

# YAP ISLANDS

## COASTAL RESOURCE ATLAS



US Army Corps  
of Engineers  
Pacific Ocean Division

# **YAP ISLANDS COASTAL RESOURCE ATLAS**

Prepared For:

**US Army Corps of Engineers  
Pacific Ocean Division**

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By

**Manoa Mapworks  
Honolulu, Hawaii**

**Sea Grant College Program  
University of Hawaii at Manoa**

July 1988

To accompany the Yap Islands Coastal Resource Inventory, prepared by the US Army Corps of Engineers, Pacific Ocean Division, 1988.

# Introduction

The Yap Coastal Resource Atlas was prepared by the University of Hawaii Sea Grant Extension Service under the auspices of the U.S. Army Corps of Engineers Coastal Resource Inventory Program. It is the companion volume to the Yap Coastal Resource Inventory, a report on the same topic, being prepared by Sea Grant.

The Corps Coastal Resource Inventory Program has been under the direction of Dr. James E. Maragos of the Corps since its initiation in 1978. Compilation of the Yap Atlas was coordinated by Peter J. Rappa and Anne M. Orcutt of the Sea Grant Extension Service. Dr. Maragos supervised the Atlas' preparation, editing, and final publication. Ross Cordy provided information on coastal archeological sites, and Mr. Sam Falanruw, Director of Resources and Development, Yap State, coordinated the review of the Atlas for Yap State.

The Atlas was designed and produced by Jane J. Eckelman of Manoa Mapworks, with technical assistance from Mike Baker, Mary Anne Breithaupt and Delia McCabe. The relief shading was drawn by Thomas H. Patterson of Washington, D.C. Negatives of maps provided by the U.S. Geological Survey through the Corps of Engineers were used as base maps. Funding for the Atlas was provided by the Corps under the authority of Section 22 of the Water Resources Development Act of 1974 (PL92-251) as amended (Planning Assistance to States), and by the Sea Grant Extension Service project, A/AS-1 under Institutional Grant No. NA 85AA-D-SG082 from the NOAA Office of Sea Grant.

## Field Methods

The Atlas data were obtained primarily from field surveys and interviews with local marine resource users and other residents and officials of Yap. During a three-week field survey period (April, 1987), 52 stations were visited around the Yap islands complex, including 18 offshore and 34 reef flat and lagoon stations, to characterize the major marine ecosystems surrounding Yap. Data collection utilized a combination of snorkeling and SCUBA methods to examine mangrove, seagrass, coral reef, embayment, beach, lagoon hole, reef pass, and ocean areas.

The survey was qualitative in nature. Each team member, using clip boards, waterproof paper, and species checklists, was assigned the responsibility for recording and sketching specific organism groups or features. Information on the relative abundance of algae, corals, other invertebrates, fishes, and reef features were also recorded. In general, only larger, more conspicuous species were recorded while other small, cryptic, or nocturnal species were only incidentally observed. Photographs and specimens were also collected for the purposes of species confirmation, identification, and obtaining more information. A reference collection of coral species observed in Yap was assembled and labeled by Dr. James E. Maragos and has been deposited with the Yap MRMD office. Team members and their areas of concentration during the field work are: Mike Gawel, fishes and invertebrates; Anne M. Orcutt, fishes and reef physiography; Mike Molina, fishes; Barry Smith, invertebrates; Dr. James Maragos, corals and reef physiography; Roy Tsuda, algae; Valerie Paul, algae; and Steve Nelson, algae.

Preliminary scoping and arrangements for the Yap atlas and inventory project were accomplished in September 1986. Interviews were conducted for one week in October, 1986, and also in October, 1987 with knowledgeable marine resource users and other key Yap State Government agencies having coastal oriented programs or expertise. The Yap State Marine Resources and Management Division (MRMD) and its staff served as the primary liaison and contact for data collection and information dissemination. The MRMD office provided interpreters and arranged a series of meetings with knowledgeable marine resource users in each of Yap's ten municipalities, to gather detailed information on the use of reef resources. At each meeting participants were presented with explanations, both in Yapese and English, on the purpose of the inventory project and meeting. Additionally, they were shown a copy of the Pohnpei Resource Atlas (Manoa Mapworks, 1985) as an example of how their contributions would be used. Participants were asked to indicate on maps the areas where various types of resources are harvested in their regions. A list of resources, compiled by Paul Paatmug, MRMD, was used as the basis of the resources

listed in the Atlas. Participants were also asked to describe resource problems, and whether the abundance of each resource category was increasing, declining or remaining the same. In addition, participants were asked as to describe the type(s) of gear used in harvesting fishing resources. All participants who signed attendance sheets are listed in the acknowledgments at the end of the atlas text. Other agencies involved in the interview sessions (October, 1987) besides MRMD include: the Yap State Department of Resources and Development, Historic Preservation Office, Tourism Office, Department of Public Works, Environmental Protection Authority, Department of Planning and Budget, Yap Fishing Authority, and WAAB Transportation.

## Literature Review

Data for the Atlas were also obtained from published reports of scientific investigations, as applicable. Additionally, the location of previous field work stations were mapped separately by report (e.g. G-1, or W-1). This information supplements the field data collected by the marine survey team and also provides the Atlas user with a quick reference on the source of additional site-specific information. Major contributions to the Atlas are from the "Yap lagoon marine biological survey," by Tsuda, R.H. (Ed.), 1978. Other information was also obtained from the following reports: Falanruw, M.C. et al., 1987, on Yap Proper vegetation; and the Defense Mapping Agency, 1985, for navigational aids. University of Guam studies by Tsuda, R., et al., 1978; Cowan, R.A., Clayshulte, R.N., 1980; Cowan, P.A., 1980; and Cowan, P.A., 1982, provided information on water quality. Reports by Strong, R.D., et al., 1982, and Amesbury, S.S., et al., 1977 list the locations of previous field work stations completed on Yap. The list of references at the end of the text includes complete citations.

## Mapping Methods

The atlas' facing page layout shows two different views of Yap's physical and cultural environment. A series of principal thematic maps appears on the right, and a series of reference maps appears on the left page.

The thematic map data were collected in the field using draft copies of U.S. Geological Survey 1:10,000 topographic maps. The data were then recompiled, simplified, and plotted onto reduced draft copies of the U.S. Geological Survey 1:10,000 topographic maps at a scale of approximately 1:13,300. The final product is a series of 2-color maps depicting locations of various types of coastal resources, types of offshore substrates, and locations of the YCRI and other field stations. In addition, all major (existing and potential) development sites have been identified. These include fill and dredge sites, mangrove planting and harvest areas, possible resort locations, channel and harbor modifications, and planned road improvements.

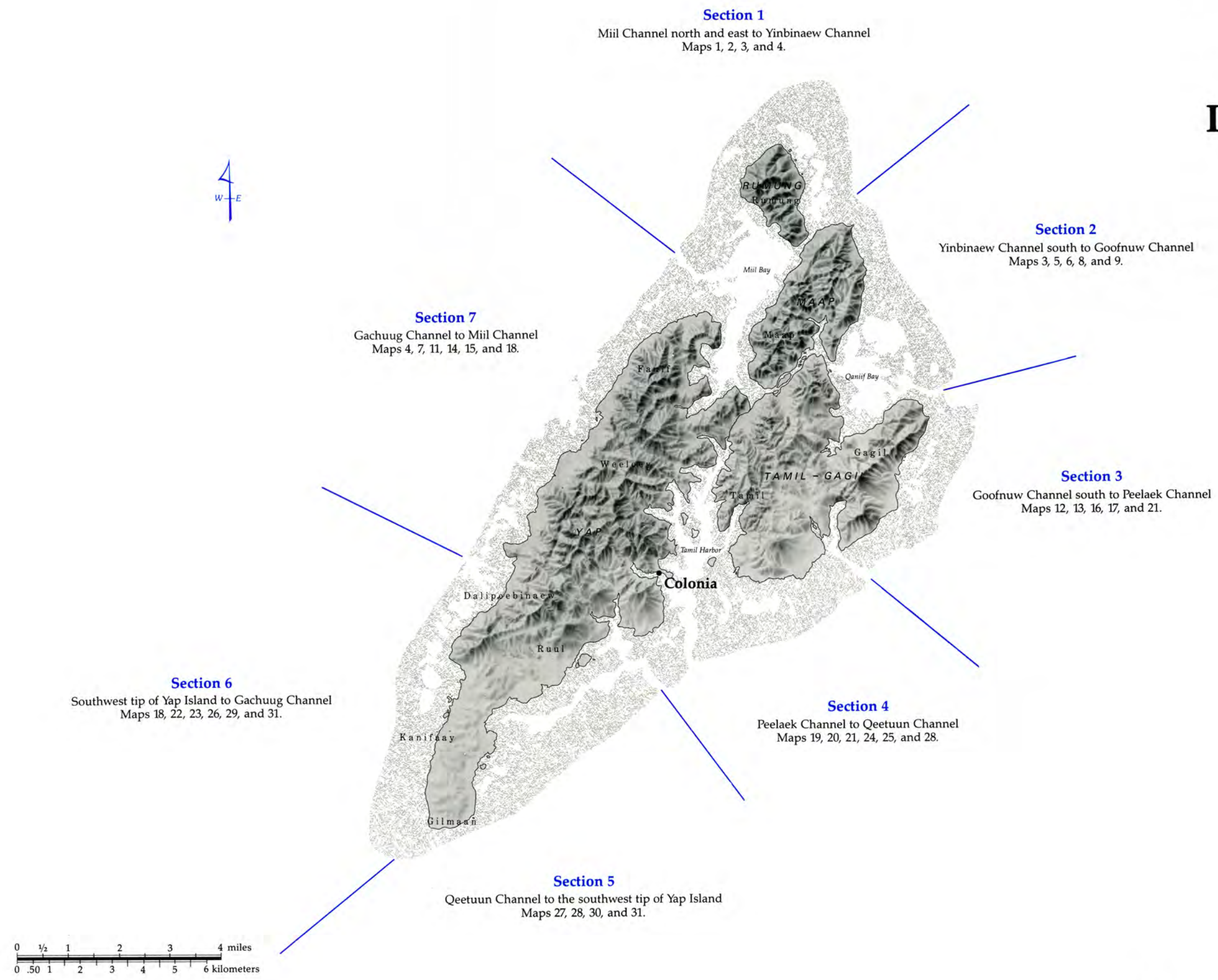
Because the topographic maps concentrate primarily on land features, basemap information for many parts of the reef was collected from other sources and on-site inspections. A change in the color of the basemap linework, from black to blue, indicates the edge of the USGS map.

The reference map pages consist of nine regional maps of the Yap Islands at a scale of approximately 1:40,000. These maps show the location of each thematic map and the YCRI section boundaries used to geographically organize the narrative report (Yap Islands Coastal Resource Inventory, 1988). They are based on a published U.S. Geological Survey 1:25,000 topographic map, except that a shaded relief drawing has been substituted for the contour network to enhance visualization of Yap's rugged high island landscape.

Cross reference between the facing pages, with their contrasting symbolization and scales, provides a framework for evaluating the relationships between resource use and the islands' physical environment.

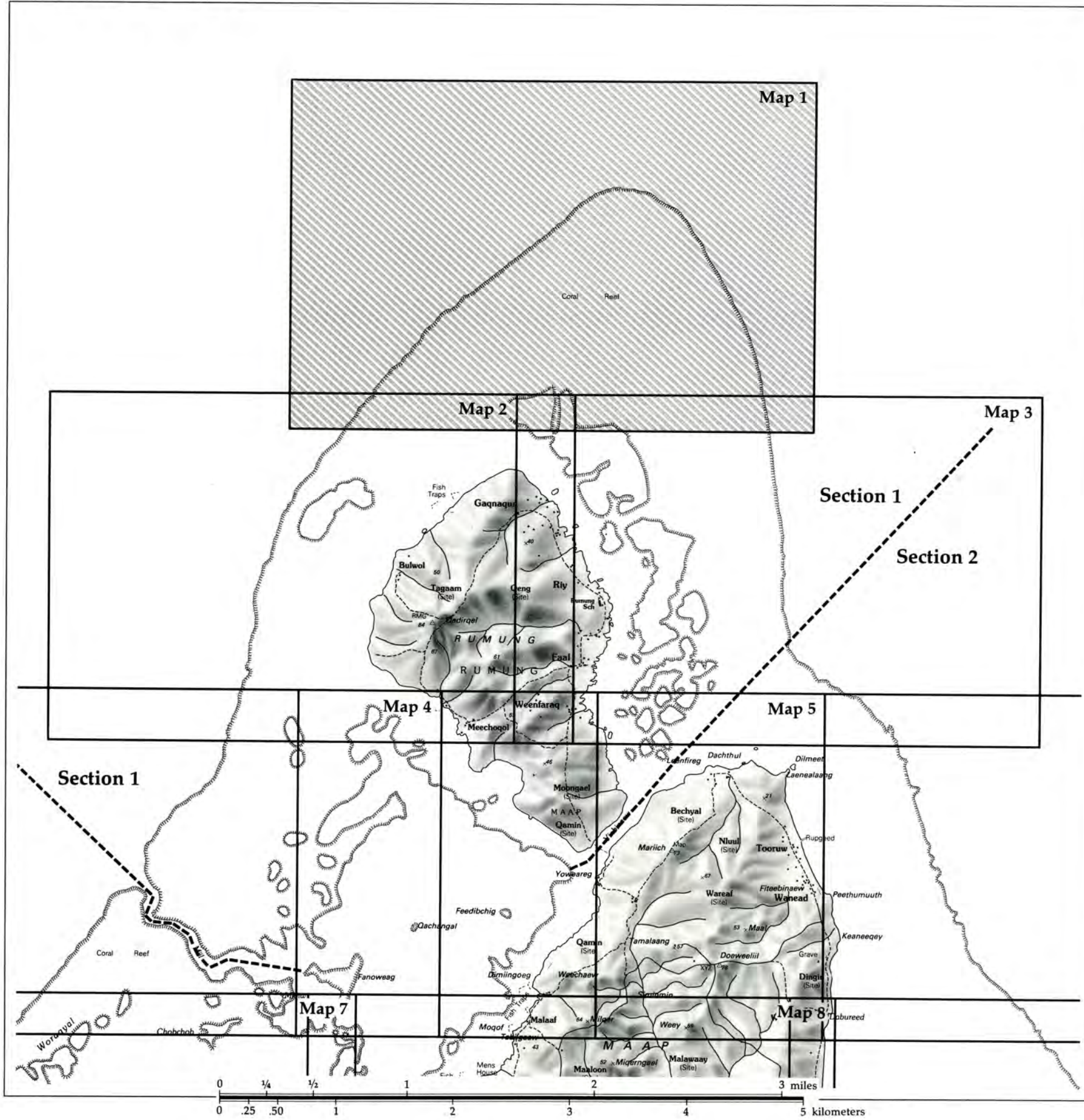
This atlas should not be used for navigational purposes or as a guide to fishing areas. Its primary purpose is as a planning tool for coastal resource management.

# YAP ISLANDS



## Index to Narrative Sections

# Reference Map 1



## Coastal Resources

### PELAGIC FISH

- Dogtooth Tuna — Yasul
- Tuna — Tuguw
- Flying Fish — Goeg
- Wahoo — Malchath
- Dolphinfish — Dabaar

### INVERTEBRATES

- Sea Cucumber — L'ugul
- Octopus — K'aay
- Lobster — Qaraangoey
- Mangrove Crab — Qamaang
- Land Crab — Galip
- Swimming Crab — Qurich
- Clam — Faasuw, Tow
- Mud Clam — Yungwol
- Topshell (*trochus*) — Yogyog
- Freshwater Shrimp — Ganeef
- Sea Turtle Capture Area — Weel
- Sea Turtle Feeding Area — Qey

### OTHER SYMBOLS

- Sand Dredging Area
- Stone Fish Trap — Qech
- Non-Stone Fish Trap — Yanup, Saagel
- Archaeological Site

### REEF FISH

- Grouper — SmaaK'uw, K'uw
- Parrotfish — Qelbad, Qalaabal, Malngoed, Quchwaq, Gamaygul
- Surgeonfish — Quum, Maath, Machagwog, Bilaew
- Mullet — Quloch, Galaed
- Squirrelfish, Soldierfish — Yooch
- Rabbitfish — Dayit, Garmiy, Buywod, Darryu, Limreq
- Goatfish — Manguch, Mbing, Soong
- Rainbow Runner, Fusilier — Thilbuw, Foofow
- Jack — Ngool, M'uul, Qelqel
- Bream — Qutun, Wachaqmal
- Emperor — Wul', Qoeyeq, Gadgad
- Angelfish — Qeer, Buloch
- Wrasse — Numean
- Stickfish, Needlefish — Buuy
- Triggerfish — Wuuq, Moelngith, Nguuf
- Milkfish — Guuguw, Tangir
- Rudderfish — Guumiy
- Eel — Looth
- Baitfish — Saadiin, Faakeayaan', Liyeq, Qachwog, Qanger, Malmeq
- Barracuda — Maal'
- Snapper — Gadaw, Gooychaaf

# Bottom Type and Land Cover Classification

**OFFSHORE**

**Sediment**

- sc — Sand bottom in water depths less than 10 meters
- sd — Sand bottom in water depths greater than 10 meters
- si — Silt



**Reef Complex**

- rc — Mixed bottom types consisting of reef rock (limestone) associated with shallow reef formations
- rcl — Consolidated limestone, lacking sediment
- rcp — Consolidated limestone with a smooth, pavement-like surface
- rcs — Mostly consolidated limestone with some (25-50%) sediment bottom
- rs — Complex reef bottom type consisting mostly of sand, but with some limestone outcrops or boulders
- co — Areas of greater than 50% live coral cover






**SHORELINE**

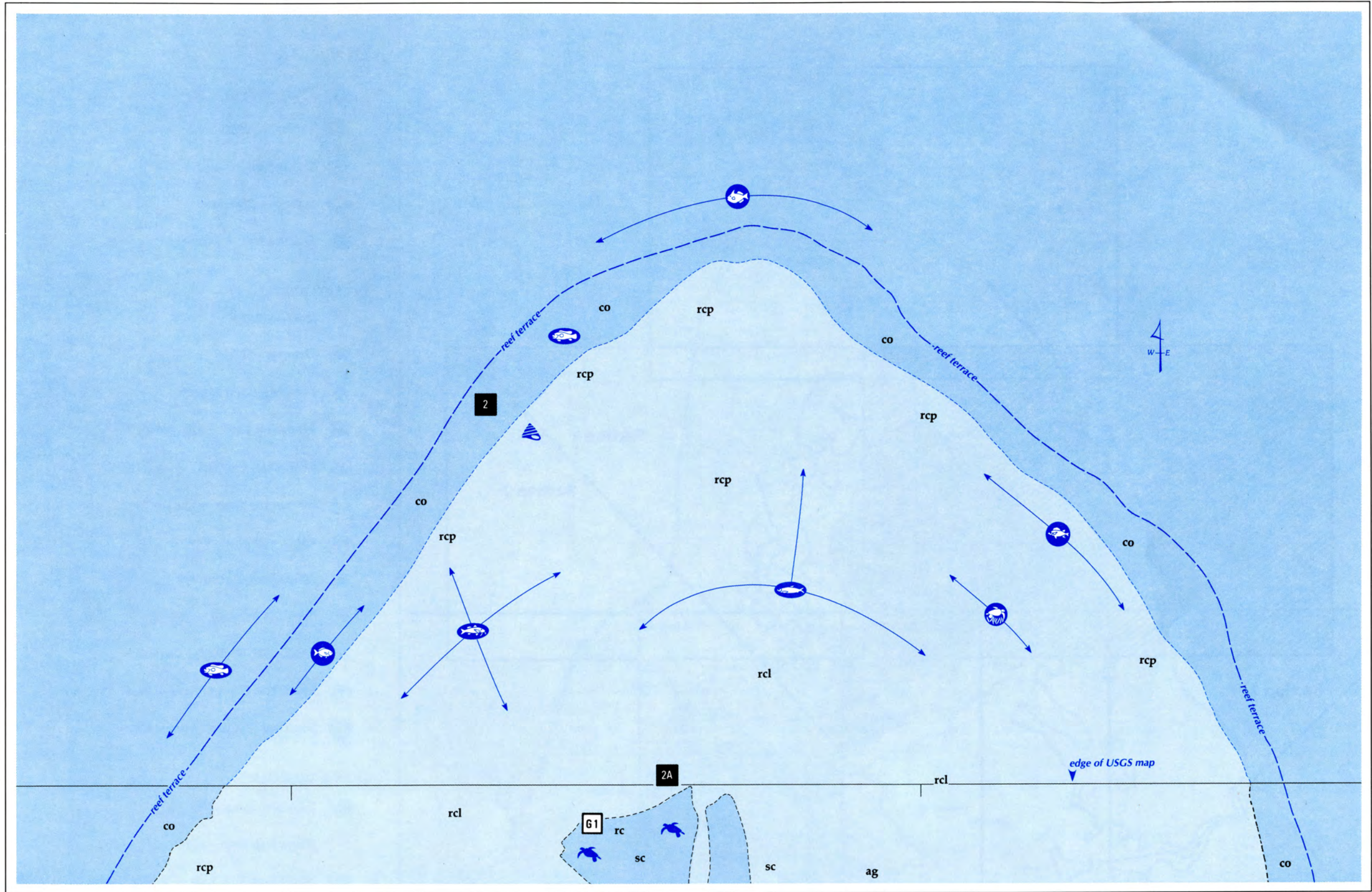
- bb — Man-made boulder shoreline
- bc — Concrete/cement masonry seawall and shoreline
- sb — White sand beach of predominately calcareous material

**VEGETATION COVER**









- ag — Algae bed
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-  Seagrass Bed

**Other Symbols**

-  Navigational Marker
-  Shipwreck
-  Observed Range of Species
-  Reef Terrace
-  Potential Development Site

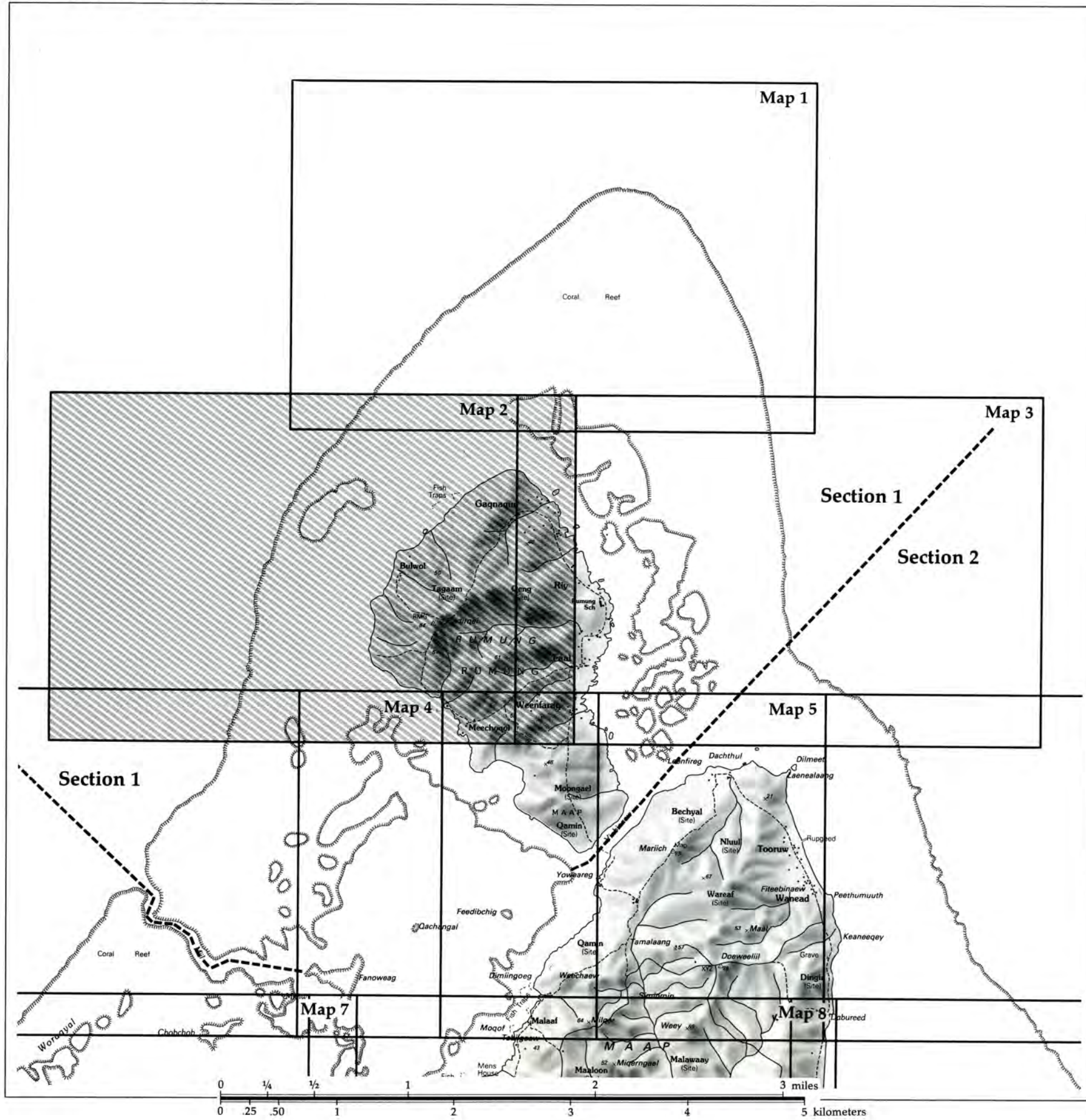


**Field Stations**

- |  |  |
|--|--|
|  <b>53</b> YCRI Station, 1987       |  <b>G1</b> UOG-45 Station, 1978   |
|  <b>W1</b> WRRC-14-10 Station, 1980 |  <b>G2</b> UOG-46 Station, 1978   |
|  <b>W2</b> WRRC-16-1 Station, 1980  |  <b>G3</b> UOG-78-4 Station, 1982 |
|  <b>W3</b> WERI Station, 1982       |  <b>G4</b> UOG-35 Station, 1977   |



# Reference Map 1



## Coastal Resources





### PELAGIC FISH

-  Dogtooth Tuna — Yasul
-  Tuna — Tuguw
-  Flying Fish — Goeg
-  Wahoo — Malchath
-  Dolphinfish — Dabaar

### INVERTEBRATES

-  Sea Cucumber — L'ugul
-  Octopus — K'aay
-  Lobster — Qaraangoey
-  Mangrove Crab — Qamaang
-  Land Crab — Galip
-  Swimming Crab — Qurich
-  Clam — Faasuw, Tow
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-  Topshell (*trochus*) — Yogyog
-  Freshwater Shrimp — Ganeef
-  Sea Turtle Capture Area — Weel
-  Sea Turtle Feeding Area — Qey

### OTHER SYMBOLS

-  Sand Dredging Area
-  Stone Fish Trap — Qech
-  Non-Stone Fish Trap — Yanup, Saagel
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# Bottom Type and Land Cover Classification

Map 2

## OFFSHORE

### Sediment

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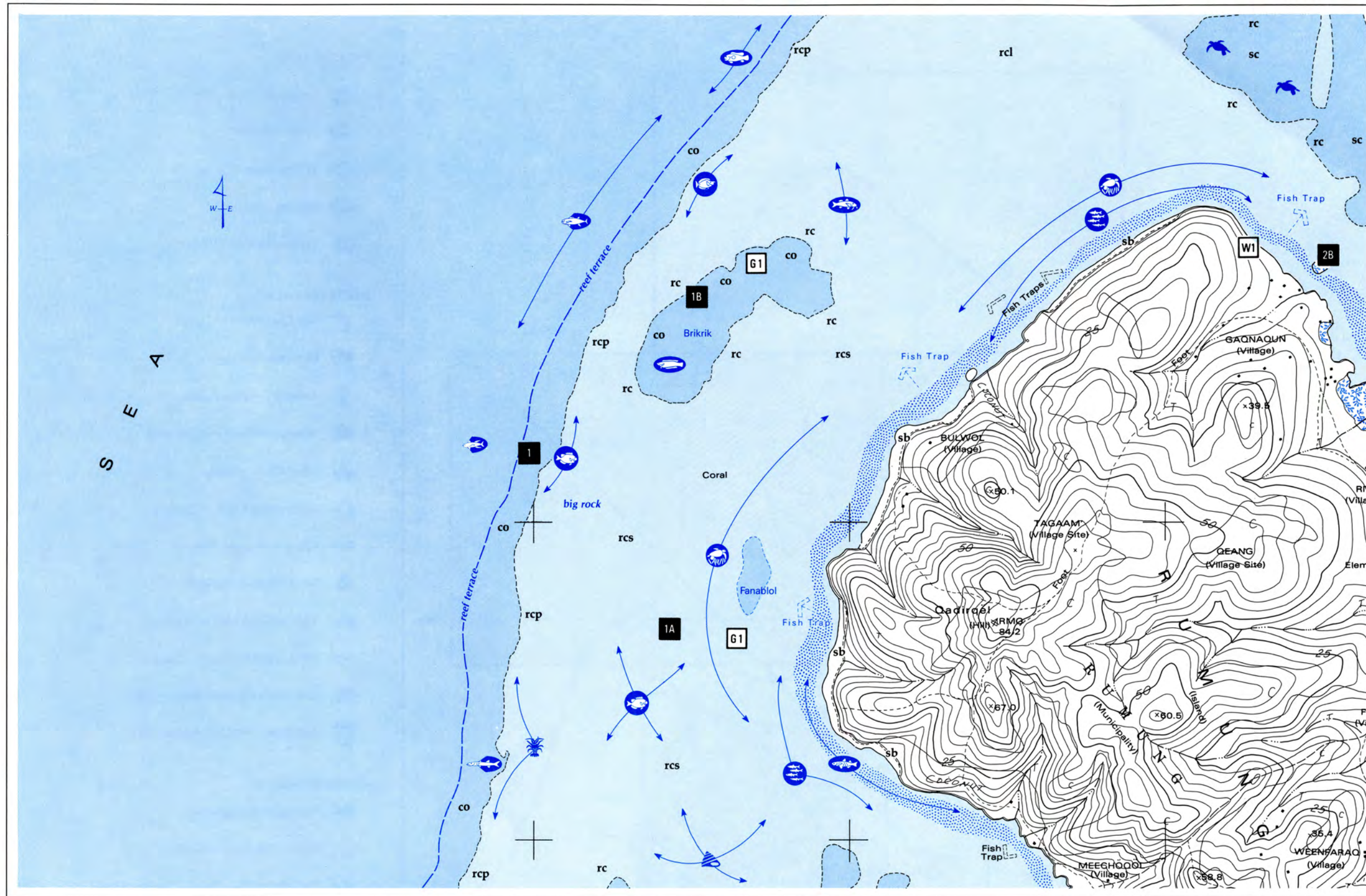
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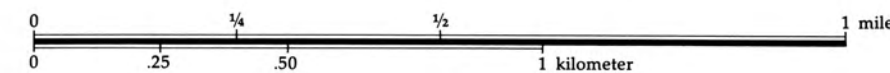
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-  Reef Terrace
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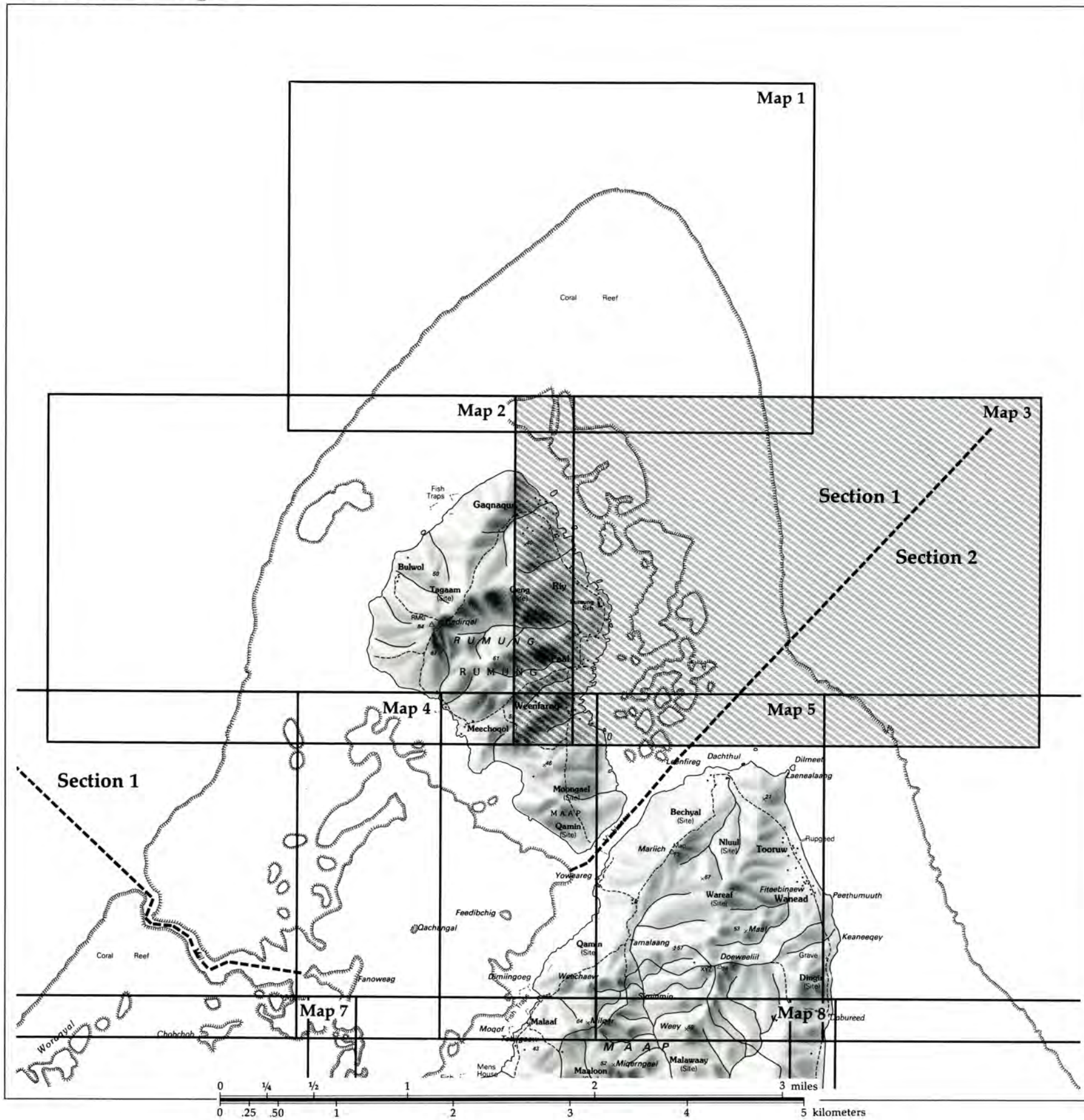
## Field Stations

- |                                    |                                  |
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-  Freshwater Shrimp — Ganeef
-  Sea Turtle Capture Area — Weel
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### OTHER SYMBOLS

