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PART D

STUDIES ON THE BIOLOGY OF TRADITIONAL MARINE RESOURCES

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THE DUGONG PROBLEM

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TRADITIONAL SIGNIFICANCE OF THE DUGONG

I doubt whether any person of European cultural background, including myself, can truly understand the significance of the dugong to many indigenous people from the coastal areas of northern Australia. However, some insight can be gained from the following statement issued by the Aborigines and Islanders who attended the Dugong Workshop held at James Cook University in 1979:

"...the dugong is of great significance in Aboriginal and Islander ceremony, religion, economy and culture and has an important co-ordinating role in these societies. **Any** local rarity or extinction in areas in which the hunting of **dugongs has occurred traditionally** would be likely to cause disruption and such communities have a very real and historic interest in the conservation of the species".

STATUS OF STOCKS

The dugong is listed as vulnerable to extinction by the International Union of the Conservation of Nature (Thornback and Jenkins, 1982). Uncontrolled, deliberate and accidental exploitation is believed to have seriously reduced populations throughout much of the **dugong's** range which encompasses coastal waters from East Africa to Vanuatu between the latitudes of 26° north and south (Nishiwaki and Marsh, 1985). Although the range includes the waters of some forty countries, Australia is the only developed country with a resident dugong population, and one of the few areas where dedicated aerial surveys to determine dugong distribution and abundance have been carried out.

Extensive aerial surveys have established that **sizeable** numbers of dugongs still occur in the shallow seas around northern Australia between Shark Bay in Western Australia and **Moreton Bay** in Queensland (Heinsohn *et al.*, 1976, 1978; Elliott, 1981; Prince *et al.*, 1981; **Anderson**, 1982; Marsh, **1985a**, in press (a); **Bayliss**, in press). It is likely that this region supports **2 substantial proportion of the world's dugongs**.

The status of the dugong in Australian waters is unknown. As discussed below, there is prima facie evidence to suggest a recent decline in the Torres Strait area (Marsh, in press (a)). Many of the Aborigines and Islanders at this meeting also

expressed concern at what they perceive as a decline in numbers in various areas.

Despite current efforts to estimate dugong numbers in parts of Western, Australia, the Northern Territory and Queensland (Marsh, 1985a and in press (a); and Bayliss, in press), I estimate that it could be a decade or **more before** the status of the dugong in **Australian** waters can be confirmed.

This time-lag is due to the combined effects of the **dugong's** patchy distribution (which makes it difficult to obtain a precise index of dugong density) and low recruitment rate. 'Meanwhile, management regimes **incorporating the principle of conservation** need to be developed.

#### **LEGAL SITUATION**

In Australia, dugongs are protected by State and Federal legislation. Only indigenous people are allowed to hunt dugongs, and trade in dugong products is illegal. Apart from these restrictions, the situation differs somewhat in different areas. In Queensland, only Aborigines and Islanders living on reserves and in certain shires are automatically allowed to hunt under State law. Indigenous people living on reserves adjacent to the Great Barrier Reef Marine Park also require a permit **from the** Great Barrier Reef Marine Park Authority to hunt within the zoned areas of the Park. Indigenous people living off reserves in Queensland may apply to the Queensland Fish Management Authority to **hunt** dugongs under permit; such permission is now **rarely** granted. In the Northern Territory, all Aborigines can hunt provided they do so in "traditional hunting areas", whereas in Western Australia the only restriction on dugong hunting by indigenous people is a ban on hunting in Shark Bay and Exmouth Gulf (Prince, this volume).

In Queensland, hunters are 'not allowed to use "noxious substances" or "explosive devices" (including guns). These restrictions do not apply in the Northern Territory or Western Australia.

Most dugong habitat areas in Australia are so remote that even these laws have been impossible to police effectively...

