

Turtle and Dugong Catch Monitoring Workshop Report

Friday 9 May 2003, Saturday 10 May 2003

Port Kennedy Hall, Thursday Island



National Oceans Office



Summary

All species of marine turtle and dugongs have a high conservation value. Torres Strait Islanders and other indigenous people of Australia and the Pacific have traditionally hunted turtle and dugong and as such this activity has important cultural significance as well as being a major source of protein in their diets. Yet management of these resources has historically been hampered by inadequate information on both the catch and biology of the species.

The objectives of the workshop were to develop one or more methods to monitor the traditional catch of turtles and dugongs in the Torres Strait (and elsewhere) that: provides the data required by management; is cost effective; provides accurate statistics; is culturally appropriate; and as much as possible has a life of its own. Although this workshop was specifically focused on developing a monitoring program for the Torres Strait it was hoped that any techniques developed would be largely transferable to other regions.

A dugong and turtle catch monitoring program operated in the Torres Strait from 1991-2001. A frame survey methodology was applied with observers monitoring the catches in individual communities for periods from 3-5 days. A second program also existed where school children recorded the catches in their communities. The success of these programs was limited, attributed largely to sampling bias but also a lack of precision, particularly at the level of individual communities.

Presentations were given by traditional hunters, experts in turtle and dugong biology, and resources managers from Torres Strait, Queensland, Northern Territory, Papua New Guinea, Vanuatu, Solomon Islands and SPREP, based in Western Samoa. Following these presentations separate dugong and turtle discussion groups identified and ranked the information requirements for their respective species into essential, desirable or optional monitoring activities. Other important considerations raised included the need to involve indigenous operators in meaningful paid activities, the importance of extension of results, awareness of cultural sensitivities and the need for the program to be ongoing.

Workshop Proceedings

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Introduction

The Australian Fisheries Management Authority (AFMA) and the National Oceans Office (NOO) jointly sponsored a technical workshop on methods to monitor traditional catches of dugong and sea turtles in Torres Strait and adjacent coastal areas of Queensland, Northern Territory and Western Pacific nations. The workshop was held on 9-10 May on Thursday Island.

The waters of the Torres Strait are internationally recognised as strongholds for dugong and turtle populations. The region is home to 6 of the 7 species of marine turtles in the world and has important nesting sites for the green, hawksbill and flatback turtles. The area is recognised as having some of the most important dugong habitat in the world and supports one of the world's largest dugong populations.

Both dugong and turtles are considered to be “charismatic megafauna” and as such have a high conservation value throughout the world. Internationally, turtles and dugongs are recognised as being vulnerable to extinction. Both dugongs and turtles are protected species under the Queensland Nature Conservation Act 1992 and the Environment Protection and Biodiversity Conservation Act 1999 which restricts the commercial sale of dugong and turtle products.

Turtle and dugong hunting is important in Torres Strait Islander culture as well as providing a major source of protein to communities. As such the people of the Torres Strait region place a high value on the sustainability of these stocks. Both dugong and turtle are hunted as part of the traditional way of life and livelihood, which is protected by the *Torres Strait Treaty*. Both fisheries were listed as Article 22 fisheries under the Torres Strait Treaty between Australia and New Guinea. Accordingly Australia and PNG negotiated subsidiary conservation and management arrangements in respect to those fisheries. These arrangements specify that the dugong fishery is a traditional fishery in both countries, where the dugongs may only be taken for traditional and customary purposes. The turtle fishery is a traditional fishery in Australia and an artisanal fishery in PNG which also affords traditional inhabitants the rights to sell turtle products in the local communities.

Dugong abundance has been estimated in Torres Strait and the adjacent coastal areas of the northern Cape York Peninsula (NPA) and Western Province on four occasions (1987, 1991, 1996, and 2001) using aerial survey techniques developed by Helene Marsh and her colleagues. Additional studies on dugong biology from Queensland, Torres Strait and Western Province have provided estimates of key biological factors that in combination with the estimates of abundance have been used to determine estimates of sustainable harvest levels using the Potential Biological Removals method (PBR). The results of these analyses clearly indicate that dugongs are being over-harvested in Torres Strait and the adjacent coastal areas. It is possible that as many as 10 times the sustainable number of dugongs are being taken.

There are no equivalent data for marine turtle species in Torres Strait. This fact stems from the more complicated life histories of some turtle species and also the fact that the aerial survey methods applied to dugongs are not equally well suited for marine turtles. However, there is evidence from nesting beach censuses that some species of turtles are also likely to be over-harvested at some point in their distribution (not necessarily locally in Torres Strait).

The limitations of the data on turtle and dugong catches, geographic ranges of stocks, and population sizes in the Torres Strait has been a major stumbling block for managers trying to get an unambiguous message about the state of these resources across to the communities.

Workshop Objectives

The objectives of the workshop were to develop one or more methods to monitor the traditional catch of turtles and dugongs in the Torres Strait (and elsewhere) that:

- Provides the information required by the communities and management
- Is cost effective
- Provides accurate statistics
- Is culturally appropriate; and
- As much as possible has a life of its own ie. Has its own budget and staff to ensure its continuation.

As the ranges of turtles and dugongs extend well beyond the Torres Strait region it was considered that many aspects of a monitoring program that would work in the Torres Strait would be largely adaptable to other areas of Australia and the south western pacific. It was also considered that experiences and expertise across northern Australian and the south west Pacific could be used to assist in designing a monitoring program for the Torres Strait. Having monitoring programs in different areas collecting data that has been identified as essential in this report will provide for good data exchange and many ancillary benefits to management turtle and dugong stocks.

Acronyms

AFMA	Australian Fisheries Management Authority
CSIRO	Commonwealth Scientific and Industry Research Organisation
CDEP	Commonwealth Development and Employment Program
DBIRD	Department of Business, Industry and Resource Development
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
GBR	Great Barrier Reef
GBRMPA	Great Barrier Reef Marine Park Authority
JCU	James Cook University
NTSC	Northern Territory Seafood Council
NGO's	Non Government Organisations
NHT	Natural Heritage Trust
NOO	National Oceans Office
NPA	northern peninsula area (northern Cape York)
NT	Northern Territory
NTPWS	Northern Territory Parks and Wildlife Service

PNG	Papua New Guinea
QLD	Queensland
QP&WS	Queensland Parks and Wildlife Service
SPREP	South Pacific Regional Environment Programme
TED's	Turtle exclusion Devices
TO's	Traditional Owners
TSRA	Torres Strait Regional Authority
WSB	Wan Smolbag-community theatre group
WWF	World Wildlife Fund for Nature

Workshop Agenda

The following agenda was established to give all participants of the workshop the opportunity to present relevant material. The flow of discussion was not limited to this structure.

