

## The Status of the Dugong in Torres Strait

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### Abstract

*In November 1987, dugongs were counted from the air at an overall sampling intensity of 7.4% over a total area of 30,533km<sup>2</sup> in the Torres Strait region and adjacent waters of the Great Barrier Reef Marine Park. About half the survey was repeated in March 1988: persistently bad weather prevented its completion. We corrected for perception bias (the proportion of animals visible in the transect which are missed by observers), and standardized for availability bias (the proportion of animals that are invisible due to water turbidity) with survey-specific correction factors. The resultant minimum population estimate in November 1987 was  $12,522 \pm \text{S.E. } 1,487$  dugongs at an overall density of  $0.41 \pm \text{S.E. } 0.05 \text{ km}^{-2}$ , a precision of 12%.*

*Although there were no significant differences between population and density estimates obtained from the repeat surveys of the same areas, relatively more dugongs were sighted close to the major western islands in the March survey. Our data suggest that if the dugong population were increasing maximally, this region could support an unselective man-induced mortality of 700 dugongs per year at most. If the current rate of increase is similar to that estimated from the Daru dugong catch between 1978 and 1982, the maximum unselective harvest will be of the order of 300 dugongs. If significantly more females than males are being caught, these figures are overestimates.*

*In the absence of adequate catch statistics and current life history information, it is impossible to confirm whether the current dugong harvest in Torres Strait is likely to be below the sustainable yield. A high priority should therefore be placed on public education in an attempt to pre-empt any increase in catch. The resultant maps of distribution and density*

*suggest that, if the Torres Strait dugong sanctuary area is to be effective, its boundaries should be renegotiated or an additional protection area established around Buru (Turnagain) Island.*

## Background

The dugong, *Dugong dugon*, listed as vulnerable to extinction by the International Union for the Conservation of Nature (IUCN, 1986), has traditionally been important in the culture and diet of the peoples of Torres Strait (see Johannes and MacFarlane, in press). In recent years, both some local people (see Johannes and MacFarlane, in press) and scientists (e.g. Hudson, 1986; Marsh, 1986) have been concerned by an apparent decline of dugong numbers in the area.

This concern was fuelled by the decrease in the number of dugongs passing through the local market at Daru (9° 05'S, 143° 22'E) on the Papuan side of Torres Strait from 208 in 1979 to 81 in 1981, despite an increase in the availability of motorized craft, an extension of the hunting grounds, and an apparently sustained hunting effort (Marsh, 1986). The statistics of Johannes and MacFarlane (in press) suggest a parallel slump in the dugong catch of the Western Islanders; fewer than one-fifth as many dugongs were caught in the Western Islands during their study in 1983-84 as were caught during the same months in 1976-78 (Nietschmann, 1984). In addition, a dugong hunter based on Thursday Island who kept records indicating that he had caught 41 dugongs between October 1975 and June 1976, claimed in November 1983 that he had not been able to catch a dugong for four to five years despite that fact that his catch effort remained the same and he continued to catch turtles (Marsh *et al.*, 1984a).

A dedicated aerial survey of the major dugong hunting grounds in Torres Strait in November 1983 produced a minimum population estimate of  $1,455 \pm \text{S.E. } 276$  dugongs (Marsh, 1986). It was appreciated that this was 'an underestimate, probably a gross underestimate of the Torres Strait dugong population' because the proportion of dugongs that were sighted under aerial survey conditions had not been calibrated. However, the difference between this estimate and the estimate of 22,000 required to support an annual unselective harvest of 500 dugongs, the lower limit of the estimated annual catch for at least some years between 1975 and 1982 (see Tables 1 and 2) was huge. In view of the decline in catch rates, this discrepancy led to serious doubts about there being enough dugongs in Torres Strait to sustain the level of hunting that had apparently taken place, especially as the estimate of a required population of 22,000 was based on population parameters obtained from the animals harvested by the hunters from Daru (Marsh, 1986).

Some Islanders claimed, however, that more dugongs would have been sighted if the 1983 survey had been carried out during (rather than immediately before) the wet season, and that a substantial proportion of animals occurred west of the 1983 survey area.