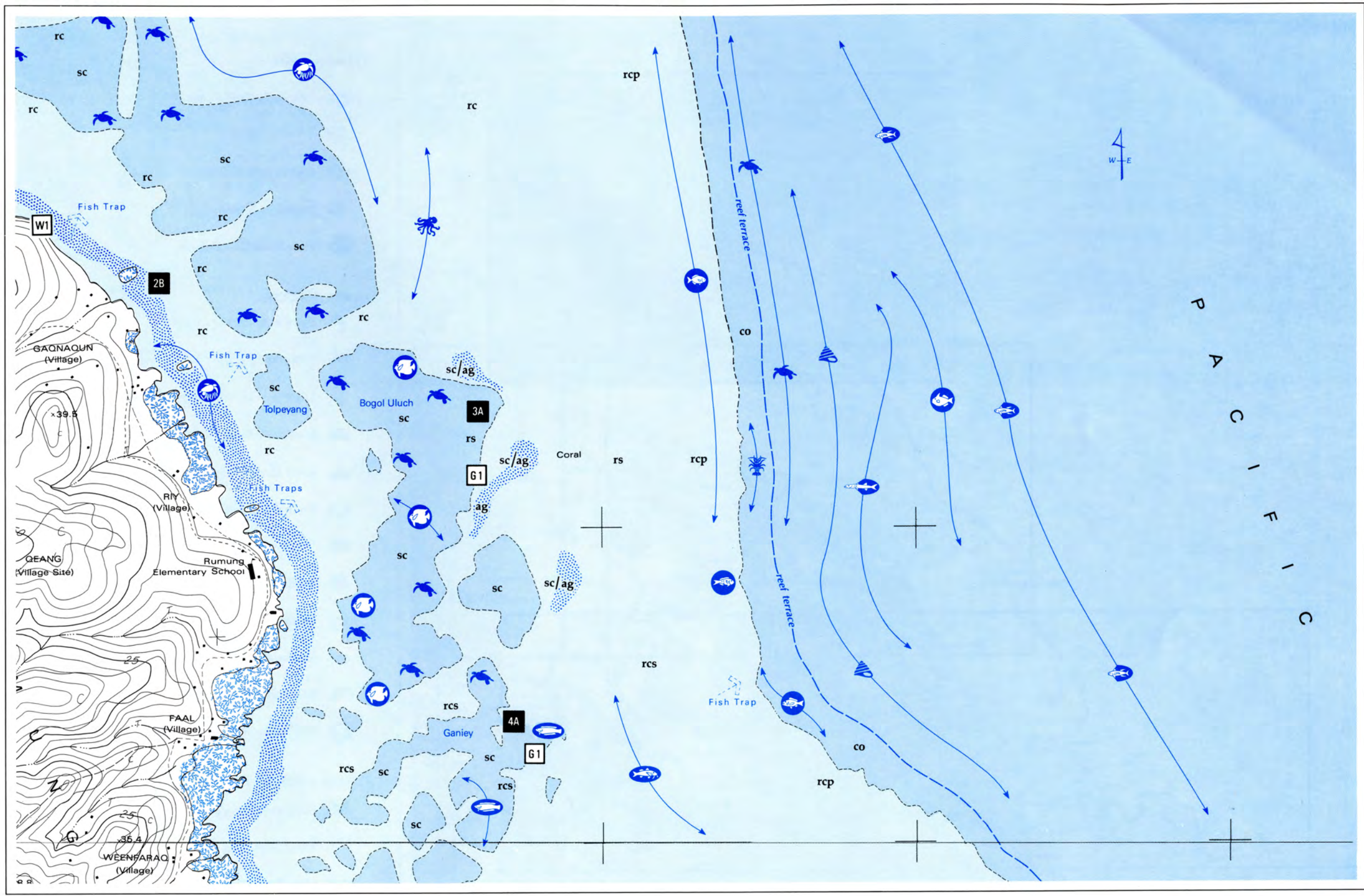
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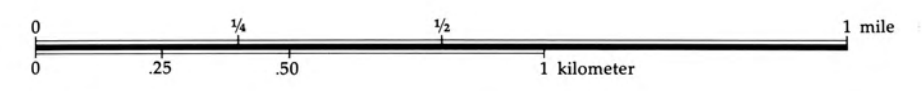
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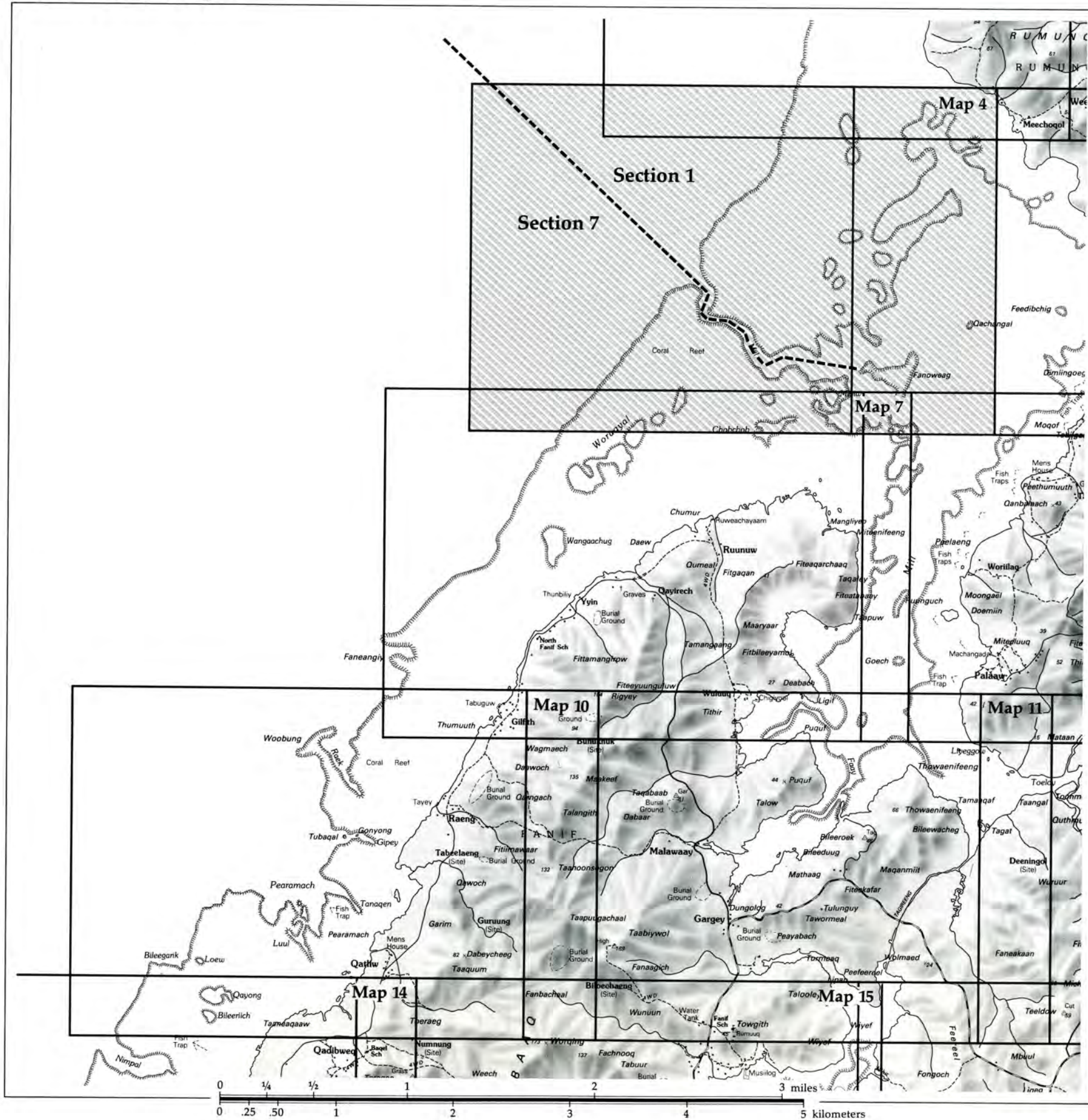


**Field Stations**

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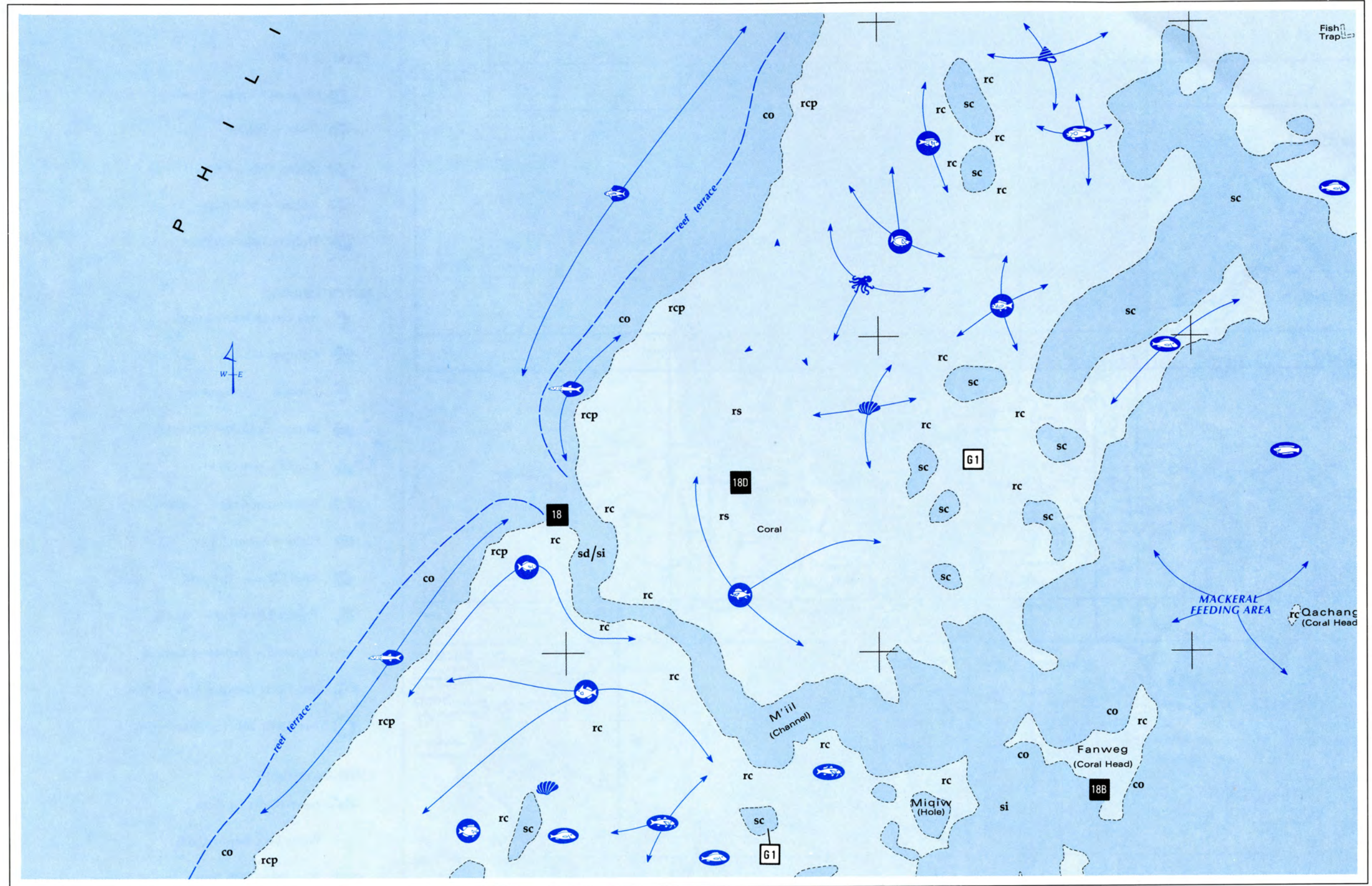
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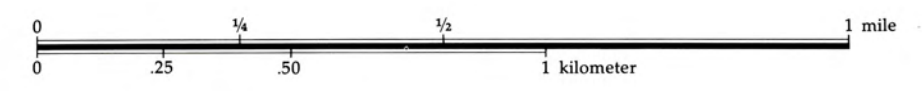
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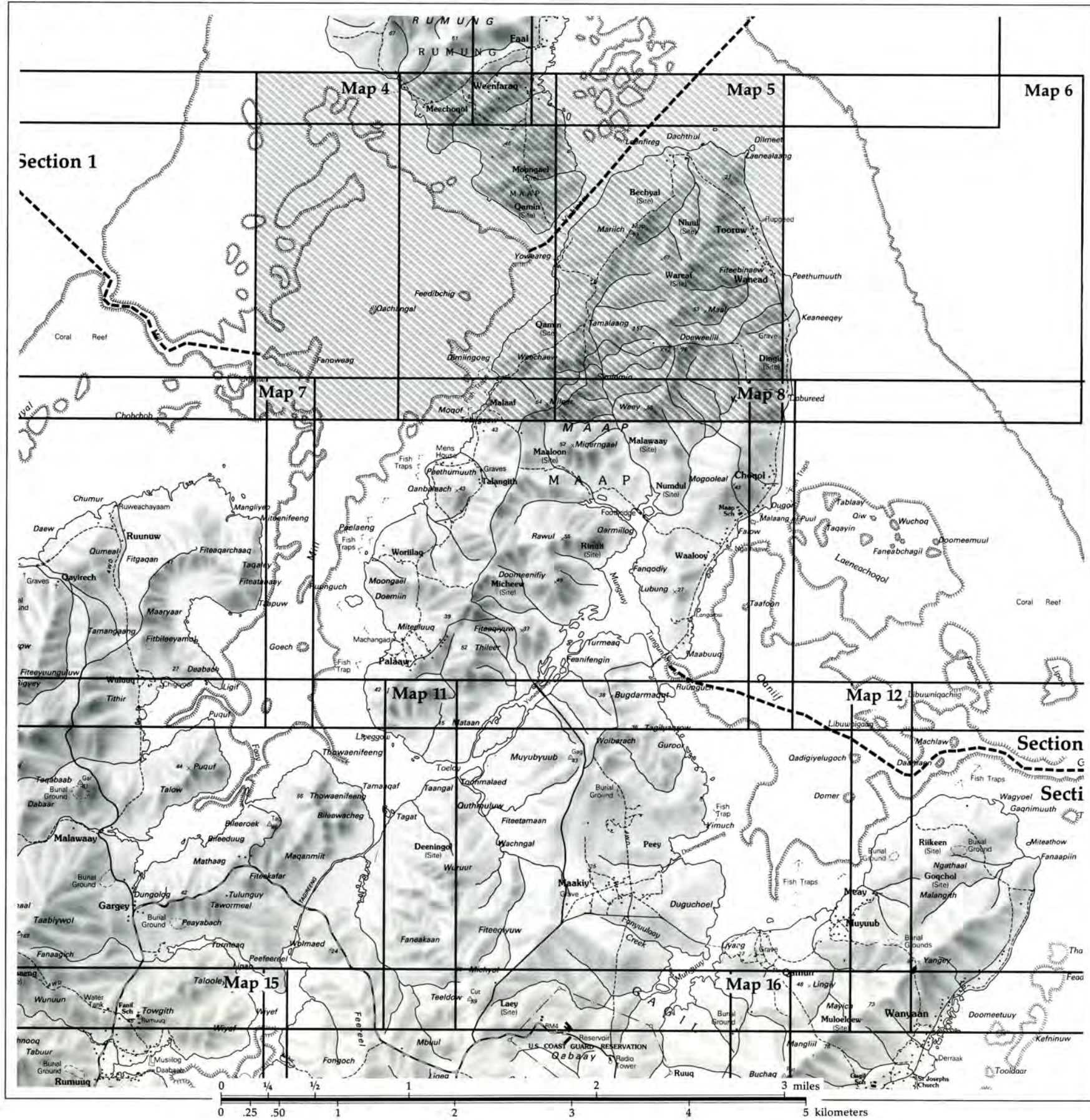


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- Sea Turtle Feeding Area — Qey

### OTHER SYMBOLS

- Sand Dredging Area
- Stone Fish Trap — Qech
- Non-Stone Fish Trap — Yanup, Saagel
- Archaeological Site

### REEF FISH

- Grouper — Smaak'uw, K'uw
- Parrotfish — Qelbad, Qalaabal, Malngoed, Quchwaq, Gamaygul
- Surgeonfish — Quum, Maath, Machagwog, Bilaew
- Mullet — Quloch, Galaed
- Squirrelfish, Soldierfish — Yoch
- Rabbitfish — Dayit, Garmiy, Buywod, Darry, Limreq
- Goatfish — Manguch, Mbing, Soong
- Rainbow Runner, Fusilier — Thilbuw, Foofow
- Jack — Ngool, M'uul, Qelqel
- Bream — Qutun, Wachaqmal
- Emperor — Wul', Qoeyeq, Gadgad
- Angelfish — Qeer, Buloch
- Wrasse — Numean
- Stickfish, Needlefish — Buuy
- Triggerfish — Wuuq, Moelngith, Nguuf
- Milkfish — Guuguw, Tangir
- Rudderfish — Guumiy
- Eel — Looth
- Baitfish — Saadiin, Faakeayaan', Liyeq, Qachwog, Qanger, Malmeq
- Barracuda — Maal'
- Snapper — Gadaw, Gooychaaf

# Bottom Type and Land Cover Classification

Map 5

## OFFSHORE

### Sediment

- sc — Sand bottom in water depths less than 10 meters
- sd — Sand bottom in water depths greater than 10 meters
- si — Silt



### Reef Complex

- rc — Mixed bottom types consisting of reef rock (limestone) associated with shallow reef formations
- rcl — Consolidated limestone, lacking sediment
- rcp — Consolidated limestone with a smooth, pavement-like surface
- rsc — Mostly consolidated limestone with some (25-50%) sediment bottom
- rs — Complex reef bottom type consisting mostly of sand, but with some limestone outcrops or boulders
- co — Areas of greater than 50% live coral cover






## SHORELINE

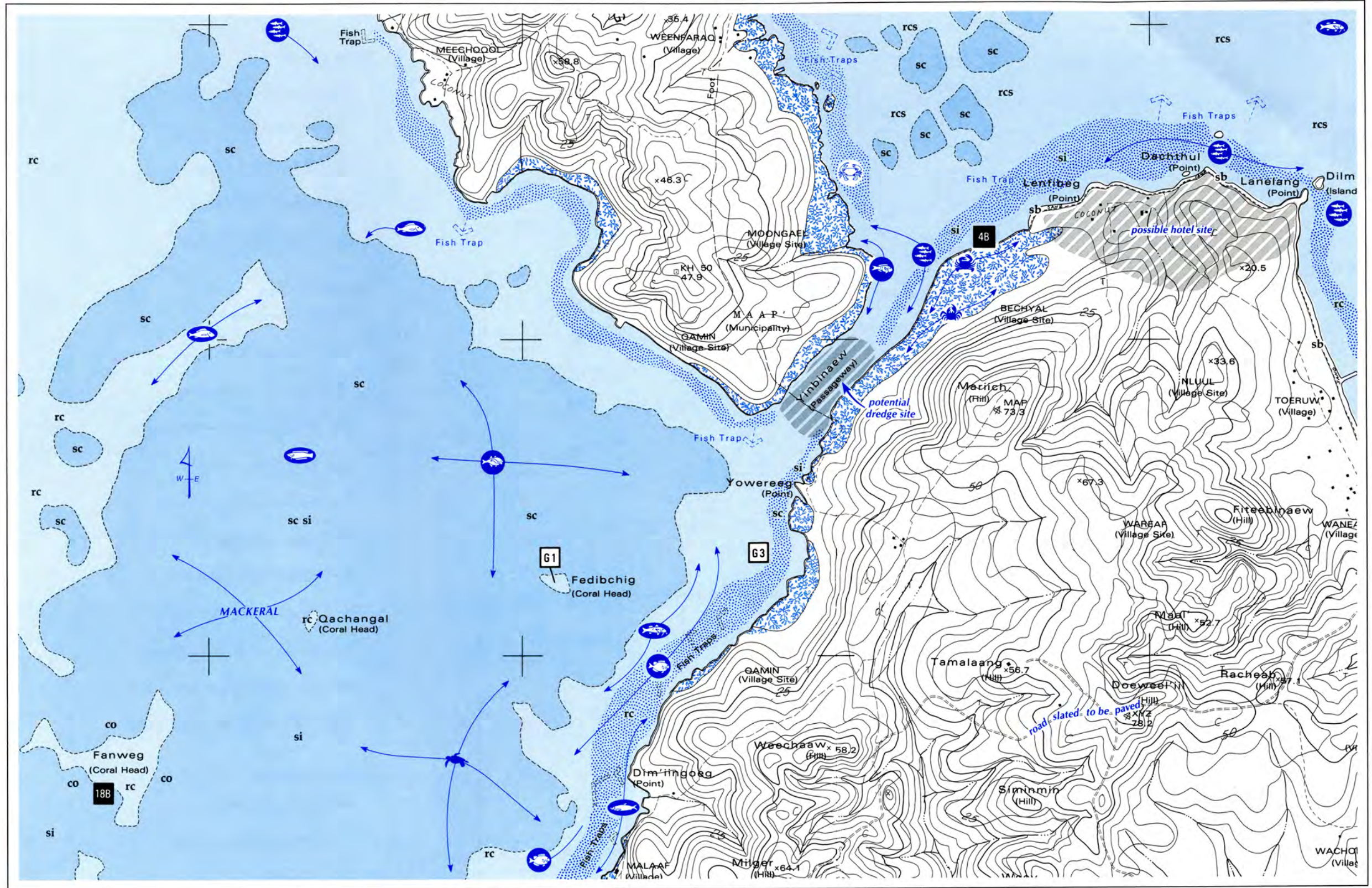
- bb — Man-made boulder shoreline
- bc — Concrete/cement masonry seawall and shoreline
- sb — White sand beach of predominately calcareous material

## VEGETATION COVER









- ag — Algae bed
-  Mangrove Forest
-  Seagrass Bed

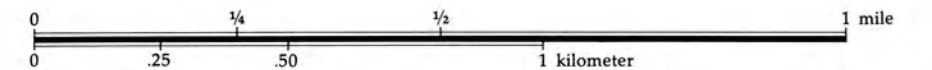
## Other Symbols

-  Navigational Marker
-  Shipwreck
-  Observed Range of Species
-  Reef Terrace
-  Potential Development Site

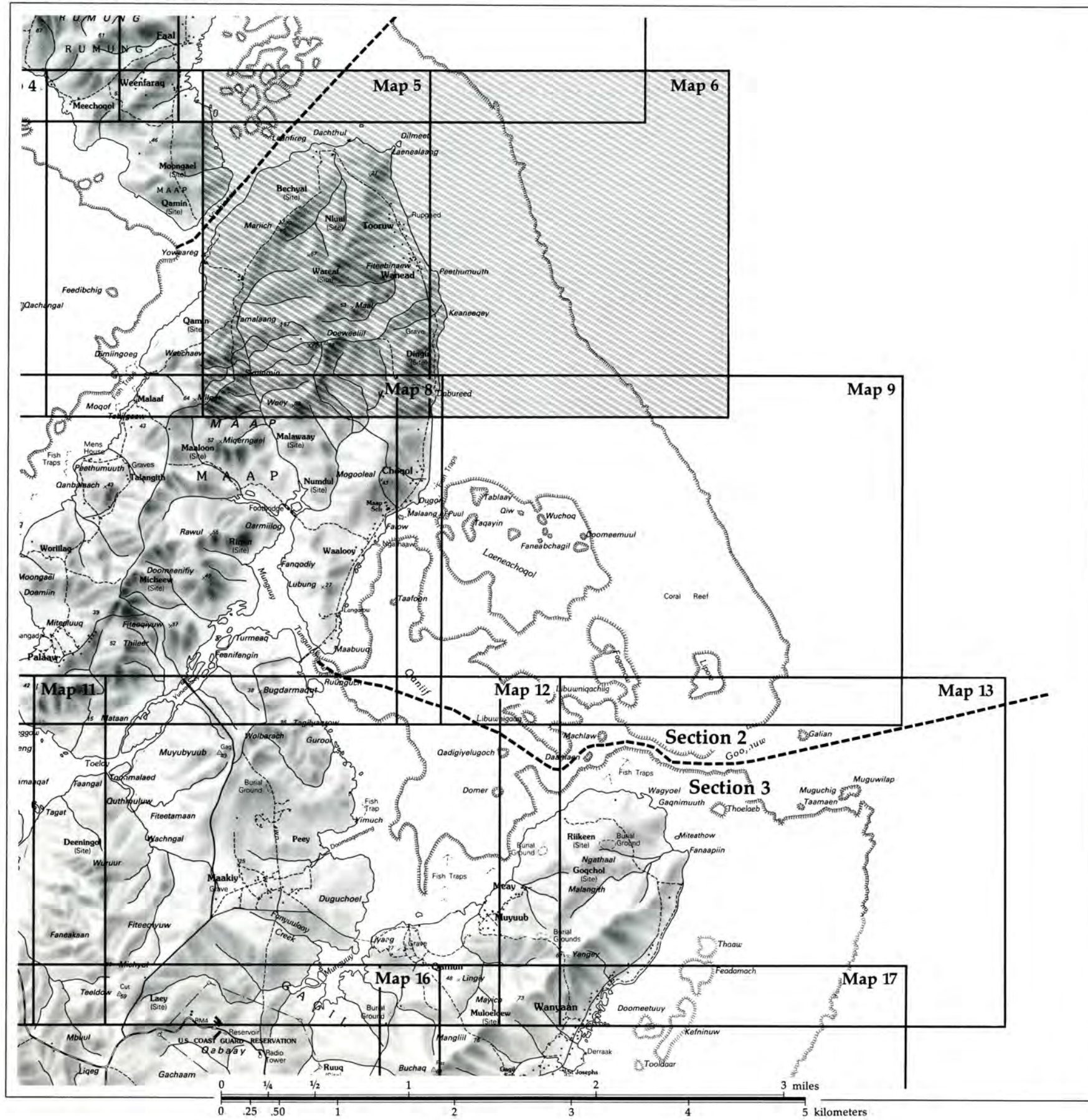


## Field Stations

- |  |  |
|--|--|
|  YCRI Station, 1987       |  UOG-45 Station, 1978   |
|  WRRC-14-10 Station, 1980 |  UOG-46 Station, 1978   |
|  WRRC-16-1 Station, 1980  |  UOG-78-4 Station, 1982 |
|  WERI Station, 1982       |  UOG-35 Station, 1977   |



# Reference Map 4



## Coastal Resources





### PELAGIC FISH

-  Dogtooth Tuna — Yasul
-  Tuna — Tuguw
-  Flying Fish — Goeg
-  Wahoo — Malchath
-  Dolphinfish — Dabaar

### INVERTEBRATES

-  Sea Cucumber — L'ugul
-  Octopus — K'aay
-  Lobster — Qaraangoey
-  Mangrove Crab — Qamaang
-  Land Crab — Galip
-  Swimming Crab — Qurich
-  Clam — Faasuw, Tow
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-  Sand Dredging Area
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-  Barracuda — Maal'
-  Snapper — Gadaw, Gooychaaf

# Bottom Type and Land Cover Classification

Map 6

## OFFSHORE

### Sediment

- sc — Sand bottom in water depths less than 10 meters
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- si — Silt



### Reef Complex

- rc — Mixed bottom types consisting of reef rock (limestone) associated with shallow reef formations
- rcl — Consolidated limestone, lacking sediment
- rclp — Consolidated limestone with a smooth, pavement-like surface
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- rs — Complex reef bottom type consisting mostly of sand, but with some limestone outcrops or boulders
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## SHORELINE

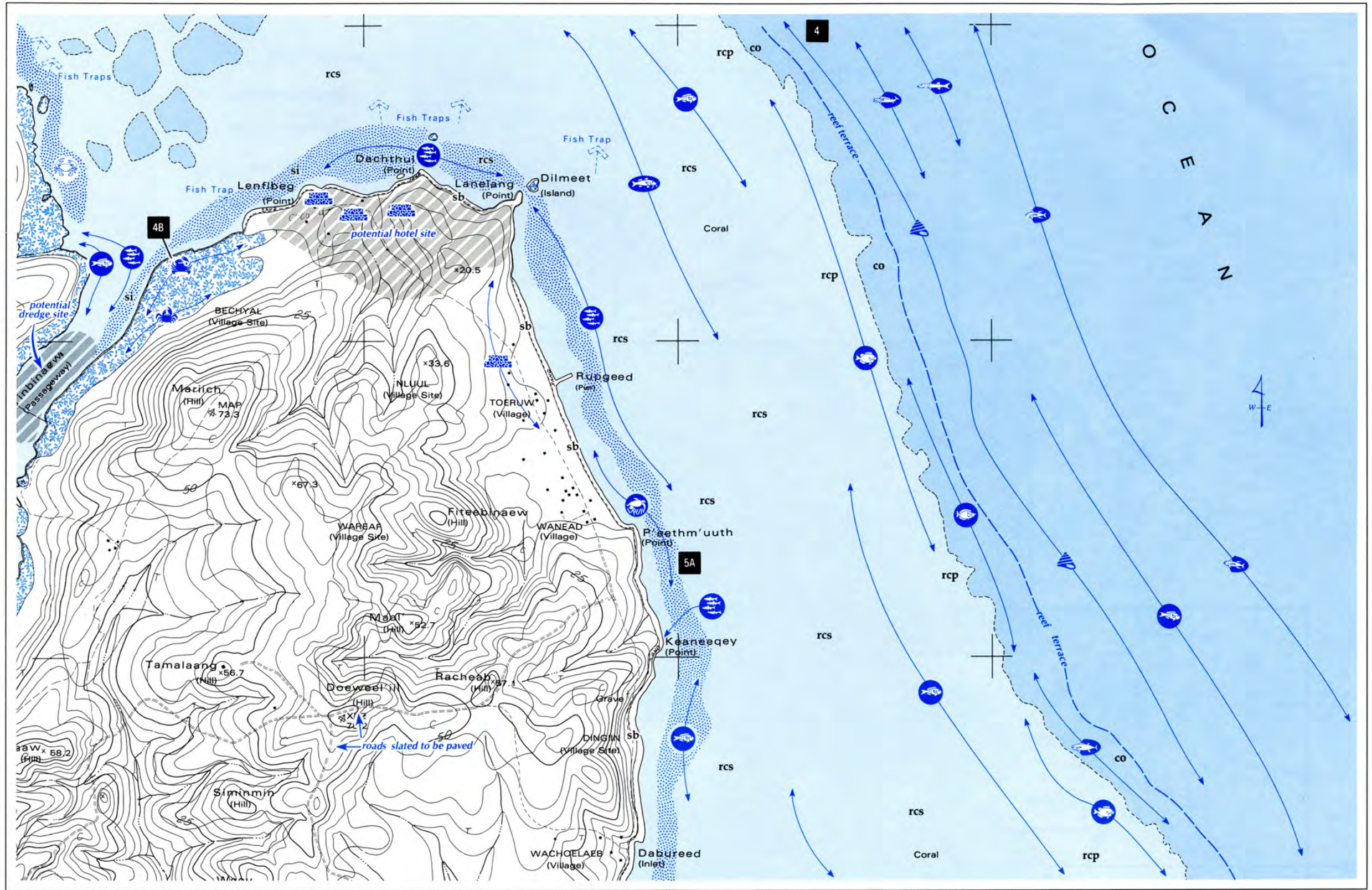
- bb — Man-made boulder shoreline
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- sb — White sand beach of predominately calcareous material

## VEGETATION COVER









- ag — Algae bed
-  Mangrove Forest
-  Seagrass Bed

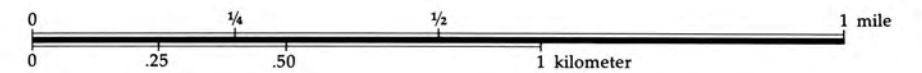
## Other Symbols

-  Navigational Marker
-  Shipwreck
-  Observed Range of Species
-  Reef Terrace
-  Potential Development Site



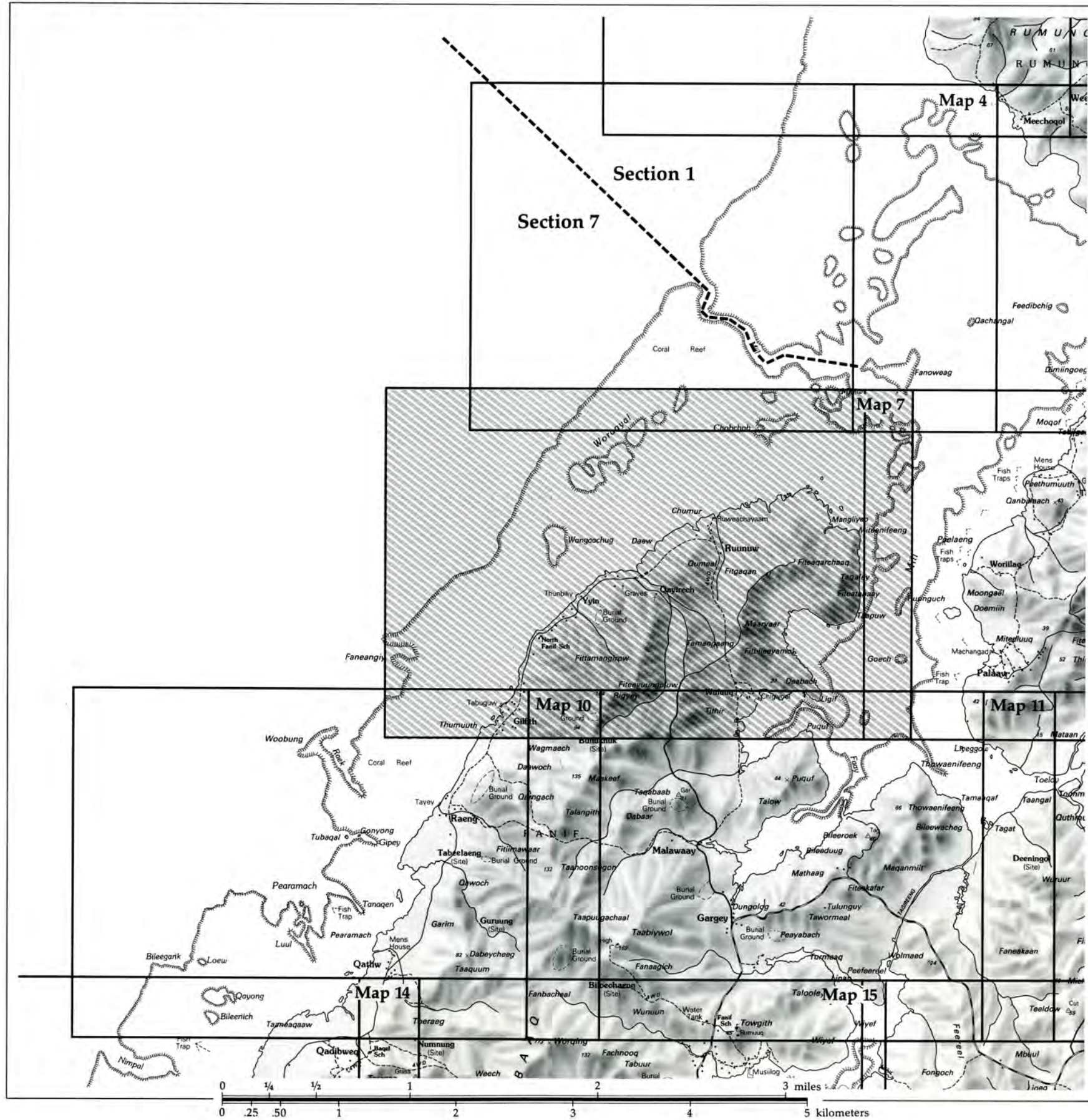
## Field Stations

- |  |  |
|--|--|
|  YCRI Station, 1987       |  UOG—45 Station, 1978   |
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# Reference Map 2



## Coastal Resources





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-  Dolphinfish — Dabaar

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## SHORELINE

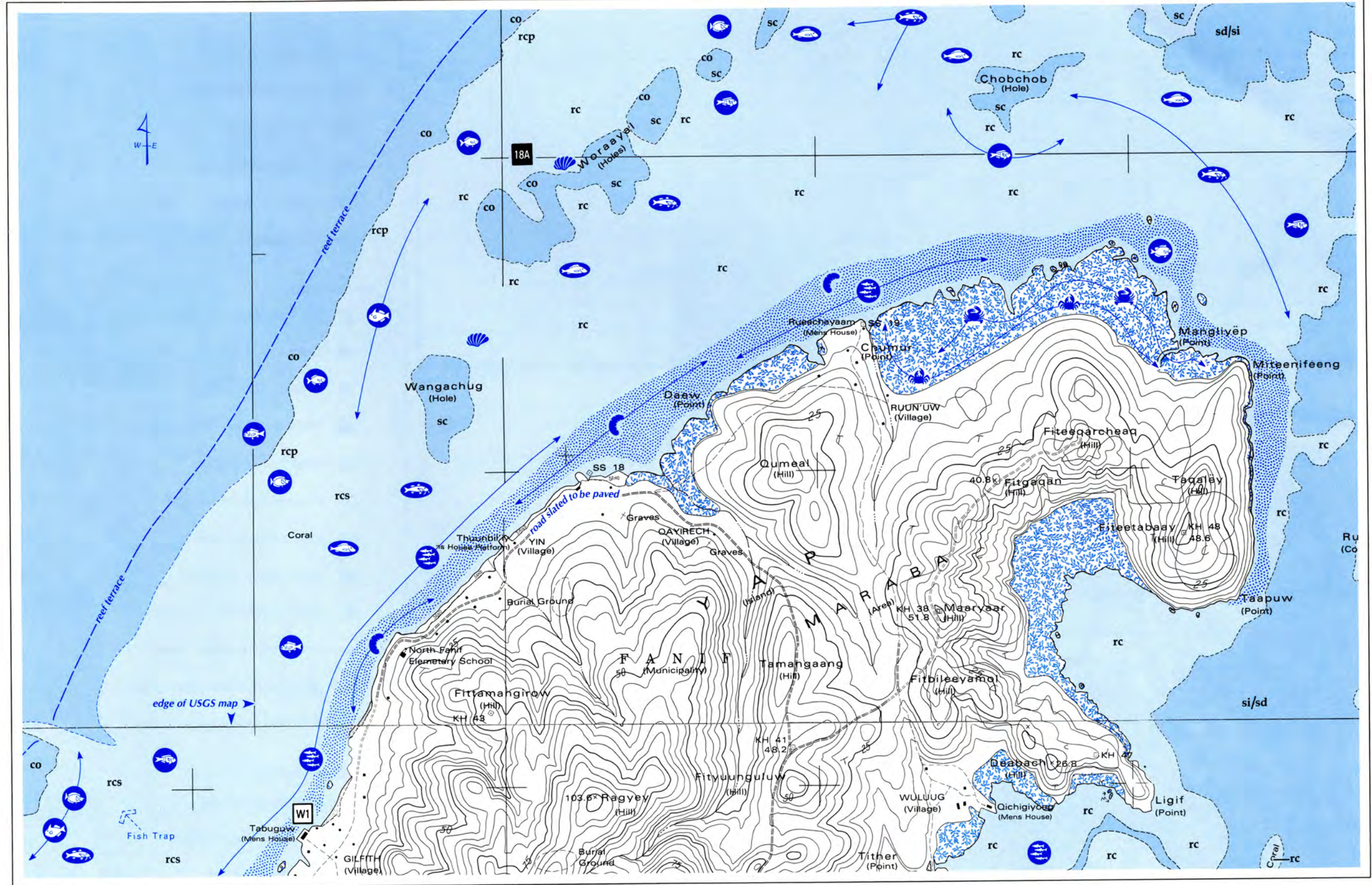
- bb — Man-made boulder shoreline
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## VEGETATION COVER

- ag — Algae bed
- Mangrove Forest
- Seagrass Bed

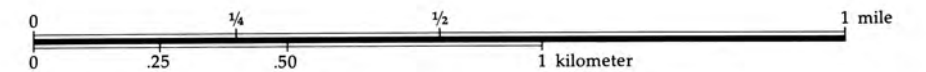
## Other Symbols

- Navigation Marker
- Shipwreck
- Observed Range of Species
- Reef Terrace
- Potential Development Site