#### **LIFE HISTORY**

Almost all information has been obtained from the study of over 600 dugong carcasses. Specimens were obtained from animals accidentally drowned in shark nets in the Townsville area or killed for food by indigenous hunters at various communities in northern Australia and Papua New Guinea (Marsh, 1980, 1985b, in press (a); Marsh et al., 1984 a, b, c). Age has been estimated from tusk **dentinal** growth layer group counts, the deposition rate being deduced from the seasonal pattern of growth layer deposition. The maximum **longevity** observed is 73 years. Females have their first calf at a minimum age of 9 to 10 years, and sometimes not until the age of 15 to 17 years. A single calf is usually born and suckles for **up to** at least 18 months. Calving interval estimates based on apparent pregnancy rates, placental 'scar counts, or calf counts **range** from three to seven years for various Australian/Torres Strait populations (Marsh, 1985b, in

press (a); Marsh et al., 1984c). Even though there are no reliable data on age-specific fecundity or mortality, there is no evidence of a marked decline in fecundity with age in females (Marsh, 1985b). However, some males may become post-reproductive (Marsh et al., 1984b).

Population simulations indicate that, even with the most optimistic combination of life history parameters, a low schedule of natural mortality and no man-induced mortality, a dugong population is unlikely to increase at more than about five percent per year (Marsh, in press (a)). This means that there needs to be at least 200 dugongs in a population to harvest five females per year without causing the population to decline.

#### PRESSURES ON AUSTRALIA'S DUGONG STOCK

Are there enough dugongs in Australian waters to sustain the current level of man-induced mortality? In the absence of data on the status of our dugong stock, it is impossible to give an unequivocal answer to this question. However, perceptions of local declines in sightings and/or catches suggest that the answer is no in some areas. One thing is certain. The situation is currently very complex and varies greatly from region to region as discussed further in this paper.

Table 1 summarises my perceptions of the differences between the pressures on Australia's dugong stock at the time of European contact (when there was apparently no problem in harvesting dugongs at a sustainable level), and the situation now. Several conclusions can be drawn about current circumstances:

1. In many areas, the dugong is now subject to multiple sources of man-induced mortality and habitat damage.
2. Even if the present level of legal protection could be policed effectively, it would not protect the dugong from all these sources of man-induced mortality.
3. It is possible for a dugong population to decline even if the level of indigenous hunting remains constant or decreases.
4. A local situation can change rapidly for a variety of reasons; for example, the availability of new technology, the opening of a new fishery (even for another target species), the loss of traditional knowledge, changing economic circumstances, or a natural event such as a cyclone or storm surge.
5. As pointed out by Johannes (1978), traditional fishermen (in the Pacific Islands) developed better gear primarily to reduce the effort needed to acquire the catch, rather than to increase the catch per se. Thus, the availability of better gear to traditional hunters in the form of Western technology does not necessarily mean that the catch will be increased. Conversely, banning the use of Western technology for hunting dugongs will not guarantee that the catch will be kept at a level consistent with population maintenance, particularly if a population is subject to other impacts.

## THE DIFFERING NATURE OF THE DUGONG PROBLEM

Three case studies are outlined to illustrate the regional variation in the pressures on dugongs in Australian waters.

### Torres Strait

The following account of the status of the dugong in Torres Strait is based on Barker-Hudson and Marsh (both in press).

Although it has been illegal to sell dugong meat in Australia since the 1960s and in most of Papua New Guinea since 1976, the people of Daru on the Papua-New Guinean side of Torres Strait received a special dispensation which enabled them to continue selling dugongs in the market, (Hudson, 1981).

The capacity to sell dugongs during a period of rapid technological change and development of a cash economy led to a marked increase in the dugong catch passing through the Daru market in the late 1970s coincident with the expansion of the barramundi and crayfishing industries. Papua New Guinea Division of Wildlife records indicate that most hunting occurred on Wednesdays and Thursdays for markets which coincided with the distribution of pay to community members. During the same period, substantial numbers of dugongs were also caught by the people of the Australian islands (Nietschmann, 1984), although in the absence of a long-term data, it is impossible to view the Australian catch levels in an historical perspective.

Available records suggest that of the order of 500 to 1,000 dugongs were being caught annually in Torres Strait at this time. The Papua New Guinea Division of Wildlife monitored the catch passing through the Daru market between 1978 and 1981. During this period more than 500 dugongs were sold, including 218 in 1979 alone. Nietschmann (1984) documented the catch of a total of 504 dugongs at three communities in the Western Islands during several periods between 1975 and 1979, and estimated that the annual dugong catch in Torres Strait was probably of the order of 750 animals. (It is not clear whether this estimate included the Daru catch.)

