

## Options for Managing the Sustainable Use of Green Turtles: Perceptions of Hammond Islanders in Torres Strait

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### Abstract

One of the largest populations of green turtles (*Chelonia mydas*) in the world spends at least part of its life cycle in the remote Torres Strait between Australia and Papua New Guinea. This population is subjected to traditional harvests from geographically dispersed communities including along the northern and eastern coasts of Australia, Indonesia and south-western Pacific nations. In Torres Strait, green turtle hunting is classed as a traditional fishery and is guaranteed by Australian legislation (Native Title Act 1993) and the Torres Strait Treaty between Australia and Papua New Guinea that aims to protect the traditional lifestyle of the region's indigenous peoples. To investigate the Islanders' thoughts and aspirations regarding marine turtle management, we interviewed hunters and Islander Elders from the Hammond Island community in the Kaurareg nation of Kaiwalagal. Although not the Traditional Owners of the Kaiwalagal sea country in which they live and hunt, Hammond Islanders wish to be involved in the management of resources on which they depend, including marine turtles. They considered community-based processes to be important, especially the application of (1) cultural norms to the development of tools to achieve compliance and enforcement within the community, and (2) consensus-based decision-making amongst hunters and elders within the community, with regard to the use of more formal rules. However, the need for co-operation with other communities and stakeholders across scales was also recognised, particularly with regard to enforcement. Our results suggest that co-management is likely to be a more appropriate approach for managing green turtles in Torres Strait than either community-based management or government-driven management.

**Keywords:** co-management, indigenous hunting, green turtle, Torres Strait, fisheries

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### INTRODUCTION

Appropriate processes to manage common pool resources depend on factors such as the scale of the resource and the types of use, the degree to which stakeholders are willing to share decision-making power, and the capacity of various stakeholders to be involved (Berkes 2005; Campbell *et al.* 2009). Management approaches include community-based, government-driven, and co-management. Community-based management can overcome the problems—excludability or controlling access and subtractability or rivalry (Feeny *et al.* 1990; Ostrom *et al.* 1992; Ostrom 1999)—associated with single common pool resources that occur within a limited area and are used by relatively few groups because communities

are able to exclude/manage other resource users and regulate their own use (Berkes 2005). However, as the spatial scale of the resource increases, the resource tends to be used by multiple groups, often in several jurisdictions (inter and intra nations). In these more complex situations, management approaches that bring together groups of resource users, stakeholders and governments are needed to achieve effective management (Hilborn 2004; Berkes 2005). Government-driven management is one option. Government-driven management may incorporate the views of multiple stakeholder groups that use and/or value various habitat and species resources (Sagarin & Crowder 2009). Although such an approach may utilise stakeholder participation, the government regulatory agency typically controls the implementation of management

plans (Berkes 2005; Evans & Klinger 2008). Alternatively, a co-management approach may be used. In contrast to top-down approaches, co-management tends to focus on developing and maintaining a formal partnership between local resource users and government agencies (Berkes 2005; Pomeroy & Rivera-Guieb 2006; Campbell *et al.* 2009). The ultimate aim of co-management is the sharing, and eventually the transfer, of authority and responsibility to the community. Nevertheless, the co-management model includes a broad spectrum of arrangements where the decision-making power can vary widely among stakeholders (Berkes *et al.* 1991; Pomeroy & Rivera-Guieb 2006; Tyler 2006; McConney & Baldeo 2007).

Co-management is likely to be a more appropriate approach than either community-based management or top-down government-driven management for managing the use of migratory marine resources such as turtles, especially when (1) people have rights to use the resources and exclude or limit the activity of non-community members, (2) people require access to the resources for livelihood and cultural survival, and (3) resource management needs to occur in remote communities or regions. Compliance and enforcement, both at the community scale and especially at larger scales, are major challenges for community-based management (Berkes 2005). People with enforcement powers in communities generally find it difficult to impose local rules on outsiders who also use the resource in other parts of its range (Feeny *et al.* 1990). Intra community enforcement can also be challenging, especially in small communities, because community rangers find it difficult to impose rules on their family or neighbours (Gibson & Marks 1995). In addition, governments with broad responsibilities for natural resource management are often unwilling (or unable) to delegate management responsibilities to only one interested party (Berkes 1995, 2005; Campbell *et al.* 2009). Thus, local communities may not have the capacity to control use across the range of the resource or to prevent exploitation outside the community, leading to the reduction of resources for their community, rendering community-based management ineffective. Conversely, as discussed below, the government will find enforcement challenging in remote communities, thus rendering government-driven management ineffective.

Government-driven management may attempt to address the issue of scale by allowing for the participation of multiple stakeholders (Berkes 2005). However, this top-down approach may not adequately ensure compliance by people who have legal rights to use a resource, because it does not always include mechanisms for communities to self-regulate their resource use (Pomeroy & Rivera-Guieb 2006). Indeed, while not always the case, top-down management has been criticised for displacing local knowledge, experience and priorities (Hilborn 2004; Sagarin & Crowder 2008). Furthermore, when resource users live in remote locations, issues of implementation, enforcement and compliance within communities are challenging for management agencies that are based in distant urban centres (Agrawal 2003; Campbell *et al.* 2009). In contrast, the partnership approach of co-management systems uses the capacities and interests of local resource

users and communities, and complements them with the provision of government services such as enabling legislation, conflict resolution, and other assistance (Pomeroy & Berkes 1997; Campbell *et al.* 2009). Hence, the development of co-management arrangements between government and other stakeholders in management of resource use by indigenous and local communities has increasingly led to the development of management plans to guide use (Fernandez-Gimenez *et al.* 2008). These plans may be drafted together, through an iterative process started by the government or the community, or drafted by communities themselves, but usually with the approval of government before they can be implemented.

