CSIRO Marine Laboratories Report

Guide to Monitoring the Traditional Catch of the Torres Strait

G. Dews, A. Harris, I. Poiner, J. Kerr *

CSIRO Division of Fisheries, Marine Laboratories

Cleveland

***CSIRO Division of Mathematics and Statistics**

Long Pocket Laboratories, Brisbane

1993

Contents

C.1.2 Sampling technique

FIGURES

RESOURCES

Introduction

This field guide describes a reliable way of monitoring the traditional marine catches of the Torres Strait Protected Zone. It was written to assist Torres Strait Islanders trained as Fisheries Observers to collect data systematically. However, the guide may also be useful to other communities wishing to monitor their traditional marine catch.

The guide has three parts:

Section 1: Provides background information on the Torres Strait and on gathering catch information. This section can be used as a desk reference.

Section 2: A guide to the field sheets, with information on the species, fishing methods, recording and sampling methods. This section is for observers to use when working in the communities.

Appendies: Contain all the information on the communities, names of fish and other useful material.

We have used the word “fishermen” as a general term for either men of women who fish.

This field guide was produced as part of a project undertaken by CSIRO Division of Fisheries, Cleveland, between 1991 and 1993. It was funded by CSIRO and the Australian Fisheries Management Authority.

The publishers of *Australian Geographic* kindly gave their permission to reproduce the map of Torres Strait. The identification keys to turtles are published by the Queensland Department of Environment and Heritage, and sponsored by Greenpeace.

Section 1

Guide to Recording Torres Strait marine catch

Anyone engaged in collecting artisanal fishing data should have some appreciation of the traditions and customs of the people, for these influence both fishing practices and life styles. A knowledge of traditions and customs can make it easier to collect and analyse the data and avoid conflict with the people. This section provides some background information on the Torres Strait and on gathering catch information. It can be used as a desk reference.

1.1 Background

Named after the Spanish navigator Torres, who sailed through the strait in 1606, the Torres Strait (Fig. 1) is a 200 km stretch of sea between Cape Yorke on the Australian mainland and the Western Province of Papua New Guinea. There are some 150 islands, islets, coral reefs and cays in 8,000 square kilometres of ocean, but only 17 islands are inhabited. The total population of about 6,500 (Australian Bureau of Statistics census 1991) fluctuates, as people move between islands, the Australian mainland and Papua New Guinea for cultural and employment purposes.

Torres Strait Treaty The seafood and its resources are important to the traditional inhabitants for subsistence, commercial and traditional reasons. In 1985 a treaty was signed between Papua New Guinea and Australia to define their jurisdiction over the fisheries and seabed.

As part of the treaty, the Torres Strait Protected Zone was established to acknowledge and protect the traditional way of life and livelihood of the Torres Strait Islanders, including their fishing activities.

The Torres Strait Protected Zone (Fig. 1) includes all the inhabited islands except Darru in the north-east, and Thursday, Horn and the Prince of Wales Island in the south and the south-western group (see below).

Geography of the Torres Strait The Torres Strait Islands under Australian jurisdiction can be divided into five geographic groups. The descriptions of each group come from the work by Johannes et al. (1991).

Eastern Group (Murray, Darnley and Stephens)

Located near the northern extremity of the Great Barrier Reef, these islands are steep and of volcanic origin, with brown soil derived from decomposing basalt. The islands are encircled by well-developed fringing reefs. Coral communities flourish and reef fish and invertebrates abound in the clear waters.

Central Group (Sue, Coconut, Yorke and Yam)

These islands are centrally located and are mainly small, low, sparsely vegetated, sandy cays and sandbanks perched on reef limestone. Most of the cays have fringing reefs. Yam differs from others in the group, because of its higher rocky relief.

Top Western Group (Boigu, Saibai, Dauan)

Boigu and Saibai are low-lying islands with extensive areas of the interior subject to seasonal flooding. They are fringed by dense mangroves, mudflats and muddy reefs. Dauan is a smaller, steep granite island.

Western Group (Mabuiag, Badu and Moa)

These are mainly high islands that are geological extensions of the Australian mainland. Most of the islands have fringing mangroves and reefs. Moa is the only island with two distinct communities: Kubin and St Pauls.

South-western Group (Thursday Island, Hammond, Friday and Prince of Wales)

These islands have different recent histories and inhabitant status under the Torres Strait Treaty. They are not included in the marine-catch survey as they are not in the Torres Strait Protected Zone.

Cultural background and its significance to the survey Originally Islanders used canoes (up to 20 m long) for hunting dugong and turtle. The turtle were harpooned or caught ("bulldogging") from the canoes or taken while nesting on the beach. There are also accounts of turtles being caught with tethered remora. Dugong were harpooned from platforms or canoes.

Dugong ranks highest as a traditional food amongst Torres Strait Islanders, and occupies a special place in the social life of the Western and Top Western Islanders (Johannes et al., 1991). Hunting for dugong is concentrated on the Western Islands and on the Warrior Reef seagrass beds, where they feed. Nowadays, they are hunted from outboard-powered aluminium dinghies, although on some islands wooden dinghies are used. The wooden dinghies make less noise and allow the hunter to approach the dugong more easily. The hunter still uses the traditional wap or harpoon shaped from timber with a detachable metal barb at the front. Today, hunting is only done during the day, by approaching with stealth or at speed, depending upon the hunter and the weather conditions. The animal is usually brought back to the community for slaughter, though it may be slaughtered near the hunting grounds if the animal is too large or the community beach is not suitable.

Turtles have been exploited for their flesh and eggs for centuries in the Torres Strait. Two species are important to the Islanders: the green turtle (*Chelonia mydas)* and the hawksbill (*Eretmochelys imbricata).* During summer thousands of green turtles move through Torres Strait from the Gulf of Carpentaria, the Arafura Sea and Indonesian waters on their way to nesting grounds on the Great Barrier Reef (Limpus et al., 1986).

Some nest in the Torres Strait, where they are liable to be caught by Islanders as they come ashore.

Islanders prefer to eat fat female green turtles. Hawksbill turtles are only eaten when butchered by an experienced elder who knows how to remove the poison sacks for the animal. If a turtle is not slaughtered immediately, it is either left tethered by a rope around a flipper and allowed to swim, or it is turned on its back on the beach.

Before the influence of Europeans, women and men of all ages speared fish and collected shellfish from reefs. Fish were also caught with hooks made from tortoise-shell, with bow and arrow in rock weirs or by poisoning shallow tidal pools. These days a variety of techniques are used. Women often use a dough of flour and water for bait and burly when handlining near the community for mullet, rabbitfish or butterflyfish, and most prefer to fish from the recently constructed jetties instead of rocks, reefs or beach.

Nets were not known in the strait before European settlement, but now they are widely used.

Fish for eating are caught by gill, seine and drag nets, while cast nets are usually used mainly for bait. The extent to which nets are used differs between communities and seasons.

Pelagic fish are trolled mostly from dinghies, usually after other fishing activities have been completed.

Lobsters were originally fished with spears on reefs or from canoes. Now Islanders use modern dinghies equipped with outboard motors and sometimes hookah-diving equipment.

The first recorded commercial fishery in the Torres Strait was for beche-de-mer. However there were probably commercial (traded) fisheries before then, as Captain James Cook observed Islanders wearing pearl shell pendants.

In 1868 the first pearling station was established in the Torres Strait; it began the first of a succession of booms in maritime industry in the strait (Johannes et al., 1991). Pearling in the Torres Strait was at its peak in 1900, when 359 registered vessels worked the straits (Bach, 1955). Today pearling is done from some of the remaining pearl luggers (three luggers were operating in 1992) or converted trawlers (one in 1992). Some of these boats also operate as cray freezer boats during the cray season.

The marine resources of the Torres Strait have a significant place in the lives of the people of the Torres Strait, particularly on the small outer island communities. These marine resources can support the communities by providing both food and income. Traditionally, Torres Strait Islanders have harvested the seas to survive; in the future there will be pressure on the Islanders to increase their commercial exploitation of the marine resources.

1.2 Reasons for recording catch

There are four reasons why it is important to record the catches of traditional and islander-based fisheries in the Torres Strait:

- to manage the fisheries
- to provide catch information for assessing any heavy metals loads
- to counter extreme claims by other interest groups
- to aid development planning.

(a) Management of the fishery

The management of a fishery involves assessing the effects of harvesting the fish stocks and implementing schemes that satisfy both present users and future generations. The aim is to have a sustainable fishery that enables fishing to be successfully carried on now, and in the future.

Marine animal resources are regarded as renewable because they can be used year after year without destroying the resource. Torres Strait Islanders have successfully used their marine animal resources such as dugong, turtle, fish, shellfish and crayfish for hundreds of years.

If too many animals in a population are killed by humans, the population shrinks. Eventually the animals will be so rare and difficult to catch that they will no longer be a valuable resource.

On the other hand, if the animals are not hunted by people and predation from other animals is low, many of the animals will die of old age. Sometimes a population grows in size until it runs out of food and some animals die of starvation. In this case, a food resource for humans has been wasted.

Without affecting the use of the resource for future generations, each generation of people should be able to get as much as possible from a resource. The marine animal must be considered along with its environment. Spoil the environment and there will be no resource to manage.

It is the people who matter. Who gets to use a resource should depend on tradition, history, politics and popular opinion, not management. Management takes actions to ensure the resource is sustainable and distributed, taking into consideration the circumstances, previous use and importance of the resource to the community groups. For example, it was politics, history, tradition and local opinion that decided most aspects of the Torres Strait Treaty. However, it is the Australian Fisheries Management Authority on Thursday Island that is responsible for seeing that agreements in the treaty relating to the fisheries are kept.

To manage a fishery resource, there must be information on: the animals (their biology, how many there are, how many are caught) and the people (who fishes for the animal, how they fish for it; and how much effort they spent in catching it). Information on the animals biology and population size comes from research. Other information comes from monitoring the fisheries, either through logbooks of commercial fisherman or through catch surveys of small-scale artisanal and traditional fisheries.

Fortunately, only a few rules, such as those preventing the sale of traditional species, are needed. Rules to regulate traditional fishing are usually unenforceable, and usually ignored.

Management is best carried out by the traditional owners fishing along traditional lines; however, traditional methods change with new technology. Younger generations without the wisdom of their elders may not be aware of how the new technology is changing their traditional culture. They only know the resource is easier to catch the new way; they may not know they could be endangering a resource.

Throughout the world, artisanal small-scale fisheries are being over-exploited as populations grow and new technology comes into use. Apart from the prawn fishery, fisheries in the Torres Strait are lightly exploited. But to understand changes taking place in the fisheries we need catch and biological information. We can then assess whether the changes are benefiting a community or endangering a resource.

(b) Assessment of trace metals loads

Trace metals (such as copper, iron, cadmium and mercury) are found naturally in the environment and are incorporated to varying degrees into all the tissues of all animals. However, while most also have known biological/metabolic functions (copper and iron in the transport of oxygen) other such as cadmium and mercury have no biological function.

