THE SEA TURTLE RESOURCES OF THE TORRES STRAIT REGION*

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INTRODUCTION

Six species of sea turtle occur within Torres Strait. Accounts of their biology within Torres Strait can be found in the internal reports of C.J. Parmenter and D. Carter to Applied Ecology P/L. These can be accessed through the Australian National Parks and Wild'life Service. Recent publishe'd accounts of the species within Torres Strait are listed below.

Family: CHELONIIDAE

Green turtle, Chelonia mydas: Kowarsky (1978, 1982), Parmenter (1977, 1978, 1980a, 1980c), Limpus (1980a), Nietschmann (1979), Spring (1982), Garnett et al. (1985).

Flat-back turtle, Chelonia depressa: Bustard (1972), Limpus et al. (1983a), Spring (1979, 1982).

Loggerhead turtle, Caretta caretta: Nil.

Hawksbill turtle, Eretmochelys imbricata: Bustard (1974, 1979), Carr and Main (1973), Carr and Stancyk (1975), Kowarsky (1978), Limpus (1980), Limpus et al. (1983b), Parmenter (1983), Pritchard (1979), Spring (1979, 1982).

Olive ridley turtle, Lepidochelys olivacea: Limpus et al. (1983b).

Family: DERMOCHELYIDAE

Leatherback turtle, Dermochelys coriacea: Limpus and McLachlan (1979).

The following report summarises the above along with additional unpublished records of the authors. For the purposes of this study, Torres Strait is defined as the area bounded by 'latitudes 9° and 11° south and longitudes 141° and 145° east. For brevity, the species will be considered collectively by the principal life history phases as they occur in Torres Strait. Two species, Dermochelys coriacea and Lepidochelys olivacea, occur only rarely within Torres Strait and will not be discussed further. The standard size measurement used is midline curved carapace length (CCL).

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NESTING

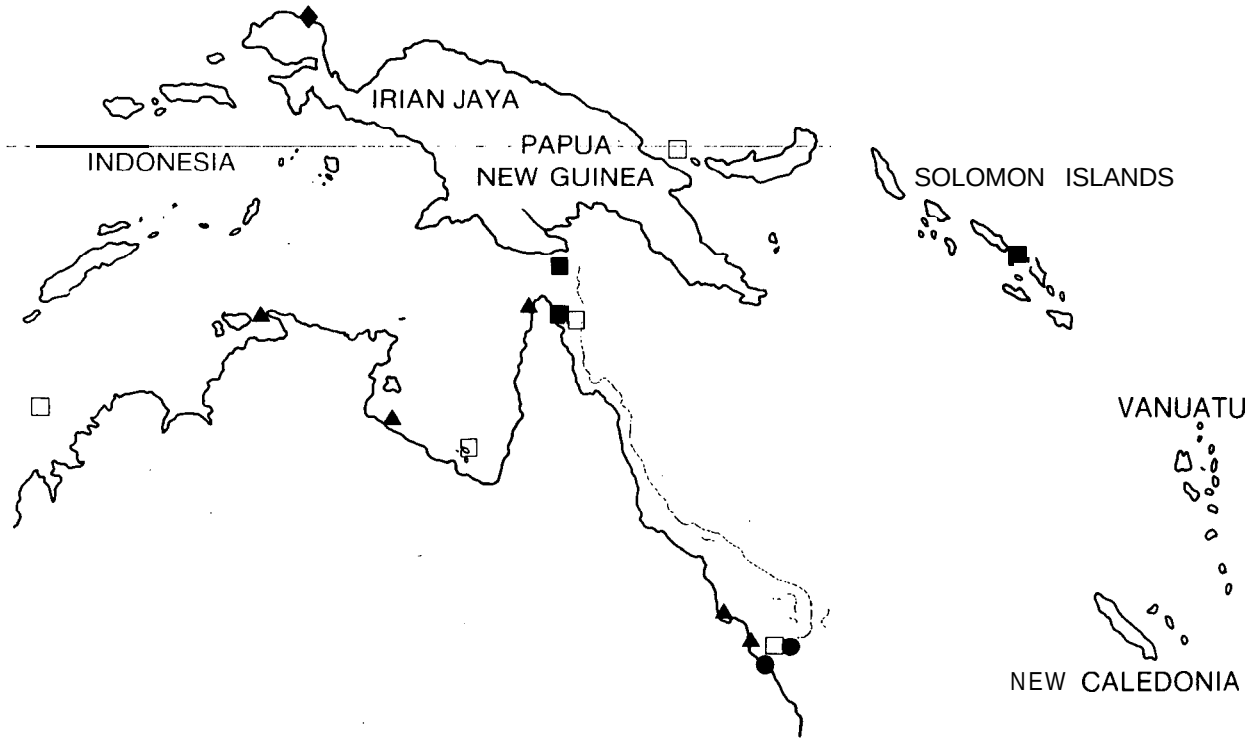
There are two nesting aggregations of sea turtles of international significance within Torres Strait (Parmenter, 1980b; Limpus, 1982; Spring, 1982) (Figure 1)