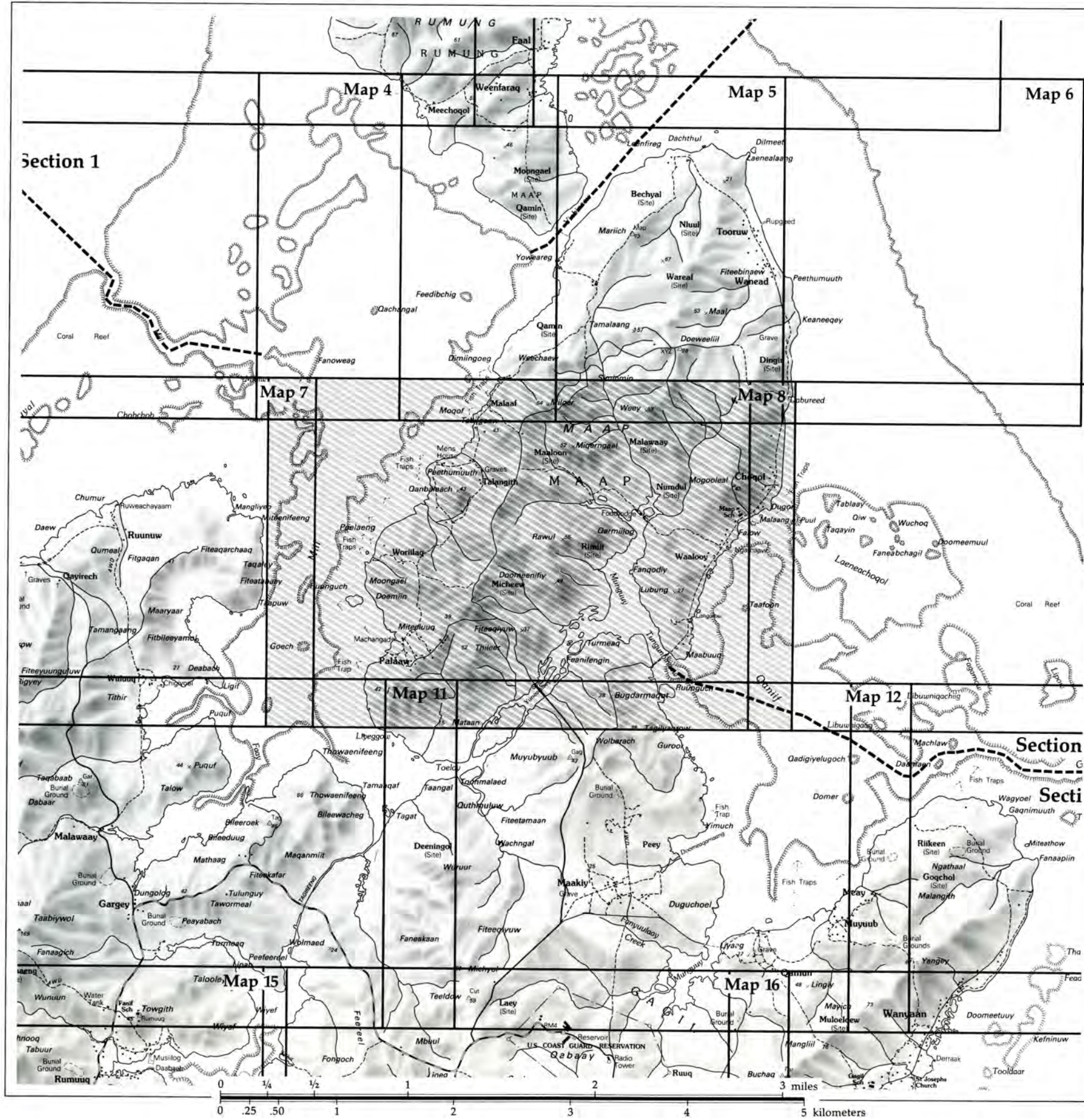


## Field Stations

- |                             |                           |
|-----------------------------|---------------------------|
| 53 YCRI Station, 1987       | G1 UOG-45 Station, 1978   |
| W1 WRRC-14-10 Station, 1980 | G2 UOG-46 Station, 1978   |
| W2 WRRC-16-1 Station, 1980  | G3 UOG-78-4 Station, 1982 |
| W3 WERI Station, 1982       | G4 UOG-35 Station, 1977   |



# Reference Map 3



## Coastal Resources





### PELAGIC FISH

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-  Dolphinfish — Dabaar

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-  Angelfish — Qeer, Buloch
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-  Stickfish, Needlefish — Buuy
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-  Eel — Looth
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# Bottom Type and Land Cover Classification

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## SHORELINE

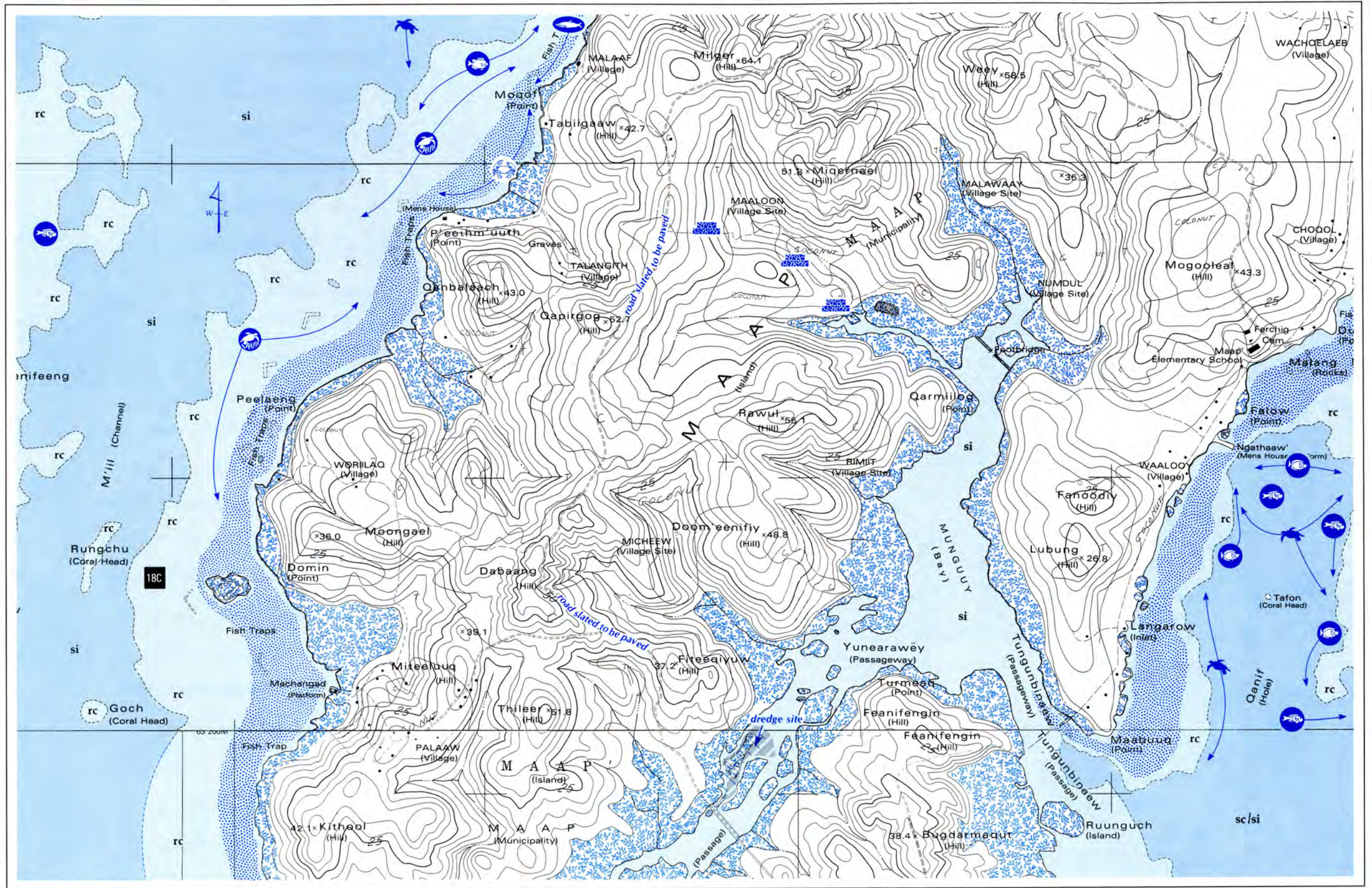
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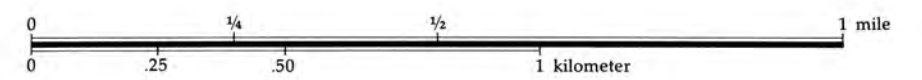
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- Observed Range of Species
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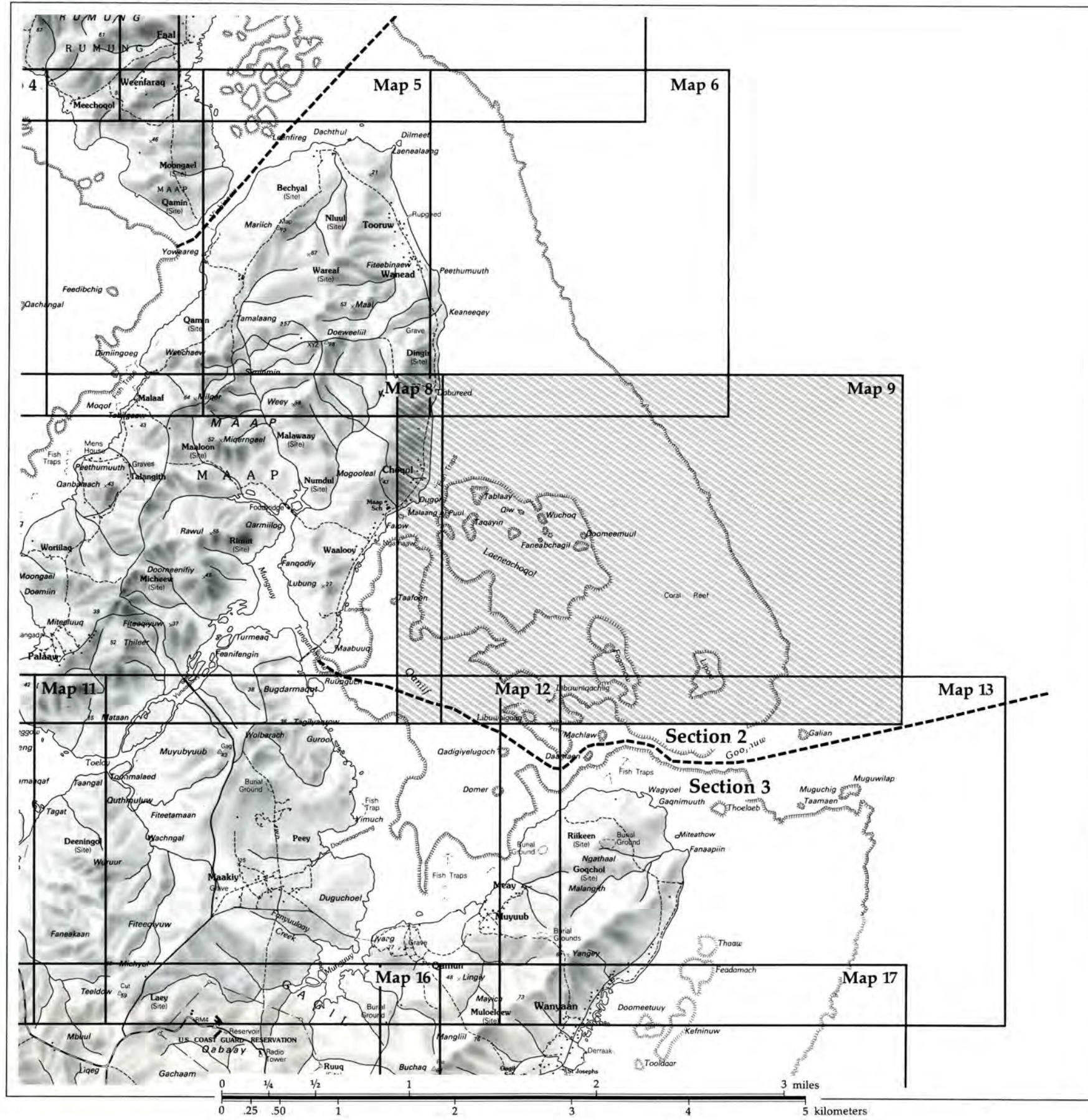


## Field Stations

- |                                    |                                  |
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| <b>W2</b> WRRC-16-1 Station, 1980  | <b>G3</b> UOG-78-4 Station, 1982 |
| <b>W3</b> WERI Station, 1982       | <b>G4</b> UOG-35 Station, 1977   |



# Reference Map 4



## Coastal Resources

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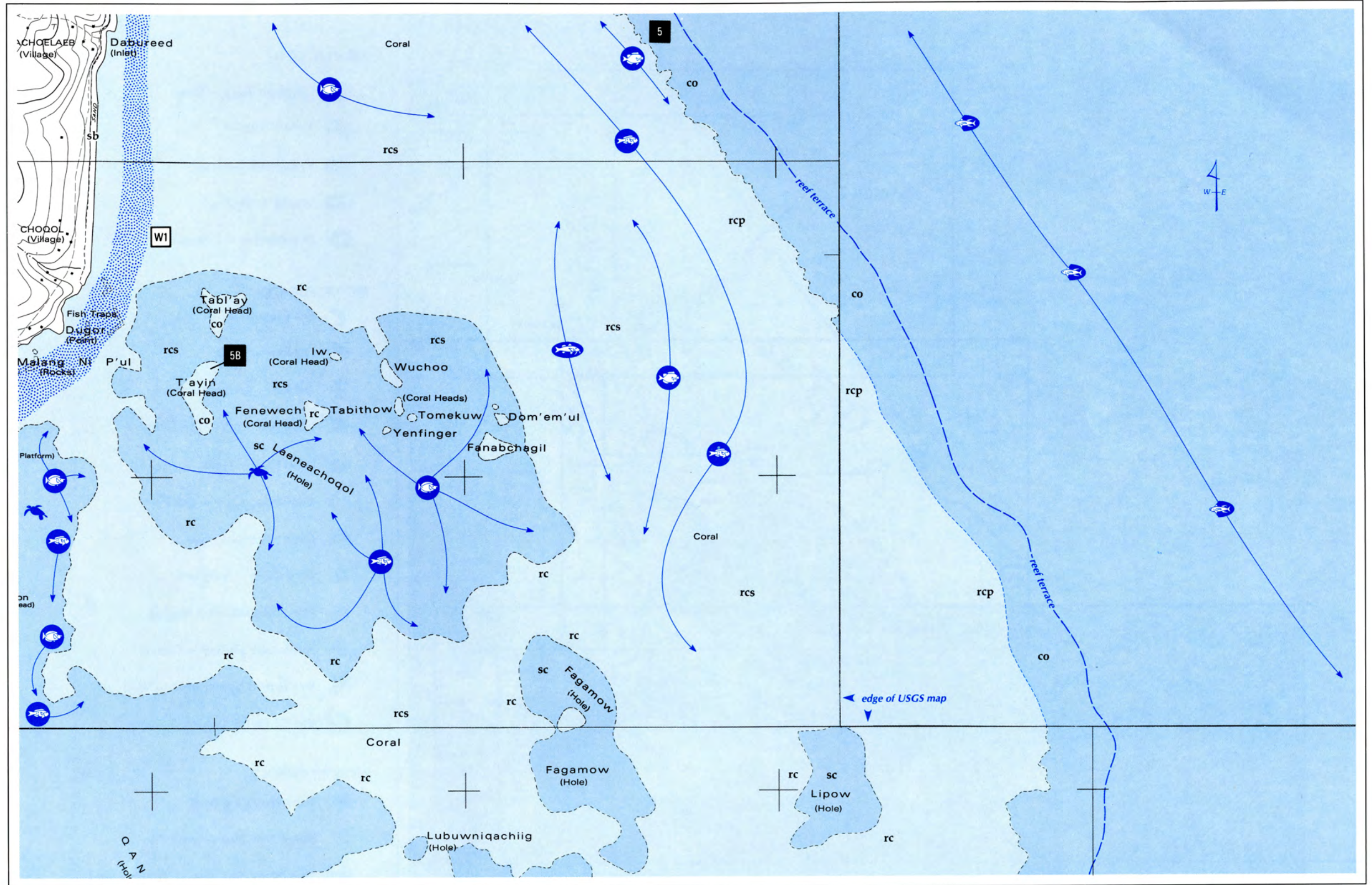
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






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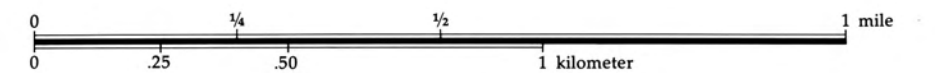
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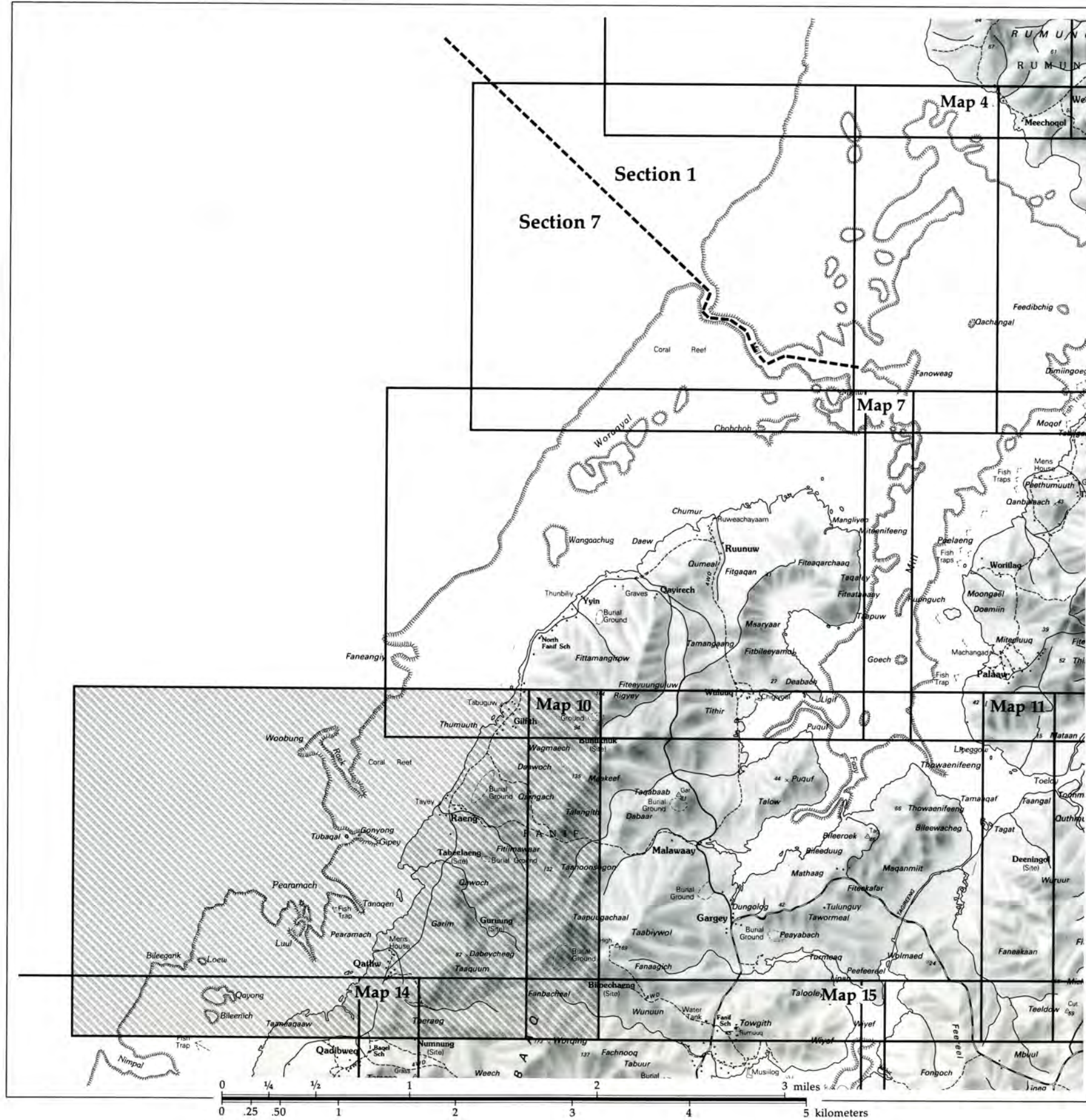


## Field Stations

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# Reference Map 2



## Coastal Resources





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-  Wrasse — Numean
-  Stickfish, Needlefish — Buuy
-  Triggerfish — Wuuq, Moelngith, Nguuf
-  Milkfish — Guuguw, Tangir
-  Rudderfish — Guumiy
-  Eel — Looth
-  Baitfish — Saadiin, Faakeayaan', Liyeq, Qachwog, Qanger, Malmeq
-  Barracuda — Maal'
-  Snapper — Gadaw, Gooychaaf

# Bottom Type and Land Cover Classification

## OFFSHORE

### Sediment

- sc — Sand bottom in water depths less than 10 meters
- sd — Sand bottom in water depths greater than 10 meters
- si — Silt

### Reef Complex

- rc — Mixed bottom types consisting of reef rock (limestone) associated with shallow reef formations
- rcl — Consolidated limestone, lacking sediment
- rclsd — Consolidated limestone with a smooth, pavement-like surface
- rps — Mostly consolidated limestone with some (25-50%) sediment bottom
- rs — Complex reef bottom type consisting mostly of sand, but with some limestone outcrops or boulders
- co — Areas of greater than 50% live coral cover

## SHORELINE

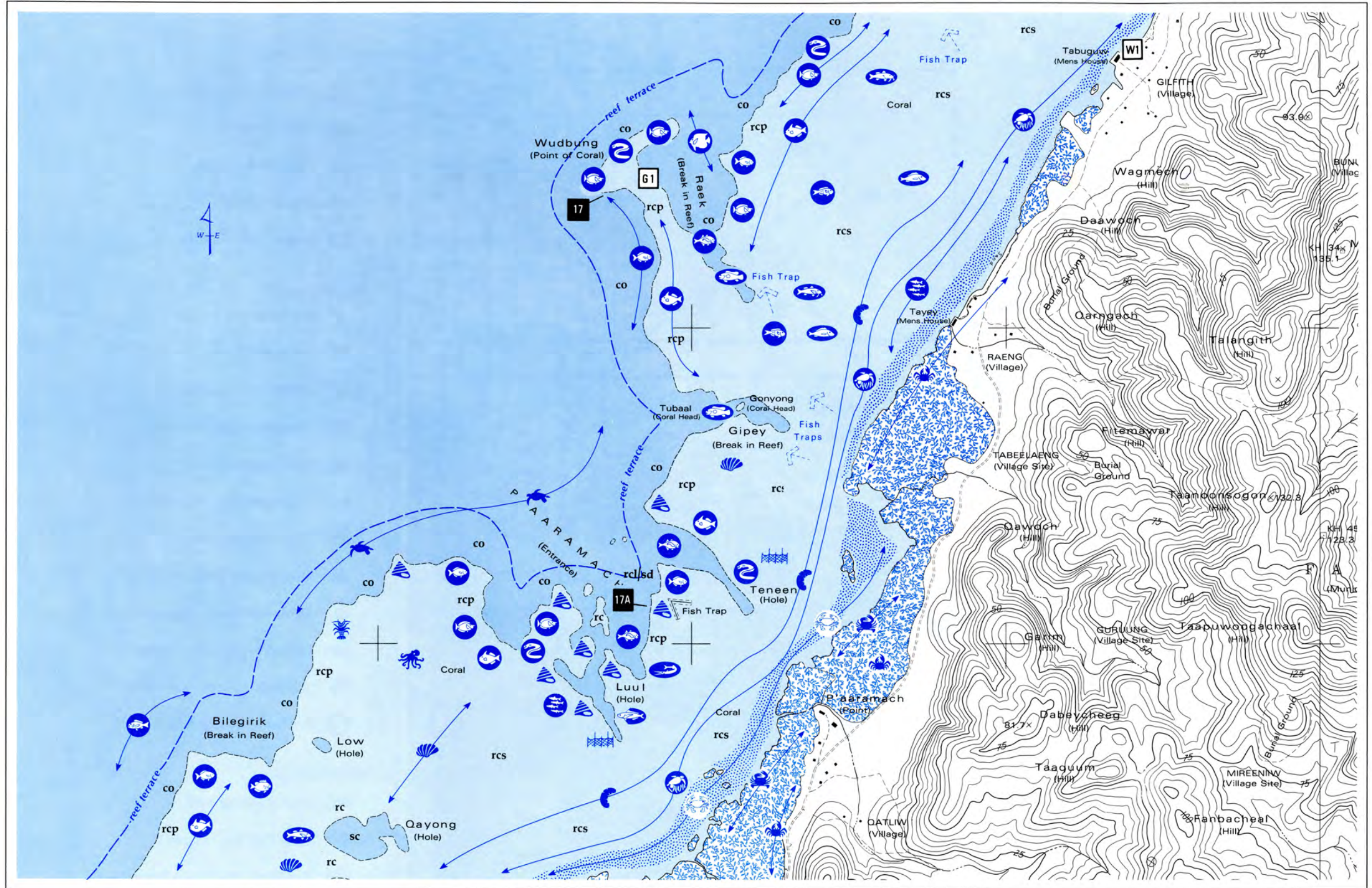
- bb — Man-made boulder shoreline
- bc — Concrete/cement masonry seawall and shoreline
- sb — White sand beach of predominately calcareous material

## VEGETATION COVER

- ag — Algae bed
- Mangrove Forest
- Seagrass Bed

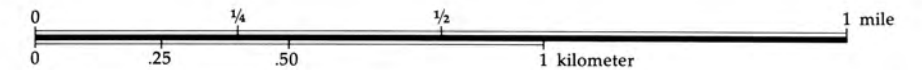
## Other Symbols

- Navigational Marker
- Shipwreck
- Observed Range of Species
- Reef Terrace
- Potential Development Site



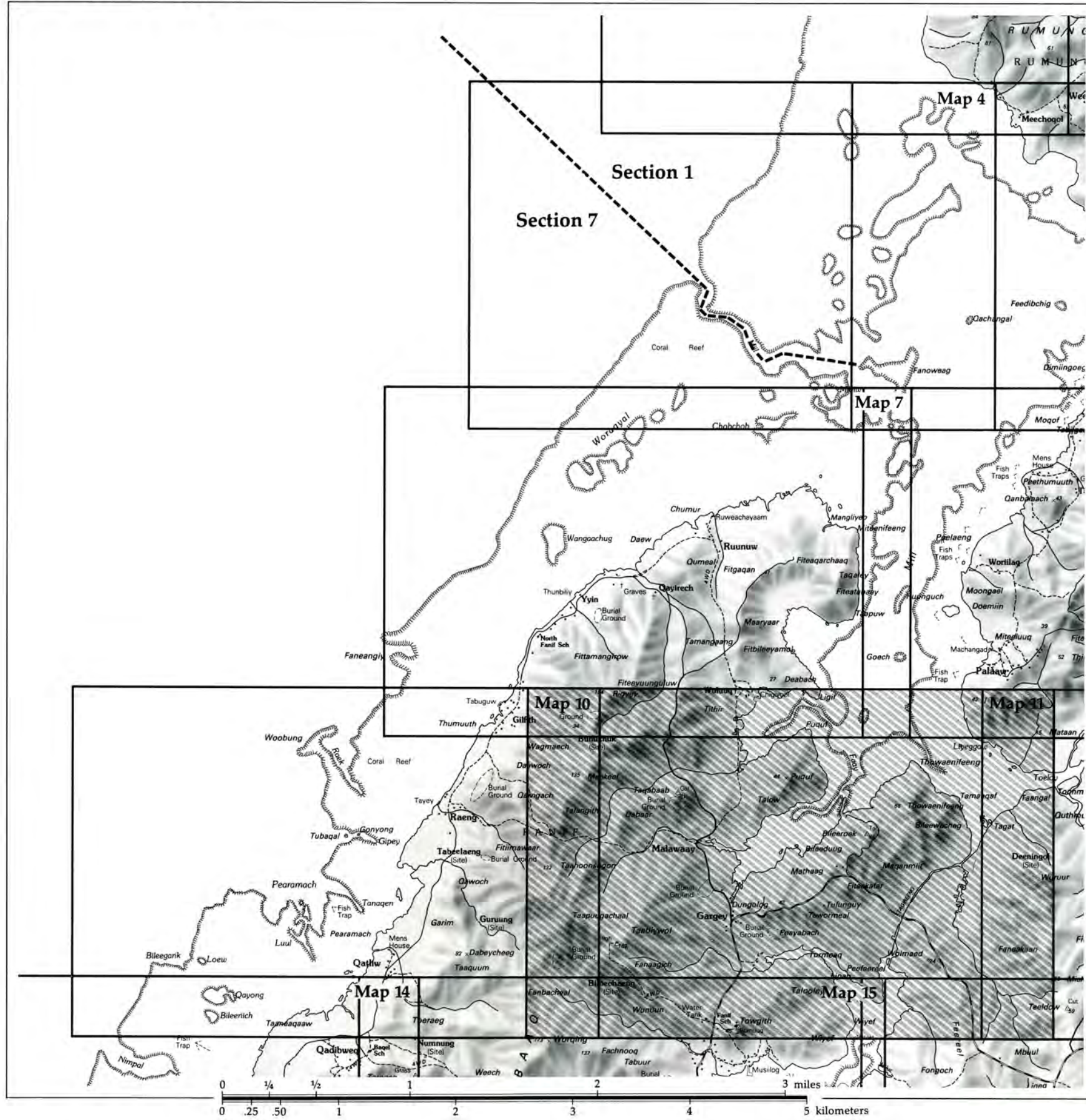
## Field Stations

- |                          |                        |
|--------------------------|------------------------|
| YCRI Station, 1987       | UOG—45 Station, 1978   |
| WRRC—14-10 Station, 1980 | UOG—46 Station, 1978   |
| WRRC—16-1 Station, 1980  | UOG—78-4 Station, 1982 |
| WERI Station, 1982       | UOG—35 Station, 1977   |





# Reference Map 2



## Coastal Resources

### PELAGIC FISH

- Dogtooth Tuna — Yasul
- Tuna — Tuguw
- Flying Fish — Goeg
- Wahoo — Malchath
- Dolphinfish — Dabaar

### INVERTEBRATES

- Sea Cucumber — L'ugul
- Octopus — K'aay
- Lobster — Qaraangoey
- Mangrove Crab — Qamaang
- Land Crab — Galip
- Swimming Crab — Qurich
- Clam — Faasuw, Tow
- Mud Clam — Yungwol
- Topshell (*trochus*) — Yogyog
- Freshwater Shrimp — Ganeef
- Sea Turtle Capture Area — Weel
- Sea Turtle Feeding Area — Qey

### OTHER SYMBOLS

- Sand Dredging Area
- Stone Fish Trap — Qech
- Non-Stone Fish Trap — Yanup, Saagel
- Archaeological Site

### REEF FISH

- Grouper — SmaaK'uw, K'uw
- Parrotfish — Qelbad, Qalaabal, Malgoed, Quchwaq, Gamaygul
- Surgeonfish — Quum, Maath, Machagwog, Bilaew
- Mullet — Quloch, Galaed
- Squirrelfish, Soldierfish — Yooch
- Rabbitfish — Dayit, Garmiy, Buywod, Darryu, Limreq
- Goatfish — Manguch, Mbing, Soong
- Rainbow Runner, Fusilier — Thilbuw, Foofow
- Jack — Ngool, M'uul, Qelqel
- Bream — Qutun, Wachaqmal
- Emperor — Wul', Qoeyeq, Gadgad
- Angelfish — Qeer, Buloch
- Wrasse — Numean
- Stickfish, Needlefish — Buuy
- Triggerfish — Wuuq, Moelngith, Nguuf
- Milkfish — Guuguw, Tangir
- Rudderfish — Guumiy
- Eel — Looth
- Baitfish — Saadiin, Faakeayaan', Lyeq, Qachwog, Qanger, Malmeq
- Barracuda — Maal'
- Snapper — Gadaw, Gooychaaf

# Bottom Type and Land Cover Classification

## OFFSHORE

### Sediment

- sc — Sand bottom in water depths less than 10 meters
- sd — Sand bottom in water depths greater than 10 meters
- si — Silt

### Reef Complex

- rc — Mixed bottom types consisting of reef rock (limestone) associated with shallow reef formations
- rcl — Consolidated limestone, lacking sediment
- rcp — Consolidated limestone with a smooth, pavement-like surface
- rcs — Mostly consolidated limestone with some (25-50%) sediment bottom
- rs — Complex reef bottom type consisting mostly of sand, but with some limestone outcrops or boulders
- co — Areas of greater than 50% live coral cover

## SHORELINE

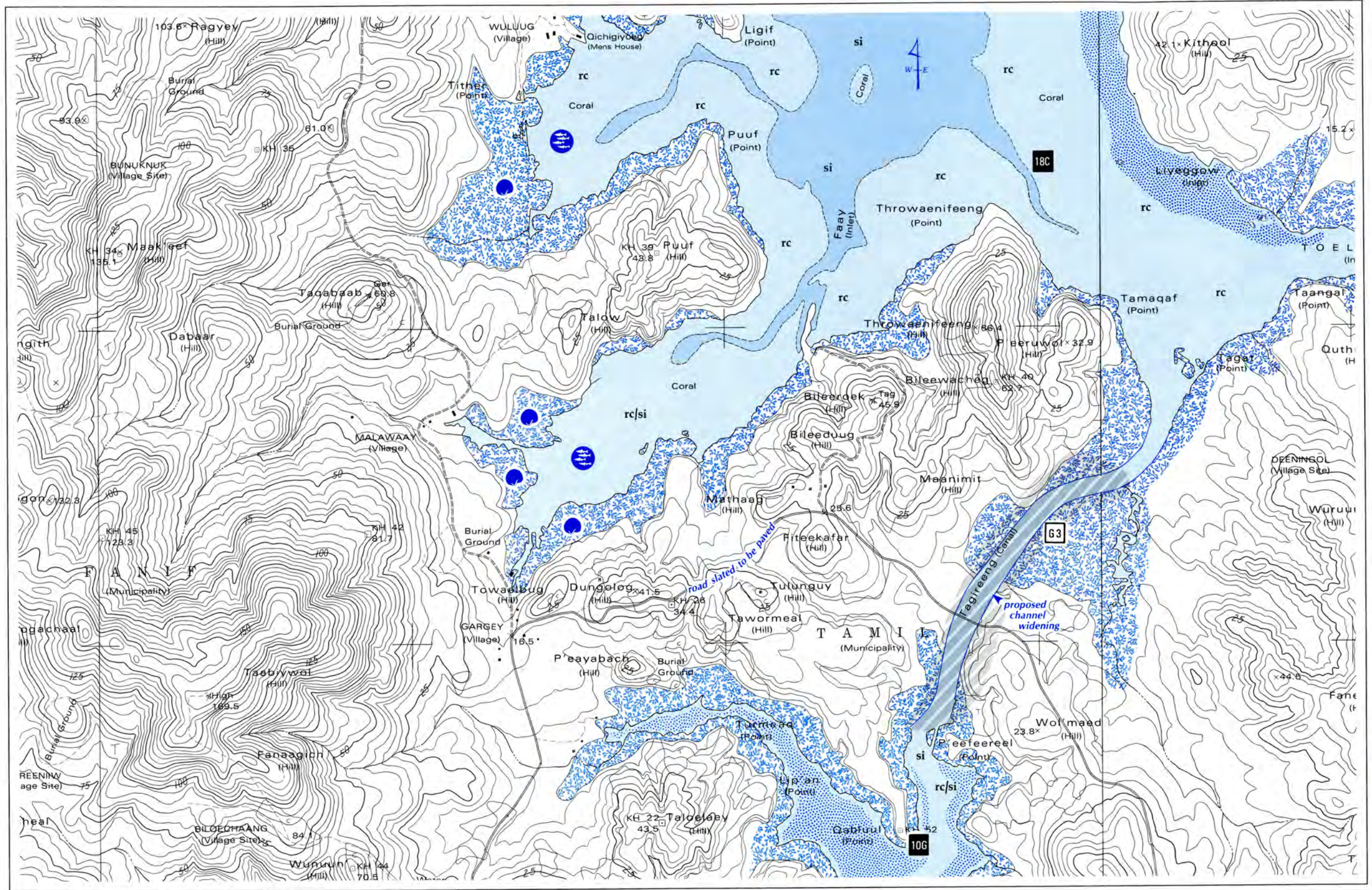
- bb — Man-made boulder shoreline
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- sb — White sand beach of predominately calcareous material

## VEGETATION COVER

- ag — Algae bed
- Mangrove Forest
- Seagrass Bed

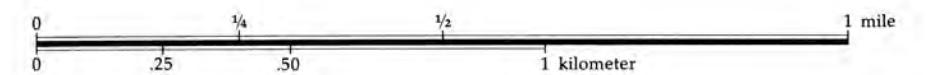
## Other Symbols

- Navigational Marker
- Shipwreck
- Observed Range of Species
- Reef Terrace
- Potential Development Site

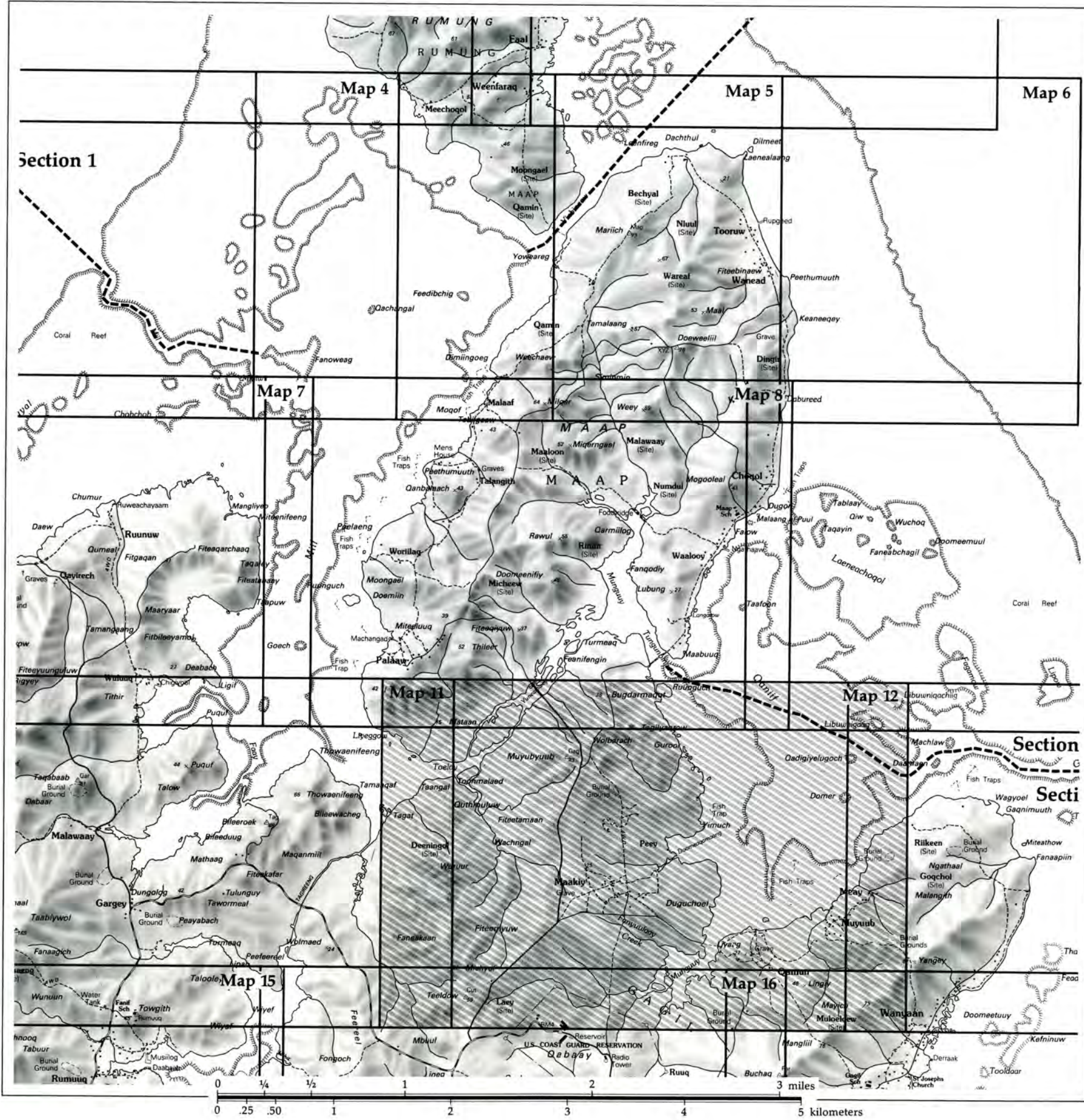


## Field Stations

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# Reference Map 3



## Coastal Resources

### PELAGIC FISH

- Dogtooth Tuna — Yasul
- Tuna — Tuguw
- Flying Fish — Goeg
- Wahoo — Malchath
- Dolphinfish — Dabaar