People have always eaten food that contained trace metals. At low levels they are harmless, and in some cases are beneficial to plants and certain animals. Not all plants and animals have the same levels of heavy metals. Some may have high levels because they concentrate specific metals from their environment, others may have low levels because they are efficient at getting rid of the metals.

The concern about trace metals relates to their effects on health when the levels are increased above that which is normal in the human body. At high levels they are poisonous; at medium levels they may contribute to heart diseases, some cancers and learning difficulties in children.

Trace metals cumulate when absorbed by humans. Once within the body, their removal through excretion (urine) is very slow (about 50 years for lead and cadmium). To set limits on what levels of contamination are acceptable in a food is difficult, as the effect on a person depends not just on how much is in a piece of food, but also on how much of the food is eaten over a long period. It is important therefore to find out how many animals are caught and eaten in the island communities.

Since 1985, Torres Strait Islanders, commercial fishermen and scientists have expressed concern about the possible effects on Torres Strait waters of mining operations around

the Fly River in Papua New Guinea. It was feared these operations could release sufficient amounts of contaminants such as cadmium and lead (also known as heavy metals) in the Gulf of Papua to increase the natural levels in the marine environment.

In July 1989 the Australian government funded a four-year study to investigate the problems of trace metal contamination of the Torres Strait. Later that year the Torres Strait baseline study was started to determine what the natural levels of trace metals are and whether there had been any contamination.

Evidence from the baseline study to date does not suggest that there has been any contamination of the Torres Strait environment. It is thought that the levels of trace metals that have been measured are natural levels that have existed for thousand years. However, the study is establishing a baseline so that in the future any increases can be detected. If levels of heavy metals were ever found to be above the natural levels in some of the animals used as food in Torres Strait, the catch information could be used as a guide to which marine foods would have the greatest health effects.

(c) Claims by other interest groups

The world is changing and more people are concerned with the environment and the animals in the environment. To influence governments, some people form groups to try to change situations they consider undesirable or "environmentally unfriendly". Some of the changes they suggest are beneficial, but sometimes the groups lack information and understanding, so make wild claims that are either wrong or misguided.

Often these people live in cities and have little understanding of life in remote areas, where killing animals for food may be an everyday necessity. They may even be critical of the methods of killing dugong and turtle. The collection of information on the catch and on fishing activities can demonstrate that a fishery is being managed in a sustainable and culturally acceptable manner.

(d) Development planning

Biological information suggests that the fisheries resources of the Torres Strait can be further exploited. Under the treaty, the gains from these resources should be for the Torres Strait Islanders. The Torres Strait economy is developing rapidly. With the introduction of electricity and freezers to the islands, people can sell their catches, which leads to increased community participation and provides a livelihood for the Islanders. This trend is likely to grow, as when training and marketing schemes for the fisheries become more widespread.

By collecting information on the catch and fishing activities, the effect of these developments can be assessed. This avoids development programs being based on inaccurate assumptions. Collecting information on the island-based fisheries can show where the islands are succeeding and where there could be more development.

1.3 Aim of the project

The Australian Fisheries Management Authority (AFMA) manages the fisheries in the Torres Strait. Under the Torres Strait Treaty, these fisheries are to be protected and reserved for the benefit of the traditional communities. It is important to know, therefore, how the fisheries are developing so that AFMA can fulfil the requirements of the treaty. The aim of the Torres Strait catch-monitoring project is to provide AFMA with information and techniques to monitor the catch and effort of the traditional and commercial islander-based fisheries.

The project proceeded in the following order:

- The traditional and commercial Islander fisheries were documented, along with their importance to each of the Islander communities in a representative subset.

- The variability of each of the main traditional and commercial Islander fisheries through time was estimated on the same set of Islander communities.

- The methods of monitoring the Islander catch were refined so that long-term catch monitoring can be carried out at less cost.

Surveying of the seafood catch by CSIRO personnel began in 1991 and continued into 1993.

1.3.1 Why sampling works

It is not possible to have a Fisheries Observer present on each island all the time to record all the fish catch.

To get a reliable estimate of the year's catch for each island, we take samples of the catch. By making several short visits to an island and applying a mathematical formula we can estimate the catch for the whole year.

To make this formula work, we use chance to decide when to record the catch on an island. Picking a day at random means that any day of the year can be selected. It could be a Sunday or a Monday, a wet day or a fine day, or even Christmas Day. Observing catches on random days gives every day an equal chance of being observed.

Some days the weather is good and many people go out fishing and the catch is high. If a scientist sampled only those days, he or she would think far more fish were caught in a year than is true. On other days the weather is bad or everybody is working in a Community Development Employment Program (CDEP) and the catch is nil. If a scientist sampled only on *those* days, he or she would get the wrong answer again.

But when the observer samples on days chosen randomly, the good days and the bad days are just as likely to be sampled. Taking an average of the days in a year gives a fair estimate of the catch for the year. The estimate will not be exact, but it will be near the

mark. The estimates can be further improved by getting more samples and sampling over many years.

In the Torres Strait, airline schedules and weather conditions make it impossible to visit the islands on any day of the year, so we can´t choose them completely at random. We take this into account when estimating total yearly catches. It is not as good as pure random sampling, but much better than not using random sampling at all.

1.4 Seafood Catches

Seafood is landed in the Torres Strait for:

- personal consumption (including distribution to relatives and friends)
- feasts and traditional ceremonies
- commercial gain.

The inhabitants of the Torres Strait have one of the highest seafood consumption rates in the world, and the resources of the sea are important in the diets and traditional customs of the Torres Strait Islanders. Johannes (1991) compared the seafood consumption of three Torres Strait Islands communities with that of other cultures. All three communities (Boigu, Yorke and Mabuiag) had higher consumption rates than the traditional fishing cultures in Oceania. The only fishing communities where per capita seafood consumption was as high, or higher, than in Torres Strait were communities that could not get store-bought foods as easily as the Torres Strait communities during the study periods.

Average rate of consumption of seafood (grams per person per day) (Johannes, 1991):

Australia	22
Japan	102
United States	19
Boigu	238
Yorke	202
Mabuiag	450

1.4.1 Non-commercial fishing activities

Non-commercial seafoods are eaten by the immediate family soon after they are caught. If sufficient quantities are landed, then they are distributed to relatives and friends. With the recent advent of reliable electricity on the islands, communities can now store their

catch in home freezers, reducing the need to fish for immediate consumption. Some species of fish and crayfish, but not turtle or dugong, can be sold to commercial buyers.

Seafood makes up a major portion of the traditional feasts held for tombstone openings, weddings, funerals, etc. Turtle and dugong are predominantly used for feasts and are given as gifts; they are never sold.

The wide variety of fishing methods used in the Torres Strait today can be broadly grouped as: line-fishing, harpooning or spearing, and net fishing. Within these three groups, 17 specific methods have been defined for the purpose of data collection (see Section 2 part 2.12).

Turtle and dugong hunting is done by men. Handlining and reef gleaning are carried out by the women and children, although in some communities men fish for trevally off the beach and jetties and use troll lines for mackerel. Netting is done by both men and women.

1.3.2 Commercial fishing activities

Commercial fishing can be defined as catching fish for money. It is mainly undertaken by the men. The level of participation depends on the season and prices being offered. The main Islander commercial fishery is lobster-diving, and to a lesser extent diving for trochus and pearl shell, crabbing and fin-fishing. The commercial fishery with the largest value—prawn trawling—has little Islander involvement.

Currently Badu, Mabuiag, Yorke, Darnley and Yam have freezers for commercial lobster and fish processing. The catch from commercial fishing activities is marketed through island-based freezers and freezer-boats. Other islands such as Saibai, Badu and Mabuiag may also have access to freezer boats during the peak lobster season or when a demand arises.

1.5 Outline of the Methods

1.5.1 Marine catch records

Monitoring the catch requires that someone records the quantity and the type of fish landed and the fishing methods used, over an entire day. Normally each island is monitored continuously for between three and ten days at least once every three months. The observer records all the information on field data forms. Later this information is entered onto a computer.

Good places from which to observe fishing activities have been identified on every island although on many islands the observer must walk along the beach.

The Fisheries Observer must accurately observe and record all the day´s fishing activities on an island. This is done by interviewing the fishermen and recording the species and weight of all the catch.

When a fisherman cannot be interviewed, the observer records:

- the time at which the fishing trip began and finished
- where the fishing took place (e.g. boat harbour jetty)
- what gear the fishermen took with them (e.g. spear, lines, diving gear)
- how many people took part in the fishing activity.

With training, and by using good judgement, an observer can guess what method of fishing was used. This can be noted on the field sheets (as explained in detail in Section 2).

Details are recorded whether or not the fishing trip is successful. For every fishing activity, a record is made of the fishing method used, the weight of the catch, the species caught, where the catch is going, and if possible the name of the fisherman or woman. (This is explained in detail in Section 2).

Fisheries Observers collect the catch information wherever fishermen are working. This may be :

- where most fishermen land their catch (e.g. beach, jetty, rocks)
- where most dinghies are moored (e.g. harbours, beach)
- where the fishermen sell their catch (e.g. freezer site)
- where there is some natural shelter from the weather (e.g. on the lee side of islands).

The importance of these areas may vary during a day or between visits to the island, depending on the wind, tide and weather, social activities such as employment, and the locality of freezers or freezer boats. In 1992, the construction of jetties and harbours influenced the site of fishing activity on some islands. Fisheries Observers have to be aware of such changes and adjust their observation strategies.

In Appendix B are guides to observation points in each community, along with other information on the island and the community.

When interviewing the fishermen, the Fishery Observer needs to find out

- *The catch composition*. Each type of fish landed is identified, generally to a species level (i.e. each fish is named by its Latin name, common name, and island name if known).
- *The weight of each animal or item of catch landed* where possible. If the catch is large a *subsample is taken and the total weight estimated.

- *The size and sex of each dugong and turtle* that is landed (see Appendix C for method). Note whether the turtle has eggs or the dugong has recently carved or is pregnant.

- *The number of people involved* in the fishing activity.

- *The number of hours* the people were fishing.

- *The destination* of the catch.

- *The fishing gear* used.

- *The area* where the animals were caught.

Catches may be landed over an entire length of one or more beaches on an island. It is therefore not always possible for the observer to see all the catches landed in one day, despite being in the best place to watch. The information that was missed may be gained by interviewing the fishermen on the next or subsequent days.

** Subsample: a representative proportion of a large catch. The subsample is weighed and then multiplied to give an estimate of the total catch: e.g. For example, if one-tenth of the catch is weighed, this figure is multiplied by 10 to give an estimate of the total.*

If the observer knows there has been a fishing trip but wasn´t able to record the catch or interview the fishermen, he or she refers to it as *sighted but not interviewed*. When the information is analysed, this catch is given an average based other instances where the fishing method was used on that island. If the fishing method had not been previously recorded from that island, then the average catch from all other islands is taken.