Population simulations indicate that, assuming the life history information outlined in Section 4 above is correct, at least 22,000 dugongs would need to occur in Torres Strait to sustain an unselective harvest of 500 dugongs, 44,000 to sustain a harvest of 1000 animals. If there was an effective hunting bias in favour of pregnant females as some hunters claimed (Olewale and Sedu, 1980), these figures are underestimates.

In November 1983, the Torres Strait area was surveyed from the air for dugongs using a technique derived from that developed for censussing kangaroos. Results were generally disappointing. The largest group seen was six in contrast to the large groups seen on some other aerial surveys in Northern Australia in recent years. The survey indicates that there were of the order of 1500 dugongs in the region. This figure is an underestimate, probably a gross underestimate of the number of dugongs in Torres Strait. However, the discrepancy between this figure and the number, needed to sustain the harvest levels of the late 1970s is so great that there is cause for concern, particularly as catch levels have declined.

The number of dugongs passing through the Daru market plummeted from the high of 218 in 1979, to 70 in 1981, and 18 in the first eight months of 1982. No records have been kept since then, but verbal reports indicate that very few were caught between mid 1982 and early 1984 when the sale of dugong meat in the market was banned. The decline occurred despite a sustained hunting effort (the number of turtles in the market actually increased), and despite the increased availability of motorised craft which enabled the hunters to extend their hunting grounds.

Catches in the Western Islands also appear to have declined. The catch statistics collected by the CSIRO traditional fisheries project in 1983-84 were substantially lower than those recorded by Nietschmann in the late 1970s (R.E. Johannes and Wallace MacFarlane pers. comm.). Again the turtle catch has been maintained suggesting that the effort has not declined.

Although the Torres Strait dugong situation is not typical, it provides an example of how a traditional fishery under the influence of Westernization can overexploit a stock that was previously harvested at a sustainable level.

### Borroloola

Despite the usage of Western technology, dugong hunting by the Yanyuwa people who live in the Borroloola area is still comparatively traditional and maintained at a low level of eleven animals or less per year (Bradley, this volume). The people of this area are very concerned at what they perceive as a decline in dugong numbers. They attribute this decline to the activities of white fishermen who apparently kill more dugongs than the traditional hunters. In 1985, for example, ten dugongs drowned in a fishing net at the mouth of the McArthur River in one night, and dugongs with bullet wounds were not uncommonly found floating or washed up dead (Bradley, this volume).

This dugong population has also been subject to high natural mortality recently. A storm surge associated with Cyclone Kathy in March 1984 stranded at least 27 dugongs, up to nine kilometres inland. Although 23 of these animals were returned to the sea, many were young calves which probably failed to survive.

The combined effect of these impacts has resulted in a perceived decline in dugong numbers in the Borroloola area, even though there is no evidence of an increase in the level of traditional hunting in this area.

A fuller account of the status of the dugong in the Borroloola area is given by Marsh et al. (1984 e), Harvey (1985), and Bradley (this volume).

### Townsville

Although dugongs are no longer exploited traditionally in the Townsville area (with the exception of a very occasional animal taken by members of the community on Palm Island), they have been subjected to significant incidental mortality over the last twenty years or so. Shark nets, introduced for bather protection in 1964, caught 249 dugongs between August 1964 and July 1983 (Paterson, 1979, and personal communication 1984). Eighty-one animals were caught in the first year of netting. Forty-one

animals were drowned in 1972, the year after Cyclone Althea: severely damaged **seagrass** beds in the area (**Heinsohn** and Spain, 1974). Since then, the number of dugongs caught in the nets has dropped to an average of about five per year. The cause of this decline has not been determined. Each year, members of the general public voluntarily report dugong carcasses which wash up on populated beaches in the Townsville area. **Eight** such cases were reported in 1985. Many of these animals are too decomposed to determine the cause of death, but others bear scars suggesting that they have tangled in a **gill-net** and drowned. Thus the Townsville dugong population is subject to a **significant** level of man-induced mortality both from government shark-nets and commercial gill-nets, even in the **absence** of **traditional hunting**.

#### **SUGGESTIONS FOR MANAGEMENT**

In Australian waters, the range of the dugong extends along some 15,000 km of coastline and includes seas variously controlled by the federal government and three different state governments and their assorted departments and authorities.

Both conservation and development are necessary in this region and must be made compatible with each other. This will require sophisticated resource-use planning and management involving cooperation between different governments in some areas. I believe the management of Australia's dugong stocks should not be considered in isolation but within the context of the overall management of the coastal seas of the various parts of northern Australia.