Many tools and/or control measures used in contemporary fisheries management were developed out of traditional management systems used by communities (e.g., closed areas, closed seasons, catch quotas, and size limits; Berkes *et al.* 2001). However, traditional and more contemporary approaches tend to differ in the way decisions are reached on when and how to apply the tools (Berkes *et al.* 2001). Traditional approaches use the community's observations to make the decision, and the tools are applied through community norms or rules that are disseminated by the community (Wilson *et al.* 1994). In contrast, contemporary approaches tend to use broad-scale scientific information to decide when to apply management tools, and these tools are applied through formal rules implemented by centralised management agencies (Wilson *et al.* 1994). Co-management uses aspects of each of these approaches. In particular, a community's observation of a crisis in the stock has been cited as one of the many pre-conditions for successful co-management (Pinkerton 1989), because such a crisis increases the acceptability of using scientific information to implement formal intervention. In addition, community cohesion and multi-scale co-operation among resource users and stakeholders may also influence co-management outcomes (Campbell *et al.* 2009).

It is our hypothesis that a co-management approach is likely to be the most appropriate for managing the indigenous fishery for green turtles (*Chelonia mydas*) in the Torres Strait region of northern Australia for many of the reasons outlined above. The Torres Strait/northern Great Barrier Reef green turtle population is one of the largest in the world, but is subjected to traditional harvests from geographically dispersed communities within Australia from the Northern Territory to southern Queensland, and from West Papua in Indonesia, to southern and eastern Papua New Guinea, up to Vanuatu and New Caledonia (Limpus 2009). Green turtles are listed as a species of conservation concern in Australia, where they are protected by biodiversity legislation at the national and sub-national levels. Specifically, green turtles are listed as vulnerable under both the national Environment Protection and Biodiversity Conservation Act 1999 and Queensland's Nature Conservation Act 1992.

In Torres Strait, green turtles (and dugongs) have considerable ecological, spiritual and cultural values and form the basis of an important subsistence economy (Marsh 1996, Kwan *et al.* 2006). Consequently, the cultural importance of green

turtles and their use by indigenous Torres Strait Islanders and Aboriginal people is protected by the Native Title Act 1993, and in Torres Strait, the Torres Strait Treaty 1985 between Australia and Papua New Guinea, which obliges both parties to protect hunting as part of the traditional way of life and livelihood of the indigenous inhabitants (Kwan *et al.* 2001). These statutory rights to use green turtles, together with their cultural and economic importance, mean that successful management will be strongly related to the level of involvement of Torres Strait Islander communities in the management of the species.

In this paper, we present a case study investigating the perceptions of the Torres Strait community of Hammond Island, with regard to managing green turtles. We investigate the opportunities and challenges of management from a community perspective. The migratory nature of green turtles requires management at a large scale which makes community-based management less suitable than co-management. Government-driven management is also unsuitable because indigenous Australians' right to hunt for non-commercial cultural purposes is protected by law. We provide a potential model for the management of green turtles based on community-based management plans, but with broader regional coordination by the Torres Strait Regional Authority. We also investigated various management tools, and how decisions about when and how to apply these tools are made within communities. The outcomes of this case study have potential implications for other Torres Strait communities, other northern Australian communities and indigenous coordinating bodies and Papua New Guinean communities. Indeed, the development of turtle and dugong co-

management plans by eight other Torres Strait communities has taken several years partly because of the dual need to incorporate both cultural norms and more formal management rules.

## MATERIALS AND METHODS

### Study site

Zenadth Kes (Torres Strait) is the shallow body of water separating the Australian mainland and Papua New Guinea (Figure 1). This remote strait is inhabited by people from 18 island—and 2 mainland—communities. There are five traditional island nations (i.e., clusters of islands) in the Torres Strait, Guda Maluiligal (Top Western Islands), Maluiligal (Western Islands), Kemerkem Meriam (Eastern Islands), Kulkalgal (Central Islands) and the Kaurareg nation of Kaiwalagal (Inner Islands and the Northern Peninsula Area of the mainland). Hammond Island which is the focus of this study is part of the Kaurareg nation of Kaiwalagal (Figure 1). Traditional people of Aboriginal or Torres Strait Islander descent live in Kaiwalagal. Thus both Kaurareg Aboriginal Elders and Torres Strait Islander Elders live on Hammond Island, but most of the community is of Torres Strait Islander (Melanesian) descent. The Kaurareg Traditional Owners live mostly on Horn Island. Hammond Island supports a small cohesive community of about 230 people and lies across a narrow (<1 km) channel from Thursday Island, the main administrative centre of the Australian Torres Strait.