E. imbricata rookeries in central and eastern Torres Strait (especially on Long Aukane, Mimi and Kabbikane Islands).

C. depressa rookery at Crab Island near Bamaga.

In addition, sporadic to annual low density turtle, nesting occurs on almost every small island and beach.

Figure 1. Major sea turtle rookeries of northern and eastern Australia and adjacent nations. Open square = Chelonia mydas; triangle = Chelonia depressa; circle = Caretta caretta; square = Eretmochelys imbricata; diamond = Dermochelys coriacea.



Chelonia mydas

No major green turtle rookery occurs within Torres Strait. Bramble Cay (9°9'south, 143°52'east) supports the largest for Torres Strait but it is a minor rookery by Queensland standards, supporting up to several hundred nesting females annually in mid summer. Verbal reports of fishermen indicate that Bramble Cay was a much more significant rookery some thirty years ago. The decline was largely the result of harvesting of nesting adults and eggs by crews of Papuan coastal shipping in addition to low level harvests by Australian Torres Strait Islanders. The natural erosion of a major part of the island with the onset of the north-westerly winds each' summer with the associated loss of up to forty-four per cent of a season's egg: production may also' be contributing to a decline,in nesting numbers. Descriptions of past nesting densities suggest that Bramble Cay once supported a nesting density at least an order of magnitude greater than at present, perhaps approaching that of Raine Island.

Turu Cay, Deliverance and Kerr Islands in north-west Torres Strait are rookeries of undetermined importance. Meek (1913) reported Tara (Turu) Cay as "one great nest for turtles!' and captured several green turtles ashore nesting in May 1910. Kowarsky (1978), although he could not differentiate between tracks of C. mydas and C. depressa, flew over these western cays on 9 December 1975 and recorded the best C. mydas nesting for Torres Strait in what was a year of record low level nesting on the eastern Australian C. mydas rookeries (Limpus, 1982). However Torres Strait Islanders in verbal reports have separately identified both C. mydas and C. depressa nesting at Turu, Deliverance and Kerr Islands. The species composition and population sizes of turtles nesting on these three islands need to be determined.

Sporadic to low density C. mydas nesting occurs on most islands of Torres Strait, but especially in eastern Torres Strait: Recaptures of tagged turtles show that some C. mydas nesting at islands such as Don Cay, Darnley Is. and Dowar Is. are part of the Bramble Cay population. A small proportion of the nesting females interchange between adjacent rookeries within and probably between breeding seasons. However, because the majority of the C. mydas nesting is at a very low density in Torres Strait, the species does not nest on Bramble Cay ,as well. In any one season the combined total of this dispersed nesting population is smaller than the Bramble Cay population.

Eretmochelys imbricata

Given that low density nesting by this species' is a feature of almost every island in Torres Strait and that there are a few substantial rookeries for the species there as well, Torres Strait is one of the few remaining major breeding grounds for this species in the world. The species nests year round, peaking in February. The largest nesting density ever recorded for the species has been recorded from Long Island (Bustard in Pritchard, 1979). However the size of the E. imbricata population for the region has never been accurately assessed. In addition, almost every egg laid on the inhabited islands is harvested, as are many eggs on the uninhabited rookeries of eastern Torres Strait. In

western Torres Strait, some rookeries suffer from near total egg predation by varanid lizards. There is a distinct probability that there is no longer sufficient hatchling productivity on a regional basis to maintain a future substantial E. imbricata nesting population in Torres Strait.

