CORAL REEF MONITORING FOR MANAGEMENT

2ND EDITION

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Hazel O. Arceo, Porfirio M. Aliño and Alan T. White

MARINE SCIENCE INSTITUTE
MARINE ENVIRONMENT & RESOURCES FOUNDATION, INC.
UNIVERSITY OF THE PHILIPPINES, DILIMAN

GUIUAN DEVELOPMENT FOUNDATION, INC.
UNIVERSITY OF THE PHILIPPINES IN THE VISAYAS, TACLOBAN

VOLUNTARY SERVICE OVERSEAS – PHILIPPINES,
BOHOL INTEGRATED DEVELOPMENT FOUNDATION, INC.

Supported by

United States Agency for International Development

Department of Agriculture-Bureau of Fisheries and Aquatic Resources

Department of Environment and Natural Resources

through the following projects

The Fisheries Improved for Sustainable Harvest (FISH) Project

Philippine Environmental Governance Project 2

The Coastal Resource Management Project-Philippines

United Nations Development Programme
Global Environment Facility-Small Grants Programme

University of the Philippines
Center for Integrative & Development Studies

Coral Reef Monitoring for Management

SECOND EDITION

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Second Edition 2010. Printed in Cebu City, Philippines

Citation: Uychiaoco, A.J., S.J. Green, M.T. dela Cruz, P.A. Gaite, H.O. Arceo, P.M. Aliño, and A.T. White. 2010. *Coral Reef Monitoring for Management*. University of the Philippines Marine Science Institute, United Nations Development Programme Global Environment Facility-Small Grants Program, Guiuan Development Foundation, Inc., Voluntary Service Overseas, University of the Philippines Center for Integration and Development Studies, Coastal Resource Management Project, Philippine Environmental Governance Project 2, and Fisheries Resource Management Project. 122 p.

This guidebook was developed through support provided by the United Nations Development Programme Global Environment Facility-Small Grants Program (UNDP GEF-SGP) Project No. BC-0037-19.XI.96.L/V, the United States Agency for International Development (USAID) under the terms and conditions of Contract No. AID-492-0444-C-00-6028-00, AID-492-C-00-04-00037-00 and, AID-492-C-00-03-00022-00 supporting the Department of Environment and Natural Resources Coastal Resource Management Project and Philippine Environmental Governance Project 2, and the Department of Agriculture Bureau of Fisheries and Aquatic Resources Fisheries Improved for Sustainable Harvest Program, respectively; the University of the Philippines Center for Integrative and Development Studies; the University of the Philippines Marine Science Institute (UP-MSI); and the Fisheries Resource Management Project, which is implemented by the Department of Agriculture-Bureau of Fisheries and Aquatic Resources and funded by the Asian Development Bank and Japan Bank for International Cooperation. The opinions expressed herein are those of the authors and do not necessarily reflect the views of the UNDP GEF-SGP, USAID, UP-MSI, or FRMP.

FISH Document No. 47-FISH/2010
UP-MSI Contribution No. 308

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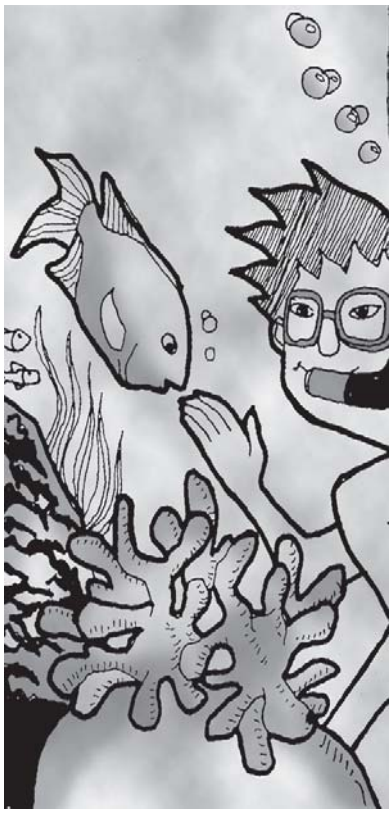
What's Inside



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History and Acknowledgments

Reef survey systems such as ReefCheck by Hodgson (1999), methods adapted for Earthwatch volunteers and conservation projects by White *et al.* (2000), and ReefBase's Aquanaut system by McManus *et al.* (1997) are available for SCUBA divers who wish to do coral reef monitoring with the benefit of some initial training. There are also other methods such as the Global Coral Reef Monitoring Network system described by English *et al.* (1997) for reef scientists who wish to achieve more detailed monitoring. But because there are not enough volunteer SCUBA divers and reef scientists to monitor all the world's coral reefs or even Philippine reefs, simpler methods for non-SCUBA divers were developed from the existing methods. This is a guide for communities and field level staff who are involved in project implementation in how to do low-cost, less technical surveys to evaluate the effectiveness of their coastal management efforts.

This guide began from independent efforts of M.T. dela Cruz in 1995 in Eastern Samar and S.J. Green in 1996 in Bohol to guide local fisher communities in the underwater monitoring of their marine environment and protected areas. M.T. dela Cruz of the Guiuan Development Foundation, Inc., and University of the Philippines Visayas at Tacloban was then supported by the Foundation for the Philippine Environment and assisted by M.C.G. Militante. S.J. Green was a British volunteer under the Voluntary Service Overseas (VSO) program working in the Bohol Integrated Development Foundation, Inc. In 1996, A.J. Uychiaoco of the University of the Philippines Marine Science Institute (UP-MSI) proposed a dissertation to the Department of Ecology and Evolution, State University of New York at Stony Brook to investigate the effectiveness of Philippine fish sanctuaries in restoring reef functional diversity.

Dela Cruz, Green, and Uychiaoco met and planned collaborative arrangements through the various activities of the Philippine Coral Reef Information Network (PhilReefs) in late 1996. Funding was obtained from the University of the Philippines Center for Integrative and Development Studies initially and the work began. Later on, the Coastal Resource Management Project of the United States Agency for International Development and the United Nations Development Programme Global Environment Facility-Small Grants Programme joined in 1997. In addition, resources were contributed by the UP-MSI, the Guiuan Development Foundation and the Bohol Integrated Development Foundation, Inc. Through this joint effort, the methods described up to Chapter 9 have been field tested by various teams of non-SCUBA diving local community volunteers.

Field testing and improvement of the methods resulted from the participation and assistance of many persons and groups in various locations as follows: Samar: Cathy Capanang of Guiuan Development Foundation, Inc.; Camanga Monitoring Team (especially Cornelio Macatimpag and Victor Duran) and the Duran family; Bohol: Lomboy Farmers, Fishers and Carpenters Association, Pangangan Island, Calape especially the local monitoring team composed of Zosimo Cuadrasal, Al Asunto, Boboy, and various others; Mayor Atty. Julius Caesar Herrera and Kagawad Gerardo Cuadrasal, Jr. also provided financial assistance and their time in the development of the monitoring system within Calape; Nagkahiusa Mananagat sa Cabacongan (The United Fishers of Cabacongan), Cabilao Island, Loon, especially the local monitoring team composed of Natalio Lajera, Eduardo Castiotos, Teodoro Mulato, and various others; the Municipality of Loon was fully supportive of the

monitoring activities and provided counterparts and assistance to the monitoring through Mayor Cesar Tomas Lopez, M.D. and Vice-Mayor Atty. Raul Barbarona; Patricio Semante, Julie Cavero, Pedro Caet, and Victor Orevillo from the Bohol Integrated Development Foundation, Inc.; Didi of Sea Explorers; Negros Oriental: Negros Oriental Environment and Natural Resources Management Division (especially Mercy Teves, Jose Glendo Lazarte, Annabelle Barillo, and Arsenia Cariño); St. Joseph's Fishermen's Association and Sibulan Bantay Dagat (especially Maximo and Leoncio Decipolo and sons); Cebu: University of San Carlos-Marine Biology Section (especially Jonathaniel Apurado and Joey Gatus); Gilutongan Barangay Fisheries and Aquatic Resources Management Council (especially Timoteo Menguito); Mike Ross of the Coastal Resource Management Project; Department of Environment and Natural Resources-Region VII; International Marinelife Alliance-Philippines; Sarangani: Kiamba Municipal Government (especially Venancio Banquil); Hermenigildo Cabangon, Olive Gonzales, Johnette Delegero, and Alvin Salting; Luzon: Bolinao Community-based Coastal Resource Management Project; Samahan ng Mangingisda at Magsasaka ng Balingasay; and Connie Morales of the Hayuma Foundation; and Palawan: Palawan Council for Sustainable Development Staff and U.S. Peace Corps.

Field activities that culminated in this guide were coordinated by A.J. Uychiaoco, S.J. Green, M.T. dela Cruz, H.O. Arceo, P. Gaite, and M. Teves. Writing of the guide, in addition to the main authors, was assisted by Ma. Fritzie D. Uychiaoco. Those responsible for review, editing, and various insights were: S.J. Green, A.T. White, Kai-Jens Kuhlmann, P.M. Aliño, Ma. F.D. Uychiaoco, Gregor Hodgson, C. Morales, M. Ross, Arlene Brookes (VSO), Maeve Nightingale (VSO), Karen Vidler (Philippine Rural Reconstruction Movement), Maike Waltemath (German Development Service), other participants of the VSO sponsored Marine Protected Areas Workshop and the UP-MSI sponsored MPA workshop in December 1997. Participants of the workshop to produce a source book on participatory methods for community-based coastal resource management held in September 1997, organized by the International Institute for Rural Reconstruction, also helped in refining the writing and methods.

The Philippine Environmental Governance Project 2 has utilized the manual for its participatory monitoring in its sites in Illana Bay, Camotes Sea, Illana Bay and Davao Gulf.

Finally, in view of all the welcome assistance and participation in conceiving, developing an experiential basis for, and writing this reef monitoring guide, the authors assume responsibility for the result and any errors or discrepancies that remain.

Preface

Coral reefs are the focus of the methods in this guide because reefs are less accessible to monitor and evaluate than either mangroves or seagrasses. Due to their naturally high productivity and aesthetic attractiveness, coral reefs are more frequently the centerpiece of marine protected areas, as well as the target of extractive activities. Mangroves are also of high priority for management and important for the physical protection of reefs from sediments and storms but are addressed in other publications.

We must manage our coral reefs wisely so we can continue to benefit from them. We must keep track of changes on coral reefs so that we can tell whether present use and management is sustainable and where and how management can be improved. We must also be able to respond appropriately to changes on reefs from whatever cause. This guide describes ways that local communities, volunteers, and other interested parties can use to monitor and evaluate changes on their reefs for improved management. These methods should only be introduced to communities after they have already had basic environmental education, understood the value of coral reefs, and preferably have demonstrated their commitment to coral reefs (e.g. by having set up a sanctuary).

This guide describes a system to monitor and evaluate coral reefs designed for local coastal communities who have no training in SCUBA diving. However, those who wish to use these reef monitoring methods must be good snorkelers. This guide outlines the importance of monitoring reefs, the steps to gather data, to analyze trends, and to choose solutions based on the observations. The simple methods described here are not unique or original. They were adapted from the other methods developed for volunteer SCUBA divers and reef scientists (see History and Acknowledgments). This system was especially designed to collect data that are comparable to data collected by those other methods. It is hoped that the skills in monitoring and the knowledge from monitoring will help empower local communities to be more effective managers of the resources on which they depend.

This guide is intended for both development workers and members of local community monitoring teams. Notes for trainers have been incorporated in each chapter. It is emphasized that trainers must be trained in and have practiced monitoring and evaluation of coral reefs. Trainers must encourage trainees to openly discuss local and personal observations, methods, and ideas. Each trainee should have his/her personal copy of this guide to use and keep notes on. All trainees are encouraged to later become trainers!

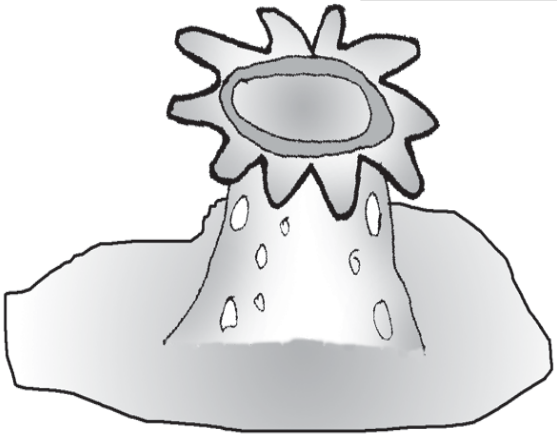
Fish and invertebrate guides are especially important. Each team should have a copy of one or more basic coral reef life guidebooks. Each team should also have at least two sets of mask and snorkel and four sets of underwater slate boards of their own. Geographic positioning systems (GPS) have also become extremely handy for determining exact locations.

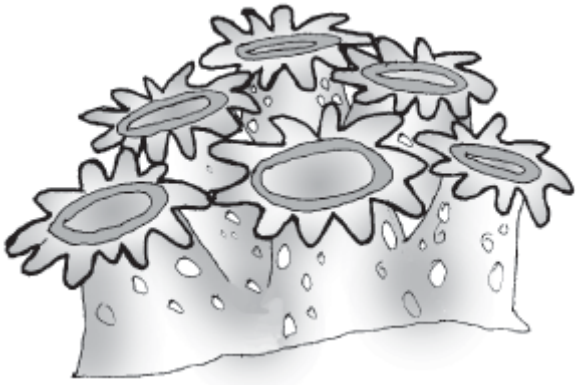
This user-friendly guide is intended for field use. Read it, test it, use it, and make adaptations for successful field monitoring of coral reefs for management!

WHAT ARE CORAL REEFS?

1

Hard corals are tiny animals whose individuals consist of tubular bodies with a mouth ringed by tentacles at one end. These individuals secrete cup-shaped limestone skeletons within and around their bodies. (Soft corals have tiny particles instead so they are not as rigid.)

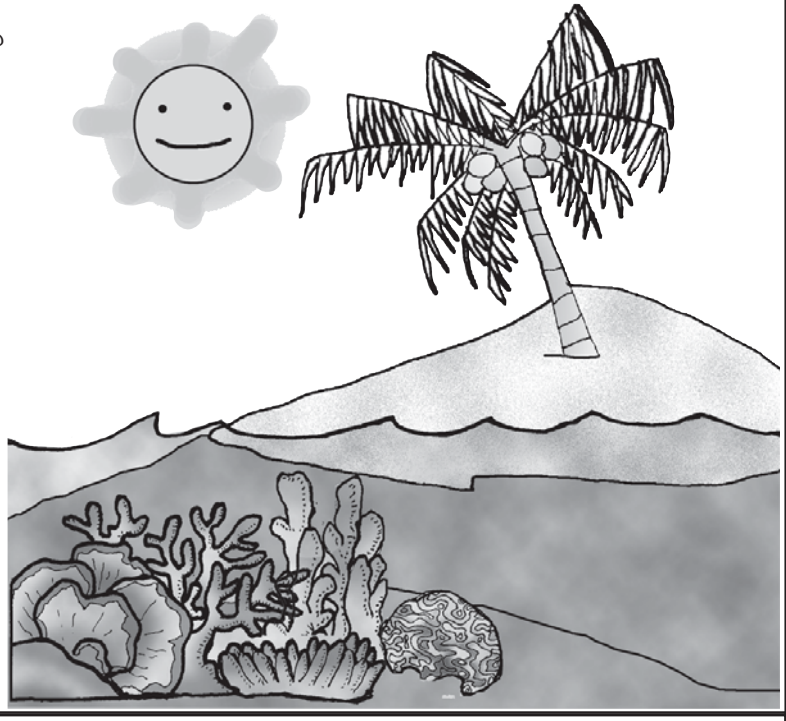




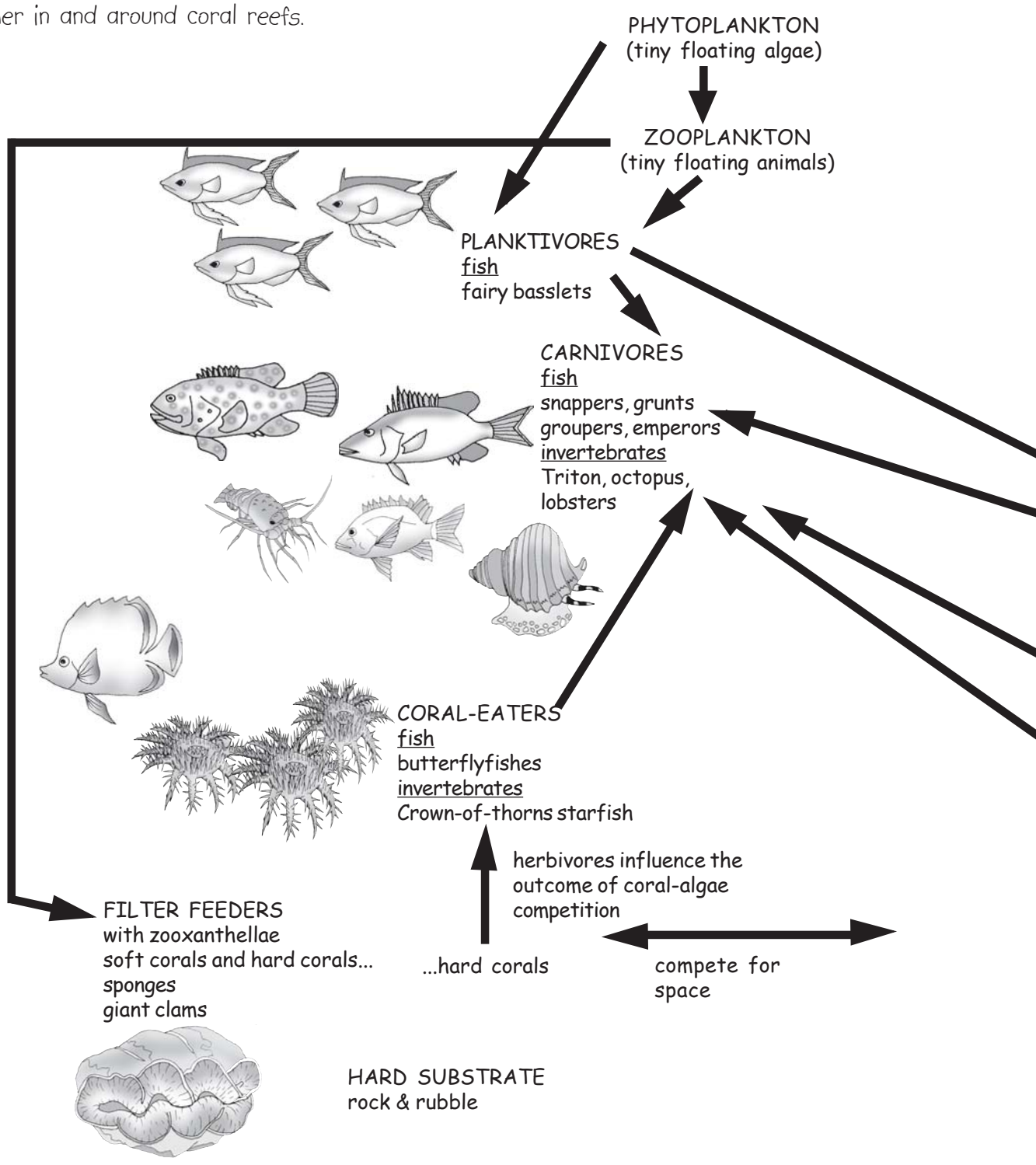
Individuals grow and divide repeatedly, forming colonies. Coralline algae cement these colonies together into hard structures known as coral reefs.

Coral reefs only develop in warm tropical climates. Corals may get suffocated by silt, so they need water movement to continuously wash their surfaces.

In addition, symbiotic algae—which photosynthesize, live within corals, and help them grow faster—also need sunlight.

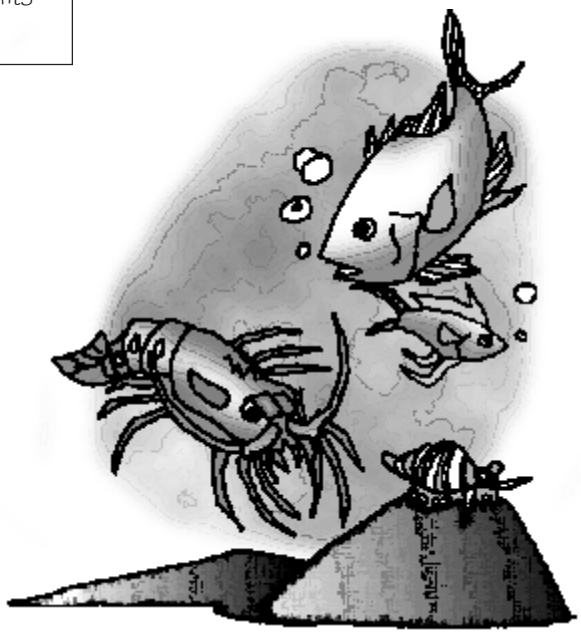


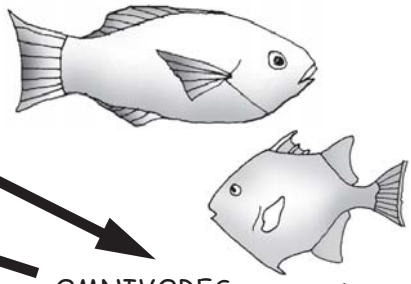
Communities of plants, algae, animals, and other living things interact with each other in and around coral reefs.



Plants, animals, and detritivores are connected to one another by this "chain" of eating and being eaten.

Animals eat either plants and/or other animals.

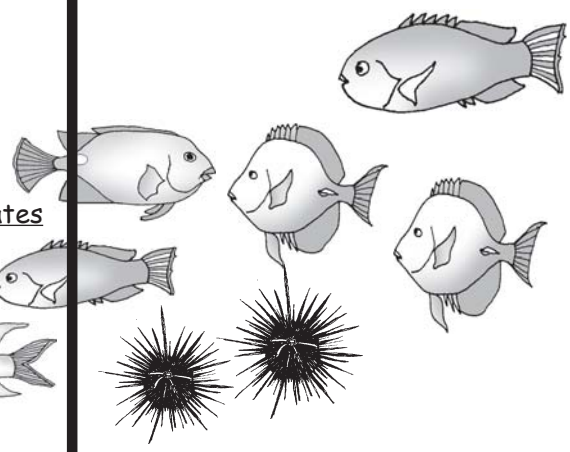




OMNIVORES
fish
wrasses, triggerfishes
invertebrates
gastropods, worms

HERBIVORES
fish
parrotfishes,
surgeonfishes,
rabbitfishes,
damselfishes

invertebrates
urchins
crabs



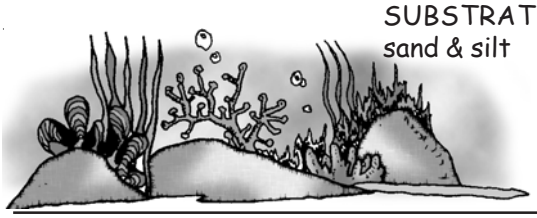
...with algae
seagrasses
DETRITIVORES

Detritivores break down the wastes, dead parts & bodies of plants, animals, and other living things and make them available as nutrients in the water.

invertebrates
sea cucumbers,
bivalves, sponges

Plants and algae use sunlight, gases, and nutrients in the water as food.

SOFT
SUBSTRATE
sand & silt



Trainer's Tips for Chapters 1 to 4

Key Concepts:

1. Monitoring and evaluation is essential for management to be responsive to the changes in the biophysical and socioeconomic realities as an area is being managed.
2. Observations must be done in places and times that represent the variation in the places and time of interest.
3. Observe those indicators that address what you want to know.
4. The monitoring plan must be feasible.

Though there are many definitions of adaptive management, the basic idea is that management strategies are continuously improved as understanding of the system being managed improves.

It is very important that the indicators you decide to monitor are relevant to what the community wants to know. If current use is sustainable under the present management strategy, your indicators must either be stable or changing towards the direction desired (e.g. fish catch is stable or increasing). If you are evaluating management, your indicators must potentially be responsive to management.

The reef monitoring methods described here generally collect the simplest type of data with which changes can be detected. More detailed data may be collected for indicators of particular interest. Tables in the appendix outline how these methods may collect more detailed information as well as what levels of detail are collected by other monitoring systems.

If the organisms you are censusing have:

- greater movement ranges, you'll need to have your samples more spread apart
- higher abundances, you'll need lesser samples
- clustered distributions, you'll need more samples

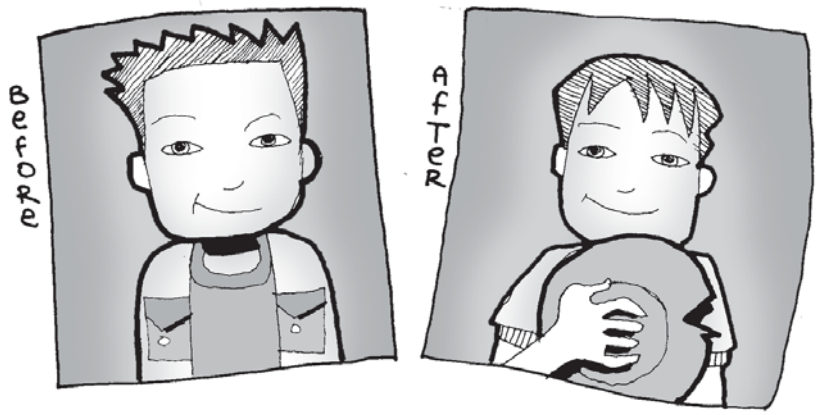
Review Questions

1. What use is monitoring to management?
2. What major components do we monitor?
3. Why do we observe outside protected areas too? Why do we observe at different times?
4. Why must we take several observations at each site at each time?
5. What does "representative" sampling mean?

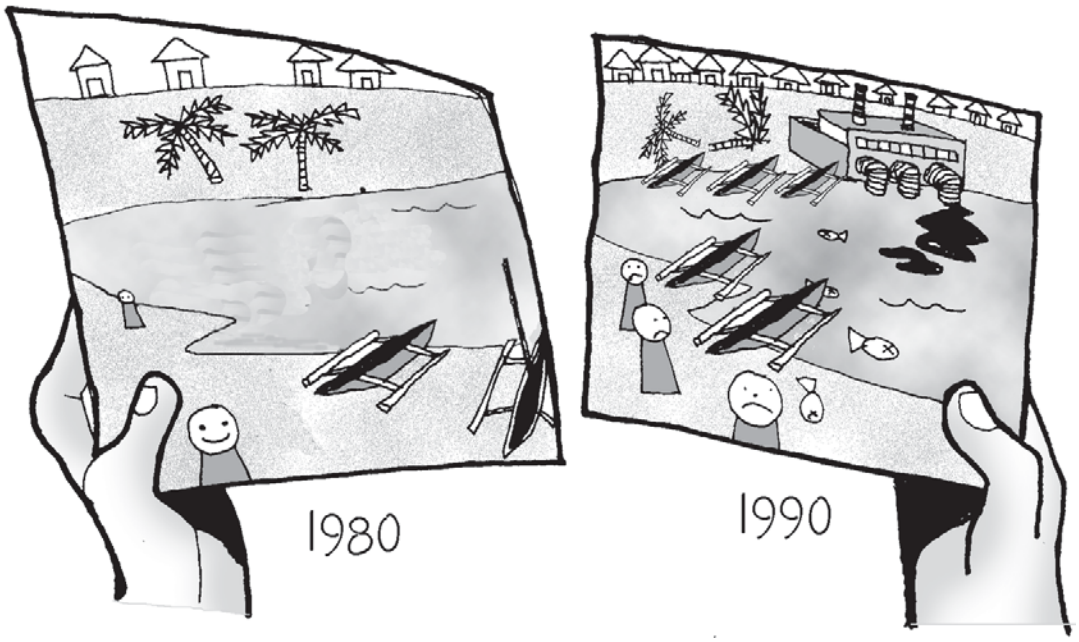
"Representative" means a part whose characteristics are similar to the whole.

WHAT IS MONITORING? 2

Monitoring is using a standard method to observe one thing in one place over a period of time.

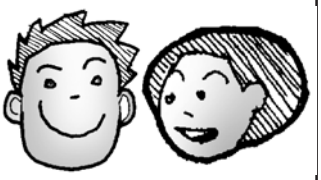


Information from monitoring is like a picture. Two pictures of a person taken at different times can be compared to see if the person has changed. Similarly, monitoring collects evidence of changes.



Trends may be deduced from a series of pictures. These trends may help predict the direction and speed of future changes.

Learning Discussion



Write/draw on this page major changes that have been observed in your coral reef area in the past 10 years. Write what you think is the cause of each change and what you think are the results of each change.

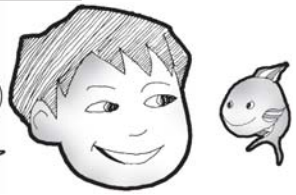
year	cause	changes	results

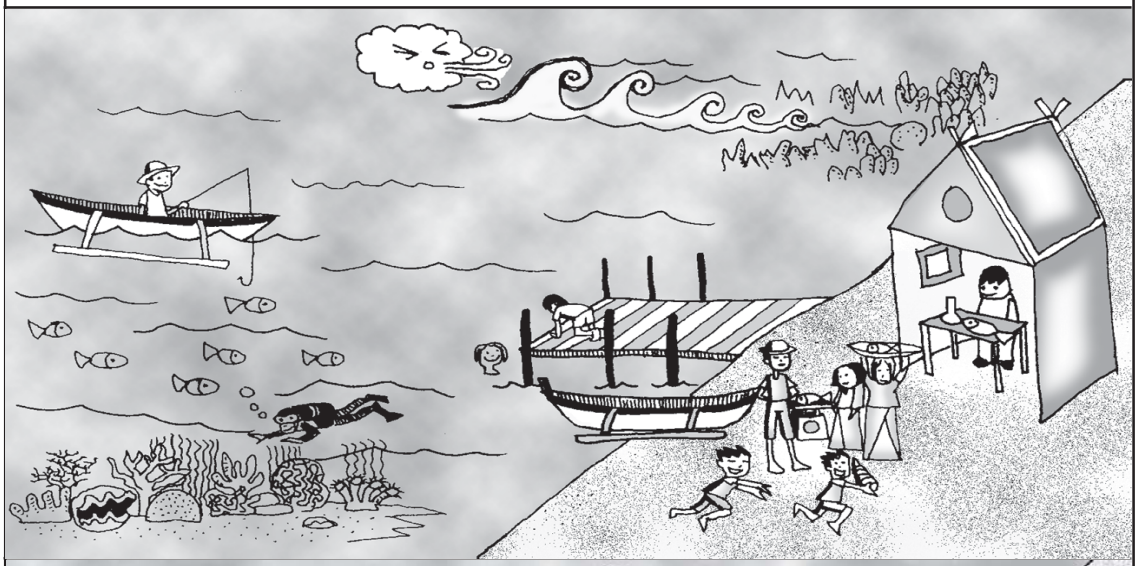
Sample Data

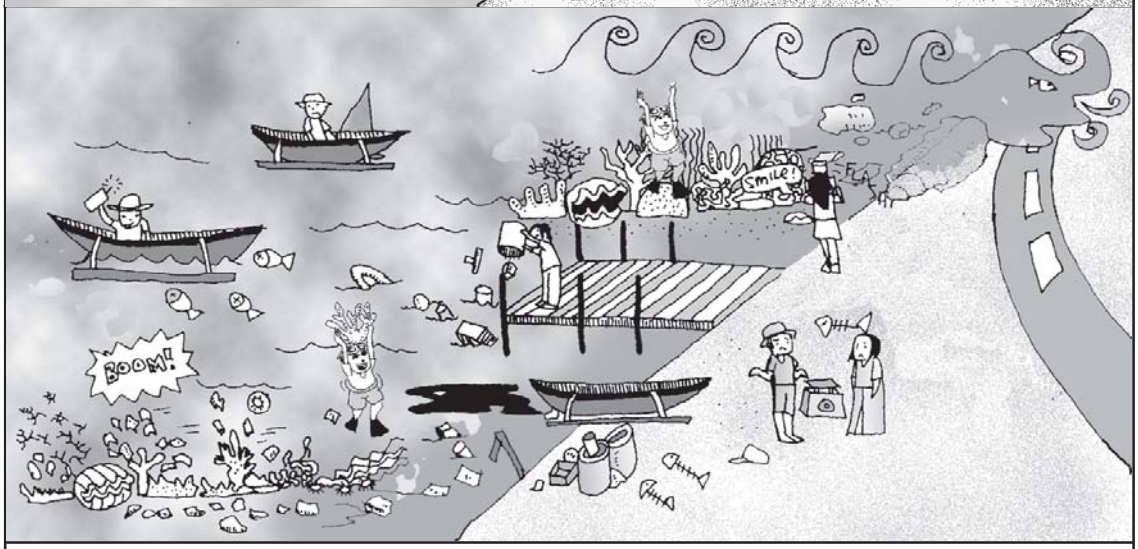
EXAMPLE year	(from Hughes 1994) cause	changes	results
1950s-1970s	overfishing	carnivorous, omnivorous, & herbivorous fishes decrease	less urchin predators, less competitors for algae
1950s-1970s	less urchin predators, less competitors for algae	urchins increase	urchins become dominant
1982-1984	urchins hit by virus	urchins decrease	few herbivores left to control algae
1983-1990s	few herbivores left to control algae	algae increase (4% cover -> 92% cover)	algae outcompete corals
1985-1990s	algae outcompete corals	corals decrease (from 52% cover -> ...	
1987, 1989 & 1990	mass bleaching	corals further decrease ... -> to 3% cover)	

3 WHY MONITOR REEFS?

Reefs give us food, income, pleasure, and protection from storms. Reefs are also a potential source of medicine.