### REEF FISH

- Grouper — SmaaK'uw, K'uw
- Parrotfish — Qelbad, Qalaabal, Malngoed, Quchwaq, Gamaygul
- Surgeonfish — Quum, Maath, Machagwog, Bilaew
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- Bream — Qutun, Wachaqmal
- Emperor — Wul', Qoeyeq, Gadgad
- Angelfish — Qeer, Buloch
- Wrasse — Numean
- Stickfish, Needlefish — Buuy
- Triggerfish — Wuuq, Moelngith, Nguuf
- Milkfish — Guuguw, Tangir
- Rudderfish — Guumiy
- Eel — Looth

### INVERTEBRATES

- Sea Cucumber — L'ugul
- Octopus — K'aay
- Lobster — Qaraangoey
- Mangrove Crab — Qamaang
- Land Crab — Galip
- Swimming Crab — Qurich
- Clam — Faasuw, Tow
- Mud Clam — Yungwol
- Topshell (*trochus*) — Yogyog
- Freshwater Shrimp — Ganeef
- Sea Turtle Capture Area — Weel
- Sea Turtle Feeding Area — Qey

### OTHER SYMBOLS

- Sand Dredging Area
- Stone Fish Trap — Qech
- Non-Stone Fish Trap — Yanup, Saagel
- Archaeological Site

# Bottom Type and Land Cover Classification

Map 12

## OFFSHORE

### Sediment

- sc — Sand bottom in water depths less than 10 meters
- sd — Sand bottom in water depths greater than 10 meters
- si — Silt

### Reef Complex

- rc — Mixed bottom types consisting of reef rock (limestone) associated with shallow reef formations
- rcl — Consolidated limestone, lacking sediment
- rcp — Consolidated limestone with a smooth, pavement-like surface
- rscs — Mostly consolidated limestone with some (25-50%) sediment bottom
- rs — Complex reef bottom type consisting mostly of sand, but with some limestone outcrops or boulders
- co — Areas of greater than 50% live coral cover

## SHORELINE

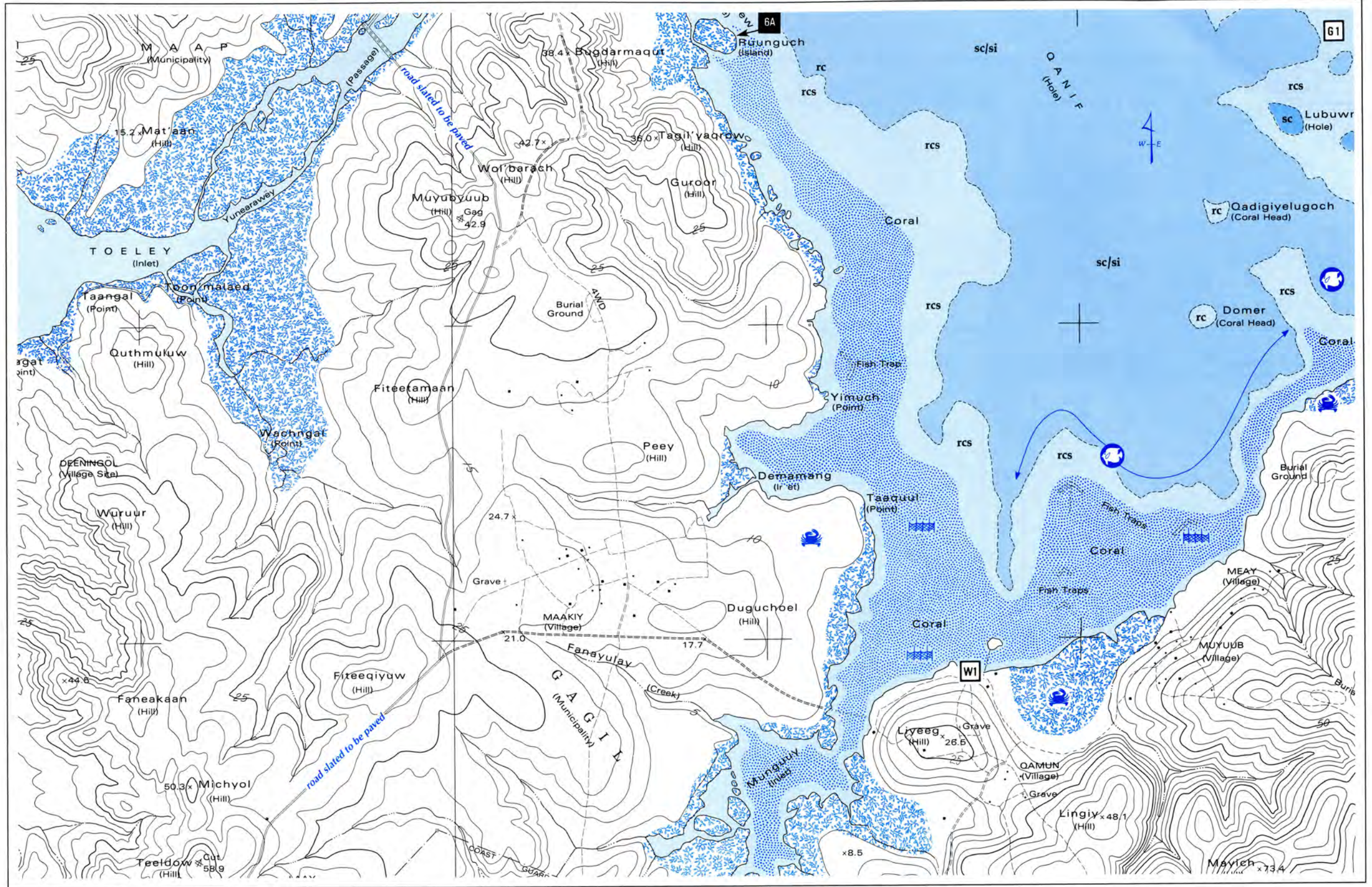
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- bc — Concrete/cement masonry seawall and shoreline
- sb — White sand beach of predominately calcareous material

## VEGETATION COVER

- ag — Algae bed
- Mangrove Forest
- Seagrass Bed

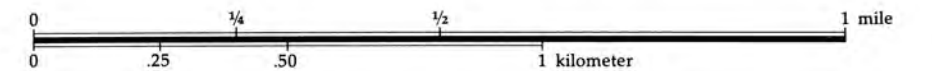
## Other Symbols

- Navigational Marker
- Shipwreck
- Observed Range of Species
- Reef Terrace
- Potential Development Site

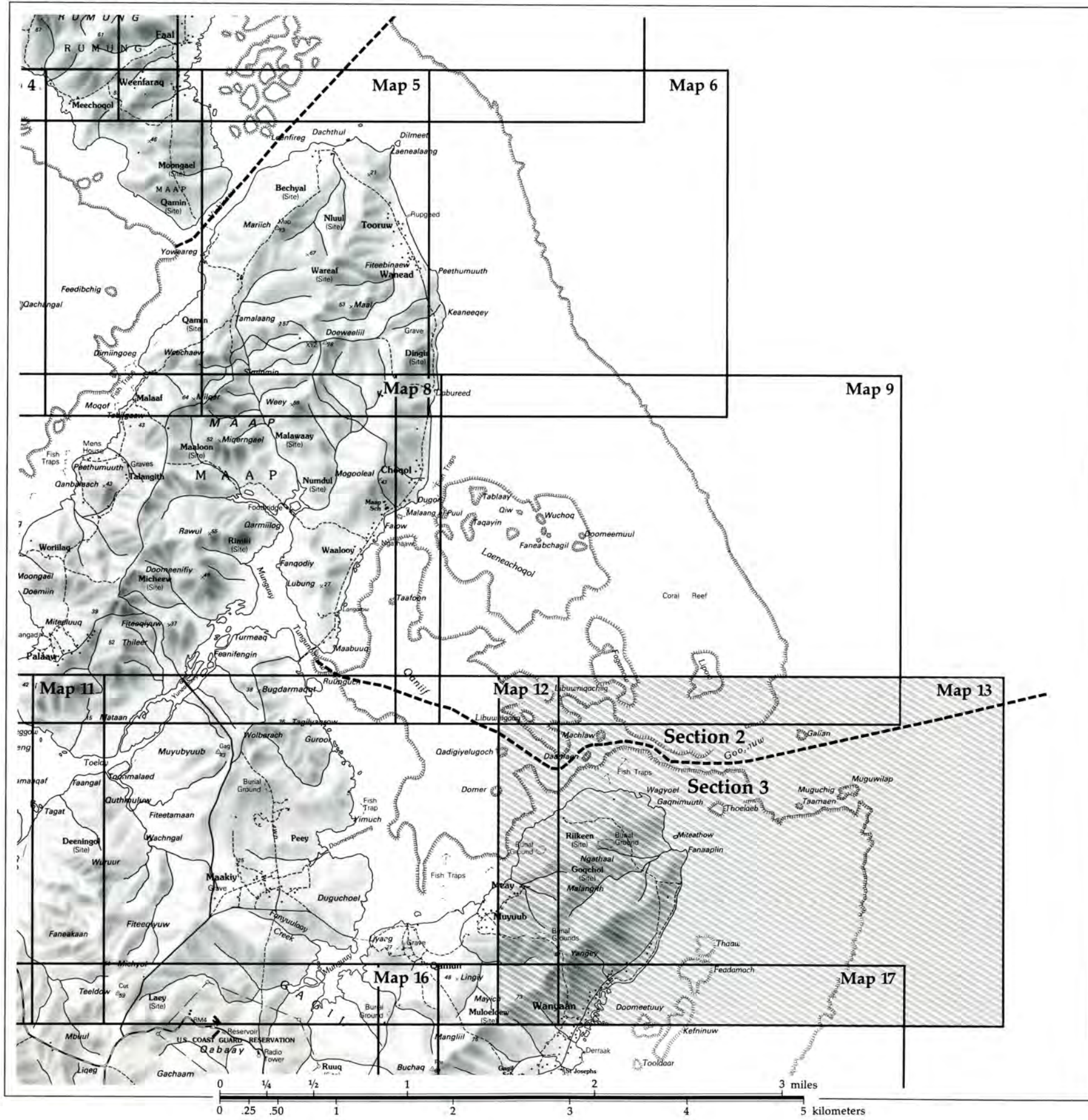


## Field Stations

- |                          |                        |
|--------------------------|------------------------|
| YCRI Station, 1987       | UOG-45 Station, 1978   |
| WRRC-14-10 Station, 1980 | UOG-46 Station, 1978   |
| WRRC-16-1 Station, 1980  | UOG-78-4 Station, 1982 |
| WERI Station, 1982       | UOG-35 Station, 1977   |



# Reference Map 4



## Coastal Resources

### PELAGIC FISH

- Dogtooth Tuna — Yasul
- Tuna — Tuguw
- Flying Fish — Goeg
- Wahoo — Malchath
- Dolphinfish — Dabaar

### INVERTEBRATES

- Sea Cucumber — L'ugul
- Octopus — K'aay
- Lobster — Qaraangoey
- Mangrove Crab — Qamaang
- Land Crab — Galip
- Swimming Crab — Qurich
- Clam — Faasuw, Tow
- Mud Clam — Yungwol
- Topshell (*trochus*) — Yogyog
- Freshwater Shrimp — Ganeef
- Sea Turtle Capture Area — Weel
- Sea Turtle Feeding Area — Qey

### OTHER SYMBOLS

- Sand Dredging Area
- Stone Fish Trap — Qech
- Non-Stone Fish Trap — Yanup, Saagel
- Archaeological Site

### REEF FISH

- Grouper — SmaaK'uw, K'uw
- Parrotfish — Qelbad, Qalaabal, Malngoed, Quchwaq, Gamaygul
- Surgeonfish — Quum, Maath, Machagwog, Bilaew
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- Squirrelfish, Soldierfish — Yooch
- Rabbitfish — Dayit, Garmiy, Buywod, Darryy, Limreq
- Goatfish — Manguch, Mbing, Soong
- Rainbow Runner, Fusilier — Thilbuw, Foofoow
- Jack — Ngool, M'uul, Qelqel
- Bream — Qutun, Wachaqmal
- Emperor — Wul', Qoeyeq, Gadgad
- Angelfish — Qeer, Buloch
- Wrasse — Numean
- Stickfish, Needlefish — Buuy
- Triggerfish — Wuuq, Moelngith, Nguuf
- Milkfish — Guuguw, Tangir
- Rudderfish — Guumiy
- Eel — Looth
- Baitfish — Saadiin, Faakeayaan', Liyeq, Qachwog, Qanger, Malmeq
- Barracuda — Maal'
- Snapper — Gadaw, Gooychaaf

# Bottom Type and Land Cover Classification

## OFFSHORE

### Sediment

- sc — Sand bottom in water depths less than 10 meters
- sd — Sand bottom in water depths greater than 10 meters
- si — Silt



### Reef Complex

- rc — Mixed bottom types consisting of reef rock (limestone) associated with shallow reef formations
- rcl — Consolidated limestone, lacking sediment
- rcp — Consolidated limestone with a smooth, pavement-like surface
- rsc — Mostly consolidated limestone with some (25-50%) sediment bottom
- rs — Complex reef bottom type consisting mostly of sand, but with some limestone outcrops or boulders
- co — Areas of greater than 50% live coral cover






## SHORELINE

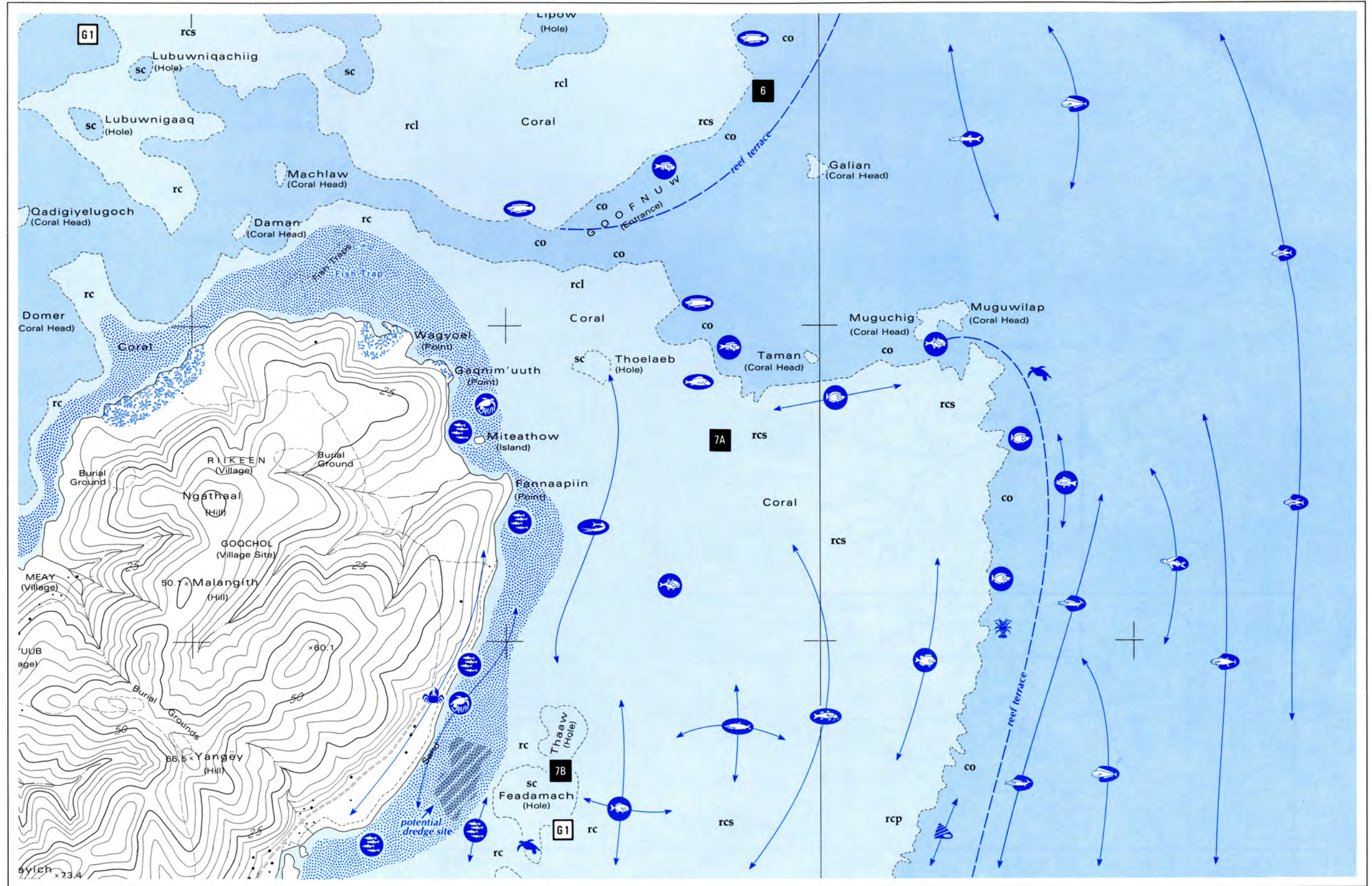
- bb — Man-made boulder shoreline
- bc — Concrete/cement masonry seawall and shoreline
- sb — White sand beach of predominately calcareous material

## VEGETATION COVER

- ag — Algae bed
-  Mangrove Forest
-  Seagrass Bed

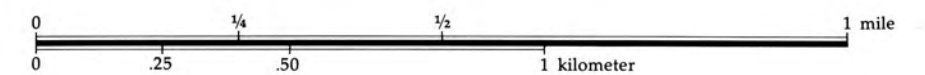
## Other Symbols

-  Navigational Marker
-  Shipwreck
-  Observed Range of Species
-  Reef Terrace
-  Potential Development Site

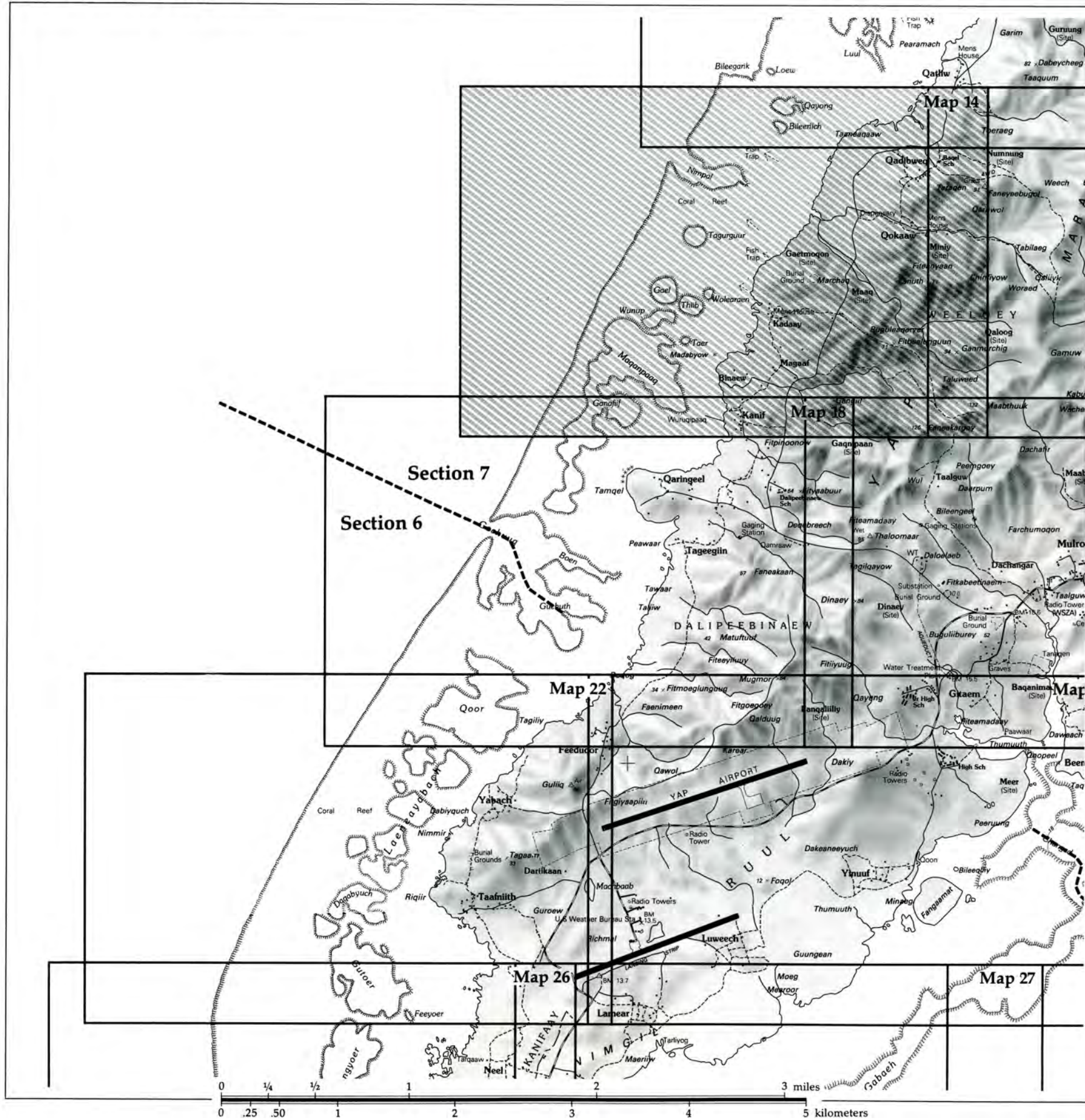


## Field Stations

- |                                    |                                  |
|------------------------------------|----------------------------------|
| <b>53</b> YCRI Station, 1987       | <b>G1</b> UOG-45 Station, 1978   |
| <b>W1</b> WRRC-14-10 Station, 1980 | <b>G2</b> UOG-46 Station, 1978   |
| <b>W2</b> WRRC-16-1 Station, 1980  | <b>G3</b> UOG-78-4 Station, 1982 |
| <b>W3</b> WERI Station, 1982       | <b>G4</b> UOG-35 Station, 1977   |



# Reference Map 5



## Coastal Resources

### PELAGIC FISH

- Dogtooth Tuna — Yasul
- Tuna — Tuguw
- Flying Fish — Goeg
- Wahoo — Malchath
- Dolphinfish — Dabaar

### INVERTEBRATES

- Sea Cucumber — L'ugul
- Octopus — K'aay
- Lobster — Qaraangoey
- Mangrove Crab — Qamaang
- Land Crab — Galip
- Swimming Crab — Qurich
- Clam — Faasuw, Tow
- Mud Clam — Yungwol
- Topshell (*trochus*) — Yogyog
- Freshwater Shrimp — Ganeef
- Sea Turtle Capture Area — Weel
- Sea Turtle Feeding Area — Qey

### OTHER SYMBOLS

- Sand Dredging Area
- Stone Fish Trap — Qech
- Non-Stone Fish Trap — Yanup, Saagel
- Archaeological Site

### REEF FISH

- Grouper — Smaak'uw, K'uw
- Parrotfish — Qelbad, Qalaabal, Malngoed, Quchwaq, Gamaygul
- Surgeonfish — Quum, Maath, Machagwog, Bilaew
- Mullet — Quloch, Galaed
- Squirrelfish, Soldierfish — Yooch
- Rabbitfish — Dayit, Garmiy, Buywod, Darryu, Limreq
- Goatfish — Manguch, Mbing, Soong
- Rainbow Runner, Fusilier — Thilbuw, Foofoow
- Jack — Ngool, M'uul, Qelqel
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- Angelfish — Qeer, Buloch
- Wrasse — Numean
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- Rudderfish — Guumiy
- Eel — Looth
- Baitfish — Saadiin, Faakeayaan', Liyeq, Qachwog, Qanger, Malmeq
- Barracuda — Maal'
- Snapper — Gadaw, Gooychaaf

# Bottom Type and Land Cover Classification

Map 14

## OFFSHORE

### Sediment

- sc — Sand bottom in water depths less than 10 meters
- sd — Sand bottom in water depths greater than 10 meters
- si — Silt

### Reef Complex

- rc — Mixed bottom types consisting of reef rock (limestone) associated with shallow reef formations
- rcl — Consolidated limestone, lacking sediment
- rcp — Consolidated limestone with a smooth, pavement-like surface
- rsc — Mostly consolidated limestone with some (25-50%) sediment bottom
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- co — Areas of greater than 50% live coral cover

## SHORELINE

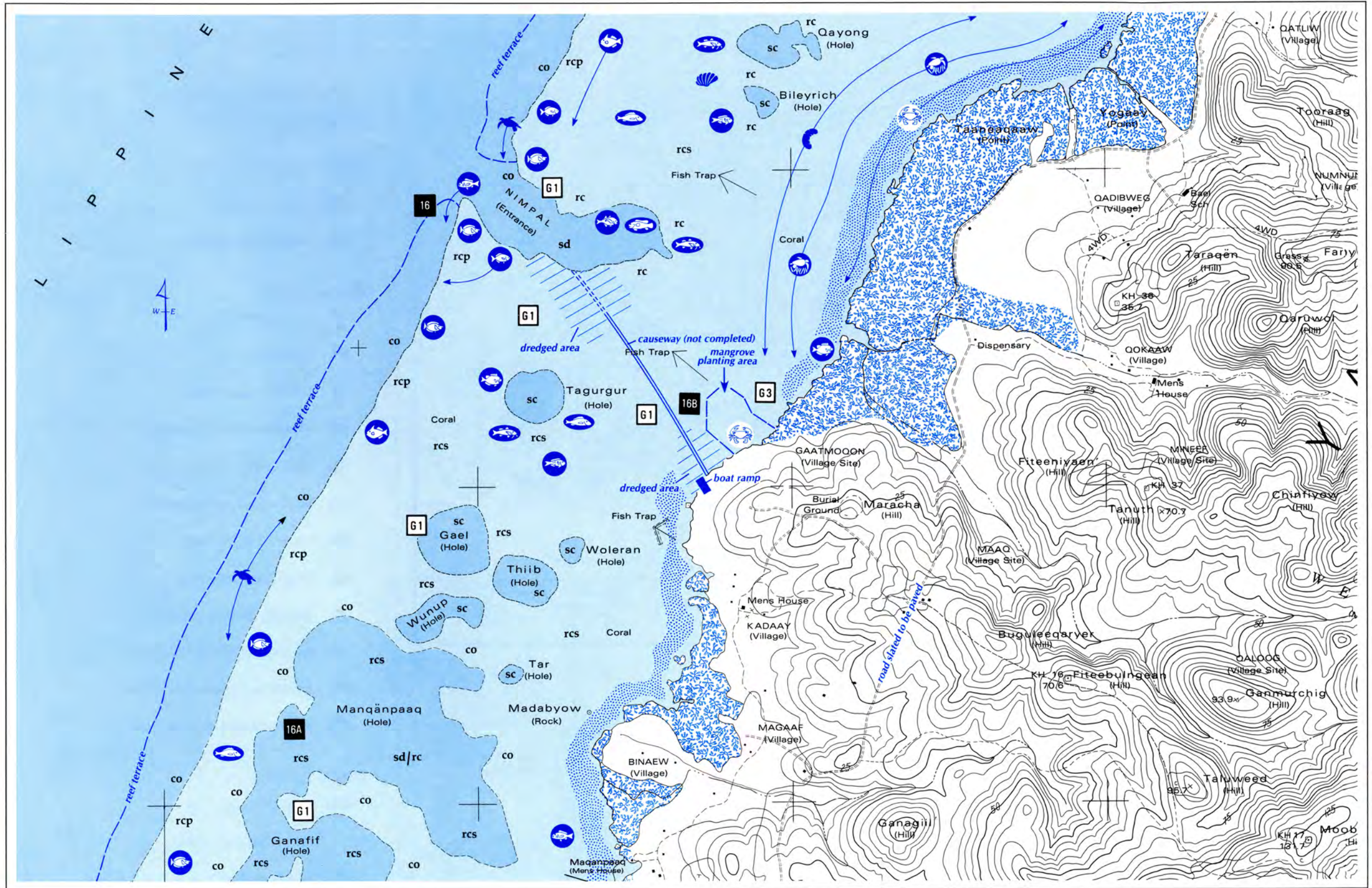
- bb — Man-made boulder shoreline
- bc — Concrete/cement masonry seawall and shoreline
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## VEGETATION COVER

- ag — Algae bed
- Mangrove Forest
- Seagrass Bed

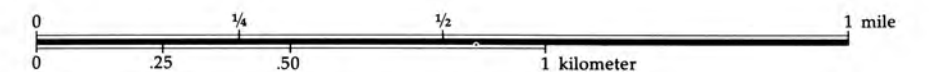
## Other Symbols

- Navigational Marker
- Shipwreck
- Observed Range of Species
- Reef Terrace
- Potential Development Site



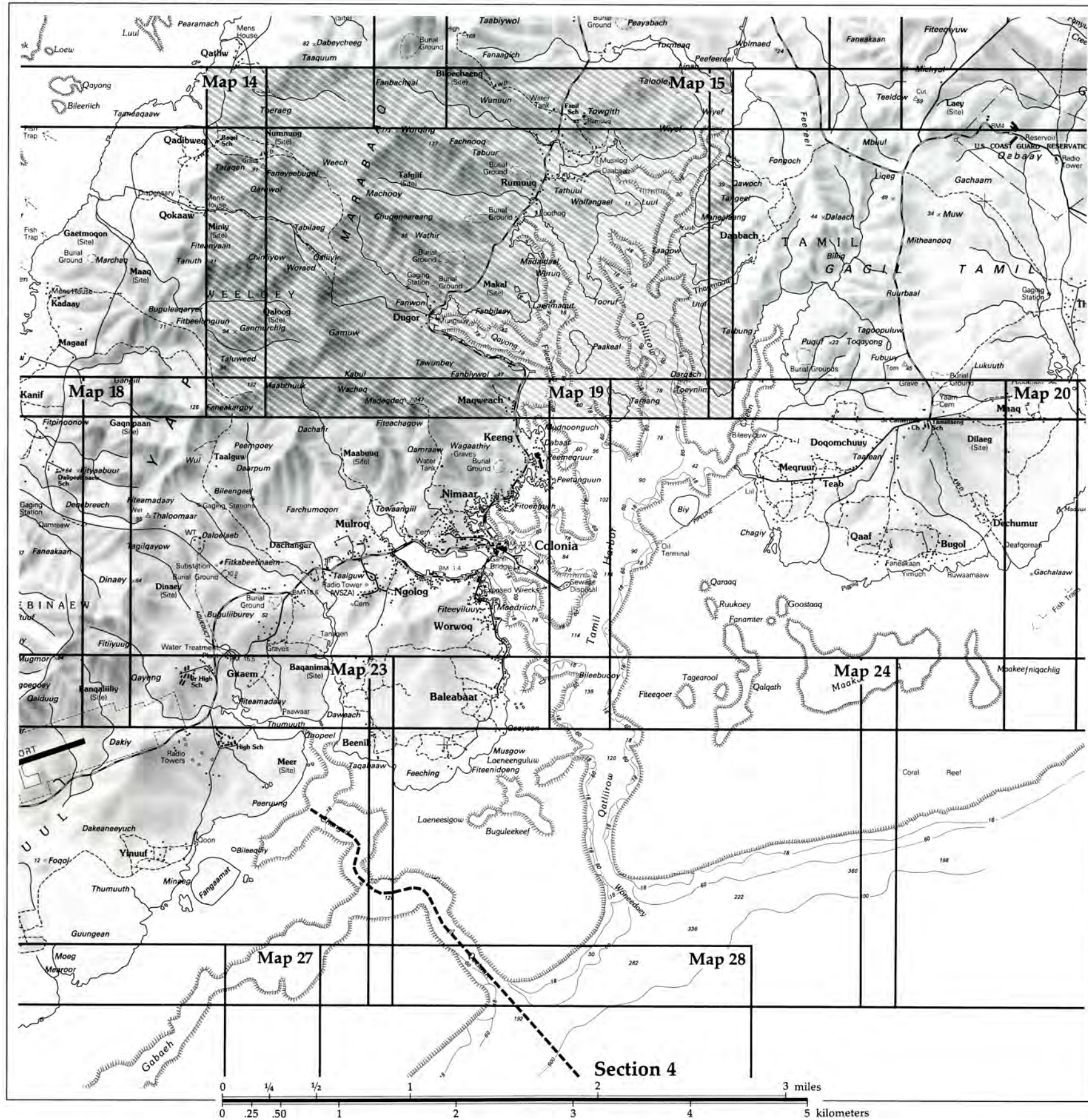
## Field Stations

- |                          |                        |
|--------------------------|------------------------|
| YCRI Station, 1987       | UOG—45 Station, 1978   |
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# Reference Map 6



## Coastal Resources





### PELAGIC FISH

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-  Tuna — Tuguw
-  Flying Fish — Goeg
-  Wahoo — Malchath
-  Dolphinfish — Dabaar

### INVERTEBRATES

-  Sea Cucumber — L'ugul
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### OTHER SYMBOLS

-  Sand Dredging Area
-  Stone Fish Trap — Qech
-  Non-Stone Fish Trap — Yanup, Saagel
-  Archaeological Site

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# Bottom Type and Land Cover Classification

## OFFSHORE

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## SHORELINE

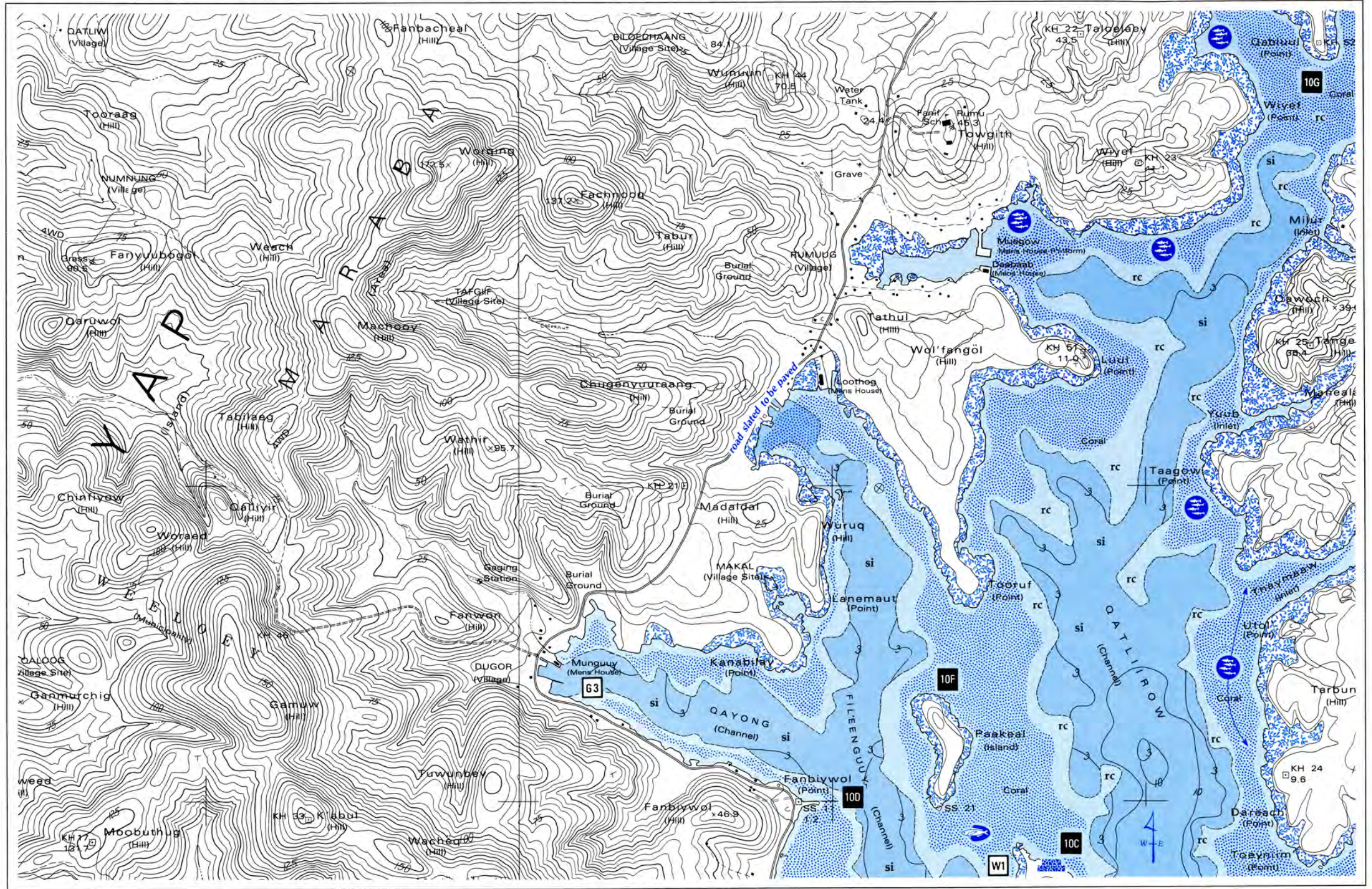
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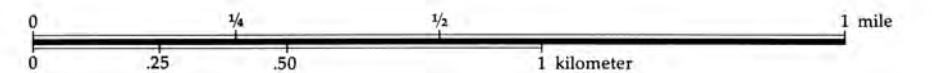
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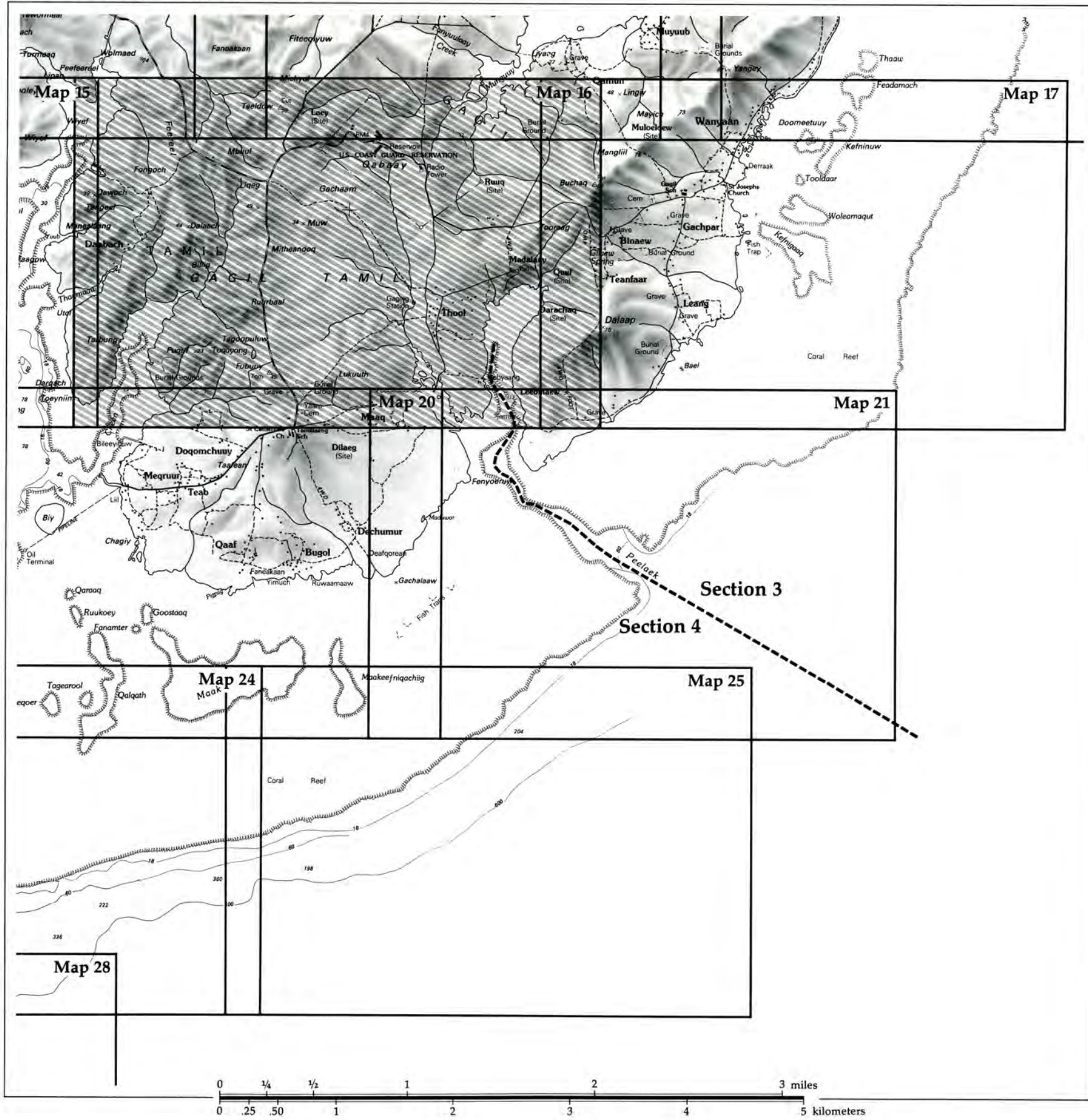