Effective management of Australia's dugong population will require an assessment of the impact of various human activities on dugong numbers. Activities which are incompatible with dugong population maintenance will need to be excluded from **at least** some of the areas which support large numbers of animals. The areas set aside will need to be large enough to protect the full range of necessary habitats including dugong feeding, **calving and** resting areas. As our knowledge of dugong **habitat** requirements is inadequate, zoning plans will need provision for updating to take account of new information. Although management **areas** which will protect dugong stocks are being developed along these lines in the Great Barrier Reef Marine Park (see Great Barrier Reef Marine Park Authority 1983 and **1985**), this approach has not yet been used on a large scale in other parts of northern Australia.

In areas where marine resources are harvested traditionally, effective management regimes will need to **recognise** the **cultural** and dietary needs of the indigenous inhabitants of the area. **Caughley** (1985) has pointed out "that all management decisions, are underpinned by an amalgam of facts and values, and that values are the most influential". As discussed above, it is difficult if not impossible for people of one cultural background to appreciate the values of another. Successful management of resources subject to traditional harvest will require the involvement of indigenous hunters and fishermen in all stages of the planning and management process.

An example of this approach has been detailed by Barker-Hudson (in press). Indigenous hunters were directly involved in the management of dugong hunting in the Maza Wildlife Management Area based at Daru in Torres Strait between 1978 and 1981. User involvement was reinforced by a vigorous programme of community education which was simultaneously developed by the Papua New Guinea Division of Wildlife.

The management regime was developed by a committee which included two representatives from each hunting community. The committee responded to the evidence of over-harvesting by successfully banning the hunting of small dugongs and the use of nets to catch dugongs in 1980, and had discussed returning to fully "traditional" hunting from non-powered sailing canoes by the time the programme was unexpectedly discontinued due to lack of funds in late 1981.

This abrupt termination of the programme meant that there was no time to assist the committee in the transition to being fully self-supporting and it virtually lapsed. However, the programme left a legacy of awareness about the potential for over-harvesting dugongs and the government ban on the sale of dugong meat introduced in 1984 has been respected. In contrast, many of the dugong hunters I have spoken to in the Australian parts of Torres Strait (who have not been exposed to such a programme) remain unconvinced that the perceived decline in dugong numbers could be due to over-harvest.

Baldwin (this volume) has outlined the need for user involvement in an integrated programme of research, management and education to conserve dugongs in the Great Barrier Reef Marine Park. After spending thirteen months living at Hopevale Aboriginal Community, Smith (1985) also advocated a community-based regime to control local dugong hunting, despite the fact that this approach had been rejected by the Hopevale Council when first proposed by Great Barrier Reef Marine Park Authority Staff.

The experience at Daru has shown that it takes at least several years for a successful community-based management programme to evolve even when it is accompanied by vigorous public education initiatives, and I consider that this approach should not be disbanded in Australia because it was initially rejected at Hopevale.

Although community-based management programmes will take time to establish, the hunting rights of indigenous people can be quickly and formally acknowledged by the declaration of appropriate "Traditional Hunting Areas" when zoning plans for a region are drawn up or revised. The Scientific Research Zone which straddles the boundary between the Cairns and Far-North Sections of the Great Barrier Reef Marine Park partially functions as an unofficial "Traditional Hunting Area" for the Hopevale people. However, because this function has not been publicly acknowledged, the hunters do not appreciate the fact that the dugongs they harvest have been protected from incidental mortality from commercial fishing in this area. (This fact has not escaped the commercial fishermen, however.)

Despite the 'different management problems that exist in different' areas, I consider that the effectiveness of marine parks and other management areas in conserving Australia's dugongs will be enhanced if an integrated management programme is developed for the whole region. Monitoring programmes are expensive and once optimised should be standardised to facilitate comparisons between areas. The development of public **education programmes** is **also expensive**, and although such programmes should be **customised** for different localities., it is desirable for each to benefit from the **experience** of others.

Within Queensland, the Queensland Fish Management Authority took a commendable lead in this direction in 1984 by establishing an interdepartmental committee with both **State** and Federal Government representatives **which is** considering **the** overall problem of dugong management. It is to be hoped that this **committee** is the forerunner' of a more broadly-based body which will include indigenous hunters and which will co-ordinate dugong management throughout northern Australia.