1. Opening comments (AFMA NOO) – Why we are here and what we hope to achieve.
2. Helene Marsh – Why accurate monitoring is vital for effective management
3. Presentation from Tim Skewes/ Robert Ware – Past monitoring Programs in the Torres Strait
4. Presentation from Donna Kwan – Monitoring dugong catches at Mabuiag Island
5. Presentation from hunters (Toshio Nakata) – monitoring from the hunters perspective
 - Acceptable practice
 - Accuracy of the information
6. Monitoring in other parts of Australia and southwest Pacific
 - Keith Saalfeld (dugongs - NT)
 - Nanikiya Munungurritj/Rod Kennett (indigenous management of turtles - NT)
 - Tony Stokes (GBRMPA – turtles and dugong)
 - Col Limpus (turtles)
 - Ian Bell (turtle research in indigenous communities in Qld)
 - Samuel Antiko (turtles and dugongs - PNG)
 - George Petro (turtles - Vanuatu)
 - John Pita (turtles - Solomon Islands)
 - Job Opu (turtles – PNG)
7. What data needs to be collected for:
 - Dugong
 - Turtle
8. Open forum on ways to go forward
 - Ideas , Funding (NHT, CDEP), Training monitors

Turtle and Dugong Monitoring

Format of Report

The critical information contained in this report relates to addressing the workshop objectives. The presentations from participants provide useful background information that establishes the context with which management must occur and largely justifies the prioritisation of information requirements.

For this reason the format of this report does not follow the agenda of the meeting. The outcomes of the workshop are discussed upfront followed by a brief summary of the presentations to provide the background information.

General Discussions

It was important to get an outcome from the workshop that identified the data requirements for successful management of turtle and dugong stocks. It would then be desirable to determine the most appropriate ways of collecting this information.

Why do we need the data from a monitoring program?

From a management perspective:

- We currently have the analytical tools for assessing stocks and making informed management decisions but we generally do not have the necessary information.
- Accurate data is a requirement in all fisheries under the EPBC Act and will greatly aid in passing strategic assessment.

From an Traditional Inhabitant or resource users perspective:

- Need to know how much is out there so we can determine how much can be taken
- Communities need to be involved

Why should we monitor turtles and dugong?

- In order to conserve the species
- To maintain the traditional link between traditional inhabitants and the species
- To empower communities to manage their use of the species and their habitat

The information required from a monitoring program are quite different for turtles and dugongs. The workshop was split into two groups depending on where peoples specialist knowledge and interests lay. Each group was tasked to determine what information could be collected from a monitoring program, and to prioritise that information into essential, desirable and optional categories. The following table details those requirements identified and gives a brief insight into the reason for their classification

TURTLES

Essential Monitoring Activities

- Estimate the number (by species) of turtles taken for the whole of the Torres Strait - obtaining an estimate of the take is essential to determine if the catch is sustainable. This estimate needs to differentiate between species as each have different population dynamics. Catch estimates should include the whole area including the inner islands (Thursday Island, Prince of Wales, Horn, Hammond), the NPA communities and western Province of PNG.
- Estimates of bias and precision of catch estimates – catch estimates need to be statistically defensible in order to be useful. If the estimates of catch are too imprecise or overly biased their usefulness for management is limited. Good survey design and training of monitors was identified as being integral to increasing precision and reducing the bias of estimates.
- Monitor size of turtles – The preferable method of measurement is the curved carapace length although accurate measurements of other body parts can be measured to indicate curved carapace length.
- Estimate the number of hawksbill turtle eggs harvested – Data on egg harvests of all turtles is possible however for hawksbill turtles this information is essential as the harvest of hawksbill turtles in Torres Strait is one of the major threats to this species. It was also seen as important to try to restrict the take of hawksbill eggs. The sustainable loss limit for hawksbill turtles eggs, estimated by Col Limpus, is approximately 600 clutches per year for the northern GBR stock. This figure includes loss to pigs and other feral animals.
- Continue the ongoing green turtle nesting monitoring at Raine Island. The northern GBR stock of green turtles is showing evidence of being in the early stages of decline. The breeding population of green turtles on Raine Island has been subject to a long-term monitoring program and it was considered essential that this monitoring continue. Monitoring includes tagging turtles; measuring curved carapace length; counting, weighing and measuring eggs; measuring sand temperatures (will hatchlings be male or female?); and hatching survival rates.
- Monitor nesting for hawksbill and flatback turtles – Regular monitoring sites need to be established for both hawksbill and flatback turtles. The Torres Strait has significant nesting sites for both of these species although to date monitoring of nesting sites has been opportunistic and sporadic. Crab Island is seen as possibly the optimal site for monitoring flatback turtles and Sassie Island would be a possible site for hawksbill monitoring
- Gonad assessment – Assessment of the gonads of turtles can be used to determine the sex of turtles, the maturity (adult or immature) and the breeding status (whether this is the turtles first breeding season or if it has breed previously). Gonad assessment can occur both on harvested animals and also by using laparoscopy on animals taken and returned alive. Assessments on harvested animals is relatively simple and could easily be incorporated into a monitoring

program involving traditional inhabitants Where possible this examination should occur on all animals observed by monitors. Laparoscopy is a much more involved process and requires significant equipment, resources and highly trained personnel. The use of this type of examination would not be as extensive but is essential to get information from animals that are not regularly harvested.

- Genetic testing of turtle populations in areas other than Torres Strait – Genetic testing of turtle populations is used to determine the movement of turtles between nesting and feeding grounds, to determine the degree of mixing of populations and to aid in setting appropriate management strategies. Study on the genetics of Torres Strait turtle populations is relatively advanced, although in other areas very little is known about the genetic makeup of stocks.
- Collecting and returning data from tagging programs – Information from tagging programs is used to determine how many turtles there are, if the population is increasing or decreasing, the proportion of adults to juveniles, the proportions of males and females, where turtles are going to nest, how often they are laying eggs and if they are staying in the same areas to nest and feed. A large amount of resources are used to tag turtles and it is therefore very important that information is gathered on captured tagged turtles.
- Monitor sources of mortality unrelated to hunting – Sources of mortality unrelated to traditional harvest potentially have a large impact on the stock. Gaining information on these mortalities may allow the implementation of other management arrangements that can aid in sustainability of turtle and dugong populations. The use of turtle exclusion devices (TED's) is one example of these measures.

Desirable Monitoring Activities:

- Develop green turtle monitoring sites at Bramble Cay and Mer Island – Due to evidence of stock decline and the amount of harvest of green turtles in Torres Strait it was considered desirable by workshop participants to extent the current Raine Island monitoring program to other important green turtle nesting sites in the Torres Strait.
- Estimate the number of flatback turtle eggs harvested – Some gathering of flatback turtle eggs occurs in the Torres Strait although it is not as common as is for hawksbill turtles. Significant pig predation also occurs. Studies by Col Limpus have estimated sustainable loss limit for flatback turtles eggs to be approximately 450 clutches per year which includes loss to pigs and other feral animals.
- Monitor turtle feeding populations (Rodeo) – The turtle rodeo is used to monitor turtles that are at their foraging site. This includes adult male turtles, non-breeding adult female turtles, pubescent turtles and juvenile turtles.
- Environmental factors such as weather, El-Niño, seagrass dieback etc – It was considered there was a need to gain some information on environmental factors that could aid interpretation of monitoring results. The type and amount of data to collect needs further discussion.