Where the weight of a catch is recorded but the numbers of fish landed are not known, the numbers are estimated from other instances where both weight and numbers have been recorded. When only the species and number are known, the weight is similarly estimated.

Monitoring normally begins at 7.30 a.m. but can be earlier if the fishermen are going out earlier (e.g. trevally fishing early in the morning). The day´s recording normally ends at dusk but can be extend if some fishermen are still out. Observers may break for lunch from 12.30 to 1.30 p.m when there is little fishing activity.

1.4.2 Vessel survey

The number and size of vessels in a community indicates how much it fishes, or to use the scientist´s term *level of fishing effort.* If the number of dinghies or the size of the boats or engines increases, the level goes up. The most common vessel used in the Torres Strait is the aluminium dinghy powered by an outboard motor.

Information on the number and length of boats in a community is gathered regularly (see details Section 2 part 2.1.3). If a dinghy has its motor attached it is recorded as “active” even when it is on the beach, as it can quickly be used either for fishing or for transport between islands. A dinghy without a motor and not ready for use is recorded as “not active”.

Although dinghies are also used to transport goods and people between islands, and for traditional trading visits to Papua New Guinea communities, their main role is for fishing.

From these records it will be possible to see if the fishing capacity in a community is increasing, decreasing or staying the same.

1.5 Marine Animal Resources

The main marine animal resources are dugong, turtle, crayfish, a variety of fin-fish, and molluscs. Traditionally the most important of these are dugong and green turtle (Johannes, 1991). Crayfish and some fin-fish are important commercially. The relative importance of each varies between Island communities and within communities at different times of the year. Dugong meat is more important in the western communities; green turtle and fin-fish are important in all communities. Dugong and turtle are distributed to relatives and friends on other islands and to mainland centres such as Townsville and Cairns.

The biology of the marine animal groups caught in the Torres Strait differs greatly. An understanding of the biology of each animal group is useful when operating in the field. The main marine animals fished in the Torres Strait are listed in Appendix E.

1.5.1 Dugong

The dugong (*Dugong dugon*) is one of the four existing species of Sirena or seacow.

They are herbivorous mammals and are strictly marine, living in the shallow warm tropical and subtropical coastal waters of the Indian and western Pacific oceans.

Dugongs have a life span of 70 years or more. The females mature at about 10 years and produce a single calf every 3 to 5 years. The calf is just over a metre long at birth, and weighs about 30 kg. Although it begins eating seagrass soon after birth the calf continues to nurse from its mother until it is 18 months old (Marsh, 1991).

Hunting of dugong in the Torres Strait has been concentrated over the seagrass beds around the Western Islands off the two mainland coastlines and on the Warrior Reef. The seagrass beds diminish east of Warrior Reef, as do the dugong (Johannes, 1991).

Of about 70,000 dugongs in Australian waters, there may be 12,500 in the Torres Strait (Marsh 1991). Dugong are also found in Northern Territory waters, the Gulf of Carpentaria, Great Barrier Reef Marine Park and southern Queensland. Because dugong are long-lived animals, it can take up to 10 years before it is known whether their numbers are increasing or decreasing.

1.5.2 Turtle

Sea turtles were on earth at the same time as the dinosaurs. Unlike most reptiles today, they are adapted to living in sea-water.

There are seven species of sea turtle, six of which are found in the Indo-Pacific region (Indian and Pacific oceans), including Torres Strait: the green, hawksbill, loggerhead,

flatback, olive ridley and leatherback. Mostly green and hawkbills are caught in the Torres Strait.

Being reptiles, turtles have to breathe air. They lay their eggs (about 100 of them) on beaches just above high-tide mark. The eggs are left unattended in the sand. They hatch in 45 to 70 days and the new-born turtles make their way to the sea, trying to escape the many predators such as goannas and frigate birds.

In the sea, the newly hatched turtles drift with the currents, eating whatever else drifts with them. Little is known about this period of their life, which biologists call the 'lost time'. After a few years, the turtles return to the shores and reefs as juveniles. Five of the species eat meat, fish, sponges, jellyfish and other small animals. The green turtle, however, becomes a vegetarian when it reaches the juvenile stage and mostly eats seagrasses.

There are more green turtles than hawksbill turtles in the Torres Strait. The population of green turtles is made up of both resident animals and animals that only nest in the straits and then migrate to other areas of northern Australia.

Large numbers of males and females are seen mating off the fringing reefs in September and early October. Nesting starts in November and continues until about February. During this period turtles may wander around the communitie´s houses at night searching for a nesting site (on Murray for example).

The green turtle is hunted throughout the year and is highly regarded as food by Islanders. A slaughtered turtle is shared with relatives and friends and all the parts of the turtle are used. The oil may be kept for later use as a medicine or tonic.

The hawksbill turtles nest in small numbers on most islands and their eggs are usually preferred to those of green turtles. These turtles are only eaten on islands (for example Warraber) where members of the community know how to slaughter and to remove the poison gland from the animal´s lower neck.

1.5.3 Fish

The Torres Strait has a very varied and colourful fish fauna because it is close (10°S) to the equator, where living coral reefs are a major feature of the waters. To give themselves the greatest chance of survival, tropical fishes have evolved many shapes and colours, with different lifestyles and feeding habits. Many fascinating aspects of tropical fishes are described in the books about them. For example some eel-like fishes (pearlfishes, family Carapidae) live within the gut of beche-de-mer, wandering out at night and quickly returning into the beche-de-mer when danger strikes. Many of the common reef fishes such as the tuskfish and cod start life as females and change to males later in life.

Fishes that are found in Torres Strait are commonly referred to as Indo Pacific fishes. Because many tropical fish species have eggs or small fish fry that drift with the currents over long distances, some species of fish can be found on the East African coast, across the Indian Ocean and into the Pacific Ocean as far as Hawaii. The Philippines, Indonesia, Papua New Guinea and Australia are in the middle of this vast area and have the greatest variety of fish; that is why the Torres Strait has so many different fishes.

Fishes are often placed in two broad groupings: demersal and pelagic . Demersal fish live mostly on the sea bottom, while pelagic fish live mostly in the mid-water or on the surface. These differences in lifestyle are associated with some other characteristics.

Pelagic fishes are usually silvery, with slightly different colouring on the upper and lower parts of the body. This is thought to make them less visible to predators. Pelagic fishes are fast swimmers, move great distances between seasons, and grow rapidly. They have areas of dark muscle tissue that help them swim for long periods. The tuna, mackerel, some trevallies and sardines are all pelagic fishes.

The demersal group includes some reef fish such as coral trout, cods, snappers and sweetlips. Demersal fishes usually have white muscle tissue, grow slowly, and don´t travel far when adults.

For identifying the fishes of the Torres Srait we recommend the book "The Marine Fishes of North-Western Australia" and "Reef Fishes of New Guinea", both by G. Allen and R. Swainston. These guides have many accurate colour paintings of the fishes and interesting information on their biology. It is useful to use the colour paintings and accompanying text for identifying the fishes. However not all species are illustrated. So if a fish is not exactly like the painting, it is better to use the family or genus name only (see Appendix E, Guide to Scientific Names).

1.5.4 Lobster / crayfish

The lobster (*Panulirus ornatus*), which is also called painted, creasy or tropical crayfish, is the target of the most important Islander fishery in the Torres Strait. The barrier or banded cray (*Panulirus versicolor*), and the blue-spot rock lobster or coral cray (*Panulirus femoristriga*) are less abundant.

The lobster larvae develop in the open ocean and grow in about six months to small juvenile lobsters. These settle into small holes in the seabed in Torres Strait but grow very quickly: one year later their tails are about 100 mm long. At that stage they move into the area of the fishery, where they are fished until they are just over 2.5 years old. They then leave the Torres Strait, around August October, and catch rates decline. Scientific tagging studies have shown that some lobsters move north east into the Gulf of Papua to spawn (shed their eggs into the water). This is known as a spawning migration. The lobsters that reach the eastern Gulf of Papua near Yule Island appear to be in poor condition and die after breeding. Lobsters on reefs off the north-east Queensland coast do not take part in this migration, but move to the south-east. Indications are that Yule Island is not the only breeding ground for the Torres Strait population (Pitcher, 1990).

Regulations on crayfish are: total ban on trawling of lobsters to protect the spawning migration, a minimum size limit of 100 mm (tail length), and strict entry criteria intended to prevent any increase in non-Islander involvement in the fishery.

1.5.5 Pearls

Gold- or silver-lipped mother-of-pearl oyster (*Pinctada maxima)* is the most important species for pearl enterprises in the Torres Strait (Colgan, 1988). The black-lip (*Pteria penguin)* is also found in the Torres Strait.

Unlike the clam, an oyster is either male or female, but it changes its sex during its life. These oysters spawn in October and March. The larvae develop thin shells and settle on the bottom, attaching themselves to the substrate for about three years. After three years, the shell lives freely on the bottom (Colgan, 1988).

The techniques used in Australia for culturing pearls are similar to those used in Japan (Dybdahl et al., 1985). The oysters are collected from the wild and placed on a frame for one year. A nucleus is inserted into the shell for round pearls or a semi-spherical nucleus is attached to the inside of the shell for half pearls. The shells are harvested after two years.

2.5.6 Clams

Clams are harvested for meat and shell by traditional inhabitants in the Pacific and Southeast Asia. They are over-fished in some areas but some species are being successfully cultivated.

There are six species in the Torres Strait: giant clam (*Tridacna gigas*), smooth giant clam (*Tridacna derasa*), fluted or scaly clam (*Tridacna squamosa*), great clam or rugose clam (*Tridacna maxima*), boring or crocus clam (*Tridacna crocea*), and horse´s hoof, bear paw or strawberry clam (*Hippopus hippopus*).

Clams usually contain both male and female sexual organs at the same time. The clam begins life as a very small larva floating freely in the water column and feeding on phytoplankton. It settles permanently onto the substrate about nine days after spawning. It grows slowly at first: giant clams take several months to reach a few millimetres shell length (Lucas, 1988). After a year the shell may be 20 to 40 mm long, but thereafter the larger species grow rapidly. Giant clams may live for several decades.

1.5.7 Trochus

Trochus (*Trochus niloticus*) are only found naturally in the Indo Malaysia area, Melanesia and Micronesia, but because of their economic importance, they have been introduced to other islands (Wells, 1989).

Trochus spawn about once a month all year round (Nash, 1986). The larvae grow rapidly and within three days settle on the bottom. They prefer a gently sloping rocky bottom, such as a wide reef-flat exposed at spring low tides. Young animals settle in outer reef-flat intertidal areas and migrate into deep water as they grow. They are not generally found below 5 to 8 m depth (Nash, 1988). Growth is variable but fast in the first 2 to 3 years and then slows down. It takes 10 years for the basal diameter of the shell to reach 12 cm (Wells, 1989).