Like the other nations in the western part of the Torres Strait, hunters in the Kaiwalagal mostly harvest green turtles that are

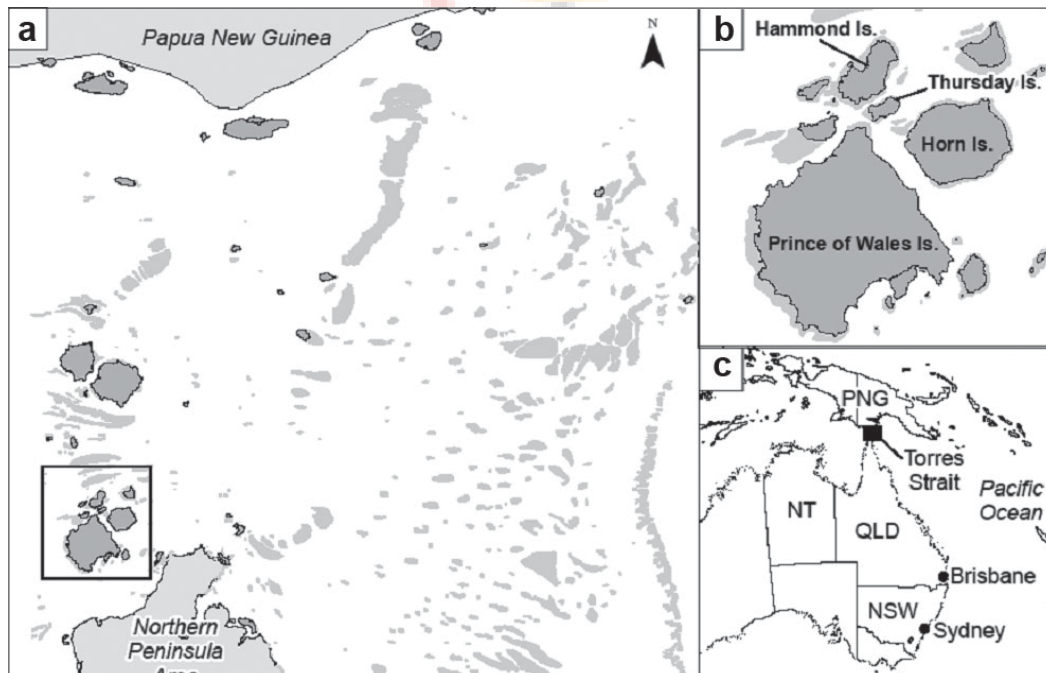


Figure 1

Study site: a) Torres Strait, b) inner islands including the study community Hammond Island and neighbouring communities of Thursday Island, Horn Island and Prince of Wales Island, and c) Torres Strait relative to mainland Australia and Papua New Guinea (PNG)

caught while feeding or mating. Although most hunting is carried out within 10 km of the hunter's community, some hunters were recorded travelling up to 30 km (Grayson *et al.* unpublished data). Given the relatively small area of the Torres Strait and these hunting patterns, it is clear that Hammond Island hunters share the local resident green turtles with hunters from other Torres Strait communities, especially neighbouring communities in the Kaurareg nation—Thursday Island, Horn Island and Prince of Wales Island. At a larger population scale the turtles are shared by other Torres Strait communities, northern Peninsular Area communities, and even further afield into the Northern Territory as well as communities from other countries (e.g., Indonesia, Papua New Guinea, Vanuatu and New Caledonia).

In Torres Strait, green turtle (and dugong) fisheries are managed under the Torres Strait Fisheries Act 1984 (C'wth) and Torres Strait Fisheries Act 1984 (Qld). Torres Strait communities aspire to have a large share of the power and responsibility in management arrangements for marine resources (Loban 2007). These aspirations have been incorporated into environmental planning in the Torres Strait over the last 15 years. For example, the Marine Strategy 1994 placed management of the environment and resources of the region in the context of recognition of the social, economic and cultural rights and interests of Torres Strait Islanders and their associated resource management responsibilities (Smyth 2001). The Torres Strait Land and Sea Management Strategy (2005) provides a framework for developing a co-ordinated, comprehensive, adaptive and integrated approach to environmental management including providing opportunities for community-based management. Community-based management of green turtles and dugongs in Torres Strait has also been endorsed at various workshops by hunters, scientists and managers 'to maintain *Ailan Kastom* (island custom) and ensure the long-term survival of Culture, Identity and Sealife' (Mission Statement from the 1998 Turtle and Dugong Management Workshop). Most recently, eight communities were supported in 2008 by the Australian Government to develop and implement community-specific co-management plans for marine turtles and dugongs. In addition to hunting, other sources of mortality of green turtles in Torres Strait include seagrass dieback, illegal foreign fishing, and ghost nets.

## Methods

Data collected and analysed in this paper were obtained as part of a broader project (referred to below as the catch-monitoring project) to assist two neighbouring Torres Strait communities—Hammond Island and Thursday Island—to collect information relevant to the management of their traditional green turtle and dugong harvests. The first stage of the project was to meet with the Chair of the Hammond Island Community Council to discuss the project's scope and direction. Following advice from the Hammond Island Council, we interviewed two groups of people—active hunters and Elders that had been hunters in the past. These two groups were interviewed because they are closest to the issue and would be most affected by any

changes resulting from management. In Torres Strait, turtle-hunting is exclusively a male activity and therefore all of the interviewees were male.