Optional Monitoring Activities

- Monitor catch effort – Stock populations of most fisheries around the world are monitored using catch per unit effort data. Due to the complexity of collecting this information for turtle and dugong fisheries it was considered an optional data requirement
- Conduct research on hatchling production to increase survivorship – Projects have been undertaken in the past to increase the survivorship of hatchlings by techniques that included moving clutches from areas where survival chances were restricted, or encouraging collection of eggs from unproductive areas rather than areas where survivor rates would be higher. There was much benefit seen in doing this work although it is very labour intensive and was thus considered optional. [Note: GBRMPA & others have concerns about this process, called ‘headstarting’. There’s no guarantee it assists post-release survivability as migratory cues may be disrupted.]
- Genetic testing of Torres Strait populations – Much of the genetic study of turtle stocks in the Torres Strait has already been completed and scientists have a good understanding of stock relationships in the area. There is a need to get this information out to the Torres Strait Islander community

DUGONG

Essential Monitoring activities

- Estimates of total catch over the whole of the Torres Strait (including PNG, NPA) – Using the potential biological removal method we can estimate the sustainable catch level for dugong in the Torres Strait is between 100-200 but we currently have little knowledge of the current take. Catch estimates should include the whole area including the inner islands (Thursday Is., Prince of Wales, Horn, Hammond), the NPA communities and western Province of PNG.
- Estimates of bias and precision of catch estimates – catch estimates need to be statistically defensible in order to be useful. If the estimates of catch are too imprecise or overly biased their usefulness for management is limited. Good survey design and training of monitors was identified as being fundamental to increasing precision and reducing the bias of estimates.
- Estimates of relative abundance from aerial surveys using Islander observers – Since 1987 aerial surveys have been used in the Torres Strait to estimate the size and distribution of the dugong population. At present this is the best available method for estimating the abundance of dugong. Using traditional inhabitants as observers will give them some insight into the process and hopefully promote higher community acceptance of the results.
- Information on distribution at spatial scales – This information can largely be obtained from aerial surveys. An attempt will be made by researchers to coordinate future aerial surveys throughout the region to get a better estimate on total abundance and on the migration of animals between management zones.

- Biological information on catch (size, sex, pregnancy, lactating, visual assessment of body condition) – with adequate training traditional inhabitant monitors can be trained to collect basic biological information on dugongs. The important information to be collected is the size (preferable total length but conversions are possible for measurements of other body parts), sex, pregnancy, lactating and a visual assessment of body condition.
- Genetic analysis of dugong populations in areas other than the Torres Strait – Work on the genetics of dugongs in Torres Strait has been performed or is currently being undertaken however there is some scope for similar projects to be undertaken in other areas of Australia and the western Pacific
- Monitor sources of mortality not related to hunting - Sources of mortality unrelated to traditional harvest potentially have a large impact on the stock (in the Borroloola region 42% of dugong mortality was attributed to causes other than traditional harvests). Gaining information on these mortalities may allow the implementation of other management arrangements that can aid in sustainability of turtle and dugong populations
- Collect details of hunt and hunters – When collecting information on dugong catch it is important to collect a degree of basic information relating to the hunt. Examples of this important information include the date, time, method used, weather conditions, length of hunt and reason for hunt.

Desirable Monitoring Activities:

- Absolute estimates of abundance – An estimate of absolute abundance is required to estimate sustainable catch limits as an input into the potential biological removal model. Absolute estimates of abundance have been performed for the 2001 aerial survey after correcting relative estimates for possible sampling biases. In this case estimates of absolute and relative abundance are very close making the extra calculation not essential but still desirable. However as an absolute estimate can be obtained for very little work it is strongly recommended that this work be performed in the future.
- Higher level biological information on catch – This includes information on tusks for age determination, genetics and fat sampling to determine body condition, heavy metal concentrations etc. Collection and analysis of this level of information requires a higher level of training and expertise than can be easily given to traditional monitors. Although this information is useful it is not essential and could be collected opportunistically rather than on every specimen sampled
- Monitor seagrass communities at key dugong habitats and link with dugong condition – The key seagrass communities to monitor are the deep water seagrasses west of Norman Reef.

Optional Monitoring Activities

- Collection of reproductive organs and stomach contents for laboratory examination - Although this information is useful it is not essential and could be collected opportunistically rather than on every specimen sampled.

- Study dugong movement and habitat using satellite tracking – this is a very expensive procedure that has been done in the past and would provide little new information to justify its establishment costs, however it is a way of involving the community in research and would have significant educational benefits

Other Issues Raised

- Communities need to be involved in the process. Greater community ownership of a program is likely to lead to higher levels of involvement, more complete and accurate information gathering and greater uptake of program outcomes. This would involve, where possible, traditional inhabitants participation in the monitoring.
- Local observers need to be trained and employed as part of the program. Involvement of Indigenous people in research and monitoring programs is increasingly seen as an alternative source of employment and income in remote communities. Remuneration for work performed, especially where the work is sporadic/seasonal and where a significant degree of independent and unstructured work is required, is an issue. Rod Kennett and Nanikiya Mununngurritj identified the Northern Territory model of establishing ranger organisations to co-ordinate and run monitoring activities as a preferential method of achieving these objectives. It was proposed that the investment of time, money and energy in an Indigenous ranger program in the Torres Strait would be a wise investment.
- Monitors need to be involved in more than just monitoring of their own catch. Indigenous people want to be meaningfully and actively involved in other monitoring activities that need to be developed or continued to provide adequate data for turtle and dugong management in Torres Strait. These activities include most (if not all) of the activities listed in the above table. The key message is that catch monitoring needs to be developed and implemented in a holistic way in the broader context of Indigenous management of marine resources.
- Monitors need to be adequately compensated for their time in order to provide good data and to ensure some continuity of personnel to the program. Without adequate pay, trained and effective monitors will be enticed away to other areas where their skills and time are more highly valued.
- The community needs to be educated on issues relating to turtles and dugongs in an appropriate way. This could involve using the monitors to communicate with their individual communities or by holding community meetings where information can be properly disseminated. Regular and timely feedback needs to be provided to the communities regarding the results of the monitoring program.
- Traditional knowledge should be documented. This ought to include documentation of traditional management techniques, knowledge of hunting grounds, cyclical movements of animals, and any other knowledge that traditional inhabitants are willing to share. This information should be used in conjunction with modern science in managing turtle and dugong resources.

- Annual catch monitoring workshops should be held. An annual catch monitoring workshop would bring together all monitors to provide and receive feedback on the program, refine aspects the project, provide further training to monitors and to maintain levels of enthusiasm about the program.
- One possible method of counting the number of turtles and dugongs taken would be to hold body parts. This technique has proved successful for turtle counting in the Northern Territory and it is possible to estimate the size of turtles or dugong from measuring body parts. This would aim to give a total count of animals taken and could possibly be used to verify results from a sampling program. It was noted that this technique would only work if it was culturally appropriate to collect these body parts and that this technique would not provide for estimates of precision and bias.
- It would be essential to establish a reliable community contact point. This would provide an avenue for monitors to pass on information and for feedback of results. This contact could be based at AFMA or TSRA and would have the role of administering the whole monitoring program.
- There is a need to be aware of culturally sensitive issues for example issues in the Torres Strait with night time monitoring.
- The idea of the monitoring program needs to be introduced through the community elders and community council in order to promote community ownership of the program.
- It would be useful to use local terms (names) in a monitoring program. Peter Yorkston detailed some of the common names used for turtle and dugong in the Torres Strait.
 - Warukus – Turtles from dinner plate size up to approx 30-50 cm (western Islands)
 - Muri – medium sized turtles 40-90 (western Islands)
 - Waru – the largest turtles – mature breeding females (western Islands)
 - Dhangal – Traditional name for dugong (western Islands)
 - Deger – Traditional name for dugong (eastern Islands)
 - Nam – Traditional name for green turtle (eastern Islands)

Monitors could be in charge of collecting data on wildlife stranding and mortality reports. They could also give out monitoring sheets similar to the ones used in Queensland (see attached example) to encourage community members to record incidental mortality of dugong and turtles.