Chelonia depressa

Crab Island is the largest rookery for this species which is endemic to the Australian continental shelf. Crab Island supports several thousand nesting females annually. All year round nesting occurs at this rookery, peaking in August. C. depressa also nests at almost inconsequential low density on the continental islands of south western Torres Strait. In central and eastern Torres Strait it is known as a nesting species by the locals. Eggs from Crab Island particularly are harvested at an undetermined rate as, at times, are the nesting females. These are eaten locally and traded at Thursday Island.

C. depressa also nests at low density along the mainland coast of western Cape York Peninsula. Almost all eggs laid on these mainland beaches are destroyed by feral pigs. If the mainland nesting turtles are part of the Crab Island population then at the regional level the species is probably under a substantial combined predator and harvest pressure.

Caretta caretta

There is no recorded nesting by this species in Torres Strait.

COURTSHIP

While reports of C. mydas mating (turtle fast) in the months (September-November) prior to the summer nesting season are common from throughout Torres Strait, courtship has been reported most frequently from eastern Torres Strait (Warrior Reef to south of the Murray Islands) and from western Torres Strait (Badu, Moa, Mabuiag area). Females are harvested selectively from courting groups in both areas. Because turtles do not usually court in their home feeding ground and because the numbers of mating turtles usually far exceeds the local nesting population, it is assumed that these mating aggregations are of migrating turtles enroute to their respective rookeries. A tagging programme will be needed to identify the rookeries associated with the various mating aggregations.

No courtship aggregations of C. depressa or E. imbricata have been reported from the region:

POST HATCHLING PLANKTONIC PHASE

The dispersal patterns of hatchling turtles from the north Queensland rookeries are totally unknown. As is typical of shallow water habitats, turtles in the size range between hatchlings (CCL about 4 cm) and immatures with a carapace length of about 35 cm are extremely rare in Torres Strait.

FEEDING GROUND RESIDENT POPULATIONS

Turtlesoccur in a diversity of habitats throughout Torres Strait but the population levels are unquantified. In the deeper inter-reef habitats, Caretta caretta, Chelonia mydas and C. depressa have been captured in prawn trawls. C. mydas has been recorded from the extensive shallow sea grass beds of north western Torres Strait. Only in the shallow coral reef habitats of eastern Torres Strait has a systematic study of the turtle community been made (CJP, unpublished data). Results o'f this non-selective sampling study of turtles inhabiting the coral reefs are summarised as follows (Table 1):

Chelonia mydas comprised 87.0 per cent of all turtles examined from coral reef habitats in eastern Torres Strait. They ranged in size from small immatures ("waru kasi" with CCL of about 40 cm) to large adult males and females. Most (74.6 per cent) were immatures since they were less than 91 cm CCL (the minimum breeding size for the species in eastern Australia).

Eretmochelys imbricata made up 10.8 per cent of turtles captured from the same habitats. The size range of the resident E. imbricata was mostly that of adults. The smaller immature turtles were noticeably scarce on the reefs of eastern Torres Strait in contrast to their abundance in coral reef habitats within the Great Barrier Reef.

Caretta caretta was present in only low density on the eastern Torres Strait reefs, representing 2.2 per cent of turtles examined. They were all large immature or adult turtles. C. caretta of similar size were reported by turtle fishermen at Daru to be present on the Warrior Reefs in similar low density.

Table 1. Species composition of resident sea turtle populations on coral reef habitats in north-eastern Torres Strait, February 1977–April 1979. Most turtles were caught selectively by the turtle rodeo capture technique (Limpus, 1978). This data was reported on in part by Parmenter (1980a).

Species	Number of turtles caught (number)	(per cent)
Chelonia mydas	201	87.0
Eretmochelys imbricata	25	10.8
Caretta caretta		2.2

The principal turtle harvested from feeding grounds throughout Torres Strait is C. mydas. It is a traditional food item for the region. In the late 1970s we estimated that about 10,000

C. mydas were being harvested annually within the Torres Strait region. Kowarsky (1982) estimated the C. mydas harvest from Cape York and Queensland Torres Strait communities to be in the range 2,500 - 5,000 a year. Isolated records of C. caretta being caught and eaten were also obtained. Although E. imbricata are also caught and eaten on rare occasions, they are generally regarded as poisonous to eat. Only some of the old people were supposed to still know how to cut out the poisonous parts. They are more frequently used as a source of tortoise shell and polished carapaces. These are used locally or traded, as are the polished carapaces of some C. mydas caught for food. No estimate of the size of the E. imbricata harvest has been made.