## Field Stations

- |                                    |                                  |
|------------------------------------|----------------------------------|
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# Reference Map 7



## Coastal Resources

### PELAGIC FISH

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# Bottom Type and Land Cover Classification

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- sc — Sand bottom in water depths less than 10 meters
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## SHORELINE

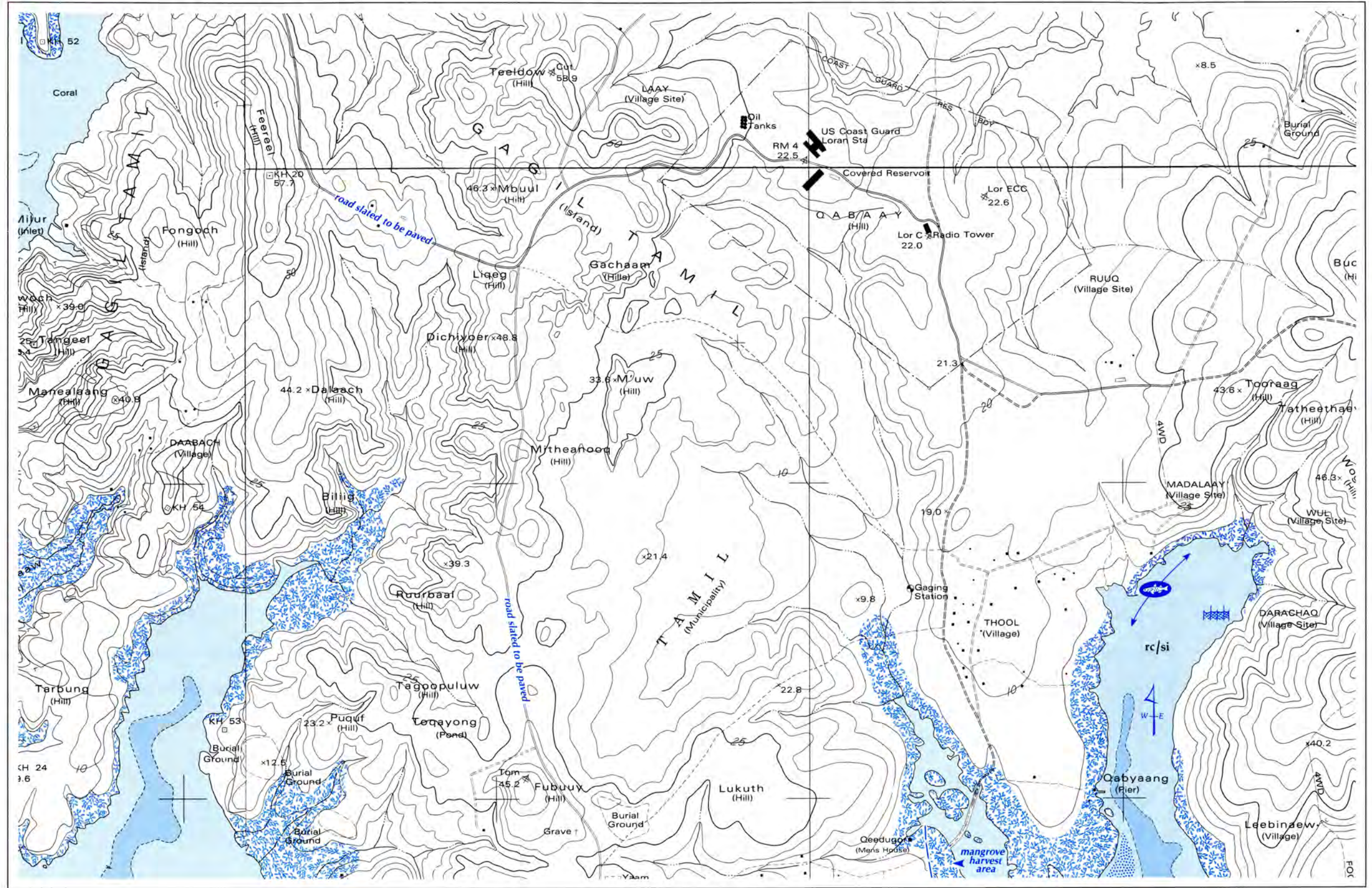
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- bc — Concrete/cement masonry seawall and shoreline
- sb — White sand beach of predominately calcareous material

## VEGETATION COVER

- ag — Algae bed
- Mangrove Forest
- Seagrass Bed

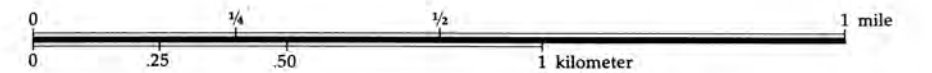
## Other Symbols

- Navigational Marker
- Shipwreck
- Observed Range of Species
- Reef Terrace
- Potential Development Site

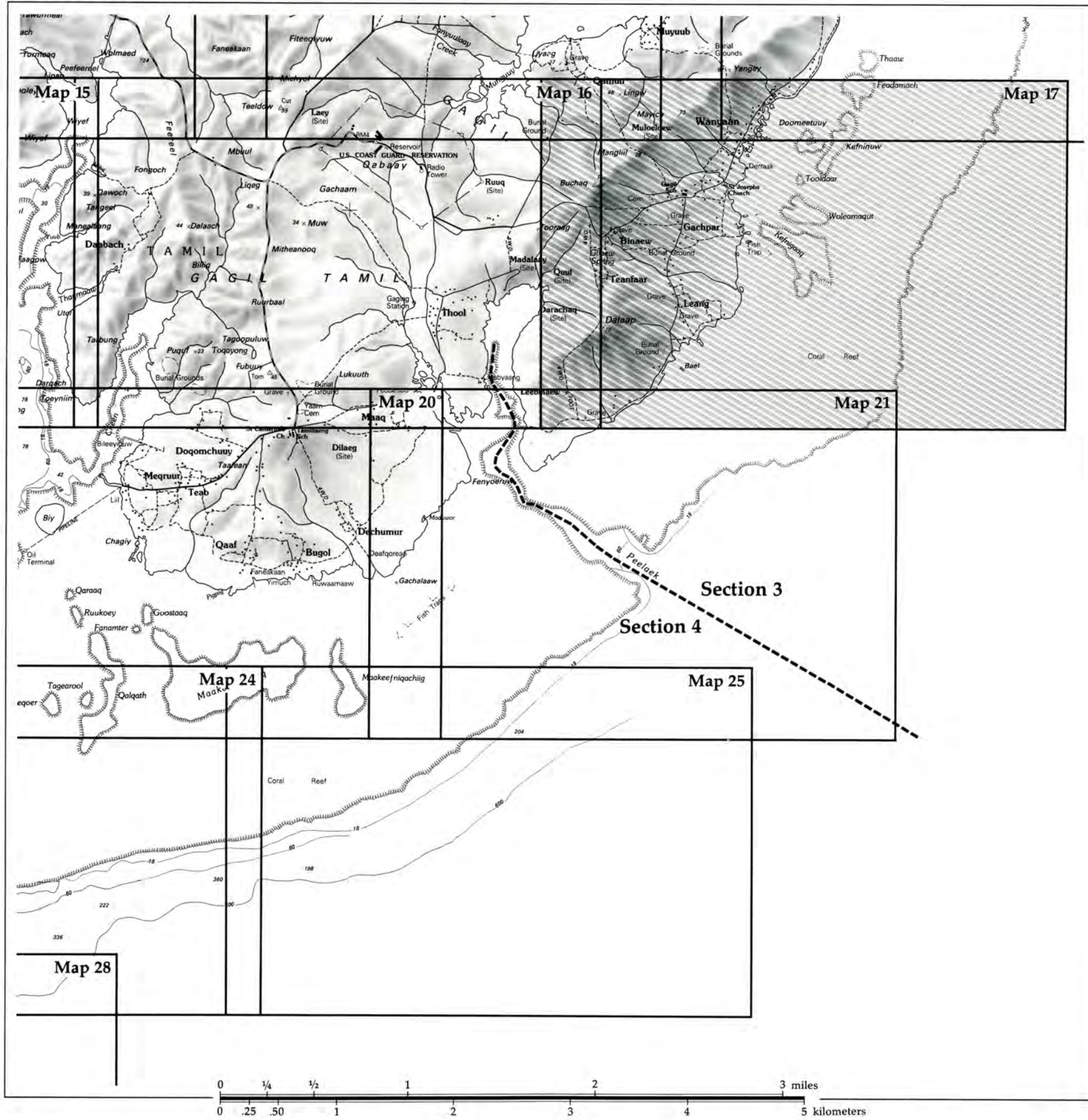


## Field Stations

- |                          |                        |
|--------------------------|------------------------|
| YCRI Station, 1987       | UOG-45 Station, 1978   |
| WRRC-14-10 Station, 1980 | UOG-46 Station, 1978   |
| WRRC-16-1 Station, 1980  | UOG-78-4 Station, 1982 |
| WERI Station, 1982       | UOG-35 Station, 1977   |



# Reference Map 7



## Coastal Resources

### PELAGIC FISH

- Dogtooth Tuna — Yasul
- Tuna — Tuguw
- Flying Fish — Goeg
- Wahoo — Malchath
- Dolphinfish — Dabaar

### INVERTEBRATES

- Sea Cucumber — L'ugul
- Octopus — K'aay
- Lobster — Qaraangoey
- Mangrove Crab — Qamaang
- Land Crab — Galip
- Swimming Crab — Qurich
- Clam — Faasuw, Tow
- Mud Clam — Yungwol
- Topshell (*trochus*) — Yogyog
- Freshwater Shrimp — Ganeef
- Sea Turtle Capture Area — Weel
- Sea Turtle Feeding Area — Qey

### OTHER SYMBOLS

- Sand Dredging Area
- Stone Fish Trap — Qech
- Non-Stone Fish Trap — Yanup, Saagel
- Archaeological Site

### REEF FISH

- Grouper — SmaaK'uw, K'uw
- Parrotfish — Qelbad, Qalaabal, Malngoed, Quchwaq, Gamaygul
- Surgeonfish — Quum, Maath, Machagwog, Bilaew
- Mullet — Quloch, Galaed
- Squirrelfish, Soldierfish — Yooch
- Rabbitfish — Dayit, Garmiy, Buywod, Darryy, Limreq
- Goatfish — Manguch, Mbing, Soong
- Rainbow Runner, Fusilier — Thilbuw, Foofof
- Jack — Ngool, M'uul, Qelqel
- Bream — Qutun, Wachaqmal
- Emperor — Wul', Qoeyeq, Gadgad
- Angelfish — Qeer, Buloch
- Wrasse — Numean
- Stickfish, Needlefish — Buuy
- Triggerfish — Wuuq, Moelngith, Nguuf
- Milkfish — Guuguw, Tangir
- Rudderfish — Guumiy
- Eel — Looth
- Baitfish — Saadiin, Faakeayaan', Liyeq, Qachwog, Qanger, Malmeq
- Barracuda — Maal'
- Snapper — Gadaw, Gooychaaf

# Bottom Type and Land Cover Classification

## OFFSHORE

### Sediment

- sc — Sand bottom in water depths less than 10 meters
- sd — Sand bottom in water depths greater than 10 meters
- si — Silt



### Reef Complex

- rc — Mixed bottom types consisting of reef rock (limestone) associated with shallow reef formations
- rcl — Consolidated limestone, lacking sediment
- rclp — Consolidated limestone with a smooth, pavement-like surface
- rclsc — Mostly consolidated limestone with some (25-50%) sediment bottom
- rs — Complex reef bottom type consisting mostly of sand, but with some limestone outcrops or boulders
- co — Areas of greater than 50% live coral cover






## SHORELINE

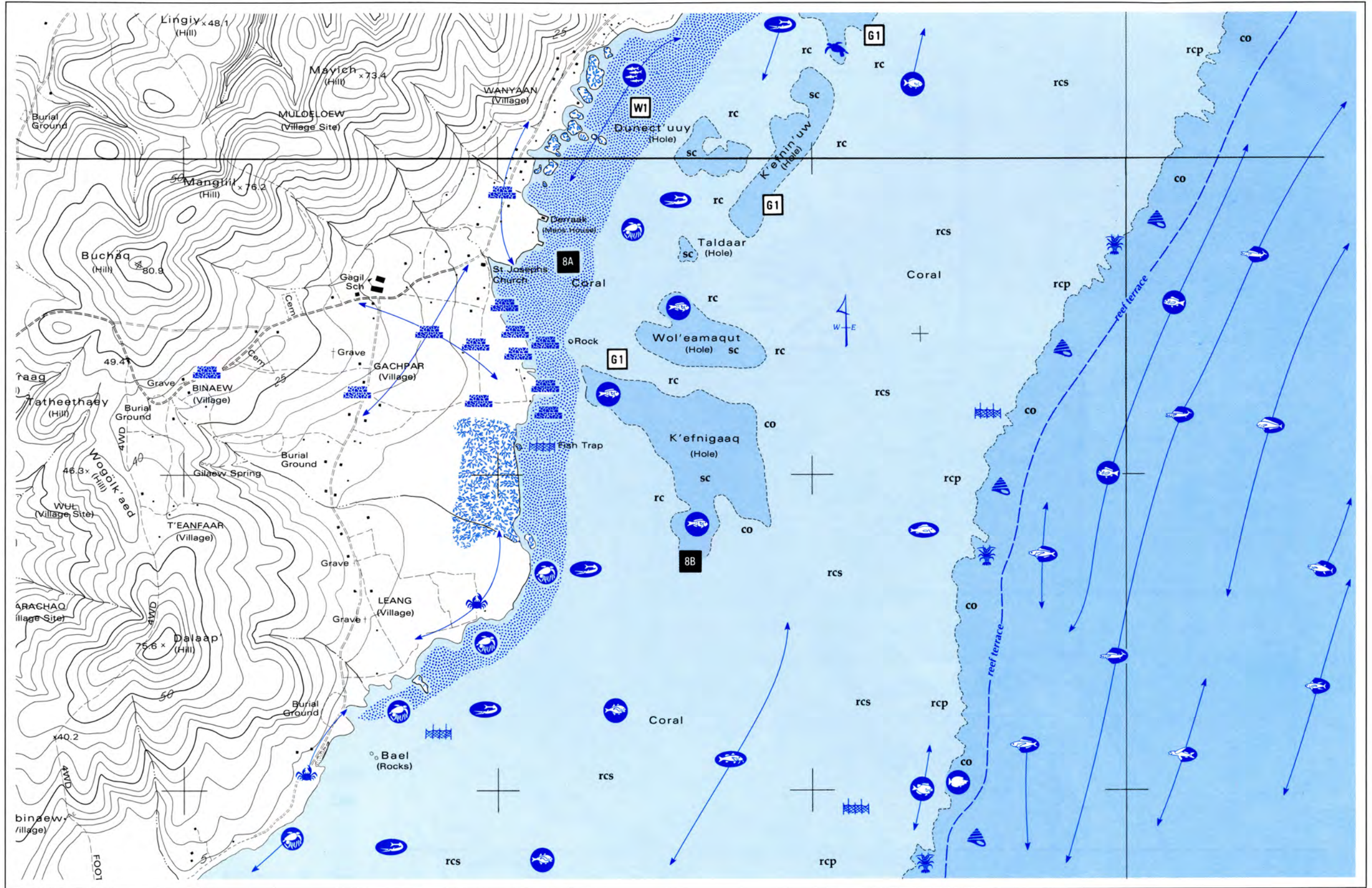
- bb — Man-made boulder shoreline
- bc — Concrete/cement masonry seawall and shoreline
- sb — White sand beach of predominately calcareous material

## VEGETATION COVER









- ag — Algae bed
-  Mangrove Forest
-  Seagrass Bed

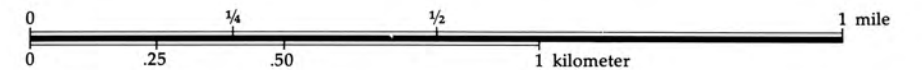
## Other Symbols

-  Navigational Marker
-  Shipwreck
-  Observed Range of Species
-  Reef Terrace
-  Potential Development Site

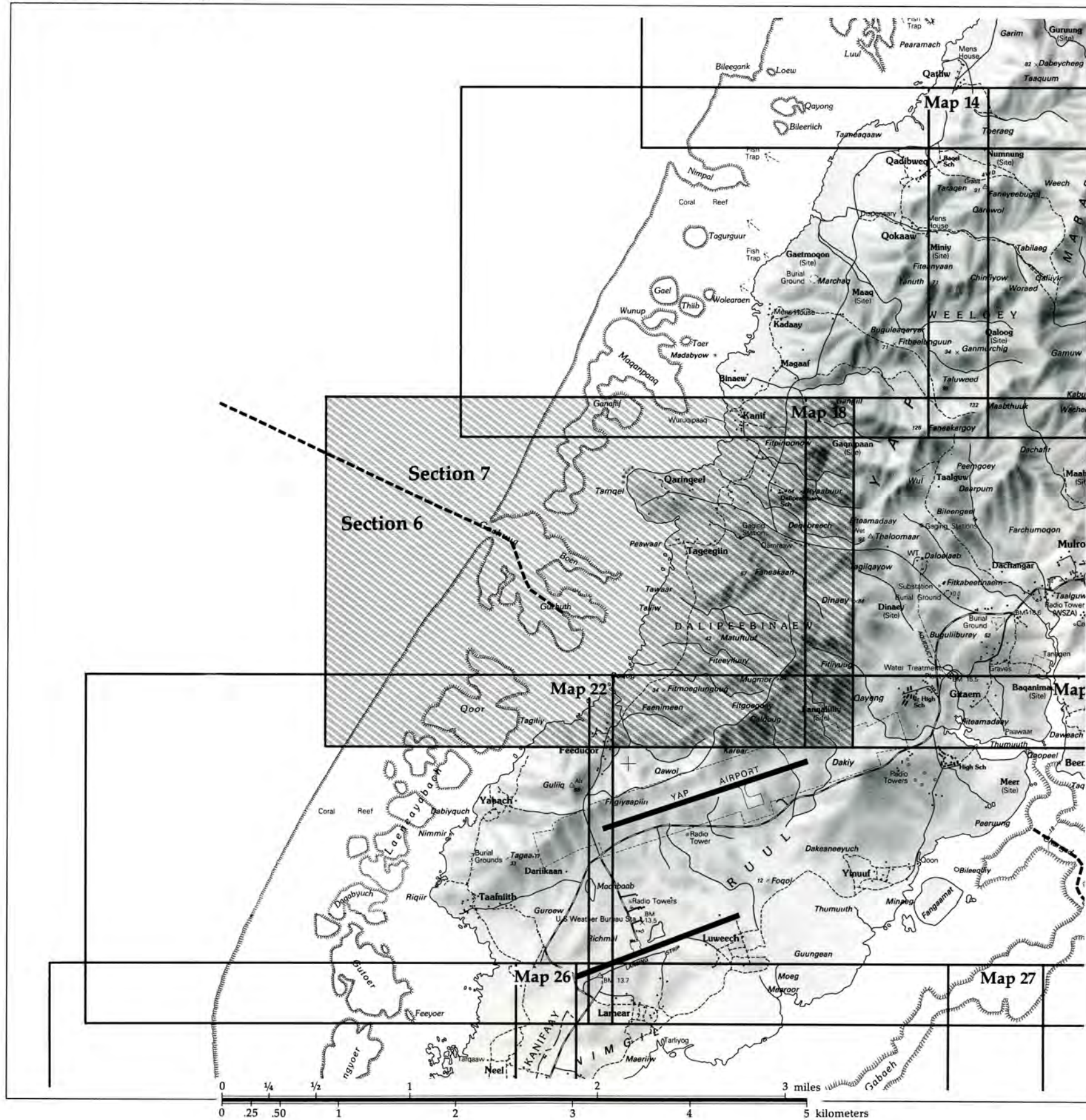


## Field Stations

- |   |   |
|---|---|
|  53 YCRI Station, 1987       |  G1 UOG-45 Station, 1978   |
|  W1 WRRC-14-10 Station, 1980 |  G2 UOG-46 Station, 1978   |
|  W2 WRRC-16-1 Station, 1980  |  G3 UOG-78-4 Station, 1982 |
|  W3 WERI Station, 1982       |  G4 UOG-35 Station, 1977   |



Reference Map 5



Coastal Resources





PELAGIC FISH

-  Dogtooth Tuna — Yasul
-  Tuna — Tuguw
-  Flying Fish — Goeg
-  Wahoo — Malchath
-  Dolphinfish — Dabaar

INVERTEBRATES

-  Sea Cucumber — L'ugul
-  Octopus — K'aay
-  Lobster — Qaraangoey
-  Mangrove Crab — Qamaang
-  Land Crab — Galip
-  Swimming Crab — Qurich
-  Clam — Faasuw, Tow
-  Mud Clam — Yungwol
-  Topshell (*trochus*) — Yogyog
-  Freshwater Shrimp — Ganeef
-  Sea Turtle Capture Area — Weel
-  Sea Turtle Feeding Area — Qey

OTHER SYMBOLS

-  Sand Dredging Area
-  Stone Fish Trap — Qech
-  Non-Stone Fish Trap — Yanup, Saagel
-  Archaeological Site

REEF FISH

-  Grouper — Smaak'uw, K'uw
-  Parrotfish — Qelbad, Qalaabal, Malngoed, Quchwaq, Gamaygul
-  Surgeonfish — Quum, Maath, Machagwog, Bilaew
-  Mullet — Quloch, Galaed
-  Squirrelfish, Soldierfish — Yooch
-  Rabbitfish — Dayit, Garmiy, Buywod, Darruy, Limreq
-  Goatfish — Manguch, Mbing, Soong
-  Rainbow Runner, Fusilier — Thilbuw, Fofow
-  Jack — Ngool, M'uul, Qelqel
-  Bream — Qutun, Wachaqmal
-  Emperor — Wul', Qoeyeq, Gadgad
-  Angelfish — Qeer, Buloch
-  Wrasse — Numean
-  Stickfish, Needlefish — Buuy
-  Triggerfish — Wuuq, Moelngith, Nguuf
-  Milkfish — Guuguw, Tangir
-  Rudderfish — Guumiy
-  Eel — Looth
-  Baitfish — Saadiin, Faakeayaan', Liyeq, Qachwog, Qanger, Malmeq
-  Barracuda — Maal'
-  Snapper — Gadaw, Gooychaaf

# Bottom Type and Land Cover Classification

Map 18

## OFFSHORE

### Sediment

- sc — Sand bottom in water depths less than 10 meters
- sd — Sand bottom in water depths greater than 10 meters
- si — Silt



### Reef Complex

- rc — Mixed bottom types consisting of reef rock (limestone) associated with shallow reef formations
- rc1 — Consolidated limestone, lacking sediment
- rcp — Consolidated limestone with a smooth, pavement-like surface
- rsc — Mostly consolidated limestone with some (25-50%) sediment bottom
- rs — Complex reef bottom type consisting mostly of sand, but with some limestone outcrops or boulders
- co — Areas of greater than 50% live coral cover






## SHORELINE

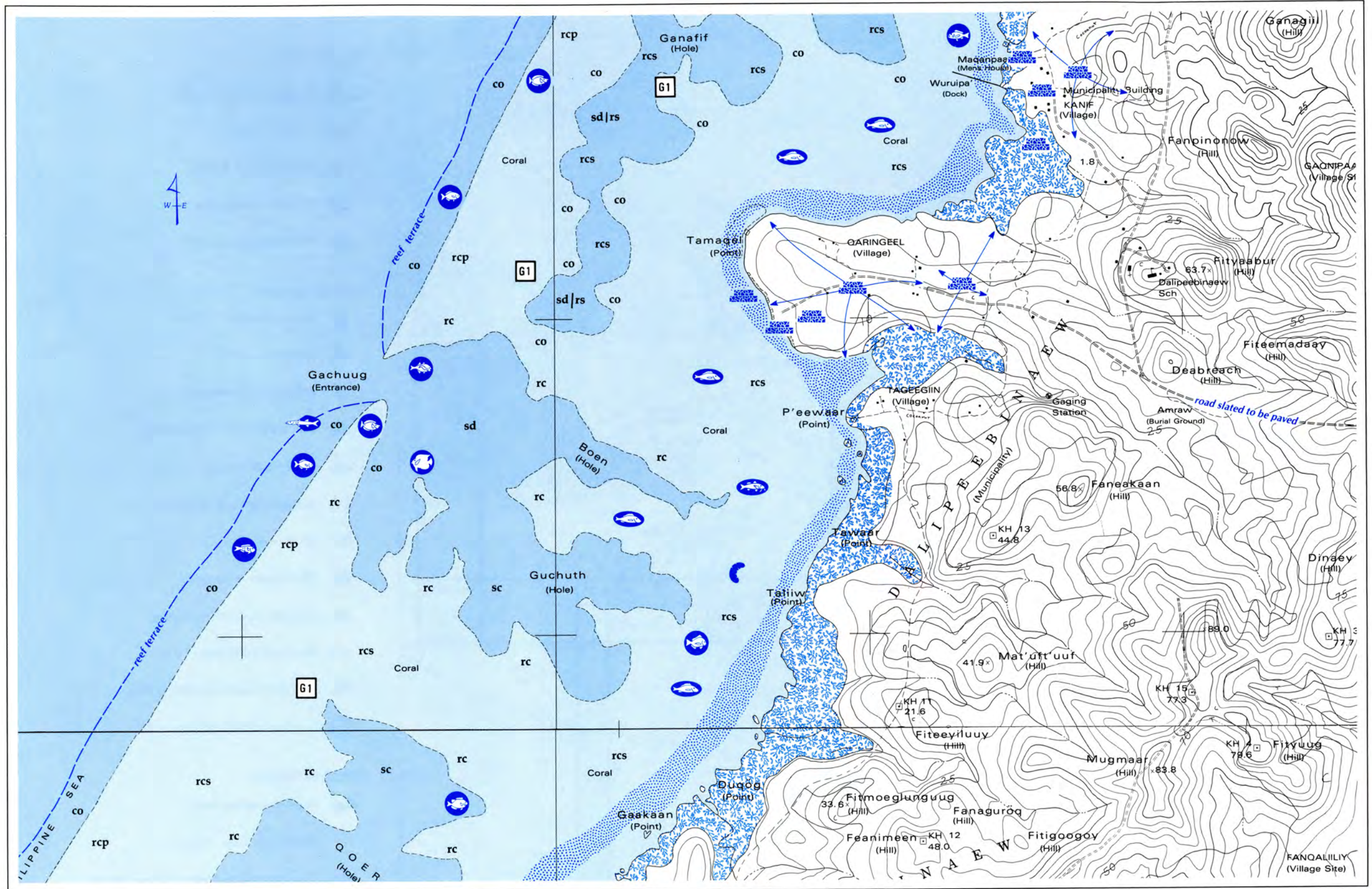
- bb — Man-made boulder shoreline
- bc — Concrete/cement masonry seawall and shoreline
- sb — White sand beach of predominately calcareous material

## VEGETATION COVER









- ag — Algae bed
-  Mangrove Forest
-  Seagrass Bed

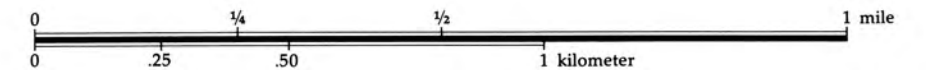
## Other Symbols

-  Navigational Marker
-  Shipwreck
-  Observed Range of Species
-  Reef Terrace
-  Potential Development Site



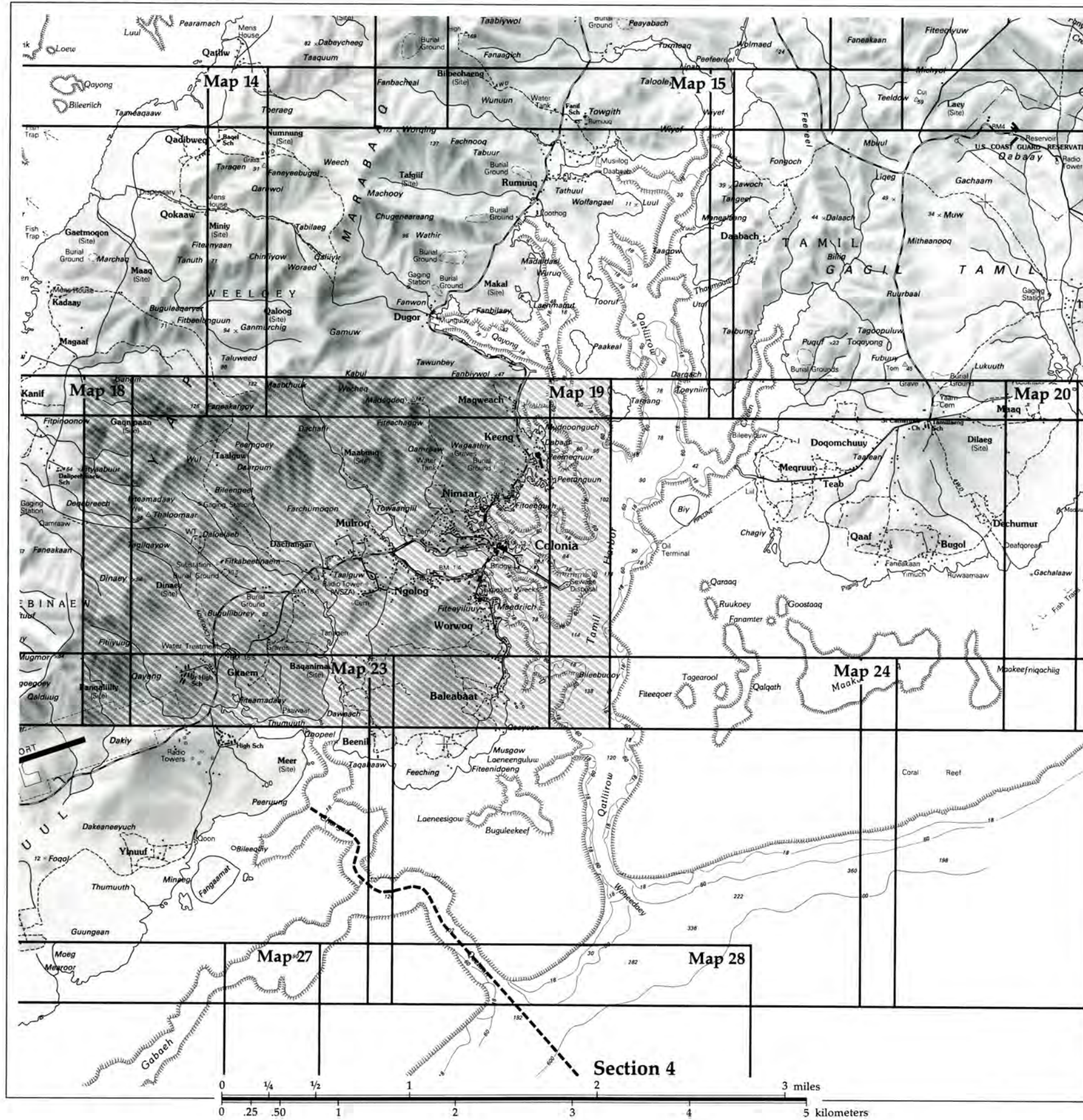
## Field Stations

- |  |  |
|--|--|
|  YCRI Station, 1987       |  UOG—45 Station, 1978   |
|  WRRC—14-10 Station, 1980 |  UOG—46 Station, 1978   |
|  WRRC—16-1 Station, 1980  |  UOG—78-4 Station, 1982 |
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# Reference Map 6



## Coastal Resources





### PELAGIC FISH

-  Dogtooth Tuna — Yasul
-  Tuna — Tuguw
-  Flying Fish — Goeg
-  Wahoo — Malchath
-  Dolphinfish — Dabaar

### INVERTEBRATES

-  Sea Cucumber — L'ugul
-  Octopus — K'aay
-  Lobster — Qaraangoey
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-  Swimming Crab — Qurich
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-  Topshell (*trochus*) — Yogyog
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-  Sea Turtle Capture Area — Weel
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### OTHER SYMBOLS

-  Sand Dredging Area
-  Stone Fish Trap — Qech
-  Non-Stone Fish Trap — Yanup, Saagel
-  Archaeological Site

### REEF FISH

-  Grouper — SmaaK'uw, K'uw
-  Parrotfish — Qelbad, Qalaabal, Malngoed, Quchwaq, Gamaygul
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-  Rudderfish — Guumiy
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-  Barracuda — Maal'
-  Snapper — Gadaw, Gooychaaf

# Bottom Type and Land Cover Classification

## OFFSHORE

### Sediment

- sc — Sand bottom in water depths less than 10 meters
- sd — Sand bottom in water depths greater than 10 meters
- si — Silt



### Reef Complex

- rc — Mixed bottom types consisting of reef rock (limestone) associated with shallow reef formations
- rcl — Consolidated limestone, lacking sediment
- rcp — Consolidated limestone with a smooth, pavement-like surface
- rcs — Mostly consolidated limestone with some (25-50%) sediment bottom
- rs — Complex reef bottom type consisting mostly of sand, but with some limestone outcrops or boulders
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## SHORELINE

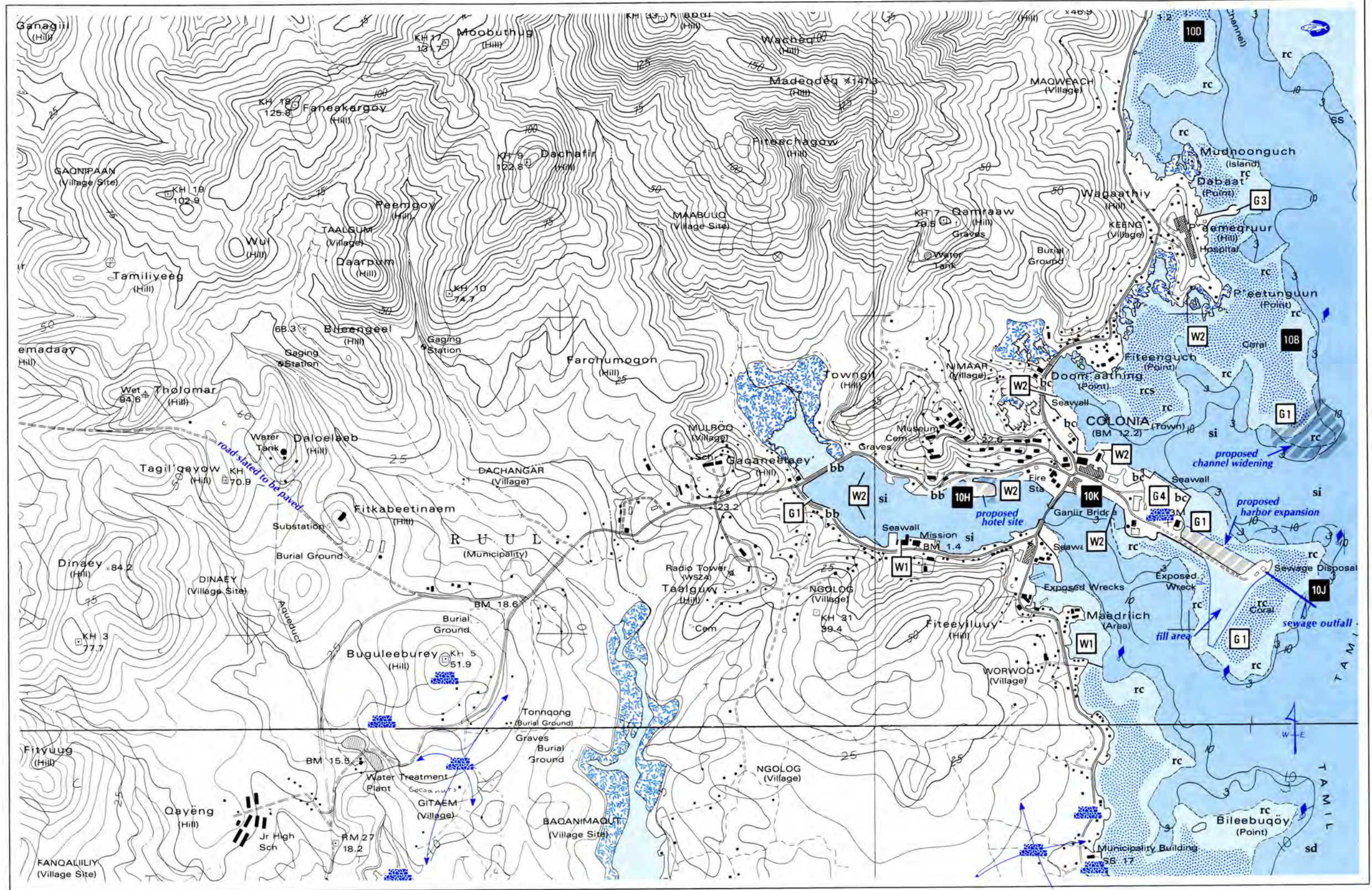
- bb — Man-made boulder shoreline
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## VEGETATION COVER