Conclusions: Where to from here?

A range of follow-up activities is required to further develop the ideas discussed in the workshop. Coarse calculations on the cost of a program with one full-time project coordinator monitors operating in 17 Island communities covering 20% of the effort (approximately 70 days per year) would be \$540 000. If areas on the PNG side of the Torres Strait are to be included (the preferred option) then costs would increase significantly beyond this. Possible sources of funding to operate such a program will be investigated. There is a possibility to get some funding from NHT2, or from NGO's, however both these sources of funding have a limited life and probably more

appropriate to use for initial set up costs, training of monitors and initial operating of the program. Eventually it is important to get some form of core funding for this program to ensure a long-term commitment.

It is recognised that during any monitoring program such as this there is a degree of “slack time” during monitoring when there is little activity. A number of other activities can be identified that monitors could be involved in during days when the catch of turtle and dugong is not high. As such tasks could be prioritised, with counting and taking biological measurement of the catch receiving the highest priority, and other tasks like removing marine debris, counting turtle tracks etc receiving a lower priority. Identifying such activities will be a matter for further consultation with the communities and researchers.

A round of consultation will be occurring with the communities of the Torres Strait discussing the outcomes of this workshop. As stated many times in this report it is essential that this program has the full support of the communities and is meeting an identified need from their perspective.

There is a need for a follow up meeting with possible attendees including Charis Burridge, Tim Skewes, AFMA, TSRA and Donna Kwan to discuss the most appropriate way of stratifying the sampling to increase the precision of estimates and to reduce sampling bias.

Sustaining populations of turtle and dugong in order to enable continued traditional hunting of these species is very important to all Australians, but especially Torres Strait Islanders and other Indigenous groups. Information on the catch and the biology of the species is crucial to effective management of the species in order to achieve the ultimate goal of sustainability. The monitoring program identified can achieve many of these aims and also have ancillary benefits including educating and transferring information to the communities, promoting awareness of sustainability issues and employment in remote communities

Helene Marsh is a Professor of environmental science from James Cook University in Townsville. Dr Marsh has been researching dugongs in Queensland and the Torres Strait now for over 30 years, and has conducted the aerial surveys of dugong populations in the Torres Strait since 1987. Similar aerial surveys have also been undertaken in other parts of Australia and overseas.

Changes in dugong distribution and abundance have been monitored using:

- 1. Catch per unit effort in shark nets for bather protection** (on the Queensland coast). - This analysis provided a good time series of data from 1962 – 1998. It is estimated that the dugong population in the area decreased at about 8% per annum over this time.
- 2. Aerial surveys** - Since 1987 aerial surveys have been used in the Torres Strait at approximately 5 year intervals to estimate the size and distribution of the dugong population. The surveys use standardised methods that correct for perception bias (the numbers that could be seen but were missed by the observers) and availability bias (the number that were not at the surface so could not be seen). The absolute abundance estimates for dugong in the Torres Strait are shown in the following table.

Year	Population estimate	Standard error
1987	13319	± 2136
1991	24225	± 3276
1996	27881	± 4720
2001	14061	± 2314

Dr Marsh noted that dugongs can take large regional scale movements at spatial scales of 100's of kilometres. The stimulus for such movements are unknown but may be partially explained by seagrass dieback. These movements make population trends difficult to detect except over long time frames. At present the best method available for estimating the abundance of dugongs is through aerial surveys.

The potential biological removal (PBR) technique can be used to estimate the sustainable catch of dugongs in an area. To apply this technique information needs to be gathered on the population size, and the maximum rate of increase of the population. A recovery factor between 0.1 and 1 is also applied depending on the status of the population. A recovery factor of 0.5 was applied to the Torres dugong population. This technique resulted in an estimated sustainable catch for Torres Strait of:

- Based on the 1996 population estimate: about 200 dugongs
- Based on the 2001 population estimate: about 100 dugongs

Based on the current available catch estimates from communities in the Protected Zone, the catch of dugongs in the Torres Strait is not sustainable. Catches have not been monitored in the PNG area or on the NPA or Inner Islands, and the harvest in these areas is likely to be substantial and will further exacerbate the problem.

In conclusion Dr Marsh shared some of the valuable lessons that she has learnt in her attempts at catch monitoring in the past. She considered that to be successful a monitoring program has to:

- Be supported by the local community
- Be culturally appropriate
- Train participants
- Protect native title rights of informants
- Provide regular feedback
- Be under the control of the relevant management agency

Helene also noted that researchers have an important role in monitoring design, testing and training of observers to collect biological and social information.

Agenda Item 3 – Traditional Fishing Monitoring Project 1991-2001 – Tim Skewes and Robert Ware

From 1991 until 2001 the CSIRO in conjunction with AFMA conducted a traditional catch monitoring project in the Torres Strait that concentrated primarily on catches of turtles and dugongs. Tim works for the CSIRO in Cleveland, Brisbane and was involved in analysing the data from the monitoring program and preparing the project final report. Robert Ware is a Torres Strait Islander who was employed by AFMA to conduct monitoring during 2000 - 2001.

The original project objectives were to:

- Describe and quantify the fishing activities in the 14 Island communities in the Australian area of the TSPZ, and estimate the catch and effort
- Develop an effective way to monitor the marine resources harvested by communities in the TSPZ to detect changes in the fishing pattern, catch levels and levels of seafood use in the Torres Strait.

The following table shows the main results from the surveys in terms of the numbers of turtles and dugongs caught over this period. A more complete analysis of the data collected can be found in Skewes, T.D., A.G. Kingston, D.R. Jacobs, C.R. Pitcher, M. Bishop, C.M. Burrridge, S. Lilly (2002).

Sample Period	Dugong catch (per year)		Turtle catch (per year)	
	mean	s.e.	Mean	s.e.
1991/92	1010	240	2410	250
1991-93	1226	204	2504	358
1994	860	241	2600	378
1996*	241	92	1896	445
1998*	287 [#]	131	1097	340
1999	692	150	1507	358
2000/01	619	134	1619	574

* Considered biased downward [#]Includes Donna Kwan's Mabuiag data

Methodology

A frame survey method was employed for the monitoring. Observers visited individual communities for periods from 3-5 days. Sampling in communities was essentially random but was constrained by scheduled airline flights. Observers estimated both the catch (numbers of turtles and dugongs) and fishing effort of the entire community for each day by carrying out interviews and monitoring important

landing sites. Other information recorded included biological information (size, sex) hunting methods, locations, vessel information, number of fishers, weather and tides.

Project Issues

For a number of reasons estimates of the catches of dugong and turtle made from the catch monitoring program are considered to be unrepresentative of true catches. This explains the large variations in the estimated catch of dugongs from 1226 in 1992 to 241 in 1996.

Precision and Accuracy

The workshop took time to contemplate the precision and accuracy of estimates. It is important that both these factors are considered when designing and reviewing a monitoring program.