Grayson and Ambar (the Community Ranger employed on the project) conducted fifteen open-ended semi-structured interviews with 13 hunters and three Elders (two hunters were interviewed together, and are analysed as one interview). The total number of hunters on Hammond Island was 26, and 21 of these were participating in the catch-monitoring project (those who were not participating were not convinced that Hammond Islanders would be given the responsibility of managing their own use of marine turtles and dugongs and this was the same reason they did not participate in the interviews). Of the 13 hunters we interviewed, 12 were participating in the catch-monitoring project and one was not. The nine hunters who were participating in the catch-monitoring project but who were not interviewed were either away from the island or busy working at the time of the interviews. Only one elder approached did not wish to be interviewed.

Ambar organised the interviews and conducted two interviews alone; the other interviews were conducted by Ambar and Grayson. Interviews were digitally recorded except in one case in which the responses were scribed by Grayson. The digitally recorded interviews were transcribed by Grayson and the transcriptions were given to the participants to ensure that there had been no misunderstandings. The digital recordings and transcribed interviews were stored in password protected computer files according to James Cook University Ethics requirements under Human Ethics Approval Number H1805.

We chose to use open-ended semi-structured interviews because we were interested in gaining rich information from experts rather than more superficial information from a larger selection of participants that could be obtained using a questionnaire (Kvale 1996). We also considered that people would feel more comfortable engaging in informal face-to-face conversations than filling out a questionnaire. The interviews were analysed using the software QSR NVivo (version 7) to facilitate coding of the information into themes (Table 1).

We asked each question (Table 1) with regard to both green turtles and dugongs, though sometimes the flow of questions did not follow the plan of the interview, and depending on the interviewee, the answer was sometimes more specific for one species than the other. Attempts were made to clarify whether the statement referred to turtles or dugongs or both. In this paper, we were interested in a sub-set of themes related to our original research questions, and we used the responses to several questions to address these themes. Not all of the questions asked were relevant to these themes so are not discussed (those not discussed are indicated in Table 1). For example, we do not present the discussions about the community-based catch-monitoring project. Some additional themes emerged during our discussions (Table 2). Rather than sticking to the schedule, we allowed the discussion to flow, and therefore, responses to some questions were often given as part of responses to other questions. We present a



**Table 1**  
**Questions asked in semi-structured interviews with hunters and Elders organised into themes that emerged during analysis**  
*(Supplementary questions were asked after some questions)*

| Questions (framed to include both turtles and dugongs) |   | Supplementary questions   |
|--|---|---|
| Perceived need for local management                    |   |   |
| Local status of turtles                                |   |   |
| 1  | What is your opinion about green turtle numbers around the inner islands?   | Do you perceive a decline or have the populations remained stable?    |
| Causes of declines                                     |   |   |
| 2  | What do you think has contributed to these declines in numbers?   | Do you think Indigenous hunting has contributed?                      |
| 3  | Do you think more people are hunting now than there used to be?   | Do you think this has affected the numbers of turtles around?         |
| 4  | Do you think people are catching more turtles now than they used to?  | Do you think this has affected the numbers of turtles?                |
| 5  | Have the methods used to catch turtles changed? How?  | What do you think about this?   |
| 6  | Do you think any of these changes are a problem for future turtle hunting?  |   |
| Perception of controlling take                         |   |   |
| 7  | What is your opinion about controlling the take of turtles? Why?  | How would you feel about going along as you are without any controls? |
| Management options                                     |   |   |
| 8  | What types of controls and rules, if any, should the community implement to look after turtles?   |   |
| 9  | How do you feel about implementing a zoning plan for green turtle hunting, leaving some areas as sanctuaries and designating other areas as hunting grounds?  |   |
| 10   | What are your thoughts about having a permit/quota system administered by the community for green turtle hunting?   |   |
| 11   | What are your thoughts about closing the green turtle fishery for some parts of the year?   |   |
| 12   | What are your thoughts about applying sex limits—banning/restricting the catch of female green turtles?   |   |
| 13   | What are your thoughts about applying size limits—banning/restricting the catch of green turtles above a particular size?   |   |
| 14*  | What are your thoughts about restricting the types of gear or methods that could be used to catch green turtles?  |   |
| Community based catch-monitoring project               |   |   |
| 15*  | In what ways has the information we collected during the dugong and green turtle catch-monitoring project contributed to your ideas about the types of management controls that you think might work in your community? |   |
| 16*  | How long do you think you need to collect catch-monitoring information before you can use it to inform management plans?  |   |
| Perception of the future situation                     |   |   |
| 17*  | Thinking about the future, what do you think is going to happen to green turtle numbers and what do we need to do?  |   |

\*These questions are not presented

range of responses to questions being examined because of the small number of participants, but we indicate where there was a strong prevalence for particular responses. We have also provided some examples of responses that illustrate the perceptions presented.

We provide an analysis of two main issues relating to community-based management; community cohesion and co-operation at various scales. We investigate community cohesion by evaluating the consensus of hunters and Elders surrounding the need for management and perceptions of various management tools. With regard to co-operation, the green turtle population hunted locally by Hammond Islanders is shared with other northern Australian communities and other countries as explained above. Thus the actions of local, regional and international communities are likely to affect the effectiveness of management by individual communities. We did not set out to investigate co-operation at these different scales. However, the issue of collaboration between communities was raised during our discussions with hunters and Elders, and therefore we provide an analysis of their perceptions of this issue with respect to co-management. Thus we started out investigating community-based management in

one community and ended up also investigating multi-scale co-management from a community perspective.

## RESULTS

Not all of the Hammond Islanders interviewed answered all of the questions (Table 2). Hammond Islanders did not answer particular questions because they did not wish to, we did not ask them or they answered for dugongs, but not for turtles.