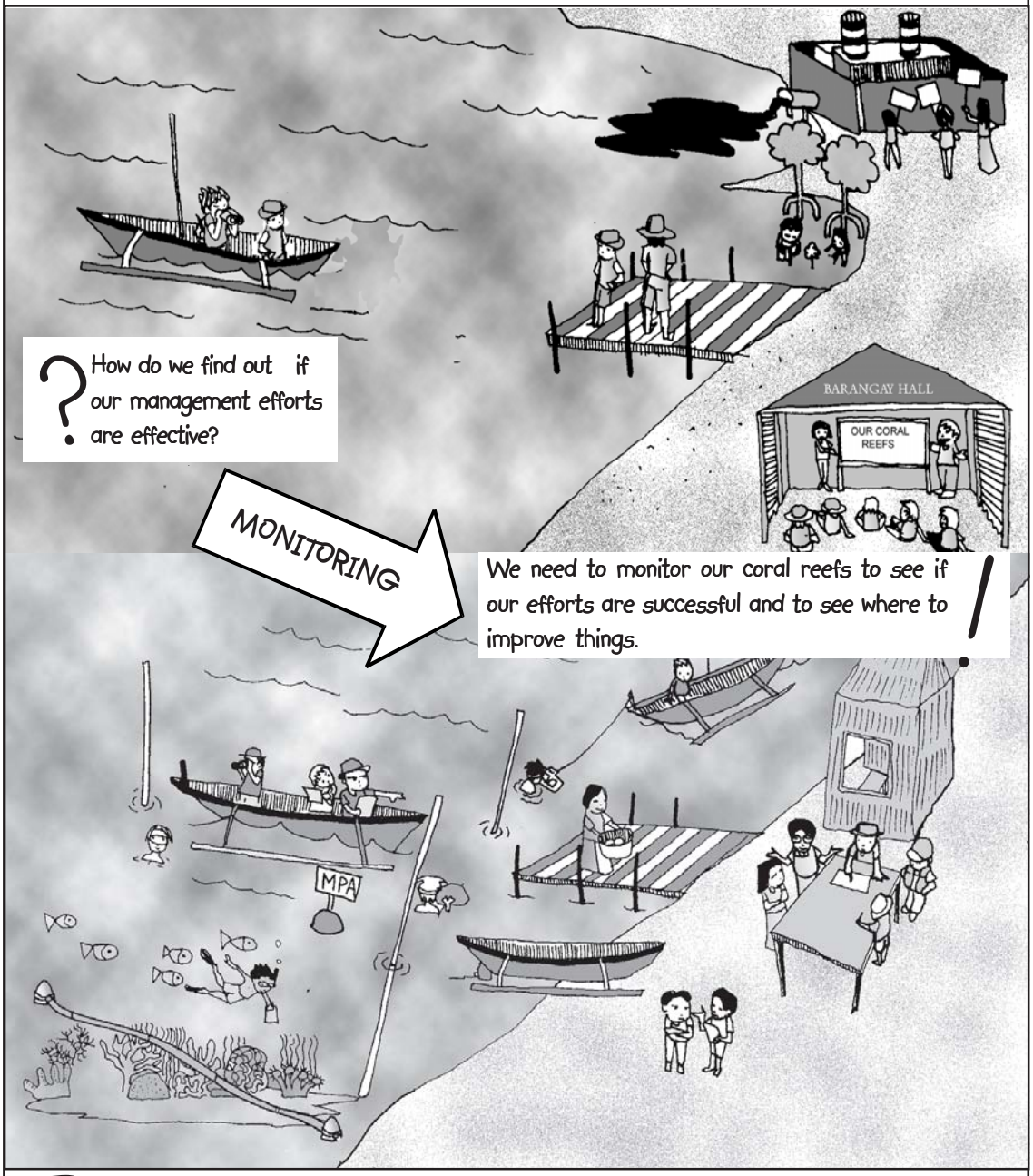






But reefs are being threatened by destructive fishing methods; overharvesting; siltation; sewage; garbage; agricultural, mining and industrial pollution; tourism-associated damage; coastal construction; and global warming.

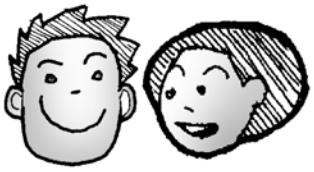
So it is important for us to manage our reefs. Many of us are helping to manage our coastal environment by establishing marine protected areas (also known as marine reserves or sanctuaries), patrolling, educating others, recycling and proper waste disposal, reforesting, and reseeding.



Reef scientists and volunteer SCUBA divers are keeping watch on the earth's reefs. We present here simple methods for non-SCUBA divers... to allow rural communities and development workers to see for themselves what is going on on the coral reefs under the sea.

Learning Discussion

Answer the following items.



List 3 ways that reefs are useful to you.

1. _____

2. _____

3. _____

Adaptive Management Cycle

List the top 3 problems of your coastal environment.

1.
2.
3.

List 3 ways by which you are helping to solve these problems.

1.
2.
3.

List 3 ways you can improve coastal management.

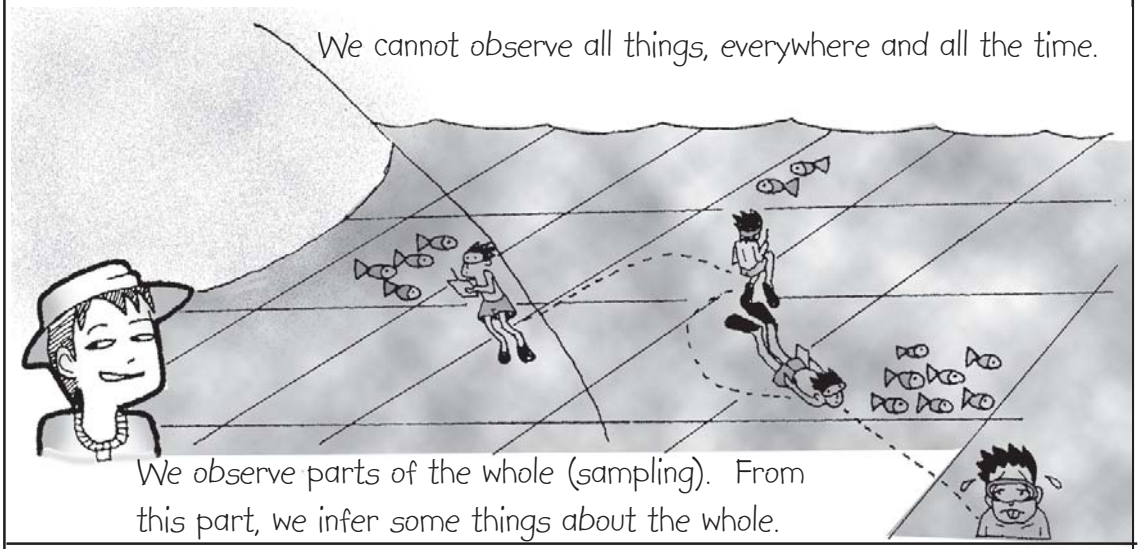
1.
2.
3.

List 3 effects of your efforts.

1.
2.
3.

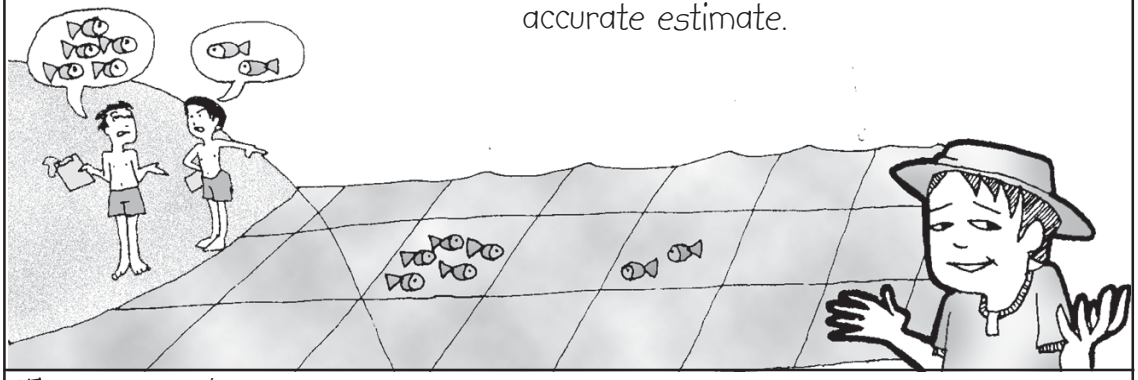
DRAWING UP A MONITORING PLAN 4

We cannot observe all things, everywhere and all the time.

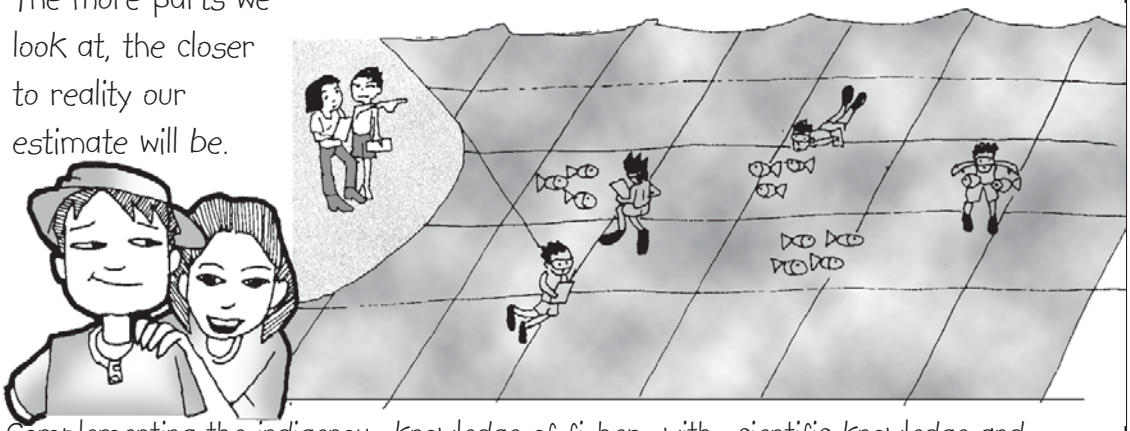


We observe parts of the whole (sampling). From this part, we infer some things about the whole.

A single observation might not give us an accurate estimate.



The more parts we look at, the closer to reality our estimate will be.

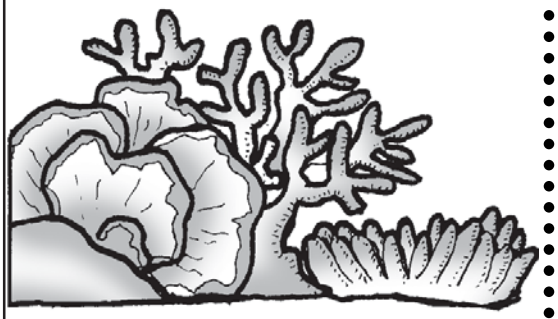


Complementing the indigenous knowledge of fishers with scientific knowledge and information from monitoring can give us a representative picture of what is happening.

Be clear about what you want to know, then select a few things to observe in several places through time.

Observe the things of interest that are likely to change due to poor or good management.

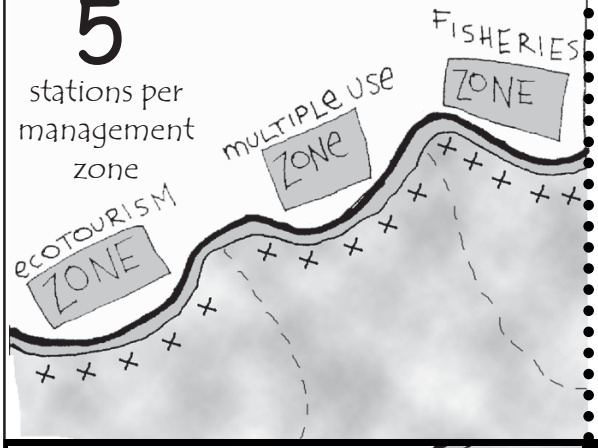
Legend: ⊖ causes decrease
⊕ causes increase
⊕ may cause increase or decrease ⊖

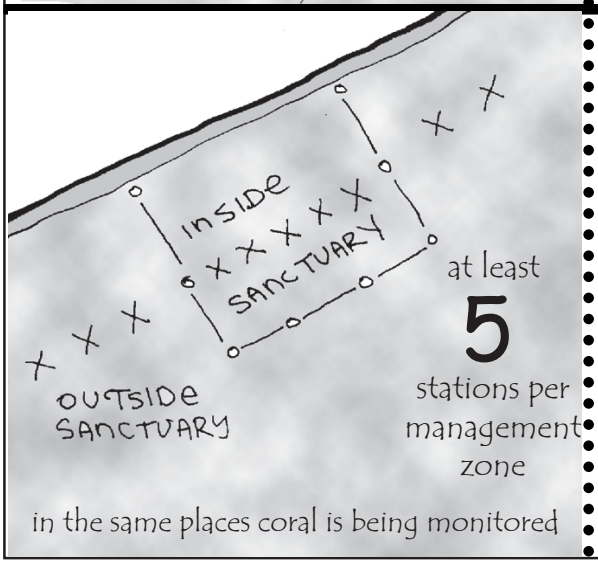
NEEDS/ INTERESTS	CHANGE MAINLY DUE TO
CORALS  ☆ home of fish & many other species ☆ tourist attraction ☆ storm protection	⊖ **destructive fishing** ⊖ siltation ⊖ **pollution** ⊖ coastal construction ⊖ storms ⊖ *global warming*
ALGAE  ☆ competitor of corals ☆ food for fish and invertebrates ☆ some live in the bodies of and produce food for corals and other invertebrates	⊕ pollution ⊕ overfishing ⊖ ⊕ **EPIDEMICS** ⊖ (algae are normal on reefs; but certain stresses may cause algae to be unusually rare or unusually abundant)

Observe in different kinds of places: inside and outside the management zone or use zone (e.g. inside and outside the marine protected area [MPA]). Try to observe at 5 stations within each management zone

WHERE

at least **5** stations per management zone





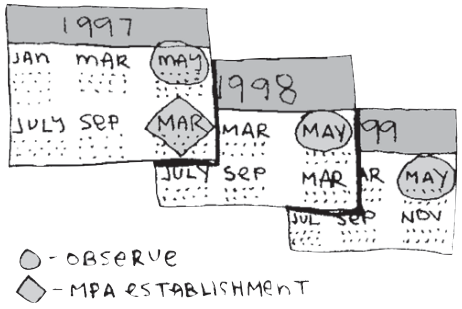
at least **5** stations per management zone

in the same places coral is being monitored

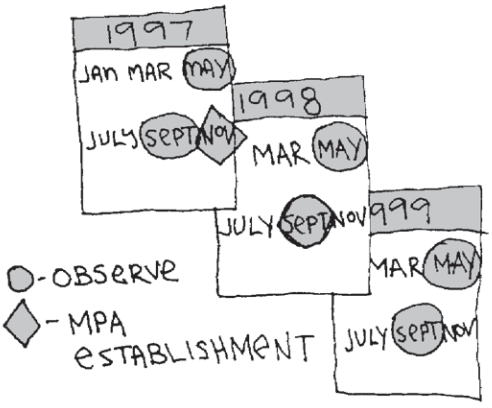
Observe before, and every year after establishment of the management actions, during each season. Things that don't change much can be observed less frequently.

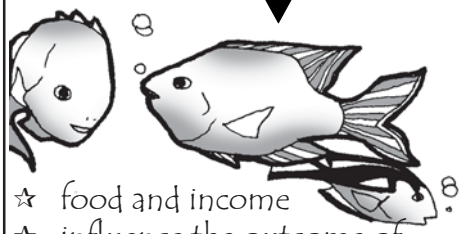
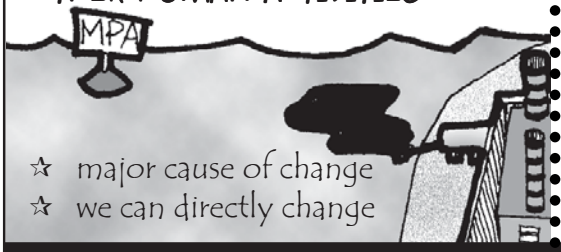
WHEN

Before and every year after management



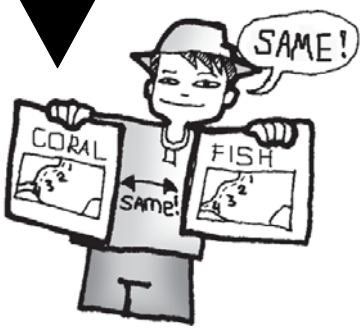
Before and every year after management. Ideally, once per season.



NEEDS/ INTERESTS	CHANGE MAINLY DUE TO
FISHES  ☆ food and income ☆ influence the outcome of competition between algae and corals	⊕ sanctuaries ⊖ destructive and overfishing ⊕ change in corals ⊖ ⊕ patrolling and enforcement
INVERTEBRATES  ☆ food and income ☆ influence the outcome of competition between algae and corals	⊕ sanctuaries ⊕ *reseeding* ⊖ *overfishing* ⊕ **EPIDEMICS** ⊖ ⊕ change in corals ⊖
CATCH  ☆ food and income	⊕ sanctuaries ⊕ change in fish and invertebrates ⊖ ⊕ patrolling and enforcement
OTHER HUMAN ACTIVITIES  ☆ major cause of change ☆ we can directly change	⊖ upland deforestation ⊕ education ⊖ shoreline development ⊕ legislation and enforcement
NATURAL DISTURBANCES  ☆ major cause of change ☆ we are not able to change	⊕ *global climate* ⊖ *(e.g. El Niño)* ⊖ **PATHOGENS**

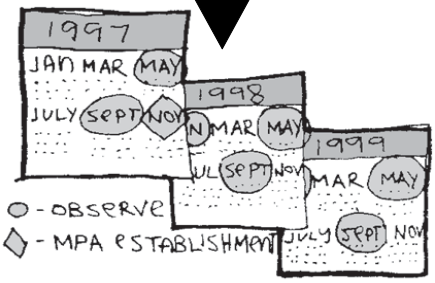
WHERE

at least **5** stations per management zone

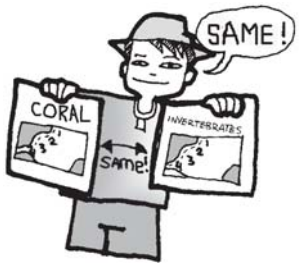


in the same places coral is being monitored

WHEN

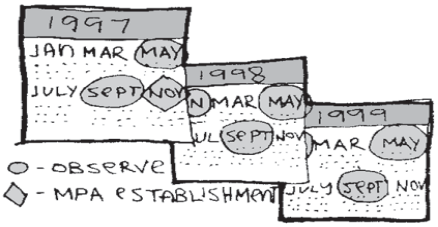


Before and every year after management. Ideally, once per season.



at least **5** stations per management zone

in the same places coral is being monitored



Before and every year after management. Ideally, once per season.

where local fishers are fishing and in local waters

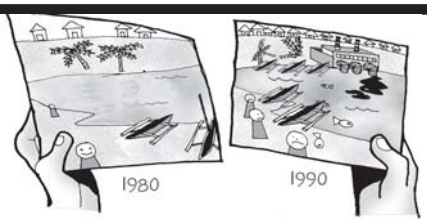
WHO

15 fishers or 10% of fisher population, whichever is greater

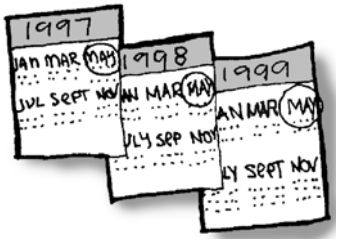
types used once every week or every 2 weeks

entire area of interest (e.g. within village / municipality / region / province)

AT LEAST once a year
BETTER if monthly or quarterly



entire area of interest (e.g. within village / municipality / region / province)



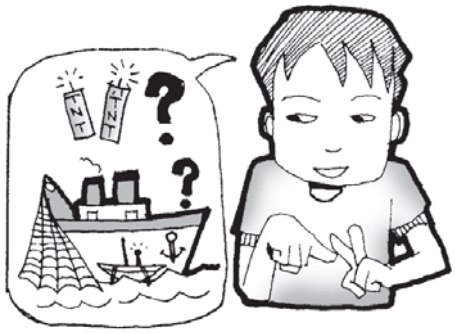
once a year

1 Meet with the community and the people who are important in decision-making.

Be clear about what you want to know.

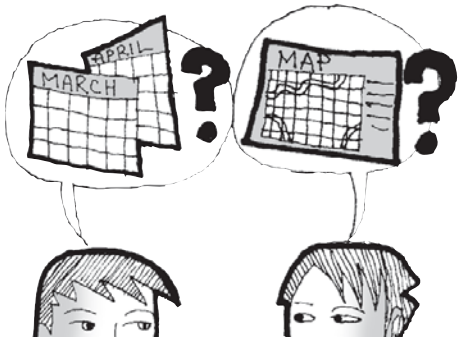
2 Determine whether monitoring can help in solving the problem or concern.

3 Use the Data Checklist Form 1 as shown on page 18.



Select a few things that can be used as an indicator or to directly answer your question.

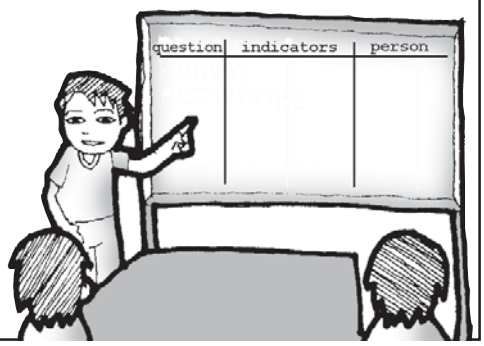
4 Discuss what may cause changes in your indicators.



Agree on where and how often these indicators need to be monitored.

5 Decide what monitoring method the group will implement and make sure everyone understands how to do the methods.

6 List the things needed and assign one person to take responsibility for monitoring each indicator.



For example, you could monitor algae, fish, and invertebrates inside and outside an MPA.

* Depth at which each transect is laid parallel to the shore or depth contour: 6 meters (20 feet) [also at 13 m (40 ft) if divers are available]. Transect can also be laid going down the slope if interested in change through depth

MONITOR EVERY YEAR

during the dry season,
the northeast monsoon
and the southwest monsoon
...so that changes from season to season
can be noted

(Corals may be monitored only once a year since they change very slowly)

Sample Checklist

Form 1 can be used to determine what data should be collected when monitoring.

DATA CHECKLIST FORM — **Form 1**

Question, issue or problem	Possible indicator(s)	What may cause change	Where to monitor	When to monitor	Monitoring method	Materials needed	Person(s) assigned	Target dates & # days needed
Overfishing Poaching in MPA	fish sizes & abundance	changes in fishing effort; natural disturbances; changes in coral cover; management practices	inside & outside the MPA	northeast monsoon, southwest monsoon, summer	fish visual census	50-m rope marked at 5-m intervals; mask & snorkel, slates w/ pencils; boat & gasoline; data sheets	MPA monitoring team	1st weekend of January; 1st weekend of May; 1st weekend of September (2-3 days per session)
	invertebrate abundance	same as above	same as above	same as above	invertebrate census	same as above	same as above	same as above
	fishing effort; catch per unit effort	increase in fishing effort; management practices like MPA enforcement	whole village	at least once a week	fish catch monitoring	data sheets & pencils; logbook or notebook; fish identification materials, resource map; weighing scale; calculator	MPA monitoring team; women's group	every Wednesday: collection/ submission of data forms 4th Saturday of the month: data summarization
Habitat Degradation	coral cover	destructive fishing practices; natural disturbances; management practices like MPA enforcement	inside & outside the MPA	once a year	manta tow, snorkel survey	50-m rope marked at 5-m intervals; mask & snorkel, slates w/ pencils; boat & gasoline; data sheets, watch, geographic positioning system (GPS)	MPA monitoring team	1st weekend of May; 1-2 days

A blank copy of this form is provided in Appendix 2, page 101

OBSERVING CORALS and ALGAE:
MANTA TOW, SNORKEL SURVEY, and POINT-INTERCEPT TRANSECT

5

A. Manta Tow

Definition

A manta tow survey is the observation of an underwater area of good visibility by a snorkeler who is being pulled by a small boat.

Purpose

Manta tows are used to get a general idea of the various types and amounts of habitat types and large obvious things in an area. This information may be used:

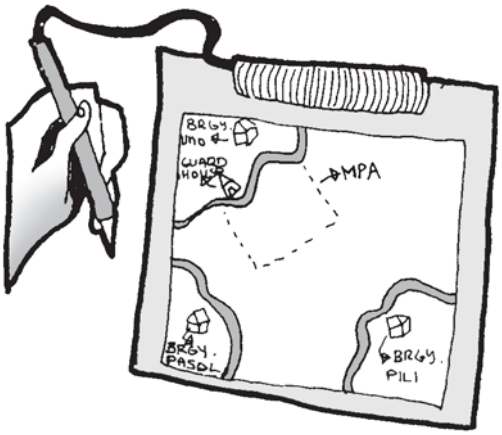
- ✓ to help in the selection of sites and numbers of samples for closer observation
- ✓ for comparison with local perceptions of the coastal area.
- ✓ in the detection of large-scale changes (e.g. due to storms or mass siltation)

Requirements

- ❑ Small boat and fuel
- ❑ Mask and snorkel
- ❑ Manta board
- ❑ Map of the area
- ❑ Watch preferably showing the seconds
- ❑ 17-m rope (approx. 10 mm in diameter marked at 6-m and 12-m from one end)
- ❑ Geographic positioning system (GPS) or compass

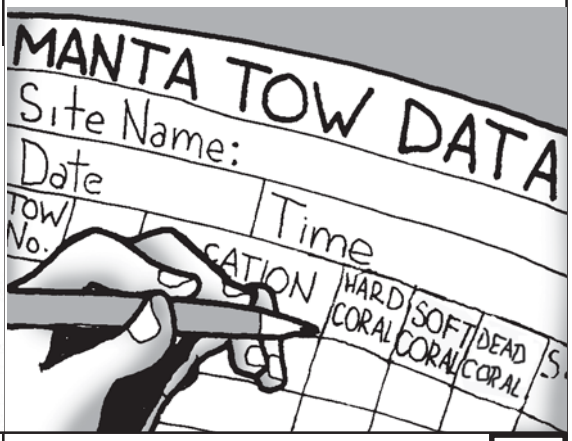
1 Copy a map of the area to be surveyed onto a slate.

2 Mark features (landmarks and boundaries) and zones (uses and protection) on the map.

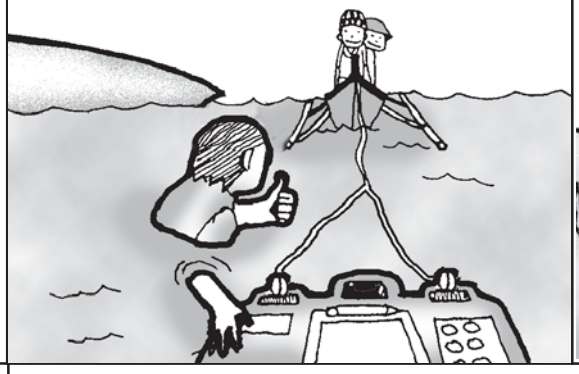


3 Plan and mark the tow survey path (usually along the reef perimeter or selected depth contour) on the map.

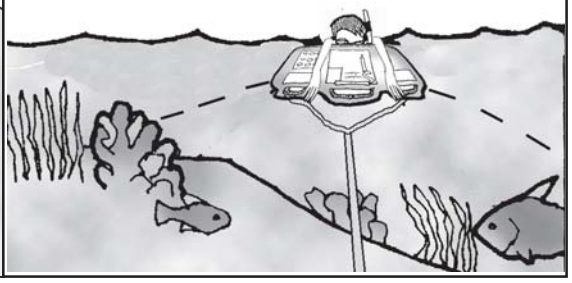
4 Choose 3 to 5 items (e.g. live hard coral, dead coral, soft coral, and sand/silt) to estimate.



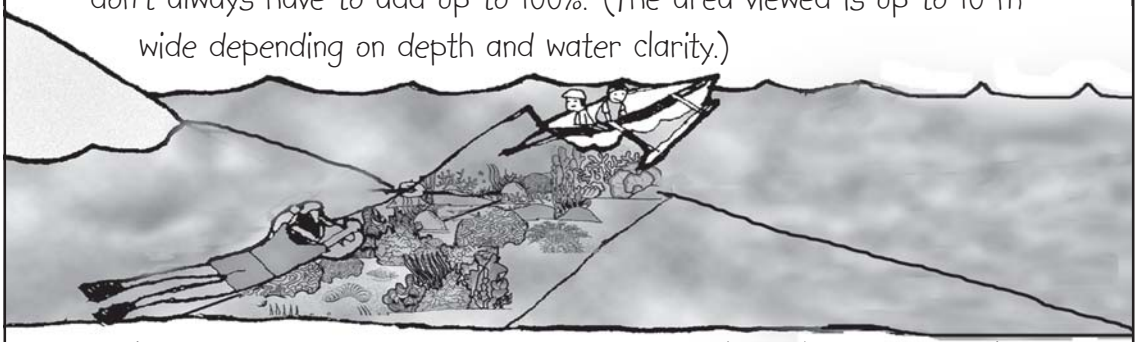
5 Attach a manta board to the boat using the rope.



6 When the observer (snorkeler) is ready and gives the "OK" signal, tow the snorkeler parallel and over the reef edge along the area to be surveyed.

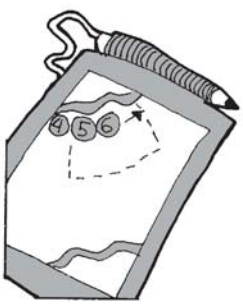


7 During each tow, the observer estimates the approximate percentage cover of the items chosen in step 4. Percentages of the various items don't always have to add up to 100%. (The area viewed is up to 10 m wide depending on depth and water clarity.)



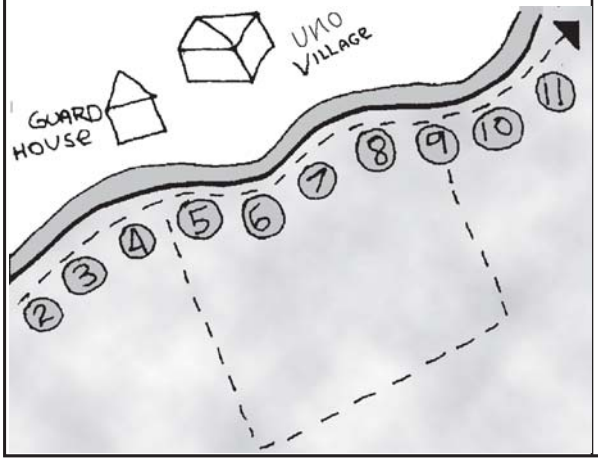
Meanwhile, a person keeping watch of the time or 'timer' on the boat looks out for the observer's **safety** and directional signals and relays these to the driver.

8 After 2 minutes of towing (around 100 to 150 m), the timer should inform the driver and the observer to pause and take notes (e.g. by tugging on the rope or using a whistle).



The observer then records onto the board the tow number and his/her observations of the last 2-minute tow while the driver or the timer marks the tow number at their current position on the map. One's current position on a map may be estimated by using a GPS, by using landmarks, and/or by triangulation with the help of a compass.

9 Repeat steps 6 to 8 until the entire planned tow path has been surveyed.



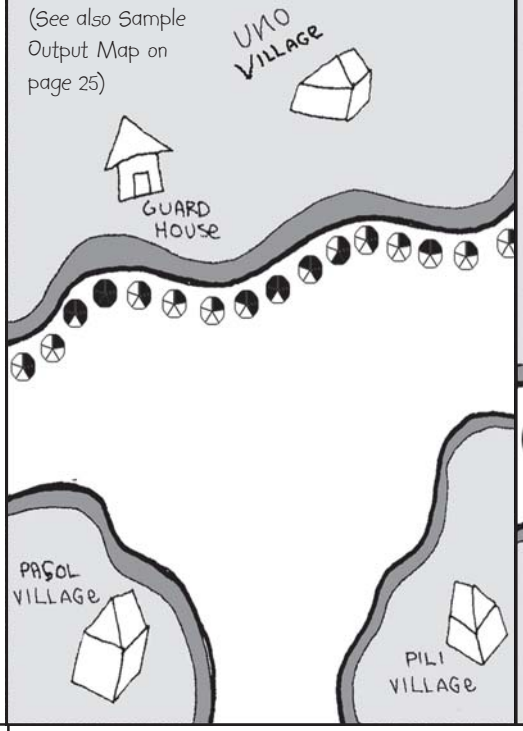
10 Copy the data onto the Data Form 3 as shown on page 24 and enclose a copy of the map (with tow numbers and path marked) with the raw data.

11 Convert the various percentage estimates of coral cover into its score on the five-point scale below:

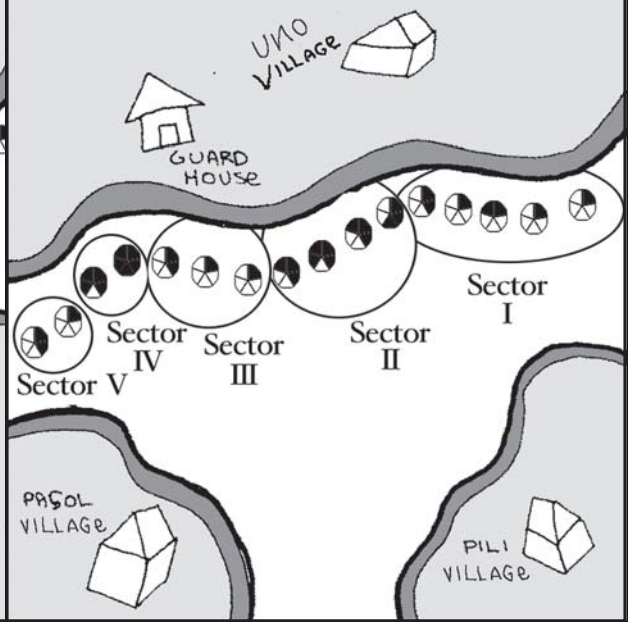
Score	%Cover	Symbol
1	0-10%	
2	11-30%	
3	31-50%	
4	51-75%	
5	76-100%	

12 Plot scores on the map. Put the live hard coral scores for each tow segment on the corresponding position of the tow segment on the manta tow map.

(See also Sample Output Map on page 25)



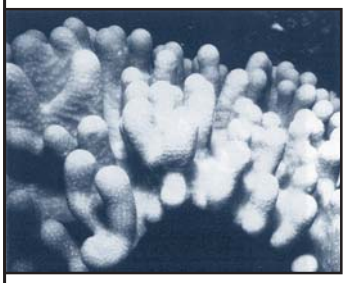
13 Use scores to group tow segment areas into sectors. Draw a circle around each set of continuous and similar hard coral scores on the map. You may also use the other scores (soft coral, dead coral, etc.) and observations to help group areas into sectors.



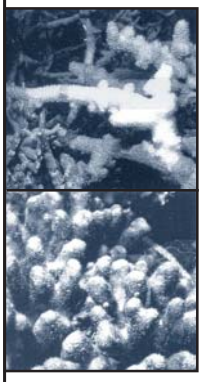
Tips:

Practice snorkeling, distinguishing, and estimating hard, soft, and dead coral in one spot before towing.

