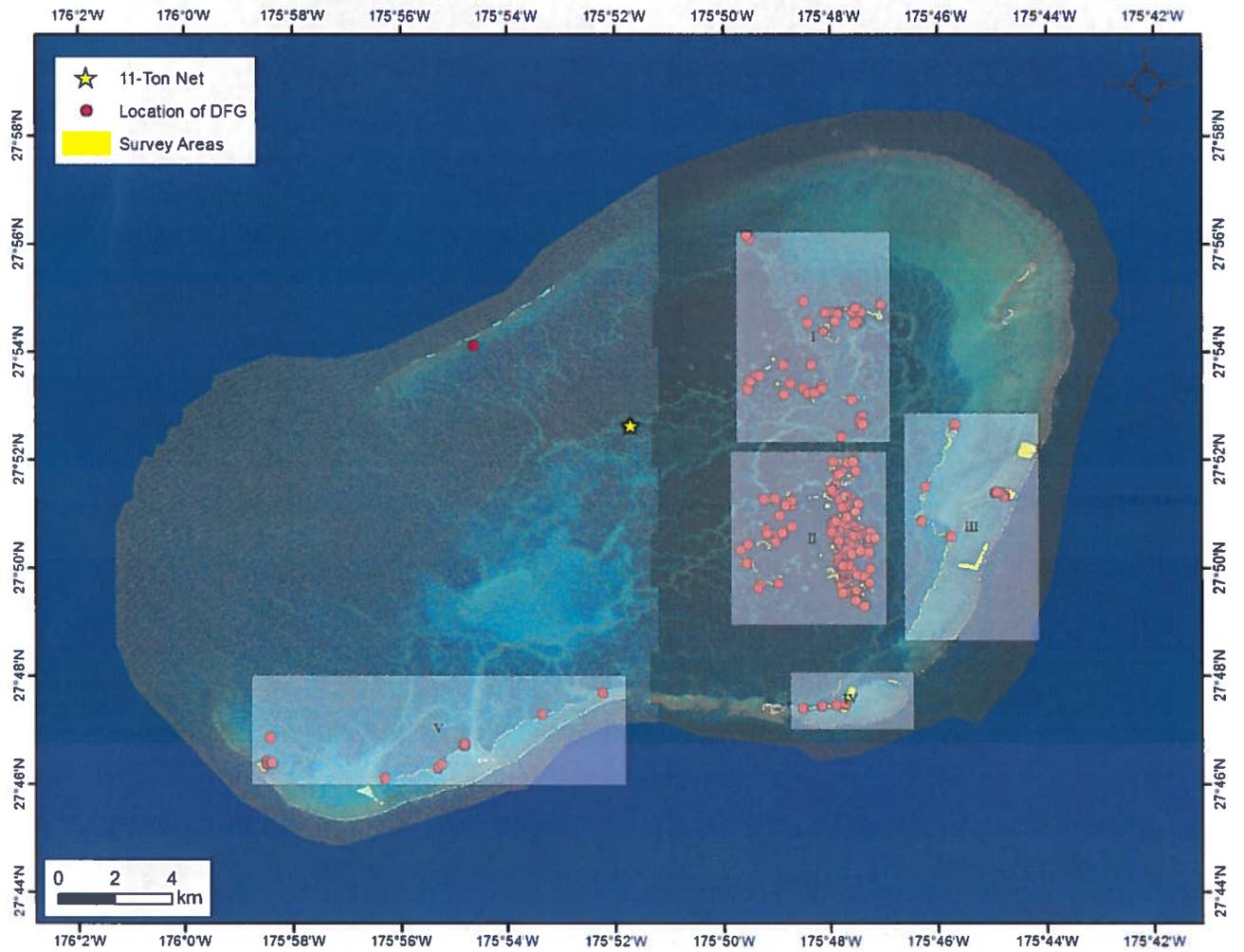


Figure 10. Pearl and Hermes Atoll: Survey area for SE-14-07 and distribution of marine debris.