- ag — Algae bed
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-  Seagrass Bed

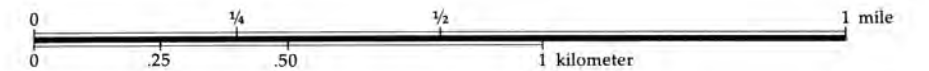
## Other Symbols

-  Navigational Marker
-  Shipwreck
-  Observed Range of Species
-  Reef Terrace
-  Potential Development Site

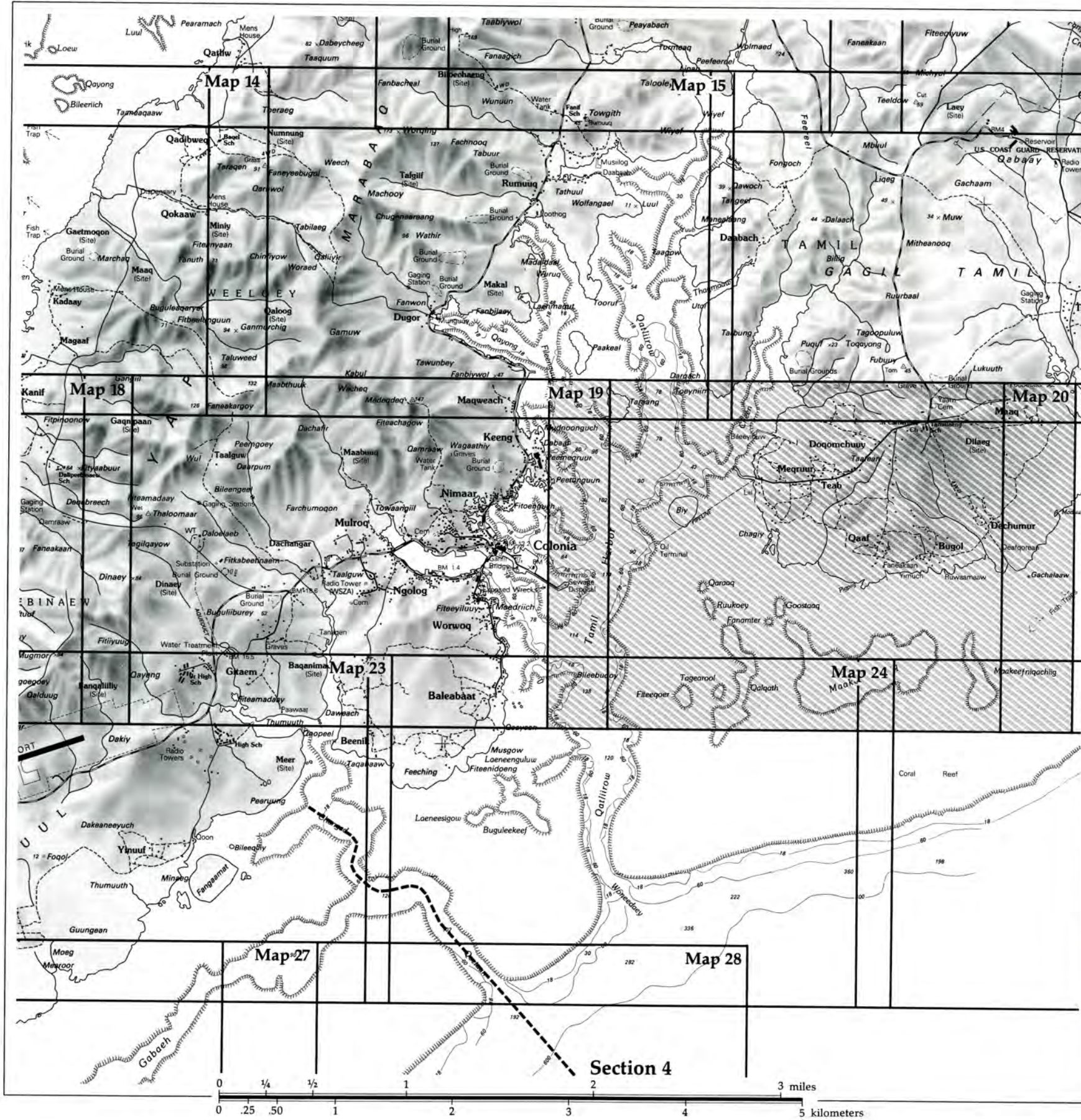


## Field Stations

- |  |  |
|--|--|
|  YCRI Station, 1987       |  UOG-45 Station, 1978   |
|  WRRC-14-10 Station, 1980 |  UOG-46 Station, 1978   |
|  WRRC-16-1 Station, 1980  |  UOG-78-4 Station, 1982 |
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# Reference Map 6



## Coastal Resources





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-  Flying Fish — Goeg
-  Wahoo — Malchath
-  Dolphinfish — Dabaar

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-  Octopus — K'aay
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### OTHER SYMBOLS

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# Bottom Type and Land Cover Classification

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**Sediment**

- sc — Sand bottom in water depths less than 10 meters
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**SHORELINE**

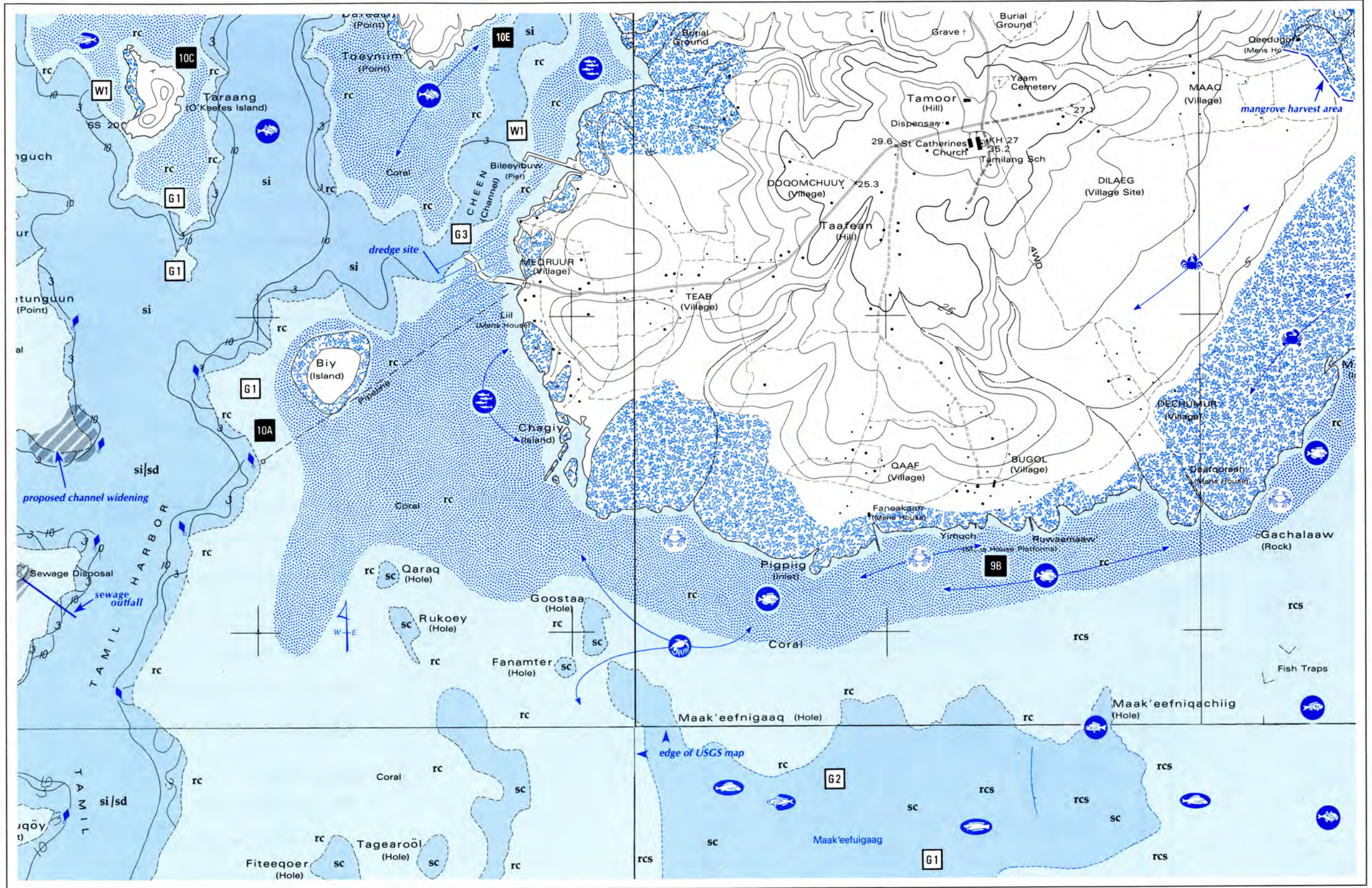
- bb — Man-made boulder shoreline
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**VEGETATION COVER**

- ag — Algae bed
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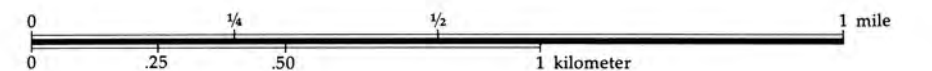
**Other Symbols**

- Navigational Marker
- Shipwreck
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- Reef Terrace
- Potential Development Site

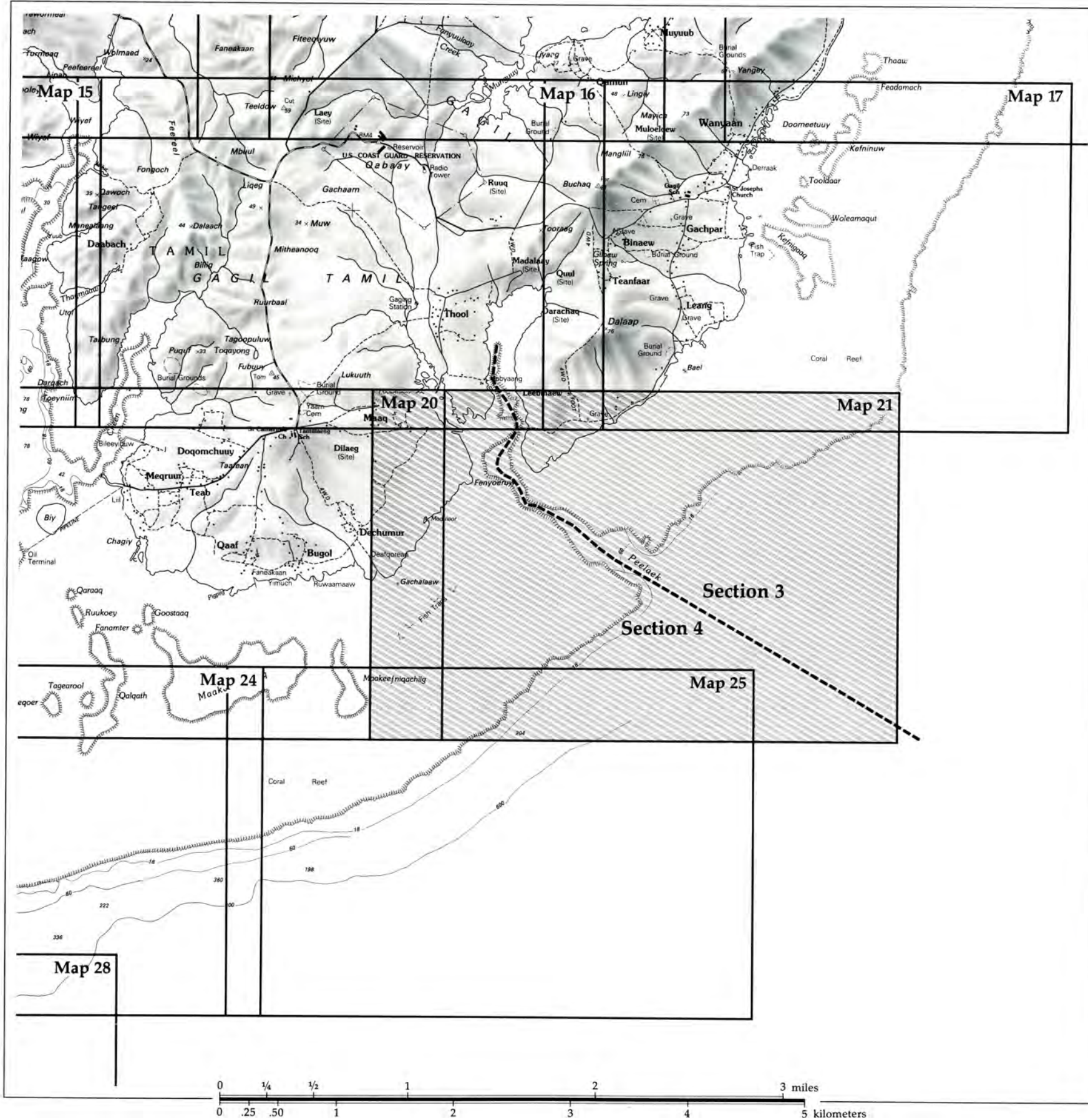


**Field Stations**

- |                             |                           |
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# Reference Map 7



## Coastal Resources

### PELAGIC FISH

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- Dolphinfish — Dabaar

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- Topshell (*trochus*) — Yogyog
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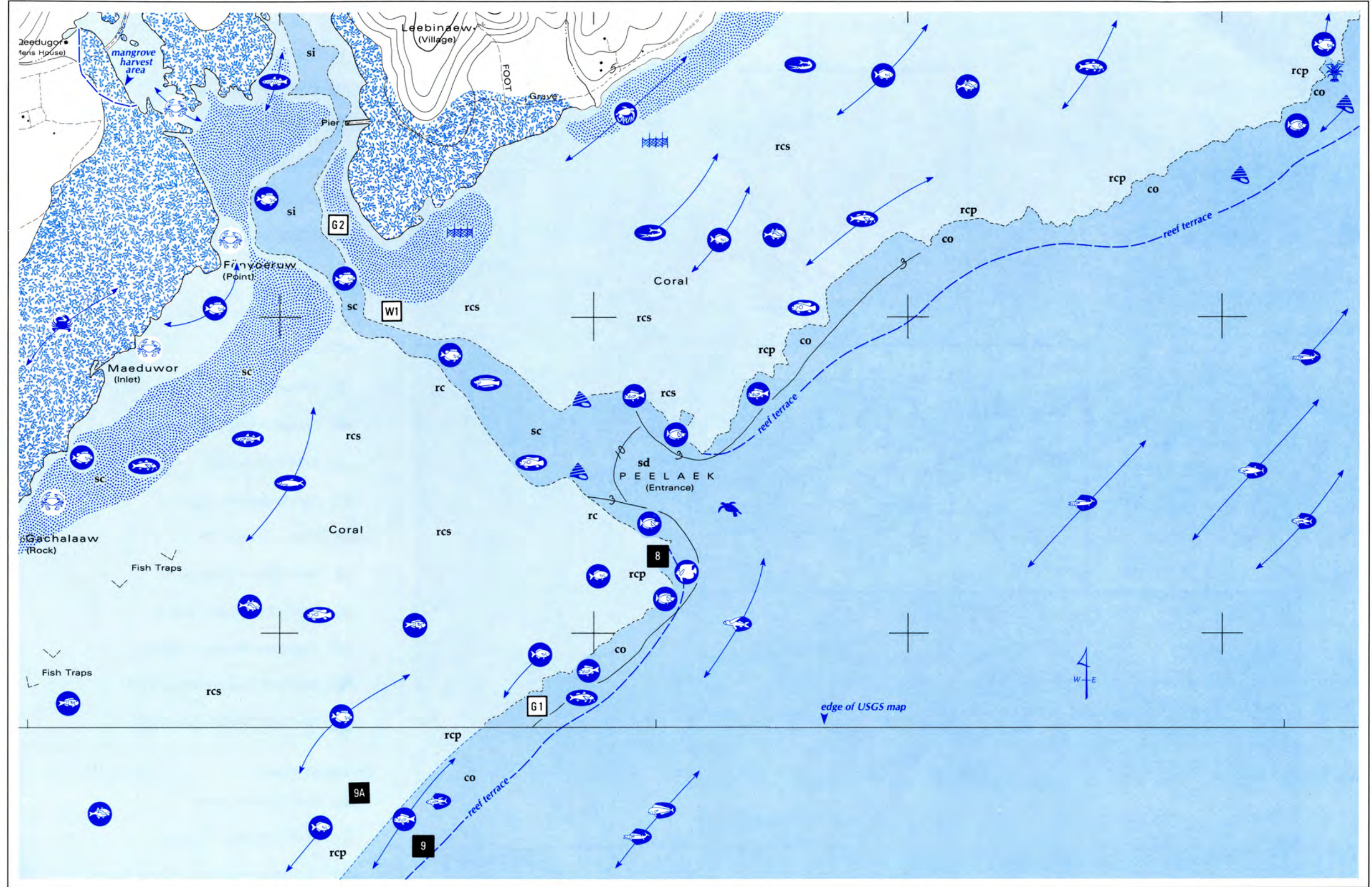
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- Barracuda — Maal'
- Snapper — Gadaw, Gooychaaf

# Bottom Type and Land Cover Classification

Map 21

- OFFSHORE**
- Sediment**
- sc — Sand bottom in water depths less than 10 meters
  - sd — Sand bottom in water depths greater than 10 meters
  - si — Silt
- Reef Complex**
- rc — Mixed bottom types consisting of reef rock (limestone) associated with shallow reef formations
  - rcl — Consolidated limestone, lacking sediment
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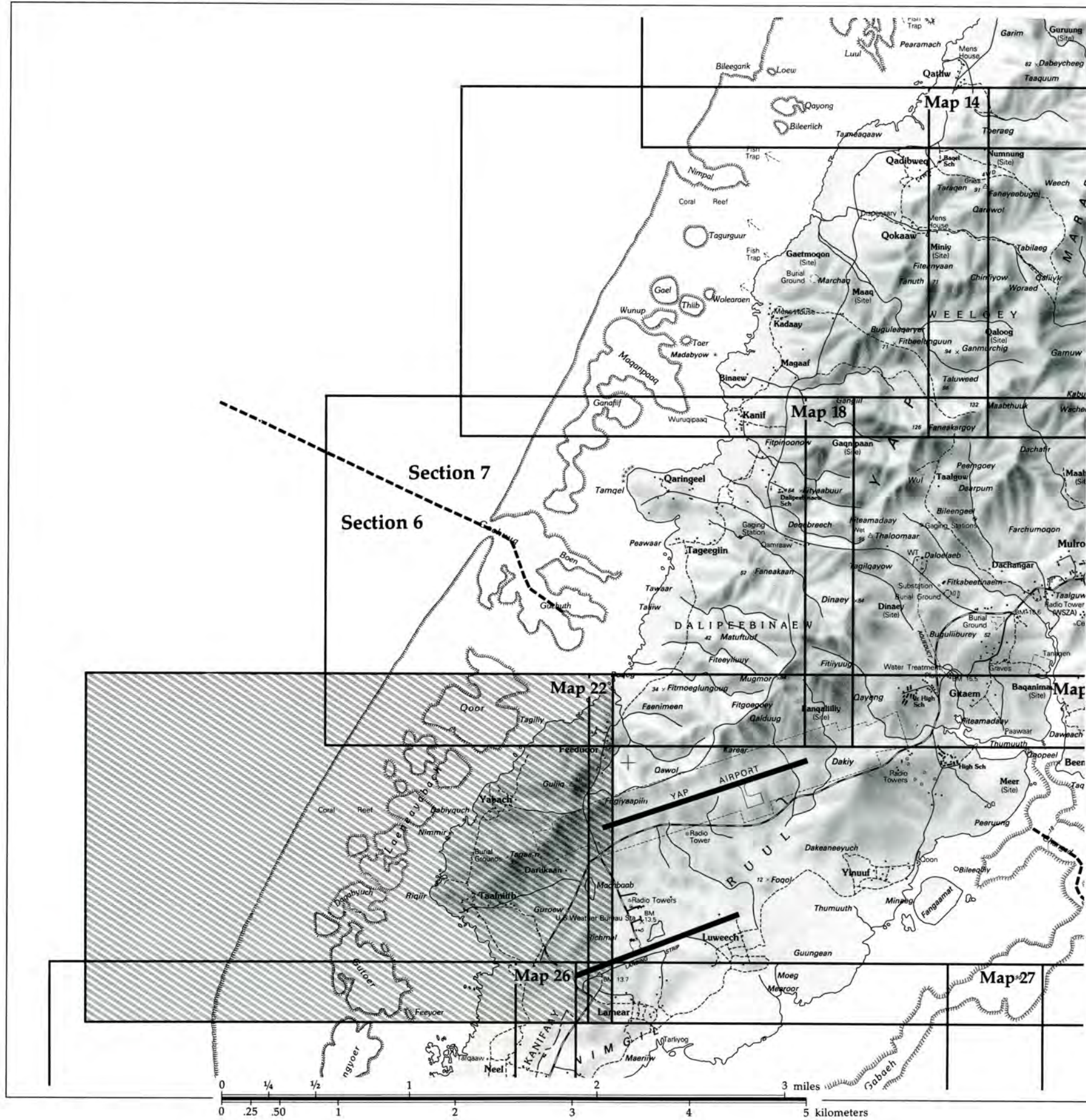


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- |                            |                           |
|----------------------------|---------------------------|
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| W2 WRR-16-1 Station, 1980  | G3 UOG-78-4 Station, 1982 |
| W3 WERI Station, 1982      | G4 UOG-35 Station, 1977   |



# Reference Map 5



## Coastal Resources





### PELAGIC FISH

-  Dogtooth Tuna — Yasul
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-  Dolphinfish — Dabaar

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-  Mangrove Crab — Qamaang
-  Land Crab — Galip
-  Swimming Crab — Qurich
-  Clam — Faasuw, Tow
-  Mud Clam — Yungwol
-  Topshell (*trochus*) — Yogyog
-  Freshwater Shrimp — Ganeef
-  Sea Turtle Capture Area — Weel
-  Sea Turtle Feeding Area — Qey

### OTHER SYMBOLS

-  Sand Dredging Area
-  Stone Fish Trap — Qech
-  Non-Stone Fish Trap — Yanup, Saagel
-  Archaeological Site

### REEF FISH

-  Grouper — SmaaK'uw, K'uw
-  Parrotfish — Qelbad, Qalaabal, Malngoed, Quchwaq, Gamaygul
-  Surgeonfish — Quum, Maath, Machagwog, Bilaew
-  Mullet — Quloch, Galaed
-  Squirrelfish, Soldierfish — Yooch
-  Rabbitfish — Dayit, Garmiy, Buywod, Darruy, Limreq
-  Goatfish — Manguch, Mbing, Soong
-  Rainbow Runner, Fusilier — Thilbuw, Foofow
-  Jack — Ngool, M'uul, Qelqel
-  Bream — Qutun, Wachaqmal
-  Emperor — Wul', Qoeyeq, Gadgad
-  Angelfish — Qeer, Buloch
-  Wrasse — Numean
-  Stickfish, Needlefish — Buuy
-  Triggerfish — Wuuq, Moelngith, Nguuf
-  Milkfish — Guuguw, Tangir
-  Rudderfish — Guumi
-  Eel — Looth
-  Baitfish — Saadiin, Faakeyaan', Liyeq, Qachwog, Qanger, Malmeq
-  Barracuda — Maal'
-  Snapper — Gadaw, Gooychaaf

# Bottom Type and Land Cover Classification

Map 22

## OFFSHORE

### Sediment

- sc — Sand bottom in water depths less than 10 meters
- sd — Sand bottom in water depths greater than 10 meters
- si — Silt

### Reef Complex

- rc — Mixed bottom types consisting of reef rock (limestone) associated with shallow reef formations
- rcl — Consolidated limestone, lacking sediment
- rcl — Consolidated limestone with a smooth, pavement-like surface
- rcl — Mostly consolidated limestone with some (25-50%) sediment bottom
- rs — Complex reef bottom type consisting mostly of sand, but with some limestone outcrops or boulders
- co — Areas of greater than 50% live coral cover

## SHORELINE

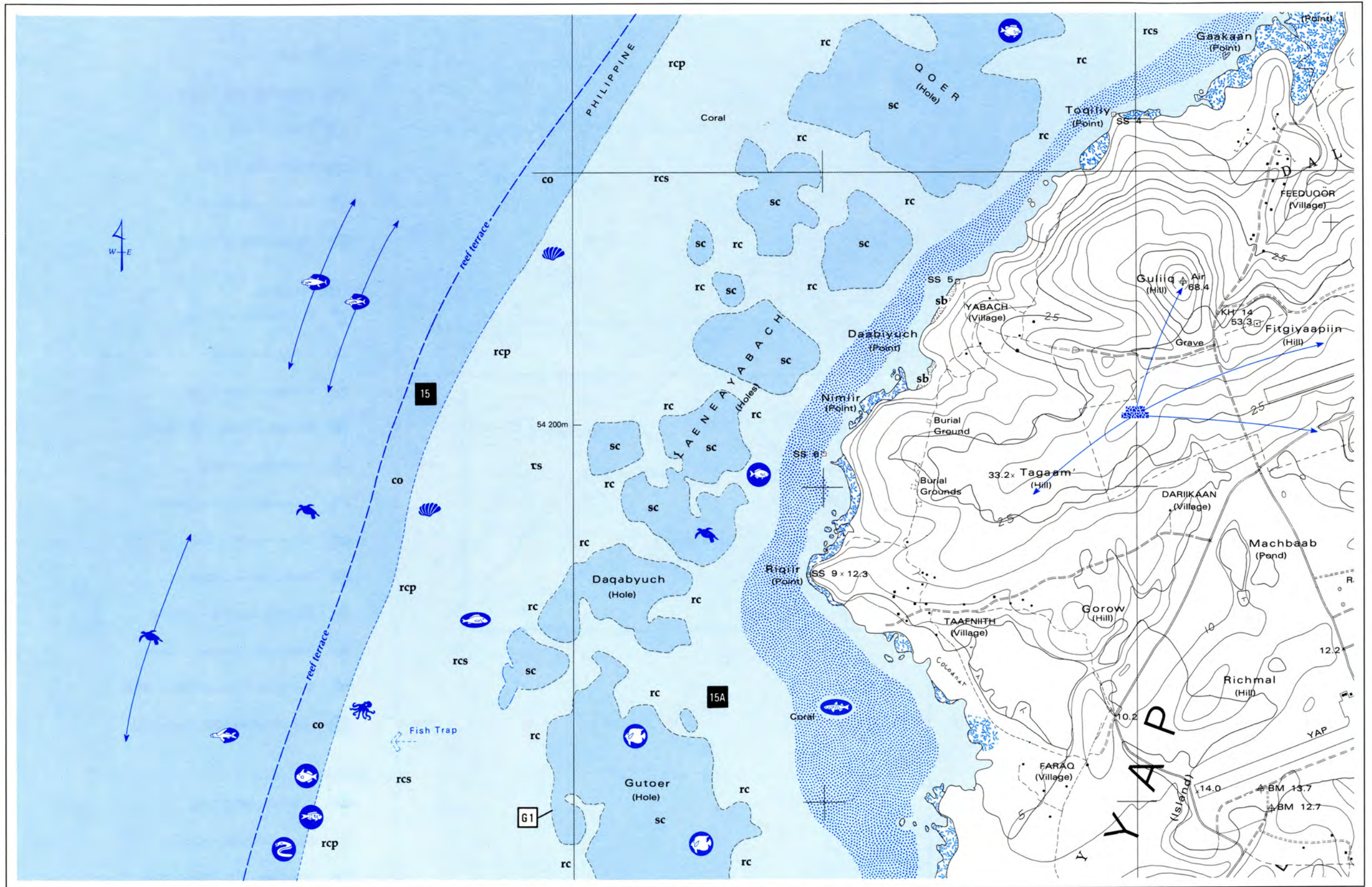
- bb — Man-made boulder shoreline
- bc — Concrete/cement masonry seawall and shoreline
- sb — White sand beach of predominately calcareous material

## VEGETATION COVER

- ag — Algae bed
- Mangrove Forest
- Seagrass Bed

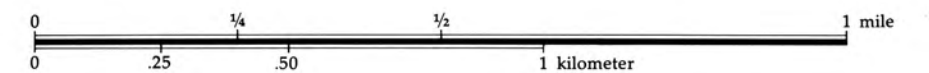
## Other Symbols

- Navigational Marker
- Shipwreck
- Observed Range of Species
- Reef Terrace
- Potential Development Site



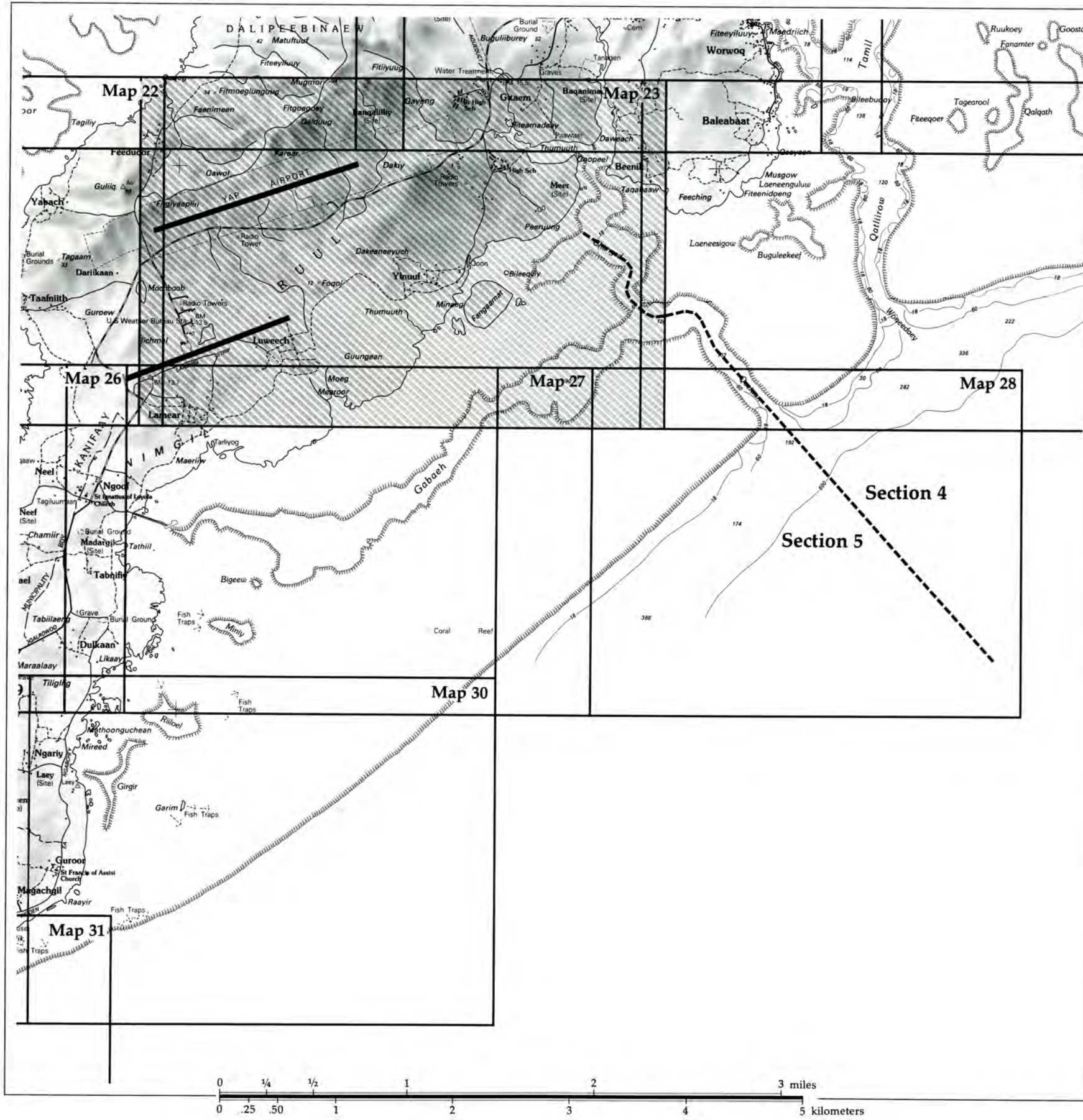
## Field Stations

- |                             |                           |
|-----------------------------|---------------------------|
| 53 YCRI Station, 1987       | G1 UOG-45 Station, 1978   |
| W1 WRRC-14-10 Station, 1980 | G2 UOG-46 Station, 1978   |
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| W3 WERI Station, 1982       | G4 UOG-35 Station, 1977   |





# Reference Map 8



## Coastal Resources

### PELAGIC FISH

- Dogtooth Tuna — Yasul
- Tuna — Tuguw
- Flying Fish — Goeg
- Wahoo — Malchath
- Dolphinfish — Dabaar

### INVERTEBRATES

- Sea Cucumber — L'ugul
- Octopus — K'aay
- Lobster — Qaraangoey
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- Land Crab — Galip
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- Mud Clam — Yungwol
- Topshell (*trochus*) — Yogyog
- Freshwater Shrimp — Ganeef
- Sea Turtle Capture Area — Weel
- Sea Turtle Feeding Area — Qey

### OTHER SYMBOLS

- Sand Dredging Area
- Stone Fish Trap — Qech
- Non-Stone Fish Trap — Yanup, Saagel
- Archaeological Site

### REEF FISH

- Grouper — Smaak'uw, K'uw
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- Jack — Ngool, M'uul, Qelqel
- Bream — Qutun, Wachaqmal
- Emperor — Wul', Qoeyeq, Gadgad
- Angelfish — Qeer, Buloch
- Wrasse — Numean
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- Milkfish — Guuguw, Tangir
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- co — Areas of greater than 50% live coral cover






## SHORELINE

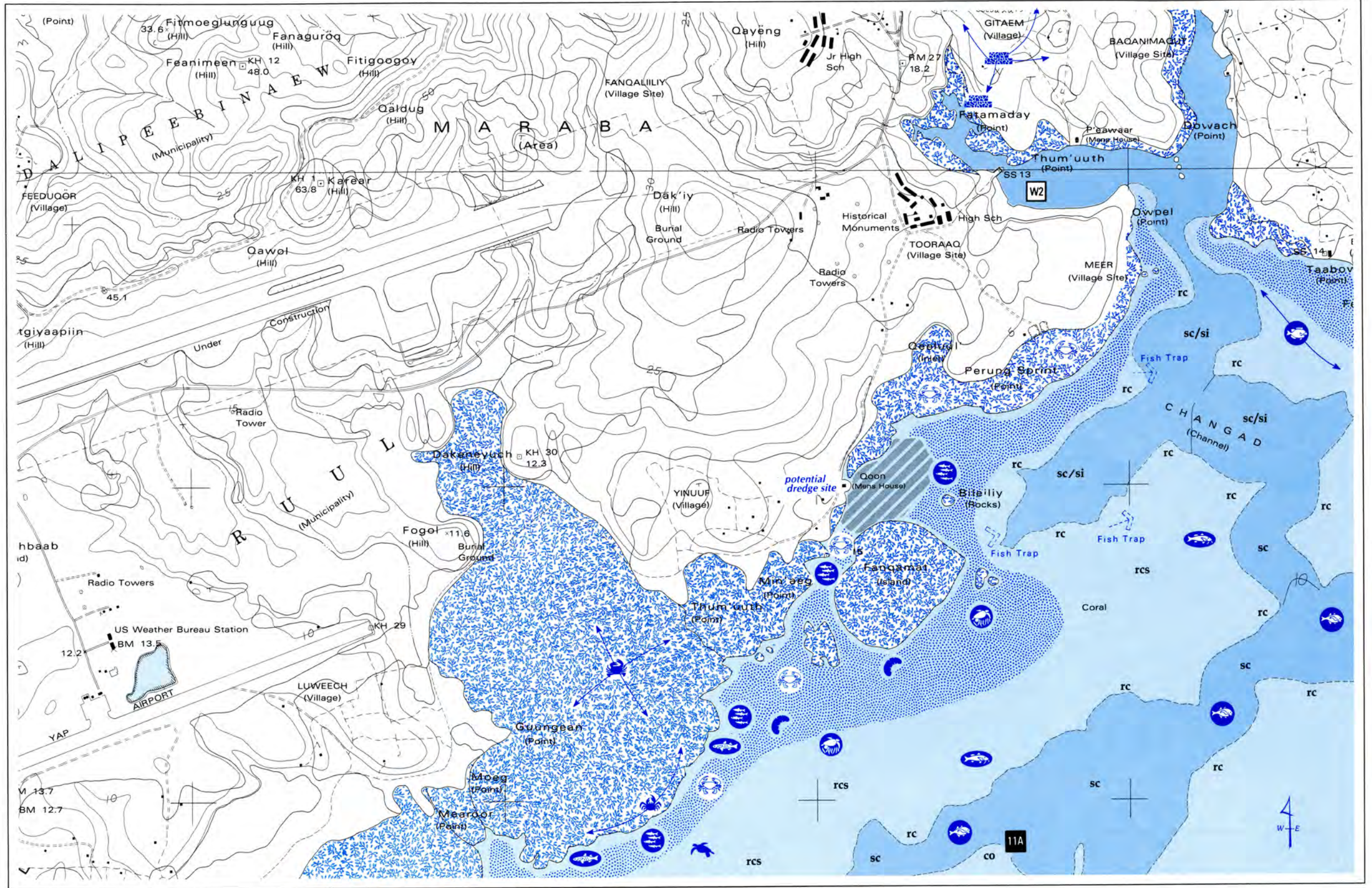
- bb — Man-made boulder shoreline
- bc — Concrete/cement masonry seawall and shoreline
- sb — White sand beach of predominately calcareous material