1.5.8 Beche-de-mer

Beche-de mer is a general term applied to any species of holothurian of commercial value (Tuma, 1992). They are also known as sea cucumber, trepang or sea slug. They are relatively sluggish animals and live on the bottom surface or burrow in the sand or mud and are deposit or suspended feeders.

They are eaten in various ways: raw, cooked in coconut milk, or grilled. Chinese communities use beche-de-mer in soups and as a main course after it has been boiled, smoked and sun-dried.

1.5.9 Mud crab

Mud crab (*Scylla serrata*) is found in estuarine and inshore waters throughout the tropical and sub and tropical Indo West Pacific.

The external "shell" of crabs does not grow as the animal grows. Instead, it is shed (or moulted). The new soft shell underneath expands before hardening. Mud crabs mate after the female has moulted. Burrows provide shelter for mating crabs and are thought to be important at this stage of the life cycle.

Fertilised females migrate off-shore to spawn, usually in spring. Egg-carrying females are therefore rarely seen. The eggs hatch in 10 to 20 days. After about three weeks the larvae move back inshore and the juveniles live in shallow water.

Mud crabs feed on slow-moving or immobile prey such as oysters, mussels, clams, small crabs and barnacles. Apart from the offshore spawning migration by the females, they do not migrate, but generally remain in the area to which they come as juveniles.

There is a well-established mud crab fishery in Queensland and the Northern Territory, where commercial and recreational fisherman use baited pots or traps. Only male crabs over a certain size are permitted to be taken.

1.5.10 Squid

Inshore squid are demersal or semi-pelagic inhabitants of coastal and continental shelf areas. Several species are found only in shallow waters. Most squid gather near the bottom during the day and disperse into the water column at night. Many are attracted to light, so fishermen often use lamps at night with jigs or spear.

Many species migrate seasonally in response to temperature changes. They usually have extended spawning seasons, which peak in spring and early summer. The eggs are encapsulated in gelatinous, finger-like strings with which they become attached to the bottom. These animals live between 1 and 3 years (Roper et al., 1984). The inshore squids feed on crustaceans and small fishes.

Squid are an important commercial fishery in the Mediterranean, Indo Pacific and southern Atlantic, where they are caught with trawls, seines, nets and jigging.

1.5.11 Octopus

Most octopus are benthic animals. Some change colours to help them hide unobserved in crevices, empty shells, seagrass beds etc. during the day while others occur over open bottom. Most hunt at night, although the big blue octopus (*Octopus marmoratus)* hunts during the day. The species that shelter in crevices etc. establish territories and therefore rarely form aggregations (Roper et al., 1984), while others may form aggregations.

The spawning season can extend from December to February. Some species lay eggs that are brooded by the females, who stop feeding until the eggs are hatched. The females have a high mortality rate at this time.

The most important fisheries are in Asia (particularly Japan) and Mediterranean countries. They are caught with jigs, lures, traps or spears in shallow pools at low tide, and trawls or seines in open areas.

Section 2 Field Recording Techniques

The first step for surveying the seafood catch in a community is to find positions on the island from where it convenient to observe and interview fishermen departing and returning from fishing activities.

The Fisheries Observer records all fishing activities each day from early in the morning (7.30 am) until sunset. Records are kept on a field sheet of all the fishing activities for that day, particularly: the fishing site(s), name and sex of the fisherman, fishing method used, destination of the catch, the number of fishermen, size and type of catch.

The observer also records weather conditions and any other factors that may influence the fishing effort, such as holidays or feasts. During each survey the number of vessels in the community and their state of operation are also recorded onto field sheets.

When it is not possible to interview fisherman because they returned on another path or stayed overnight on another island, the observer should try to interview them the following day. It is important to gather as much information as possible for each day. If it is not possible to interview a fisherman, the observer should record the time the fishermen departs and returns, along with the fishing gear used. The catch is estimated by averaging previous records.

The information collected by the observers on field sheets is entered later into a computer data base.

It is important that the observations and recordings are as precise as possible because the overall accuracy of the survey depends on the quality of the original information collected. If observers are not sure about something, they should either not include the data or should add a note explaining why they think the observation may not be accurate.

2.1 How to Complete Field Records

Two field observation sheets must be completed every day.

One is a *Daily Activity Record.* This is a diary of conditions at the time of observations and of the time and level of fishing effort. It is to be completed at the beginning and end of each day.

The second is a *Fishing Activity Record.* This is a record of each specific fishing activity on the island. It is to be completed immediately an observation is made, and thus is a continuous recording of fishing activity

One *Vessel Survey* field sheet must be completed every time a survey of a community is undertaken. The vessel survey records the number and condition of all the vessels in a community.

From time to time there may be other field sheets that need to be completed to collect data for other agencies.

This guide should be read in conjunction with the sample field sheets at the beginning of each section. The bold numbers in the sample field sheet correspond to the section in the explanation.

In Appendix D there are blank field sheets that can be photocopied for field work.

SAMPLE DAILY FIELD SHEET TO BE INSERTED HERE

2.1.1 Daily Activity Record

The daily activity sheets record what the day was like. One line of the sheet is filled every day to summarise things that could have affected the amount of fishing recorded.

The daily activity sheet is for recording daily activities; it is not to be regarded as a time sheet. The information must be consistent, as it will be used with the Fishing Activity Record to help decide how much fishing there was and to what extent this was affected by the weather, tide, celebrations etc.

If nobody goes fishing, fill in details of weather, tides etc. and write "no fishing" in the comments section.

(1) Date: the days date (e.g. 10 Dec 1995)

(2) Island: the name of the Island or community (e.g. Mabuiag)

(3) Weather: while there are a number of different ways of recording the weather, for simplicity and consistency the following should be used for field observation. It has been refined into broad groups.

Category	Prevailing conditions
Fine	Constant sun no rain
Mild	Description of the temperature
Hot	Description of the temperature
Very hot	Description of the temperature
Showers	Rain periods throughout the day
Rain	Constant rain through out the day
Stormy	Monsoonal storms during the day

(4) Wind: this can be estimated by observing the wave conditions on the seas.

Wind speed (knots)	Conditions
0 to 5	sea mirror calm, some isolated wind lines on the water
5 to 10	dark patches on the water, small ripples, no white caps
10 to 15	wind-waves forming, some white caps

15 to 20	wind-waves well formed, white caps on every wave
20 to 25	wind-waves with deep troughs between each wave, white caps on every wave
25	upwards waves turning into swells and breaking constantly, ocean full of white caps

Wind is always expressed as the direction from which the wind is blowing, followed by the estimated speed expressed in knots. e.g. SE (south-east) 15 (knots); entered as SE 15

(5) Sea conditions: best qualified by estimating the heights of the waves. Each height range corresponds to a sea condition.

Category	Description (height of waves in metres)
Smooth	0.0 m to 1.25 m
	small or no distinct waves, no white caps
Moderate	1.25 m to 4.0 m
	distinct waves forming, some white-caps starting to appear
Rough	4.0 m to 9.0 m
	large waves, white caps on all waves
Very rough	9.0 m to14.0 m
	waves breaking continually, deep troughs between waves, white caps predominate
Phenomenal	greater than 14 m (unlikely in the Torres Strait)

These conditions may be described for *open waters* or the time *sheltered waters*. On some islands the seas are rough in open waters but smooth in sheltered waters (around the jetty etc.). This should be entered as *rough in open waters, smooth in sheltered waters*.

(6) Tide: currently it is not possible to get accurate tide tables for most of the Torres Strait Protected Zone. The tide stations are at Thursday Island, Booby Island, Goods Island, Twin Island and Hammon Rock Lighthouse, but because of the dynamic nature of this area they can only be used at these locations. The times of low or high water are very important as they affect when people go fishing (when people can get to their boat, when the reef is submerged, etc.). Since we cannot get the information from the tide tables, we have to record it for the day.

Where there is a beach, the times for high tide and low tide can be determined by observing the water marks in the sand. It may also help to place a stick or rock in the sand to mark the progress of the water. Jetties have marks on the piles, which can be used to gauge the water levels.

Tide is recorded as HW (high water) and LW (low water), together with the time hours and minutes.

(7) Description of day: this is a short description of what type of day it is in the community. For example, people might be working under CDEP, going to church throughout the day, attending a workshop or a sporting event.

It is important to document any event or events that reduce or increase fishing activities, such as freezers breaking down, freezer ships leaving, or. other activities such as funerals, christenings, birthdays, special visitors, tombstone opening, ANZAC Day, Labour Day, army reserve activities, school starts or school holidays start.

(8) Estimate of recording effectiveness (ERE): the ERE is a subjective estimate of the percentage of total fishing activities that the observer feels he or she was able to monitor. It is expressed as a percentage between 0% to 100%. It is not an estimate of the amount of time worked and it is not considered of any importance to the way the observer performs his or her work.

If, for example, there was fishing taking place at different parts of an island and the observer thought he or she had seen about half of the action, then the observer would record the ERE as 50%. On another day when the observer was at a place where most of the fishing could be counted, then an ERE of 95% would be recorded. The ERE is to be entered onto the field sheet at the end of each day.

(9) Hours surveyed: this is a record of the hours in which the observer was monitoring catches. This has nothing to do with payment. The observer may not be monitoring for various reasons such as telephone calls, sickness, travelling between islands, having lunch, but is still entitled to payment. This record is to give an indication of which hours were covered. It is to be completed by using five periods in the 24 hour day (midnight to 8 a.m., 8 a.m. to mid-day, mid-day to 2 p.m., 2 p.m. to 6 p.m., and 6 p.m. to mid-night). In each period the number of hours monitored should be entered after subtracting time away from sampling for such things as telephone calls, meeting with chairperson etc.

(10) Notes: this section is for any comments that the observer may think important for understanding what happened with the fishing activities of the day. The observer can add any information that he or she thinks is relevant. Such additional information is very important sometimes to give a proper understanding of the fishing in that community.

SAMPLE FISHING ACTIVITY FOR THIS PAGE

2.1.2 Fishing Activity Recording

This section should be read with the field sheet at the end of this section. Appendix D contains field sheets that can be photocopied for field work.

The information for this field sheet is entered throughout the day, just after the observer has examined a catch or interviewed a fisherman.

(1) Island: the name of the island where the record was taken.

(2) Landing Site

(3) Date: date of the fishing activity.

(4) Fishing activity: there are many ways of fishing in Torres Strait. So that there is no confusion, the fishing methods have been standardised in a list derived from previous surveys.

Cast netting: thrown from over the shoulder, usually for bait

Crabbing: any form of fishing for crabs; usually collected at low tide by kicking the crab onto its back and tying it up

Cray diving: diving where crayfish is the most important catch in value or weight

Diving for fish:: diving where fish is the most important part of the catch by value/weight

Dugong hunting: any hunting where the hunter sets out that day for dugong

Gill netting: net is set and left unattended and captures the fish by entangling their gills in the mesh. This differs from seining, where the net is used to encircle or trap the fish.

