

EXECUTIVE REPORT #2

MANAGEMENT IMPLICATIONS

TOWARDS A SUSTAINABLE INDIGENOUS FISHERY FOR DUGONGS IN TORRES STRAIT: A CONTRIBUTION OF EMPIRICAL DATA AND PROCESS

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IMPLICATIONS OF RESULT OF THIS STUDY TO MANAGEMENT APPROACHES FOR DUGONG

The current major management approaches for dugongs will need to consider several key findings of this study presented in Executive Report #1. These findings have significant management implications particularly in terms of the temporal and spatial scales of (1) habitat protection, (2) monitoring of populations, (3) catch monitoring and (4) estimates of sustainable harvest levels. The following section discusses each of these management approaches in the context of my results.

Habitat Protection

The extensive seagrass areas of in Torres Strait support the exceptionally large population of dugongs in the region. These seagrass communities are very dynamic at both spatial and temporal scales. The processes governing the temporal changes in seagrass distribution and community composition are poorly understood. Evidence of large-scale movements of dugongs from aerial surveys (Lawler 2001; Lawler *et al.* 2001; Marsh and Lawler 2001a, 2001b; see Marsh *et al.* 2002), satellite telemetry (Marsh and Rathbun 1990; Preen 2001; Holly *et al.* 2001; Lawler *et al.* 2001; see Marsh *et al.* 2002) and anecdotal evidence from hunters in Torres Strait suggests that these movements are likely to be in response to a spatially and temporally variable food source. However, very little is known about how individuals and populations of dugongs are able to respond to changes in the quality and availability of their food.

The tendency for seagrass habitats to be vulnerable to large-scale episodic losses or diebacks resulting from stochastic events require that habitat protection needs to focus on maintaining habitats containing high quality forage for dugongs during the intervening periods when diebacks have not occurred. Evidence that the impacts from dieback events can be exacerbated by poor land-use activities (Preen and Marsh 1995) indicates that effective protection of dugong habitats will require monitoring of the potential impacts to catchment areas adjacent to and coastal waters that contain important dugong habitats.

To date, management strategies to protect seagrass habitats have traditionally focussed on establishing marine parks, dugong protected areas and fishing industry closures to prevent structural damage to seagrass beds through trawling (see Marsh *et al.* 2002). As noted by Marsh *et al.* (2002), there have been few attempts to protect seagrass beds from adverse impacts on ecosystem processes associated with land use. While there has been evidence that the adverse impacts of extreme weather events can be exacerbated by poor land use practices in Hervey Bay (Preen *et al.* 1995), obtaining evidence of such impacts is problematic in geographically large and complex systems in remote areas such as Torres Strait. This is well illustrated by the difficulties in establishing whether there are any impacts to the adjacent Torres Strait environment and biota (including dugongs) from increased sediment loads, which contain high concentrations of heavy metals such as copper from mining tailings deposited into the Fly River (Dight and Gladstone 1993; Gladstone 1996; Haynes and Kwan 2001)

Understanding the impacts of seagrass loss (from both anthropogenic and/or environmental stochastic processes) requires that the seagrass resources used by dugongs be identified. While many important seagrass habitats for dugongs have been identified and mapped in northern Queensland and Torres Strait, effective long term monitoring of the status of key habitat areas will also be required. In order to maintain high quality habitats for dugongs, much more research is required to better understand the factors that affect patterns of spatial and temporal variability in seagrass communities (see Marsh *et al.* 2002).

We have a good understanding of the preferred species of dugongs from analyses of stomach contents, however, surprisingly little is known of how dugongs use specific areas within their overall home ranges (Ivan Lawler, pers. comm. 2002). New research proposed by Marsh and her co-workers has the potential to provide valuable insights into dugong foraging strategies. Specifically, it is necessary to identify what cues (e.g., local depletion, change in chemical or species composition) dugongs use to select patches or to move to another.