Studies of the turtles harvested in western Torres Strait (Nietschmann, 1979), Yorke Island (Kowarsky, 1978) and Daru (Prescott, in press) describe the turtle catch but do not describe the resource from which the catch was taken. Parmenter (1980a) demonstrated that the Yorke Islanders were selecting principally for large female mydas when they hunted and this would seem to apply generally throughout the region. Turtles of any size class are scarce on reefs immediately adjacent to settlements such as Yorke Is., Thursday Is. and Daru and is assumed to be the result of localised overfishing for turtle. The same probably applies to all reefs adjacent to settlements. The few turtles captured on Yorke Is. reef were usually at the lower end of the size range for the area are presumed to have been newly recruited to this reef.

FEEDING GROUND AND ROOKERY INTERRELATIONSHIPS

Sea turtles do not normally live adjacent to their rookeries. Rather the adults migrate from their respective, and often widely scattered, feeding grounds to their breeding grounds. The rookeries supplying turtles to the Torres Strait feeding grounds can be identified from the results of our extensive tagging programs on sea turtle populations throughout eastern Australia.

Feeding ground recoveries of turtles tagged on nesting beaches cannot be used directly to quantify dispersal patterns or harvest rates due to variations in the reportage of tag recoveries, tag loss and unequal census at all localities. However the following general conclusions can be drawn from the data.

Tag recoveries have identified at least some of the rookeries used by three species of turtles inhabiting Torres Strait feeding grounds. In summary:

Chelonia mydas: Torres Strait residents breed at widely scattered rookeries including

north-east Torres strait (Bramble Cay, Campbell Is.)
northern Great Barrier Reef (Raine Island, Pandora Cay) (Figure 2)
southern Great Barrier Reef (Capricorn-Bunker Group) (Figure 2)

These migrations covered distances between feeding ground and rookery with a range of 53 to 1734 km.

Eretmochelys **imbricata:** Torres strait residents breed at least as far afield as Solomon Islands, more than 1650 km distant (Parmenter, 1983).

Caretta caretta: Torres Strait residents breed almost exclusively in south Queensland

southern Great Barrier Reef (Capricorn-Bunker Groups)
mainland coast (Bundaberg to Round Hill Head)

These migrations range between 1741 and 1957 km.

Females do not necessarily breed at the rookery closest to their feeding ground. Nor do those living in the same area all breed at the same rookery.

While tagged C. mydas have been recovered from throughout Torres Strait, 59 per cent came from the Warrior Reefs, Daru, Parama area (Table 2). This suggests that over half of the total Torres Strait C. mydas harvest is concentrated in the relatively small area of the Warrior Reefs. These turtles are being taken by PNG fishermen from Daru and adjacent communities. At this time we have no reason to suspect non-compliance with the underlying assumptions of this extrapolation (viz. equal mixing and equal reportage of tagged turtles within the region).

Until there have been adequate tagging programs, the importance of the following rookeries in supplying turtles to the Torres Strait feeding grounds is conjectural: Turu Cay, Deliverance and Kerr Islands and Rocky Islands (south east Gulf of Carpentaria, C. mydas); Coral Sea cays (C. mydas); inner shelf cays of the northern Great Barrier Reef (E. imbricata).

There would appear to be little movement of C. mydas between Torres Strait feeding grounds and the rookeries on the north coast of PNG (Spring, 1983; V. Baker, pers. comm.).