HARD coral (HC)



SOFT coral (SC)

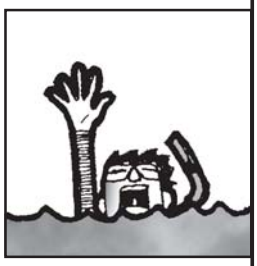


DEAD coral (DC)

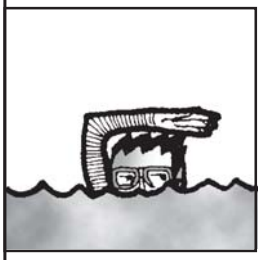
DEAD coral with algae (DCA)

Agree on HAND SIGNALS

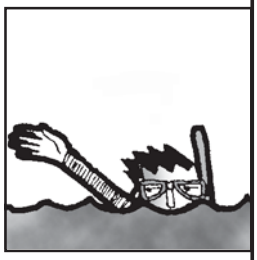
OK / start tow



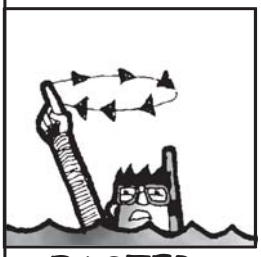
STOP towing



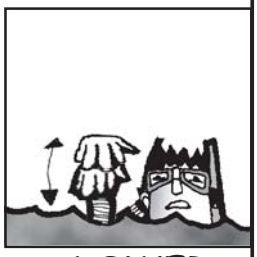
LEFT



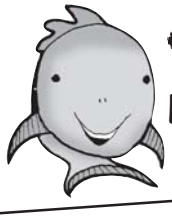
RIGHT



FASTER



SLOWER



STRENGTH

Large areas can be observed in a short time.

LIMITATIONS

1. Method can only be used in areas of good visibility & during calm sea conditions.
2. Measurements are only approximate.
3. Can be tiring.

Sample Data for Form 3
Manta tow data form

MANTA TOW DATA FORM

Form 3

Site Name: CABACONGAN **No.:** **Municipality & Province:** LOON, BOHOL

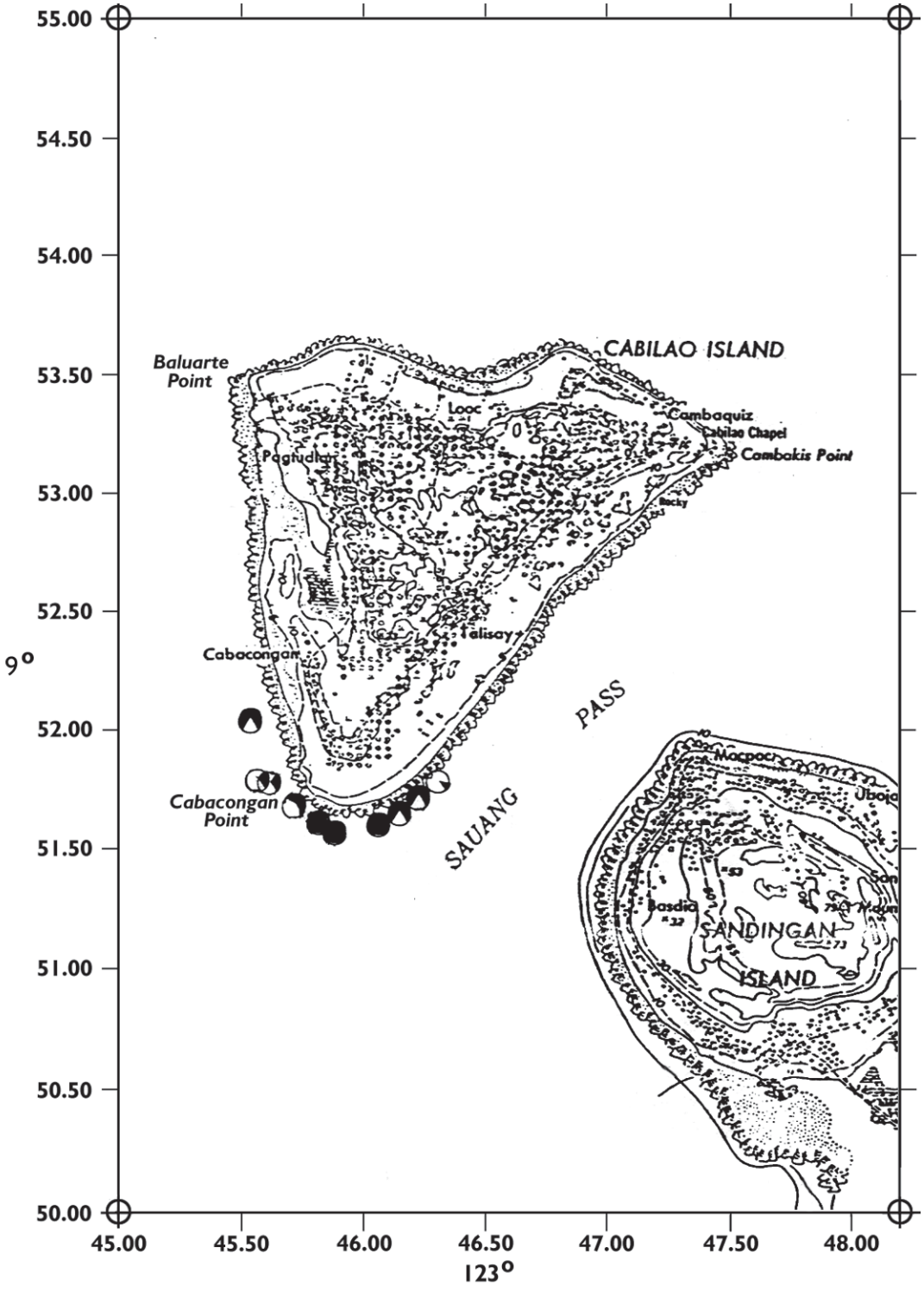
Date (month/day/year): 04/26/1999 **Time:** 4:00-5:00 PM **Observer:** Andre/Paulyn **Timer/Mapper:** Paulyn/Andre

Tow No.	Start Time	Location			Estimate % substrate cover					Notes (e.g. crown-of-thorns starfish, *Diadema* urchins, algae, etc.)
		Latitude & Longitude/Compass Bearing/Landmarks		Depth (m)	Hard Coral	Soft Coral	Dead Coral	DC w/ Algae	Sand/ Silt	
		Start	End							
1	16:07:25	9°51.873 123°46.484	9°51.793 123°46.404		10	5	0		30	Observer: AU
2	16:10:00	9°51.792 123°46.404	9°51.722 123°46.330		70	0	0		5	Observer: AU
3	16:12:50	9°51.717 123°46.327	9°51.655 123°46.240		70	0	0		0	Observer: AU
4		9°51.649 123°46.241	9°51.606 123°46.167		85	0	0		0	Observer: AU
5			9°51.570 123°46.063							none
6	16:26:35	9°51.570 123°46.063			85	0	0		0	Observer: PAG
7	16:29:00	9°51.566 123°45.997	9°51.612 123°45.907		80	0	0		5	Observer: PAG
8	16:32:00	9°51.617 123°45.895	9°51.683 123°45.801		35	0	0		0	Observer: PAG
9	16:34:30	9°51.692 123°45.791	9°51.780 123°45.747		30	5	0		0	Observer: PAG
10	16:37:00	9°51.790 123°45.743			30	0	0	50	0	Observer: PAG
11	16:40:15	9°51.932 123°45.712	9°51.932 123°45.712		60	0	0	20	<1	Observer: PAG

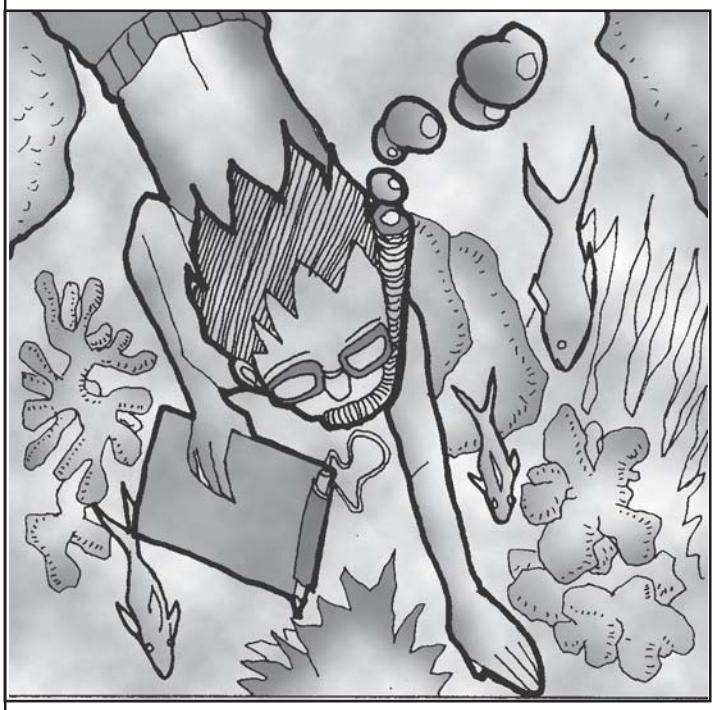
A blank copy of this form is provided in Appendix 2, page 106

Sample output map

Hard coral cover plotted on the map for Cabacongan Point, Loon, Bohol from the manta tow results



B. Snorkel Survey (for Snorkelers)



Definition

Snorkel survey is a method used by a snorkeler for estimating the relative abundance of living and non-living things on the reef bottom observed within a defined area.

Purpose

The snorkel survey estimates the abundance of hard corals, dead corals, algae, and various reef substrates which may reflect the health of the reef.

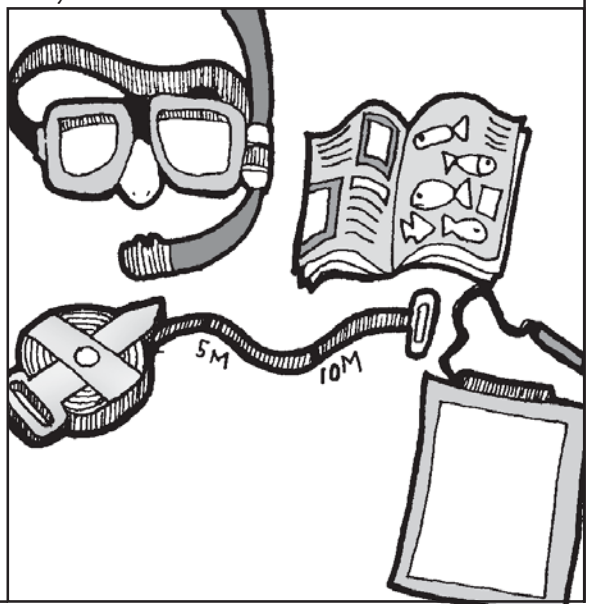
Requirements

- ❑ Picture book of the plant and animal types to be quantified (laminated guides would also be useful for training)
- ❑ Mask and snorkel
- ❑ 50-m transect line (marked every 5 m)
- ❑ Underwater slates with attached pencil

Optional

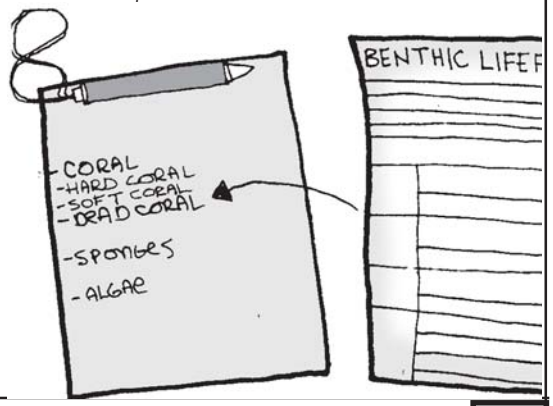
- ❑ Fins
- ❑ Life jacket

Look for the various lifeforms in the field and practice identifying other examples of those lifeforms in a given area prior to doing the actual assessments

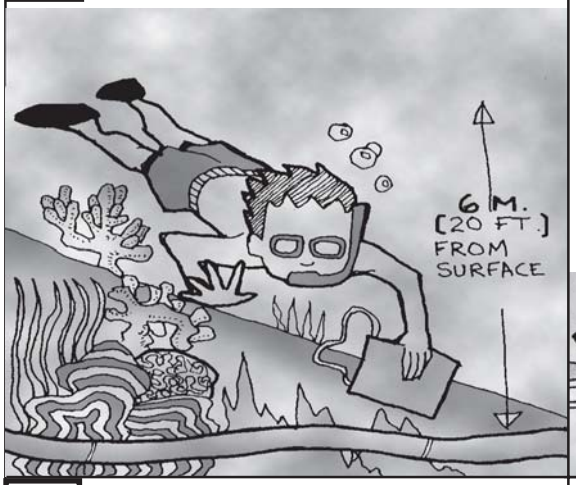


1 Select representative sampling stations to be surveyed/monitored based on the manta tow results.

2 Copy the Data Form 4A (with the selected benthic lifeform types - see Appendix 2, page 107) onto the plastic slates used for writing underwater.

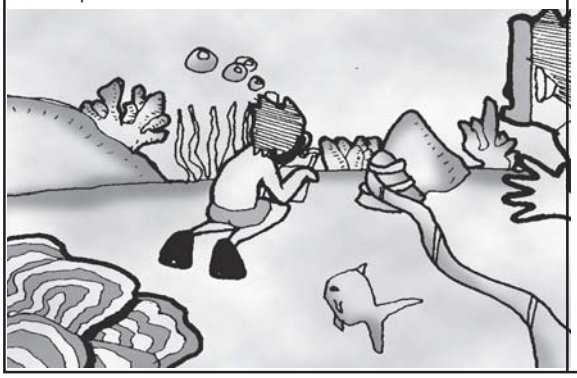


3 Lay the transent line on a constant depth contour. Record the depth.



4 Starting at one end of the transect line, the snorkeler swims over the transect estimating and recording the % cover of each benthic lifeform within 2½ m on either side of the transect until the 5-m mark. The estimates of each 5x5 m quadrat should total 100%. (See Sample Data Form 4A on page 34.)

5 Similarly record each 5-m interval until the entire 50-m transect line has been observed as shown in the Sample Data Form 4A.



6 Add the 10 readings for the transect and divide by 10 as shown on page 34.

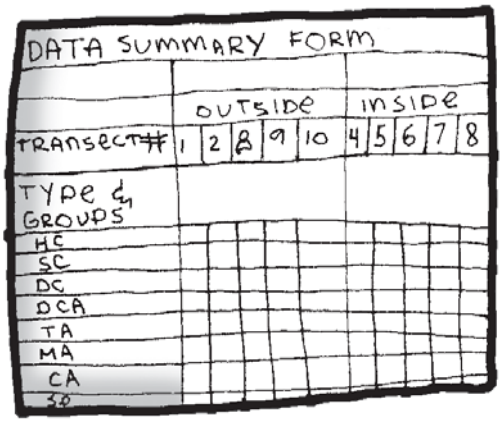
		TOTAL
HC	23+42+35 +40+14+16+ 24+27+32 +30	28.3

7 Classify the various transects according to your purpose for data summarization. For example:

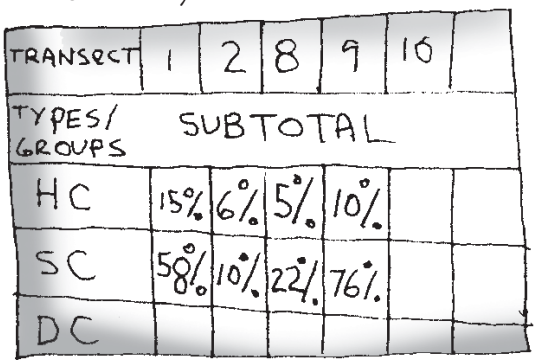
* reef zones or types (e.g. reef flat, reef slope, fringing reef, offshore reef, etc.),
* time of sampling (e.g. year 1/dry season, year 1/wet season, year 2/dry season, etc.)
* management or use zones (e.g. sanctuary, fishing grounds), and/or
* intensity of impacts (e.g. high pollution, medium pollution, low pollution)

List the transects by groups along the upper portion of the Summary Form 4C as shown on page 35.

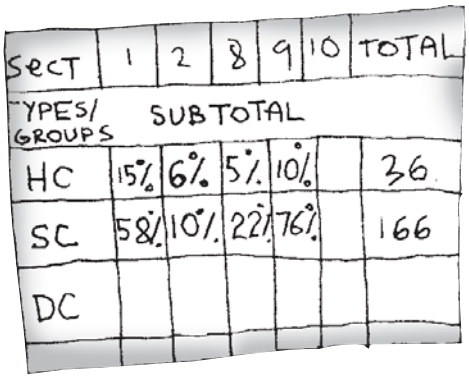
8 List the benthic lifeforms (by groups) along the left side of the Summary Form 4C.



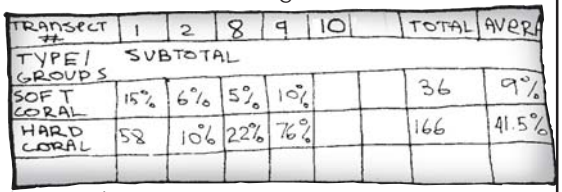
9 From the data sheets per transect copy the percentages of each type of lifeform to the Summary Form 4C.



10 Sum sub-totals for each benthic lifeform for each transect group.



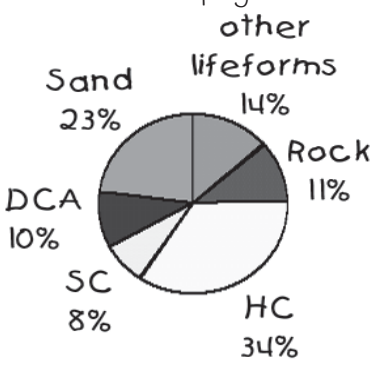
11 Standardize sub-total by sample size: Divide the total percentages by the number of transects actually observed. Write this on the column for averages.



Example:

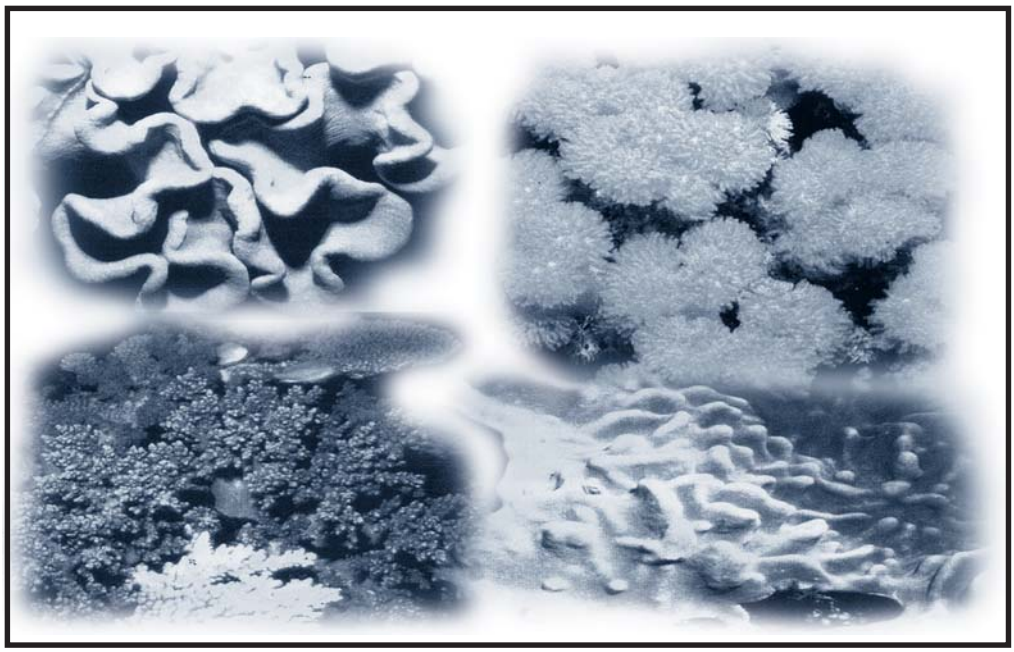
$$\frac{43\%+8\%+20\%+32\%+17\%}{5 \text{ transects}} = 24\%$$

12 Draw pie charts for the average percentages of each transect group on the Benthos Form 4D Graph as shown on page 36.

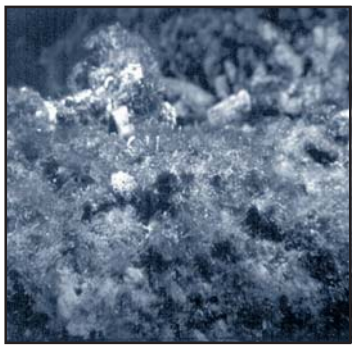


Common Benthic Lifeforms

Hard Coral
(HC)

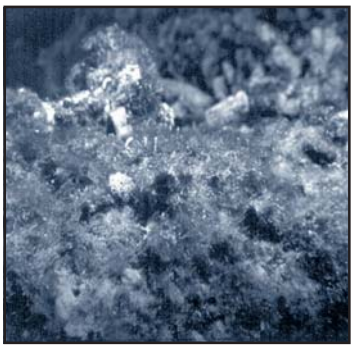


Soft Coral
(SC)



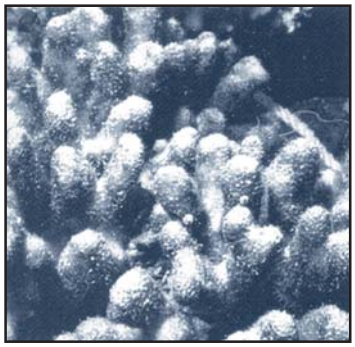
Turf Algae
(tiny filaments)

Dead Coral
(white with no living tissue)



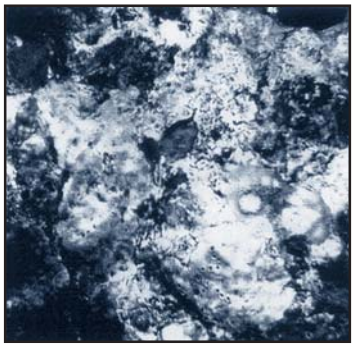
Sand/Silt

Macroalgae
(can be picked up with fingers)



Dead Coral with Algae
(corallites still visible)

Rock/Rubble
(rubble: coral fragments)



Coralline Algae
(hard, pink or reddish crusts)

STRENGTH

The lifeform categories do not require knowledge of coral taxonomy.

LIMITATIONS

1. Sometimes there is confusion as to how to categorize some lifeforms (do standardization exercises with your trainer)
2. Without sufficient replication, it may be difficult to obtain precise information on changes through time.

C. Point-intercept Transect (for SCUBA divers)

Definition

Benthos point-intercept transect is a method used by SCUBA divers for estimating the relative abundance of living and non-living things on the reef bottom observed within a defined area.

Purpose

The point-intercept transect is used to more precisely estimate the abundance of hard corals, dead corals, algae, and various reef substrates which may reflect the health of the reef.

Requirements

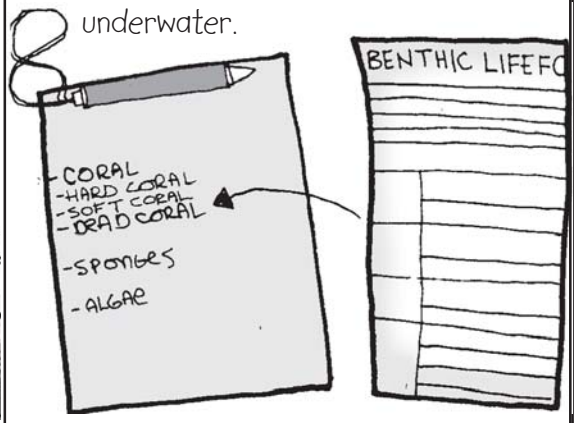
- ❑ Picture book of the plant and animal types to be quantified
- ❑ SCUBA diving gear
- ❑ 50-m transect line (marked every 0.25 m)
- ❑ Underwater slates with attached pencil
- ❑ Properly-certified SCUBA divers

Optional

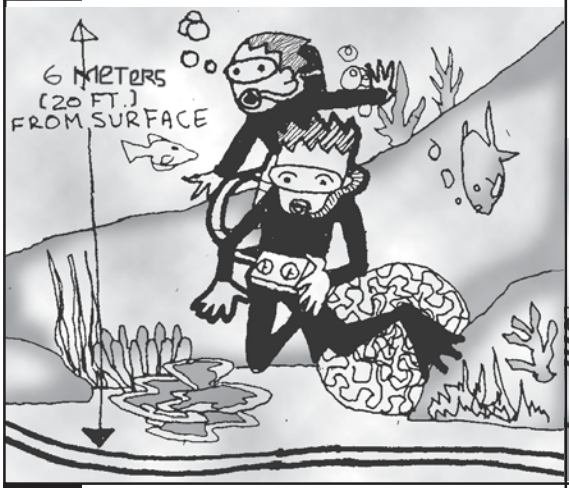
- ❑ Boat (depending on where the survey site is)

1 Select representative sampling stations to be surveyed/monitored based on the manta tow results.

2 Copy Data Form 4A (with the selected benthic lifeform types - see Appendix 2, page 107) onto the plastic slates used for writing underwater.

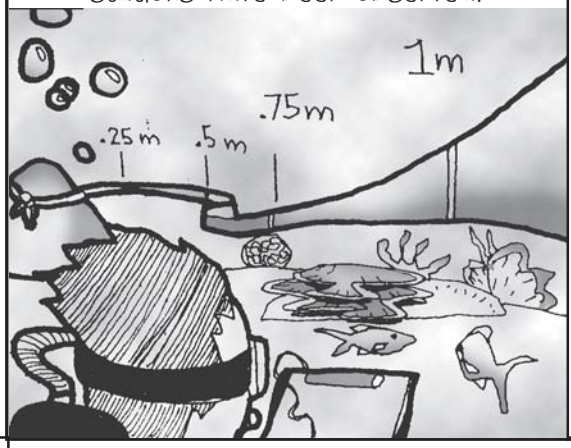


3 Lay the transect line on a constant depth contour. Record the depth.

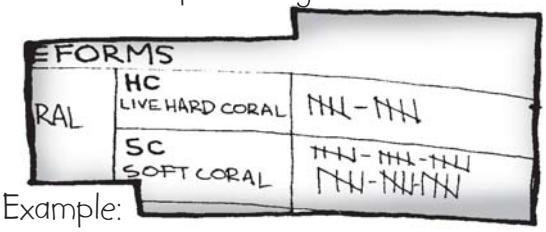


4 Starting at one end of the transect line, the observer identifies and tallies on the data form the benthic lifeform directly underneath each 0.25 m interval along the transect line.

5 Similarly, record the other stations in turn until all the planned stations have been observed.



6 Total the number of points under which each lifeform was observed and divide this by the total number of points observed to derive your estimate of percentage cover.



Example:

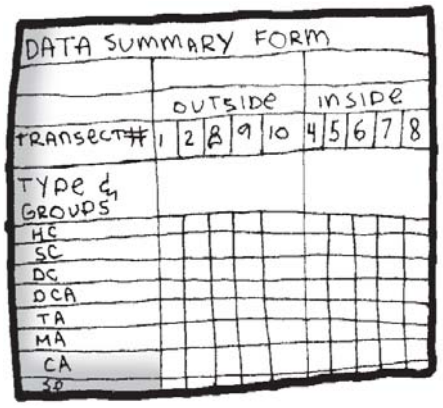
$$\frac{\text{30 soft coral points}}{\text{200 observed points}} = 15\% \text{ soft coral}$$

7 Classify the various transects according to your purpose for data summarization. For example:

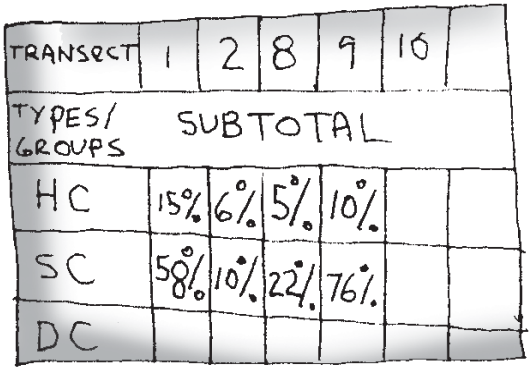
* reef zones or types (e.g. reef flat, reef slope, fringing reef, offshore reef, etc.),
* time of sampling (e.g. year 1/dry season, year 1/wet season, year 2/dry season, etc.)
* management or use zones (e.g. sanctuary, fishing grounds), and/or
* intensity of impacts (e.g. high pollution, medium pollution, low pollution)

List the transects by groups along the upper portion of the Summary Form 4C as shown on page 35.

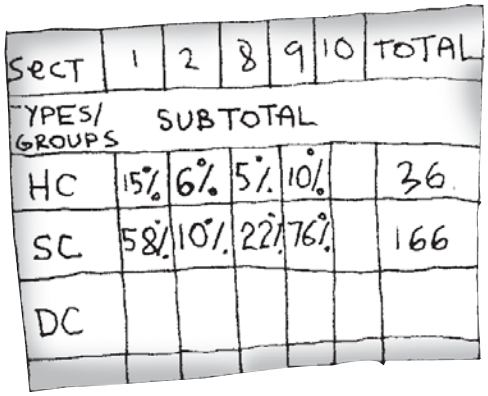
8 List the benthic lifeforms (by groups) along the left side of the Summary Form.



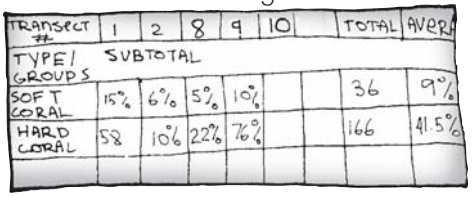
9 From the data forms per transect copy the percentages of each type of lifeform to the Summary Form.



10 Sum sub-totals for each benthic lifeform for each transect group.



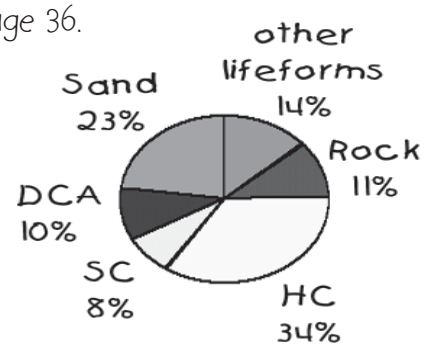
11 Standardize sub-total by sample size: Divide the total percentages by the number of transects actually observed. Write this on the column for averages.



Example:

$$\frac{15\% + 6\% + 5\% + 10\%}{4 \text{ transects}} = 9\%$$

12 Draw pie charts for the average percentages of each transect group on the Benthos Form 4D Graph as shown on page 36.



Sample Data Form 4A showing results of a 50-m transect using the snorkel survey method

BENTHIC LIFEFORMS & INVERTEBRATES DATA FORM — Form 4A

Site Name: Gilutongan Marine Sanctuary	**Municipality & Province:** Cordova, Cebu
Transect No.: 1 **Scuba:** **Snorkel:** ✓	**Coordinates:** 10°12.701′ N, 123°59.301′ E
Date (mo/dy/yr): 11/4/99	**Benthos observer:** R. Amolo **Invertebrates observer:** A. Diola
Horizontal water visibility (m):	**Depth (m):** 3.5 m **Reef zone:** fore slope **Topography:** moderate **Slope:**
Habitat notes:	

BENTHIC LIFEFORMS		Tally number of points or est. % occupied by each lifeform e.g. ~~𝍸 𝍸 𝍸~~ 11 or 12% +34% +22% +...										Total Count	% Cover
coral	**HC** live hard coral	25	10	15	8	8	5	17	10	18	23	139	13.9%
	SC soft coral	0	10	0	15	0	5	5	0	0	0	35	3.5%
dead coral	**DC** white dead coral	0	0	3	0	0	0	0	5	0	0	8	0.8%
	DCA dead coral w/ algae	0	6	0	0	2	0	0	3	0	0	11	1.1%
other animals	**SP** sponges	0	0	0	0	0	0	0	0	0	0	0	0%
	OT other animals	0	0	0	0	0	0	0	0	0	0	0	0%
plants	**TA** turf algae	46	43	32	2	40	35	34	39	49	47	367	36.7%
	MA fleshy macroalgae	14	8	15	20	10	5	10	10	8	5	105	10.5%
	CA coralline algae	0	3	0	5	0	0	4	0	0	0	12	1.2%
	SG seagrass	0	0	0	0	0	0	0	0	0	0	0	0%
non-living	**R** rubble	0	0	0	0	0	20	0	15	0	15	50	5%
	RCK rock	0	5	10	5	0	5	0	3	5	0	33	3.3%
	S / SI sand/silt	15	15	25	45	40	25	30	15	20	10	240	24%
TOTAL												1000	100%

INVERTEBRATES	# within 5-m width
Diadema urchins; *tuyom*	45
Pencil urchin	0
Crown-of-thorns starfish; *dap-ag*	0
Giant clam; *taklobo*	0
Triton shell; *tambuli*	0
Lobster; *banagan*	0
Sea cucumber; *balat*	0
Banded coral shrimp	0
others	0

Causes of coral damage:

Put x if found on corals. Circle the box of the dominant cause

- ☐ sediment
- ☐ blasting patterns
- ☒ anchor damage
- ☐ other breakage
- ☐ bleaching
- ☐ black band disease
- ☐ white band disease
- ☐ other coral disease
- ☐ seaweed overgrowth
- ☐ coral-eating snails
- ☐ crown-of-thorns starfish
- ☐ plastics
- ☐ other trash
- ☐ other causes (specify): _____

A blank copy of this form is provided in Appendix 2, page 107.