Monitoring of Populations

The dependency of dugongs on dynamic seagrass systems has implications for monitoring the status of populations using aerial surveys to estimate population sizes. Evidence of large-scale movements of dugongs over long distances from standardised aerial surveys in Shark Bay (see Gales in Marsh *et al.* 2002), Torres Strait and Queensland (Marsh and Lawler 2001a, 2001b) indicates that reliable estimates of population sizes will require surveys to be undertaken over very large spatial scale and appropriate temporal scales. This has been highlighted by previous uncertainties as to whether survey results were indications of a population decline or redistribution of dugongs within and between survey areas (Lawler 2001; Marsh and Lawler 2001a, 2001b).

Determining the limits of appropriate spatial and temporal scales over which to conduct aerial surveys of Torres Strait will be extremely difficult. For example, obtaining a more reliable estimate for the Torres Strait dugong population may require survey areas to the west into West Papua, into the Gulf of Carpentaria and include south along the eastern side of Cape York Peninsula. Clearly, undertaking a survey of such magnitude would be politically infeasible at present and very difficult logistically and financially. The capacity of dugongs to move long distances including across international and state jurisdictional boundaries, means that it will be necessary to co-ordinate monitoring and management initiatives on a regional basis.

Estimates of PBR

Marsh (1998) used the Potential Biological Removal (PBR) method (Wade 1998) to estimate an average sustainable catch of about 500 (range 63 – 2016) for the *entire region* of Torres Strait. The method is inherently conservative and requires an estimate of abundance and its precision and an estimate of the maximum growth rate of a population (Wade 1998; Johnston *et al.* 2000).

Based on the results of this study, even under the most optimistic conditions, the maximum rate of change in a population is only 5.7% per year. As indicated by Boyd *et al.* (1999), the sustainable harvest is thus likely only to be in the order of 2-3% of the female population per year. The results of this study indicate that the sustainable harvest rate will be lower when the sex ratio at birth is skew to males as the estimated maximum rate of population increase (based on the observed sex ratio of 1:3 females to males in this study) was only 2% for dugong populations at Mabuig Island in 1997-99. In addition, the sustainable harvest rate will be lower when the fecundity is reduced and pre-reproductive period and/or calving intervals are lengthened by food shortage (Marsh 1995a; Boyd *et al.* 1999; this study).

Given the above discussion, the effects of food supply on the population dynamics and movements of dugongs present challenges for attempts to estimate sustainable catch. Improved estimates of a PBR will require not only better estimates of life history parameters but also absolute estimates of dugong population size, which are currently not available. Marsh and Lawler (2001a) note reliable estimates of sustainable harvest rates for dugongs by Indigenous Australians will also require a spatial population model that accounts for the movement of dugongs in response to stochastic weather events. This model would need to incorporate realistic stochastic population dynamics, and then examine the effects of hunting at various levels (Tim Gerrodette, pers comm., Marsh and Lawler 2001a). Nonetheless, it is unlikely that the Torres Strait population is at risk of extinction in the short term, given that estimates of the relative abundance of dugongs are considered conservative (Marsh *et al.* 1997; 2002) and the uncertainty about whether current rates of harvest are sustainable.

Catch monitoring

As discussed in Executive Report #1, there are a number of factors that affect dugong hunting effort and hunting success including local weather conditions, moon phase, environmental conditions, local abundance of dugongs, socio-economic factors (i.e., cash income from crayfish catches) and the skill of hunters (see above). Thus hunting effort is not normally distributed through time, not easy to predict accurately; factors which make it very difficult to obtain reliable estimates of total catch from sampling.

Monitoring dugong catches in Torres Strait using sampling regimes is expensive, logistically difficult and unreliable. Obtaining reliable catch estimates has also proven highly problematic. I used my continuous catch records of dugongs landed at Mabuig Island to examine the effectiveness of the sampling regime used by the AFMA/CSIRO monitoring program. My data indicate that even under the most ideal sampling scenario (i.e., 15 days sampling, three times a year every 100 days) would yield only an 85% chance of falling within the 95% confidence interval of the 'actual' catch. This suggests that a program based on continuous monitoring rather than sampling catch rates of dugong in Torres Strait is likely to be more reliable.