MIGRATORY PATHWAY

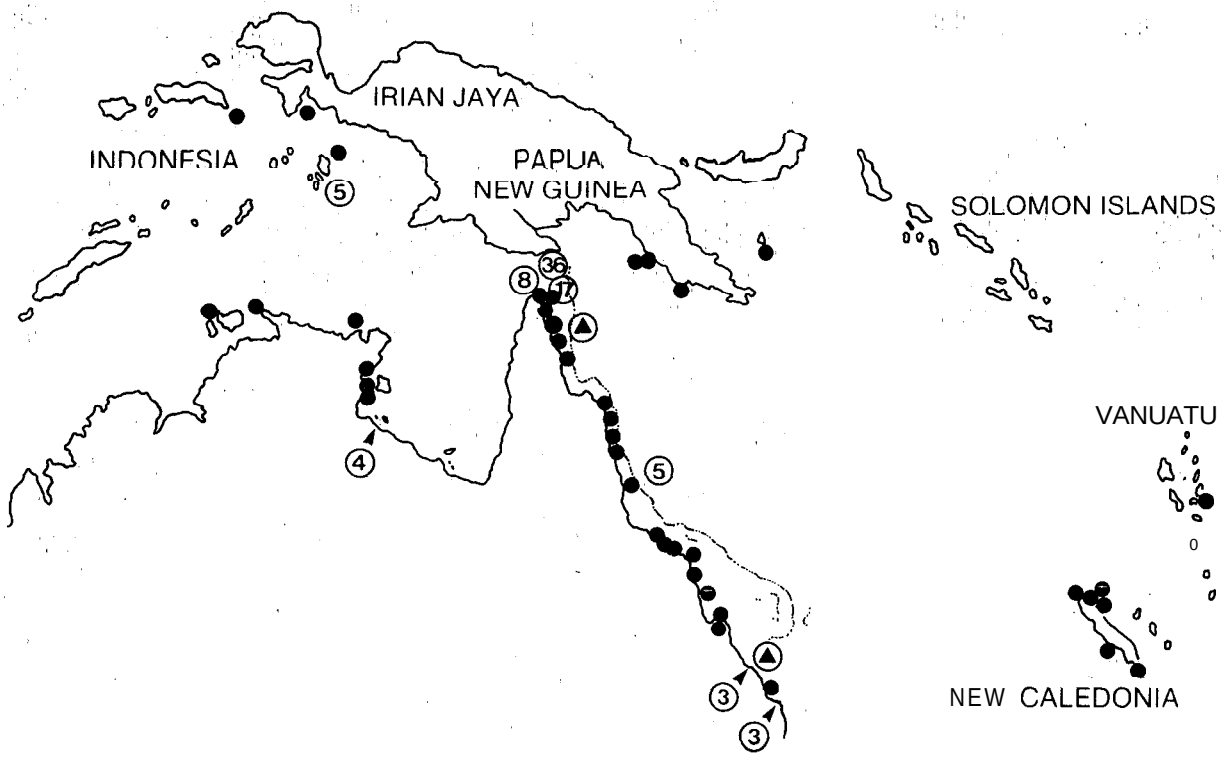
Examination of Figure 2 shows that C. mydas from the Gulf of Carpentaria, Arnhemland, eastern Indonesian Archipelago and Irian Jaya must pass through Torres Strait twice each summer when migrating to and from their rookeries within the Great Barrier Reef. Similarly Caretta caretta migrating between the Gulf of Carpentaria and the southern Great Barrier Reef rookeries must also pass through Torres Strait. Thus Torres Strait acts as a bottleneck to turtles migrating from the most westerly feeding grounds and the Great Barrier Reef rookeries. It appears that many of the C. mydas engage in courtship as they pass through the shallow area of the strait. Thus, Torres Strait is of vital strategic importance to the migration of turtles living to the west, which breed in the Great Barrier Reef.

Table 2. Recaptures of migrant green turtles, Chelonia mydas, originally tagged while breeding at eastern Australian rookeries.

FEEDING GROUND RECAPTURES	Raine Is. Pandora Cay	Bramble Cay	Campbell Island	Capricorn Bunker Gp. male	Capricorn Bunker Gp. female	TOTAL
Indonesia*	6	2				8
Irian Jaya*	2					2
PNG						
- non-Torres Strait	4	3				7
- Torres Strait	36	10	1			47
Australia						79
- Torres Strait	25	4		3		32
- Northern Territory	10					10
- Eastern Queensland	6			27	3	36
Vanuatu	1					1
New Caledonia				6	1	7
TOTALS	90	19	1	36	4	150

* Note: Caution is necessary in use of these figures. Local reports indicate that the majority of recovered tags remain unreported in these regions.