### Perceived need for local management

There was no widespread perception of a crisis in the local green turtle stock. Although almost all of the respondents thought that green turtles are abundant in the local area, there was approximately equal agreement that the local population was either stable or declining. One hunter commented that it was impossible to gauge the population status without more information on population size. The interviewees that thought the numbers of green turtles locally were declining suggested reasons such as boat-traffic scaring turtles away and making them more dispersed, hunting and egg predation, and effects

Table 2

*The number of Hammond Islanders interviewed that answered questions about particular themes and topics*

| Theme (based on interview questions)    | Answered  | Not answered                    |
|---|-----------|---------------------------------|
| Perceived need for local management     |           |                                 |
| Local status of turtles                 | 13        | 2                               |
| Causes of declines                      | 7         | 8*                              |
| Need for controls                       | 13        | 2                               |
| Management Options                      |           |                                 |
| Type(s) of controls that should be used | 8         | 7                               |
| Spatial closures                        | 7         | 8 (7 answered only for dugongs) |
| Quotas                                  | 13        | 2                               |
| Breeding season closure                 | 12        | 3                               |
| Sex limits                              | 12        | 3                               |
| Size limits                             | 11        | 4                               |
|   |           |                                 |
| Theme (based on discussions)            | Discussed | Not discussed                   |
| Cultural considerations                 |           |                                 |
| Flexibility for ceremonies              | 5         | 10                              |
| Cooperation at various scales           |           |                                 |
| Cooperation within the community        | 10        | 5                               |
| Cooperation amongst communities         | 5         | 10                              |
| International cooperation               | 2         | 13                              |
| Compliance with local level management  | 4         | 11                              |

\*Five of these participants did not think the local population of green turtles was declining and therefore were not asked about possible causes of declines.

on feeding grounds from pollution, but there was no consensus as to the relative importance of these reasons.

The perceived need for management mirrored the perception of the status of the green turtle population. About half of the respondents thought that management was needed. The remainder had a range of alternative views implying that management was not needed or would not be accepted. Nonetheless many respondents thought it would be good to have controls so that future generations could access turtles (and dugongs).

‘It’s good to have the taking of how much you take controlled so that in time to come there will be plenty for our future generations;’

‘If we just went along as we are I reckon there will be none left in the future.’

Another view was that management was not needed at all.

‘We don’t need a control for turtles because there are heaps up here;’

‘No we don’t need to, there’s all this piece going around to stop this thing, we don’t need to.’

Other participants thought that management would not be needed if hunters only took what they needed.

‘They really need to start to think about how to hunt, just like I said, take what they need not over-fish them.’

Finally, concern was expressed about the impact of management on culture.

‘I wouldn’t like a control because it’s our culture.’

### Management options

Although some hunters did not perceive a need for

management, we asked them to tell us their views on different controls, in the event that management was needed in the future. When asked to suggest controls that could be implemented by the community to look after turtles, quotas were suggested by more participants than other controls, including spatial closures, seasonal closures, size limits and turtle-farming. However, when participants were asked specifically about quotas, almost all participants who suggested them as a management tool admitted that some people would not want a quota system or would not be willing to abide by a quota system.

‘Some people might not want to have a permit system, but I think it’s a good idea.’

‘It’s good, but people have different ideas. Maybe just keep going. It would be hard to stop people.’

Although seven participants answered only for dugongs, about half of participants suggested that spatial management was an appropriate strategy and/or noted that it was already being used in the form of the dugong sanctuary, established by the Australian Government in 1986 in western Torres Strait, external to most community hunting areas. The remaining respondents identified problems with spatial management including (1) difficulties with enforcement, illustrated by the occurrence of hunting in the existing dugong sanctuary, (2) the challenge of incorporating cultural needs, and (3) the need to discuss the approach with the Council and elders.

‘That would be good if we had sanctuaries...and if you don’t hunt in the sanctuary then it gives them a lot more chance to survive and they’ll breed up more and you’ll have a lot more for future generations.’

‘I suppose you could do that (have closed areas), but you’d

have to put a marker and have people there all the time.’

A large number of green turtles migrate through the Torres Strait at breeding time, between August and November each year. This time, when the turtles are in courtship, is known locally as ‘turtlefast’. We asked participants specifically whether they thought there should be a temporal closure on turtle hunting during turtlefast. There was approximately equal agreement that there should not be a closure during turtlefast or that at least part of the turtlefast season could be closed to hunting.

‘...I reckon maybe when they’ve got eggs in there they should limit it to half that breeding season.’

Reasons for not wanting to restrict hunting during turtlefast included the perceived very large impact on the community because hunting during turtlefast gave many ‘non regular’ hunters the opportunity to practise hunting, an important part of their culture, that they did not do at other times of the year.

‘That’s part of our culture, if you’re going to close that then that’s going to have a big impact.’

Another reason that people did not want to have a closure during turtlefast was that turtles were needed all year round because they are an important source of fresh meat, which is expensive to buy in Torres Strait. Marine turtle and dugong meat cannot be sold in Torres Strait and is shared around the family or community when turtles and dugongs are caught.

‘Dugong and turtle are fresh meat for us here so we need them all year round.’

Most respondents considered that sex-based limits on turtle hunting would not be an acceptable management option because people tend to catch female turtles and they did not think that there would be interest in catching male turtles.