Councils at both Mabuig and Badu Islands have regularly expressed a strong interest in direct community participation in catch monitoring. They have been negotiating with AFMA to develop a locally based community catch-monitoring program. The initiative to develop a catch-monitoring program at Badu Island Council was originally instigated independently of AFMA (D. Jacobs, *pers. comm.*, 2000).

As outlined in Executive Report #1, with adequate funding and support, community-based catch monitoring can provide employment, training and capacity building enabling community members to be more actively involved in the monitoring and management of their dugong resources. Community-based monitoring has the advantage of potentially providing more reliable catch rates than sampling because it provides total counts rather than estimates. In addition, costs for travel and labour are considerably diminished because a community member can record catches with less time and effort than roving monitoring observers. However, the success of this approach will require an adequate level of ongoing support from AFMA to collate data and provide feedback to communities.

Technical support by AFMA staff for community-based catch monitoring will enhance opportunities for AFMA to provide an important liaison between communities and AFMA on traditional fisheries issues. The planned collaborative development of an appropriate community-monitoring program for dugong and turtle by AFMA, communities and their councils has the potential to produce reliable catch statistics. Other important anecdotal evidence (e.g., the relative abundance of dugongs in hunting areas near communities) and additional information (e.g., how many functional dinghies in the community) important for assessing the status of the dugong fishery can also be collected by community monitoring programs.

To date, catch monitoring in the Torres Strait Protected Zone has focused on the major hunting communities of Boigu, Mabuiag and Badu Islands (Harris *et al.* 1997), with various attempts to monitor catches in Islander communities in the Northern Peninsula Area and Inner Islands. Catch monitoring in Northern Peninsula Area communities and the Inner Islands is highly problematic because there are no centralised locations where hunters land their catches. Future catch monitoring efforts in Torres Strait will require a flexible and more comprehensive approach to include monitoring of dugong hunting where and when it occurs in order to obtain accurate catch statistics. Efforts to refine and expand community-based catch monitoring programs currently being developed by AFMA will need wide community support and commitment by all levels of governments (Commonwealth, State, Regional and local Island Councils) and their management agencies. A catch monitoring program should also be extended to include PNG communities in Torres Strait. However there are significant logistical and financial constraints associated with establishing an effective monitoring programme in PNG. At present, it is highly unlikely that the PNG government has the capacity to undertake a task without considerable technical and financial assistance from Australia.

MANAGING THE DUGONG HARVEST TO MAXIMISE THE LIKELIHOOD OF SUSTAINABILITY

While the rate at which a species can be harvested sustainably is a function of its intrinsic rate of increase, ensuring a sustainable harvest often depends on factors beyond an understanding of the target species' biology. When a resource such as the dugong holds diverse values (biodiversity, intrinsic, cultural, social, economic and nutritional), its sustainable use is shaped by social, cultural, political, economic and institutional factors as well as by biological parameters. These factors have important influences on the management approach taken and the effectiveness of management actions. In the following section, I address the question of how harvesting might be managed to ensure the sustainability of the dugong fishery in Torres Strait.

The value of collaborative management approaches has been increasingly recognised for a wide range of resources, particularly those used for subsistence (see IHED 1994; White *et al.* 1994). One of the key elements of this approach is that key stakeholders such as Torres Strait Islanders, have a significant say in the management of a resource on which they depend. Together with government agencies, which are

generally informed by scientific information, collaborative management approaches permit the incorporation of the local knowledge, aspirations and experiences of Indigenous peoples (White *et al.* 1994).