Figure 2. Major breeding grounds **and** recapture points **in the northern** Australia **region.** Chelonia mydas: Dot = single capture; circled number = multiple catch; circled triangle = rookeries.



A SHARED INTERNATIONAL RESOURCE

The eastern Australian C. mydas rookeries of the Great Barrier Reef are the most significant breeding grounds for the species in the south-west Pacific. The same applies to Caretta caretta and E. imbricata. Turtles migrate to breed at these rookeries from eastern Indonesia and Irian Jaya, Papua New Guinea, Solomon Islands, Vanuatu and New Caledonia as well as Northern Territory, Gulf of Carpentaria, Torres Strait, Great Barrier Reef, and inshore south Queensland waters within Australia. These turtles are a shared international resource with the feeding grounds and migratory pathways of some individuals spanning the territorial waters of three nations.

The combined extensive harvest of C. mydas that occurs in eastern Indonesia, Irian Jaya, southern Papua New Guinea, Torres Strait, Northern Territory, eastern Queensland, Solomon Islands, Vanuatu and New Caledonia probably involves a harvest of tens of thousands of turtles annually. A large proportion of this harvest is of turtles from the Raine Island population. We believe that over-harvesting probably is already occurring for this and the other Australian C. mydas nesting populations.

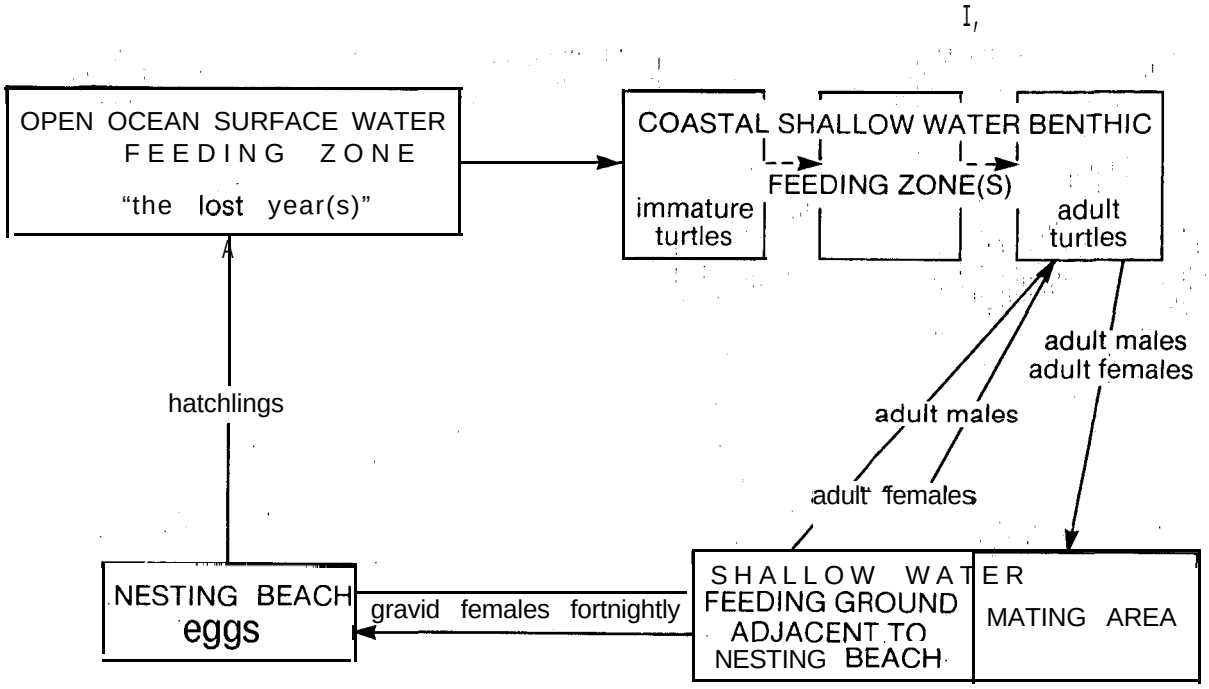
International cooperation in management of these shared turtle resources is essential if they are to be available to future generations.