In view of improvements in aerial survey methodology (Marsh and Sinclair, 1989a and b), it was decided to conduct further surveys in 1987-88 to determine the distribution and abundance of dugongs in Torres Strait. These surveys were designed to take account of the Islanders' criticisms of the design of the previous survey.

Table 1. Dugong catch statistics from five Torres Strait communities 1975-82.

Collection Period	Location	Number caught		Source
		Total	Average per month	
October 1987 - June 1976	Thursday Island	41	4.6	Personal records kept by one hunter for Dr G.E. Heinsohn
September 1976 - August 1978	Mabuiag	227	9.5	Records collected by Nietschmann during his stay on Mabuiag plus records kept for him by an Islander in Kubin and Badu - March. (Neitschmann 1984)
January 1977 - December 1977	Kubin	50	4.2	
October 1976 - 1979	Badu	227	7.8	
July 1978 - March 1982	Daru	454	10.1	Records of dugongs sold in Daru market collected by PNG Division of Wildlife (Hudson, 1986)

Table 2. Estimates of the dugong catch of Islanders on crayboats in 1983 on the basis of interviews conducted in late 1983 by Marsh *et al.*, (1984) and MacFarlane (see Johannes and MacFarlane, in press).

Informant	Interviewer	Estimate	Basis of Estimate
Islander leader not involved with fishery	Marsh	>100	discussions with other Islanders
Islanders who owned and operated crayboats	Marsh	~ 500	30 taken one week <sup>1</sup> from several boats; maximum of 11 per day; last week (Nov. 12-18 1984) four taken from one boat
Crayboat crews plus personal involvement with cray industry 1980-81	MacFarlane	~ 240	Assumed 2 dugongs per week per boat. 4 boats, 30 week season. <sup>2</sup>

<sup>1</sup> Probably an overestimate; the Islanders wished to emphasise their prowess as hunters.<sup>2</sup> This is probably an overestimate of the length of the crayfishing season and of the weekly catch. Peter Channells (pers. comm. 1988) reports that the average number of days per year worked by a freezer boat in 1981-86 was 109 and that vessels do not work continuously in areas where dugongs occur.

## **Results of the 1987-88 Surveys**

In November 1987, dugongs were counted from the air at an overall sampling intensity of 7.4% over a total area of 30,533 km<sup>2</sup> in the Torres Strait region and adjacent waters of the Great Barrier Reef Marine Park (Figure 1). About half the survey was repeated in March 1988; persistently bad weather prevented its completion.

Corrections were made for perception bias (the proportion of animals visible in the transect which are missed by observers), and availability bias (the proportion of animals that are invisible due to water turbidity) with survey-specific correction factors as outlined in Marsh and Sinclair (1989a). The resultant minimum population estimate in November 1987 was  $12,522 \pm \text{S.E. } 1,487$  dugongs at an overall density of  $0.41 \pm \text{S.E. } 0.05 \text{ km}^{-2}$ , a precision of 12%.

This estimate is, of course, substantially higher than the minimum estimates obtained for part of the same area by Marsh (1986). The difference is due to the improved survey methodology; Marsh's (1986) estimate was uncorrected for the biases inherent in the survey technique.

We consider that even the estimate of  $12,522 \pm \text{S.E. } 1,487$  dugongs is more likely to be an underestimate than an overestimate. The correction for availability bias for each survey is based on the ratio of the proportion of dugongs sighted that are at the surface during the survey to the proportion sighted in a clear water area when all dugongs present were potentially available, and assumes that the proportion of dugongs at the surface is the same for all habitats and at all times (Marsh and Sinclair, 1989a). This assumption may not be valid in Torres Strait, where in contrast to the east coast of Australia where our other dugong surveys have been carried out, significant numbers of animals are seen in relatively deep water (see below). Observations by Paul Anderson (unpublished data) suggest a trend for dugongs to remain submerged longer in deeper water. A more accurate correction for availability bias in Torres Strait will require further investigation of dugong diving behaviour in this area.