Sample summary data showing the results of 10 50-m transects using the point-intercept method

DATA SUMMARY FORM — Form 4C

Site Name: Gilutongan Marine Sanctuary | **Municipality & Province:** CORDOVA, CEBU

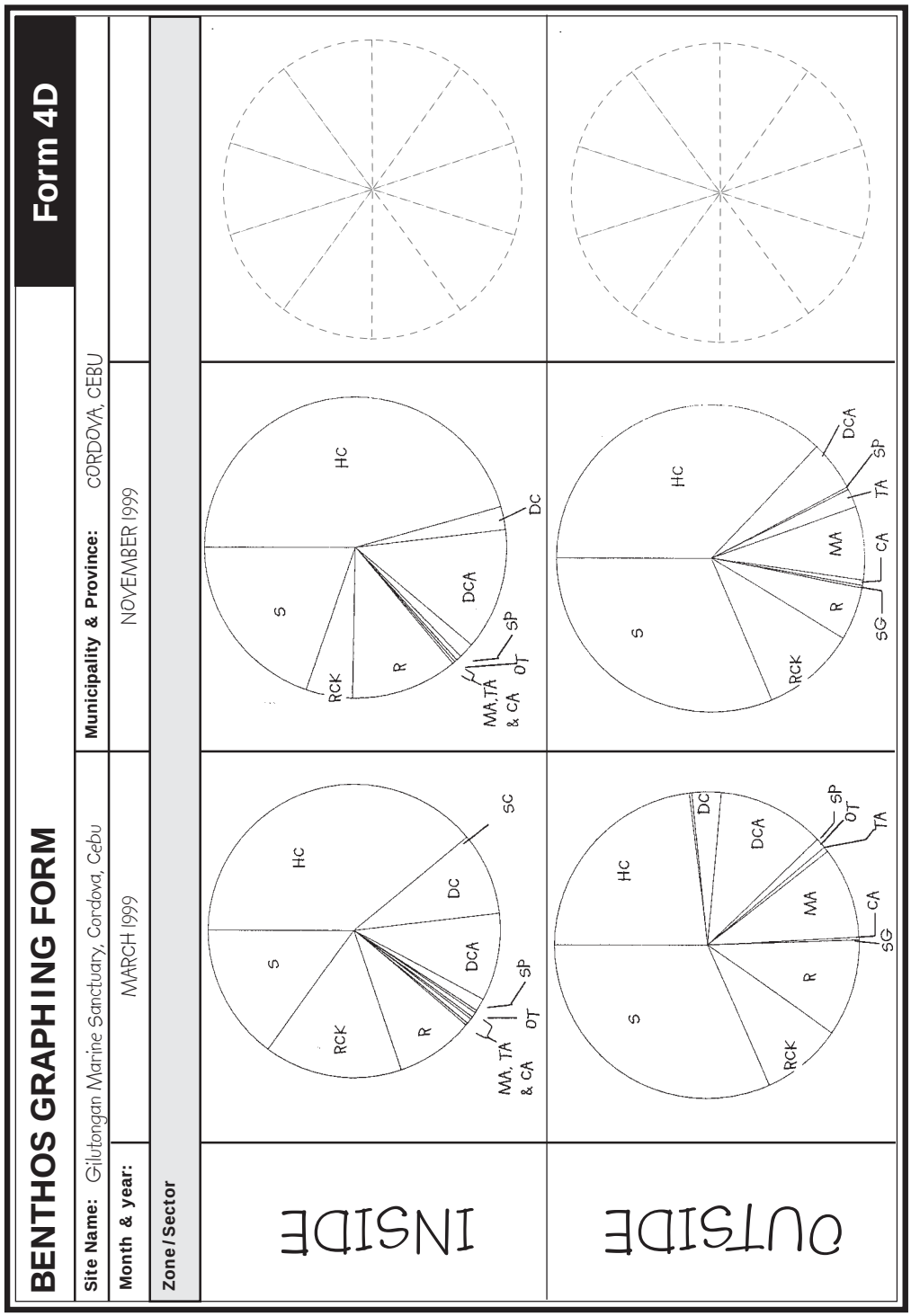
Zone/Sector: Outside | Inside

Month & year: November 1999 | November 1999

Transect #:	1	2	3	9	10			4	5	6	7	8		
Types/groups	**Sub-total**					**Total**	**Avg.**	**Sub-total**					**Total**	**Avg.**
Live hard coral	44.0%	28.0%	56.5%	41.0%	15.3%	184.8	37%	66.0%	58.5%	24.1%	42.5%	38.5%	228.6	45.7%
Soft coral	0.0%	0.0%	0.0%	0.0%	0.5%	0.5	0%	0.5%	0.0%	0.0%	0.5%	0.0%	1.0	0.2%
White dead coral	0.0%	0.0%	0.0%	0.0%	0.0%	0.0	0%	0.0%	0.0%	4.0%	6.5%	1.0%	11.5	2.3%
Dead coral with algae	4.0%	5.0%	9.0%	7.0%	2.6%	27.6	6%	9.0%	12.0%	13.6%	18.0%	12.0%	64.6	12.9%
Sponges	0.0%	0.0%	0.0%	0.5%	0.5%	1.0	0%	2.0%	1.0%	1.5%	2.0%	1.0%	7.5	1.5%
Other animals	0.0%	0.0%	0.0%	0.0%	0.5%	0.5	0%	1.0%	0.0%	1.5%	0.0%	0.5%	3.0	0.6%
Turf algae	0.0%	0.0%	7.5%	0.0%	0.0%	7.5	2%	0.0%	0.0%	0.0%	0.0%	0.5%	0.5	0.1%
Fleshy macroalgae	11.5%	27.5%	0.0%	0.0%	0.5%	39.5	8%	0.0%	0.0%	0.0%	0.5%	0.0%	0.5	0.1%
Coralline algae	0.5%	0.0%	0.0%	0.0%	0.5%	1.0	0%	0.0%	0.0%	0.5%	0.0%	0.0%	0.5	0.1%
Seagrass	0.0%	0.0%	0.0%	0.0%	2.6%	2.6	1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0	0.0%
Rubble	6.0%	9.5%	6.5%	5.0%	0.5%	27.5	6%	9.5%	9.5%	17.1%	9.5%	14.0%	59.6	11.9%
Rock	14.5%	15.0%	9.5%	4.0%	6.6%	49.6	10%	8.0%	7.0%	5.5%	3.0%	2.0%	25.5	5.1%
Sand/Silt	19.5%	15.0%	11.0%	42.5%	69.9%	157.9	32%	5.0%	12.0%	32.2%	17.5%	30.5%	97.2	19.4%
INVERTEBRATES														
Diadema	7	21	2	5	3	38	7.6	?	92	6	6	?	104	35
Sea cucumber	1	0	1	2	2	6	1.2	?	0	2	1	?	3	1

A blank copy of this form is provided in Appendix 2, page 109

Sample graphs showing the results of 10 transects at Gilutongan Marine Sanctuary, Cordova, Cebu



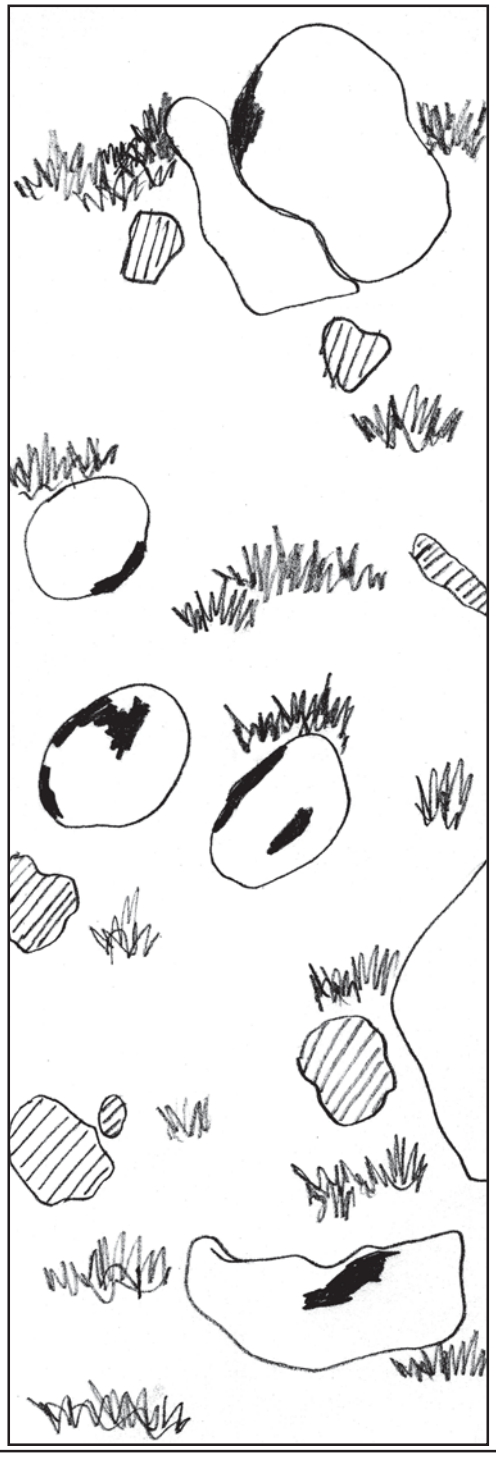
See explanation of acronyms on Form 4A, p. 34.

A blank copy of this form is provided in Appendix 2, page 110

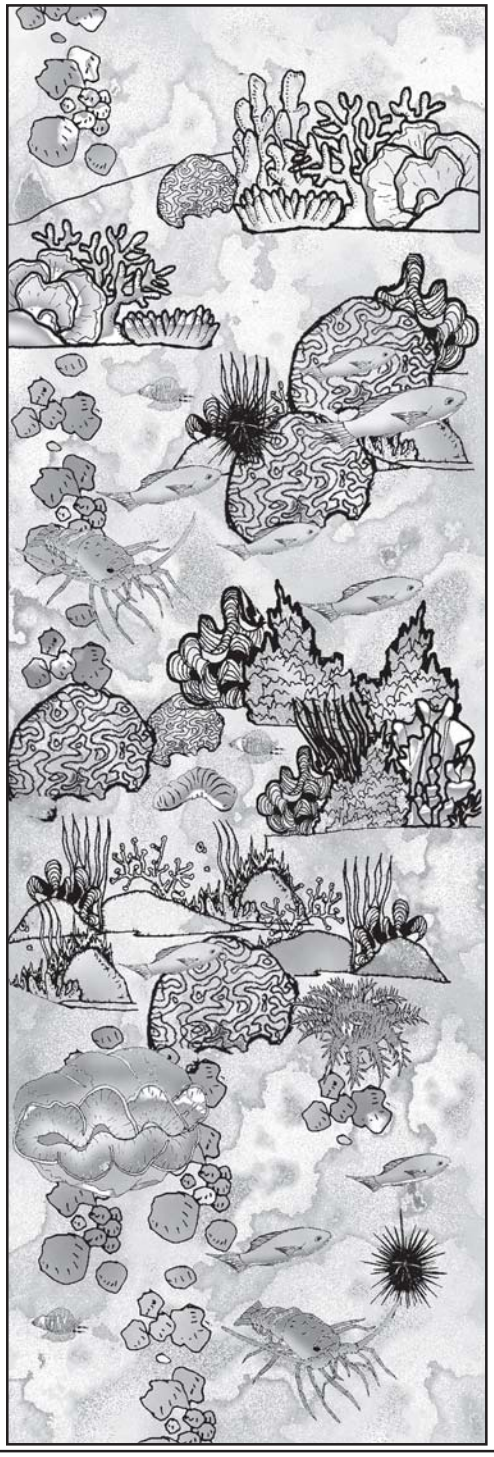
Learning Laboratory

Using the sample pictures below, estimate the percentage of the area covered by each of the various things found within the transects. Use a ruler as your sample transect line to practice snorkel survey or point-intercept transect. Don't use a ruler/transect if practicing manta tow.

TRANSECT A



TRANSECT B



Trainer's Tips for Chapter 5

The method of estimating benthic cover while snorkeling described in the handbook is an untested hybrid of the manta tow developed and regularly used by the Australian Institute of Marine Science and the systematic snorkel developed and tested by White *et al.* (2000) with Earthwatch volunteers and other survey groups.

Transects are to be laid at a constant depth (except when one's particular interest is to have a cross-sectional sample through depths—even then it would be preferable to collect separate samples at different fixed depths). A depth contour is a line of constant depth on the bottom surface. If you encounter an obstacle when laying the line, go around (rather than above) it so as to keep the transect on a constant depth.

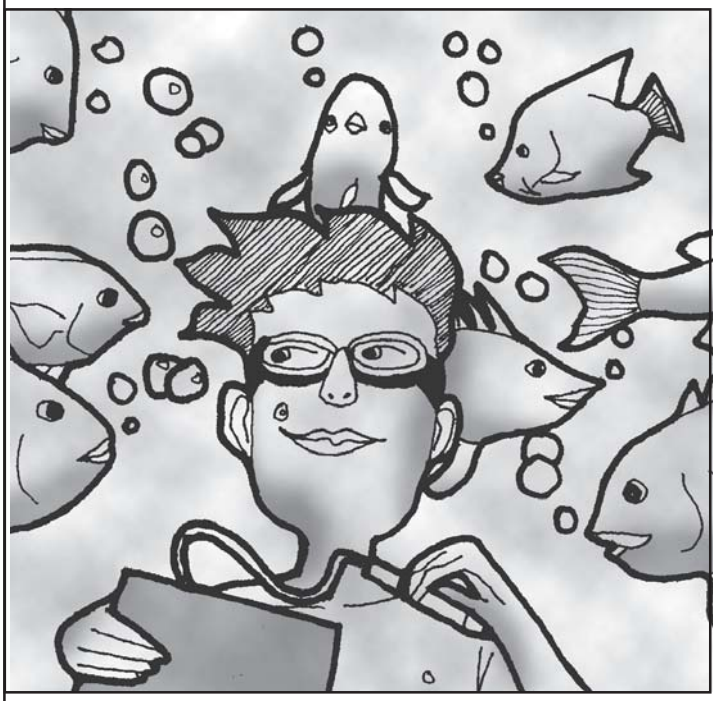
Review Questions

1. How do you tell the difference between a live hard coral and a dead hard coral?
2. How do you tell the difference between a hard coral and a soft coral?

Live hard corals are frequently pigmented. Dead hard corals are white and have no tissue. Hard corals with algae growing on them (not inside them) are almost always dead or dying.

Observing Reef Fishes: Fish Visual Census

6



Definition

Fish visual census is the identification and counting of fishes observed within a defined area.

Purpose

Fish visual census can be used to estimate the variety, numbers, and even sizes of common, easily-seen, easily-identified fishes in areas of good visibility. This information may reflect the health of the fish stocks within the surveyed coral reef areas.

Requirements

- ❑ Picture book of the animals (e.g. reef fishes) to be counted
- ❑ Goggles or mask and snorkel
- ❑ One or two 50-m lines each marked every 5 m
- ❑ Underwater slates with attached pencil

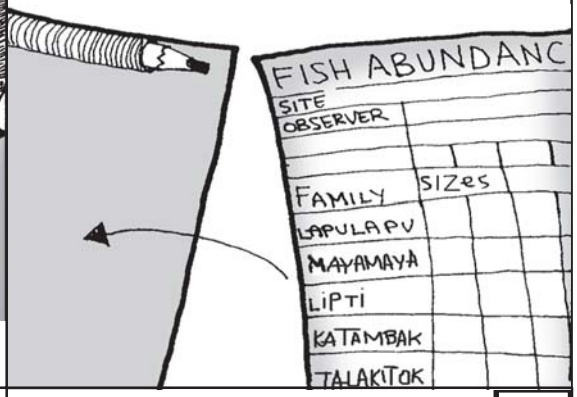
Optional

- ❑ Boat (depending on where the survey site is)
- ❑ Laminated fish identification guide (if observers are not familiar with the various fish types)
- ❑ Laminated butterflyfish identification guide (if indicator species are to be censused)
- ❑ Fins
- ❑ Life jackets

1 Select the sampling stations and fish types to be censused.

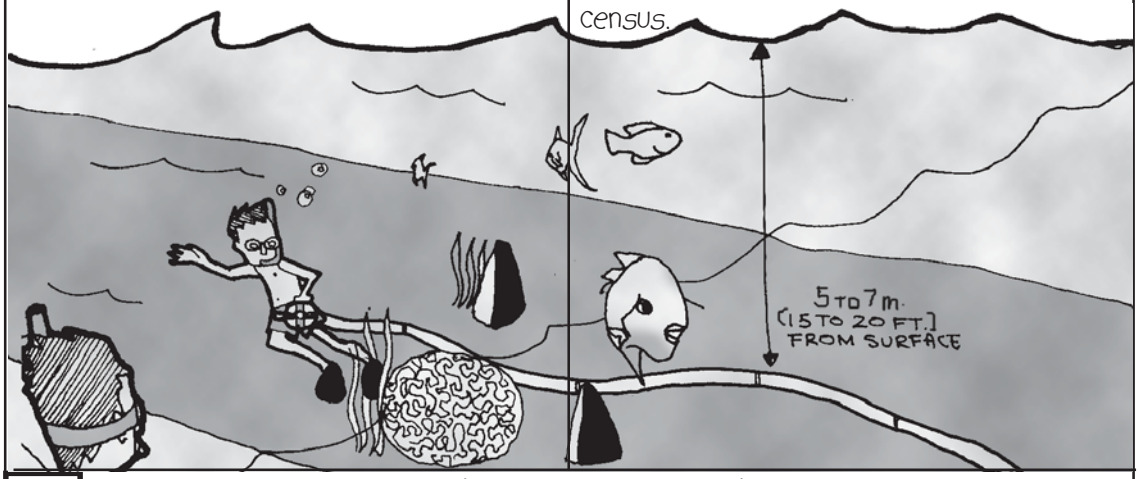
For each of the stations, do steps 2 to 6.

2 Copy the Data Form 5A (see Appendix 2, page 111) onto the slates and draw columns for the different size classes.



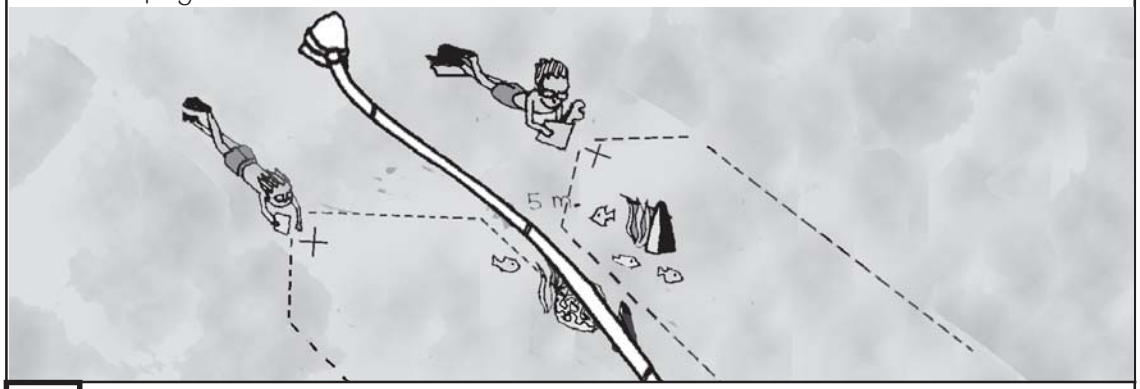
3 Lay the transect line on a constant depth contour. Record the depth.

4 Wait 10-15 minutes for the disturbed fishes to return. Be careful not to disturb the fishes during the census.

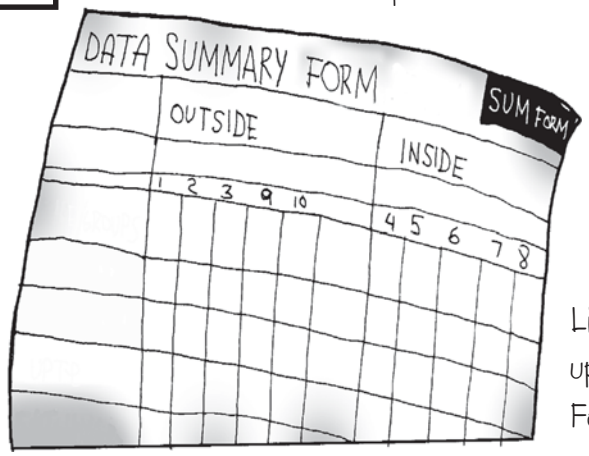


5 Starting at one end of the line, each observer floats on each side of the transect line while observing 5-m to his/her side of the transect and forward until the next 5-m mark.

6 Both observers swim to and stop every 5-m along the line to record the counts of fish per size class until the transect is completed. Generally, the faster moving fishes are counted before the slower moving fishes are counted. Each transect covers an area of 500 m^2 (50 m x 10 m width). Total counts on both sides and transcribe onto Data Form 5A as shown on page 47.



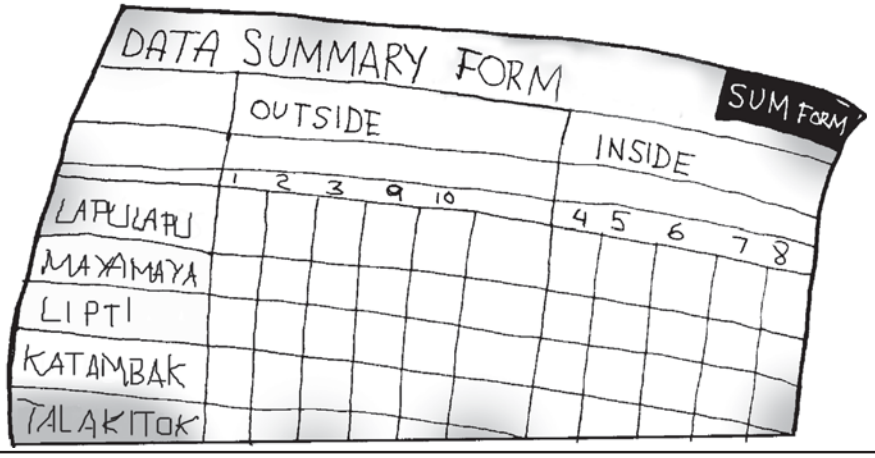
7 Classify the various transects according to your purpose for data summarization. For example:



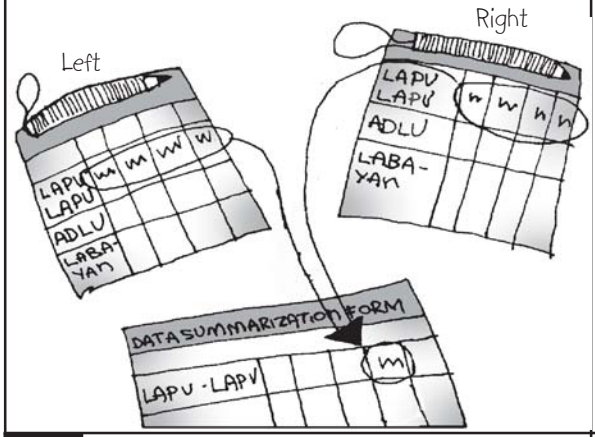
* reef zones or types (e.g. reef flat, reef slope, fringing reef, offshore reef, etc.),
* time of sampling (e.g. year 1/dry season, year 1/wet season, year 2/dry season, etc.)
* management or use zones (e.g. sanctuary, fishing grounds), and/or
* intensity of impacts (e.g. high pollution, medium pollution, low pollution)

List the transects by groups along the upper portion of the Data Summary Form 5B as shown on page 48

8 List the fish groups or fish types (by groups) along the left side of the Summary Form.



9 Total the counts of the different size classes for each type of fish per transect.



10 Write these sub-totals onto the appropriate boxes on the Summary Form.

NSECT 1	TRANSECT 2	TRANSECT 3	TRANSECT 9	TRANSECT 10	TOTAL	AVERAGE
12	11	5				
4	7	8				
2	12	14				

11 Sum sub-totals for each fish type/group for each transect group.

SUB-TOTAL

SECT 1	TRANSECT 2	TRANSECT 3	TRANSECT 9	TRANSECT 10	TOTAL	AVERAGE
2	11	5	3	5	36	
4	7	8	5	1	25	5
2	12	14	0	2	30	6

12 Standardize the sub-total by sample size: Divide the total counts by the number of transects actually observed.

Example:

$$\frac{12 + 11 + 5 + 3 + 5}{5 \text{ transects}} = 7 \text{ fishes/transect}$$

13 Choose a few fish types of interest and list these along the left side of the Fish Graphing Form 5C as shown on page 49.

GRAPHING FORM

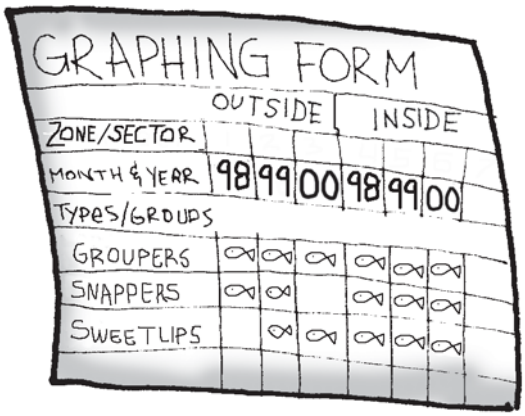
ZONE/SECTOR						
MONTH & YEAR						
TYPES/GROUPS						
LAPU LAPU						
MAYA MAYA						
LIPTI						

14 List the zone/sector, month, and year on the designated space on the form.

GRAPHING FORM

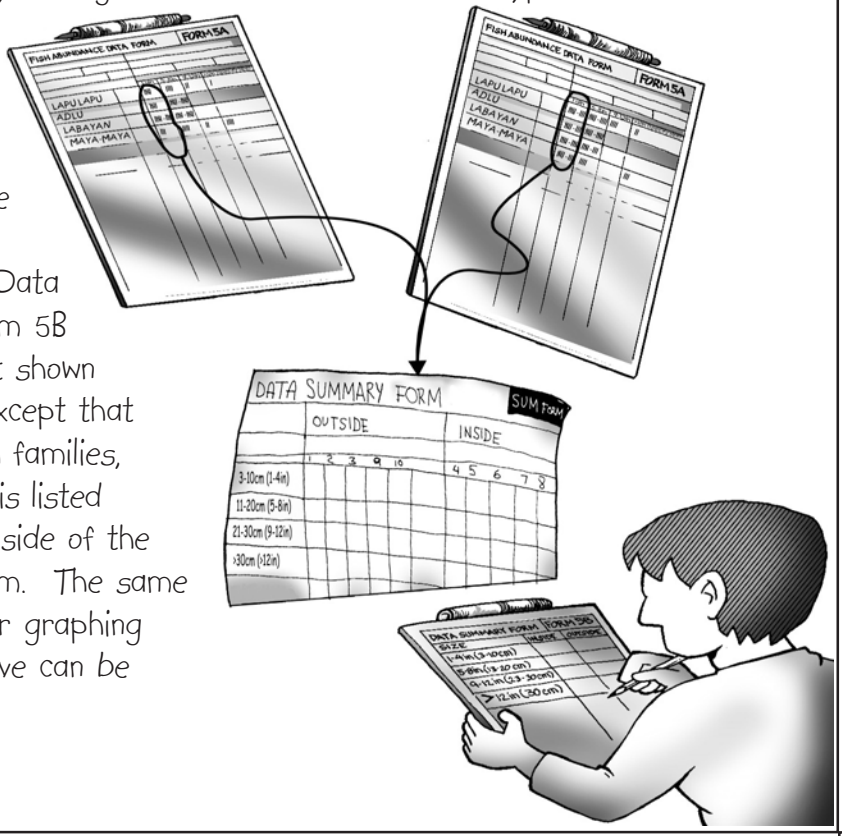
	OUTSIDE			INSIDE		
ZONE/SECTOR						
MONTH & YEAR	97	98	99	97	98	99
TYPES/GROUPS						
LAPU LAPU						
MAYA MAYA						
LIPTI						

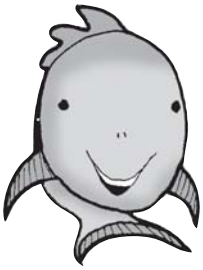
15 Use the following guide to represent the average number of fishes observed in each zone/sector and month/year.



NUMBER OF FISHES	PICTOGRAPH
>0-5	
>5-25	
>25-125	
>125-625	
>625	

16 Another way of summarizing data from fish visual census is by computing the total number of fish according to size. The results of this analysis are very helpful in determining changes in the quality of fish catch as a result of management: an increase in the number of larger-sized fishes not only often means better quality fish catch (the bigger fishes are usually more commercially valuable than the smaller ones) but could also indicate improvements in overall ecosystem health. These data can be obtained by adding the counts of the different types of fish for each size class in each transect and writing these sub-totals onto the appropriate boxes of the Data Summary Form 5B similar to that shown on page 48, except that instead of fish families, the size class is listed along the left side of the Summary Form. The same procedures for graphing described above can be applied.





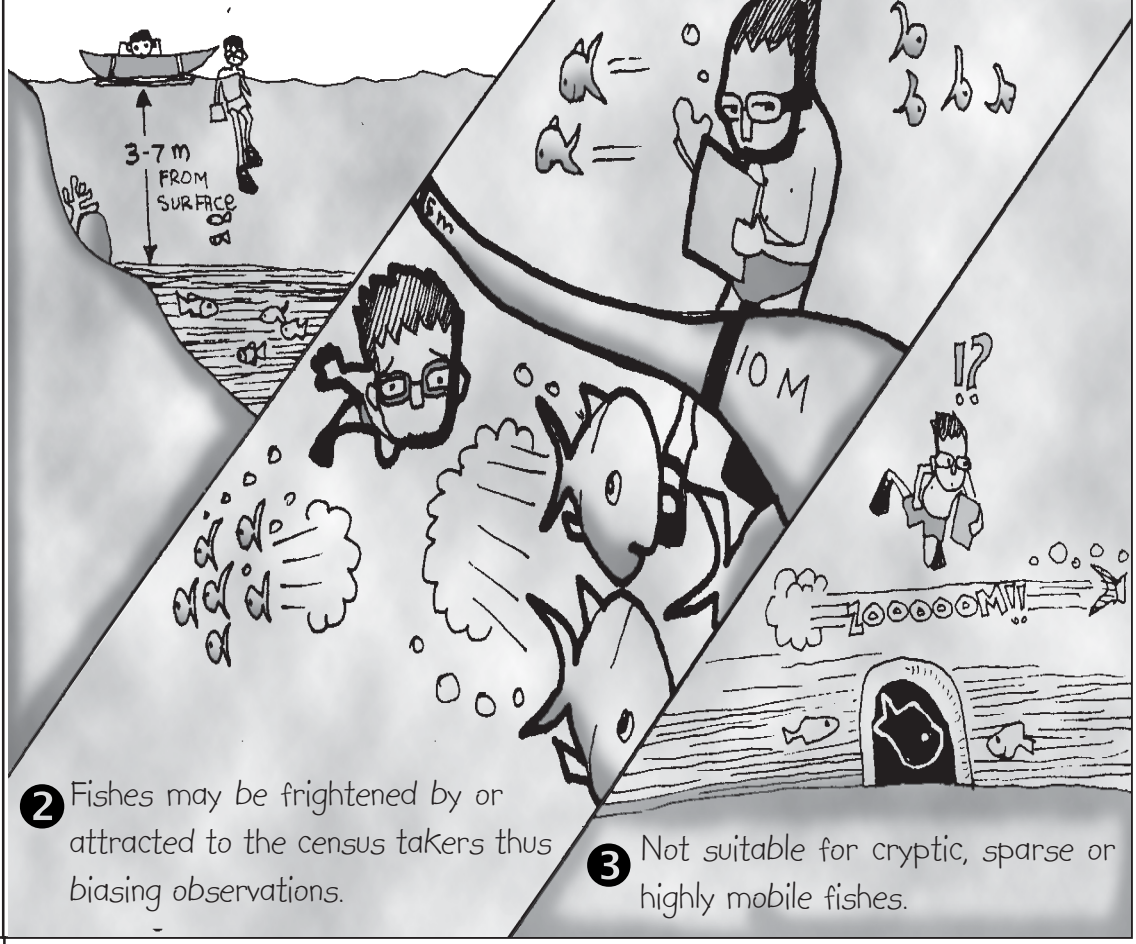
STRENGTHS

1. Useful for simultaneously censusing many species

2. Can also be used for other organisms like Crown-of-thorns starfish and urchins.

LIMITATIONS

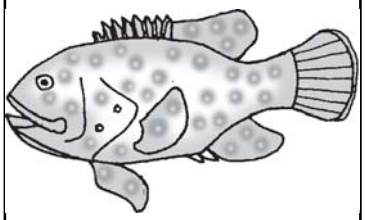
1. Only the shallower depths (upper 3-7 m [15-20 ft] depending on visibility) may be censused by non-divers.



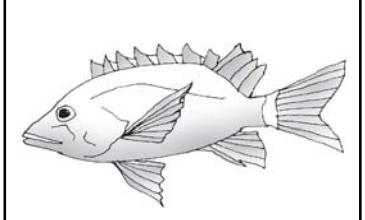
2. Fishes may be frightened by or attracted to the census takers thus biasing observations.

