

SUMMARY

- We used the 38-year data set collected by a government program to provide information on the status of dugongs on the urban coast of Queensland, Australia, additional to information provided by anecdotal reports and dedicated monitoring. 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 population numbers. Admitting this deficiency, we believe it is important to take serendipitous advantage of all information on the status of a dugong population, because of the difficulty of detecting trends using dedicated surveys, especially if population sizes are relatively small and the period covered by dedicated monitoring relatively short.
- The State Government conducted the 'Queensland Shark Control Program' by progressively introducing anti-shark measures at popular coastal resorts from 1962. This Program aims to protect swimmers in 10 districts (known as contract areas) on the east coast of Queensland between Cairns (16.5°S) and the Gold Coast (28°S). Six of these contract areas are in the Great Barrier Reef World Heritage Area. Each contract area consists of a number of beaches where gear is deployed to reduce the number of large sharks in the local area.
- Since its inception, the Program has deployed shark nets and baited drum lines in a 'mixed gear strategy' that adapts the type of gear to the characteristics of each beach. In addition to sharks, these nets also catch a variety of non-target species including marine mammals such as dugongs and sea turtles. Contractors employed by the Program have to record this by-catch as a condition of their contracts.
- We analysed the dugong by-catch data with two objectives: (1) to investigate factors affecting dugong mortality in nets, and (2) to use the change in catch of dugongs in shark nets as an index of the change in the status of the dugong population in the region between 1962 and 1999.
- The analysis indicated that the numbers of dugongs caught in shark nets set adjacent to the urban coast of Queensland at shark contract areas between latitudes 16.5° and 27°S declined from the inception of the Queensland Shark Control Program in the 1960s. The estimated rate of decline for a balanced data set from six contract areas 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 eight areas, the overall capture rates were 8.2% per year (6.8, 9.7), only marginally lower than for the reduced data set. The rate of decline also increased over time, starting at about 6% in 1962, and increasing to 14% in 1999. This analysis is conservative, especially with respect to dugong mortality in the early years of the Queensland Shark Control Program. It is likely that the actual decline in the number of dugongs caught is greater than that reported here.
- The catch rates varied strongly between contract areas, and to a lesser degree between beaches within areas. Four of the six contract areas in the reduced data set showed severe declines, with two areas showing a modal distribution of catches, with higher catches centred around 1980–1982.
- There was weak monthly variation in catch rates, with catches significantly higher in the second half of the year than the first half.
- The number of nets at a beach and the number of fishing days per month did not appear to influence catch rates, however, the power of these tests are weak because of the confounding effects of beach and year on these parameters.
- Dugong catch rates did not change following the annual removal of nets at beaches for periods of 1–2 months.

- The 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 is dependent on dugong population density in the contract area, (2) dugongs have not learned to avoid the nets, or (3) dugongs have 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.
- 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 their 1960 value, reinforcing concern for the status of the dugong along the urban coast of Queensland based on other evidence. The spatial scale over which any depletion has occurred is unknown. However, the extensive movements monitored by satellite-tracking individual dugongs suggest that any decline is likely to have occurred at regional rather than local scales.
- The likely reasons for any decline are complex and include habitat loss, traditional hunting and incidental drowning in commercial gill and mesh nets, as well as the Shark Control Program *per se*.
- The most salient questions to be determined by management agencies and stakeholders is the target level of recovery for dugong populations in this region and the time frame to achieve this target.