Although there were no significant differences between population and density estimates obtained from the November 1978 and March 1988 surveys of the same areas, relatively more dugongs were sighted close to the major western islands in the March survey. This result is consistent with the Islander's perceptions that dugongs are more abundant in the area from Cape York to Mabuiag during the North-West monsoon (Johannes and MacFarlane, in press).

The survey results indicate that Torres Strait is a very important area for dugongs with a population comparable to that of the entire Great Barrier Reef Marine Park (Marsh and Saalfeld, 1989, 1990).

In November 1987, dugong density was highest on the seagrass beds around Badu and extending north across Orman Reef around Buru Island and east to Gabba Island (9° 46'S, 142° 37'E) (Figure 1). The next highest density was observed over the Warrior Reef complex. Densities were very low along the coasts of Papua New Guinea and Cape York including the northernmost waters of the Great Barrier Reef Marine Park.

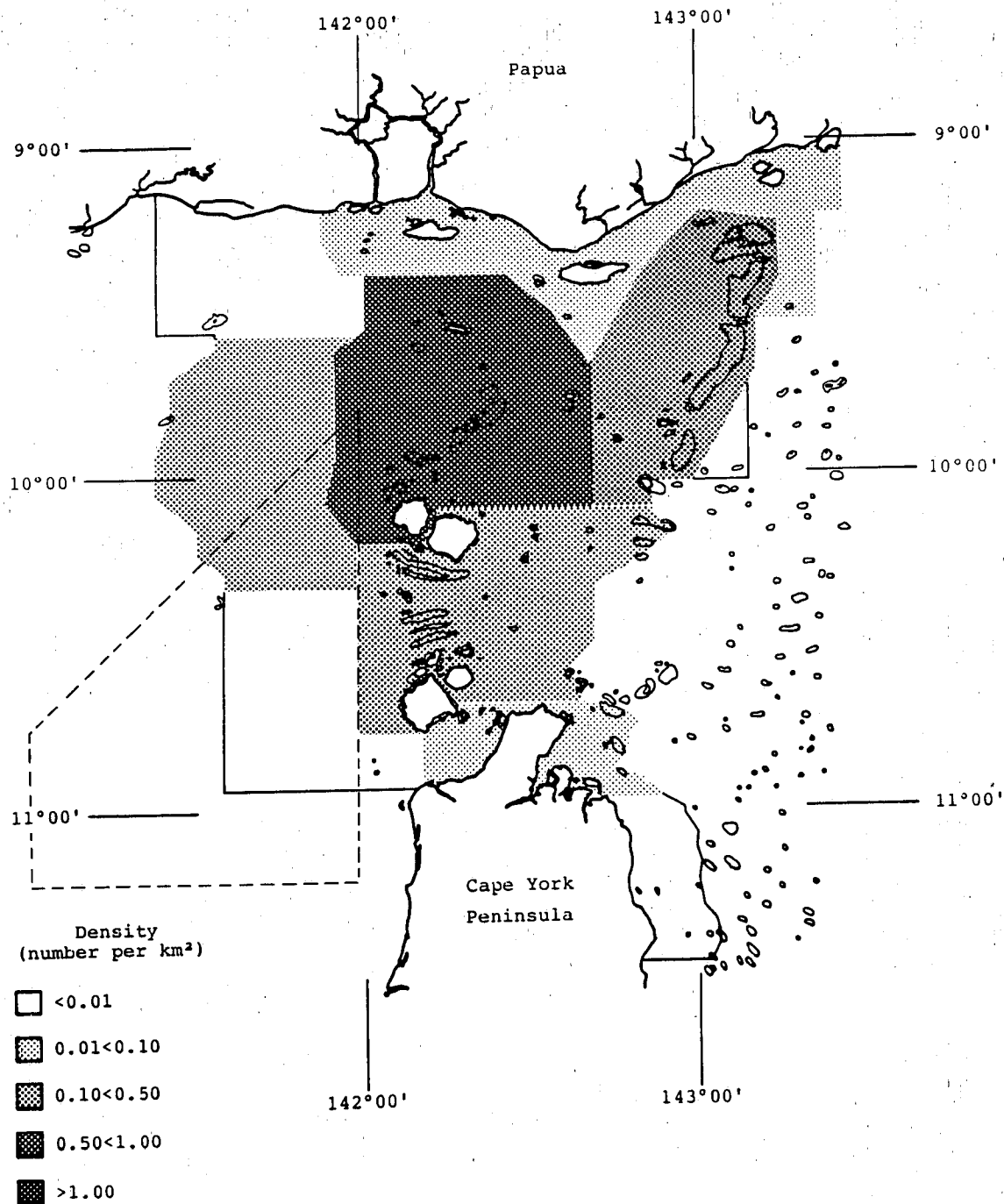


Figure 1. The distribution of dugong density in the survey area in November 1987. The broken line shows the boundaries of the Protected Zone Joint Authority Dugong Sanctuary Area.

High densities of dugongs were observed in the Buru Island/Orman Reef area in both November 1987 and March 1988. This was also the area supporting the highest densities of dugongs in November 1983 (Marsh, 1986). Large numbers of dugongs were also sighted in this area on a Coastwatch flight on June 17 1988 (M. McCarthy, pers. comm). It seems likely that the extensive seagrass beds in this area are consistently important dugong habitat, despite the essentially seasonal nature of the dugong catch from this area by Boigu Islanders (Johannes and MacFarlane, in press).

As much of the Orman Reef area is uncharted, we were able to estimate the depth of water in which only about 45% of dugongs were sighted in the November 1987 survey. Nonetheless, the survey indicates that significant numbers of animals are sighted in relatively deep water (>10m), in contrast to the northern waters of the Great Barrier Reef Marine Park where 56% of dugongs are sighted in water less than 5m deep (Marsh and Saalfeld, 1989). Significant numbers of dugongs are seen more than 10km from land in Torres Strait, in contrast to their essentially inshore distribution in most other areas. Dugong distribution in Torres Strait undoubtedly reflects the extensive beds of both intertidal and subtidal seagrass beds in this area.