This approach is likely to ensure the commitment and participation of Indigenous peoples because their social, cultural and economic objectives become an integral part of the management framework (White *et al.* 1994). This is ensured by paying particular attention to the needs of those who depend on the resource (White *et al.* 1994).

Such collaborative approaches to the management of the marine resources in Torres Strait are still comparatively undeveloped. However, co-management of their marine resources, including dugongs, is now a major socio-political and economic imperative for Torres Strait Islanders (see Kwan *et al.* 2001). The following sections provide a context for the application of the results of my research discussed in Executive Report #1.

Institutional Frameworks for Environmental Management in Torres Strait

The *Torres Strait Treaty* between Australia and PNG provides the overarching jurisdictional and administrative structure for the region. Although the Treaty has resulted in a complex network of bureaucratic structures, it provides a framework for initiatives, which support community-based management of natural resources.

While the *Torres Strait Treaty* seeks to ensure protection of traditional fishing and free movement of traditional inhabitants, it has come under sustained criticism from many interest groups. One of the most significant criticisms comes from the area's traditional inhabitants, especially Torres Strait Islanders. Critics claim that the Treaty has resulted in significant logistical and bureaucratic problems, which have effectively precluded Islander communities from taking strategic decision-making roles in managing local or regional resources. The establishment of the Protected Zone and the Protected Zone Joint Authority has also been criticised for precluding or obviating the need for more localised community centred initiatives. Moreover, the Treaty arrangements are considered to provide inadequate recognition of Torres Strait Islander aspirations and rights to control and manage their marine environment and resources (Smyth 1993), matters on which Torres Strait Islanders have become increasingly assertive. The recent establishment of the Torres Strait Fisheries Task Force has facilitated developments towards a much more inclusive role by Islanders in management of fisheries including the dugong fishery.

Since continuous association and the maintenance of customary laws relating to land ownership enabled recognition of Native Title on Mer (Murray Island) in 1992, Native Title determinations for other islands have remained high priorities for Torres Strait Island communities. In 1999–2001, 11 islands, including Mabuiag Island secured legal recognition of their Native Title rights. Native Title claims over the other Torres Strait islands continue to be actively progressed, principally by the Torres Strait Regional Authority (TSRA) Native Title Office. In November 2001, the Native Title Office lodged a regional sea claim over Torres Strait on behalf of all Torres Strait Islander communities. If successful, this claim will have significant implications for the future management of the marine resources of the region (Kevin Murphy, TSRA, *pers. comm.*) because it will recognise the rights of Torres Strait Islander peoples to have a say in managing as well as using these resources.

Having gained recognition of Native Title in common law, the people of Torres Strait are now about to set another political precedent in their goal to achieve greater regional autonomy (Smyth 1993). The TRSA interprets this to mean the 'authority and capacity of the Torres Strait Islanders and Aboriginal people living

in the region to manage their own affairs, make decisions that affect their lives, and maintain their culture, identity, values and traditions as Indigenous people' (TSRA 1998). Economic and political autonomy are considered critical to the achievement of these goals.

In such a dynamic political climate, it is not surprising that Torres Strait Islanders are becoming more assertive about gaining more substantial control of their traditional islands, reefs and sea. Thus, collaborative management of important resources such as dugongs is now a major imperative for Torres Strait Islanders and provides an opportunity for dugongs to be a 'flagship species' for the effective management and conservation of other marine resources.

The Marine Strategy (MaSTERS, see below) developed by the Island Co-ordinating Council (ICC) provides a mechanism to raise awareness of environmental issues at the community level that can be coupled with capacity building for communities to participate actively in management.

Marine Strategy for Torres Strait

The MaSTERS program developed by the ICC and primarily funded under the Marine Protected Areas component of the Ocean Rescue 2000 Program, aimed to provide a comprehensive conservation and sustainable development strategy from which a foundation for future public policy and economic development could be drawn. The program provides a regional strategy for the implementation of broader local and national conservation strategies. The initial outline of the program focused on developing the marine strategy for the region. The evolution of the program saw the need for an implementation phase to run concurrently with local programs to address issues of immediate concern to the community. These initiatives include Indigenous Protected Areas (IPAs, see below), regional environmental management plans, the collection and storage of data, a service of technical advice, and community-based management.