Handlining: any fishing with lines, hook, sinkers and bait

Jigging: when jig lures are used on lines to catch squid

Light fishing: reef gleaning or fishing using lights, lamps or torches

Pearling: collecting pearls shells, usually by diving and often with hookah

Picnic: when a group of people move to an isolated area on the same or another island and spend the day picnicking. They may handline, collect shells, crabs etc. for eating on the picnic and may also return with some seafood.

Reef gleaning: collecting or gathering seafood from the reef, e.g. shells, beche-de-mer, octopus

Seining: dragging or encircling with a net. The net is not left unattended; it usually requires a group of people to pull it through the water.

Shark fishing: fishing for shark with large buoys, hooks and chains

Trading: any trading of seafood between PNG and Torres Strait islands. It is often difficult to get details of when, where and by whom the seafood was caught, but attempt to collect as much information as possible.

Trochus fishing: any form of collecting, gleaning, diving and gathering from reefs etc., where trochus is the main part of the catch value or weight

Trolling: when the main form of fishing is towing a lure behind a dinghy

Turtle hunting: any hunting for turtle, usually from a dinghy, but includes collecting nesting turtles on the beach

(5) Vessel / gear: list all the fishing gear that is taken on the trip even if it is not used. For example, when people in a dinghy go trochus diving but catch a turtle on the way home. The fishing method entered would be trochus diving and the gear would be dinghy and diving equipment, trochus bag, and spear. When a dinghy is used, record it as a fishing gear. This is important as it identifies whether the fishing was on or off the island.

The list of the common fishing method / gear combinations below can be used as a guide. If different gear are taken, note this in the comments section.

If there is not enough space on the field sheet, list the most important gear.

Method	**Gear**
Cast netting:	cast net
Crabbing:	dinghy, bags
Cray diving:	dinghy, spear
Drag net:	net
Dugong hunting:	waps and dinghy

Gill net:	gill net
Handlining:	lines
Hunting (all):	waps, spears
Jigging:	line, lures, jigs
Light fishing:	lamp or torches and spears
Line fishing:	dinghy, line
Mixed fishing:	dinghy, line, spear
Pearling:	dinghy, pearl cage
Picnic:	dinghy, line, spear
PNG trading :	dinghy, spears, flour-drums
Reef gleaning:	spears, knives, buckets
Seining:	drag net
Shark fishing:	line, drum
Spearing:	spear
Trochus:	dinghy, buckets
Trolling:	dinghy, line
Turtle hunting:	dinghy, wap

(6) Leader's Name: the name of the person who leads the fishing trip. In a dinghy this will often be the person driving, or the person who owns the boat. If a seine net is used, it will often be the elder who is organising the other people who owns the net. The observer must sometimes use his or her judgement as to who is the leader in the fishing trip.

(7) Number of persons: the number of males (mer), women (woner) and children who took part in the fish activity. It is up to the observer to decide whether the person is a child rather than a man or a woman. Children might contribute to the catch (for example when reef gleaning), or might make a direct contribution (e.g. when dugong hunting) but in any case they are a culturally important part of the team, learning skills from the elders. Generally all people in a dinghy are recorded as taking part in the fishing trip. Where a mother or father is fishing on a jetty and the children are playing around, then the children are not included as part of the fishing group.

(8) Start time: the time at which the fishing activity started.

(9) End time: the time at which the fishing activity ended.

(10) Location: where the fishing took place (e.g. jetty, particular reef).

(11) Record quality: records how reliable the information is. If the observer identified, weighed the catch, and interviewed the fisherman, the information is regarded as reliable. If the fisherman is interviewed the next day, and the observer cannot see the catch, there is no way of knowing the exact weight or correctly identifying of the catch.

The quality of a record is assigned a number (see below) for the information of people analysing all the records. For estimating the composition of the catch, for example, only the #1 quality records are used as they include accurate fish identification. Catches that are of quality # 2 and #4 are treated differently, as they depend on the accuracy of the fisherman memory and cannot be verified in the analysis.

The number entered is to correspond to one of the listed categories.

- 1 The fisherman was sighted, seen and interviewed the same day.

- 2 The fisherman was interviewed the day after the fishing activity.

- 3 The fisherman was known to have fished but was not interviewed (maybe because he was too far away from where the catch was landed or the catch was landed late).

- 4 This is for instances where a fisherman told an observer of what he or she caught a few days or weeks before the observer came to the island.

(12) Comments: this section is filled in at the discretion of the observer. It can be used for extra information that the observer thinks may be important to that fishing trip or relevant to that record. Comments can enhance the quality of the data and can be useful for understanding the nature of fishing on a particular island.

(13) Species: the Latin name of an animal should be used to avoid confusion. A common name may be used if it refers to only one species and cannot be confused with any other fishes (see Appendix E). A list of commonly caught fish with corresponding Latin, Islander and common names is given in Appendix F.

(14) Weight or length (wt / lt): the *weight* of each fish, or the *length* of each turtle or dugong landed. The weight should be in kilograms to one decimal place only (e.g. 5.2 kg, 8.2 kg). Length should be to the nearest whole centimetre. When possible, each fish should be weighed, but if there are many small fish, then the total weight is acceptable along with the number. If the catch is large, representative subsample weights should be

used (see section 2.4.1). Measuring techniques for dugong are described in Appendix C.1 and for turtles in Appendix C.2.

15) No.: the number of fish landed.

(16) Process stage: this describes the state of the fish when it was recorded.

Category	**Explanation**
W	The fish is **W**hole.
G&G	The fish has been **G**illed and **G**utted.
F	The fish is in **F**illets.
E	It was not possible to weigh the fish; therefore its weight has been **E**stimated (used when the fish is too big for the scales or the catch is large).
T	Crayfish **T**ails
H	Crayfish **H**eads
B	**B**arrels; the head has been removed and only the cleaned body of the fish is left (sometimes for mackerel or pike etc.)

(17) Destination: this number records where the catch will finish up. When the catch will go to a number of different places, more than one number can be used (but must be separated by commas). For example (1,4,6) means some of the catch will be eaten by the fisherman, some given to relatives and some sent to another island.

Category	Explanation
• 1	To be used by the fisherman, the household and the immediate family.
• 2	The catch will be sold.
• 3	The catch will be used as feed for live stock
• 4	The catch will be distributed to relatives and friends
• 5	The catch will be used as bait.
• 6	The catch is to go to another island (in trade or as gifts to relatives there).

- 7 Used when none of the above explanations apply. In such cases also add comment.

Dugong and turtle entries; For turtle and dugong, the sex (either boy or girl) and length are to be recorded (See Appendix C.1 for measuring and sampling dugong, and Appendix C.2 for turtles.). When a tissue sample of dugong or turtle is taken and preserved, the sample number should be recorded on the vial.

2.1.3 Vessel Survey

A survey of the vessels is carried out on each island whenever observers come to record fishing activities. Every vessel at the community should be recorded, including freezer boats, luggers and traditional craft.

(1) Island: name of the Island (e.g. Badu)

(2) Date: the date e.g. 10 Dec 1995

(3) Reg. No./Owner: registration number and owner or both. Leave blank if there is no registration number or the owner is not known.

(4) Type: the kind of vessel. Examples are dinghy, speedboat, dory, tender, long boat, banana-boat, traditional outrigger, canoe, freezer boat, lugger, barge, mackerel boat.

(5) Activity: each vessel is either active or not active

Active: the vessel has a motor or sail or oars and is either being used or could be used at a moment´s notice

Not active: the vessel does not have a motor and is not regularly used and it is unlikely that the vessel would be used on that day or in the next few days (may be up on the beach or behind a house).

6) Engine: the make or brand of the engine e.g. Marina, Johnson

(7) HP: the Horse Power of the engine e.g. 40 HP or 35 HP

(8) Mooring: the place where the vessel is moored in the community. This could be up on the beach, in the water, at a house or at the jetty.

(9) State: a record of the condition of the vessel: good, fair, poor, needs repair, or wrecked.

(10) Notes: comments that the observer considers relevant

Appendix A Main Species in the Traditional Catch of the Torres Strait, June 1991 to June 1992

Group	Common name	Species
Bivalves		
	Akul	*Anadara* sp.
	Blacklip oyster	*Pinctada margaritifera*
	Clam	*Tridacna* spp.
	Cockles	*Cardium* spp.
	Pearl oyster	*Pinctada maxima*
Cephalopods		
	Squid	order *Teuthoidea*
	Octopus	order *Octopoda*
Crayfish		
	Barrier cray	*Panulirus versicolor*
	Cray	*Panulirus ornatus*
Decapods		
	Mud crab	*Scylla serrata*
	Sand crab	*Portunus* spp.
	Tiger prawn	*Penaeus monodon*
	Reef crabs	
	Ghost crabs	*Ocypode* spp.
	Other decapods	
Dugong		
	Dugong	*Dugong dugon*

Gastropods

Trochus	*Trochus niloticus*
Spider shell	*Lambis* spp.
Bailer shell	*Melo* spp.

Teleost

Barracuda	*Sphyraena barracuda*
Barracuda	*Sphyraena jello*
Barramundi	*Lates calcarifer*
Bluefish	*Choerodon schoenlenii*
Coral trout	*Plectropomus* spp.
Emperor	*Lethrinus laticaudis*
Mackerel	*Scomberomorus* spp.
Mullet	*Liza vaigiensis*
Mullet	*Mugil* spp.
Mullet	*Valamugil buchanani*
Nightfish	*Psammoperca waigiensis*
Queenfish	*Scomberoides commersonnianus*
Rabbitfish	*Siganus lineatus*
Sardine	*Herklotsichthys quadrimaculatus*
Spanish mackerel	*Scomberomorus commerson*
Stripey	*Lutjanus* spp.
Trevally	*Carangoides gymnostethus*
Tuskfish	*Choerodon cephalotes*
Tuskfish	*Choerodon cyanodus*
Whitefish	*Carangoides fulvoguttatus*
Whitefish	*Caranx papuensis*

	Whitefish	*Gnathodon speciosus*
Turtles		
	Hawksbill turtle eggs	
	Hawksbill turtle	*Eretmochelys imbricata*
	Green turtle eggs	
	Green turtle	*Chelonia mydas*

Source of data : Harris et al., 1992.

Appendix B Guide to Islands and Observation Positions

Each island in the study area is listed alphabetically on the following pages.

Details of each island are from surveys conducted in 1991 to 92. Some information, such as on community buildings and freezers becomes rapidly out-dated. Population figures are from the Australian Bureau of Statistics 1991 census.

B.1 Badu

Badu is part of the Central West Group. It is one of the largest islands, with a varied landscape of hills and low plains. The community lives on the south-eastern part of the island on the channel that separates Badu from the larger Moa Island. The main community is on the beach, with a small Papuan sector on a point further south known as Dogai. The jetty and ramp are at Dogai, where there is a dinghy repair shed and a seafood freezer plant.

Surveying Badu can be difficult because the dinghies are concentrated at the beach near the main community and at the jetty. The beach is about two kilometres long and fish catches can be landed anywhere along the beach. Dinghies can unload to a freezer boat anchored offshore or freezers near the jetty at Dogai. Handlining is mainly from the jetty and occasionally from the rocks near the church.