### **Is the Dugong catch in Torres Strait sustainable?**

On the basis of experience in Torres Strait in the late 1970s, Nietschmann (1984), 'guesstimated' an average annual dugong catch in Torres Strait of about 750 animals. We do not know whether this estimate was restricted to the Australian Islands or whether it included dugongs caught by Islanders who operate crayboats. From the limited statistics available (see Tables 1 and 2), Marsh (1986) estimated that the total annual dugong catch for the Torres Strait area for at least some years between 1975 and 1982 was at least 500 to 1000 animals. She then estimated the minimum populations required to support an annual unselective harvest of 500 and 1000 dugongs assuming a population sex ratio of 1:1 on the basis of a simple population model which was constructed to determine the annual rate of increase of stable dugong populations with various combinations of life-history parameters in the range observed for several populations.

Marsh (1986) calculated that, even with the most optimistic combination of life history parameters, a dugong population was unlikely to increase at more than about 5% per year. If the parameters calculated from the dugongs passing through the Daru market in 1978-1982 are operable, the maximum rate of increase is likely to be only about 2%. It is likely, however, that the rate of increase of the Torres Strait dugong population is currently higher than this latter figure which was obtained soon after anecdotal evidence suggests there was a period of extensive seagrass dieback in Torres Strait (Johannes and MacFarlane, in press). The mean calving interval (the parameter to which the dugong population model is most sensitive) decreased significantly from nine years in 1978-79 to three years in 1981-82, coincident with the reported recovery of the Torres Strait seagrass beds (Marsh and Hudson, unpublished data).

Marsh's (1986) population model indicates that 12,500 dugongs are likely to be able to sustain an unselective harvest of only 700 animals per year when dugongs are breeding optimally. If the population parameters calculated on the basis of the dugong specimens obtained from the Daru harvest in 1978-82 are currently valid,

the maximum sustainable harvest is of the order of 300 per year. Johannes and MacFarlane (in press) reported that adult females outnumbered adult males in the 'unselective' catch of the Boigu Islanders recorded by Mrs Pabai from Boigu by a ratio of 5:2. Dugong tusks are sexually dimorphic and the small sample which has been forwarded to us by Mrs Pabai indicate that her records are correct. Nonetheless, we find this sex ratio surprising, as the (much larger) catches from Mabuiag, Badu and Kubin (Nietschmann, 1984), and from Daru (Hudson, 1986) indicated a ratio close to parity. However, if the Torres Strait dugong catch as a whole is currently biased in favour of females, the sustainable harvest figures of between 300 and 700 dugongs are substantial overestimates.