Managing dugongs in Australian waters should be relatively simple compared with most of the rest of the range where human population density is higher, and the conflicting demands, on coastal resources much greater and more complex. As an affluent nation whose waters support a significant proportion of world dugongs, Australia should be prepared to take a leading role in developing programmes to conserve these animals - or to take most of the blame if they become extinct.

If effective management programmes are not developed and dugongs become rare or extinct in northern Australia, coastal Aborigines and Islanders will lose not only a major part of their diet, but a major part of their traditional lives.

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#### WORKSHOP DISCUSSION

The discussion covered the following points;

A formal method of coordinated dugong management in northern Australia must be devised..

There is a perceived problem with respect to trawlers destroying dugong habitat. The likelihood of this was disputed by a participant on the basis that trawlers do not work directly on **seagrass** beds.

Table 1. A contrast between the pressures on dugongs in Australia? waters at the time of European contact and in the 1980's. It should be noted that there is considerable temporal and spatial variation in present-day techniques and that those listed are not necessarily in widespread use.

PRECONTACT			1980'S
HUNTING			
WHERE:	overall	Many areas in the range which extends from Shark Ray WA to <b>Moreton</b> Bay QLD.	Restricted to relatively few communities e.g. there is no legal hunting south of Palm Island in QLD.
	single communities	Individual forays restricted by range of craft and the rules of sea-tenure (see Chase, 1978 and Barker-Hudson, in press)	Hunters able to traverse large areas e.g. <b>Hopevale</b> people travel more than <b>90km</b> to their main dugong hunting ground (Smith, this <b>volume</b> ).
HOW:	equipment	harpoon (see <b>Haddon</b> , 1912, Thomson, 1934)	harpoon (see Marsh et al., 1981; Nietschmann and Nietschmann, 1981); gun (Marsh et al., <b>1984d</b> ) motorized boat (Marsh et al., 1981; Nietschmann and Nietschmann, 1981)
	platform	canoe (Thomson, 1934) raft (Smart, 1951) hunting platform ( <b>Haddon</b> , 1912)	
	knowledge	extensive traditional knowledge (see Nietschmann, 1984)	some <b>knowledge</b> may be lost due to community disruption (see Smith, this <b>volume</b> )
	ancillaries		CB <b>radio</b>
WHEN:		weather/tides permitting	Better craft have extended the <b>range</b> of suitable weather conditions, however, boat <b>usage</b> is often curtailed by fuel costs, mechanical repairs, and job commitments (see Marsh et al., 1981).
WHY:	for whom	sharing with tribal members	sharing with tribal members, sale (see Marsh, in press <b>b</b> )
	consumption	immediate use	immediate use, freezing, salting (Marsh et al., 1981; <b>1984d</b> )
NETTING			
WHERE:	deliberate	a few areas e.g. hand-held nets Mornington Island area (Roughsey, <b>1971</b> )	
	incidental		commercial gill net fisheries e.g. for barramundi Mary River north in Qld (Hundlde, 1985) (see Marsh, in press <b>b</b> ); shark-netting programmes for bather protection at several Queensland localities (see Paterson, 1979)

OTHER DIRECT MORTALITY

HOW:	occasional mass-strandings due to tidal surges e.g. Marsh <u>at1 . , 1984e</u> ) natural predators e.g. killer whales (Anderson and <u>Prince, 1985</u> ), sharks (Anderson, 1981)	presumably unchanged  occasional drownings in trawls ( <u>H. Marsh</u> , unpublished data, 1985)
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HABITAT DAMAGE

HOW:	natural	occasional cyclonic <b>damage to seagrass</b> beds e.g. Birch and Birch 1984), <b>seagrass diebacks</b> like that which occurred in parts of Torres Strait in the 1970'5 *. ( <u>Yamashita</u> , in press)	unchanged
	man-induced		potential for local <b>damage to seagrass</b> beds from dredging, trawling, pollution etc (see Larkum and West, 1982); little evidence of such damage to date. Many Aborigines and Islanders claim that dugong habitat is rendered unsuitable by <b>motor</b> noise; these claims have not been proved.

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\*Yamashita (in press) attributed this die-back to the "Oceanic Grandeur" oil spill, however, this has  
not been proved and the available evidence suggests otherwise.