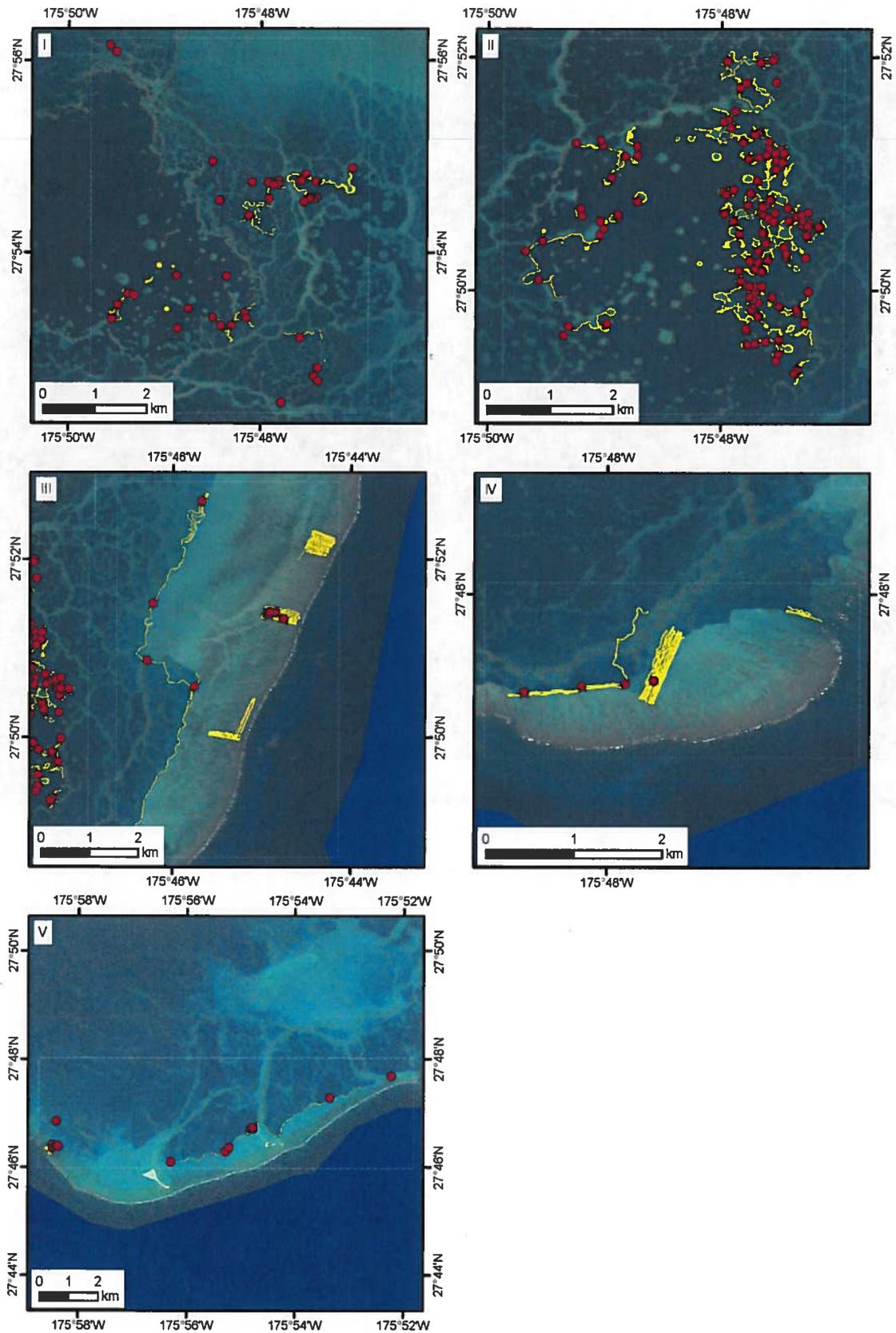


Figure 11. Pearl and Hermes Atoll: Magnification of sections I, II, III, IV, and V in Figure 10.