3. Not suitable for cryptic, sparse or highly mobile fishes.

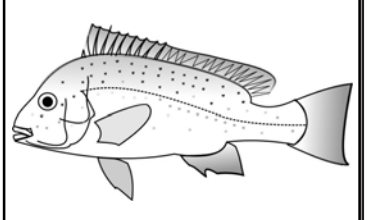
Common Reef Fish Families



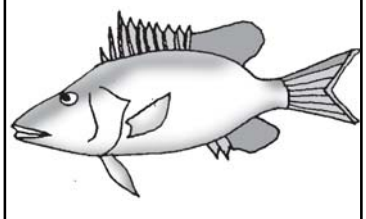
EPINEPHELINAE
groupers,
lapu-lapu, pogapo, sono



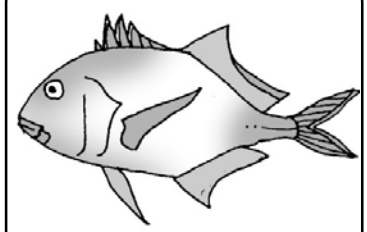
LUTJANIDAE
snapper,
katambak, awoman, maya-maya, islawan



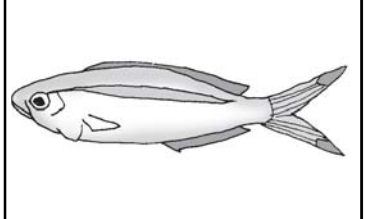
HAEMULIDAE
sweetlips, grunts,
lipti



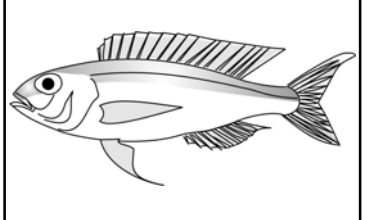
LETHRINIDAE
emperors,
katambak, dugso



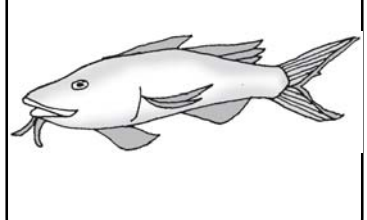
CARANGIDAE
jacks, trevallies,
talakitok, mamsa



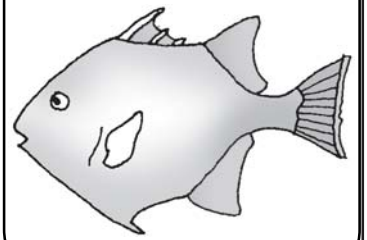
CAESIONIDAE
fusiliers,
dalagang-bukid, solid



NEMIPTERIDAE
coral breams,
silay

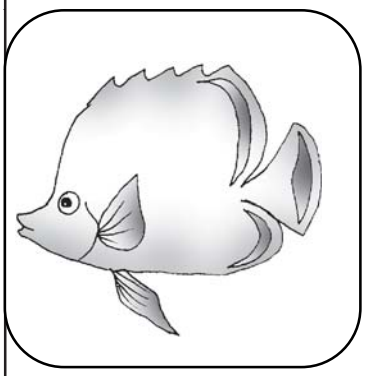


MULLIDAE
goatfish,
timbongan

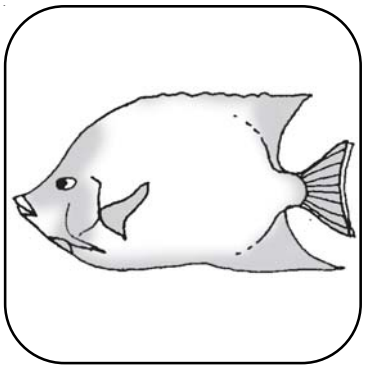


BALISTIDAE
triggerfish,
pakol, pugot

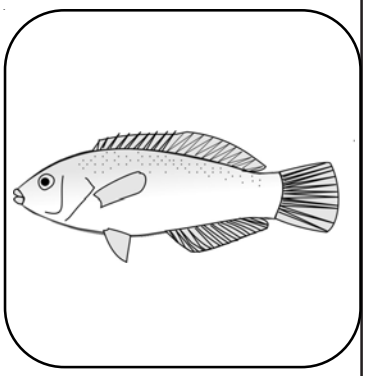
Common Reef Fish Families



CHAETODONTIDAE
butterflyfish,
alibangbang,
pisos-pisos

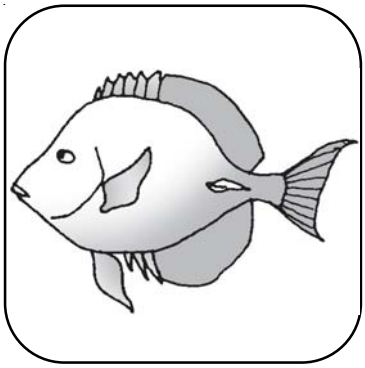


POMACANTHIDAE
angelfish,
adlo

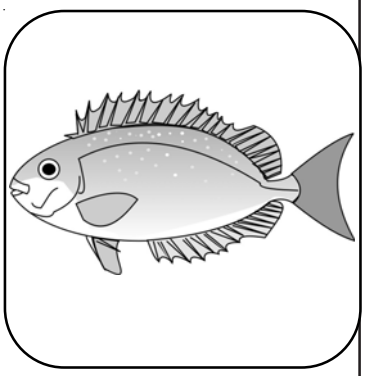


LABRIDAE
wrasses,
labayan

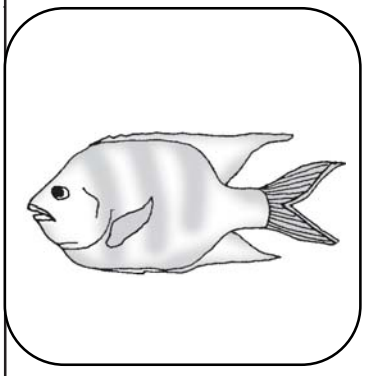
SCARIDAE
parrotfish,
molmol



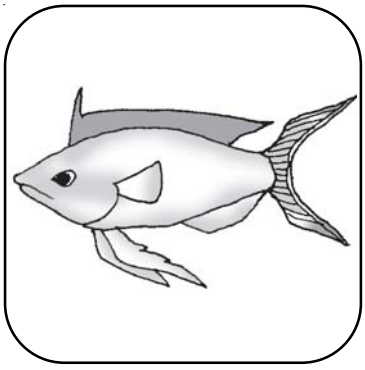
ACANTHURIDAE
surgeonfish,
indangan, labahita,
sunghan, bagis



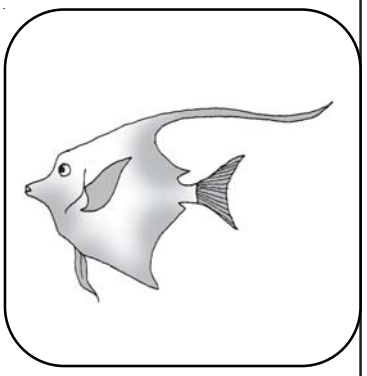
SIGANIDAE
rabbitfish,
danggit, kitong,
samaral



POMACENTRIDAE
damselfishes,
pata, kapaw, palata



ANTHIINAE
fairy basslets,
bilong-bilong



Zanclus cornutus
Moorish idol,
sanggowanding

Sample data for the Fish Abundance Data Form showing data from one transect

FISH ABUNDANCE DATA FORM — Form 5A

Site Name: TUKA 1 (BUFFER ZONE)		**Municipality & Province:** Kiamba, Sarangani	
Transect No.: 10	**Depth (m):**	**Coordinates:** 5°59.10' N, 124°36.71' E	
Date (mo/day/yr): 3/20/99	**Time:**	**Left observer:** Ben Banquil	**Right observer:** Andre U.
Habitat notes:		**Horizontal visibility (m):** 3.5	**Angle of slope:** 15-20° / **Transect orientation:** East

FAMILY	Species	Record number of fishes per size class			
		1-4in (1-10 cm)	5-8in (11-20cm)	9-12in (21-30cm)	Specify sizes for >12in (>30cm)
<EPINEPHELINAE> groupers; lapu-lapu		2			
Barramundi cod; senorita					
<LUTJANIDAE> snappers; *maya-maya*		12			
<HAEMULIDAE> sweetlips; grunts; *lipti*					
<LETHRINIDAE> emperors; *katambak*		1			
CARANGIDAE jacks; trevallies; *talakitok*					
CAESIONIDAE fusiliers; *dalagang bukid; solid*					
NEMIPTERIDAE coral breams; *silay*		4			
MULLIDAE goatfishes; *timbongan*		7	2		
BALISTIDAE triggerfishes; *pakol*		11			
CHAETODONTIDAE butterflyfishes; *alibangbang*		24			
POMACANTHIDAE angelfishes; *adlo*					
LABRIDAE wrasses; *labayan*		26			
Humphead wrasse; *mameng*					
[SCARIDAE] parrotfishes; *molmol*		4			
Bumphead parrotfish; *taungan*					
[ACANTHURIDAE] surgeonfish; *indangan*		33			
[SIGANIDAE] rabbitfishes; *kitong*; *danggit*			1		
[KYPHOSIDAE]* rudderfishes; *ilak*			1		
POMACENTRIDAE damselfishes; *palata*		670			
ANTHIINAE fairy basslets; *bilong-bilong*		12			
Zanclus cornutus Moorish idol; *sanggowanding*					
sharks					
rays					
sea turtles					
others	cardinal fish	6			
	filefish	3			
	soldierfish	3			
	flutemouth		1		

Legend: <fishes> = major reef carnivores; [fishes] = major reef herbivores, **fishes** = fishes which are indicators of hard corals

A blank copy of this form is provided in Appendix 2, page 111

Sample summary data of fish abundance from 10 transects in Tuka, Kiamba, Sarangani

DATA SUMMARY FORM — Form 5B

Site Name: *Tuka Reef (Barangay Poblacion)* **Municipality & Province:** *Kiamba, Sarangani*

Zone/Sector: *Outside* / *Inside*

Month & year: *March 1999* / *March 1999*

Transect #:	1	2	3	9	10				4	5	6	7	8			
Types/groups	**Sub-total**						**Total**	**Avg.**	**Sub-total**						**Total**	**Avg.**
Groupers	5	0	2	3	2		12	2.4	5	2	3	2	6		18	3.6
Snappers	5	0	1	2	13		22	4.4	3	7	4	1	1		16	3.2
Sweetlips	1	0	0	1	0		2	0.4	0	0	0	0	0		0	0
Emperors	0	0	2	0	1		3	0.6	16	0	5	1	1		23	4.6
Jacks	0	0	1	2	0		3	0.6	0	0	1	10	1		12	2.4
Fusiliers	13	0	0	35	0		48	9.6	0	0	1	0	0		1	0.2
Spinecheeks	1	0	2	14	4		21	4.2	12	0	14	3	2		31	6.2
Goatfishes	22	18	21	36	9		106	21.2	7	23	16	5	0		51	10.2
Triggerfishes	33	20	41	36	11		141	28.2	9	15	21	34	27		106	21.2
Butterflyfishes	82	43	54	49	24		252	50.4	21	55	50	24	58		208	41.6
Angelfishes	26	16	21	15	0		78	15.6	9	45	20	12	4		90	18
Wrasses	69	65	83	272	26		515	103	30	619	239	64	128		1080	216
Parrotfishes	11	8	0	2	4		25	5	2	12	13	2	51		80	16
Surgeonfishes	122	74	44	118	43		401	80.2	61	215	227	33	264		800	160
Rabbitfishes	5	0	1	0	0		6	1.2	1	10	9	2	2		24	4.8
Damselfishes	1032	1157	1420	617	670		4896	979.2	868	972	686	662	439		3627	725.4
Fairy basslets	13	18	3	45	12		91	18.2	4	1	12	9	1		27	5.4
Moorish idol	3	2	2	6	0		13	2.6	1	12	11	0	3		27	5.4
Cardinal fishes	76	0	0	0	6		82	16.4	3	0	2	2	1		8	1.6
Filefishes	3	0	7	0	3		13	2.6	0	0	0	7	2		9	1.8
Soldier fishes	38	1	9	0	3		51	10.2	9	0	10	0	10		29	5.8
Hawkfishes	3	2	0	0	1		6	1.2	0	0	5	0	0		5	1

A blank copy of this form is provided in Appendix 2, page 112

Sample graph using pictographs of fish abundance

FISH GRAPHING FORM — Form 5C

Site Name: Tuka Reef — **Municipality & Province:** Kiamba, Sarangani

Zone/Sector:	Outside	Outside	Outside		Inside	Inside	Inside	
Month & Year:	Oct. 1998	Mar. 1999	Apr. 2000		Oct. 1998	Mar. 1999	Apr. 2000	
Types/groups								
Groupers	🐟	🐟🐟	🐟		🐟	🐟	🐟	
Snappers	🐟	🐟			🐟	🐟	🐟	
Sweetlips		🐟	🐟		🐟	🐟	🐟	
Jacks	🐟🐟	🐟				🐟		
Fusiliers	🐟🐟🐟	🐟🐟	🐟🐟		🐟🐟🐟	🐟	🐟	
Parrotfishes	🐟	🐟	🐟🐟🐟		🐟	🐟🐟	🐟🐟	
Surgeonfishes	🐟	🐟🐟🐟	🐟🐟🐟		🐟🐟	🐟🐟🐟	🐟🐟🐟	
Rabbitfishes	🐟🐟🐟	🐟			🐟🐟🐟	🐟		

A blank copy of this form is provided in Appendix 2, page 113

Learning Laboratory

Write the local names for each of the various fish species in each fish family. Learn the English family name for that family. Do this for each of the fish families on the Data Form 5A (page 111).

Picture	Local Names	English Family Name
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Trainer's Tips for Chapter 6

Explain that species that are closely related are grouped into families.

Be careful not to disturb the fishes before and during the census. So, detailed benthos monitoring (this does not include manta towing) should be done after the fish census.

Check accuracy of count and size estimates. Fish dummies of different lengths may be used to train observers to estimate fish lengths underwater. Count estimates by the local team and by the trainers should not differ by more than one log5 abundance category (on page 43).

Some ways to collect more detailed information:

1. **Fish Length Observation.** Estimating the fish size to the nearest cm or inch is particularly effective for assessing marketable food species. However, close attention must be paid to standardizing the length estimates and adjusting the tendency for objects to look larger underwater than in reality. Prior to using this variation, the team must practice estimating underwater with fish models of known lengths. Even though having only one observer yields more consistent results, having a team is more sustainable and participatory.
2. **Indicator Butterfly Species.** Approximately half the species of butterflyfishes feed almost only on corals and so the number and variety of butterflyfishes is sometimes used as an indicator of the health and biodiversity of a coral reef. Simply list the kinds (species) of butterflyfishes observed on the transect and report this on Form 5D (Appendix 2, page 114).

Other sampling units (e.g. 7-m radius cylinders) other than 50-m transects are also used by other visual census practitioners. When comparing your data with data from others using different sizes of transects, convert all their data to the same sampled volume (e.g. 2,500 m^3) first.

Review Questions:

1. If our marine fishery reserve is managed properly, what do you expect will happen to the fish counts inside the reserve? What about fish counts outside?
2. What should you use to estimate the width of the transect to be observed?

Trainer's Tips for Chapter 7

Invertebrates are counted over a 250 m^2 area while fishes are counted over a 500 m^2 area. You must convert the counts to density to make them comparable. For example, if 5 groupers were counted in a 500 m^2 area and 10 *Diadema* urchins were counted over a 250 m^2 area:

$$\frac{5 \text{ groupers}}{500\ m^2} \times \frac{10{,}000\ m^2}{1 \text{ hectare}} = \frac{100 \text{ groupers}}{\text{hectare}}$$

$$\frac{10 \text{ urchins}}{250\ m^2} \times \frac{10{,}000\ m^2}{1 \text{ hectare}} = \frac{400 \text{ urchins}}{\text{hectare}}$$

7 Observing Invertebrates

Definition

Invertebrate census is the identification and counting of animals without backbone (vertebrae) observed within an area of interest.

Purpose

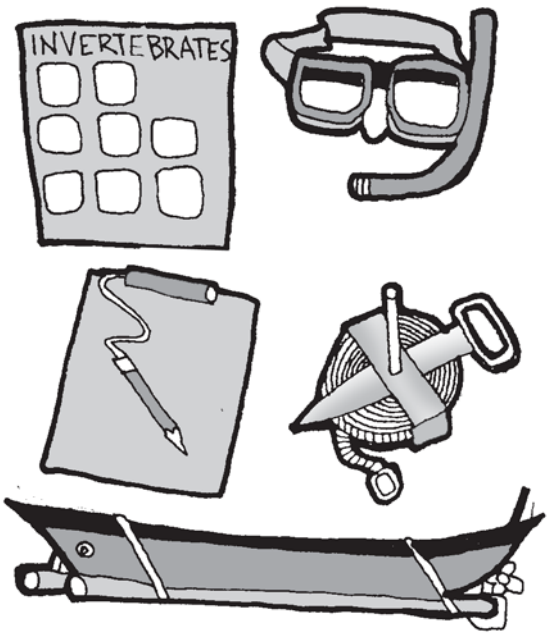
Invertebrate census can be used to estimate the numbers of non-cryptic invertebrates in areas of good visibility (although many invertebrates hide during the day). This information may reflect the health of the coastal resource stocks relative to the extent of invertebrate collection (giant clam, lobster, Triton, coral shrimp, sea cucumber, pencil urchin) as well as help identify threats (Diadema urchins and Crown of thorns).

Requirements

- ❑ Pictures of the animals (see next page) to be counted
- ❑ Goggles or mask & snorkel
- ❑ 50-m transect line marked every 5 m
- ❑ Underwater slates with attached pencil

Optional

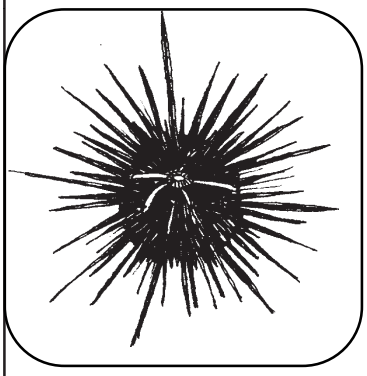
- ❑ Boat (depending on where the survey site is)



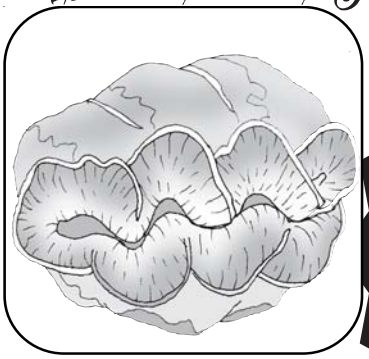
Step-by-step Procedure

Simply use the procedure for monitoring fish but count invertebrates instead (use Form 4A (page 107) to record data and Form 5C (page 113) to graph data). Look for invertebrates under overhangs and inside crevices. Sizes of invertebrates may or may not be recorded or monitored.

Invertebrates to be observed

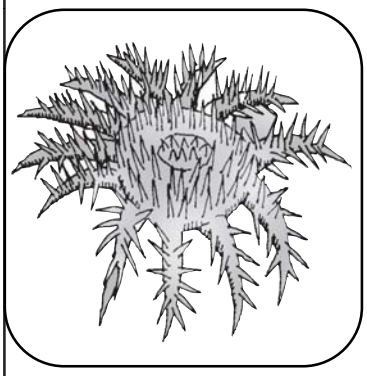


DIADEMA URCHIN
tuyom, para-para

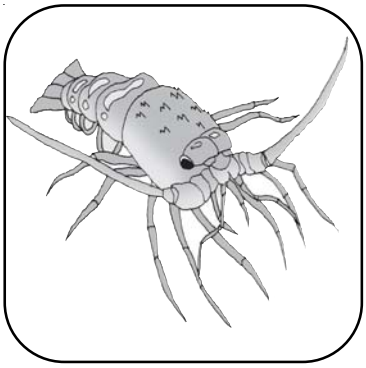


GIANT CLAMS
taklobo

Since invertebrates are not as mobile as fishes, 5-m transect width is used instead of 10-m transect width (total area sampled is 250 m^2)

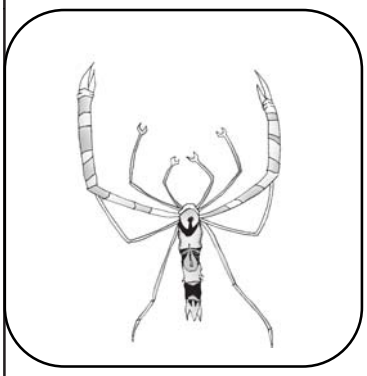


CROWN-OF-THORNS STARFISH
dap-ag, salamay



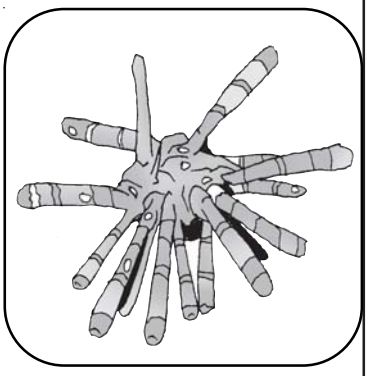
LOBSTER
banagan

TRITON
tambuli



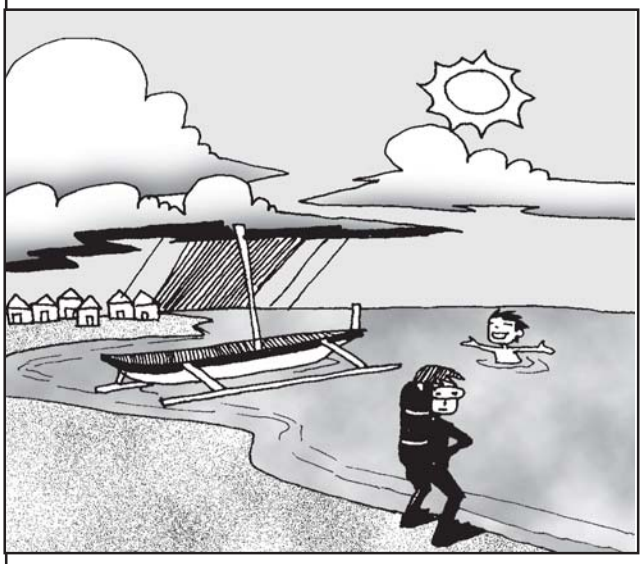
BANDED CORAL SHRIMP

SEA CUCUMBER
balat



PENCIL URCHIN

8 Observing Human Activities and Natural Disturbances



Definition

This procedure is simply one suggested way to quantify various human and natural variables that may be influencing the observed reef community. Other ways may be to simply (1) note presence or absence of various stresses or threats to the reef on a checklist or to just (2) jot down notes which catch the attention of the monitoring team.

Purpose

Human activities, whether beneficial or harmful, and natural disturbances (e.g. storms) are major influences on coral reefs. Noting down some of these may help us explain our observations of the reef environment and resources. Specifically, the observed changes in the reef community through time may be graphed parallel to the changes of relevant human and natural variables through the same time period. Refer to Chapter 4 (Drawing Up a Monitoring Plan) for a list of factors that tend to influence specific community elements.

Requirements

- ❑ Survey Form 2C (page 104)
- ❑ Data Form 2B (page 103)
- ❑ Map of the area
- ❑ Resource person(s) / Key informant(s) familiar with the area
- ❑ Municipal ordinances and other laws relevant to the coastal area

Optional

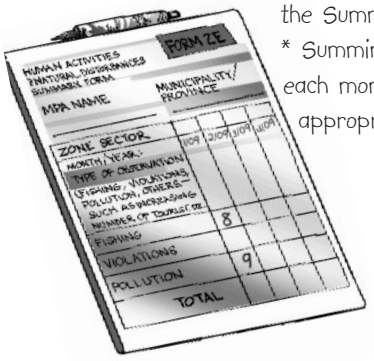
- ❑ Camera
- ❑ Binoculars

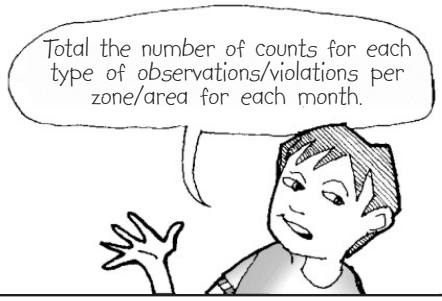
1 Go to the area of interest and fill out Survey Form 2A and 2B as shown on pages 57 and 58 with estimates of the occurrences of human activities and natural disturbances in the area. You may base these estimates on your own observations, interviews with key informants and/or through consensus among a group of people familiar with the area.

2 Many human and natural stresses and threats are not readily observable in the few days of formal field monitoring time per season. So organize a logbook (Form 2C, page 104) where coastal watchers and/or marine protected area guards will regularly record such observations (e.g. violations of the sanctuary, fishing or tourism activities in the area, oil slicks, storms, etc.). Ask observers to record the start-date and time and end-date and time of each observation period even if they did not observe anything noteworthy. Ask them to try to quantify their observations where possible and relevant (e.g. number of violators, number of fishers, number of tourists, estimated size of oil slick, strength and duration of storm, etc.)

3 Periodically summarize the information from the logbook by:

* Categorizing observations into general types
* Listing down the general types of observations and/or nature of violations along the left side of the Summary Form 2D (page 105)
* Summing the quantity of each type of observation/violation per zone/area for each month. Also record the total observation time logged per month in the appropriate box in the Summary Form 2D.





e.g.

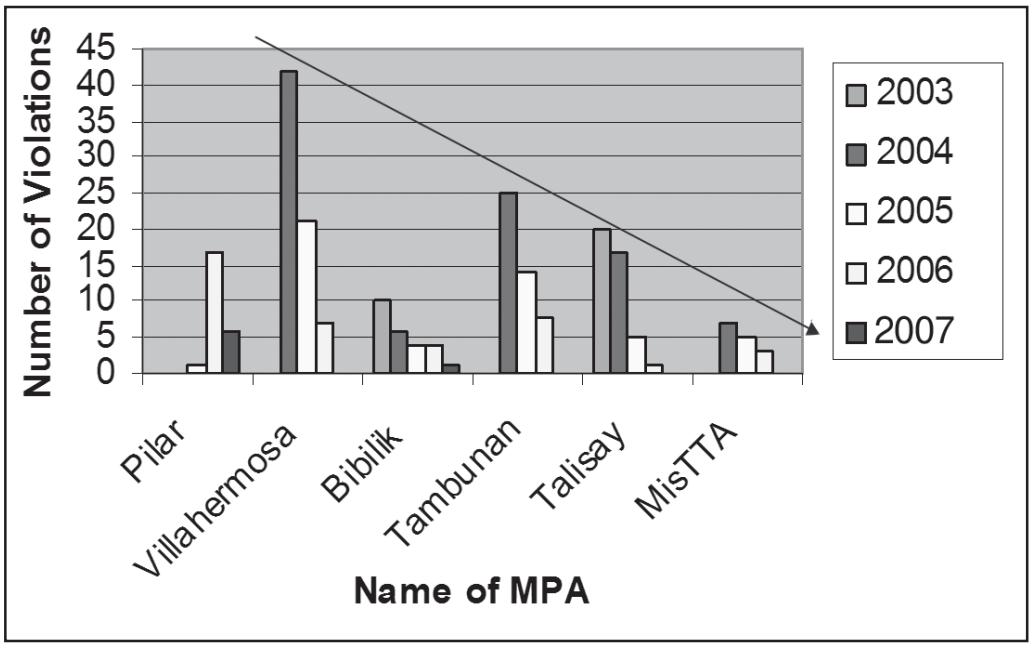
FISHING

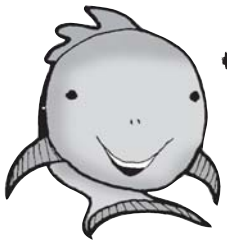
1+0+0+0+1=8

POLLUTION

0+0++0+1+1+7=9

The data can subsequently be plotted in a graph to show changes over time.





STRENGTHS

1. Quantified scores facilitate comparison of data sets from different areas
2. A checklist of things to observe lessens the possibility of missing important items to take note of.

LIMITATION

Unique features and/or the history of stress/management of the area may be missed.

Trainer's Tips

It is useful to record in the logbook the observers and the total hours/days of each of their observation periods because the quantity of notable observations will be proportional to the observation time.

Photographs of the same areas taken once a year would also be very useful!

Sample data from Port Barton Marine Park, San Vicente, Palawan

SITE DESCRIPTION AND DETAILS FORM

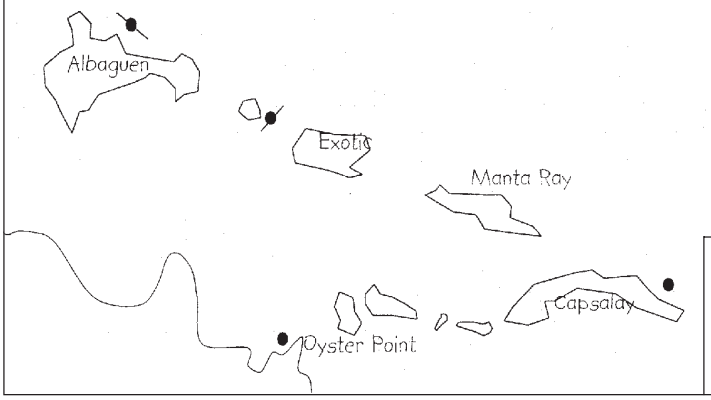
Form 2A

Site Name: Port Barton Marine Park	**Municipality & Province:** San Vicente, Palawan
Reason for choosing to monitor this site: It is a marine protected area	**Overall Documentor:** V. Bungabong

SURVEY/MONITORING SITE DETAILS

Transect No.	[Capsalay]	[Exotic]	[N.Albaguen]	[Oyster Pt.]	[Middle Reef]
Fish abundance observers	B. Francisco / H. Arceo	B. Francisco / H. Arceo	B. Francisco / H. Arceo	B. Francisco / H. Arceo	B. Francisco / H. Arceo
Benthic lifeforms observers	C. Calagui / V. Bungabong	C. Calagui / V. Bungabong	C. Calagui / V. Bungabong	C. Calagui / V. Bungabong	C. Calagui / V. Bungabong
Start date (mo/day/year)	5/7/99	5/7/99	5/7/99	5/7/99	5/8/99
Start time (am/pm)	9:40 AM	11:40 AM	2:10 PM	4:20 PM	12:45 PM
Latitude (e.g. 9º23.012')	10°27.547'	10°29.429'	10°30.301'	10°27.090'	10°27.054'
Longitude (e.g. 112º34.781')	119°10.987'	119°09.075'	119°08.423'	119°07.496'	119°07.487'
Transect orientation (e.g. N, NE, ...)					
Depth (in m)	6.0	4.5	4.5	6.0	6.0
Reef zone (e.g. fore slope, flat, etc.)	slope	slope	flat	slope	flat
Is the site sheltered or exposed?	sheltered	sheltered	sheltered	sheltered	exposed
Approx. steepness of site (angle of slope)	~25-30°	~10-15°	<10°	70°	<10°
Topographic complexity (in m)	medium	medium	medium	mod. high	mod. low
Horizontal visibility (in m by transect line)	10-15	10-15	10-15	10-15	10-15
Vertical visibility (in m by secchi depth)	5.0	4.5	4.5	6.0	6.0
End date (mo/day/year)	5/7/99	5/7/99	5/7/99	5/7/99	5/8/99
End time (am/pm)	10:20 AM	12:25 PM	3:10 PM	4:50 PM	1:25 PM
Weather	Sunny [X] Cloudy [ ] Rainy [ ] Windy [ ]				
Temperature: (not taken)	Air [ ] Water surface [ ] 3-m depth [ ] 10-m depth [ ]				

Sketch map or reef and coastline showing transect locations and other features



Coordinates from map [ ] or GPS [X]

If GPS, specify map datum: WGS 84

A blank copy of this form is provided in Appendix 2, page 102

HUMAN ACTIVITIES & NATURAL DISTURBANCES FORM

Form 2B

A. FISHING	% or #	Notes
# fishing boats observed w/in 500 m	1	
# aquarium fishers w/in 500 m	0	
# invertebrate gleaners w/in 500 m	0	
# blasts heard during the dive	0	
% area used for mariculture w/in 500 m	1	near Oyster Point
B. POLLUTION	**% or #**	**Notes**
Distance to nearest pop. center (in km)		depends to which specific transect
Population of pop. center (in thousands)	4,000	
# factories per km of adjacent coast	0	
Distance to nearest river (in km)		depends to which specific transect
% farmed area of coastline	0	
% forested area of coastline	88%-90%	
# mines within sight	0	
# items of floating trash observed	1	plastic bottle
# items of trash observed underwater	1	old fish trap
# fish nets left as trash	5-10	at Black Coral
C. OTHER STRESSES & THREATS	**% or #**	**Notes**
# boats anchoring within 500 m	>4 boats	at Exotic Beach only; 5-6 picknickers or more per boat
# divers observed within 500 m	0	
# dive shops within 10 km	1	
Years since last typhoon (>100 kph)	<1	Typhoon Norming, 11 December 1998
# large ships within sight	0	
% of coast built-up with structures	1	Just at main village center
Years since last mass bleaching	1	April to May 1998
% bleached coral area	0	none now; already recovered
% diseased coral area	0	

MANAGEMENT OF AREA — **Is this a legally protected area?** Yes

Name of Marine Protected Area: Port Barton Marine Park (additional regulations have been proposed)	Organization responsible: Albaguen Fishermen's Association
Describe restrictions herein: No fishing or gathering of marine organisms and diving in core zones (Albaguen, Exotic, Manta Ray and Haines Reef)	
Ordinance No. & Year: Ordinance 1997-03, Jan. 6, 1999	Start date of protection by law: Jan. 6, 1999
Date boundaries were marked: April 26, 1999	Date patrols/enforcement began:
Coordinates of protected area boundaries: 119°8'13.03"E, 10°29'50.19"N Albaguen 119°9'5.62"E, 10°29'50.19"N Exotic 119°8'29.73"E, 10°30'19.48"N Haines Island	

A blank copy of this form is provided in Appendix 2, page 103

Monitoring fish catch

Definition

Fish catch monitoring is the systematic collection of standardized information about fish catch, fishing gear, fishing effort/time, and fishing grounds.

Purpose

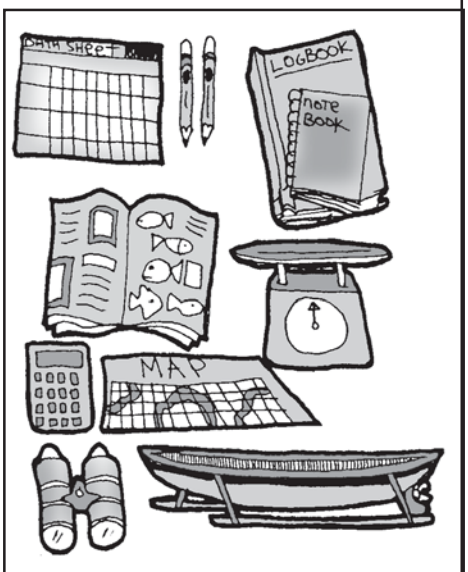
Catch data can be used to help determine if, when, and where fish catches are increasing or decreasing. These changes may be due to management practices (e.g. properly protected sanctuary vs. rampant illegal fishing) or natural causes.