The public release of the Marine Strategy in 1999 sets the policy framework by which Torres Strait Islanders can engage in development of these initiatives and deal with the potential impacts from infrastructure projects. It also sets a policy framework within which agencies that operate in the Torres Strait can facilitate and support local initiatives such as community-based management programs.

The development of the Marine Strategy was achieved through three years of community consultation combined with field surveys. The policies were aimed at addressing current environmental, cultural and conservation issues facing remote island communities from the viewpoint of the traditional owners of the resources. The Marine Strategy provides a mechanism to raise awareness of environmental issues at the community level that can be coupled with capacity building for communities to actively participate in management.

Indigenous Land Use Agreements

One avenue for implementing the principles of collaborative management contained in MaSTERS is through the Indigenous Land Use Agreement (ILUA) provisions of the Commonwealth Native Title Act 1993 which enable Indigenous communities to negotiate collaborative management agreements (see Sutherland and Muir 2001). ILUAs provide the means for Native Titleholders to negotiate agreements to manage land use (and now potentially sea use) and future activities in areas of land and sea where Native Title exists by creating binding contractual obligations on governments, industry groups, non-Indigenous landowners, and all Native Titleholders in an area. ILUA may be a useful mechanism for giving legal recognition and status to collaborative management agreements at both the community and regional level (i.e., in event of the

successful regional sea claim discussed above). However, Native Titleholders are still required to undertake the difficult task of obtaining the resources necessary for both negotiating ILUAs and to implement any management plans.

Indigenous Protected Areas

The Indigenous Protected Areas (IPA) program is a Commonwealth government initiative aimed at supporting Indigenous peoples to formally designate land or sea that has significant conservation value as 'protected areas' and to manage those areas in accordance with IUCN guidelines. The IPA program is part of Australia's National Reserve System Program, which aims to establish a network of protected areas that includes a representative sample of all types of ecosystems across the country. The advantage to Indigenous landowners of declaring an IPA is that the IPA program funds management plans and practical work to protect natural and cultural features and to contribute to conserving biological diversity. To date, 13 IPAs have been declared over Indigenous owned land, including one in Torres Strait (Warul Kawa or Deliverance Island).

In comparison with most IPAs declared on mainland Australia, IPAs in Torres Strait face particular challenges because of the need to include marine environments. These are complicated to delineate because of shallow water areas, reefs and sandbanks, which are influenced by tidal fluctuations. The establishment of IPAs in Torres Strait may provide an appropriate framework, within which community-based management of resources such as dugongs could be developed. If such proposals are to be supported by the community, they will need to be developed at the right time and place and will require a sound understanding of the complex factors that drive community concerns

For example, a feasibility study undertaken by Ponte in 1996 (see Davies *et al.* 1999) for an IPA based on dugong conservation and management at Boigu Island demonstrated that, without any perceived threat to local dugong stocks, the community was unwilling to agree to any restrictions on hunting in spite of national or international conservation goals.

In contrast, in 2001, the community of Boigu Island declared Warul Kawa (Deliverance Island) an IPA on the basis of its cultural significance as a spiritual hunting and fishing area. Warul Kawa also represents one of the few islands in Torres Strait that have maintained relic terrestrial vegetation habitat. The island supports important nesting habitats for large numbers of sea birds, the scrub fowl (*Megapodius reinwardt*) and three species of sea turtles (flatback (*Natator depressus*), hawksbill (*Eretmochelys imbricata*), and green turtle (*Chelonia mydas*). Warul Kawa also has very high international and national ecological significance as the most northerly located major rookery for the endemic flatback turtle (Limpus *et al.* 1989).