The preferred observation point is the jetty, but frequent surveys along the beach front are necessary, as most turtle and dugong are landed there. Some fish, turtle and dugong landings are made on the beach on the western side of the island.

Population

488

Accommodation

Council guest house or school flat

Transport

Regular air service that also services Kubin on the same sector

Contact numbers

Council office	Tel.	070 694 214
	Fax	070 694 121
School	.....	

Other information

IBIS store and a well-stocked independent supermarket that opens on weekends and after hours.

B.2 Boigu

Boigu Island is part of the Top Western Group and is separated from the Papua New Guinea mainland by a few kilometres of open water. The island is low-lying and is prone to flooding in the wet season. The community lives on the northern tip of the island between the airport and the sea. The community jetty and ramp are at the north-east end of the village near the church. Most fish, dugong and turtle are landed either at the ramp or on the small beach in the centre of the community. Some seafood is landed at the beach to the east of the church grounds and can only been seen by walking through the church grounds. Because of the close proximity of a number of Papuan communities, trading is common. Trading usually takes place either at the jetty or near the Tia Pan store at the western end of the community.

The observation point commonly used is on the jetty or near the Tia Pan store. Because of the diverse fishing on Boigu, there need to be regular surveys along the water front, as most fishing is from dinghies away from the community. When these dinghies return they may land in front of their respective houses and not from where they departed.

Population

246

Accommodation

School flat

Transport

Regular flights that also service Dauan and Saibai on the same route; airport may be closed after heavy rain

Contact Numbers

Council office	Tel.	070 694 093
	Fax.	070 694 079
School	Tel.	070 694 162

Other information

Two food stores: IBIS, and Tai Pan. May have water shortages during extended dry seasons.

B.3 Coconut

Coconut is part of the Central Group of islands. It is a very small sand outcrop, low-lying with sparse vegetation and fringed by reef. The community area takes up most of the island on the south-western end, the remainder being used for the airstrip. The jetty is on the western side in the centre of the community and there is a small harbour around the jetty. Fishing is from dinghy, jetty or reef.

The preferred observation point is at the base of the jetty, although periodic surveys of the whole island are necessary.

Population

255 (including Warraber)

Accommodation

School flat

Transport

Regular air services in all weather

Contact numbers

Council office	Tel.	070 694 277
School	Tel.	070 694 209
	Fax.	070 694 - - -?

Other information

An IBIS store is open during the week. Water can become scarce in the dry season.

B.4 Darnley

Darnley is part of the Eastern Group of islands. It is dominated by high hills and dense vegetation surrounded by well-developed fringe reefs, with deep water further offshore.

The community is situated on the south-western side of the island and stretches for three kilometres along the beach front. The jetty and ramp are on the furthest southern corner of the island in the centre of the community. Dinghies are moored in front of the houses, although in poor weather some are moored in the small harbour near the jetty. The school is on the hill above the council offices.

The preferred observation site is the jetty or half-way along the eastern beach near the small rock outcrop. It is not possible to survey all the community, so observers will need to make several walking surveys a day.

The council offices are near the jetty and IBIS store.

Population

254 (including Stephens)

Accommodation

School flat

Transport

Air services are regular; airstrip may be closed in poor weather or heavy rains

Contact numbers

Council	Tel.	070 694 001
	Fax.	070 694 036
School Tel.		070 694 007

Other information

The IBIS store is near the council office and is open on week days.

B.5 Dauan

Dauan is part of the Top Western Group. It a is small island, dominated by high hills The community lives on the northern edge of the island near a small sandy beach and a rocky point. The jetty, ramp and small harbour are at the western end of the community. Most fishing is from the jetty, although dinghies are moored in front of most of the houses and operate away from the island. Fish are landed at the ramp or on the beach near the school.

The best observation point is on the beach in front of the school or on the jetty. It is advisable to survey both areas regularly, as the dinghies fish away from the community and return at irregular intervals. Some landings occur on the western side of the island where the community has gardens. Handlining is done either from the rocks near the school or from the jetty and ramp.

Population

131

Accommodation

Council guest house near the school

Transport

Via dinghy from Saibai. This can be arranged through either the Dauan Council office or the Saibai Council offices.

Contact numbers

Council office	Tel.	070 694 266
School	Tel.	070 694 107

Other information

There is ample water supply and an IBIS store. Transport by dinghy can be restricted in rough seas.

B.6 Kubin

Kubin is part of the Western Group of islands and is one of the two communities on Moa island. Situated on the south-east corner of the island, the community has access to a beach on the eastern side, and a jetty, ramp and harbour on the southern side. The people fish from dinghies, the beach and jetty.

The preferred observation point is split between the jetty and the eastern beach. The amount of time spent between the two would depend upon the day of the week and the weather. Some lobster fisherman sell their catch to the freezer boats at Badu before returning home.

Population

Moa 346 (which includes St Pauls)

Accommodation

School flat

Contact numbers

Council offices	Tel.	070 694 272
	Fax.	070 694 272
School	Tel .	070 694 140
	Fax.	070 694 319

Other information

There is an air service, and the dinghy trip from Badu takes 30 minutes in good seas.

B.7 Mabuiag

Mabuiag is part of the Western Group of islands. It is surrounded by reefs and is a major cray fishing area. The community lives on the north-eastern side of the island in front of a large hill. The air strip running across the island borders the village to the north. At the north-east edge of the island, the jetty and ramp are relatively isolated from the community and are not used for handlining, unlike on other islands. The main fishing area is in front of the community at high tide and on the rocky headland in the north. Dinghies are moored on the beach in front of the houses. Because of the shallow fringe reef off the beach, dinghies can only reach the community at high tide.

The preferred observation point is in front of the school at the southern end of the community. The northern rocks and the jetty must be surveyed periodically.

Population

193

Accommodation

Guesthouse or school flat

Transport

Air service

Contact numbers

Council office	Tel.	070 694 184
	Fax.	070 694 185
School	Tel.	070 694 198

Other information

Regular air services on an all-weather airstrip. In extended dry seasons there can be a shortage of water.

B.8 Murray

Murray Island, part of the Eastern Group, is the most easterly island in the Torres Strait Zone. It is near the top of the Great Barrier Reef and has a diverse range of marine life. The high hills and dense vegetation are surrounded by well-developed fringe reefs. The community, which is on the north-western side of the island, spreads for 2 kilometres along the beach front. The centre of the community is the council offices and meeting hall.

There is no jetty or ramp on the island and most of the fishing is from the beach or dinghies close to the community. The dinghies are moored on the beach along the length of the community and are easily launched into deep water. Some fishing is done on the other side of the island in certain seasons and tidal conditions.

The preferred observation site is near the church, but this does not give a full view of the fishing areas. The observer needs to survey constantly along the entire length of the beaches because there is much activity throughout the day from the beach.

Population

324

Accommodation

Guest house

Transport

Regular air services

Contact numbers

Council office	Tel.	070 694 133
	Fax.	070 694 157
School	Tel.	070 694 090

Other information

The IBIS store is open on week days. As the airport is a long way from the community, transport is required to reach it.

B.9 Saibai

Saibai is part of the Top Western Group. It is separated from the Papua New Guinea mainland by a few kilometres of open water. The island was formed from sediment deposits and is very low lying. During heavy rains flooding can occur. The community is situated on the western end of the island, with a jetty and ramp at the south-western end near a section of houses used by the Papuans.

Surveys are along the 2 kilometres of sea wall road that extends along the front of the community. Handling and net fishing are carried out all along the sea wall. Dinghy fishing is done away from the community and the catches are landed at the north-east end of the sea wall, the jetty or at the airstrip.

The preferred observation point is near the airstrip or in front of the IBIS store. Surveys along the entire sea wall road are necessary throughout the day.

Population

248

Accommodation

School flat or council flat

Transport

Regular flights; the airport is subject to flooding and closure after heavy rains.

Contact numbers

Council offices	Tel.	070 694 270
	Fax.	070 694 245
School	Tel.	070 694 122

Other information

The IBIS store is in the centre of the community. There can be water shortages during the dry season.

B.10 St Pauls

St Pauls, which is part of the Western Group, is on Moa Island at the north-eastern end. The community is on a beach with fringe reefs offshore that dry out at low tides, restricting dinghy access. The jetty and ramp are 2 kilometres south along the beach where there is access to a channel.

The preferred observation point is between the school and council offices, from where most of the dinghies depart and return. The reef is also utilised by the community. Some handling is carried out from the jetty, so the jetty and the reef beyond must be surveyed regularly.

Population

Moa 346 (which includes Kubin)

Accommodation

School fla

Transport

There is no airport at St Pauls. A 4-wheel-drive taxi is operated by the St Pauls council.

Contact numbers

Council office	Tel.	070 694.....
	Fax.	070 694.....
School	Tel .	070 694 197
	Fax.	070 694 134

Other information

IBIS store is open during week days. There is a good supply of water all year.

B.11 Stephens

Stephens Island is part of the Eastern Group of islands. It is a small island, with dense vegetation and steep hills rising from the water. It is fringed by reefs surrounded by deep water. People rely on dinghy transport to either Darnley or Yorke Islands for mail etc.

The community is on the high plateau in the centre of the island. The jetty and ramp are on the western side of the island, but have restricted access because the channel does not extend into the deep water. There is no airport on the island but there are facilities for helicopter landings.

The preferred observation point is at the jetty, although there can be other activities on the eastern beach side of the island where some dinghies are moored.

Population

Less than 30

Accommodation

School flat

Transport

No air service except for helicopter flights on charter. Dinghies can be chartered from either Darnley or Yorke.

Contact numbers

Council offices	Tel.	070 694 029
	Fax.	070 694 ----
School	Tel.	070 694 106
	Fax.	070 694 106

Other information

The IBIS store near the jetty is open on week days.

B.12 Warraber (Sue)

Warraber is part of the Central Group of islands. Small and low, it is sparsely vegetated and has fringing reefs. The community is on the north-eastern side of the island. The jetty and ramp are on the south-west corner about 1 kilometre from the community. Fishing is varied, with some dinghy fishing and some jetty and reef handlining. The Islanders also spear crayfish at nights on the reefs.

The preferred observation point is near the community and the jetty, with occasional surveys to the other side of the island.

Population

255 (including Coconut)

Accommodation

Council guest house

Transport

Regular air services

Contact numbers

Council office	Tel.	070 694 177
	Fax.	070 694 183
School	Tel.	070 694 107

Other information

IBIS store is open on weekdays.

B.13 Yam

Yam is part of the Central Group. It is fringed by reefs. A small hill dominates the centre of the island. The community is on the western side of the island on a narrow beach zone. The jetty and ramp are in the centre of the community. Most of the dinghies are moored in the small boat harbour near the jetty or on the beach either side. There is access to deep water for the dinghies on most tides. Near the jetty is an IBIS store and a small commercial freezer.