Requirements

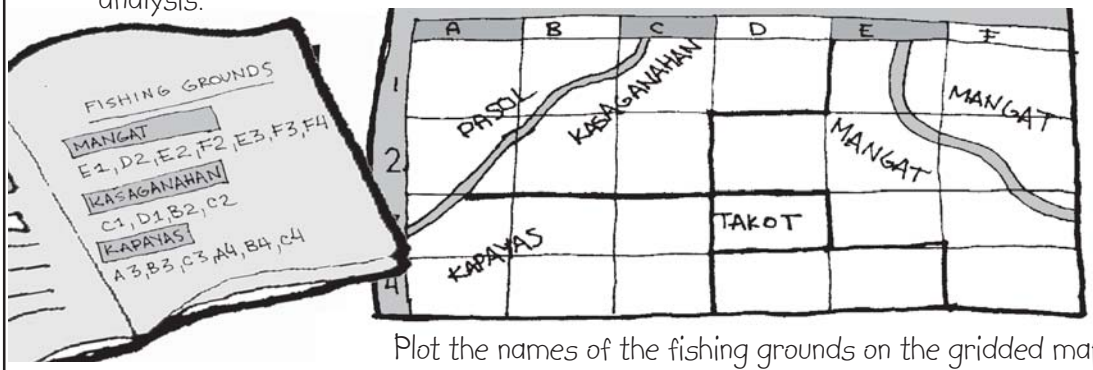
- ❑ Data forms and pencils
- ❑ Logbook or notebook
- ❑ Fish identification materials (picture book)
- ❑ Resource map (with grids, habitats, and use zones marked)
- ❑ Weighing scale preferably that which can measure from 0.1 to 10 kg (or whatever is available or used locally for measurement)
- ❑ Calculator

Optional

- ❑ Binoculars and boat (depending on the distance of the fishing grounds from the shore)

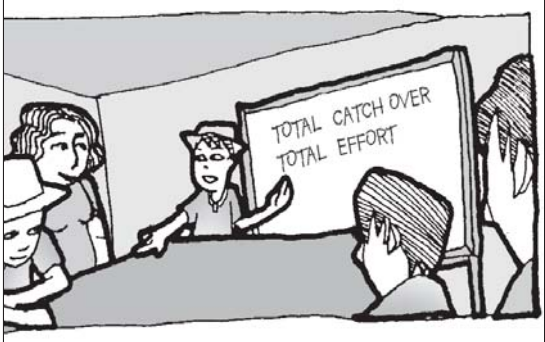


1 List in a logbook or notebook a) the locations of fishing grounds, b) the different types of fishing gear, and c) the fishes of interest to the area or to the group of fishers. These lists will be used as the standard lists for data entry and analysis.



Plot the names of the fishing grounds on the gridded map.

2 Discuss the concepts of 'Catch per unit Effort', 'Total Fishing Effort', 'Total Catch' and look at sample catch monitoring outputs.



3 Fill out the Gear Survey Form 6A as shown on page 65. Multiply the number of people using each gear type by the typical effort per person to get an estimate of the Total Fishing Effort of the village.

For some gear types, it may sometimes be more useful to use the number of gear units (e.g.traps) rather than time as the measurement of fishing effort.

4 Plan how to get data to compute Catch per unit Effort per gear type.

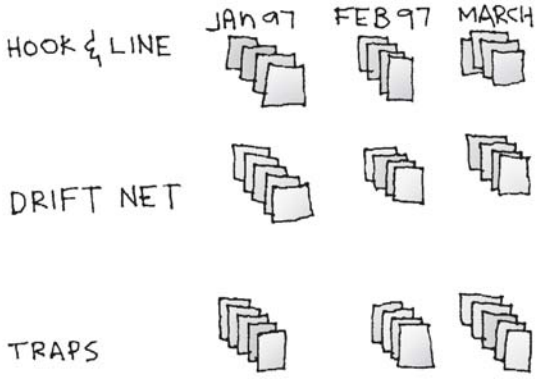
Catch per unit Effort = $\frac{\text{total catch}}{\text{total person-hours or total units of gear}}$.

The data may be gathered by:

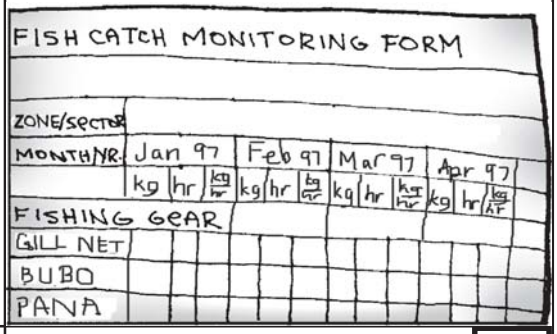
a. A team member collecting catch information using Form 6B as shown on page 66 once a week, or...

b. many individual fishers voluntarily recording on Form 6C their own catches (as shown on page 67) 5 times per month and submitting their forms every month.

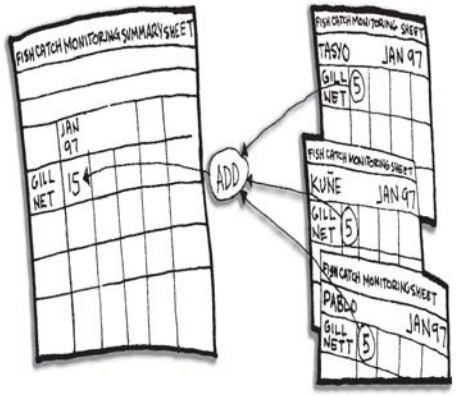
5 Collect all forms and sort according to gear type and month.



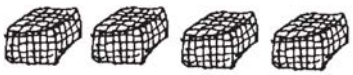
6 List down zone/sector and month year on the upper portion of the Summary Form 6D as shown on page 68 and write the gear types on the left side of the Summary Form.



7 Compute the Total Catch per gear type per month for the data sample.



8 Compute Total Effort per gear type per month for the data sample.

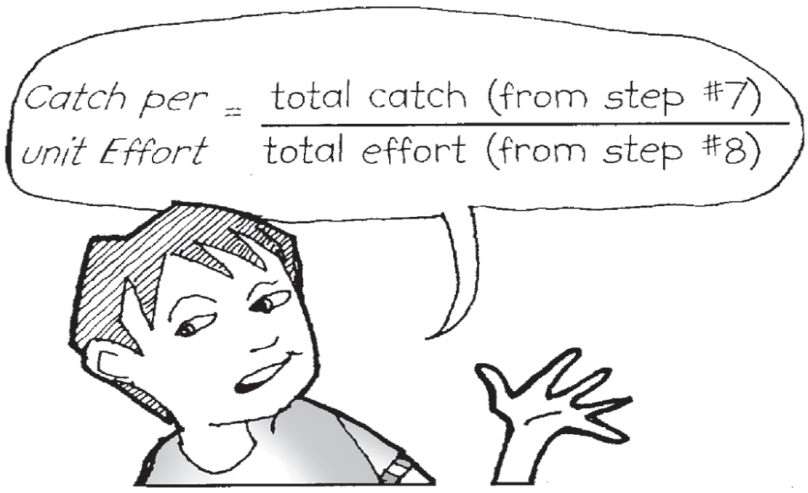


Total Effort = total # of units of gear

- or -

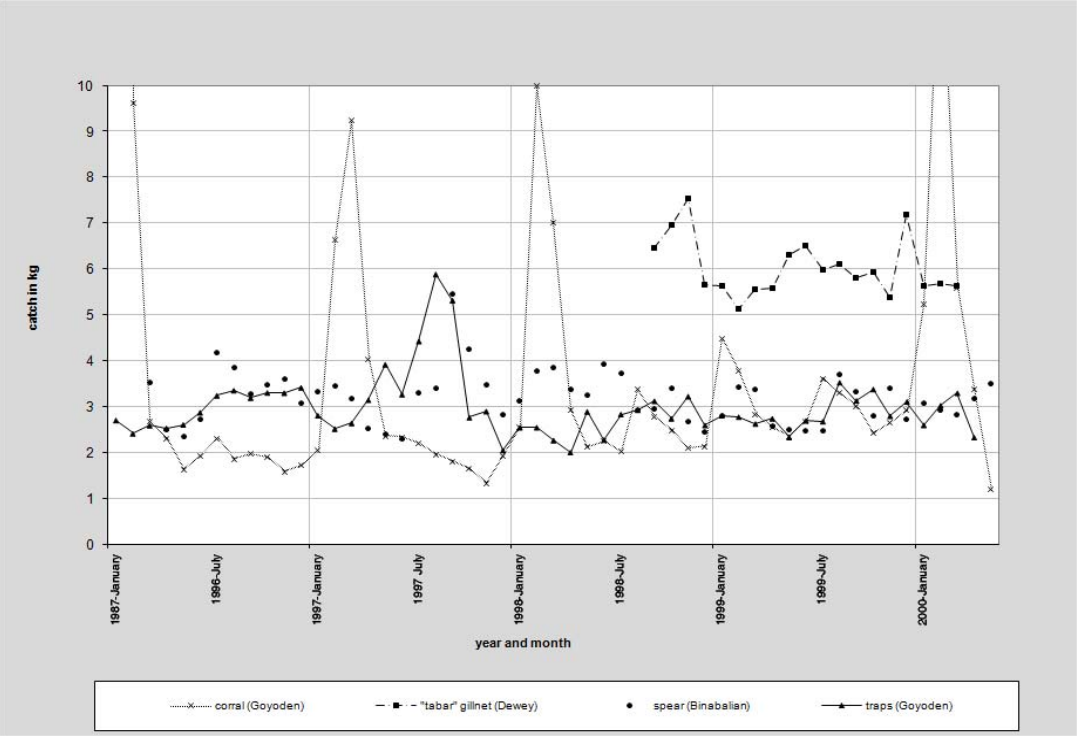
Total Effort = # of fishers x time spent fishing

9 Compute Catch per unit Effort (CPUE) for each gear type per month.



10

Using the gear, catch and effort data, plot Catch per unit Effort per gear type through the months from the data in the Summary Form.

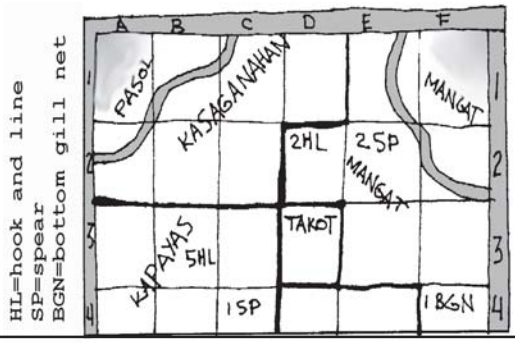


Most of the time, fishing grounds are not exclusive to particular commnunities. To get a better estimate of the total catch for the village waters, conduct Gear Mapping.

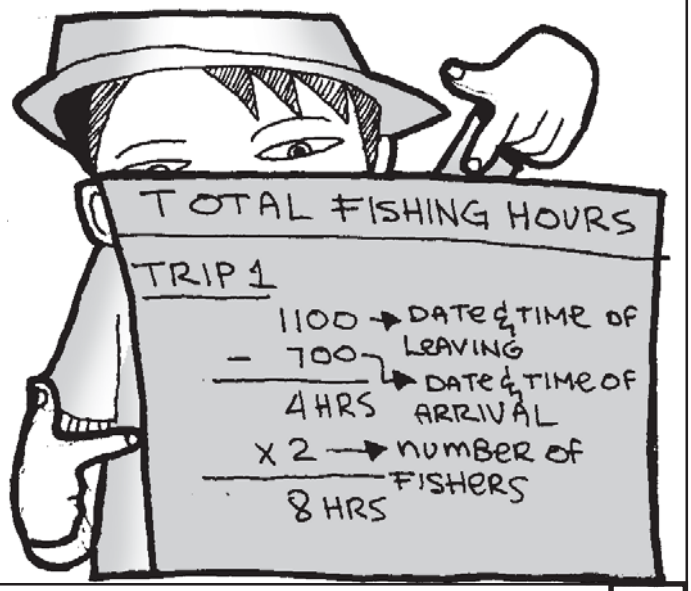
Gear mapping may be used by more advanced communities.

11 Based on the Gear Survey Form 6A, get the peak hours per gear type.

12 From these peak hours select one hour with the most gear types to observe the village waters. Write how many fishers are seen using what gear type per grid box.



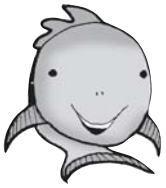
13 Compute the Total Effort in village waters by multipying the observed number of fishers per gear type by the typical number of hours spent using that gear.



14 To get Total Catch, multiply CPUE (from Step 9) with Total Effort (from Step 3 or Step 13).

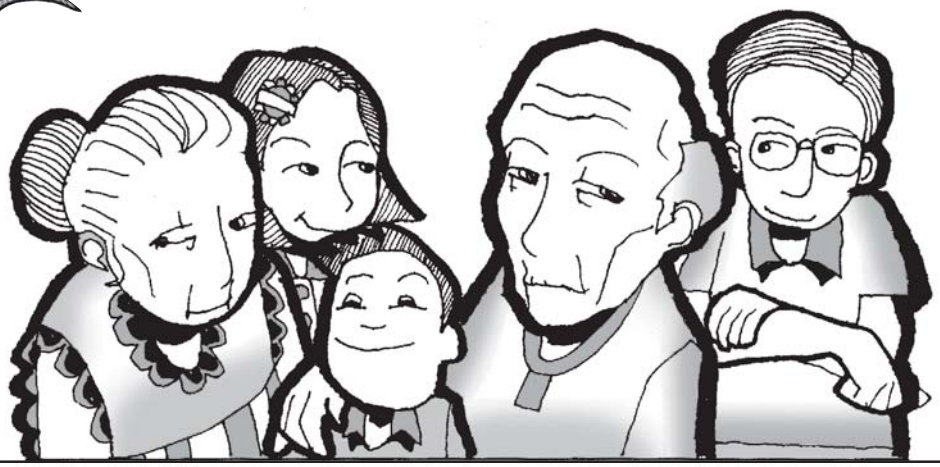
CPUE (Step 9) x Total Effort in village waters (Step 13) = TOTAL CATCH in village waters

CPUE (Step 9) x Total Effort of village (Step 3) = TOTAL CATCH of village fishers



STRENGTH

Nearly anyone can be involved and help.



LIMITATIONS

1. Some fishers may not want to cooperate because of misconceptions about the objectives of the monitoring and/or selfish interests. This may bias the results.

It may be difficult to locate the fishing grounds on maps (due to their distance from shore, the lack of landmarks, and/or the lack of maps).

A lot of data may be needed before trends are revealed.

Sample Gear Survey Form with data from Poblacion 13, Tingloy, Batangas

GEAR SURVEY FORM — Form 6A

Site Name: Poblacion 13 **Municipality & Province:** Tingloy, Batangas

Date (month/day/year): 7/14/97

Type of fishing gear	# of persons in village using gear type	# of motor boats using gear type	Typical # of persons per boat	Months when gear is typically used	Hours when gear is typically used	Fishing grounds (use grid letter in map)	Where is catch sold (which market)	Type(s) of fish usually caught	# of persons from whom information was collected
hook and line	12	0	1	All year	0700-1800	G	Pob. 13 market	groupers, coral breams, rainbow runner	4
gillnet	8	1	6-7	All year	1900-2230	G, H, M, N, O, P	Pob. 13 market	fusiliers, needlefish, mackerel	4
push net (*sakag*)	4	2	2	May-July	0700-1800	G, H, M	Pob. 13 market	herring fry	4
traps	3	0	2-3	All year	24 hr	G	Pob. 13 market	grouper, damselfish, sea bream, triggerfish	4

A blank copy of this form is provided in Appendix 2, page 115

Sample data for Fish Catch Monitoring in Lomboy, Calape, Bohol

FISH CATCH MONITORING FORM FOR DATA COLLECTION TEAMS — Form 6B

Name: Patricio Semante **Village/Barangay:** Lomboy, Calape, Bohol

Collect catch data once per week. Be sure to record the trip even if nothing was caught (record '0' in the weight).

Type of fishing gear	# Fishers in boat	Fishing ground (use grid letter in the map)	Time & date of departure	Time & date of arrival	Number of gear units	Use one line per kind of fish. Use more than one line per fishing trip if needed.	
						Kind of fish caught	Weight (kg)
corral	1	B4	9/5/97 7:00 AM	9/5/97 8:00 AM	1	rabbitfish	0.8
corral	1	B4	9/6/97 6:00 AM	9/6/97 7:00 AM	1	rabbitfish	1
corral	1	B4	9/7/97 6:00 AM	9/7/97 7:00 AM	1	rabbitfish	0.5
corral	1	B5	10/24/97 7:00 AM	10/24/97 8:00 AM	1	catfish	0.5
						rabbitfish	4.5
corral	1	B4	10/24/97 7:00 AM	10/24/97 8:00 AM	1	rabbitfish	2.5
						mojarra	0.5
corral	1	B4	10/25/97 7:00 AM	10/25/97 8:00 AM	1	rabbitfish	0.5
						mojarra	0.5
double net	2	C2	9/16/97 11:00 AM	9/16/97 5:00 PM	1	rabbitfish	3
double net	2	B5	9/17/97 1:00 PM	9/17/97 5:00 PM	1	parrotfish	3
double net	2	B5	9/18/97 4:00 PM	9/18/97 5:00 PM	1	parrotfish	2
						rabbitfish	1
double net	3	C3	10/24/97 9:00 AM	10/24/97 4:00 PM	1	rabbitfish	2
double net	2	C3	10/24/97 1:00 PM	10/24/97 5:00 PM	1	rabbitfish	5
double net	2	C3	10/27/97 7:00 AM	10/27/97 1:00 PM	1	rabbitfish	2
spear	1	B2	9/1/97 3:00 PM	9/1/97 4:00 PM	1	parrotfish	1
						unicornfish	2
spear	1	D3	9/15/97 12:00 AM	9/15/97 5:00 AM	1	octopus	1.1
spear	1	C6	9/16/97 2:00 AM	9/16/97 5:00 AM	1	octopus	2
spear	1	C6	9/19/97 7:00 PM	9/19/97 12:00 PM	1	octopus	1
						assorted fish	2
spear	1	C2	10/24/97 9:00 AM	10/24/97 11:00 AM	1	rabbitfish	1.5
						grouper	0.5
spear	1	C2	10/26/97 7:00 AM	10/26/97 8:00 AM	1	parrotfish	1
spear	1	B2	10/30/97 2:00 PM	10/30/97 3:00 PM	1	unicornfish	2.5

A blank copy of this form is provided in Appendix 2, page 116

Sample Fish Catch Monitoring Form with data from Lomboy, Calape, Bohol

FISH CATCH MONITORING FORM FOR INDIVIDUAL FISHERS

Form 6C

Site/Village/Barangay: Lomboy | **Month & Year/Buwan at Taon:** Nov. 1997

List down at least 5 fishing days per month (e.g. once a week). Be sure to record the trip even if nothing was caught (record '0' in the weight). Magtala ng hindi bababa sa limang araw ng pangingisda sa bawat buwan. Siguraduhin na magtala pa rin kahit walang nahuli sa paglaot [magtala pa rin ng '0' sa timbang (kilos)].

		Record catch per fishing trip				
		1	**2**	**3**	**4**	**5**
Date & time of leaving Petsa at oras ng paglabas		11/02/97 10:00 PM	11/08/97 7:00 PM	11/19/97 10:00 PM	11/24/97 3:00 AM	11/27/97 1:00 AM
Fishing gear Uri ng pamamalakaya		spear w/ light	spear w/ light	spear w/ light	spear w/ light	spear w/ light
# Fishers in boat Bilang ng tao sa bangka		1	1	1	1	1
Fishing ground (use grid letter on map) Lugar na pinangisdaan		B3	B3	B3	D2	B3, D2
Weather condition, tide and sea state Kumusta ang panahon, hunas/taob at alon		sunny calm	sunny calm	sunny calm	cloudy rough	sunny calm
Date & time of return Petsa at oras ng pagbalik		11/03/97 3:00 AM	11/08/97 10:00 PM	11/20/97 3:00 AM	11/24/97 6:00 AM	11/27/97 6:00 AM
CATCH Huli	**Kinds of fish caught** Mga uri ng nahuli	**Weight** Timbang	**Weight** Timbang	**Weight** Timbang	**Weight** Timbang	**Weight** Timbang
	octopus	5.5		2		
	parrotfish		3	1	1.5	1
	rabbitfish					2
TOTAL CATCH (kilograms) *Pangkalahatang huli (kilos)*		5.5	3	3	1.5	3

Circle each date that you went out to fish. *Bilugan ang bawat petsa na ikaw ay nangisda.*

1 (2)(3)(4)(5) 6 (7)(8)(9)(10)(11)(12) 13 (14)(15)(16)(17)(18)(19) 20 (21)(22)(23)(24)(25) 26 (27)(28)(29) 30 31

A blank copy of this form is provided in Appendix 2, page 117

Sample Fish Catch Monitoring Summary Form with data from Camanga, Salcedo, Samar

FISH CATCH MONITORING SUMMARY FORM

Form 6D

Site Name: Camanga **Municipality & Province:** Salcedo, Eastern Samar

Zone/Sector:

Month & Year:

	Sep. 1997			Oct. 1997			Nov. 1997			Dec. 1997			Jan. 1998		
	Total kg	Total gear unit-days or fishing-hours	kg/ unit effort	Total kg	Total gear unit-days or fishing-hours	kg/ unit effort	Total kg	Total gear unit-days or fishing-hours	kg/ unit effort	Total kg	Total gear unit-days or fishing-hours	kg/ unit effort	Total kg	Total gear unit-days or fishing-hours	kg/ unit effort
Fishing Gear															
traps	438.5	109	4.0	522.5	100	5.2	825	101	8.2	694	86	8.1	668	48	13.9
corral	305	30	10.2	326	43	7.6	505	52	9.7	682	62	11.0	1215	92	13.2
spear	45.8	28	1.6												
longline	100	35	2.9												
hook & line										27	14	1.9	22	8	2.8

A blank copy of this form is provided in Appendix 2, page 118

Trainer's Tips for Chapter 9

Catch monitoring is quite laborious so there should be a well-defined need for these detailed data. If only general information on the local fisheries is needed, only some or other participatory methods (e.g. group discussions with key informants) may be more appropriate.

Remember, it is more important to get a sample that represents the range of variations than to get very intensive sampling of just a few fishers, locations, or gear types. One way to sample both seasonal and monthly variations is to select a month near the middle of each of the seasons (for example, hot-dry, cool-wet, cool-dry) of the site being sampled. If seasons are not very distinct, you may sample one month per quarter. Within each of these months, sample one day each week. Select a day which is more representative of most days of the week. For example, do not select Saturday or Sunday when some fishers may be taking a rest.

Take special time and effort to make sure that trainees understand the implications of the catch per unit effort equation. By knowing 2 out of the 3 variables, the 3rd variable may be estimated. For example, to estimate the total catch (which in practice can almost never be actually observed), you can multiply the catch per unit effort by your estimate of the total effort.

Warning on local names
Many different fish species/fishing grounds/fishing gear may be referred to by the same local name. Many different local names may also refer to the same species, area or gear. When using local names, make sure that the local names are distinct for each of the different objects you want to distinguish by adding an adjective/modifier to the local name.

CPUE, total catch, and total effort may be summarized (not only through time) but also by each of the grids on the fishing grounds. This way you can determine if catches near the fishery reserve are increasing more quickly than catches away from the reserve.

Fishers from other areas may fish in the area being monitored while local fishers may fish outside the area of interest.

Fish length monitoring
It may sometimes be useful to monitor the average lengths of certain fish species prized by fishers.

- Ask the team to select a few indicator or representative fish species to monitor.
- Demonstrate to the volunteers how to measure fish in the standard way (from the tip of the snout to the peduncle of the tail).
- Once per week, measure the lengths of a random sample of 10-20 individuals (from

various batches of fishes caught) of the species being monitored. The average length (through time) of the fish species being monitored can also be plotted on the billboard.

- Groupers (*Plectropomus, Cephalopholis*), parrotfishes (*Scarus*), snappers (*Lutjanus*), and/or jacks (*Caranx*) might be possible fishes to measure when monitoring coral reef reserves.

The team must decide beforehand which of the following measurements of effort they are interested in (those marked with * are preferred):

a) * both the number of gear units (e.g. fish traps) and the time spent fishing or
b) only the time spent fishing is to be recorded
and
a) * the total time spent fishing or
b) the total time spent fishing and traveling to the fishing area
... and record data accordingly.

Review Questions

1. If our marine fishery reserve is managed properly, what do you expect will happen to the fish catch near the reserve? How might fishers who now fish in far waters benefit in the future?
2. Since we cannot collect data on all the catch taken from the village waters, what data can we use to estimate the total catch of the village waters?

MPA PERCEPTION SURVEY 10

Definition

Perception survey is a direct method of gathering information on the thoughts, feelings and opinions of members of a community about a particular research topic following a standard set of guide questions. In this particular method, the questions relate to observations about the marine protected area (MPA), which usually includes coral reef areas, in the locality, how it is being managed, and perceived changes since its establishment.

Purpose

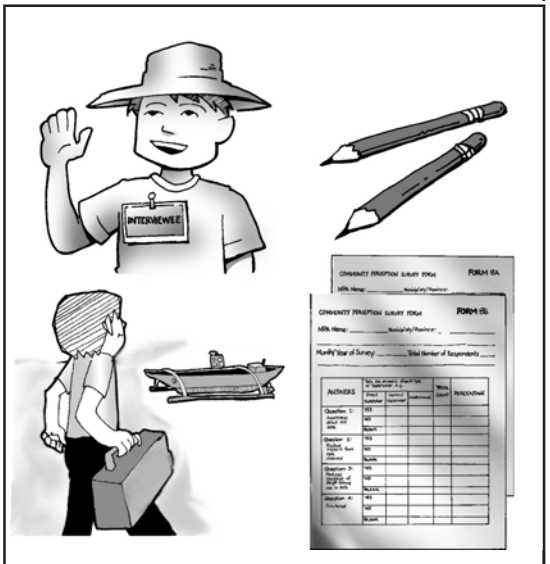
The perception survey is used to:

- Obtain general observations of community members about coral reef/MPA management in their locality;
- Validate the impacts of the MPA especially on the beneficiary community;
- Gauge the level of management effectiveness
- Evaluate the performance of the management body

The outputs of this survey will be useful for the management body to assess its strengths and areas for improvement, as well as to plan and strategize to improve MPA management, e.g. by strengthening IEC/advocacy if awareness is low, enhancing MPA support structures, and developing mechanisms to engage community volunteers.

Requirements

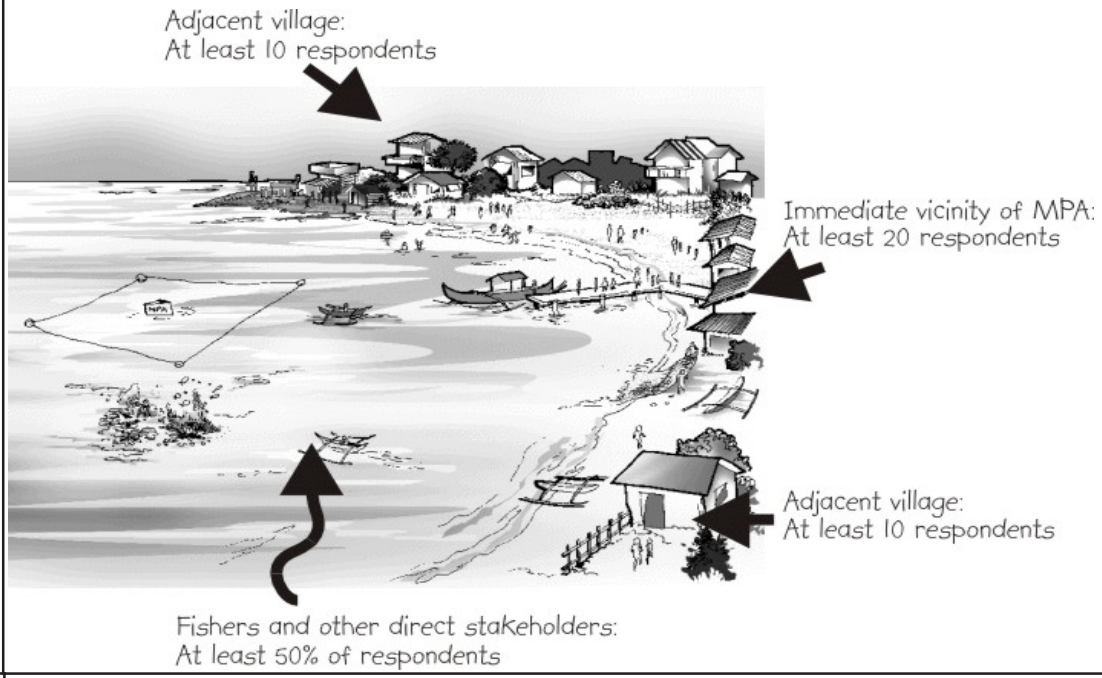
- Human resources (interviewees who can be members of the MPA management group or community volunteers)
- Logistic resources for travel
- Data forms (Form 8A on page 120 and Form 8B on page 121) and pencils



1 Determine the most optimum time to conduct the interview, i.e. when most of the target respondents are available.

2 Choose the respondents randomly. Interview at least forty (40) persons from different households distributed as follows:

* At least 20 respondents from within the immediate coastal vicinity of the village where the MPA is situated.
* At least 10 respondents coming from each of the adjacent coastal villages on both sides of the village where the MPA is situated.
* At least 50% of the respondents (or 20 persons) should be direct stakeholders (e.g. fishers, gleaners, resort owners, fish vendors, etc.), and the rest can come from other sectors (e.g. academe, religious group, youth, etc.)



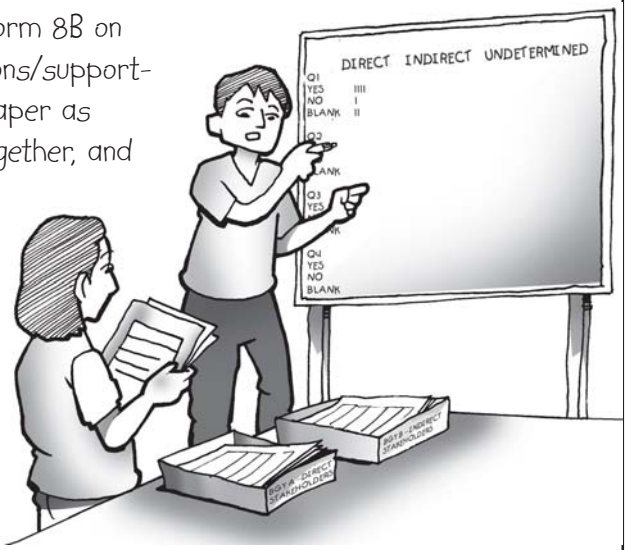
3 Introduce yourself and the purpose of the survey, and politely ask for permission to proceed.

4 Ask each question clearly and note the supporting explanations/reasons as accurately as possible (use Form 8A on page 120). It is best to conduct the interview in the local dialect.

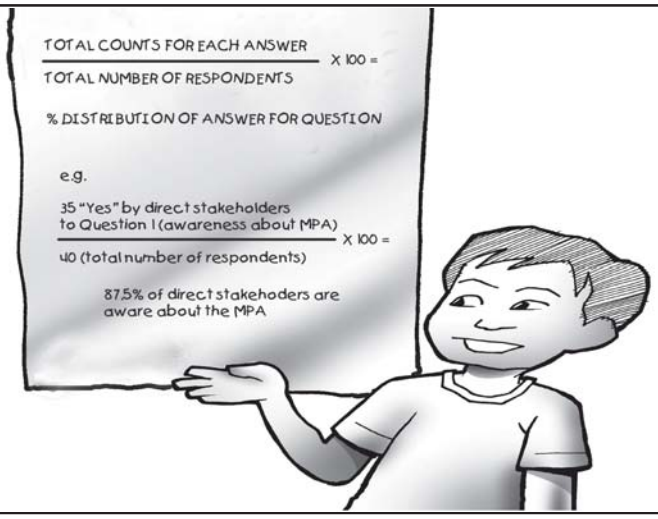
After the interview be sure to express your appreciation for the person's time and effort.

5 Collate all forms and sort according to village and type of stakeholder (direct, indirect or undetermined if not indicated).

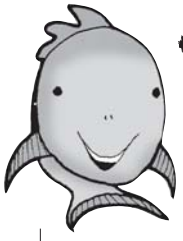
6 Tally the answers to each question under each type of stakeholder (use Form 8B on page 121) and list down the reasons/supporting explanations in a separate paper as notes. Group similar answers together, and note the most common reasons for each answer. Listing the answers by type of stakeholder helps in determining if the respondents are well-represented and that the target distribution of interviewees is followed.



7 Add the total counts for each answer and divide this by the total number of respondents to derive the percentage distribution of answers for each question.



STRENGTHS



1. Perception surveys can generate observations and opinions in detail, and ensures that information is obtained from the most relevant sources, i.e. direct stakeholders.

2. Anyone can be involved.

3. It does not take up too much of a person's time because the questions are few and brief.

LIMITATIONS

1. It can be labor-intensive and may require travel logistics to visit the adjacent villages.

2. Some responses may be influenced by the interviewer, e.g. interviewee may feel hesitant to express his true opinion if he knows that the interviewer is a member of the MPA management group, interviewer may seem tense or domineering during the interview, etc.

Interpreting Observations

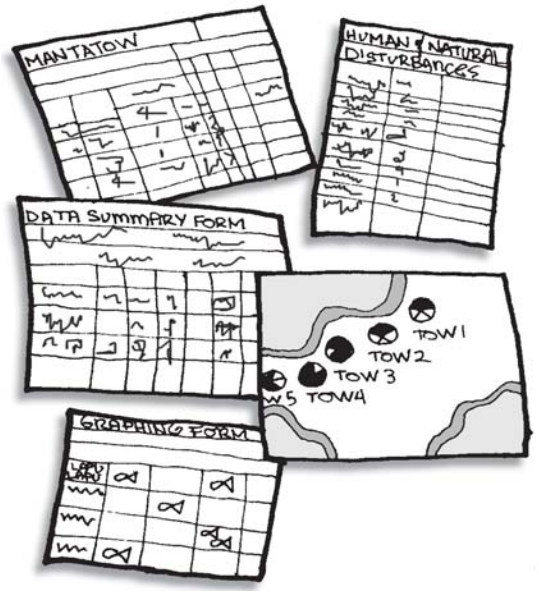
11

Relating various observations with each other and with ideas/ theories/concepts about how other similar systems operate can help us understand the processes in the observed system.

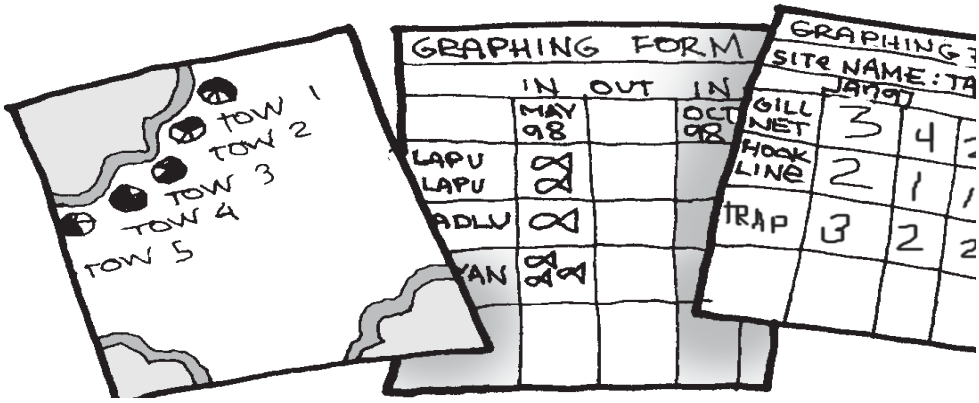
For accuracy, compile all data before team members separate! Summarize and feedback for validation as soon as possible.