A second IPA is also being progressed for Pulu Island and surrounding islets, reefs and passages, on the grounds of their cultural significance for the people of Mabuiag Island (the Gumulgal). The community has identified rock art, ceremonial grounds, old residence sites, story places (especially in the sea), and sacred sites as important areas to Gumulgal cultural heritage and local history. Establishment of an IPA at Pulu Island presents a further opportunity to develop and extend community-based management approaches for dugongs over traditional areas of high socio-cultural significance to the Mabuiag Island community. The Chair of the Mabuiag Island Council has expressed interest in the possibility of either extending the proposed IPA at Pulu Island to include Orman Reef or declare a new IPA in that region (Terrence Whap, *pers. comm.*, December 2001). Such a proposal may provide an opportunity for the Mabuiag Island community to implement management measures for hunting of dugongs in their traditional sea territory.

Given that the sea territory of the Mabuiag, Boigu and Badu Island communities contains the most important dugong habitats in the Torres Strait, the establishment of an IPA that encompasses these areas may provide an effective means securing funding for habitat protection on a regional scale. Such a move would be potentially effective for conservation if the IPA includes breeding habitats (e.g., Orman Reef) or deep-water refuge areas from hunting for dugongs.

The need for a regional strategy

Several findings reviewed in Executive Report #1 highlight that a regional approach to management will be required because the potential for over-harvesting can be exacerbated in the event of a combination of: low dugong fecundity as a result of extensive seagrass dieback events such as that reported in the 1970s; movements of dugongs close to hunting communities to feed on intertidal seagrass in response to dieback of deepwater communities exacerbating high hunting pressure; increase in hunting pressure in response to reduction in important sources of income such as the cray fishery.

Several of my other findings also indicate that the effective management and conservation of dugongs will require a regional approach in Torres Strait:

- the large-scale (~1 000 km²) diebacks to which seagrass habitats are prone to have significant effects on the population dynamics of dugongs at a regional scale because the dugong's rate of reproduction is dependent on their food supply; and
- dugong abundance and distribution (which influence harvest rates) is highly variable because of the dugong's capacity to undertake long distance movements (presumably in response to a their variable food supply).

Management coordinated at a regional scale must include the Northern Peninsula Area of Cape York and PNG. Management will need to build on established processes which incorporate *Ailan Kastom* (the customary way of life of Torres Strait Islanders) and institutional structures in the Torres Strait region which includes the: *Torres Strait Treaty*, *Torres Strait Fisheries Act* (1984), Native Title and regional Islander initiatives such as MaSTERS (Marine Strategy for Torres Strait).

In Torres Strait, a regional strategy developed under the auspices of the TSRA (and ICC) and the Torres Strait Fisheries Task Force which is supported by the relevant management agencies would enable an overarching approach to be taken to issues that affect the island communities such as maintaining sustainable catch rates and catch monitoring. Communities such as Boigu and Mabuiag Island have formed Elders groups that are already involved in Native Title and fisheries matters, including the dugong fishery. As identified in the 1998 Workshop, a regional approach for managing dugong catch rates and catch monitoring would need to be include both PNG and communities on the Northern Peninsula Area of Cape York if it is to be effective.

A regional strategy developed by Torres Strait Islanders should include a review of the boundaries of the dugong sanctuary and the consideration of the establishment of additional protected areas (where no hunting was allowed) in places with high densities of dugongs. Most importantly, a regional strategy would provide a framework within which individual communities could develop their own management strategies.

Regional initiatives might include:

- a wider community information program in cooperation with other agencies;
- cooperative development of community-based management plans for the major hunting communities of Boigu, Mabuiag and Badu, fostering wider community involvement in the development of all aspects of dugong research and management;
- a community role in determining priorities and direction for dugong conservation action and research in the region (see also Marsh *et al.* 2002); and
- development of cooperative research, management, monitoring and conservation programs with PNG for catchment areas, coastal waters and seagrass habitats in the Torres Strait region.