The precision of an estimate is measured in terms of upper and lower bounds of the estimate and how wide these may be. For example the estimate may be a population size of 10,000 plus or minus 3000 (low precision) or it may be plus or minus 100 (high precision). In sampling it is possible to increase the precision of estimates by increasing the sample size. CSIRO estimated the precision that could be achieved at various sampling intensities. It was determined the most cost effective number of days to sample that would return meaningful results was approximately 200 days per year. A high relatively intensive sampling program was required to get satisfactory precision due to the large variation in catches. It was noted that precision of estimates could be increased by temporal and spatial stratification.

The accuracy of estimates is a measure of how close the estimate is to the true value. Estimates may be inaccurate if catches are not observed or if for some reason they are reported more than once. If estimates are consistently under or over the true value than the estimates are biased. Bias is often a result of poor survey design, although some elements of bias a very difficult to account for in designing sampling programs It is suspected that there was a good deal of bias in the catch monitoring estimates. Possible sources of bias include:

- Observer effectiveness – a lack of community support, many landing sites, and the different level of effort applied by various observers meant that it was difficult for observer to count every turtle and dugong landed over the sample period.
- Behavioural changes of fishers due to observer – hunters may choose not to go hunting (or to hunt more often) when observer were present in their community
- Biased distribution of sampling effort temporally – holiday periods were not as heavily observed as observers want to spend time with their families
- Observers in terms of the amount of training, level of support, recruitment retention and turn-over of staff, knowledge of traditions and customs and other less obvious factors.

Data from Outside TSPZ – one of the limitations of the sampling program was that it did not collect data from the inner Islands (Thursday Island, Hammond Island, Horn Island and Prince of Wales) the NPA (Bamaga, Seisa, New Marpoon, Umagico, Injino) and from the PNG area. In many ways data from these areas is much more difficult to collect due to the multitude of landing sites and the difficulties in covering multiple areas.

OHS Issues – there were issues relating to the safety of observers whilst working in isolated communities with little support.

Expense – The program was expensive to run because of travel costs for every day in the field. This restricted the amount of time that observers were in the communities. It was estimated that the program cost around \$150 000 per year to run. This cost was deemed to be excessive, given what the program was delivering. The monitoring program came to an end in June 2001 (since then there has been no monitoring at all).

School Program

From 1990 – 1999 a program was run in various communities which had school children record dugong and turtle catches on purpose made calendars during the school year. The information was later forwarded to AFMA on Thursday Island. This project had a dual role of educating the children on the need to conserve these resources and to monitor the catch. The program provided information over a longer sample period. Data from the school program were compared with the data collected by the AFMA monitors and informally used to validate the results.

Unfortunately the program had a number of limitations including the difficulty in calculating precision (variance) low coverage on some Islands, historically low estimates compared to observer program, and data not being recorded during holidays and weekends. There was also a problem of multiple reporting of catches.

Robert Ware's experience as a monitor

Robert Ware was brought up in the Torres Strait and spent much time with his father diving the reefs from Queensland to the Torres Strait. From Robert's point of view there were a number of inefficiencies about the monitoring program that could be improved:

- Monitors did not monitor the day they arrived in a community, they were instructed to only monitor when they were on location for a full day (so catches they may have observed were not recorded – and in the following days of monitoring they may not have observed any new catches).
- There was no monitoring at night - catches were missed during this time
- There were sacred sites in some of the communities where monitors were not permitted to go and therefore catches landed there were not always recorded
- Some community members did not communicate with them as they thought that the information may be used against them in some way

Robert stated that there was a need to bring back some of the traditional customs into hunting in the Torres Strait. Hunting should still be done from canoes which requires great strength and skill – this would limit the number of animals being taken. It was noted that many of the young people only think about today and not about the long-term sustainability of the species. They are motivated by the thrill of the hunt but generally the community is aware that there is a problem with the numbers of turtles and dugongs being taken. Robert also pointed out that people today are eating more turtle and dugong than they ever have in the past due to the ease in hunting from power boats with spotlights. This is not only affecting the dugong and turtle populations but is also having an effect on peoples' health.

Ranger Program

Discussion arose at the meeting in regard to setting up a ranger program to do the monitoring of turtles and dugong. This technique has been very successful in the Northern Territory. It was explained that there are already a number of “ranger” programs operating in the Torres Strait such as the Australian Quarantine and Inspection Service (AQIS) and the Department of Immigration and Multicultural Affairs (DIMA). [A cost benefit analysis of a program modelled on those of the other departments identified that equivalent fishery ranger programs were currently beyond Government’s means].

The Torres Strait style of program is quite different to the one operating in the NT where work is contracted out. The prospect of such a program working in the Torres Strait is low because peoples’ expectations being quite high due to the benefits received by the AQIS and DIMA rangers including housing, office and communication facilities, four wheel drive vehicle, boat, outboard and trailer. Contracting the existing “rangers” in the region to do the work required of the monitors was discussed but it was noted that this was unlikely to work because of the competing priorities from other agencies.

It was explained by Rod Kennett and Nanikiya Munungurritj that the NT rangers have a variety of different funding sources including NHT, royalties, CDEP, their own commercial enterprises and some NGO funding. Their ranger programs are set up by the communities (not departments) and find funding for themselves. It was considered that this was an important part of the process as the organisations have a deal of independence.

Agenda Item 4 – FactorS affecting hunting of Dugong: What it means for catch monitoring in the Torres Strait – Donna Kwan

Donna Kwan authored a doctoral thesis on the Indigenous fishery for dugong. As part of her fieldwork for this project Donna lived and worked in the communities of the Torres Strait from September 1997 to November 1999. The majority of this time was spent on Mabuiag Island, one of the major dugong hunting islands in the region. Donna’s presentation was based on her experiences at Mabuiag.

Donna’s research showed that the amount of hunting that occurred at Mabuiag was influenced by:

- The local distribution and abundance of dugong
- Environmental and seasonal factors
- Lunar phase and
- Tropical rock lobster abundance (cash income)

Donna obtained accurate counts of dugongs taken. These data were examined to investigate the utility of a monitoring program that sampled to estimate the numbers of dugong being taken, as opposed to counting every dugong. The results indicated that sampling would not provide an accurate estimate of catches of dugong from Mabuiag Island. She concluded that continuous catch recording would be the most effective method of determining catches of dugong in the Torres Strait and that community based management would be the optimal method of collecting this information. Further Donna noted that people expected to get paid for their role in monitoring although it would not necessarily need to be a full time position.

It was noted that while a sampling program may not achieve adequate precision for catches from individual communities, sampling in all communities would provide reasonable precision for the Torres Strait as a whole. Since it is not critical for Management to know the catches from individual communities with great precision the problems of precision at a community level was not seen as a serious problem which would rule it out.

Agenda Item 5 – Presentation from Hunters – Monitoring from a Torres Strait Islander Perspective – Toshio Nakata

Toshio is a Torres Strait Islander who is currently working for the TSRA as a fisheries consultant with the objective of establishing fishing representatives from each Torres Strait community. Toshio by his own admission is not a true hunter although he has participated in hunts in the past. Yet through his work travelling the Torres Strait he has had a lot of communication with hunters and traditional owners (TO's) and has a genuine understanding of the way most Torres Strait Islanders feel regarding catch monitoring and management of fisheries in Torres Strait especially when related to turtle and dugong stocks.