## VEGETATION COVER









- ag — Algae bed
-  Mangrove Forest
-  Seagrass Bed

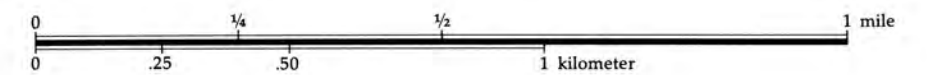
## Other Symbols

-  Navigational Marker
-  Shipwreck
-  Observed Range of Species
-  Reef Terrace
-  Potential Development Site

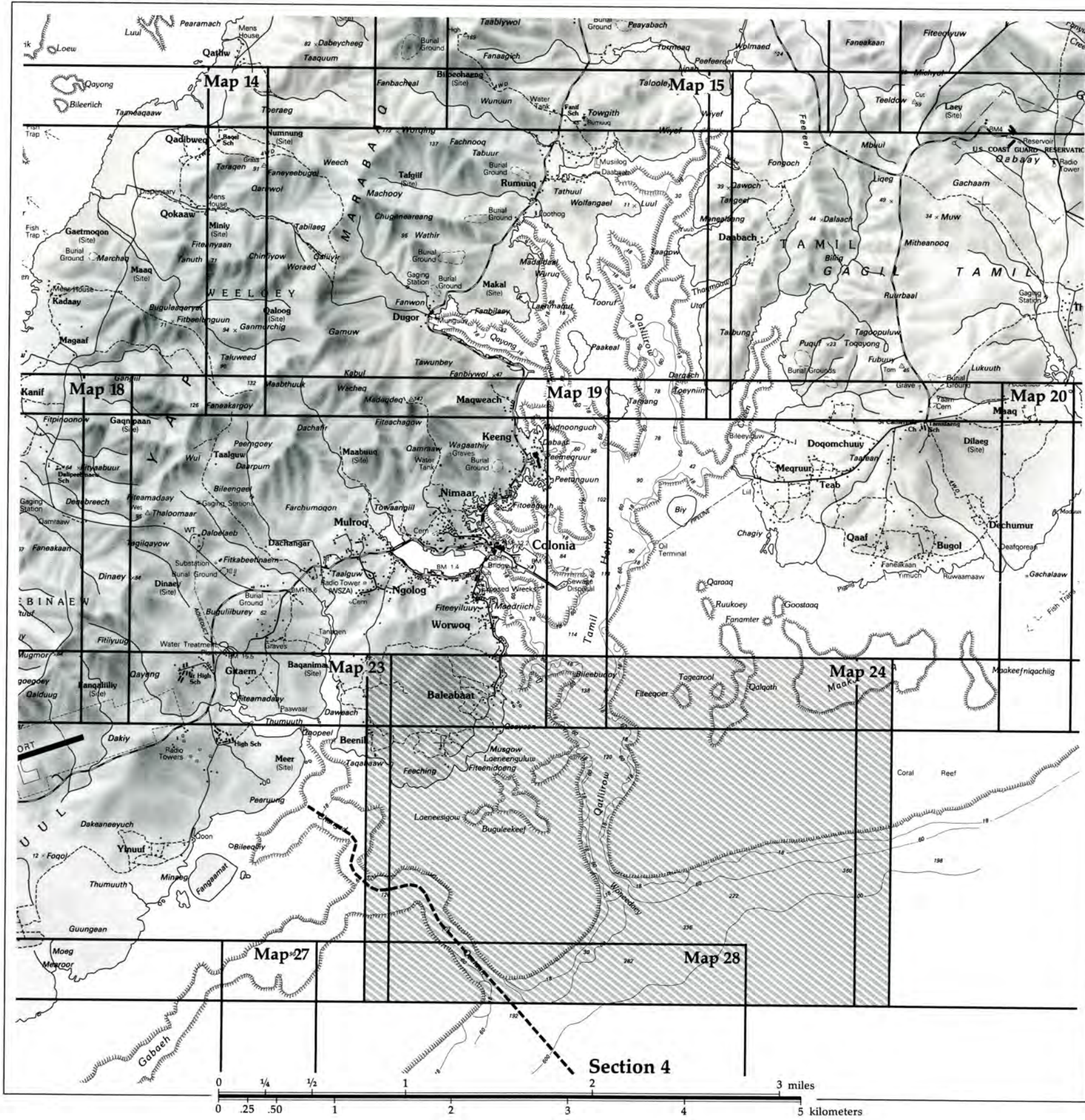


## Field Stations

- |  |   |
|--|---|
|  53 YCRI Station, 1987      |  G1 UOG-45 Station, 1978   |
|  W1 WRR-14-10 Station, 1980 |  G2 UOG-46 Station, 1978   |
|  W2 WRR-16-1 Station, 1980  |  G3 UOG-78-4 Station, 1982 |
|  W3 WERI Station, 1982      |  G4 UOG-35 Station, 1977   |



# Reference Map 6



## Coastal Resources





### PELAGIC FISH

-  Dogtooth Tuna — Yasul
-  Tuna — Tuguw
-  Flying Fish — Goeg
-  Wahoo — Malchath
-  Dolphinfish — Dabaar

### INVERTEBRATES

-  Sea Cucumber — L'ugul
-  Octopus — K'aay
-  Lobster — Qaraangoey
-  Mangrove Crab — Qamaang
-  Land Crab — Galip
-  Swimming Crab — Qurich
-  Clam — Faasuw, Tow
-  Mud Clam — Yungwol
-  Topshell (*trochus*) — Yogyog
-  Freshwater Shrimp — Ganeef
-  Sea Turtle Capture Area — Weel
-  Sea Turtle Feeding Area — Qey

### OTHER SYMBOLS

-  Sand Dredging Area
-  Stone Fish Trap — Qech
-  Non-Stone Fish Trap — Yanup, Saagel
-  Archaeological Site

### REEF FISH

-  Grouper — Smaak'uw, K'uw
-  Parrotfish — Qelbad, Qalaabal, Malngoed, Quchwaq, Gamaygul
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-  Rainbow Runner, Fusilier — Thilbuw, Foofoow
-  Jack — Ngool, M'uul, Qelqel
-  Bream — Qutun, Wachaqmal
-  Emperor — Wul', Qoeyeq, Gadgad
-  Angelfish — Qeer, Buloch
-  Wrasse — Numean
-  Stickfish, Needlefish — Buuy
-  Triggerfish — Wuuq, Moelngith, Nguuf
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-  Rudderfish — Guumiy
-  Eel — Looth
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-  Barracuda — Maal'
-  Snapper — Gadaw, Gooychaaf

# Bottom Type and Land Cover Classification

## OFFSHORE

### Sediment

- sc — Sand bottom in water depths less than 10 meters
- sd — Sand bottom in water depths greater than 10 meters
- si — Silt



### Reef Complex

- rc — Mixed bottom types consisting of reef rock (limestone) associated with shallow reef formations
- rc1 — Consolidated limestone, lacking sediment
- rcp — Consolidated limestone with a smooth, pavement-like surface
- rscs — Mostly consolidated limestone with some (25-50%) sediment bottom
- rs — Complex reef bottom type consisting mostly of sand, but with some limestone outcrops or boulders
- co — Areas of greater than 50% live coral cover






## SHORELINE

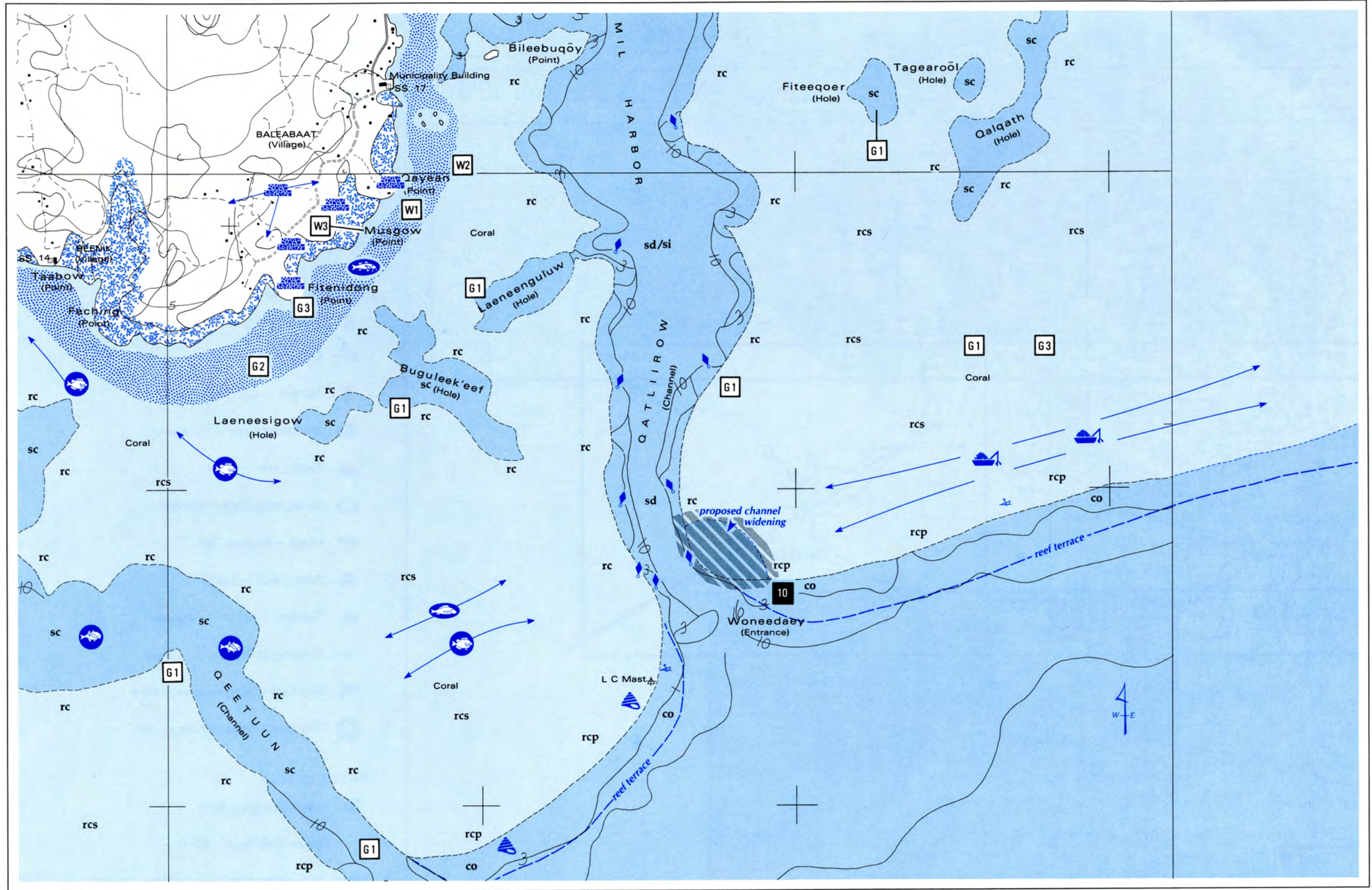
- bb — Man-made boulder shoreline
- bc — Concrete/cement masonry seawall and shoreline
- sb — White sand beach of predominately calcareous material

## VEGETATION COVER









- ag — Algae bed
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-  Seagrass Bed

## Other Symbols

-  Navigational Marker
-  Shipwreck
-  Observed Range of Species
-  Reef Terrace
-  Potential Development Site

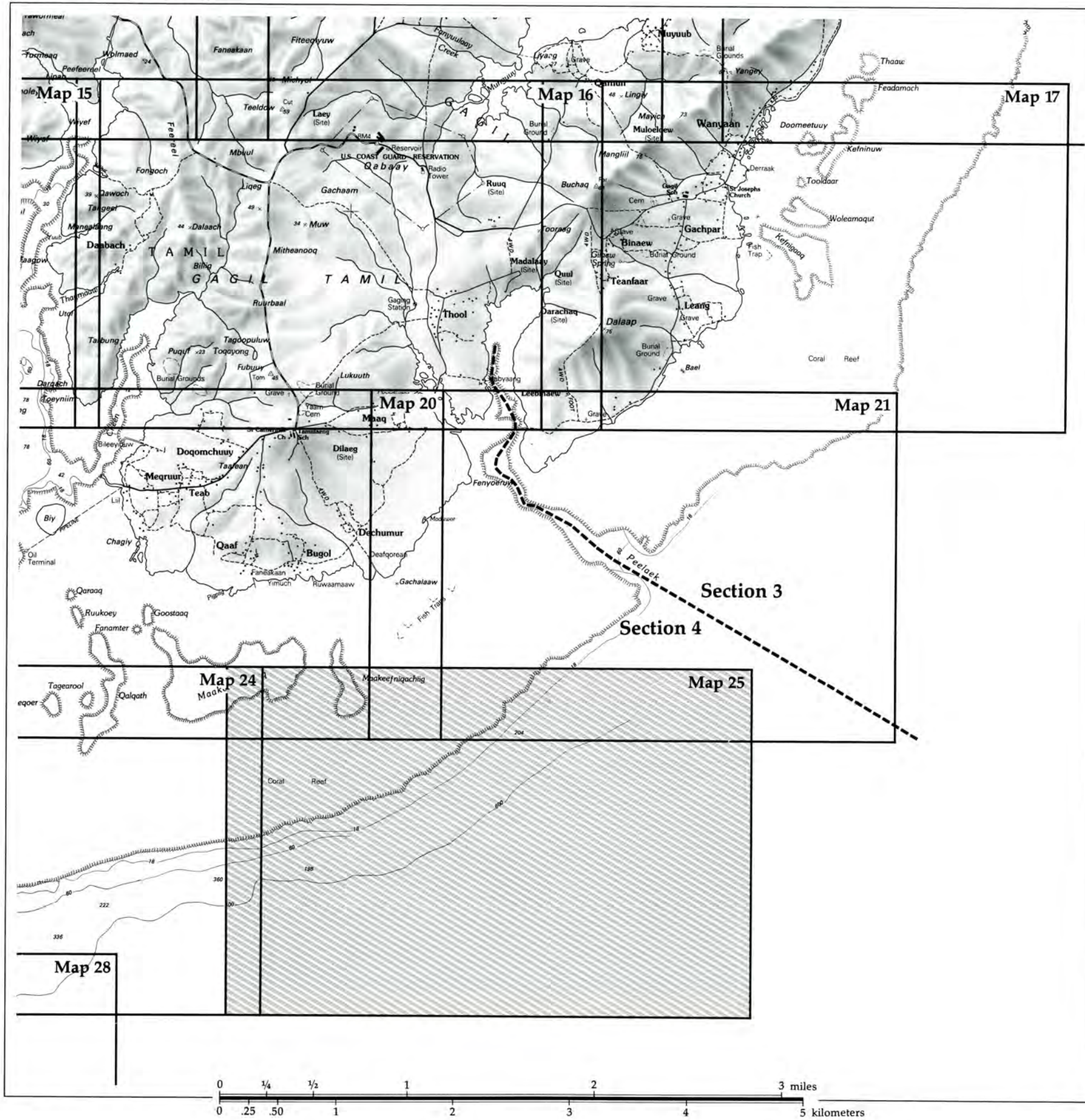


## Field Stations

- |   |  |
|---|--|
|  YCRI Station, 1987      |  UOG-45 Station, 1978   |
|  WRR-14-10 Station, 1980 |  UOG-46 Station, 1978   |
|  WRR-16-1 Station, 1980  |  UOG-78-4 Station, 1982 |
|  WERI Station, 1982      |  UOG-35 Station, 1977   |



# Reference Map 7



## Coastal Resources

### PELAGIC FISH

- Dogtooth Tuna — Yasul
- Tuna — Tuguw
- Flying Fish — Goeg
- Wahoo — Malchath
- Dolphinfish — Dabaar

### INVERTEBRATES

- Sea Cucumber — L'ugul
- Octopus — K'aay
- Lobster — Qaraangoey
- Mangrove Crab — Qamaang
- Land Crab — Galip
- Swimming Crab — Qurich
- Clam — Faasuw, Tow
- Mud Clam — Yungwol
- Topshell (*trochus*) — Yogyog
- Freshwater Shrimp — Ganeef
- Sea Turtle Capture Area — Weel
- Sea Turtle Feeding Area — Qey

### OTHER SYMBOLS

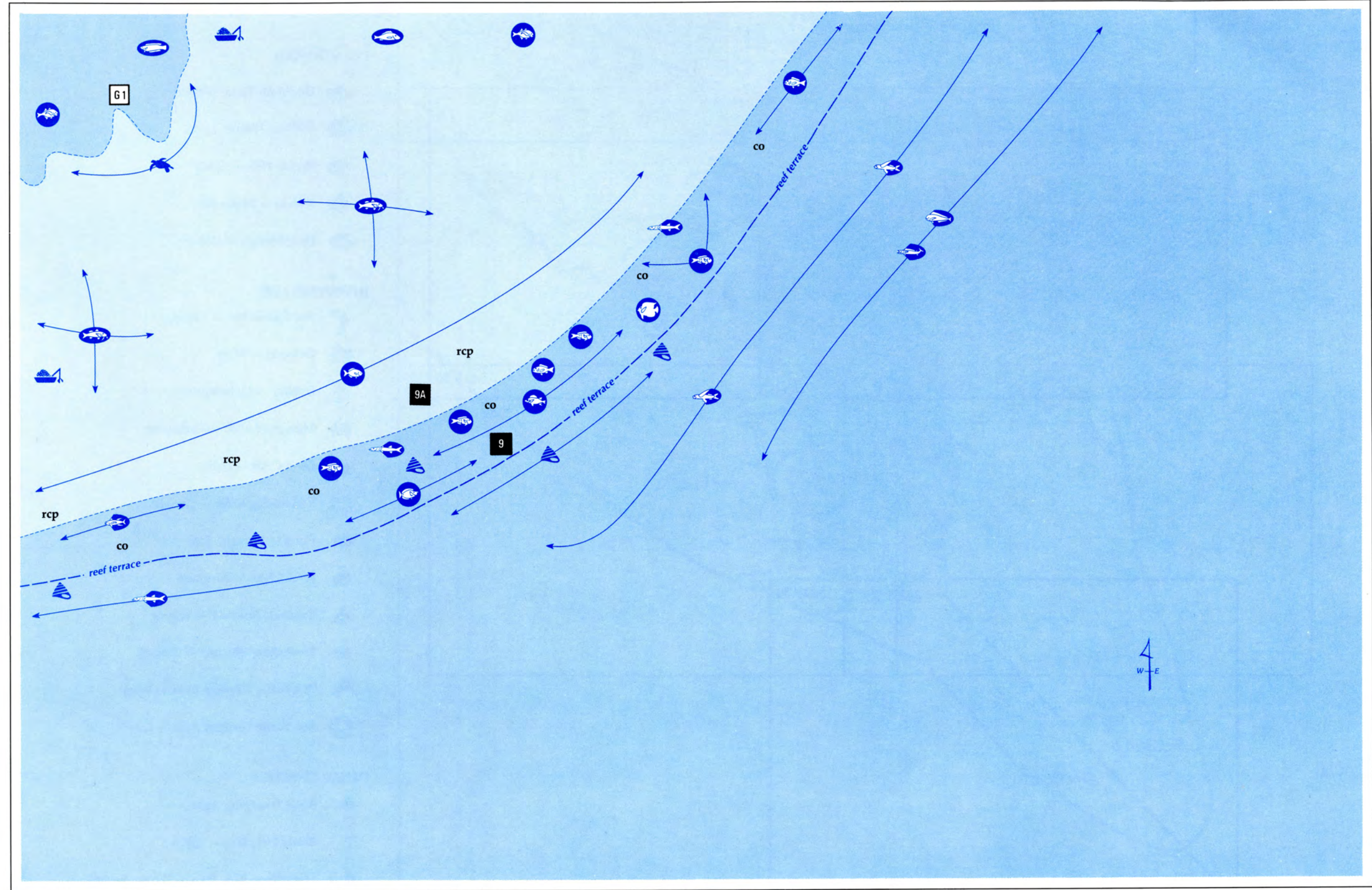
- Sand Dredging Area
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### REEF FISH

- Grouper — SmaaK'uw, K'uw
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- Barracuda — Maal'
- Snapper — Gadaw, Gooychaaf

# Bottom Type and Land Cover Classification

- OFFSHORE**
- Sediment**
- sc — Sand bottom in water depths less than 10 meters
  - sd — Sand bottom in water depths greater than 10 meters
  - si — Silt
- Reef Complex**
- rc — Mixed bottom types consisting of reef rock (limestone) associated with shallow reef formations
  - rcl — Consolidated limestone, lacking sediment
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  - rsc — Mostly consolidated limestone with some (25-50%) sediment bottom
  - rs — Complex reef bottom type consisting mostly of sand, but with some limestone outcrops or boulders
  - co — Areas of greater than 50% live coral cover
- SHORELINE**
- bb — Man-made boulder shoreline
  - bc — Concrete/cement masonry seawall and shoreline
  - sb — White sand beach of predominately calcareous material
- VEGETATION COVER**
- ag — Algae bed
  - Mangrove Forest
  - Seagrass Bed
- Other Symbols**
- Navigation Marker
  - Shipwreck
  - Observed Range of Species
  - Reef Terrace
  - Potential Development Site

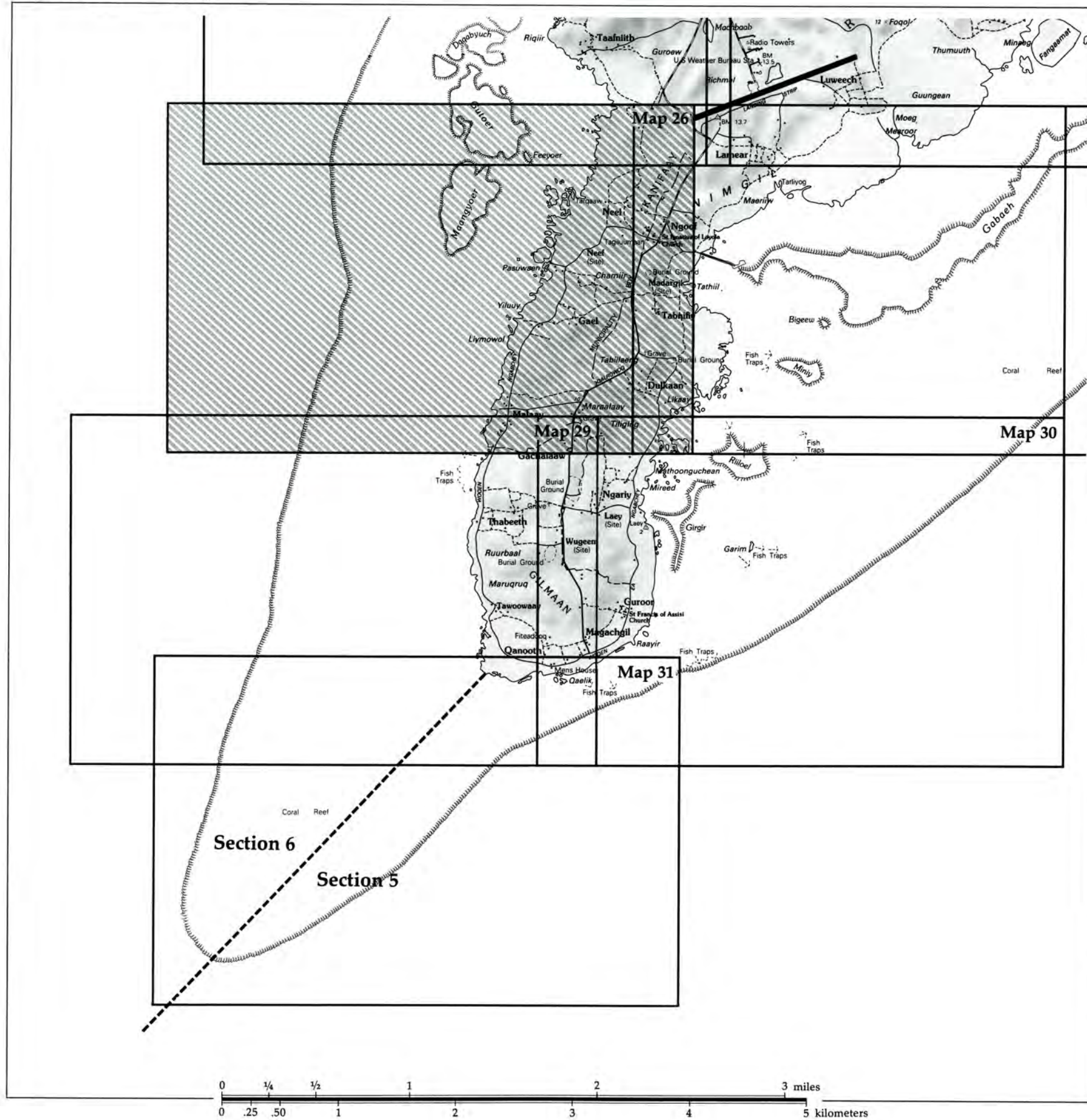


**Field Stations**

<b>53</b> YCRI Station, 1987	<b>G1</b> UOG—45 Station, 1978
<b>W1</b> WRRC—14-10 Station, 1980	<b>G2</b> UOG—46 Station, 1978
<b>W2</b> WRRC—16-1 Station, 1980	<b>G3</b> UOG—78-4 Station, 1982
<b>W3</b> WERI Station, 1982	<b>G4</b> UOG—35 Station, 1977



# Reference Map 9



## Coastal Resources





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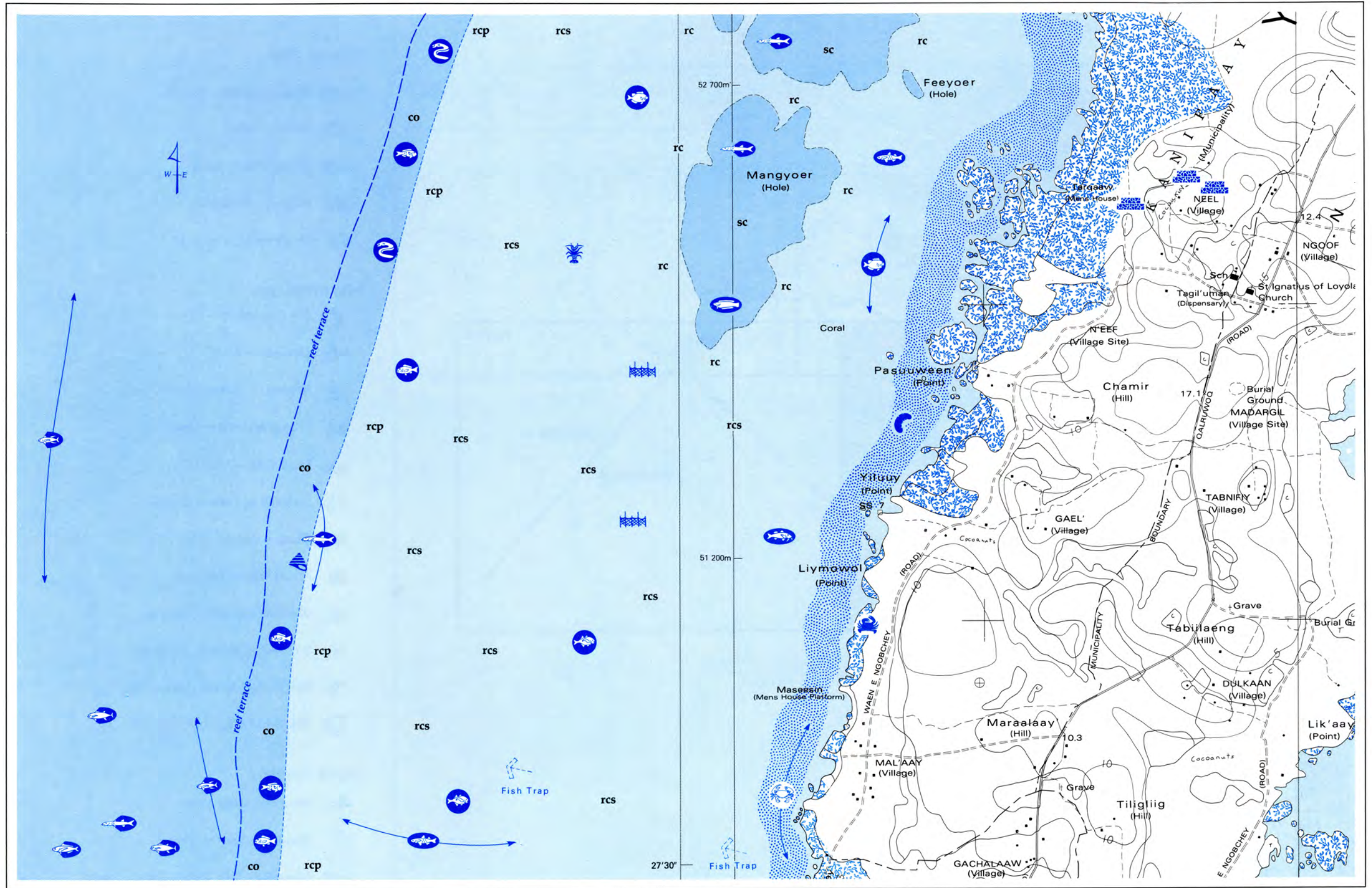
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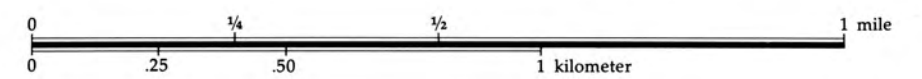
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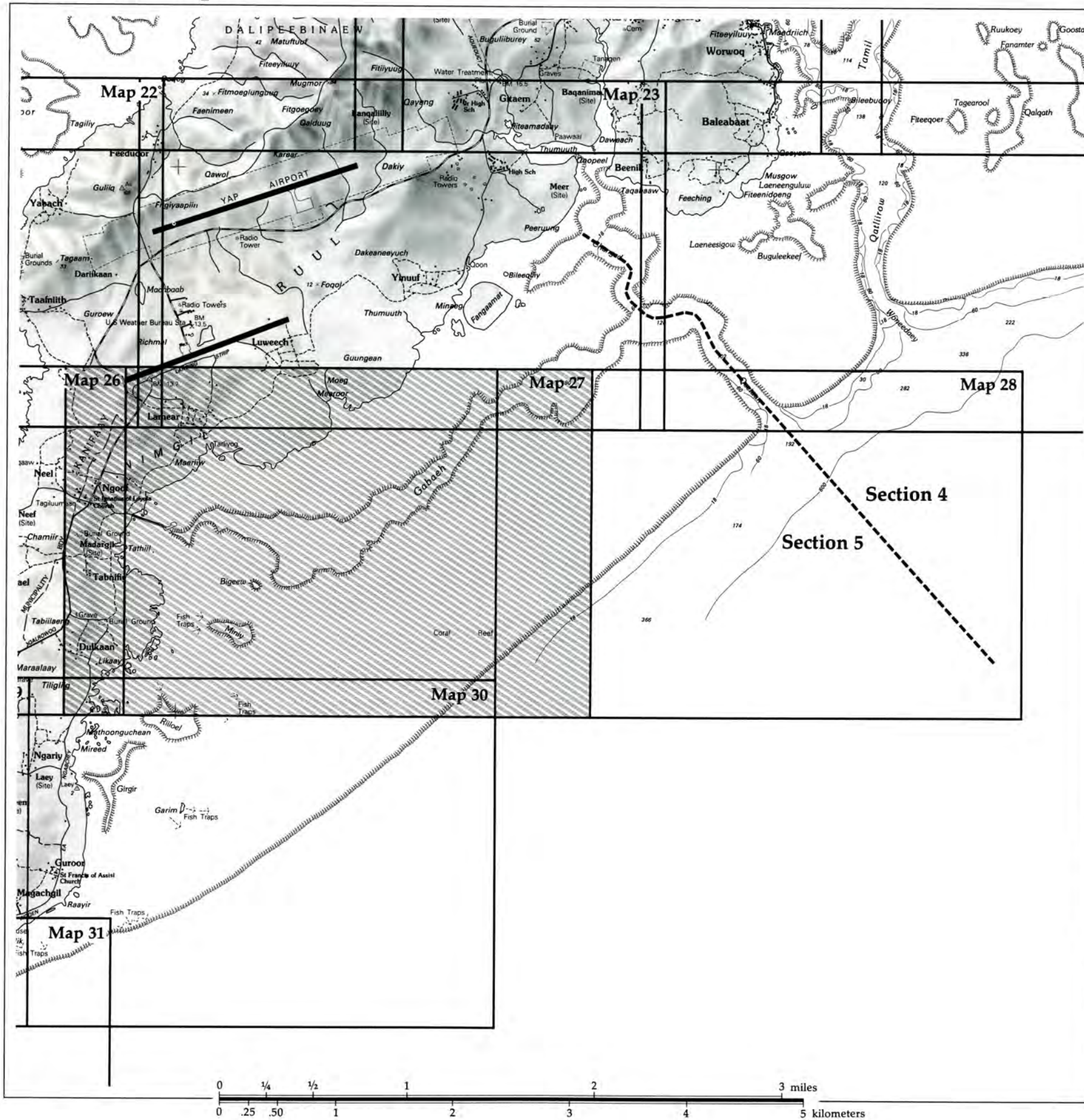
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- |                             |                           |
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## Coastal Resources





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## SHORELINE

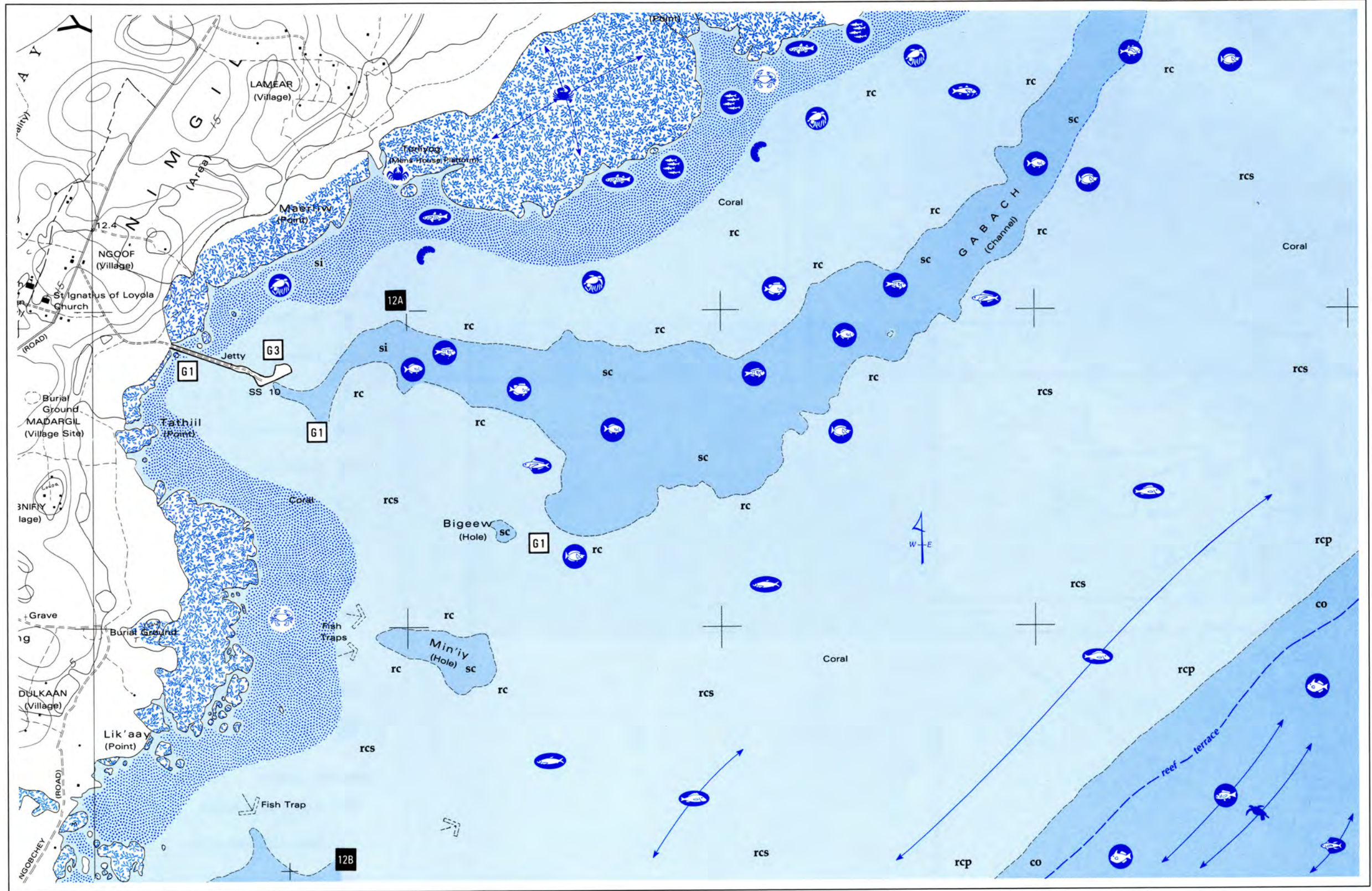
- bb — Man-made boulder shoreline
- bc — Concrete/cement masonry seawall and shoreline
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## VEGETATION COVER

- ag — Algae bed
- [Mangrove symbol] Mangrove Forest
- [Seagrass symbol] Seagrass Bed

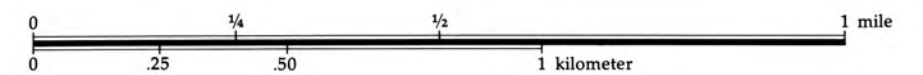
## Other Symbols

- [Fish icon] Navigational Marker
- [Shipwreck icon] Shipwreck
- [Arrow icon] Observed Range of Species
- [Dashed line icon] Reef Terrace
- [Hatched box icon] Potential Development Site