The workshop in 1998 increased community and government awareness of the need for additional dugong management measures. However, there has been insufficient effort, since that workshop, particularly from Government, to commit funds for resources and infrastructure to work with the Torres Strait communities to facilitate the development and implementation of such management measures. There is now a real need to capitalise on my empirical data and community interests in identifying possible management measures that could be implemented in the fishery. I suggest that a second regional workshop be held involving all stakeholders (including those from PNG and the Northern Peninsula Area) to decide on a 'toolbox' to be used for management of dugong fishery in the Torres Strait Protected Zone, Northern Peninsula Area and PNG. Each community would then be able to select and customise tools from this 'tool box' in developing their own local-scale management plans.

Community Management Plans

Given the variation in catch between communities (see Marsh *et al.* 1997) and in individual community awareness of the conservation status of dugongs, I believe that effective regional management will require implementation at the individual community level (within the strategic regional framework).

Following the workshop in 1998, the AFMA on behalf of the ICC initiated discussions with each community in order to assess whether there were any existing management arrangements for dugongs and turtles. The potential was canvassed of any existing community by-laws or other traditional practices contributing to community-based management. Individual communities were also asked to identify what type of management arrangements would be suitable. Some communities suggested that by-laws developed under the *Community Services (Torres Strait) Act 1984* could be used as a management tool. However such by-laws have limited application for marine activities because they are only applicable in land vested in elected councils as Deed of Grant in Trust by (DOGIT) under the provisions of the *Land Act (Aboriginal and Islander Grants) Amendment Act 1982*.

There are several fisheries management tools available to Torres Strait Islander communities. These communities may be able to use such tools effectively within their cultural, social, cultural and economic contexts. These tools might include:

- spatial (area-based control) management such as the establishment of IPAs or dugong sanctuaries
- temporal management where hunting activity is permitted only at specific times

- management based on regulation (eg., hunting permits), quotas (i.e., calculated based on PBR estimates for the region and allocated as total allowable catch for individual hunting communities or as individual transferable quotas) or competency (eg., experienced hunters endorsed to hunt on behalf of the community)
- controls on hunting equipment or restriction on other technology (eg., on the use of spotlights when hunting at night)

Initiatives such as the community catch-monitoring program for dugongs supported by Mabuiag and Badu Islands in 2001 have considerable potential to be successful. The small populations of Outer Island communities means that information about all dugong hunting activity is readily available, and the localised nature of landing and butchering sites enables good quality and reliable information for catch monitoring to be obtained. Initiatives such as these, which allow communities to monitor their own dugong catch records, can make a major contribution towards implementing the principles of the Marine Strategy for Torres Strait. Catch-monitoring by the communities is likely to provide more reliable catch statistics than the sampling approaches developed based on western science because they enable continuous monitoring to be affordable.

Development of community management plans for dugongs in Torres Strait could be informed by the dugong hunting management plan developed collaboratively by the Hope Vale community in the northern Great Barrier Reef region and relevant government management agencies (see Marsh *et al.* 2002). The Hope Vale plan aims to ensure hunting practices are sustainable and regulates: annual hunting quotas informed by research, hunting seasons and areas, prohibition on hunting pregnant female dugongs or calves and transport of meat outside the community. The plan also outlines provisions for: a Community Management Group which functions to resolve disputes and impose penalties for infringements; a community permit involving individual hunting authorities and catch monitoring by community rangers. Unfortunately as discussed above, securing funding and resources to implement this plan has proved challenging for the Hope Vale community (Marsh *et al.* 2002). The Hope Vale initiative serves as a timely and appropriate reminder to Torres Strait Islanders of the need not only to make sound management decisions but also to ensure that the funding and resources are sufficient for implementation of their management initiatives.