Toshio thanked everybody for coming and welcomed participants to the Torres Strait. He gave credit to the presenters for what they had showed so far at the workshop but considered it important to note that some of the research was dated, had been done in other geographic areas, or had been done with little involvement and consultation with the TO's. Toshio noted that most traditional inhabitants feel removed from the research and do not trust the outcomes. Torres Strait Islanders spend a lot of time on the water and the research results often seem to conflict with what they see. Toshio noted that hunters are often reluctant to listen to researchers and would prefer to receive information from another traditional inhabitant and that Torres Strait Islanders would like to manage their traditional fisheries themselves.

Dugong

In terms of dugong management in the Torres Strait, Islanders have no faith in the sustainable harvest estimates for the area of between 100 and 200. There is currently a lot of discussion in the Torres Strait looking at the methods that are used to hunt. Elders and many in the community would like to go back to traditional hunting methods, whilst a limited group of young hunters would like to keep using new hunting methods that are much more effective and result in higher catches. Toshio noted that young hunters were often better educated and as such were more effective at communicating their needs than the elders.

Communities acknowledge a problem with the sustainability of dugong stocks but the TO's often find it difficult to achieve things. Toshio also noted that what is acceptable to one community might not be acceptable to another. The importance of bringing back traditional lore into the management of the dugong fishery was highlighted.

Turtle

Turtles are eaten in much larger numbers in the Torres Strait than are dugongs. Dugongs are only taken regularly in the western Torres Strait however turtles are taken throughout the whole region. Some sectors of the communities were just now

starting to question effects of their harvest of turtles on the population. Toshio stressed how it was very important that Torres Strait Islanders got involved in the management of turtle populations.

Col Limpus pointed out that turtles in many ways are not just a Torres Strait resource because they move large distances from feeding to nesting areas. As such Torres Strait Islanders harvesting turtles can have a major effect on other indigenous hunting communities throughout Australia and neighbouring nations such as PNG, Indonesia, Solomon Islands, Vanuatu etc. Toshio stated that he was aware of this relationship and noted how some communities have already started communication with their neighbours in PNG. This workshop was seen as a positive step towards relationship building with indigenous communities in other areas.

In terms of a monitoring program Toshio did not like the idea of contracting out the current AQIS rangers to provide monitoring services. Fishermen should be monitoring the catches of fish and in most circumstances the current rangers have their time sufficiently utilised. Toshio noted that sufficient resources would be required to make things happen and pointed out that people involved in data collection and catch monitoring would need to be adequately compensated. Similarly getting CDEP workers to collect the information would provide no incentive for people to do a good job and would not encourage people to continue in the role for long periods.

Agenda Item 6.1 – Dugong Monitoring in the NT – Keith Saalfeld

Keith Saalfeld works for the Parks and Wildlife Commission of the Northern Territory in Darwin. Keith has been involved in the production of the recently produced management plan for dugong in the Northern Territory of Australia 2003-2008.

Aerial surveys have been conducted in the Northern Territory using similar methodology as those conducted in Queensland by Helene Marsh. The western top end coast was surveyed in 1983 ($13\ 800 \pm 2683$) and 1995 ($12\ 610 \pm 2\ 135$) and the western gulf of Carpentaria in 1985 ($16\ 846 \pm 3259$) and in 1994 ($23336 \pm 3\ 040$). Keith noted that although a vast area of the NT was not surveyed that this area was void of the large seagrass beds and evidence showed that dugong populations in this area were very small.

Keith raised the issue of incidental catch of dugong in the NT. One study conducted in the Borroloola region reported 42% of the total mortality of dugong in the regions was attributed to causes other than traditional harvest. This was raised as one possible data requirement that could be collected during a monitoring program in the Torres Strait and other regions.

Keith indicated that there were limited data in the NT on traditional harvest rates of dugong. The projected traditional harvests were estimated at approximately 260 per year although there was little hard evidence on which to base these estimates. Areas in the NT had reported a gradual decline in dugong hunting in the region and Rod Kennett theorised that this was in part due to the removal of the best hunters from the communities to work on cattle stations in the region.

The dugong management program 2003-2008 identified the following management actions that need to be implemented in regard to dugong fisheries in the NT:

- Consult with Aboriginal communities to establish culturally acceptable mechanisms to monitor traditional harvest
- Consult with professional fishers, local communities, DBIRD and NTSC to establish mechanisms to monitor incidental catch
- Monitor NT dugong population distribution and abundance using aerial surveys at least every 5 years with the next to be done by November 2006
- Continue mapping of seagrass distribution as part of the marine habitat mapping program.

Agenda Item 6.2 – Indigenous data collection in the NT –Nanikiya Munungurritj and Rod Kennett

Nanikiya Munungurritj is the senior cultural adviser for Dhimurru Land Management Aboriginal Corporation based out of Nhulunbuy (Gove) in North east Arnhem Land. Rod Kennett is an adjunct research fellow for the Centre for Tropical Wildlife Management at the Northern Territory University. Nanikiya and Rod have a long partnership together in running an indigenous management, research and conservation program in Arnhem Land.

Nanikiya explained to the workshop that traditional people have a lot of knowledge of their country (including the marine environment). In the past researchers and managers have not valued this knowledge but it is very important today that these two groups work in collaboration with each other.

Surveys undertaken by traditional peoples and researchers in Arnhem Land have shown that a high level of Miyapunu (turtle) nests were being harvested in heavily populated areas. All species of turtle eggs were being harvested. However much of the coastline is inaccessible so eggs are protected. Pig depredation of turtle eggs is not regarded as a serious issue in eastern Arnhem area of the NT.

Nanikiya stressed that it was very important to continue traditional hunting of species as it is important in passing on the culture to the young people. Whenever the people of the area take turtles they stock pile the shells (linking contemporary management to traditional practice). This is a traditional practice and has been used today to help monitor the numbers of turtle being taken. From the shells it is possible to measure the size of turtles being harvested and to ascertain the technique of harvest as harpooned turtles have a hole in the shell. School children are involved in these activities which serves an important community education role.

Most turtles taken in the NT are taken on the breeding grounds. The people have stopped taking turtles when they are nesting as this is not deemed traditional. People are only allowed to hunt in their country, not in other peoples lands.

The people of Arnhem Land have identified other causes of mortality including marine debris and commercial fishing. Dhimurru spends considerable sums each year patrolling beaches by vehicle and helicopter to free turtles that are found alive and entangled in nets and to participate in programs to remove marine debris from waters.

Rangers have also been used to erect fences to prevent 4WD vehicles accessing beaches to harvest turtles – a contemporary expression of customary law.

Experience from the NT highlights a number of points that need to be considered when developing a monitoring program:

- The program needs to be culturally appropriate
- The need for catch monitoring needs to be clearly identified
- The traditional land owners need to identify and agree with this need
- Before data is collected questions such as what is going to happen to the data? And who owns the data? Need to be resolved
- Plans need to be adaptable – what works in one area may not work in another area
- There needs to be a person from the community dedicated to the program. That person needs to have a stake in the program and needs to be paid.
- There needs to be ongoing support from a government agency. Other agencies can provide additional support but it is important to have government involved.
- Need to use local language
- The aim of the program should be to sustain populations to enable Indigenous harvest to continue.