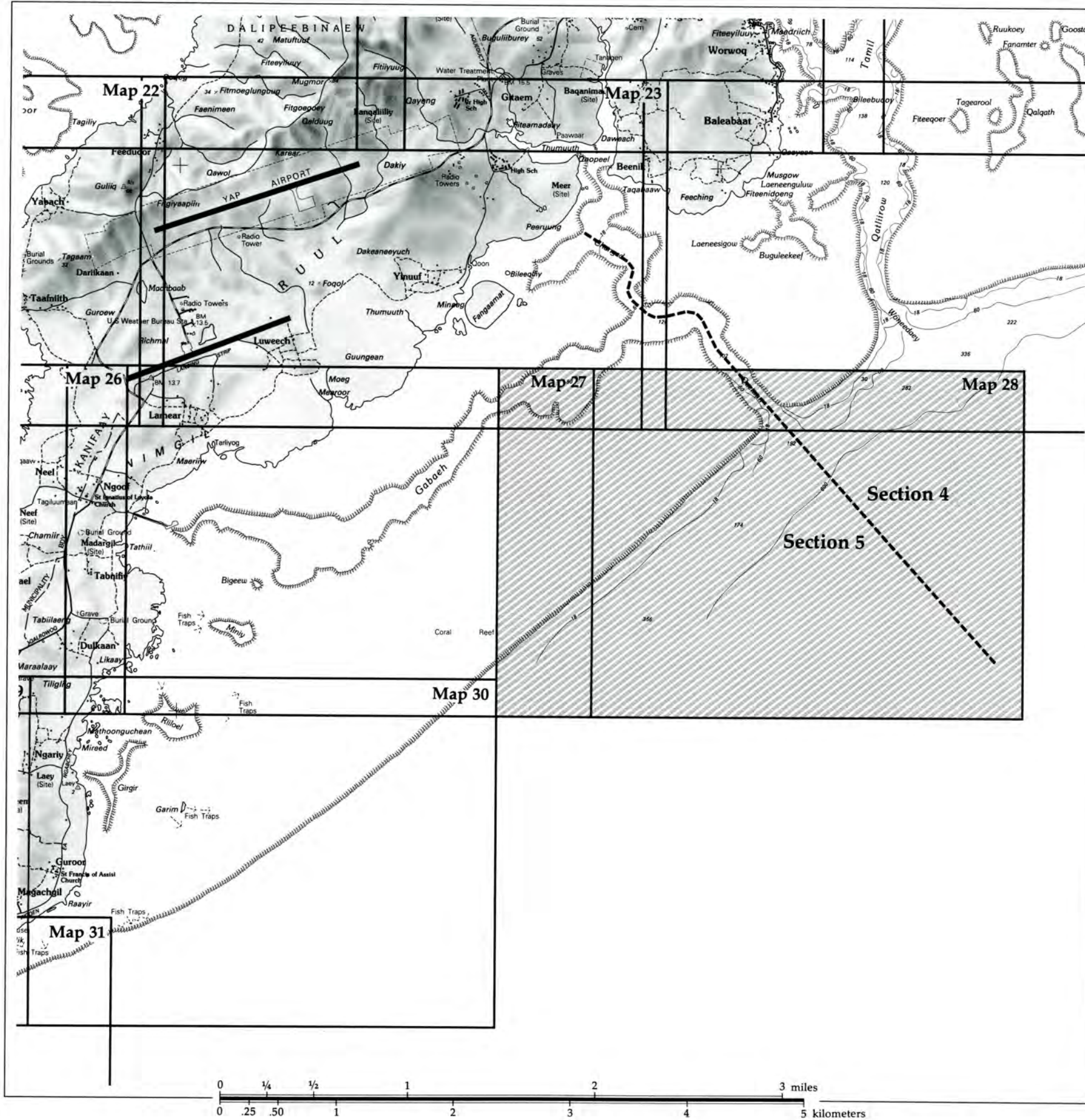


## Field Stations

- |                               |                             |
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# Reference Map 8



## Coastal Resources





### PELAGIC FISH

-  Dogtooth Tuna — Yasul
-  Tuna — Tuguw
-  Flying Fish — Goeg
-  Wahoo — Malchath
-  Dolphinfish — Dabaar

### INVERTEBRATES

-  Sea Cucumber — L'ugul
-  Octopus — K'aay
-  Lobster — Qaraangoey
-  Mangrove Crab — Qamaang
-  Land Crab — Galip
-  Swimming Crab — Qurich
-  Clam — Faasuw, Tow
-  Mud Clam — Yungwol
-  Topshell (*trochus*) — Yogyog
-  Freshwater Shrimp — Ganeef
-  Sea Turtle Capture Area — Weel
-  Sea Turtle Feeding Area — Qey

### OTHER SYMBOLS

-  Sand Dredging Area
-  Stone Fish Trap — Qech
-  Non-Stone Fish Trap — Yanup, Saagel
-  Archaeological Site

### REEF FISH

-  Grouper — SmaaK'uw, K'uw
-  Parrotfish — Qelbad, Qalaabal, Malgoed, Quchwaq, Gamaygul
-  Surgeonfish — Quum, Maath, Machagwog, Bilaew
-  Mullet — Quloch, Galaed
-  Squirrelfish, Soldierfish — Yooch
-  Rabbitfish — Dayit, Garmiy, Buywod, Darry, Limreq
-  Goatfish — Manguch, Mbing, Soong
-  Rainbow Runner, Fusilier — Thilbuw, Foofow
-  Jack — Ngool, M'uul, Qelqel
-  Bream — Qutun, Wachaqmal
-  Emperor — Wul', Qoeyeq, Gadgad
-  Angelfish — Qeer, Buloch
-  Wrasse — Numean
-  Stickfish, Needlefish — Buuy
-  Triggerfish — Wuuq, Moelngith, Nguuf
-  Milkfish — Guuguw, Tangir
-  Rudderfish — Guumiy
-  Eel — Looth
-  Baitfish — Saadiin, Faakeayaan', Liyeq, Qachwog, Qanger, Malmeq
-  Barracuda — Maal'
-  Snapper — Gadaw, Gooychaaf

# Bottom Type and Land Cover Classification

## OFFSHORE

### Sediment

- sc — Sand bottom in water depths less than 10 meters
- sd — Sand bottom in water depths greater than 10 meters
- si — Silt



### Reef Complex

- rc — Mixed bottom types consisting of reef rock (limestone) associated with shallow reef formations
- rcl — Consolidated limestone, lacking sediment
- rcp — Consolidated limestone with a smooth, pavement-like surface
- rsc — Mostly consolidated limestone with some (25-50%) sediment bottom
- rs — Complex reef bottom type consisting mostly of sand, but with some limestone outcrops or boulders
- co — Areas of greater than 50% live coral cover






## SHORELINE

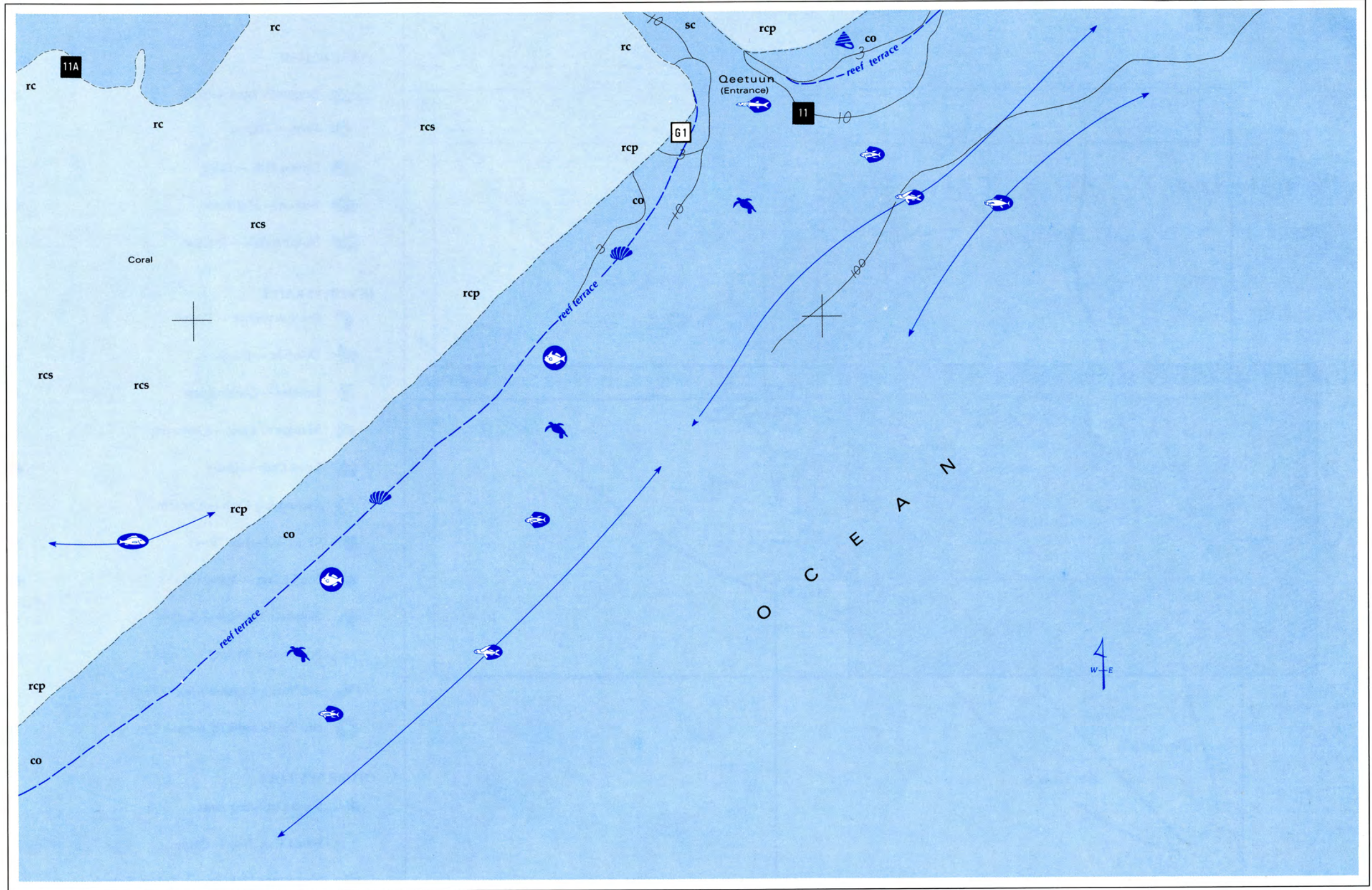
- bb — Man-made boulder shoreline
- bc — Concrete/cement masonry seawall and shoreline
- sb — White sand beach of predominately calcareous material

## VEGETATION COVER









- ag — Algae bed
-  Mangrove Forest
-  Seagrass Bed

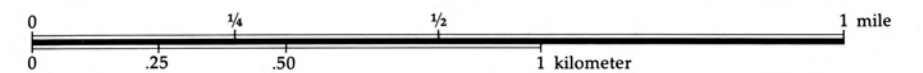
## Other Symbols

-  Navigational Marker
-  Shipwreck
-  Observed Range of Species
-  Reef Terrace
-  Potential Development Site

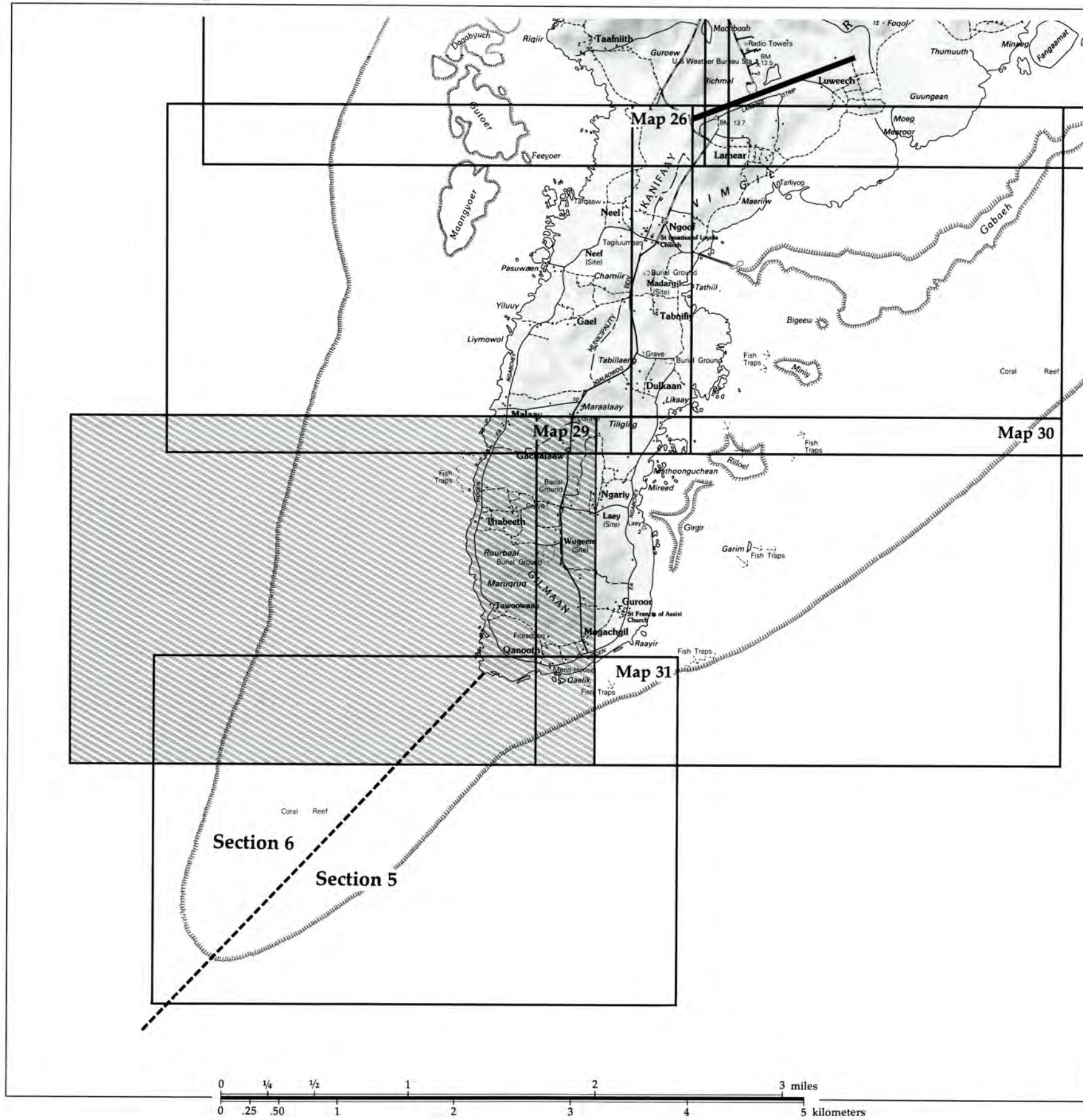


## Field Stations

- |   |   |
|---|---|
|  53 YCRI Station, 1987       |  G1 UOG-45 Station, 1978   |
|  W1 WRRC-14-10 Station, 1980 |  G2 UOG-46 Station, 1978   |
|  W2 WRRC-16-1 Station, 1980  |  G3 UOG-78-4 Station, 1982 |
|  W3 WERI Station, 1982       |  G4 UOG-35 Station, 1977   |



# Reference Map 9



## Coastal Resources





### PELAGIC FISH

-  Dogtooth Tuna — Yasul
-  Tuna — Tuguw
-  Flying Fish — Goeg
-  Wahoo — Malchath
-  Dolphinfish — Dabaar

### INVERTEBRATES

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-  Rainbow Runner, Fusilier — Thilbuw, Foofow
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-  Bream — Qutun, Wachaqmal
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-  Angelfish — Qeer, Buloch
-  Wrasse — Numean
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-  Barracuda — Maal'
-  Snapper — Gadaw, Gooychaaf

# Bottom Type and Land Cover Classification

Map 29

## OFFSHORE

- Sediment**
- sc — Sand bottom in water depths less than 10 meters
  - sd — Sand bottom in water depths greater than 10 meters
  - si — Silt
- Reef Complex**
- rc — Mixed bottom types consisting of reef rock (limestone) associated with shallow reef formations
  - rcl — Consolidated limestone, lacking sediment
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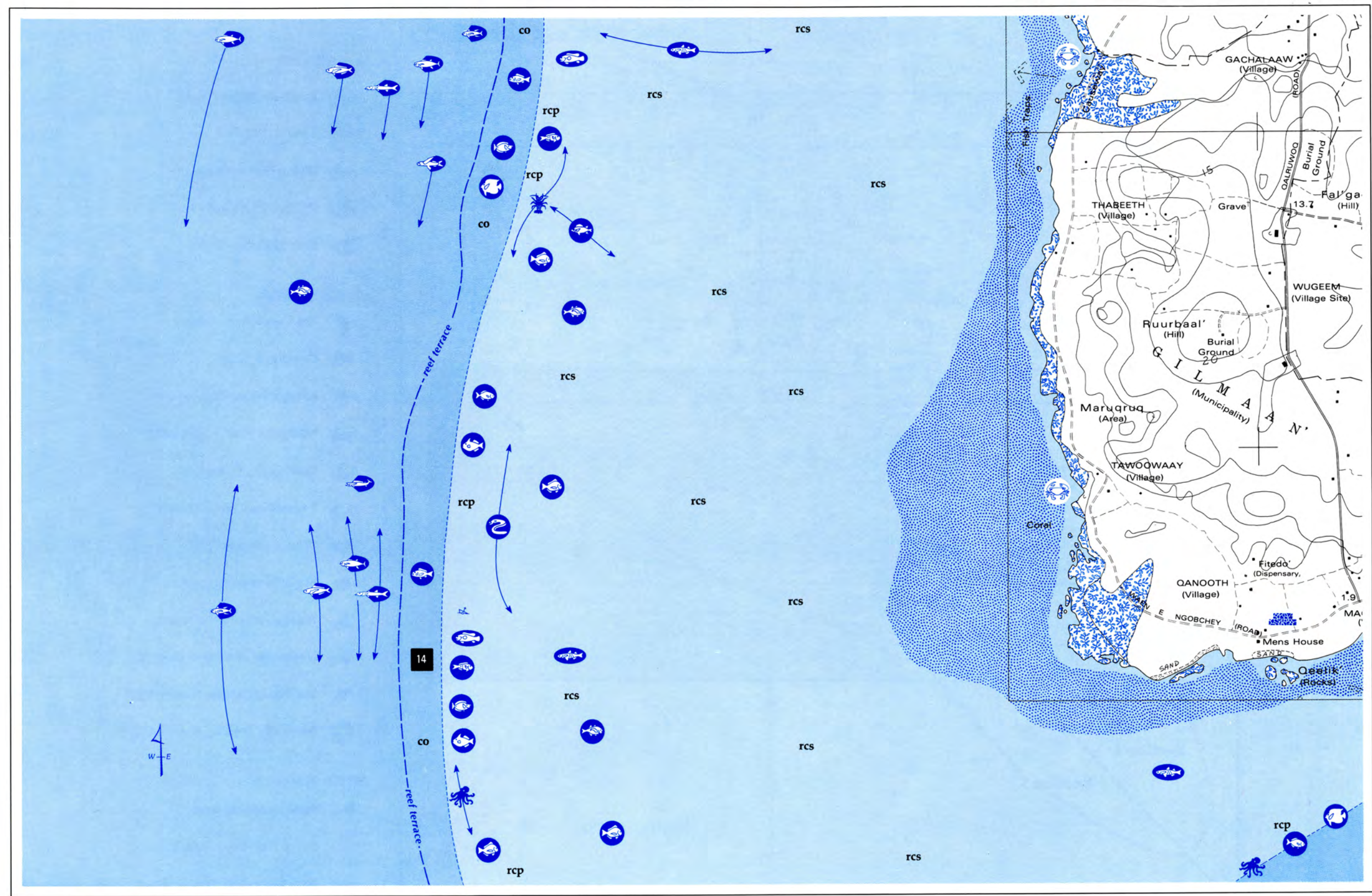
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- ag — Algae bed
- Mangrove Forest
- Seagrass Bed

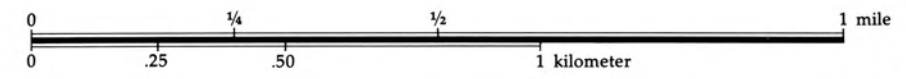
## Other Symbols

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- Shipwreck
- Observed Range of Species
- Reef Terrace
- Potential Development Site

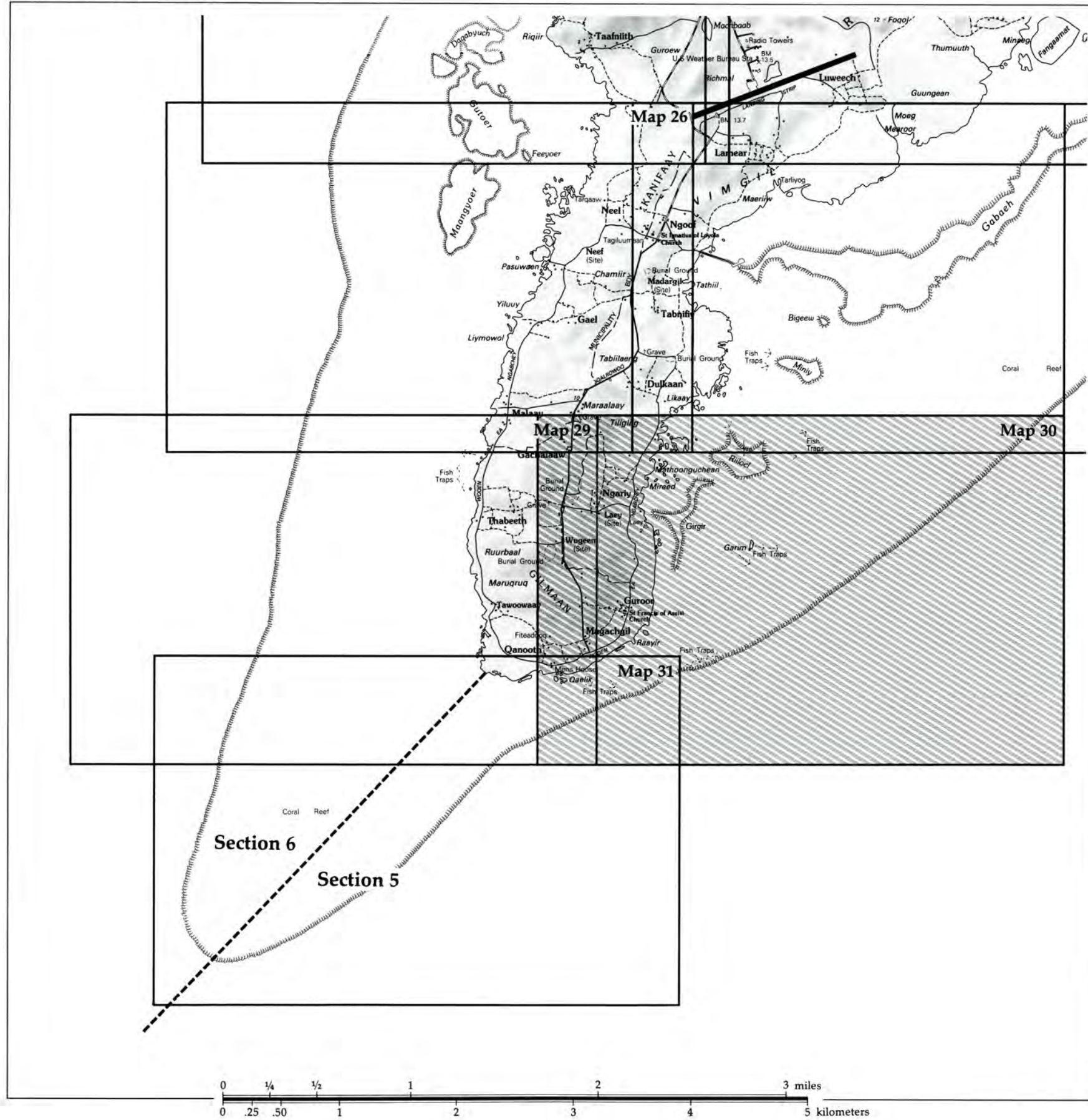


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|-----------------------------|---------------------------|
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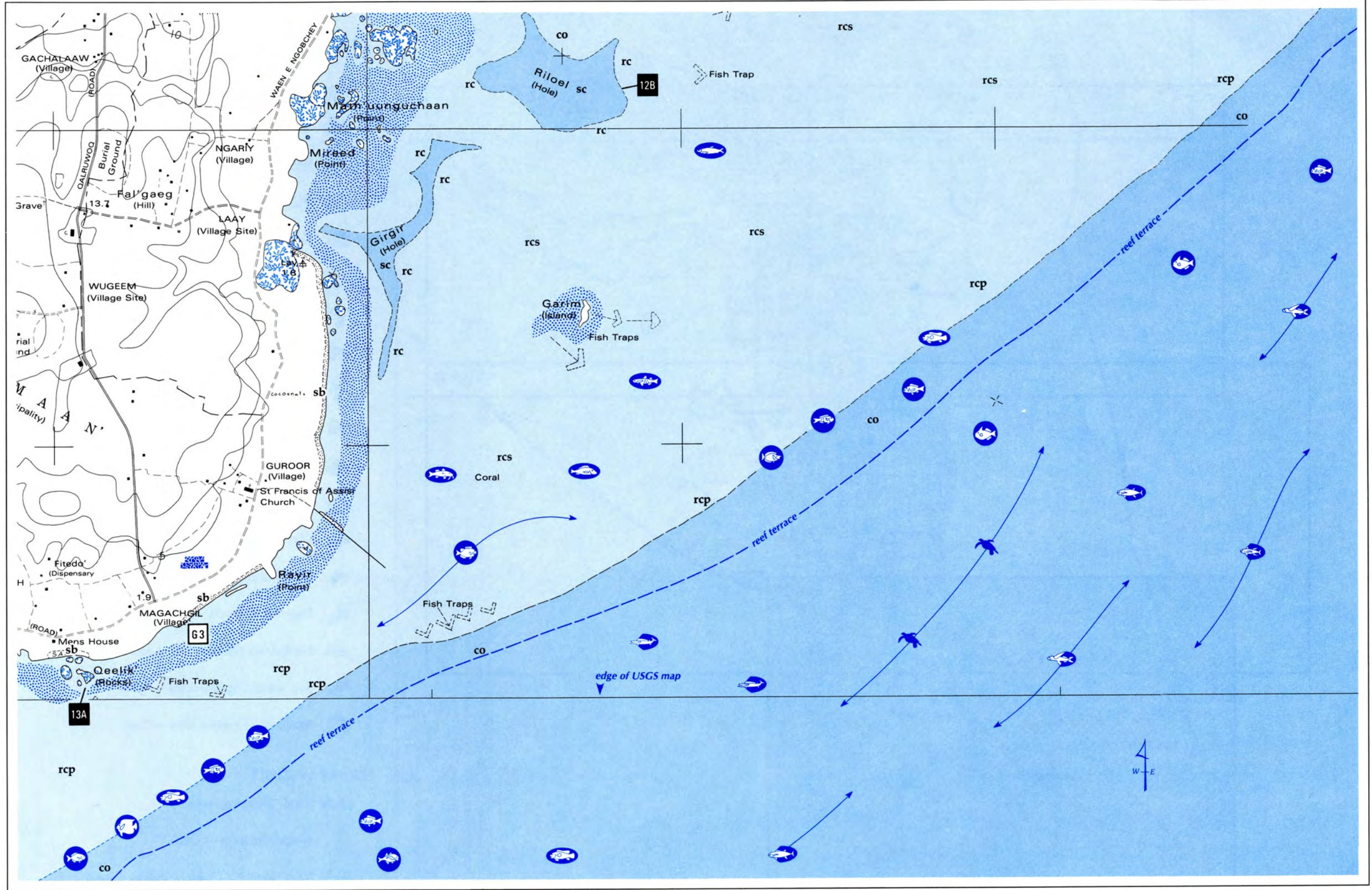
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  - Observed Range of Species
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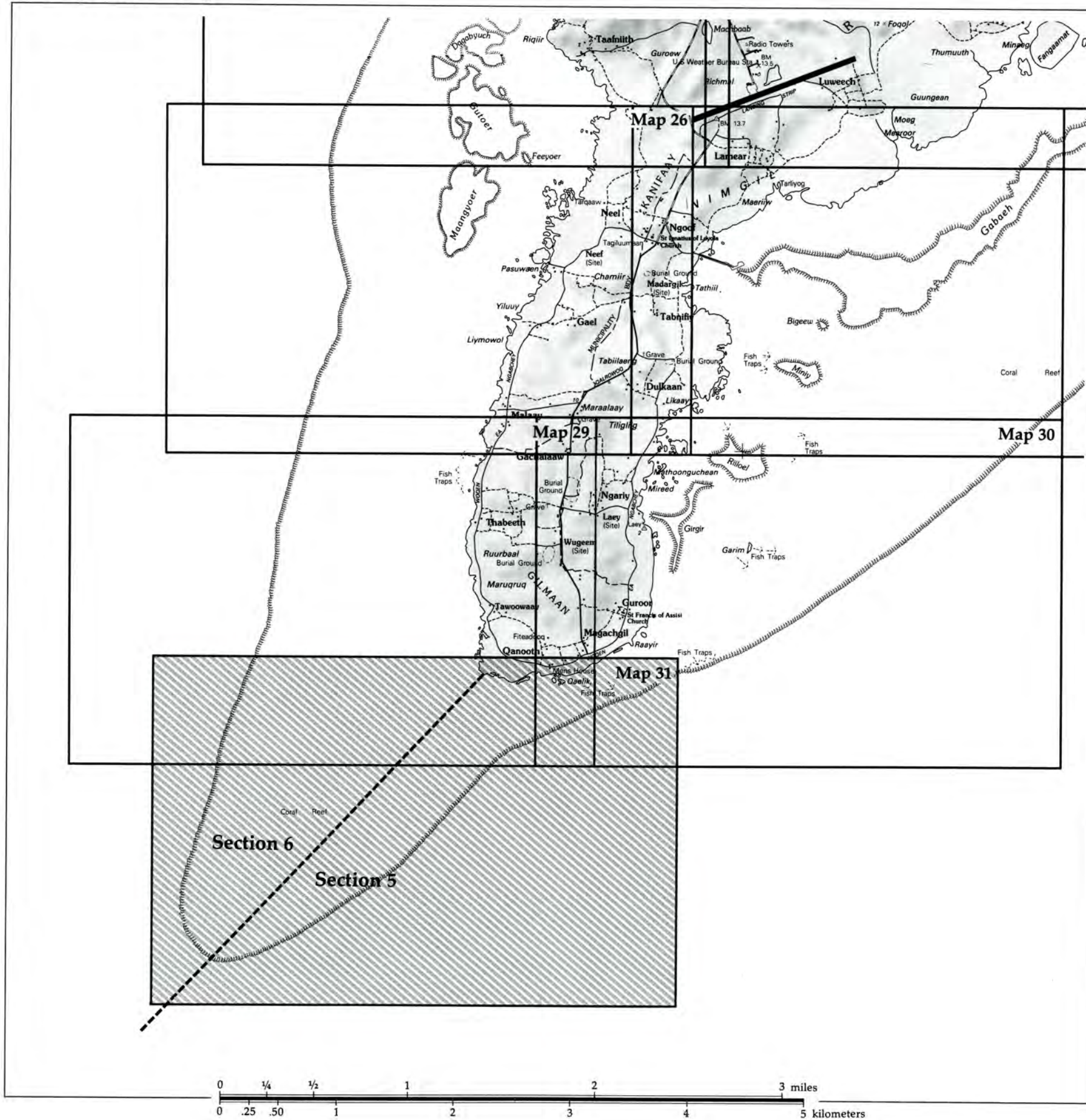
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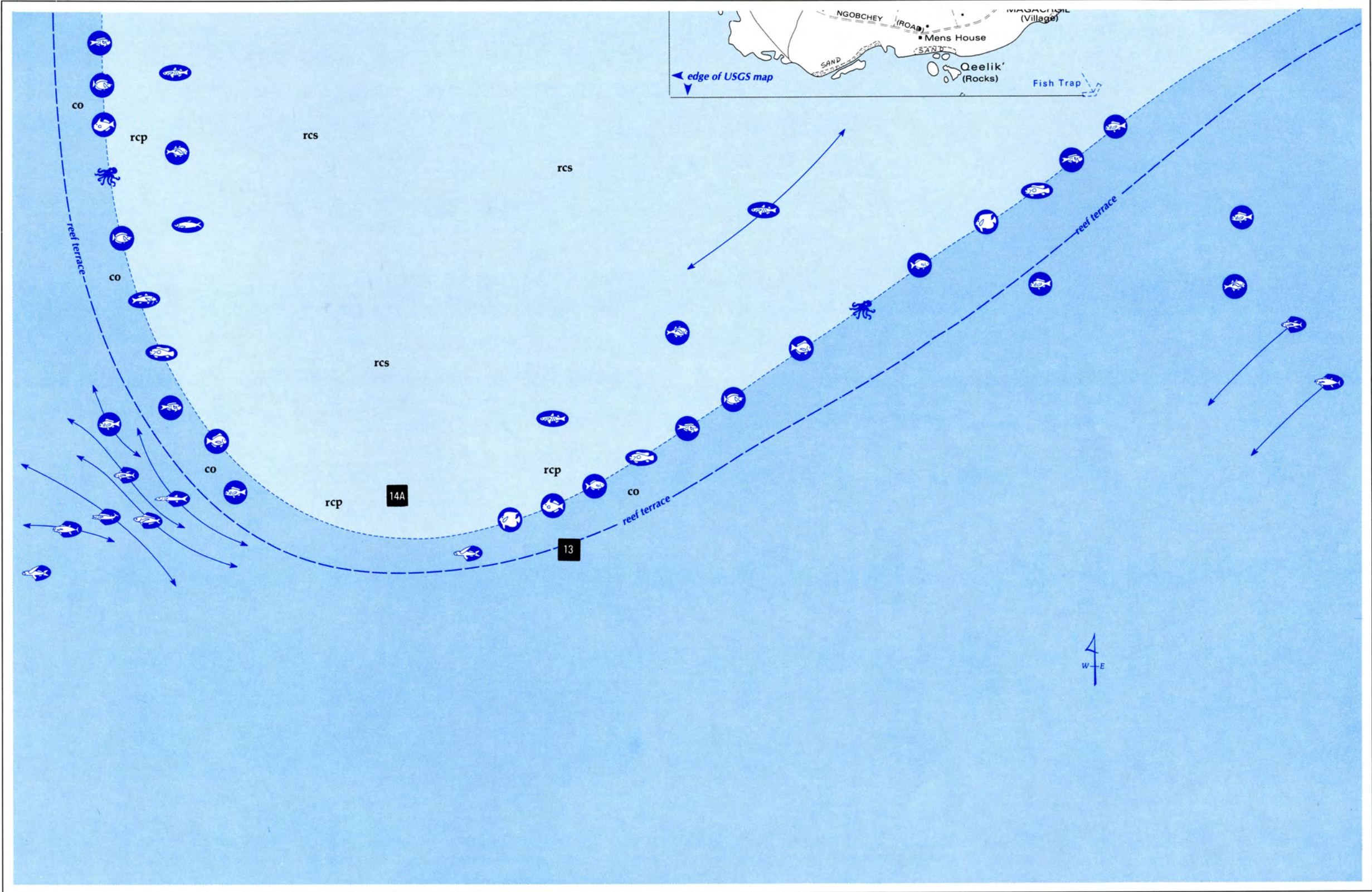


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| Wahoo — Malchath                     | Mullet — Quloch, Galaed   |
| Dolphinfish — Dabaar                 | Squirrelfish, Soldierfish — Yooch                               |
| <b>INVERTEBRATES</b>                 | Rabbitfish — Dayit, Garmiy, Buywod, Darry, Limreq               |
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| Lobster — Qaraangoey                 | Jack — Ngool, M'uul, Qelqel                                     |
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| Land Crab — Galip                    | Emperor — Wul', Qoeyeq, Gadgad                                  |
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| Clam — Faasu, Tow                    | Wrasse — Numean   |
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| Freshwater Shrimp — Ganeef           | Milkfish — Guuguw, Tangir                                       |
| Sea Turtle Capture Area — Weel       | Rudderfish — Guumiy   |
| Sea Turtle Feeding Area — Qey        | Eel — Looth   |
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| Sand Dredging Area                   | Barracuda — Maal'   |
| Stone Fish Trap — Qech               | Snapper — Gadaw, Gooychaaf                                      |
| Non-Stone Fish Trap — Yanup, Saagel  |   |
| Archaeological Site                  |   |

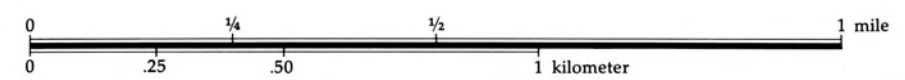
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<b>W3</b> WERI Station, 1982	<b>G4</b> UOG—35 Station, 1977



## Acknowledgments

We gratefully acknowledge the help of the following people without whose cooperation the Atlas would not have been produced; Dr. Roger Uwate, Chief, Marine Resources Management Division (MRMD), and his staff for providing essential logistical, diving, boat driver, and other field support; Mr. Paul Paatmag of MRMD for arranging the interview sessions and acting as translator, guide, driver and "all-around-handy-person;" Ms. Charmaine Price and Mr. Burl Sheldon, Peace Corps Volunteers, for their help in choosing and mapping field survey stations; Mr. Mike Gawel, Chief of Marine Resource for the Federated States of Micronesia, Mr. Mike Molina, Fisheries Specialist, FSM Marine Resources Department, Mr. Barry Smith, University of Guam Sea Grant Extension Service, for taking time for their busy schedules to participate in the dive surveys and provide notes on many of the fishes and invertebrates found; Dr. Roy Tsuda, Dr. Valerie Paul, and Dr. Steven Nelson, University of Guam Marine Laboratory for identifying marine algae at our survey stations during their survey work in Yap; Mrs. Margie Falanruw for helping us to understand the culture and people of Yap; and Daniel Dannged, Leo Siyou, and Falay, boatmen extraordinaire, for their hard work.

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We would especially like to acknowledge Dr. James Maragos, U.S. Corps of Engineers, for all of his help in making this project a success — from making the initial contacts with Yap State Authorities through taking part in the field work.

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