Requirements

- ❑ Completed summary forms and graphs of the Manta Tow, Benthos Transect, Fish And Invertebrate Visual Censuses, and Fish Catch observations
- ❑ Completed data forms for Human Activities and Natural Disturbances observations
- ❑ Crayons or colored pencils

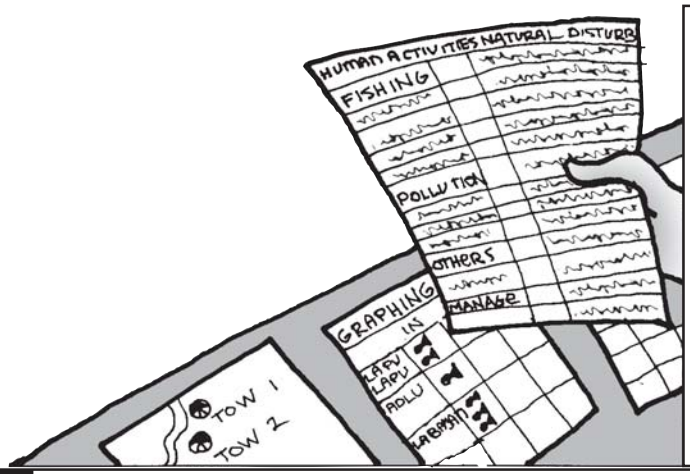


1 Use the various summary and data forms to fill out the Correlation Table (Form 7) as shown on page 81.



Review each result again.

2 Look for and note down possible trends.



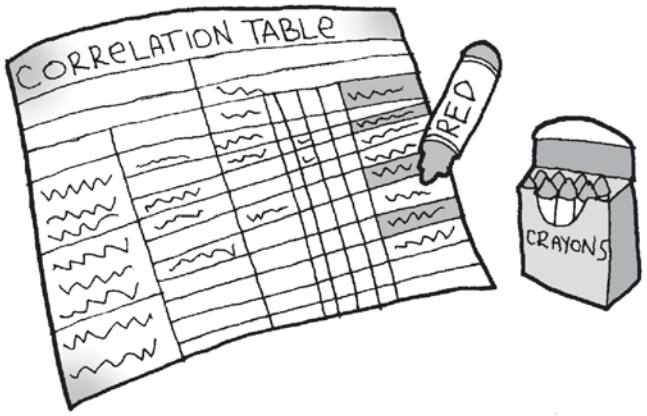
What constitutes a trend?

- consistent increase
- consistent decrease
- increase or decrease at regular intervals (for example, seasonally; look at the pattern of your graph)

3 Look for and note down relationships of variables.

Some things may tend to increase or tend to decrease together. Others may act in opposite ways; that is, one thing increases whenever the other thing decreases.

4 Use a colored pencil or crayon to mark things with opposite trends with different colors on the Correlation Table.

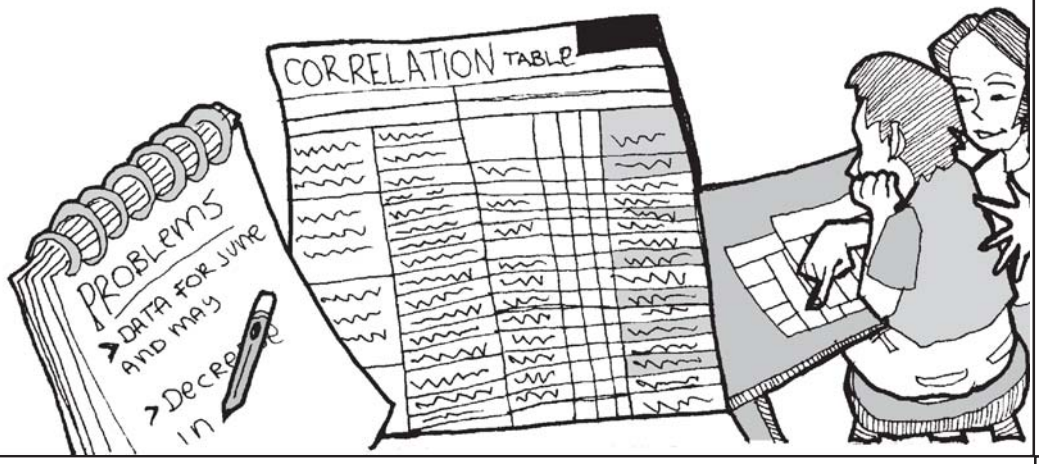


For example,

- things which are increasing may be marked with warm colors—reds and oranges;
- things which are decreasing might be marked with cool colors—blues and greens.

5 See to it that things which seem to increase and/or decrease together are marked with the same or similar colors on the Correlation Table.

6 Look for potential problems or issues in the Correlation Table and note these down for later discussion (see Evaluation & Action).

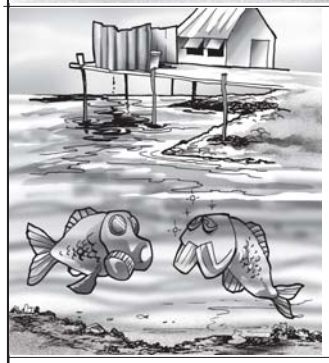


7 Look for improving trends in the Correlation Table and try to see whether they are related to improvements in management.

The five clusters of variables in the correlation table are each associated with the following potential issues (in the same order from top to bottom as they are presented in the correlation table). Tourism may be associated with both Physical Damage of Reef Habitat and Eutrophication:

Overfishing
Harvesting fishery resources faster than they can reproduce to replace themselves.

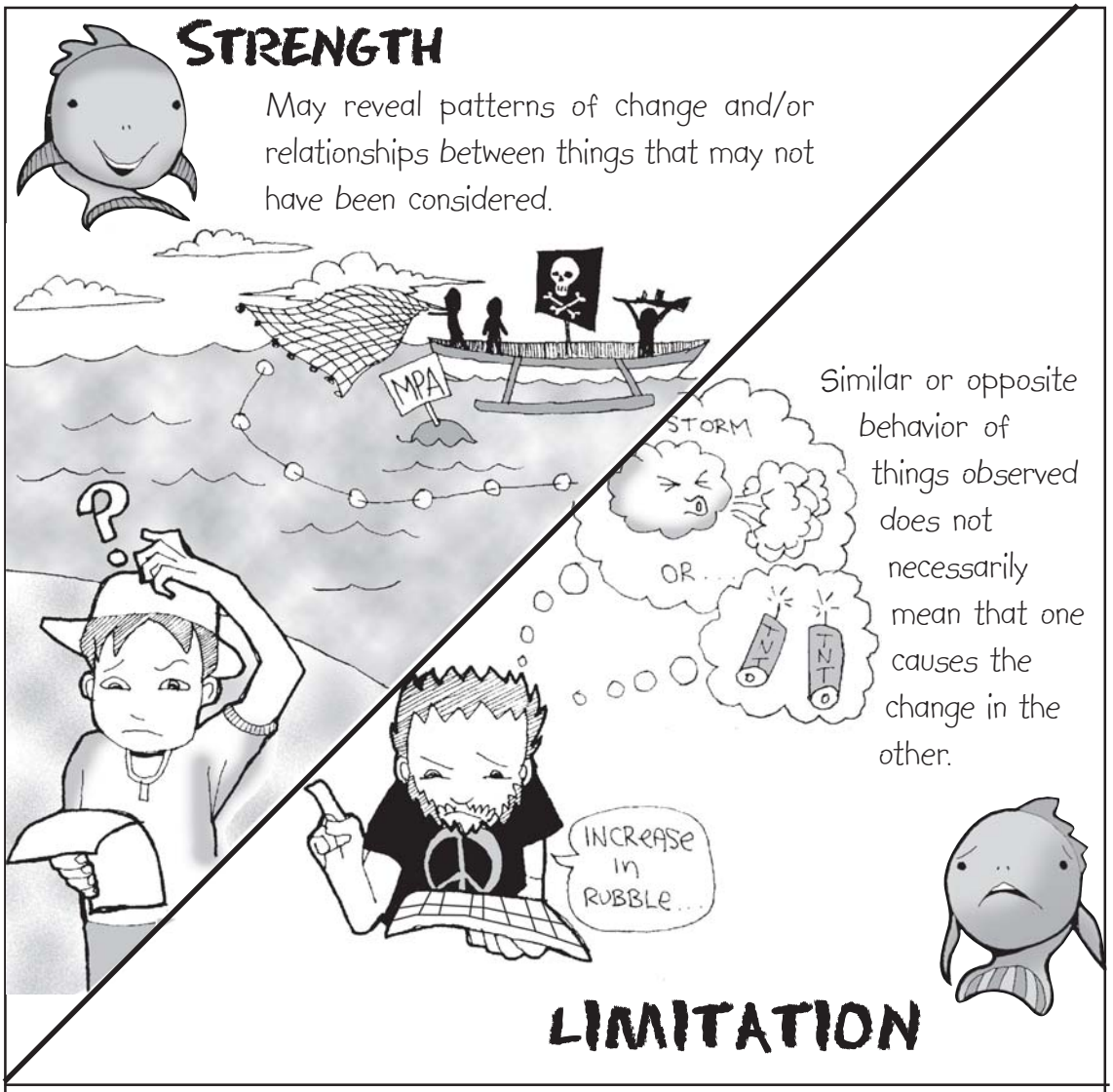
Physical Damage of Reef Habitat
This may be due to fishing with the use of explosives or other physically destructive fishing gear, storms, boat and anchor damage, or other physically destructive activities.



Eutrophication
Increase in nutrients (usually nitrogen and/or phosphorus) in the water that stimulates algal growth, decomposition and depletion of oxygen in the water. This input of nutrients may be due to agricultural run-off, domestic wastes, aquaculture, and/or sediments.

Widespread Deaths of Reef Organisms may be due to toxic industrial wastes, diseases and/or outbreaks (sudden increases in population) of other organisms.

Sedimentation
Input of sediments into the water that may be due to erosion, mining and/or construction wastes.



Trainer's Tips for Chapter 11

Correlation is the relationship between things which tend to change together in a way that is not by chance alone. Positive correlation is when things increase and/or decrease together. Negative correlation is when one thing increases whenever one thing decreases.

Objects that increase or decrease in the same manner might have a cause-effect relationship or may just both be reacting to still another object (e.g. environment) in the same manner.

Data are represented into pictographs, pie charts, line graphs, and the like to make them easy to understand and remember.

CORRELATION TABLE — Form 7

Site Name: Brgy. Flores fish reserve | **Municipality & Province:** Baybay, Catanduanes

Period covered (mo/day/yr): May 1997 to May 1999 | **Zone/Sector:** outside MPA

INDICATORS	units	potential problem if...	Year I			Year II			Year III			Trend observed
			a	b	c	a	b	c	a	b	c	
FISH (Carangidae+Caesionidae)	average count	decrease	5	0	0	35	30	20	11	6	4	
FISH (Lutj+Leth+SEpin+Haem)	average count	decrease	6	5	4	9	8	7	10	9	8	inc.
LOBSTER	average count	decrease		0			0			0		
GIANT CLAMS	average count	decrease		0			1			0		
TRITON	average count	decrease		0			0			0		
CROWN-OF-THORNS	average count	increase		0			7			1		
OVERHARVESTING/OVERFISHING	no. of fishers obs.	increase		12			10			15		
CORALS (Hard & Soft)	average % cover	decrease		26			22			19		dec.
FISH (Chaetodontidae)	average count	decrease	18	15	13	13	10	8	6	4	3	dec.
DEAD CORAL (w/ or w/o ALGAE)	average % cover	increase		21			41			10		inc.
RUBBLE	average % cover	increase		8			5			6		
DESTRUCTIVE FISHING	evidence of blasts	increase		3			1			0		dec.
ANCHOR DAMAGE	overturned corals	present		×			×			✓		
STORMS	no. of strong ones	high		0			0			0		
TOURISM	no. of resorts	>med or inc.		0			0			0		
ALGAE (turf+macroalgae)	average % cover	increase		12			18			23		inc.
FISH (Balistidae+Tetradontidae)	average count	decrease	0	0	0	0	0	2	0	0	0	
FISH (Scar+Acan+Kyph)	average count	decrease	35	30	25	15	11	10	12	10	8	dec.
URCHINS	average count	large change		20			4			3		dec.
ALGAL OVERGROWTH	occurrence	common		6			8			9		
AGRICULTURAL/FARMED AREA	% of coastline	> low or inc.		30			40			45		inc.
POPULATION		high		16,000			18,000			20,000		inc.
TRASH/GARBAGE (total)	no. observed	present		6			30			42		inc.
MARICULTURE	% area	high		0			0			0		
SAND/SILT	average % cover	increase		17			13			15		
RIVER	distance	near		3km			3km			3km		
VISIBILITY (horizontal & vertical)	in meters	decrease		15			12			8		dec.
FORESTED AREA	% of coastline	decrease		10			2			0		
COASTAL STRUCTURES BUILT-UP	% of coastline	> low or inc.		5			5			8		inc.
SHIPPING	no. of large ships	> 3-5		0			0			1		
MINING POLLUTION	no. observed	present		0			0			0		
INDUSTRIAL POLLUTION	no. of factories	> low or inc.		0			0			0		
MASS BLEACHING	% cover	> 20%		0			10			0		
DISEASED CORALS	% cover	> 20%		0			0			0		
FISH KILLS & other mass deaths		present		×			×			×		
Crown-of-thorns, algae, urchins,...	average count	rapid inc.										algae inc.
OTHER REMARKS:												

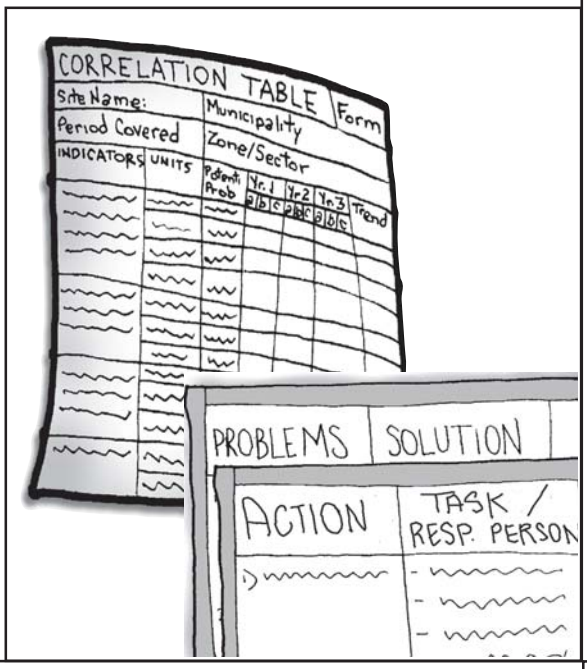
A blank copy of this form is provided in Appendix 2, page 119

Evaluation & Action 12

Studying the trends and the factors that might have resulted in the current situation may help us act upon certain factors which are within our control. Actions include (1) preventing destruction/depletion or (2) directly restoring coastal habitats/resources. Without evaluation and action all the effort put into planning, observing, summarizing, and interpreting will not lead to improvement.

Requirements

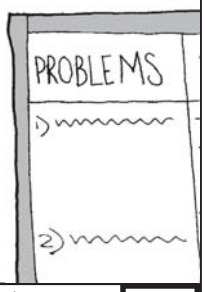
- ❑ Filled-out Correlation Table (see Chapter 11)
- ❑ Previous assessments of the situation and management strategy and/or plan



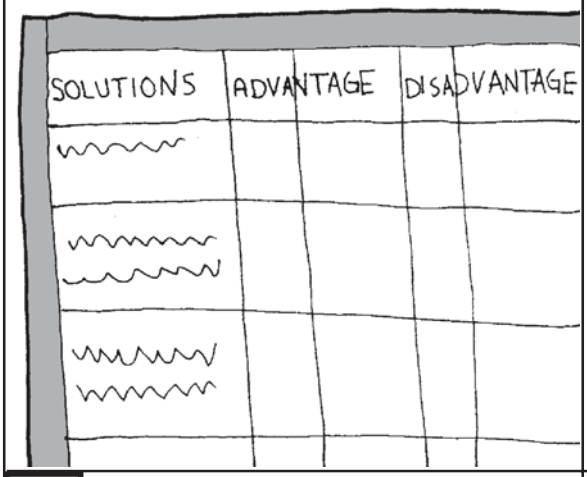
1 Review management objectives

2 Identify issues (for example, from the Correlation Diagram) hindering attainment of objectives.

Trainer's Tips:
If this is the first management cycle, this may be identified from baseline assessments, group discussions and informant interviews. On succeeding management cycles, use results of monitoring to identify which previously identified issues have not yet been adequately addressed and to identify existing issues which were not identified in the past.



3 Generate as many as possible solutions for each issue



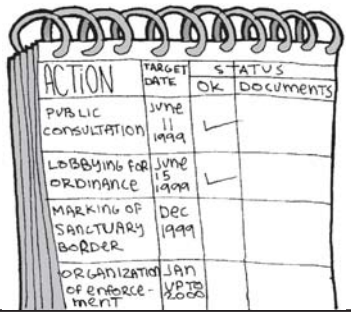
4 Jointly select the top 5 solutions and write down their advantages and disadvantages.

Use Form 9 (page 122) to facilitate the recording of discussion results.

5 Choose which solution to implement and identify collaborators, roles, resources available, resources to be used, and time frames for implementation.

6 Implement the selected solution

Monitor and evaluate progress, regularly updating Form 9 (page 122) as monitoring and evaluation results become available.



ACTION	TARGET DATE	STATUS OK	STATUS DOCUMENTS
PUBLIC CONSULTATION	JUNE 11 1999	✓	
LOBBYING FOR ORDINANCE	JUNE 15 1999	✓	
MARKING OF SANCTUARY BORDER	DEC 1999		
ORGANIZATION OF ENFORCEMENT	JAN UP TO 2000		

SOME STRATEGIES

On this page are some suggested strategies to address problems identified on the Correlation Table.

PROBLEM	STRATEGY/METHOD
Overfishing	Harvest Regulations (Marine Protected Area/Zoning, Seasonal closure, Gear restriction, Species restriction), Patrolling & Enforcement, Reseeding (e.g. Sea-Ranching)
Destructive fishing	Education, Patrolling & Enforcement, Harvest Regulations (Marine Protected Area/Zoning, Seasonal closure, Gear restriction, Species restriction)
Pollution (garbage & sewage)	Waste collection (& proper disposal system), Recycling
Pollution (agricultural & sediments)	Mangrove reforestation, Watershed revegetation, Organic farming, Crop rotation, Education
Pollution (mining & industrial)	Lobbying for waste reduction, detoxification, and redirection
Reef damage from tourism activities	Education, Mooring buoys, Patrolling & Enforcement, Marine Protected Area/Zoning
Coastal construction	Lobbying for impact reduction measures and relocation
Storms, global warming, mass bleaching, & other natural disturbances	Reduce man-made stresses (other problems above) to enable the environment to recover more easily

On the following pages the above strategies are further described...

STRATEGY/METHOD	STRATEGY/METHOD	PURPOSE/WHEN TO USE
CONSERVATION: Regulation & Enforcement		
Marine Protected Area/Zoning	Closing an area to some uses; Assigning areas for other uses	To protect and allow recovery of an area and its resources; To reduce resource-use conflicts
Seasonal closure	Not allowing fishing or diving during certain times of the year	To allow resources or habitats to recover
Gear restriction	Not allowing the use of certain gear	To prevent destruction of habitat; To promote equitability or to limit exploitation level
Species restriction	Not allowing the catching of certain species	To protect endangered species or breeding of overexploited species
Patrolling & Enforcement	Helping the authorities impose compliance with the law	Essential to realize the objectives of the above regulatory methods
CONSERVATION: Impact Reduction		
Recycling	Reusing materials for the same or for another use (e.g. composting)	To reduce waste production and extraction of materials
Waste collection/clean-ups	Moving scattered garbage from coastal habitats to a landfill	To contain waste to a place where it will do less damage
Watershed revegetation	Replanting erosion-prone areas	To reduce the sediments going to the coastal area
Anchor buoys	Providing a safe place for boats to moor without causing habitat damage	To reduce anchor damage to corals
Supplementary livelihoods	Providing additional sources of income	To reduce dependence on and extraction of coastal resources
Lobbying	Using the force of a large number of people to influence	To influence groups not concerned with the coast to be concerned
ENHANCEMENT & REHABILITATION: Transplantation & Reseeding		
Mangrove reforestation	Transferring mangrove young (propagules, seedlings or saplings)	To start up mangrove growth & reproduction and restore abundance of mangrove forest
Reseeding	Transferring young or breeding adults of species to a depleted area (e.g. sea cucumber, urchins, giant clams)	To speed up restocking of a depleted area and allow growth of these species there
Artificial reefs	Putting hard structures in a soft bottom area	To serve as a shelter for fish to aggregate

CONSIDERATIONS	ADVANTAGES	DISADVANTAGES
CONSERVATION: Regulation & Enforcement		
Must be widely accepted; Boundaries must be marked	Promotes consensus and networking; Easier to enforce than most other regulations	Legislation difficult to get; May highlight conflicts; Benefits may take a few years before becoming evident
May need alternatives for those affected; Info campaign needed	Allows use of the area at other times	Loss of fishing opportunity
May need alternatives for those affected; Info campaign needed		Usually difficult to enforce; Loss of fishing opportunity
May need alternatives for those affected; Info campaign needed		Difficult to enforce; Loss of fishing opportunity
Volunteers need para-legal training and have to be deputized; Better to prevent than apprehend violators; Boat, fuel, & radios needed		Sometimes dangerous for the deputized wardens; Cases may get stuck in court
CONSERVATION: Impact Reduction		
External facilities needed to re-use certain materials (e.g. metals)	Also reduces cost and even generates income	
May encourage with awards	Sanitation also improves health	
May also depend on farming and upland communities; Don't introduce foreign species	Also reduces air pollution	
Care needed in putting down buoy's weight	Can also be used to delineate MPA boundaries	Concentrates impact to one place
Should be environment-friendly	Sustained increased income	Activities could multiply too much and harm the environment
Prevent rather than wait for trouble	Can serve as a rallying point for unity	Potential conflicts among resource users
ENHANCEMENT & REHABILITATION: Transplantation & Reseeding		
Don't introduce foreign species or mangroves where there was none; Multi-species forests are more natural; Availability of seedlings	Stabilizes coast and reduces sedimentation	May take a long time so must ensure control of area for 10-25 years after for benefits to be felt
Young or breeding adults must be protected; Don't introduce foreign species; Watch out that other species are not harmed; Requires input of young or breeding adults	Spawn also reseeds the areas beyond; Usually economically-valuable species are reseeded	Young may die before they mature
Currently controversial; Carefully consider site, materials, & regulations	Might also serve as a substrate for corals to settle and grow	May speed up resource depletion if it is fished

CHALLENGE

Well-coordinated and time-consuming involvement by dedicated groups of people is usually critical to the success of solutions.

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APPENDIX 1

Resources for training in reef monitoring skills

Suggested training plan

The entire training course can actually be taught in a week's time. However, it is recommended that the training be spread over the course of 3 years in order to allow the team sufficient time to practice under supervision and to allow the study area to actually change in response to management activities enough to be observed. If a community is being trained by external trainers, at least two visits by them should be planned for each year. The trainees should be encouraged to collect data 2 to 4 times a year (i.e. once per season) together with their local development workers.

Year & Season	Scheduled Activities	Ongoing Activities
Year 1. Season 1. (e.g. Nov.-Mar.)	Introduce the idea of participatory monitoring & evaluation to key community leaders. Check the site for appropriate biophysical and socioeconomic conditions, logistics, and counterpart arrangements and offer to conduct the training.	
Year 1. Season 2. (e.g. Apr.-May) **3-4 days**	Review of basic reef ecology and management. Teach Chapters 1-4 and the data collection and recording steps of Chapters 5-9. Have trainees practice collecting data while experienced people collect baseline data (on the benthos, reef fishes, and invertebrates). **Intro to Monitoring & Evaluation of Coral Reefs** **(1 hr talk)** **Observing Corals and Algae [data collection]** **(1 hr talk/ 1 day fieldwork)** **Observing Reef Fishes [data collection]** **(1 hr talk/ 1 day fieldwork)** **Monitoring Fish Catch [data collection]** **(1-2 hr talk & planning)** **Human Activities & Natural Disturbances** **(1 hr talk)** **Drawing Up a Monitoring Plan** **(1-2 hr talk & planning)**	
Year 1. Season 3. (e.g. Jun.-Oct.) **2-3 days**	Trainees and their local development workers collect data (on the benthos, reef fishes, and invertebrates) again. If data collection skills are good by this point, local development workers can begin teaching the data summarization steps of	Trainees continue collecting data on fish catch and human activities

Year & Season	Scheduled Activities	Ongoing Activities
	Chapters 5-9. Otherwise, these may be taught the following season.	
Year 2. Season 1. **2-3 days**	Trainees and local develoment workers collect data (on the benthos, reef fishes, and invertebrates) together.	
Year 2. Season 2. **2-3 days**	Review the data collection and recording steps of Chapters 5-9 and quiz trainees on this knowledge. Trainees, local development workers, and external trainers collect data (on the benthos, reef fishes, and invertebrates) together. **Drawing Up a Monitoring Plan (review & revision of plan)** **(½-1 hr)** **Observing Invertebrates** **(½ hr)** **Human Activities & Natural Disturbances (review)** **(½ hr)**	
Year 2. Season 3. **2-3 days**	Trainees and local development workers collect data (on the benthos, reef fishes, and invertebrates) together. Trainees use the data collected during the previous monitoring exercises to practice data summarization under the supervision of external trainers. **Observing Corals & Algae [summarization & graphing]** **(1 hr)** **Observing Reef Fishes [summarization & graphing]** **(1 hr)** **Monitoring Fish Catch [summarization & graphing]** **(1-2 hr)**	
Year 3. Season 1. **2 days**	Traines collect data (on the benthos, reef fishes, and invertebrates).	
Year 3. Season 2. **2-3 days**	Trainees, local development workers, and external trainers collect data (on the benthos, reef fishes, and invertebrates) together. Supervise data summarization by trainees. Teach Chapters 11-12 especially using the past 3 years' monitoring data. **Interpreting Observations** **(1 hr)** **Evaluation & Action** **(1 hr)**	
Year 3. Season 3. **3 days**	Trainees collect data (on the benthos, reef fishes, and invertebrates). A contest-conference among various trainee teams may help teams share insights with each other.	

IMPORTANT

Volunteers are rarely able to participate for more than 2 straight days. So, it would be best to spread out each season's monitoring and training activities within a week's time.

No matter when you decide to formally teach Chapters 11 & 12, facilitators must always feedback monitoring results and discuss management implications at least once per season. Monitoring team members should also regularly (e.g. 2 to 4 times a year) present their findings to their organization and community for validation and comments. Encourage the community to discuss the possible implications of the data and plan for appropriate action. Graphs of the results may be displayed on a billboard near the monitoring station. This billboard should be updated regularly.

Trainer's Tips

Things to consider when planning a training:

- ✓ Who is the target audience?
- ✓ How many teachers will be needed?
- ✓ Who is in charge of first-aid?
- ✓ How much time is available for the training?
- ✓ Who will provide meals and snacks?

* Prepare and review before the actual training. Practice what you teach.
* Repeat and/or summarize key points after each talk. To facilitate understanding, assign participants to summarize.
* Understand what motivates your trainees and address their particular concerns.
* Time is usually scarce: keep talks short and simple; train through actual monitoring.
* Laminated identification guides for underwater use are especially helpful for training.
* Organize trainees into teams and assign transects and organisms to be assessed to each team.
* Assign one person to fill out Form 2 and collect all data forms from the team members. All data forms must be complete and in one place at the end of the monitoring period.
* Encourage trainees to ask questions and participate actively. Be open to ideas (especially indigenous methods) from trainees.

Training effective reef monitors requires that the trainer helps the trainee learn accurate and effective monitoring techniques through education, practice, testing, and quality checking. The following pages provide materials useful to assist trainers in educating and developing effective reef monitors. The resources and their uses are:

1. **Evaluation form for simple reef monitoring for management** (page 92)**.** This form may be used to assess each team member and the team as a whole in their ability to apply the various techniques explained in the guide. Under each monitoring technique are listed important points of knowledge or procedures that each trainee should master and understand. The form provides a means of rating the proficiency of each trainee or group in the various techniques and their attributes.

2. **Evaluation guide** (page 93)**.** The evaluation guide provides a means of assigning points and quantification to various behavioral objectives that the trainee should master to be a good reef monitor. How to assess the behavioral traits of the trainee is explained so that points can be assigned to different levels of proficiency. This evaluation guide can be used to rate trainees or groups. It covers:
    a. Demo teaching
    b. Benthos observation
    c. Fish visual census
    d. Invertebrate census
    e. Interpretation and evaluation.

3. **Comparison of reef monitoring methods** (page 98)**.** This sheet helps us decide on the level of detail required in doing reef monitoring in relation to the time and effort required. Table 1 shows the level of detail possible in relation to the level of effort where 3 is the highest level of effort. Table 2 compares four reef survey protocols. Level 3 coincides with the Global Coral Reef Monitoring Network methods of English *et al.* (1997) and requires the most effort. It is noted that the simple method of this guide collects data on most of the parameters of the other 3 methods but lacks detail in several categories such as identifying coral and fish to genera or species level.

I. Evaluation form for simple reef monitoring for management

Site Name: Municipality & Province:

Team member: Name of team:

Reef Monitoring and Evaluation Training

	Year 1	Year 2	Year 3
I. General knowledge			
■ Value of monitoring & evaluation to adaptive management			
■ Components of the monitoring program			
■ Monitoring (through time), inside/outside, replication, representative			
II. Manta tow			
■ Procedure (2-minute segments, timer keeps close watch on observer)			
■ Estimate % cover			
■ Distinguish between live hard, dead hard, live soft coral			
■ Depict hard coral cover onto map			
III. Fish visual census			
■ Procedure (lay transect on depth contour, 5-m to each side, count, size class, 50-m length, 1x/season)			
■ Recognize and name the 18 reef families on Data Form 5A (page 111)			
■ Conduct on-site (doesn't splash about, damage coral, poach or throw litter)			
■ Summarization (total count per fish type per transect, average count per fish type per area)			
■ Graphing (convert average into log score, draw picto-table)			
IV. Invertebrate census			
■ Procedure (5-m to each side, count, 50-m length)			
■ Recognize & name: *Diadema* urchins, crown-of-thorns starfish, giant clams			
V. Fish catch monitoring			
■ Procedure (records weekly; records date, fishing gear, fishing ground, catch quantity, effort)			
■ Recognize and name the major fishing gear			
■ Can map fishing effort (at peak time) on gridded map			
■ Understands: CPUE x total effort = total catch			
■ Summarization (total sampled effort, total sampled catch)			
■ Graphing (CPUE per month or area, est. total effot or total catch per month or area)			
VI. Interpretation and evaluation			
■ Understands the concept of correlation			
■ Can suggest relevant causes of observed trends			

Symbol	Definition
✓	Okay
~	needs improvement or practice
x	has not yet been taught
?	not assessed

This form may be used to assess each team member and to assess the team as a whole. Copies of assessments may be made for the individual team member, for the team leader and for the trainer.