‘...that won’t work because everyone catches females.’

The main reason given for preferring females was the taste, consistency and amount of fat. For example:

‘...we just catch female turtles...because of the meat, the taste is different, the female is more fat.’

Most respondents considered that people prefer large turtles and are unlikely to agree to take smaller turtles, although some Hammond Islanders do take *murai* turtles (i.e., large immature turtles). One of the main concerns was that small turtles were too small to share and sharing the catch is an important part of turtle-hunting. Some of the responses include:

‘...people want the adults. *Murai*, it will only be for say myself and the next door neighbour. People do catch them.’

‘...the big ones are better, there’s more fat, *murai*’s not much for sharing.’

## General discussions

During our discussions, issues about the process of developing and implementing community-based management plans emerged. About a third of participants suggested that management options would need to be flexible so that turtles would be available for cultural ceremonies and it would be impossible to predict annual numbers of certain ceremonies such as weddings and funerals.

The issue of intra-community co-operation was raised by two-thirds of participants. Three main perspectives were raised; first, it was noted that people within a particular community will have different ideas and they may not wish to participate in certain types of management, or even overall management, so it may be difficult to get them to follow the rules without enforcement.

‘...it depends what the community wants, some will agree, some will disagree, that’s the problem.’

Second, it was suggested that the Council and/or a group of Elders should guide the management process.

‘...sit down and talk to the old people, seek advice and gain advice from them so that way they can manage turtle and dugong for future generations...I think it needs to go through the Council and also have an elected body of elderly people sitting outside the Council to make decisions...’

Third, it was suggested that all of the hunters within a community should be brought together to discuss managing green turtles (and dugongs).

‘...you need everyone’s involvement, you need everyone to participate, I reckon that’s the answer, you need everyone on the island to participate... it comes down to everyone together, talking.’

The issue of co-operation among Torres Strait communities was raised by about one-third of participants. Similar to intra-community co-operation, there was uncertainty that neighbouring communities would abide by rules and it was suggested that everyone would need to be brought together to discuss and agree on management.

‘For something like that to happen, it’s got to come from the hunters themselves, get their input so in the end we have their decision.’

‘I reckon hunters should come together and have a meeting about this and have a talk because we’re all from Torres Strait...’

The issue of international co-operation was raised by only two participants who were concerned that any efforts by Torres Strait Islanders to manage green turtles may be counteracted by over-harvesting in countries with which the green turtle stocks are shared (e.g., Papua New Guinea, Indonesia, Solomon Islands). For example, one participant said:

‘If they’re taking them there and we’ve been trying to protect them it’s not going to do any good because they’re taking them all the time.’

The issue of enforcement was associated with co-operation, and a third of participants raised perceptions including that controls would be difficult to enforce, both within the community and among communities and that involvement from the government might be needed.

‘...well I suppose the only way you can do it is by law, but all of the Islands, all Islanders, would have to agree and importantly it would need to be in black and white with the government and not only the government, but the tribal people.’

‘Well the government should be able to fund it or do something if they want to push it and they want to patrol on limits and size and all that and patrolling areas there shouldn’t

be any problem about it because it's part of protecting species really.'

## DISCUSSION

The attitudes expressed by Hammond Islanders in regard to management suggest that co-management will be a more appropriate approach for managing green turtles in the Torres Strait than either community-based management or government-driven management. Community-based processes, such as applying cultural norms to tools to achieve compliance and enforcement within the community and consensus-based decision-making within the community in regard to applying more formal rules, were considered to be important. However, the need for co-operation with other communities and stakeholders across scales was also recognised, particularly in regard to achieving enforcement.

### Community cohesion

We found there was weak consensus surrounding both (1) the need for management and (2) the attitudes towards the appropriateness of various management tools for the community to incorporate into any co-management plans. However, there was strong consensus that there is no perceived crisis in the local green turtle stock. A conservation crisis is often cited as a pre-condition for successful co-management (Fernandez-Gimenez *et al.* 2008, Campbell *et al.* 2009). However, Campbell *et al.* (2009) also suggest that engagement in co-management may be based on perceived threats that are independent of stock status, such as the threat of fisheries closures. Indeed, during the development of our community catch-monitoring project in 2004, Hammond Islanders were concerned that management may be imposed on them because of statements by ministers of the Australian Government in the media that the green turtle and dugong fisheries may need to be managed by the government. At this time, Hammond Islanders we spoke to perceived that if their fisheries were well regulated by them, they would be better able to withstand outside scrutiny and it would be less likely that management would be imposed. Therefore, an incentive for Hammond Islanders to engage in co-management may be to avoid having management imposed. Further, given the strong cultural connection of Hammond Islanders to green turtles, those Hammond Islanders that did perceive a need for management may be concerned about the resultant cultural loss if green turtles were to become locally extinct.

In contrast, tensions between communities that use the same resources may make them reluctant to engage in co-management (Fernandez-Gimenez *et al.* 2008). Although not completed at the time of this study, the Kaurareg Traditional Owners, along with seven other communities, were being supported by the Australian Government through the Torres Strait Regional Authority to develop community management plans for marine turtles and dugongs. The Kaurareg plan was to be developed for the Kaiwalagal and therefore included the area

in which Hammond Islanders hunt. There may have been some reluctance amongst Hammond Islanders to cooperate with the Kaurareg, perhaps because, as with other local communities (e.g., Berkes *et al.* 2001), there are inter-nation differences in traditional practices and Hammond Islanders may not have felt adequately included in the development of the plan. Fernandez-Gimenez *et al.* (2008) suggested that strained relationships or a reluctance to communicate or co-operate amongst neighbouring communities that shared the same resource posed barriers to formalising resource management plans for Beluga whales in Alaska and livestock in Arizona. It may be important to investigate the relationships between the Kaurareg Traditional Owners and other Kaiwalagal communities to determine if barriers to developing a co-management relationship exist.

