

PREFACE

Dugongs are of significant biodiversity value as the only extant species in the Family Dugongidae and one of only four species in the Order Sirenia, all of which are listed as vulnerable to extinction by the IUCN-the World Conservation Union. Australia has international responsibilities for dugong conservation, particularly in the Great Barrier Reef (GBR) region, where the dugong's feeding grounds are listed as one of the World Heritage values of the region. As a result the Great Barrier Reef Marine Park Authority has funded a program of dugong research since the early 1980s.

This technical report consists of the reports of two of the studies commissioned by the Great Barrier Reef Marine Park Authority:

1. *Shark control records hindcast serious decline in dugong numbers off the urban coast of Queensland* by Helene Marsh, Glenn De'ath, Neil Gribble and Baden Lane.
2. *Dugong distribution and abundance in the southern Great Barrier Reef Marine Park and Hervey Bay: results of an aerial survey in October-December 1999* by Helene Marsh and Ivan Lawler.

Both reports present the results of studies aimed at monitoring changes in dugong distribution and abundance on most of the eastern coast of Queensland from Cairns south. The results of the two studies are published together because the first report provides a long-term context for the interpretation of the second.

In the first report, we used the 38-year data set collected by the Queensland State Government Shark Control Program to provide information on the status of dugongs between Cairns and the Gold Coast, additional to information provided by anecdotal reports and dedicated monitoring. We admit there are potential problems with observational data such as the shark control records. If a change is observed it may result from the influence of uncontrolled and unmeasured concomitant variables unrelated to changes in dugong numbers. Nonetheless, we believe that it is important to take serendipitous advantage of the information provided by the shark control records, because of the difficulty of detecting trends in dugong numbers using dedicated surveys, especially if population sizes are relatively small and the period covered by dedicated monitoring is relatively short.

Our analysis indicated that the numbers of dugongs caught in shark nets at eight shark contract areas between latitudes 17° and 28°S declined from the inception of the Queensland Shark Control Program in 1962. The estimated rate of decline in dugongs caught per beach per year for a balanced data set from the 31 beaches in six localities averaged 8.7% per year [95% CI = (7.1, 10.6)]. This represents a decline to 3.1% (1.4, 6.1) of initial catch rates over the 38-year sampling period (1962–1999). For the full data set from 47 beaches in eight localities, the overall capture rates were 8.2% per year (6.8, 9.7), only marginally lower than for the reduced data set.

This estimated decline in the by-catch of dugongs in shark nets can be taken as an estimate of decline in the dugong populations **from all causes** averaged over the areas where nets were deployed, provided that: (1) the catch of dugongs was dependent on dugong population density in the contract area, (2) dugongs did not learn to avoid the nets, or (3) dugongs had not been alienated from the contract areas by increased human use of the beaches. We regard the first two potentially confounding factors as unlikely and have no data to reject or support the third factor. We conclude that, at the very least, the netting data suggest a substantial depletion in dugong numbers along the urban coast of

Queensland since the early 1960s. This result accords with anecdotal reports by long-term residents including Indigenous peoples of a decline in dugong numbers. If the by-catch of dugongs in shark nets is a reliable index of changes in dugong abundance, our results suggest that by 1999, dugong numbers in the local regions of the shark nets had declined to about 3% of 1960 values, reinforcing concern for the status of the dugong along the urban coast of Queensland based on other evidence.

Our second report provides the results of another standardised aerial survey in the time series that my group have conducted since the mid-1980s to monitor the status of the dugong along the Queensland coast south of Cooktown. The survey was conducted in 1999, five years after the last survey. This is the first estimate of dugong abundance in the region since the establishment of the Dugong Protected Areas, a ban on Indigenous hunting of dugongs south of Cooktown, and other recent dugong conservation initiatives instituted by the Great Barrier Reef Ministerial Council. The survey period was characterised by unseasonably poor weather, and opportunities to survey under suitable conditions were limited. For this reason, the survey coverage was incomplete, with the focus directed towards high quality habitats at the expense of regions where few or no dugongs have been recorded in previous surveys. This resulted in the omission of the region between Cape Bedford and Innisfail, part of the coastline south of Mackay, including Broad Sound, the coast between Hervey Bay and Moreton Bay, and three of six blocks in Moreton Bay. Our statistical comparisons of the results of this survey with those of previous surveys were adjusted for these omissions which we expect to have a minimal impact on our overall assessment of the situation in the southern Great Barrier Reef region and Hervey Bay. Unfortunately, we were unable to make an assessment of dugong numbers in Moreton Bay as we were unable to survey the most important dugong area in that Bay.

The results of the 1999 survey indicate that dugong numbers in both the southern Great Barrier Reef region and Hervey Bay regions in October–December 1999 were significantly higher than the corresponding estimates in 1994, but not significantly different from that obtained for the southern Great Barrier Reef in 1986–1987. Most of the increase from 1994 was in the northern part of the survey region (the Central Section of the Great Barrier Reef Marine Park).

We consider that the observed increase is unlikely to be explainable solely by changes in dugong sighting conditions. It is also not possible for the differences between the 1994 and 1999 dugong population estimates to be solely the result of natural increase in the absence of immigration. We consider that the most plausible explanation for most of the increase observed is movement of substantial numbers of dugongs into the survey area, probably from the region north of Cooktown. In addition, northerly movement of dugongs from Moreton Bay cannot be ruled out because the survey of Moreton Bay was incomplete. Our conclusion that large-scale movements of dugongs into the survey area is the most likely reason for the change in dugong abundance in the southern Great Barrier Reef region has been supported by three independent expert reviewers. While there is no direct evidence for such movements, there is increasing evidence that seagrass abundance fluctuates over spatial scales on hundreds of kilometres in response to extreme weather events. Satellite tracking of dugongs has also proven that dugongs commonly move over large distances. For example, one animal has been tracked moving between Princess Charlotte Bay in the northern Great Barrier Reef and Cleveland Bay near Townsville.

The data from this survey support the location of the Dugong Protection Areas (DPAs) as areas which provide increased protection to a significant proportion of the dugongs in the

region. As for previous surveys, in the southern Great Barrier Reef over 50% of all dugongs were in Zone A DPAs (10% of the 1999 survey area in this region). In addition, a further 22% were in Zone B DPAs (9.3% of the survey area in the southern Great Barrier Reef). In Hervey Bay/Great Sandy Straits 72.5% of dugongs were in the Zone A DPA (18.3% of the survey area in this region). Over the entire region and based on mean population estimates, 58% of the estimated dugong population was in the Zone A DPAs and 16% in Zone B DPAs.

The analysis of the dugong by-catch in the shark nets suggest that the aerial surveys between 1986–1987 and 1999 monitor fluctuations in population numbers far below those in the 1960s, which in turn probably reflect numbers far below those at the time of European settlement.

Helene Marsh
School of Tropical Environment Studies and Geography
James Cook University, Townsville