Agenda Item 6.3 – Turtle and Dugong Traditional Catch Monitoring on the Great Barrier Reef – Tony Stokes

Tony Stokes works for GBRMPA - the agency with the role of managing turtle and dugong populations along much of the east coast of Queensland. Tony noted that the GBRMPA has been attempting to monitor the mortality (both incidental and hunting) of turtles and dugongs in the waters of the Great Barrier Reef for 20 years with limited success. Tony mentioned that GBRMPA had inadequate information on the level of human related mortality and the biological characteristics (species, age, sex, location) of the catch. These data deficiencies make it very difficult to assess the sustainability of catches and the status of turtle and dugong stocks.

The current level of traditional hunting of turtles and dugong in the GBRMP is unknown. It was recognised that improved reporting was the key to better management of stocks. Currently, information is collected through the following pathways:

- Word of mouth
- Reports from paid rangers monitoring the beaches
- Reports of carcasses by the general public
- Permit returns

Permit returns have not been a very successful monitoring technique as most turtles and dugongs are taken without a permit. Under the GBRMPA Act a permit is required to take turtles and dugongs and if a permit is issued hunters are required to report back on the number, age, sex, size and location of animals taken. But under the Native Title Act traditional owners do not need a permit to hunt provided the catch is not for commercial use.

Some of the reason that reporting rates are so low are because agencies do not ask appropriately or do not have good links with the hunters; or because hunters are not

aware about their requirements to report, can't be bothered reporting or people believe that reports may be used against them (collectively).

The current approach being taken by the GBRMPA is to work collaboratively with TO's who claim native title rights in an area of sea country. These TO's can produce regional traditional hunting plans that will outline the way in which that area of sea country will be managed. The traditional hunting plans could include things such as who has rights to hunt in the area, requirements for permits, closed areas, specific conditions on hunting, sustainable harvest levels, traditional sharing arrangements, cooperative surveillance and enforcement arrangements, etc.

Until these measures are implemented the GBRMPA recommends that hunting permits should only be issued where they are endorsed by the TO's of the area. Through relationship building and education GBRMPA hopes to develop better methods for monitoring all sources of turtle and dugong mortality, including traditional hunting.

Toshio Nakata had concerns over this approach to management. Toshio pointed out that there were several Torres Strait Islander communities living in the NPA area and that this arrangement could limit their right to hunt in the region where they live. This would lead to hunters ignoring the new arrangements and continuing to hunt as they have done for a long time. Tony pointed out that TO's may in this situation make arrangements in their traditional hunting plans to allow these communities to hunt in their sea country.

Agenda Item 6.3 – Monitoring Torres Strait Turtles – Col Limpus

Dr Col Limpus currently works for the Queensland Parks and Wildlife Service in Brisbane. Col has over 30 years experience working with marine turtles. Col's presentation explained the complicated life cycle of turtles and noted how the biology of this species means that populations of turtles would be very slow to recover from overharvesting.

When trying to develop a monitoring program for each species of turtle there are 3 major areas to consider:

1. Wild population stability and function
2. turtle and egg harvests and
3. mortality including incidental and hunter mortality.

Techniques used to collect this information include monitoring nesting and feeding populations of turtles. This can be done by tagging to track movement, collecting tag returns from hunters, measuring the carapace lengths of turtles, and measuring the recruitment rate of new breeders to a population by identifying the presence or absence of ovarian scars in captured turtles (during the butchering process or a laparoscope where the turtles are released again).

Green Turtles

The northern GBR stock of green turtles is showing evidence of being in the early stages of population decline. This has been evidenced by loss of large females from the population (mean carapace lengths are declining on nesting beaches), the declining numbers of nesting turtles observed on some "indicator" beaches, lower

recruitment to the adult population, low hatchling production rates, degraded nesting beaches and possible climate change.

A breeding population of green turtles has been monitored now for many years at Raine Island and there is a good deal of potential for monitoring at other areas in the Torres Strait including Murray Island and Bramble Cay.

Green turtles are the preferred food source of Torres Strait Islander communities who mainly target large breeding females. Population modelling suggests that the harvests could have a reduced impact on the stock if hunters targeted medium sized turtles and also took equal proportions of male and female turtles.

Flatback Turtles

The world's largest nesting population of flatback turtles is in the western Torres Strait and down to Weipa. Queensland Parks and Wildlife Service has been monitoring flatback turtles on Crab Island since 1975. The major threats to flatback turtle populations include egg harvest, pig predation of nesting sites, some fisheries bycatch (reduced since 2000 with the compulsory introduction of TED's in the Northern Prawn Fishery), and limited harvest of adult flatback turtles.

Hawksbill Turtles

The QPWS has monitored hawksbill turtles in the Torres Strait since 1978 at Milman and Campbell Islands. This has showed that the numbers of nesting females have been declining at 3-4% per year. The major threats to this species include egg harvesting in the Torres Strait, some fisheries bycatch (TED's have helped reduce this since 2000) and some hawksbill turtle harvest (in neighbouring countries).

Monitoring Turtles

Feeding population

Critical monitoring information includes the species, recruitment to the key life stages, population structure by sex and maturity, and local population abundance estimates. Other important data that can be used in demographic modelling includes the growth and age structure of the species, the genetic stock definition, and survivorship. Tagging feeding turtles, using turtle rodeo methods can provide much of this information. Satellite telemetry can also be used to gain information similar to that gained from tags in a shorter time frame. In the Torres Strait there is probably no need for satellite telemetry as there is already considerable information gained through tagging programs and the costs of satellite telemetry are quite high.

Harvest Monitoring

Important information to gather includes the species taken, the size (carapace length), sex (using internal examination or males' large tail), maturity level, and the breeding status. It is important that monitors are well trained, and it's preferable to have some form of validation often in the form of a photo. This same information is important for monitoring strandings and incidental mortality. When monitoring egg harvests the critical information is the species and the number of clutches.

Management guidelines highlighted to help sustain the turtle harvest included:

- Limiting adult harvests to no more than 10% of annual recruitment

- Without taking more turtles, harvest large immature turtles instead of adults (green turtle carapace length < 90cm)
- During “turtle fast” take males as well as females
- When harvesting eggs ensure 70% of clutches successfully produce hatchlings
- Suggested egg loss limits (including loss to pigs and other feral animals) are:
 - ~600 Hawksbill clutches per year
 - ~450 Flatback clutches per year
- Suggested turtle harvest limits are:
 - Adult green turtles (hundreds per year, not thousands)
 - Immature green turtles (low thousands only per year)

Agenda Item 6.4 – Keeping Green Turtles in Torres Strait – Ian Bell

Ian Bell works for Queensland Parks and Wildlife Service as a researcher and manager of turtles in Queensland and the Torres Strait.

Ian explained how, throughout the world, a series of ‘charismatic’ animal species are harvested based on a sound understanding of what is happening in their respective populations. There is no equivalent information for turtles in Torres Strait. It is important to have a good understanding of how many are harvested for food and how many are nesting, and other biological information. There are many techniques that can be used to gain this type of information.

Nesting Turtles

It is relatively easy to monitor nesting turtles. Effective monitoring techniques include:

- Tagging turtles with titanium tags and unique identifying number.
- Measuring carapace lengths – a decrease in the average size of a nesting population can indicate an unhealthy population
- Egg counts – how many eggs, average size and weight of eggs
- Sand temperatures – determines sex
- Hatchling survival – how many eggs were fertilised? What percent made it out of the shell? What percentage made it to the water?