Wilson *et al.* (1994) pointed out that traditional local communities usually used fisheries management systems that control the how, when and why of fishing, rather than the number of fish caught. The results of our study are consistent with this suggestion; however some social and cultural issues may preclude some of the management strategies commonly used by other traditional local communities. Our analysis suggests that while the Hammond Island community may consider some management tools, such as quotas and spatial management, appropriate to incorporate into co-management plans, there was strong consensus that others, such as seasonal closures, and sex/size-based limits, were inappropriate.

Quotas are the predominant management tool used in Australian and indeed most centralised western fisheries management systems (Wilson *et al.* 1994; Berkes *et al.* 2001). However, quota-based management has typically not been used by communities to manage small-scale/local traditional resources (Wilson *et al.* 1994). The perception of at least some Hammond Islanders that a quota system could be a good tool to manage their turtle fishery may reflect a familiarity with commercial fisheries in the Torres Strait, all of which are now managed using log books and a quota system. However, their assertion that it would be difficult to get hunters to comply with a quota system suggests that such a system would be challenging to implement, particularly with respect to fulfilling cultural obligations such as ensuring that turtles are provided for ceremonies. One way around this dilemma could be to set quotas for turtles for everyday food, or *Kai Kai*, while making less predictable cultural events, such as funerals, quota-exempt.

Spatial management is increasingly used in centralised western management systems as the primary tool to achieve ecosystem-based management (Lubchenco *et al.* 2003). This approach aims to protect the ecological characteristics of the system that are linked to growth, reproduction, migration, hierarchy, and predation of species rather than individual species protection or maintenance of the size of the populations (Wilson *et al.* 1994). Spatial management is also the predominant strategy used traditionally by local communities for fisheries management (Wilson *et al.* 1994). Although marine turtles are migratory species, spatial management may be an appropriate tool, particularly if used in combination with



other tools. This is because (1) turtles are resident in foraging areas for decades (recruitment at about 5 years and maturity at about 35 years), (2) large adult females are the most sensitive life-history stage and females do not breed each year; mean breeding intervals are around 6 years, hence most of their lives are spent at the foraging areas, and (3) green turtles in Australia show strong fidelity to particular foraging areas and individual home ranges are typically in tens to hundreds of kilometres squared. Therefore, if adequately planned, spatial closures minimise the risks to marine turtle populations because they can protect turtles for a large proportion of their life. We found that although some Hammond Islanders thought that spatial closures would be an appropriate management tool for their community, the difficulties associated with enforcement were seen as a barrier. The existing dugong sanctuary has not been enforced by the management agency (Kwan *et al.* 2006) and perceived difficulties associated with enforcement may be derived from this lack of enforcement. In addition, Wilson *et al.* (1994) found that in many traditional societies, territorial areas belonging to communities have often been used to retain resources for community use and to exclude outsiders. Hence some Hammond Islanders may perceive spatial management to be an appropriate management tool because they do not wish to forego access to any of the resources in their sea country. However, this may be difficult because much of their hunting area is shared with other communities.

Seasonal closures, particularly during the breeding season, are another tool commonly used by traditional societies to manage fisheries (Wilson *et al.* 1994). Although some Hammond Islanders could see the benefits of enabling the turtles to breed, social and cultural factors (e.g., practising hunting and sharing) appeared to preclude the widespread agreement of stopping or limiting the turtle harvest during the breeding season. In contrast, some of the turtle and dugong co-management plans developed by other communities include limits on harvesting during the turtle breeding season (Marsh 2009). This difference may be related to differences in preferences for adult female turtles between communities in the Kaiwalagal (see below) and in some other communities.

As mentioned above, Hammond Islanders appear to have a strong preference for adult female turtles because they are big enough to share and are considered to have a superior taste to smaller turtles or male turtles. The sex ratio of both the southern and northern Great Barrier Reef foraging populations of green turtles in Queensland is around 2:1 in favour of females (Limpus 2009). Thus we might expect indigenous hunters to catch more female turtles than males. However, the prevalence of females in the catch far exceeds the sex-ratio in the population. All but one of the turtles reported in our catch-monitoring project for which sex was recorded was female (Grayson unpublished data), which suggests a preference for female green turtles. Population models demonstrate that larger turtles are the most important to protect for the population to grow and that more animals overall could be taken if males and younger turtles are taken in addition to, or even in replacement of, large females (Chaloupka & Limpus 2005). However, social

and cultural factors are likely to preclude the use of sex-based or size limits for managing marine turtles in the Hammond Island community at present.