The preferred observation point is at the jetty, from where there is a clear view to both ends of the beach. The island may need to be surveyed in certain weather conditions. Most fishing is from the jetty, reefs or dinghies.

Population

233

Accommodation

School flat or MAP

Transport

Regular air service in all weathers

Contact numbers

Council office	Tel.	070 4195
	Fax.	070 694
School	Tel .	070 694 215

Other information

The IBIS store is at the end of the jetty. During extended dry spells there can be water shortages.

B.14 Yorke

Yorke is in the Central Group of islands. It is a low sand island connected to Kodall Island by a narrow sand isthmus. Neither island is far above sea level, and both have sparse vegetation.

The community is in the middle of the island at the southern end where the airstrip dissects the island. The jetty and ramp are on the western side 2 kilometres from the community. Dinghies are moored on both the south-eastern and north-eastern sides.

There is a commercial freezer on the beach in centre of the community on the north-eastern beach. Fishing is from dinghies and the jetty, and there is some reef gleaning. The fringing reef prevents dinghies from operating at low tide, although the small harbour near the jetty is suitable for larger vessels such as pilot boats. Yorke and Kodall are often used as anchorage for the prawn trawl fleet during the day. There is a permanent fuel barge anchored at Kodall Island, and during the prawn season a regular freezer ship transports product back to Cairns.

The preferred observation point is in front of the freezer on the northern side of the island, although the southern side of the island and the jetty must always be surveyed during the day.

Population

255

Accommodation

Council guest house

Transport

Regular air services

Contact numbers

Council office	Tel.	070 694128
	Fax.	070 694 135
School	Tel.	.....

Other information

The IBIS store is open on weekdays and there are two takeaway shops that open after hours.

Appendix C Dugong and Turtle Sampling

C.1 Dugong

Dugong have traditional importance in the culture and diet of the Aborigines, Torres Strait Islanders and Papua New Guineans. Today they are hunted legally by traditional methods in areas that may have different protection laws. The recent evidence that dugong numbers are declining worldwide has resulted in dugong being listed as a species vulnerable to extinction by the International Union of Conservation of Nature (IUCN, 1986). The different laws protecting dugong populations and the concern for conservation indicate that we need to learn as much as possible about an animal before we can decide how to protect it while not taking away traditional rights.

If dugong are to be effectively managed in the Torres Strait and northern Australia, it is important to determine the relationship between the management regimes in different geographical regions and the survival of dugong in those areas. How big must a dugong population be to maintain the gene pool? Is there any interbreeding between populations? Would a population be replaced naturally if it died out locally? How much hunting can the dugong population sustain?

C.1.2 Sampling Techniques

Dugong are hunted from dinghies and are slaughtered onshore on the beach in front of the community, at a beach near the hunting grounds, or sometimes at people´s homes. The carcass of the dugong is usually left for two hours before it is butchered.

By using data from the captured dugongs, school childrens records and aerial surveys, scientists can build up a profile of the population on which to base predictions. The data needs to be gathered over a long period so that scientist can estimate the size and detect changes in a population. The observer needs to record:

(a) time of capture

(b) site of capture

(c) size of the dugong

(d) sex of the dugong and its calf

There are two ways to measure a captured dugong when its on a beach:

- (1) either from the centre of the nostrils to the fork of the tail, along the curvature of the backbone (A to B in Fig. C.1). (This is the best way.)
- (2) between the tips of the flukes of the tail (C to D in Fig. C.1).

As with turtles, the weight of a dugong can be calculated from a length-to-weight ratio formula (Fig. C.2). These are calculated estimates, and individual dugongs captured in the Torres Strait may differ slightly due to local conditions such as food and the

presence of other animals, which can influence growth rates. Some may be thinner or fatter than this graph represents.

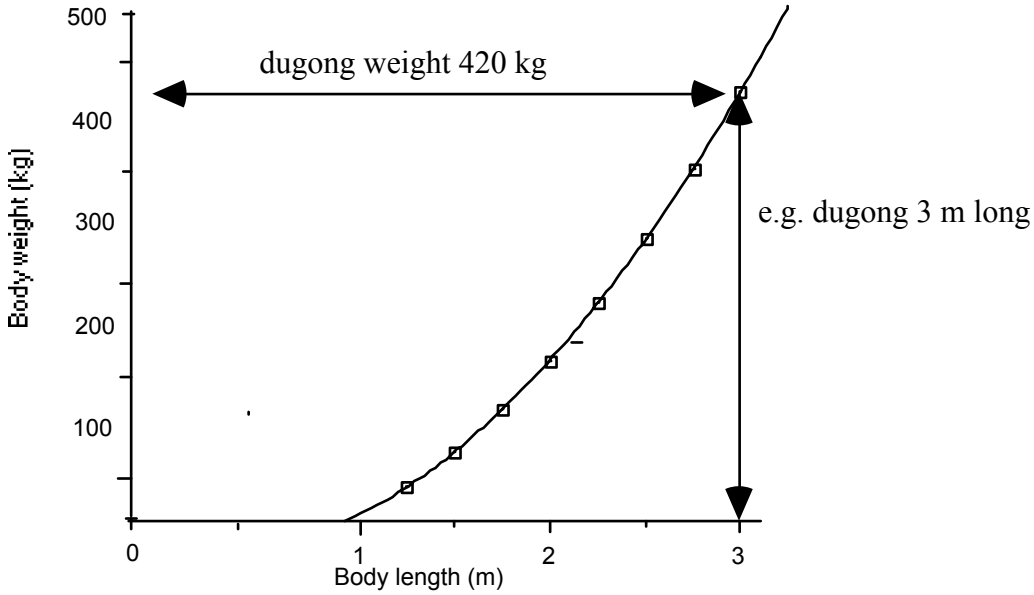


Figure C.2 Dugong length-to-weight ratio (Spain and Heinsohm, 1975)

The sex of the animal is also recorded. If the animal has already been slaughtered, ask the fisherman or examine the dead animal (females have teats on their underside; males have none). Note whether she has a calf or is pregnant. Wherever possible note the site where the dugong was caught.

C.2 Turtle Sampling

Over the past two years (1991to 92) harvest of green turtles *(Chelonia mydas)* in the Torres Strait has been estimated at 2400 (CSIRO's preliminary findings in 1992). Although hawksbill turtles *(Eretmochelys imbricata)* are harvested for their eggs, and occasionally their flesh, the main catch is large female green turtles for their flesh and eggs (Johannes *et al.*, 1991). An identification guide to other species in the Torres Strait prepared by the Queensland Department of Environment and Heritage is included in this section (Fig. C.5).

The recording by fishery observers of the number, size and sex of turtles that are slaughtered in the Torres Strait gives information on the level of exploitation. The green turtle is listed as endangered worldwide under the Convention on International Trade in Endangered Species (CITES), a treaty seeking to stamp out commerce in rare wildlife. Turtles are not used for commerce in the Torres Strait and so far as is known, the population is not endangered.

Observers are asked to:

(a) record the time of capture

(b) record the site of capture

(c) the size of the turtle

(d) the sex of the turtle

C.2.1 Sampling techniques

The species, sex, length measurements (carapace or plastron), method of capture, and site of capture are recorded.

It is difficult to determine the sex of small immature animals except after slaughter. In the mature specimens, the male´s tail extends further than the rear flippers when they are pulled back. The tail of the female never extends further than the rear flippers. Islanders rarely capture adult male turtles, although immature turtles (possibly of either sex) are taken.

It is difficult to weigh large turtles when recording the catch. We therefore use a conversion that was calculated by Hirth (1971), who measured and weighed many turtles and then found out the relationship between the carapace length of the turtle and its weight. By using his graph (Fig. C.3), it is possible to estimate the body weight of a turtle from the curved carapace length (CCL). Some individual turtles caught in the Torres Strait may vary from these estimates because the animal may be fat or lean due to local conditions.

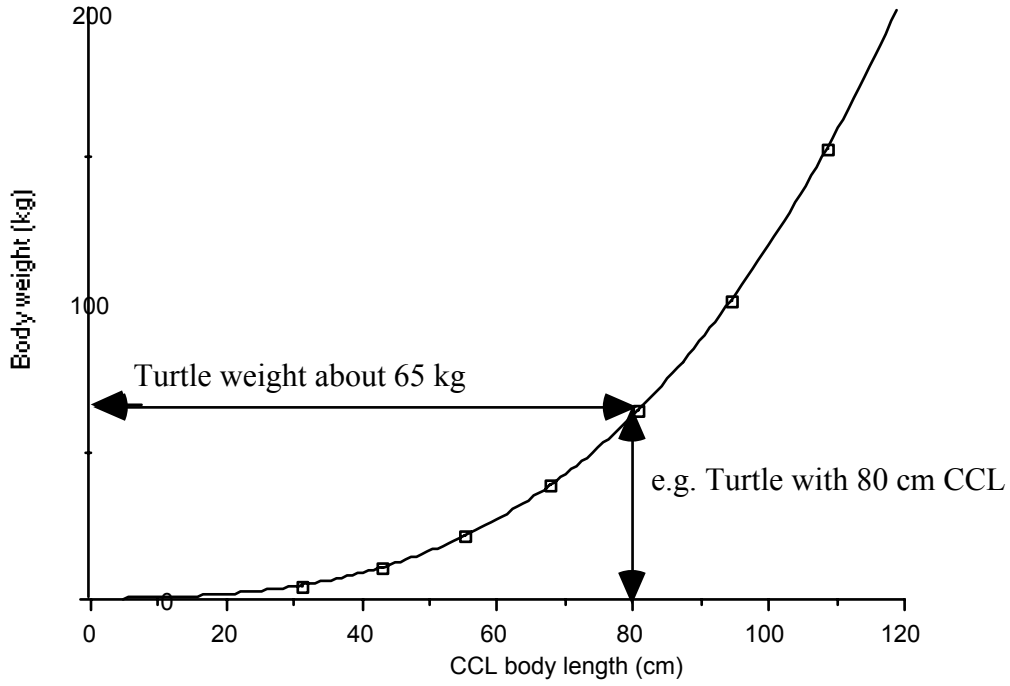


Figure C.3 Turtle weight -to-length ratio (Hirth, 1971)

Turtles are usually kept on their backs high up on the beach after capture until it is time to slaughter them. Somtimes their flippers are tied with a rope to a tree on the beach. After a turtle is slaughtered, the carapace length over the curvature of the back of the shell (CCL) can be measured (Fig. C.4 {a}). When a turtle is on its back, only the plastron measurement can be taken (Fig. C.4 {b}).