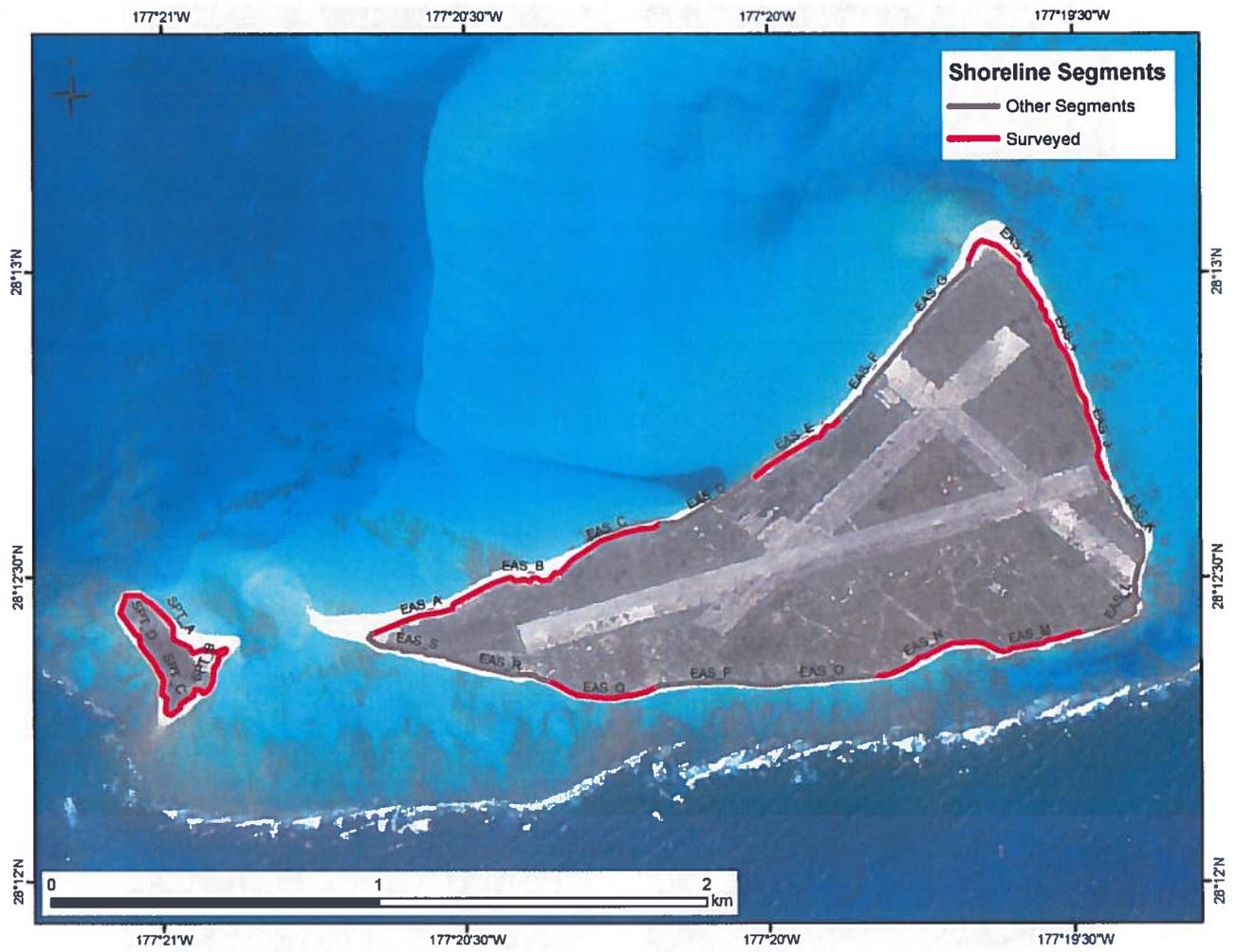


Figure 12. Shoreline survey area of Spit Island and Eastern Island.