It is impossible to evaluate whether the dugong is currently being over-exploited in Torres Strait without reliable catch figures from all the major hunting communities in the region. All the evidence available suggests that the number caught is now much lower than for the period between 1975 and 1983 as summarized in Tables 1 and 2. Johannes and MacFarlane (in press) estimate that the total legal harvest of dugongs by members of the Australian communities in Torres Strait in the mid-1980s was of the order of 120-140 animals per year. (In 1985-87, the annual average catch from Boigu, a major hunting community, averaged about 45 animals per year (Johannes and MacFarlane, in press)). Johannes and MacFarlane also consider that the illegal harvest of dugongs for cash in the course of crayfishing activities has declined substantially from the 1983 level (Table 2). We have no information about the current dugong catch by the people of the Western Province of Papua New Guinea except that it is believed to have declined substantially since the sale of dugong meat was banned in 1984 (Hudson, 1986).

We believe that there is no cause for complacency about the dugong situation in Torres Strait, despite the apparent decline in catches and the substantially higher population estimate resulting from the November 1987 survey. The situation has the potential to deteriorate rapidly if catches increase. It is clearly important to continue with the public education campaign in an attempt to pre-empt such an increase, and to encourage the Government of Papua New Guinea to do likewise. It would also be desirable to continue monitoring the legal catch by communities on both sides of the border and to repeat the aerial surveys at five yearly intervals as recommended by Marsh and Saalfeld (1989). Such data are central to a reliable assessment of the status of the dugong in Torres Strait.

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## References

- Hudson, B.E.T. (1986), 'The hunting of dugong at Daru, Papua New Guinea, during 1978-82: Community management and education initiatives', In A.K. Haines, G.C. Williams and D. Coates (eds), *Torres Strait Fisheries Seminar, Port Moresby, 11-14 February 1985*, Australian Government Publishing Service, Canberra.
- IUCN (1986), *1986 IUCN list of threatened animals*, International Union for the Conservation of Nature and Natural Resources, Gland, Switzerland.
- Johannes, R.E. and MacFarlane, W. (in press), *Traditional fishing in the Torres Strait Islands*, CSIRO Division of Fisheries, Hobart.
- Marsh, H. (1986), 'The status of the dugong in Torres Strait', In A.K. Haines, G.C. Williams and D. Coates (eds), *Torres Strait Fisheries Seminar, Port Moresby, 11-14 February 1985*, Australian Government Publishing Service, Canberra.
- Marsh H., Barker-Hudson, B.E.T., Heinsohn, G.E. and Kinbag, F. (1984a), Status of the dugong in the Torres Strait area; results of an aerial survey in the perspective of information on dugong life history and current catch levels. Unpublished report to the Australian National Parks and Wildlife Service.
- Marsh H. and Saalfeld, W.K. (1989), 'The distribution and abundance of dugongs in the northern Great Barrier Reef Marine Park', *Aust. Wildl. Res.* 16, 429-40.
- Marsh H. and Saalfeld, W.K. (1990), 'The distribution and abundance of dugongs in the Great Barrier Reef region south of Cape Bedford', *Aust. Wildl. Res.* 17, 511-24.
- Marsh H. and Sinclair, D.F. (1989a), 'Correcting for visibility bias in strip transect aerials surveys of aquatic fauna', *J. Wildl. Manage.* 53, 1017-1024.
- Marsh H. and Sinclair, D.F. (1989b), 'An experimental evaluation of dugong and sea turtle areal surevy techniques', *Aust. Wildl. Res.* 16, 639-50.
- Nietschmann, B. (1984), 'Hunting and ecology of dugongs and green turtles in Torres Strait', *Natn. Geog. Soc. Res. Rep.*, 1984, 625-652.