2. Evaluation guide

2. Evaluation Guide	Demo Teaching: 200 points	
Behavioral Objective Trainee should be able to...	Method of assessment	Scoring/ Quantification
Discuss the different aspects of the following topics: • Why monitor reefs? • Drawing up a monitoring plan* • Manta tow • Fish visual census • Invertebrate census • Observing human activities & natural disturbances • Monitoring fish catch • Interpreting observations* • Evaluation & action (based on the lectures and the handbook) * choose either of these if you are only evaluating one team & time is only sufficient to test one of the above topics	**Demo teaching by each team** Evaluator poses the scenario: "After having been trained in reef monitoring methods, it is now your turn to train others. Discuss your given topic in the most creative manner you can think of." Trainees draw lots to determine their topic for presentation. Trainees are given time (2-3 hours) to prepare their presentation. Each team is evaluated according to the following criteria: • Organization and coherence of presentation (discusses points in a logical manner) • Clear presentation of the objective at the start and a summary at the end of the presentation • Completeness and accuracy of details • Creativity in presentation: extra points given to team that presents topic in a form other than straight lecture • Accuracy and clarity of visual aids (if any) • Speed or pace of presentation If trainees miss some points in their presentation, the evaluator asks questions to check if the trainee simply forgot or really does not know that detail.	Objective (15 points) Logical order of presentation (25 points) Major points of the topic (60 points) Pace (15 points) Visual aids (20 points) Summary (15 points) **Total: 150 points**
Display understanding beyond "factual" level	In-depth questioning by evaluator(s) and audience. These require insight and application of the facts as described in this guidebook into a context or situation (e.g. to a particular area being monitored).	**Total: 50 points**

2. Evaluation Guide	Benthos observation: 125 points	
Behavioral Objective Trainee should be able to...	Method of assessment	Scoring/ Quantification
Identify the different life forms	On-site identification of 5 lifeforms pre-marked by evaluator. Items to be tagged: • Hard coral • Soft coral • Dead coral / dead coral with algae • Rubble • Macroalgae	Five (5) points per lifeform correctly identified. **Total: 25 points**
Practice the basic procedure of the manta tow	Actual conduct of manta tow. Evaluator notes whether the following are practiced by the trainee: • Correct hand signals (left, right, ok, speed up, slow down, stop) • Towing done over the reef crest • Towing done in two-minute intervals • Mapping of landmarks	Five (5) points per observed correct behavior. **Total: 20 points**
Estimate the percent cover of each lifeform accurately	Evaluator tows along with the trainees then computes the accuracy of each trainee's estimates using his/her estimates. Three tows with HC, SC, DC/DCA and S recorded for each tow. *% Cover bracket ranges from (English *et al.* 1997): % cover — Cover category 0 — 0 1-10 — 1 11-30 — 2 31-50 — 3 51-75 — 4 76-100 — 5	For each of the estimates, points may be assigned according to the scale below: Within the same % cover bracket* (5 points) Difference of 1 bracket (3 points) Difference of 2 brackets (1 point) Difference of >2 brackets (0 point) **Total: 60 points**
Plot the tow results on the map	Observe the trainees plot their tow results on the map	Ten (10) points for plotting the proper tow number on the right place on the map. Another ten (10) points for drawing the proper pie pictographs **Total: 20 points**

2. Evaluation Guide	Fish Visual Census: 210 points	
Behavioral Objective	Method of assessment	Scoring
Identify the major fish families	Identification. Evaluator shows each team a set of 15 pictures and asks them to identify the family of the fish in each picture (local names may be used instead of scientific names). Select the families to be tested by selecting the most common 15 fish families in the area from the list of 18 in the data form.	Two (2) points per fish family correctly identified. **Total: 30 points**
Practice the basic procedure of the fish visual census	Actual conduct of fish visual census. Evaluator notes whether the following are practiced by the trainee: • Laying the transect on a constant depth contour • Waiting 10-15 minutes before censusing • Swimming side by side • Minimal movement	Five (5) points per observed correct behavior. **Total: 20 points**
Estimate 5-m width from the transect	On-site testing by evaluator. 15 plastic fishes are laid inside and outside a 5-m width transect belt. Instruct trainees to "census" the plastic fishes as they normally would. Purposely set 5 of the fishes outside the 5-m width. Determine from their data whether or not they can properly estimate 5-m width.	Three (3) points for every "inside" fish correctly identified; subtract five (5) points for every "outside" fish recorded (improperly identified as "inside"). You may also have the trainees estimate the size of the plastic fish as part of the 3 points to be gained per "inside" fish **Total: 30 points**
Estimate size class and number of fish per family accurately.	Evaluator censuses a pre-selected set of 9 fish families together with the team, then computes the accuracy of each team's estimates using his/her estimates. Log5 abundance brackets: Fish count — Log5 abundance 0 — 0 >0-5 — 1 >5-25 — 2 >25-125 — 3 >125-625 — 4 >625 — 5	For each of the estimates of pre-selected fish families, points may be assigned according to the scale below: Within the same log**5** abundance bracket* (10 points) Difference of 1 bracket (5 points) Difference of 2 brackets (2.5 points) Difference of >2 brackets (0 point)
Summarize and graph data	Observe the trainees summarize and chart their results	Ten (10) points for each correct set of sums, averages, selection of families to depict, & proper conversion of abundances into pictographs **Total: 40 points**

2. Evaluation Guide	Invertebrate Census: 15 points	
Behavioral Objective Trainee should be able to...	Method of assessment	Scoring
Identify the important invertebrate indicators	Identification. Evaluator shows pictures and asks the trainees to identify each picture (local names may be used instead of scientific names): • *Diadema* urchins • Crown-of-thorns starfish • Giant clams	Five (5) points per invertebrate type correctly identified. **Total: 15 points**
	Site Details: 50 points	
Properly record details of the monitoring site	Evaluator observes the area being monitored and checks whether the data form describing the site and the human activities & natural disturbances therein have been properly filled out. • Site description form • Fisheries • Pollution • Other stresses & disturbances • Management	Ten (10) points per section of the form correctly estimated. **Total: 50 points**
	General Behavior: 50 points	
Work well with fellow trainees	Observation **by evaluator** Each team will be judged according to the following criteria: • Respect and cordiality shown to fellow trainees • Initiative in performing task at hand • Level of participation in discussions with fellow trainees	**Total: 70 points**
Anticipate and organize things needed for the field work	Observation by the evaluator	Thinks through and prepares the materials and facilities needed for monitoring ahead of time **Total: 30 points**
Show respect and care for the environment	The "secret" test (offer cigarettes and candy - watch that trainee doesn't throw butts or wrappers into the water)	**Total: 50 points**

2. Evaluation Guide	Interpretation & Evaluation: 150 points	
Behavioral Objective Trainee should be able to...	Method of assessment	Scoring/ Quantification
Copy the data of the proper time and place from the summary forms into the correlation form	Evaluator observes the trainees filling out the correlation form	Twenty (20) points for copying the various data types properly aligned (by times and places) on the data form. **Total: 20 points**
Identify trends	Evaluator observes the trainees filling out the correlation form	Ten (10) points each for correctly identifying things with increasing trends, decreasing trends, and things without trends. **Total: 30 points**
Identify problems based on observed trends	Evaluator discusses the trends with the trainees and helps them relate this to potential problems.	For potential problems correctly identified: 30 points for the top problem 20 points for the next most important problem **Total: 50 points**
Identify solutions relevant to potential problems		For each set of appropriate solutions correctly identified: 30 points for the top problem 20 points for the next most important problem **Total: 50 points**

3. Comparison of Reef Monitoring Methods

The reef monitoring methods described in this guide generally collect the simplest type of data with which changes can be detected. More detailed data may be collected for indicators of particular interest. The tables below outline how these methods may collect more detailed information as well as what levels of detail are collected by other monitoring systems. The greater the desired level of detail, the more time you will need for the observations.

Table 1. Level of detail required for reef monitoring.

	Level			
	0	**1**	**2**	**3**
Manta tow survey				
Number of variables estimated	3	3-5	3-5	3-5
Horizontal visibility estimated?	no	no	no	yes
Estimation scale	5-pt scale	5-pt scale & =	%	%
Fish visual census				
Taxonomic detail	family	family	genus	species
Butterflyfish species counted?	no	no	yes	yes
Size estimate	estimated	10-cm size classes	10-cm size classes	estimated to the closest cm
Number of invertebrate types counted	none	Acanthaster, Diadema	several	several
Benthos transect				
Taxonomic detail				
Number of lifeforms	~12	~12	28	28+
Coral genera identified?	no	no	no	yes
Number of points sampled per meter	% est. per 5 m	2	4	100

Table 2. Comparison of various reef survey protocols.

	Protocol			
	GCRMN	Reef Check	Aquanaut	This Guide
Manta tow survey				
Variables estimated	HC, SC, DC			HC, SC, DC
Number of tows	Min. 9			Min. 9
No. & location of detailed transects				
Number of areas	1 to 3		2	2+
Quality of areas to be sampled	Representative	Best except drop-offs	Representative	Representative
Quality of optional areas to be sampled		Moderate and heavy impacts		
Depth of transects	3 to 6 m (& 10 m optional)	2-6 m and >6-12 m	3, 5, 8 and 10 m	6 m
Transect position relative to the shore	Parallel	Parallel	Parallel	Parallel
Photos/videos		Recommended		Recommended
Site description		Yes		Yes

	Protocol			
	GCRMN	Reef Check	Aquanaut	This Guide
Fish visual census				
Number of transects per depth per area	3	4	2	5
Transect length	50 m	20 m	5 m	50 m
Transect width & height	5 m	5 m	2 m	10 m
# Seasons sampled	Pref. 2	1		1-3
Monitoring interval	1x/1-2 yr	1x/yr		1x/season
Taxonomic detail	Species	Groupers & 4 other sp.	None	Family
Butterflyfish species	Identified and counted	Species counted	As part of fishes	Counted
Size estimate	Food fishes	Groupers only		All to size categories
Types of invertebrate counted				
Banded coral shrimp		Y		Y
Diadema urchin		Y		Y
Sea fans			Y	
Echinometra/pencil urchins		Y	Y	Y
Acanthaster planci		Y	Y	Y
Sea cucumber		Y	Y	Y
Giant clams		Y	Y	Y
Triton		Y		Y
Lobster		Y		Y
Conch/whelk			Y	
Benthos transect				
Number of transects/area	5	4	2	5
Transect length	20 m	20 m	5 m	5 m
Taxonomic detail: number of lifeforms	28	HC, SC, DC, FS, SP, RCK, R, S, SI, OT	HC, SC, DC, FS, SG, RCK, R, S, SI, OT	HC, SC, DC, DCA, MA, TA, CA, RCK, R, S, SG, SI, SP, OT
Coral genera identified?	Pref. species	No	No	No
Points sampled per m	100	2	2	% est. per 5 m

Legend: FS = fleshy seaweed; SG = seagrass

APPENDIX 2

Blank data forms used in this guide

The following pages contain blank data forms referred to in this guide. All the forms are reproduced here in full size so that they can be photocopied for reef monitoring activities.

Titles of the forms that follow are:

Form 1: Data Checklist Form 101
Form 2A: Survey Site Description and Details Form 102
Form 2B: Human Activities & Natural Disturbances Form 103
Form 2C: Human Activities & Natural Disturbances Logbook 104
Form 2D: Human Activities & Natural Disturbances Summary Form 105
Form 3: Manta Tow Data Form 106
Form 4A: Benthic Lifeforms & Invertebrates Data Form 107
Form 4B: Benthic Lifeforms & Invertebrates Data Form with coral lifeforms 108
Form 4C: Data Summary Form 109
Form 4D: Benthos Graphing Form 110
Form 5A: Fish Abundance Data Form 111
Form 5B: Data Summary Form 112
Form 5C: Fish Graphing Form 113
Form 5D: Butterflyfish Species Checklist Form 114
Form 6A: Gear Survey Form 115
Form 6B: Fish Catch Monitoring Form for data collection teams 116
Form 6C: Fish Catch Monitoring Form for individual fishers 117
Form 6D: Fish Catch Monitoring Summary Form 118
Form 7: Correlation Table 119
Form 8A: Community Perception Survey Form 120
Form 8B: Community Perception Data Summary Form 121
Form 9: Monitoring and Evaluation Form 122

DATA CHECKLIST FORM

Form 1

Question, issue or problem	Possible indicator(s)	What may cause change	Where to monitor	When to monitor	Monitoring method	Materials needed	Person(s) assigned	Target dates & # days needed

Prepared by:

Agreed by:

SURVEY SITE DESCRIPTION AND DETAILS FORM

Form 2A

Site Name:	Municipality & Province:				
Reason for choosing to monitor this site:	Overall Documentor:				
Transect No.	[ ]	[ ]	[ ]	[ ]	[ ]
Fish abundance observers					
Benthic lifeforms observers					
Start date (mo/day/year)					
Start time (am/pm)					
Latitude (e.g. 9°23.012')					
Longitude (e.g. 112°34.781')					
Transect orientation (e.g. N, NE, ...)					
Depth (in m)					
Reef zone (e.g. fore slope, flat, etc.)					
Is the site sheltered or exposed?					
Approx. steepness of site (angle of slope)					
Topographic compexity (in m)					
Horizontal visibility (in m by transect line)					
Vertical visibility (in m by secchi depth)					
End date (mo/day/year)					
End time (am/pm)					
Weather:	Sunny [ ] Cloudy [ ] Rainy [ ] Windy [ ]				
Temperature:	Air [ ] Water surface [ ] 3-m depth [ ] 10-m depth [ ]				

Sketch map of reef and coastline showing transect locations and other features

Coordinates from
map [ ] or GPS [ ]
If GPS, specify map datum:

HUMAN ACTIVITIES & NATURAL DISTURBANCES FORM

Form 2B

A. FISHING	% or #	Notes
# fishing boats observed w/in 500 m		
# aquarium fishers w/in 500 m		
# invertebrate gleaners w/in 500 m		
# blasts heard during the dive		
% area used for mariculture w/in 500 m		

B. POLLUTION	% or #	Notes
Distance to nearest pop. center (in km)		
Population of pop. center (in thousands)		
# factories per km of adjacent coast		
Distance to nearest river (in km)		
% farmed area of coastline		
% forested area of coastline		
# mines within sight		
# items of floating trash observed		
# items of trash observed underwater		
# fish nets left as trash		

C. OTHER STRESSES & THREATS	% or #	Notes
# boats anchoring within 500 m		
# divers observed within 500 m		
# dive shops within 10 km		
Years since last typhoon (>100 kph)		
# large ships within sight		
% of coast built-up with structures		
Years since last mass bleaching		
% bleached coral area		
% diseased coral area		

MANAGEMENT OF AREA	Is this a legally protected area?
Name of Marine Protected Area:	Organization responsible:
Describe restrictions herein:	
Ordinance no. & year:	Start date of protection by law:
Date boundaries were marked:	Date patrols/enforcement began:
Coordinates of protected area boundaries:	

HUMAN ACTIVITIES & NATURAL DISTURBANCES LOGBOOK

Form 2C

Site Name: **Municipality & Province:**

DATE	TIME	ZONE / AREA (e.g. core zone, buffer zone, outside MPA)	OBSERVATION / ACTIVITY (For violations, note down type of violation, name of violator/s, place/s of residency, apprehending person/s and actions taken)	QUANTITY	TYPE OF OBSERVATION (Fishing, Pollution, Violations, Others)	RECORDER

HUMAN ACTIVITIES & NATURAL DISTURBANCES SUMMARY FORM

Form 2D

Site Name:	**Municipality & Province:**			
Zone/Sector				
Month/Year				
TYPE OF OBSERVATION **(Fishing, Violations, Pollution, Number of tourists, etc.)**	Total	Total	Total	Total
Total observation time				

MANTA TOW DATA FORM

Form 3

Site Name:	No.:	Municipality & Province:	
Date (month/day/year):	Time:	Observer:	Timer/Mapper:

Tow No.	Start Time	Location			Estimate % substrate cover					Notes (e.g. crown-of-thorns starfish, *Diadema* urchins, algae, etc.)
		Latitude & Longitude/Compass Bearing/Landmarks		Depth (m)	Hard Coral	Soft Coral	Dead Coral	DC w/ Algae	Sand/ Silt	
		Start	End							
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										

BENTHIC LIFEFORMS & INVERTEBRATES DATA FORM

Form 4A

Site Name:	Municipality & Province:		
Transect No.: Scuba: Snorkel:	Coordinates:		
Date (mo/day/yr):	Benthos observer: Invertebrates observer:		
Horizontal water visibility (m):	Depth (m):	Reef zone:	Topography: Slope:
Habitat notes:			

BENTHIC LIFEFORMS		Tally number of points or est. % occupied by each lifeform e.g. 𝍸-𝍸-𝍸-II or 12%+34%+22%+...					Total Count	% Cover
coral	**HC** live hard coral							
	SC soft coral							
dead coral	**DC** white dead coral							
	DCA dead coral w/ algae							
other animals	**SP** sponges							
	OT other animals							
plants	**TA** turf algae							
	MA fleshy macroalgae							
	CA coralline algae							
	SG seagrass							
non-living	**R** rubble							
	RCK rock							
	S / SI sand/silt							
TOTAL								**100%**

INVERTEBRATES	# within 5-m width
Diadema urchins; *tuyom*	
Pencil urchin	
Crown-of-thorns starfish; *dap-ag*	
Giant clam; *taklobo*	
Triton shell; *tambuli*	
Lobster; *banagan*	
Sea cucumber; *balat*	
Banded coral shrimp	
others	

Causes of coral damage:

Put x if found on corals. Circle the box of the dominant cause

- ☐ sediment
- ☐ blasting patterns
- ☐ anchor damage
- ☐ other breakage
- ☐ bleaching
- ☐ black band disease
- ☐ white band disease
- ☐ other coral disease
- ☐ seaweed overgrowth
- ☐ coral-eating snails
- ☐ crown-of-thorns starfish
- ☐ plastics
- ☐ other trash
- ☐ other causes (specify): _____

See page 34 for Sample Data Form 4A showing results of a 50-m transect using the snorkel survey method.

BENTHIC LIFEFORMS & INVERTEBRATES DATA FORM WITH CORAL LIFE FORMS

Form 4B

Site Name:	Municipality & Province:		
Transect No.: Scuba: Snorkel:	Coordinates:		
Date (mo/day/yr):	Observers:		
Horizontal water visibility (m):	Depth (m):	Reef zone:	Topography: Slope:
Habitat notes:			

BENTHIC LIFEFORMS		Tally number of points or est. % occupied by each lifeform e.g. 𝍸-𝍸-𝍸-II or 12%+34%+22%+...	Total Count	% Cover
coral	**HC** live hard coral			
	branching (CB)			
	massive (CM)			
	flat/encrusting (CE)			
	foliose/cup (CF)			
	SC soft coral			
dead coral	**DC** white dead coral			
	DCA dead coral w/ algae			
other animals	**SP** sponges			
	OT other animals			
plants	**TA** turf algae			
	MA fleshy macroalgae			
	CA coralline algae			
	SG seagrass			
non-living	**R** rubble			
	RCK rock and block			
	S / SI sand/silt			
TOTAL				

INVERTEBRATES	# within 5-m width
Diadema urchins; *tuyom*	
Pencil urchin	
Crown-of-thorns starfish; *dap-ag*	
Giant clam; *taklobo*	
Triton shell; *tambuli*	
Lobster; *banagan*	
Sea cucumber; *balat*	
Banded coral shrimp	
others	

Causes of coral damage:

Put x if found on corals. Circle the box of the dominant cause

- ☐ sediment
- ☐ blasting patterns
- ☐ anchor damage
- ☐ other breakage
- ☐ bleaching
- ☐ black band disease
- ☐ white band disease
- ☐ other coral disease
- ☐ seaweed overgrowth
- ☐ coral-eating snails
- ☐ crown-of-thorns starfish
- ☐ plastics
- ☐ other trash
- ☐ other causes (specify): _____

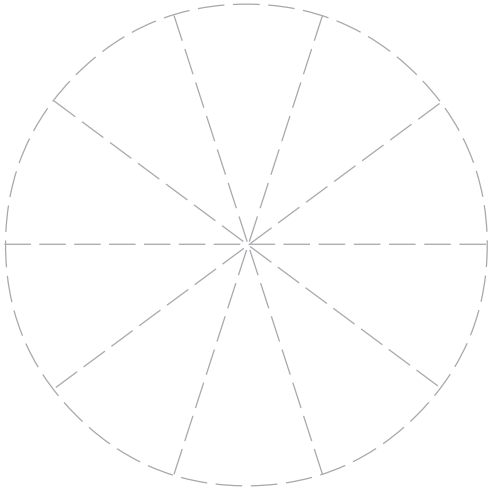
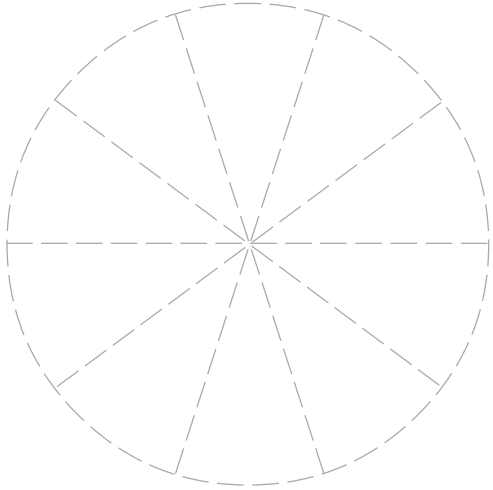
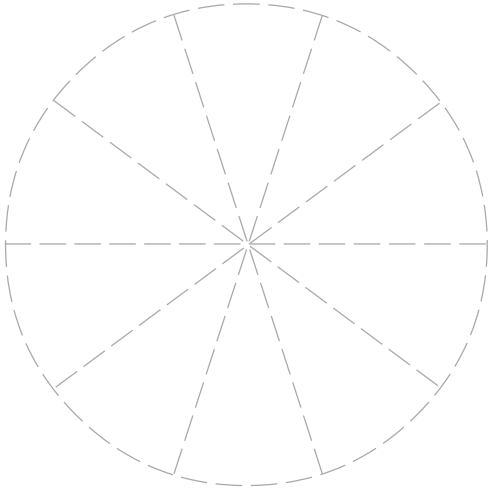
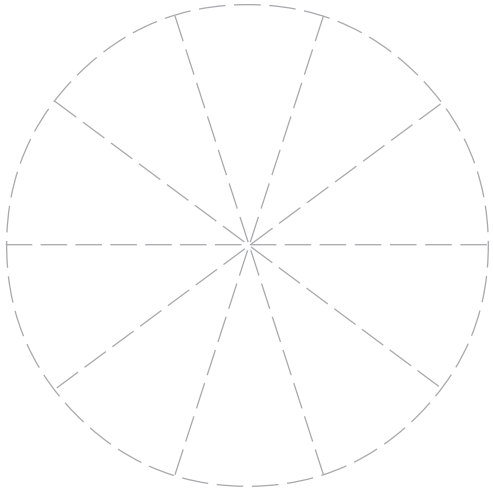
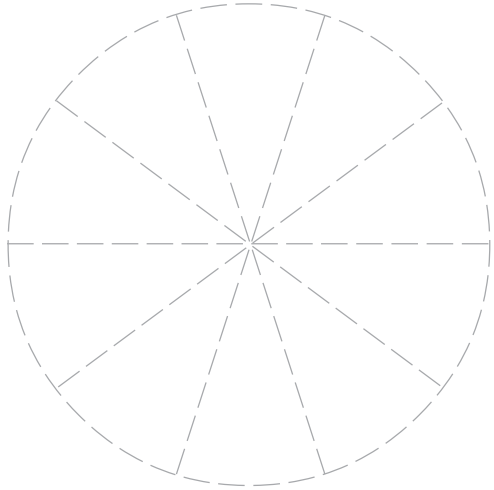
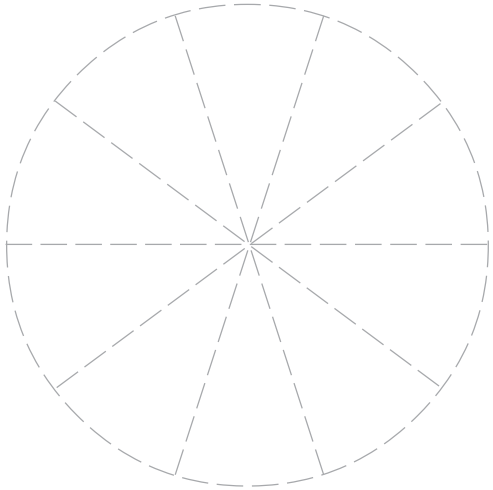
DATA SUMMARY FORM

Form 4C

Site Name:									Municipality & Province:								
Zone/Sector																	
Month & year																	
Transect #																	
Types/groups	**Sub-total**						**Total**	**Avg.**	**Sub-total**						**Total**	**Avg.**

BENTHOS GRAPHING FORM

Form 4D

Site Name:		Municipality & Province:	
Month & year			
Zone/Sector			
			
			

FISH ABUNDANCE DATA FORM

Form 5A

Site Name:		Municipality & Province:		
Transect No.:	Depth (m):	Coordinates:		
Date (mo/day/yr):	Time:	Left observer:		Right observer:
Habitat notes:		Horizontal visibility (m):	Angle of slope:	Transect orientation:

FAMILY	**Species**	Record number of fishes per size class			
		1-10 cm	11-20 cm	21-30 cm	specify sizes for >30 cm
<EPINEPHELINAE>* groupers; *lapu-lapu*					
	Barramundi cod; *señorita*				
<LUTJANIDAE>* snappers; *maya-maya*					
<HAEMULIDAE>* sweetlips; grunts; *lipti*					
<LETHRINIDAE>* emperors; *katambak*					
CARANGIDAE* jacks; trevallies; *talakitok*					
CAESIONIDAE* fusiliers; *dalagang-bukid; solid*					
NEMIPTERIDAE* coral breams; *silay*					
MULLIDAE* goatfishes; *timbongan*					
BALISTIDAE triggerfishes; *pakol*					
CHAETODONTIDAE butterflyfishes; *alibangbang*					
POMACANTHIDAE angelfishes; *adlo*					
LABRIDAE wrasses; *labayan*					
	Humphead wrasse; *mameng*				
[SCARIDAE]* parrotfishes; *molmol*					
	Bumphead parrotfish; *taungan*				
[ACANTHURIDAE]* surgeonfish; *indangan*					
[SIGANIDAE]* rabbitfishes; *kitong*; *danggit*					
[KYPHOSIDAE]* rudderfishes; *ilak*					
POMACENTRIDAE damselfishes; *palata*					
ANTHIINAE fairy basslets; *bilong-bilong*					
Zanclus cornutus	Moorish idol; *sanggowanding*				
sharks					
rays					
sea turtles					
others: e.g. tunas					

Legend: <fishes> = major reef carnivores; [fishes] = major reef herbivores, **fishes** = fishes which are indicators of hard corals, * = fishery target families

DATA SUMMARY FORM

Form 5B

Site Name:									Municipality & Province:								
Zone/Sector																	
Month & year																	
Transect #																	
Types/groups	**Sub-total**						**Total**	**Avg.**	**Sub-total**						**Total**	**Avg.**

FISH GRAPHING FORM

Form 5C

Site Name:					Municipality & Province:			
Zone/Sector								
Month & Year								
Types/groups								

BUTTERFLYFISH SPECIES CHECKLIST FORM

Form 5D

Observer	Site Name
Date (mo-day-yr)	Coordinates

Species	Common Name	1		2	
		Present	No	Present	No
1. *Chaetodon adiergastos*	Philippine butterflyfish				
2. *C. auriga*	Threadfin butterflyfish				
3. *C. baronessa*	Eastern triangular butterflyfish				
4. *C. bennetti*	Bluelashed butterflyfish				
5. *C. citrinellus*	Speckled butterflyfish				
6. *C. ephippium*	Saddle butterflyfish				
7. *C. kleinii*	Klein's butterflyfish				
8. *C. lineolatus*	Lined butterflyfish				
9. *C. lunula*	Raccoon butterflyfish				
10. *C. melannotus*	Blackback butterflyfish				
11. *C. mertensii*	Merten's butterflyfish				
12. *C. meyeri*	Meyer's butterflyfish				
13. *C. ocellicaudus*	Spottail butterflyfish				
14. *C. octofasciatus*	Eightband butterflyfish				
15. *C. ornatissimus*	Ornate butterflyfish				
16. *C. oxycephalus*	Spot-nape butterflyfish				
17. *C. plebeius*	Blueblotch butterflyfish				
18. *C. punctatofasciatus*	Spotband butterflyfish				
19. *C. rafflesi*	Latticed butterflyfish				
20. *C. reticulatus*	Mailed butterflyfish				
21. *C. selene*	Yellowdotted butterflyfish				
22. *C. semeion*	Dotted butterflyfish				
23. *C. speculum*	Mirror butterflyfish				
24. *C. trifascialis*	Chevron butterflyfish				
25. *C. trifasciatus*	Melon butterflyfish				
26. *C. ulietensis*	Pacific doublesaddle butterflyfish				
27. *C. unimaculatus*	Teardrop butterflyfish				
28. *C. vagabundus*	Vagabond butterflyfish				
29. *C. xanthurus*	Pearscale butterflyfish				
30. *Chelmon rostratus*	Copperband butterflyfish				
31. *Forcipiger flavissimus*	Longnose butterflyfish				
32. *F. longirostris*	Longnose butterflyfish				
33. *Hemitaurichthys polylepis*	Pyramid butterflyfish				
34. *Heniochus acuminatus*	Pennant coralfish				
35. *H. chrysostomus*	Threeband pennantfish				
36. *H. singularius*	Singular bannerfish				
37. *H. varius*	Horned bannerfish				
38. *Parachaetodon ocellatus*	Sixspine butterflyfish				
39. *Coradion chrysozonus*	Goldengirdled coralfish				
40. *Coradion melanopus*	Twospot coralfish				
Total number of Species/Site					

GEAR SURVEY FORM

Form 6A

Site Name:	Municipality & Province:
Date (month/day/year):	

Type of fishing gear	# of persons in village using gear type	# of motor boats using gear type	Typical # of persons per boat	Months when gear is typically used	Hours when gear is typically used	Fishing grounds (use grid letter in map)	Where is catch sold (which market)	Type(s) of fish usually caught	# of persons from whom information was collected

FISH CATCH MONITORING FORM FOR DATA COLLECTION TEAMS

Form 6B

Name: Village/Barangay:

Collect catch data once per week. Be sure to record the trip even if nothing was caught (record '0' in the weight).

Type of fishing gear	# of fishers in boat	Fishing ground (use grid letter in the map)	Time and date of departure	Time and date of arrival	Number of gear units	Use one line per kind of fish. Use more than one line per fishing trip if needed.	
						Kind of fish caught	Weight (kg)

FISH CATCH MONITORING FORM FOR INDIVIDUAL FISHERS

Form 6C

Site/Village/Barangay:	Month & Year/Buwan at Taon:

List down at least 5 fishing days per month (e.g. once per week). Be sure to record the trip even if nothing was caught (record '0' in the weight). Magtala ng hindi bababa sa limang araw ng pangingisda sa bawat buwan. Siguraduhin na magtala pa rin kahit walang nahuli sa paglaot [magtala pa rin ng '0' sa timbang (kilos)].

		Record catch per fishing trip				
		1	2	3	4	5
Date & time of leaving *Petsa at oras ng paglabas*						
Fishing gear *Uri ng pamamalakaya*						
# of fishers in boat *Bilang ng tao sa bangka*						
Fishing ground (use grid letter on map) *Lugar na pinangisdaan*						
Weather condition, tide, and sea state *Kumusta ang panahon, hunas/taob, at alon*						
Date & time of return *Petsa at oras ng pagbalik*						
CATCH *Huli*	Kinds of fish caught *Mga uri ng nahuli*	Weight *Timbang*	Weight *Timbang*	Weight *Timbang*	Weight *Timbang*	Weight *Timbang*
TOTAL CATCH (kilograms) *Pangkalahatang huli (kilos)*						

Circle each date that you went out to fish. *Bilugan ang bawat petsa na ikaw ay nangisda.*

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

FISH CATCH MONITORING SUMMARY FORM

Form 6D

Site Name:							Municipality & Province:								
Zone/Sector															
Month & Year															
	Total kg	Total gear unit-days or fishing-hours	kg/ unit effort	Total kg	Total gear unit-days or fishing-hours	kg/ unit effort	Total kg	Total gear unit-days or fishing-hours	kg/ unit effort	Total kg	Total gear unit-days or fishing-hours	kg/ unit effort	Total kg	Total gear unit-days or fishing-hours	kg/ unit effort
Fishing Gear															

CORRELATION TABLE

Form 7

Site Name:	Municipality & Province:
Period covered (mo/day/yr):	Zone/Sector:

INDICATORS	units	potential problem if...	Year I			Year II			Year III			Trend observed
			a	b	c	a	b	c	a	b	c	
FISH (Carangidae+Caesionidae)	average count	decrease										
FISH (Lutj+Leth+SEpin+Haem)	average count	decrease										
LOBSTER	average count	decrease										
GIANT CLAMS	average count	decrease										
TRITON	average count	decrease										
CROWN-OF-THORNS	average count	increase										
OVERHARVESTING/OVERFISHING	no. of fishers obs.	increase										
CORALS (Hard & Soft)	average % cover	decrease										
FISH (Chaetodontidae)	average count	decrease										
DEAD CORAL (w/ or w/o ALGAE)	average % cover	increase										
RUBBLE	average % cover	increase										
DESTRUCTIVE FISHING	evidence of blasts	increase										
ANCHOR DAMAGE	overturned corals	present										
STORMS	no. of strong ones	high										
TOURISM	no. of resorts	>med or inc.										
ALGAE (turf+macroalgae)	average % cover	increase										
FISH (Balistidae+Tetradontidae)	average count	decrease										
FISH (Scar+Acan+Kyph)	average count	decrease										
URCHINS	average count	large change										
ALGAL OVERGROWTH	occurrence	common										
AGRICULTURAL/FARMED AREA	% of coastline	> low or inc.										
POPULATION		high										
TRASH/GARBAGE (total)	no. observed	present										
MARICULTURE	% area	high										
SAND/SILT	average % cover	increase										
RIVER	distance	near										
VISIBILITY (horizontal & vertical)	in meters	decrease										
FORESTED AREA	% of coastline	decrease										
COASTAL STRUCTURES BUILT-UP	% of coastline	> low or inc.										
SHIPPING	no. of large ships	> 3-5										
MINING POLLUTION	no. observed	present										
INDUSTRIAL POLLUTION	no. of factories	> low or inc.										
MASS BLEACHING	% cover	> 20%										
DISEASED CORALS	% cover	> 20%										
FISH KILLS & other mass deaths		present										
Crown-of-thorns, algae, urchins,...	average count	rapid inc.										
OTHER REMARKS:												

COMMUNITY PERCEPTION SURVEY FORM

Form 8A

MPA Name: **Municipality & Province:**

Name: **Age:**

Site/Village: **No. of years residing in the area:**

Occupation: **Date of interview:**

For each question below, check "YES" or "NO" according to the respondent's answer and take note of the respondent's explanations.

1. **Do you know about the (state the name of the MPA and place)?**
   - **Yes** ___ How did you know? _____
     _____
   - **No** ___ Why did you not know about it? _____
     _____

2. **Do you think there is an improvement in the area because of the MPA?**

   Yes ___ **No** ___

   Why do you say that? _____
   _____

3. **Do you think that there are changes in the incidence of illegal fishing activities in the area since the MPA was established?**

   Yes ___ **No** ___

   Why do you say that? _____
   _____

4. **Do you think that the MPA management group is functional?**

   Yes ___ **No** ___

   Why do you say that? _____
   _____

5. **Do you think the MPA efforts can be sustained?**

   Yes ___ **No** ___

   Why do you say that? _____
   _____

6. **Will you support the continued management of the MPA?**
   - **Yes** ___ How will you support the MPA? _____
     _____
   - **No** ___ Why will you not support the MPA? _____
     _____

COMMUNITY PERCEPTION DATA SUMMARY FORM

Form 8B

MPA Name:		**Municipality & Province:**				
Month / Year of Survey:		**Tally the answers of each type of stakeholder, e.g. 𝍸 𝍸 𝍸**			**TOTAL COUNT**	**PERCENTAGE**
ANSWERS		***Direct Stakeholder***	***Indirect Stakeholder***	***Undetermined***		
Question 1: Awareness about the MPA	YES					
	NO					
	BLANK					
Question 2: Positive impacts from MPA observed	YES					
	NO					
	BLANK					
Question 3: Reduced incidence of illegal fishing due to MPA	YES					
	NO					
	BLANK					
Question 4: Functional management group	YES					
	NO					
	BLANK					
Question 5: Sustainability of MPA	YES					
	NO					
	BLANK					
Question 6: Willingness to support the MPA	YES					
	NO					
	BLANK					

MONITORING AND EVALUATION FORM

Form 9

Management Objective	Issues	Potential Solutions	Advantages	Disadvantages	Action Agreed Upon	Collaborators, Roles, Resources, Timeframe	Action Actually Implemented	Status of Issues

SUPPORTED BY

USAID
FROM THE AMERICAN PEOPLE

SGP The GEF Small Grants Programme

gef

UNDP

through the following projects:

The Fisheries Improved for Sustainable Harvest (FISH) Project
Philippine Environmental Governance Project 2
The Coastal Resource Management Project-Philippines