### Cooperation at various scales

Our data suggested that hunting of green turtles by Hammond Islanders is based on cultural norms at the community level. For example, the suggestion that hunters should take only what they need is a type of norm or guideline motivating people to voluntarily limit their harvest (Wilson *et al.* 1994; Fernandez-Gimenez *et al.* 2008). This type of recommendation is different from a community or government specifying the amount of a species that can be taken by imposing a quota (Wilson *et al.* 1994). However, in discussing the use of more formal controls, Hammond Islanders indicated that consensus within the community would be needed. Consensus decision-making is a common feature of many local communities, but often requires a large investment of time (Berkes 1994, Fernandez-Gimenez *et al.* 2008) and therefore may prolong the development of formal management plans. Indeed, the development of turtle and dugong co-management plans by eight other Torres Strait communities has taken several years partly because of the dual need to incorporate both cultural norms and more formal management rules.

Silver & Campbell (2005) suggested that participation by fishers in research may have implications for changes in government policies or community actions. Our survey was undertaken in the context of informing community-based management. The Hammond Island community was participating in a broader dugong and marine turtle monitoring project because they considered that having information and their views recorded would put them in a good position when negotiating management arrangements for marine turtles and dugongs in the future, and for gaining opportunities to be involved in monitoring and management activities. Thus, the outcomes of our study should assist the Hammond Island community in articulating their views with respect to co-management of marine turtles and dugongs to co-ordinating bodies such as the Torres Strait Regional Authority. The rights of indigenous Australians to hunt marine turtles for non-commercial purposes and the progress made towards co-management in recent years suggest that it is unlikely that the participation of Hammond Islanders in our study would lead to changes in government policy that would have a negative impact on the Hammond Island community. However, the outcomes of our study could encourage the development of community-based management plans in the Hammond Island community, or participation of Hammond Islanders in the development of broader plans, such as the Kaurareg Plan, which may negatively impact those hunters that do not think that management is necessary. It will be important, therefore, that hunters continue to be involved in any development of co-management affecting their community.

As discussed above, Hammond Islanders share their local

green turtle stock with neighbouring Kaiwalagal communities, other Torres Strait communities, and communities from the Northern Territory to southern Queensland within Australia and from Indonesia, southern and eastern Papua New Guinea, Vanuatu and New Caledonia. In addition to community-level considerations, some Hammond Islanders recognised that efforts to conserve marine turtles at the community level may be counteracted by the actions of other groups at larger scales (Berkes 2005). Concern about the impact of the Papua New Guinean and other overseas harvests on the management efforts of Torres Strait communities, and the need for effective collaboration, is common among communities in Torres Strait and has been expressed repeatedly in the workshops we have conducted with Torres Strait Islanders (Hamann *et al.* 2006, Marsh 2009). The development of co-management partnerships across these various local, regional, national and international scales is likely to be a suitable mechanism to obtain agreement from other communities to manage their harvest, as well as to enforce rules across scales. In addition, the cross jurisdictional complexities entail that government, in addition to communities, will need to be included in these partnerships. Thus a hierarchical approach to co-management is likely to be needed for managing green turtles, and dugongs, in the Torres Strait, because this social-ecological system crosses multiple scales and therefore requires governance at multiple levels (Olsson *et al.* 2004; Folke *et al.* 2005; Berkes 2006). Community-based management at the level of individual communities will need to be co-ordinated among communities at various levels including regional Torres Strait, the whole of northern Australia, and international management arrangements with neighbouring countries such as Papua New Guinea, Indonesia, Vanuatu and New Caledonia.

Bodies to provide such coordination already exist. In Torres Strait, the Torres Strait Regional Authority is a strong regionally-based indigenous organisation that has coordinated the development of eight community-based management plans for marine turtles and dugongs and is now coordinating their implementation, as well as broader sea country management. This coordinating role of the Torres Strait Regional Authority, which is an Australian Government Statutory Authority, has been the strength of the situation in Torres Strait. Although similar statutory authorities do not exist in other regions in Australia, some (non-statutory) Land Councils have also played an effective co-ordinating role in land and sea management (e.g., Kimberley Land Council). In Torres Strait, co-ordination with Papua New Guinea could occur through the Protected Zone Joint Authority, which includes representation from the Australian Government, Queensland State Government and the Torres Strait Regional Authority. The Protected Zone Joint Authority is responsible for managing commercial and traditional fisheries in the Australian area of the Torres Strait Protected Zone and designated adjacent Torres Strait waters. Co-ordination with other neighbouring countries such as Indonesia and Pacific Island nations could occur through agreements and organisations such as the Secretariat for the Memorandum of Understanding on the Conservation and

Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (ISOEA) and the Secretariat for the Pacific Regional Environment Program (SPREP).

## CONCLUSION

Although the right of Torres Strait Islanders to hunt green turtles is protected, the geographic extent of the stock they use means that, in addition to community-based management within their communities, they may benefit from engaging in new management approaches such as co-management at larger scales. The Australian Government, through agencies such as the Torres Strait Regional Authority, could provide assistance in co-ordinating among communities at a hierarchy of scales (Agrawal & Gibson 1999). In addition, statutory arrangements that protect the access rights of resource users mean that government may also benefit from engaging in such partnerships (Berkes 2005). Native Title rights mean that both the Australian national and sub-national governments have limited capacity to act unilaterally unless there is a severe crisis in the stock, hence governments are likely to benefit from the outcomes of the partnership in which community access and responsibility result in the protection of the resource because communities have a vested interest in such protection (Havemann *et al.* 2005). Establishing co-management arrangements across local, regional, national and international scales for marine turtles should also have implications for the management of other traditional shared resources in the Torres Strait, particularly dugongs.

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