It is polite, and will avoid offence, if you seek permission from the owner before you measure the turtle. It may happen that the owner is not around when you pass by the turtle and cannot contact him to seek permission, in which case you must decide whether to measure it in the owner's absence. However, if you do measure the turtle, inform the owner at the next opportunity.

turtle ID pages

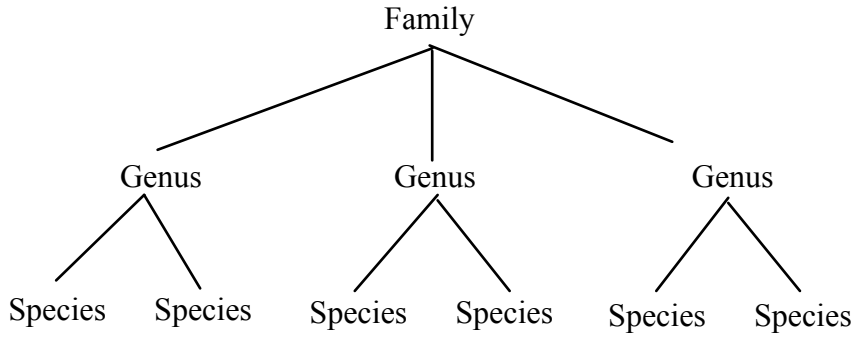
Appendix D Field Sheets

The blank field sheets on the next three pages can be photocopied for use in the field.

Appendix E Guide to Scientific Names

(The correct method of naming plants and animals etc.)

Living organisms such as plants and animals, are grouped by their similarities and differences. Individual animals that look identical form *species.* When species are compared with one another, those with most features in common are grouped together as a *genus* (plural *genera*). When the genera are compared, those that are alike are grouped into *families*, and so on. This is called a hierarchical system. The order of hierarchy is:



For example, the brown stingray (guiyer or atad warpi) and the cowtail stingray (turupo) are very much alike to look at. So they belong to the same genus (*Dasyatis*). But because there are differences between them, the brown forms the species *annotatus* and the cowtail, *sephen.*

The scientific name of an animal consists of two terms: the GENUS name followed by the SPECIES name. An example is mud crab *Scylla* (genus) *serrata* (species). It is written as *Scylla serrata* (NB The first letter of the genus name is a capital letter and the other letters are all lower-case). The full name is often shortened to its initial letter. For example *S. serrata* is acceptable for field recording.

We use these scientific names because every name belongs to only one species although we use the common names in conversation. We use the scientific species names because they are recognised as a standard throughout the world, whereas different places and languages have different names for animals and plants.

Appendix F Common Names, Species Names and Islander Names for Marine Species Found in the Torres Strait

Common	Scientific	Islander
Banded sergeant	*Abudefduf septemfasiatus*	ka-werr
Barracuda	*Sphyraena barracuda*	moogari
Barred garfish	*Hemirhamphus far*	peetai/warib
Big eye trevally	*Caranx sexfasciastus*	sigob
Blackspot seaperch	*Lutjanus fulviflamma*	____
Blacktip shark	*Carcharhinus limbatus*	poorie
Blacktip tripodfish	*Trixiphichthys weberi*	eemolau
Blotched jawfish	*Opistognathus latitabundus*	cartelai
Blotched javelinfish	*Pomodasys kaakan*	parkur
Blue-spotted stingray	*Dasyatis kuhlii*	oun
Blue-lined emperor	*Letherines fraenatus*	pooad
Bluefish	*Choerodon schoenleinii*	bluefish
Brown stingray	*Dasyatis annotatus*	guiyer/atad
		warpi
Celebes sweetlips	*Plectorhinchus celebicus*	ah-zam /quikomak
Coral trout	*Plectropomorus spp.*	waitie
Cowtail stingray	*Dasyatis sephen*	turupo
Diamond trevally	*Alectes indicus*	ylaiwap
Emperor	*Lethrinus laticaudis*	___
Estuarine stonefish	*Synanceja horrida*	whoes
Flat-tailed longtom	*Platybelone platyura*	bayaig
Golden-lined whiting	*Sillago analis*	corpat

Great hammerhead	*Sphyrna mokarran*	kursh
Hair-back herring	*Nematalosa come*	toop
Konningsberger's herring	*Herklotsichthys koningsberger*	iari ari
Long-finned rockcod	*Epinephelus qouyanus*	thakum
Mackerel	*Scomberomororus* spp.	kabal/kabar
Mangrove jack	*Lutjanus argentimaculats*	parma
Milkfish	*Chanos chanos*	bonabon
Moses perch	*Lutjanus lutjanus*	thanik
Mullet	*Liza vaigiensis*	cum
Mullet	*Valamugil buchanani*	waiai
Mullet	*Mugil spp*	mooragood
Narrow-lined toadfish	*Arothron manillensis*	korinar
Nightfish	*Psammoperca waigiensis*	
Painted sweetlips	*Diagramma pictum*	peook
Patterned tongue sole	*Paraplagusia billineata*	epotoma
Pennantfish	*Alectes ciliaris*	zazai
Queenfish	*Scomberoides commersonnian*us	
Rabbitfish	*Siganus lineatus*	parrsah
Red -bellied fusiler	*Caesio cunning*	sue-loo
Sardine	*Herklotsichthys quadrimaculat*	usari ari
Shovelnose ray	*Aptychoterma sp.*	kaigus
Slender suckerfish	*Echeneis aoucrates*	garp
Smaller salmon catfish	*Arius graefei*	boug

Snub-nosed dart	*Trachinotu blochii*	wa-karr
Snub-nosd garfish	*Arramphus scelerolepis*	zarber /moodood
Spanish mackerel	*Scomberomorus commerson*	dabar
Spin flathead	*Onigocia spinosa*	kadal tubu
Spotted eagle ray	*Aetobatus narinari*	pukai/purukah
Spotted chisel-tooth wass	*Anampses caeruleopunctatus*	dungobilla
Stars and Stripes toadfish	*Arothon hispidus*	belly mokan
Stingray	*Dasyatis leylandi last*	toopmool
Striped butterfish	*Selenotca multifasciatus*	karamuii
Stripey	*Lutjanus carponotatus*	thoar
Three-lined grunter	*Terapon puta*	booth
Trevally	*Carangoides gymostethus*	
Tuskfish	*Choerodon cyanodus*	bila
Tuskfish	*C.cephalotes Choreoron*	bila
White-blotched cod	*Epinephelus multinotatus*	kooroop
White-lipped catfish	*Paraplotosus albilabris*	waruai/dugai
Whitefish	*Caranx papuensis*	mec mec
Whitefish	*Carangoides fulvoguttatus*	
Whitefish	*Gnathodon speciosus*	
Yellowtail trumpeter	*Amniataba caudovittus*	zarum
Yellowtail Demoiselle	*Neopmacentrus cyanomos*	suiyal

Others

Green turtles	*Chelonia mydas*	waru
Hawksbill turtle	*Eretmochelys imbricata*	_____
Green turtle eggs	_____	waru kuckurl
Hawksbills turtle eggs_____		_____
Crab	order Decapoda	goorber
Mud crab	*Scylla serrata*	gitalai
Crayfish	family Palinuridae	kaiar
Seagull	_____	keke
Squid	class Cephalopods	bidi
Crocodile	*Crocodylus porosus*	kadal
Dugong	*Dugong dugong*	dangal

Bibliography

Anon. (1991). Crab Fishery Management Plan. Queensland Fishies Management Authority, Brisbane.

Colgan, K. (1988). What does the future hold for pearls in Torres Strait? Australian Fisheries 47 (1), pp.12-16.

Dybdahl, R. R. and Rose, D. A. (1986). The pearl oyster fishery in Western Australia. Torres Strait Fisheries Seminar, Port Moresby, 11-14 February 1985. (Eds A. K. Haines, G. C. Williams and D. Coats). Australian Government Publishing Service, Canberra, pp. 122-132.

Harris, A., Poiner, I., Dews, G. and Kerr, J. (1992). Preliminary estimates of the traditional and island-based catch of the Torres Strait Protected Zone. Unpublished CSIRO Division of Fisheries, Cleveland, Queensland.

Hirth, H. F. (1971). Synopsis of Biology Data on the Green Turtle *Chelonia mydas* FAO Fisheries Synopsis, 85, 33 pp.

Johannes, R. E and MacFarlane, J. W. (1990). Torres Strait traditional fisheries studies; some implications for sustainable development. *In* Sustainable Development for Traditional Inhabitants of the Torres Strait Region; Proceedings of the Torres Strait Baseline Study. (Eds D. Lawrence and T. Cansfield-Smith). GBRMPA, Townsville, pp. 403-420.

Johannes, R. E. and MacFarlane, J. W. (1991). Traditional Fishing in the Torres Strait. CSIRO Division of Fisheries, Hobart, 268 pp.

Limpus, C. and Parmenter, C. J. (1986). The sea turtle resources of the Torres Strait Region. *In* Torres Strait Fisheries Seminar, Port Moresby, 11-14 February 1985. (Eds A. K. Haines, G. C. Williams and D. Coats). Australian Government. Publishing Service Canberra, pp. 95-107.

Lucas, J. T. (1988). Giant clams; description, distribution and life history. *In* Giant Clams in Asia and the Pacific. (Eds J. W. Copland and J. S. Lucas). Australian Centre for International Agricultural Research, Canberra, pp. 21-32.

Marsh, H. (1991). Our tropical siren. Australian Geographic, Jan-Mar, 21, pp. 42-57.

Nash, W. J. (1985). Aspects of the biology of *Trochus niloticus* and its fishery in the Great Barrier Reef region. A report submitted to Fisheries Research Branch Queensland Department of Primary Industries and the Great Barrier Reef Marine Park Authority.

Pitcher, R. (1990). Research for sustainable development of the tropical rock lobster fishery in Torres Strait. *In* Sustainable Development for Traditional Inhabitants of the Torres Strait Region. Proceedings of the Torres Strait Baseline Study. (Eds D. Lawrence and T. Cansfield-Smith). GBRMPA, Townsville, pp. 253-60.

Roper, C. F. E., Sweeney M. J. and Naunen C. E. (1984). FAO species catalogue vol. 3. Cephalopods of the World. An annotated catalogue of species of interest to fisheries. FAO, Rome 277 pp.

Spain, A. V and Heinsohn G. E. (1975). Size and weight allometry in a north Queensland population of *Dugong dugon*. Australian Journal of Zoology 23, pp159-68.

Tuma, D. J. (1992). Survey report on a potential beche-de-mer industry in the Torres Strait Protected Zone (unpublished). Pagado, Brisbane.

Wells, S. M. (1989). Impacts of the precious shell harvest and trade: conservation of rare or fragile resources. *In* Marine Invertebrate Fisheries: Their Assessment and Management. (Ed J. F. Caddy). Wiley & Sons, New York, pp. 422-43.

The Torres Strait Islander peoples speak two distinct languages. The traditional language spoken in the Eastern Islands is Meriam Mir, and in the Western, Central, and Inner Islands the language spoken is Kala Lagaw Ya or Kala Kawa Ya, which are dialects of the same language. Since European colonization of Australia, the Torres Strait Creole (Kriol) language has developed as a mixture of Standard Australian English and traditional languages. The Torres Strait Islander peoples use Creole to communicate with each other and with non-islanders. Torres Strait Islander personA Torres Strait Islander