The Need for Capacity Building

Torres Strait Islanders have repeatedly voiced concerns that current catch rates of dugongs in Torres Strait may be unsustainable. They have also demonstrated a willingness to assume responsibility towards ensuring sustainability of their dugong resources. However, while individual communities have been the subject of research on various environmental issues and studies, most Torres Strait communities and organisations have very little first-hand experience of research, development of policy and regional planning or the operation of protected areas or management of natural resources. Research on marine resources in Torres Strait, undertaken by government agencies such as CSIRO, AFMA and Environment Australia, has focused on commercial fisheries and, only secondarily on traditional fisheries for dugongs and green turtles. What is urgently needed in Torres Strait are measures that will build local capacity to manage resources, and provisions to institute a community resource management process that will provide for sustainable use of a broad range of culturally significant resources. These measures should be aimed at increasing community awareness of impacts on resources, providing training for environmental planning, and claiming of intellectual property rights over traditional knowledge.

The limited capacity of state agencies, such as the Queensland Boat and Fisheries Patrol to enforce fisheries regulations in remote areas such as Torres Strait further necessitates a community-based management approach. The challenge is to determine how to implement the principles contained in Torres Strait Islander initiatives such as MaSTERS and to establish workable and effective links with Island communities for the purpose of participatory research and management. As the Hope Vale dugong hunting management initiative discussed above demonstrates, this requires governments to seek ways to ensure that communities are sufficiently supported with sound scientific advice and technical support, and with the appropriate resources to make and implement informed decisions about the sustainable use of the marine resources such as dugongs on which their future as Torres Strait Islanders depend.

CONCLUSIONS

- The links between seagrass food availability and dugong life history parameters have very important implications for management given the dugong's susceptibility to large-scale episodic losses of seagrass. Management must be coordinated at regional scale to include the Northern Peninsula Area of Cape York and PNG.
- These findings reported in Executive Report #1 have significant management implications particularly in terms of the temporal and spatial scales of (1) habitat protection, (2) monitoring of populations, (3) catch monitoring and (4) estimates of sustainable harvest levels
- Management needs to build on established processes and institutional structures in the Torres Strait region which includes the:
 - Torres Strait Treaty
 - Torres Strait Fisheries Act (1984)
 - MaSTERS (Marine Strategy for Torres Strait)
 - Native Title
 - Indigenous Land Use Agreements
 - Indigenous Protected Areas
- The importance of habitat protection in Torres Strait means that Australia should initiate discussions on the management of coastal catchments in Western Province PNG with the PNG authorities, which should be facilitated through the Torres Strait Environment Management Committee.
- A second regional workshop involving all stakeholders is recommended in order to take a regional approach to deciding on a 'toolbox' to be used for management of dugong fishery in the Torres Strait Protected Zone, Northern Peninsula Area and PNG.

- Reports of: (1) reduced fecundity in dugongs evidenced by the low number of calves sighted in the Orman Reef area during aerial surveys in Torres Strait in November 2001 (Helene Marsh, unpublished data, 2001), (2) anecdotal information that unusually large numbers of dugongs have been seen close to communities such as St Pauls in 2001, (3) anecdotal information of extensive areas of seagrass dieback in the Orman Reef area in early 2001 and (4) evidence of low crayfish catches since about 1999 indicate conditions for the potential over-harvesting of dugongs currently exist in Torres Strait. This situation provides an ideal platform for the workshop recommended above to proceed towards effective outcomes for a sustainable dugong fishery in Torres Strait.
- A framework for the development of community-based management plans, education, research and monitoring should all be co-ordinated at regional level.
- Community management plans developed within the regional strategy should include a number of management 'tools' that can be selected and customised by individual communities to achieve their management objectives.
- Communities will need funding for capacity building and infrastructure if plans are to be implemented successfully.
- A community based management approach, which builds on the research processes, and the empirical information obtained in this study has considerable potential to ensure that the Torres Strait dugong fishery is sustainable.

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