CONSERVATION--RECOMMENDATIONS

Sea turtles are particularly difficult to manage on a sustained yield basis because their biology is poorly understood. They are migratory. The post hatchling dispersal phase has never been adequately investigated. The relationship between rookeries and feeding grounds is poorly known. They are long lived to maturity (perhaps 50 years or more). Recruitment rates to the adult population are probably very low with an associated low adult natural mortality rate. The individual adult females do not breed annually. The relationship between the nesting numbers and the actual population is unknown. Sex of sea turtles is determined during incubation by the temperature of the nest and can not be assumed to be 1:1. Sex ratio may be variable between populations and indeed between different segments of the same population if different size classes and/or maturity status turtles segregate into different feeding grounds during their developmental migration.

Thus a complex situation exists for Torres Strait. Some of the people of the region rely heavily on sea turtles and/or their eggs for food. There is a high probability that the existing utilization represents over-harvest for these populations. The biology of the species is so poorly understood that no meaningful sustained yield harvest regime can be devised. Peoples in other regions and nations are exploiting heavily the same turtle populations. There are obviously many turtles still available in the feeding grounds and rookeries, leading people from these areas to erroneously believe the general population is secure.

Figure 3. Postulated sea turtle life cycle.



Turtle conservation must be planned for decades into the future because of the time scale of the turtle life cycle. Experience in other countries indicates that when a turtle population crashes recovery will be slow, if at all, and the local communities may have to go without turtles for half a century or more. Therefore if harvestable, or even secure, populations are to be maintained:

the gaps in biological knowledge and understanding that iimit available strategies for sea turtle conservation generally (and in Torres Strait in particular) must be addressed urgently. However, it will take decades to provide workable solutions to the existing pressing problems. Therefore as an interim measure we recommend that:

steps be taken to initiate international cooperation in the conservation and management of the shared turtle resources of the south-west Pacific and Arafura Sea regions;

the proportion of adult female turtles being harvested be reduced;

total protection of the nesting and courting females be introduced;

total harvest rates be reduced in feeding grounds; (This could be -achieved by introducing a quota system, by reverting to less efficient traditional capture techniques, by closing significant parts of the feeding grounds to turtle hunting, or by a combination of these. Unless these types of actions are introduced, communities such as Daru could run out of turtles within the current generation of hunters.)

egg harvests be regulated such that most clutches laid in a region produce hatchlings to the sea; (It seems from studies in south Queensland that about 65 to 70 per cent of the regional clutch production may need to produce hatchlings for population stability. Therefore when eggs are harvested it may be necessary to augment natural hatching success by management actions including protection of nests from predators and nest relocation to escape erosion and flooding.)

the E. imbricata egg harvest of central and eastern Torres Strait cease or be greatly reduced. (This more vigorous action is warranted because of the species' very depleted status globally. If it was considered important not to exclude turtle eggs from the diet of these people, an alternative but limited source of eggs is available locally. A management plan could be instituted for the Bramble Cay C. mydas rookery such that the doomed eggs (Parmenter, 1980a,b) were collected at laying. Those necessary for maintenance

of the rookery could be relocated within the stable portion of the island and the excess could be made available to those communities who have traditionally utilised eggs from this rookery and to those who have had their access to E. imbricata eggs removed.

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WORKSHOP DISCUSSION

The discussion covered the following points:

The survival of baby turtles is very low (probably two to three per 10,000 hatchlings). Therefore there should be less emphasis on taking big female turtles.

There is a long period (possibly six years) between each breeding by female green turtles.

Up to 90 per cent of the green turtle breeding' in the Great Barrier Reef Region occurs on Raine Island and in the Capricorn-Bunker group of islands; therefore the major rookeries are important sites for green turtles.'

Scattered rookeries exist in the Northern Territory. These are probably important to the loggerhead population but not so important for green turtles.,

No one has followed individual green turtles on migration. Radio/satellite tracking may become more feasible as a method is now available (laparoscopy) to, determine whether a female in a feeding ground is likely to migrate to breed.

The figure of 10,000 turtles caught per annum in Torres Strait is only an estimate and is based on observations by a number of researchers in different areas of the Strait.

Intervention at the hatchling stage to protect young turtles (by removal from hatching locality), thereby giving them a head start on growth, -may interfere with imprinting regarding breeding sites.

The critical time for survival of turtles caught in trawling nets may be forty-five minutes to one, hour, after which time they may drown.