Nesting beach studies provide important information such as where are most turtles nesting, the size of the annual nesting population, changes in the number of turtles nesting each year, survivorship of eggs, and the causes of egg mortality (harvesting, feral pigs, flooding of eggs etc)

Feeding Populations

Most turtles in the population do not come ashore to nest including the adult male turtles, non-breeding adult female turtles, pubescent turtles and juvenile turtles. This section of the population can be monitored using turtle rodeo methods. After capturing feeding turtles they are tagged, measured and weighed. This provides information on:

- where the turtles go to nest
- how often they lay eggs,
- if the turtles stay in the same area to feed
- how many turtles there are
- if the population is increasing or decreasing

- how many adults are in the population
- the sex ratio of the population

Other specialised monitoring techniques that can be used to gather information on turtles includes:

- laparoscopy to see if non breeding turtles are male/female, have laid eggs in the past
- Time depth recorders
- Sonic tracking
- Satellite tracking

In conclusion, there is information on nesting populations of green turtles in Torres Strait and that this information is of vital importance and should be continued. However there is little or no recent information on the structure of the foraging population of green turtles in the area. A monitoring program for turtles needs to include a combination of catch monitoring and field surveys and there needs to be a long term commitment to such a program.

Agenda Item 6.5 – Turtle and Dugong Monitoring in PNG – Samuel Antinko

Samuel is the Manager of the Biodiversity Research and Surveys Branch of the PNG Department of Environment and Conservation. Samuel explained that dugongs and turtles are protected fauna under PNG's legislation, the Fauna (Protection and Control) Act. As protected fauna, only traditional methods of hunting are allowed and the sale of meat and other products for commercial purposes is restricted.

Following the enactment of this legislation approximately 20 years ago there was an education and enforcement program set up with provincial wildlife officers established in 28 provinces. These wildlife officers were familiar with local conditions and provided monitoring services to the department.

During this time wildlife management areas were also established, including the Maza wildlife area adjacent to the coast of PNG in Western Province. These were driven by local communities and were then gazetted under the Fauna (Protection and Control) Act. After this process local communities then have the power to take offenders to the national court for prosecution.

Some of these areas have become less effective due to the loss of provincial wildlife officers. The government is now looking at developing partnerships with NGO's to revive effective management and enforcement to the wildlife management areas.

Helene Marsh noted that in the early 1980's the community based management of dugongs operating in Daru was the best she had seen. Part of the reason for this was that there was good data collected from the fishery and that this data was fed back to the community. Unfortunately this program did not have a life of its own and once support stopped so did the monitoring. There is an important lesson here for establishing monitoring in the Torres Strait.

Samuel stated that PNG would be very interested to partner with Australia (in particular Torres Strait) to implement an integrated monitoring program in the western Province.

Agenda Item 6.6 - Turtle Monitors Network Program – Wan Smolbag Theatre – George Petro.

George works for a non-government community theatre group in Vanuatu called Wan Smolbag (WSB). WSB has been operating since 1989 and in this time has made many village tours, staging plays that entertain and inform villagers about important issues in Vanuatu such as the environment, health and human rights. In 1995, the ‘Pacific Year of Sea Turtles’ the group introduced a play related to the life cycle of sea turtles and the need to conserve them.

WSB also collected information regarding turtles from the communities and initiated village based turtle monitors who report the numbers of turtles nesting and facilitate a campaign to help sea turtles recover. This program has expanded and now there are 200 turtle monitors in Vanuatu covering 70% of the country. The monitors have developed their own organisation that is largely funded by SPREP. The monitors meet for workshops about once a year where they provide data that they have collected and receive further training and ideas about turtle conservation.

The roles of monitors in WSB include:

- Monitoring turtle activities such as trends in population, feeding grounds, nesting sites and catch rates.
- Tagging turtles and completing tag forms
- Establishing marine protected areas
- Working with village chiefs and councils to establish taboos relating to taking turtles and their eggs
- Reporting of people violating taboos to the village chiefs. Violators are dealt with using fines or other forms of punishment
- Run awareness campaigns taking the form of community theatre/drama, radio spots, posters, videos, school visits, monitoring boards etc

The results of this program appear to have been very positive for turtle populations in Vanuatu. There is high community support for the program, and awareness of issues relating to turtle conservation has increased significantly. The use of taboos has also proved to be very effective. The major weaknesses of the program are that there is a lack of funding meaning that monitoring is voluntary work.

Recently it has been decided to change the name of this program from Wan Smolbag to Vanua-tai Resource managers (vanua = land, tai = sea). Other plans for the future include further expanding the program to cover the whole country, introducing female monitors, conducting some research, implementing a proper turtle monitoring program and documenting the program as to promote the successful ideas in other regions.

***Agenda Item 6.7 – Turtle monitoring in the Solomon Islands –
John Pita***

John Pita works for the Department of Forests, Environment and Conservation in the Solomon Islands.

The Solomon Islands has three common species of marine turtle; the green turtle, hawksbill turtle, and the leatherback turtle. Since 1990 they have conducted research on turtles with the assistance of SPREP. Turtles have always had traditional significance to the local communities in the Solomon Islands. Although traditional harvesting of turtles was practiced in the past it was recognised that the cash economy has changed the way people utilise the turtle resources.

The objective of the monitoring program in the Solomon Islands is to provide a scientific basis to assist in management of marine turtles by determining the size of the local populations, obtaining a better understanding of turtle migrations and achieving greater community understanding through education and awareness programs. The methods used to gain this information includes questionnaire's and surveys, tagging programs, genetic analysis and satellite tracking.

John gave the example of the Arnavon Islands where a monitoring program has been introduced at an important hawksbill nesting ground. Three community conservation officers are employed on a monthly cycle to collect data, tag turtles and perform other monitoring duties including education and awareness programs.

***Agenda Item 6.8 – The Huon Coast program in Northern PNG –
Job Opu***

Job Opu is a marine species officer working with SPREP. Previously Job worked for the PNG Department of Conservation and was involved in a program to protect a leatherback nesting beach on the Huon Gulf area of Morobe province. This program, the Kamiali Turtle Conservation Program, is an excellent example of how community involvement in a monitoring program can lead to effective outcomes from a program.

Job explained how in many areas of PNG the harvesting of eggs on the nesting beaches have intensified to such a level that all the eggs were basically being taken. Turtle eggs were largely being harvested for sale in the town markets. Community members of Lababia village in the area became concerned about the level of egg harvesting and also began to notice fewer nesting turtles . This concern led them to establish a wildlife protected area along a 2 kilometre section of the beach. This site is now an internationally recognised protected area. More villages are looking at getting involved and extending the protected area further along the beach.

In order to help encourage this activity local people were trained to record data on the turtles and get involved in tagging programs. These monitors patrol the beaches at night ensuring that no eggs are being harvested and recording information on the number and size of turtles nesting on the beach. These monitors are paid for their patrols, which replaces the monetary incentive to take the turtles. Basically the communities are getting paid to leave the eggs rather than harvest them. This system

is working very effectively, and may be extended by encouraging the monitors to collect more data that could be useful in turtle management and conservation.

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