

5. QUALITATIVE RISK ASSESSMENT FOR HABITAT QUALITY IN DUGONG PROTECTION AREAS

Sections 2 and 3 of this report established some of the significant anthropogenic impacts on habitat quality in the existing DPAs, such as the deterioration of coastal water quality and the degradation of seagrass habitats by:

increased turbidity due to sediment held in suspension;
increased turbidity due to the formation of particles by physico-chemical and biological processes in the presence of increased nutrients;
increased turbidity due to increasing phytoplankton populations as a result of increased nutrients; and
direct effects on seagrass performance due to increased nutrient availability.

Based on the above and the information on catchment condition outlined in Section 4 a qualitative risk assessment was completed as a screening tool to determine the potential for adverse impacts on the habitat quality to occur in DPAs as a result of activities on adjacent river catchments. The level of risk reflects the development and land use on the adjacent catchments and the associated pollution pressures to the marine environment, as well as basic site-specific attributes of the DPAs, such as the presence of significant local watercourse close to the DPA. The output of the risk assessment is an overall rating of low, moderate or high risk for each of the 16 DPAs (see Table 4), considering five water quality risk categories outlined below.

The limitations of the qualitative risk assessment are recognised as it does not quantify probabilities for impacts to occur, nor does it account for species- or site-specific differences such as pollution tolerance levels of different seagrass communities, which are generally unknown, and physical factors affecting exposure to land-based pressures. A qualitative risk assessment for river-borne contaminants has also been completed for a number of coral reefs in the GBRMP, based on pollution ratings, river discharge volumes and frequencies, and flood plume directions (Devlin et al. 2001). Our assessment does not include consideration of local government planning instruments or Integrated Catchment Management strategies that may be implemented to better manage inputs to the DPAs from land-based activities. However, the risk assessment provides an overview of current pressures to DPAs, and highlights regional issues that warrant further consideration. Better guidance for management to optimise risk reduction will be possible with a more detailed risk assessment, which requires further monitoring of pollutants in seagrasses and marine sediments at a local scale, i.e. inside the DPAs, as well as availability of results of current research into the effects of land run-off constituents on inshore biota and ecosystems.

The categories considered in the risk assessment are:

Presence of a significant local watercourse to the DPA

A number of minor river systems and small watercourses have a high priority in terms of the risk to water quality in the DPAs. These smaller watercourses drain the floodplains, which are in most catchments developed for intensive cropping. The coastal creeks and small rivers export only a small proportion of the total pollutant load to the GBR. They are, however, significant on a local scale because they flow directly into the coastal zone and can carry very high nutrient, sediment and pollutant loads with very little reduction by re-settlement and biological uptake due to the short in-stream passage.

Presence of an urban area, industrial or marine development close to the DPA

Higher levels of contaminants and disturbances by dredging, channel maintenance and vessel traffic may be expected in DPAs in the vicinity of urban centres, industrial areas, ports, marinas, or dredged access channels. Regular vessel traffic in these areas has additional implications for dugong populations through increased potential for boat strikes and the evasion of dugong from feeding areas.

The small urban areas of Ingham, Bowen, and Proserpine are located adjacent to Taylors Beach, Edgumbe Bay and Repulse Bay DPAs, respectively. Small ports, loading facilities, marinas or access channels are located close to the Taylors Beach (Lucinda port and loading facility), Upstart Bay (Molongle Creek access channel), Edgumbe Bay (Bowen marina), Sand Bay (Mackay port and marina), Llewellyn Bay and Ince Bay (Hay Point port and loading facility), and Hervey Bay-Great Sandy Strait (Hervey Bay marina) DPAs. Two significant marina facilities and dredged access channels occur adjacent to the Hinchinbrook DPA, these are the Port Hinchinbrook marina and the dredged access to Enterprise Channel which also includes a proposed marina at Dungeness. The significant urban and industrial areas and major ports of Townsville and Gladstone, with associated marinas and dredged access channels, are located inside the Cleveland Bay and Rodds Bay DPAs, respectively.

Fertiliser application on adjacent catchments

Higher nutrient concentrations may be expected in the runoff from catchments that have high fertiliser application. Average fertiliser application rates per catchment area and per unit of runoff on the adjacent catchments are presented in Table A2. The efficiency of applied fertiliser, that is the amount actually taken up by the crop, is low (Rayment et al. 1996). Hence it may be assumed that high fertiliser application rates are reflected in high nutrient concentrations in the water of receiving streams and rivers. However, the actual nutrient loading in the rivers depends on additional factors such as flow rate and status of wetlands, aquatic and riparian vegetation, which is generally in a poor state in the GBR catchments (DPI 1993a; Johnson et al. 1997). Areal fertiliser use was rated as low, moderate or high according to the following rating scale: low = $<7 \text{ kg N ha}^{-1}$ and $<1 \text{ kg P ha}^{-1}$, moderate = $7\text{--}14 \text{ kg N ha}^{-1}$ and $1\text{--}5 \text{ kg P ha}^{-1}$, high = $>14 \text{ kg N ha}^{-1}$ and $>5 \text{ kg P ha}^{-1}$ (Table A2). A mixed fertiliser rating denotes different ratings for N and P fertiliser. Fertiliser use was rated as low for three DPAs, low/moderate for one DPA, moderate for two DPAs and high/moderate for six DPAs (Bowling Green Bay, Repulse Bay, Newry Region, Sand Bay, Llewellyn Bay and Ince Bay; Table 4).

Pesticide use on adjacent catchments

Higher pesticide concentrations may be expected in the runoff from catchments where large amounts of herbicides, insecticides and fungicides are applied. Data for pesticide application were only available for sugar cane areas (Hamilton & Haydon 1996). The scale for the rating of pesticide use on the adjacent catchments was low = $<10 \text{ g/ha}$, moderate = $10\text{--}100 \text{ g/ha}$ and high = $>100 \text{ g/ha}$ (Table A2). For a number of catchments where grazing is the main land use no data for fertiliser application were available and the fertiliser application was rated as being low. Pesticide use on the adjacent catchments were rated as being low for six DPAs, moderate for three DPAs and high for the remaining seven DPAs (Bowling Green Bay, Repulse Bay, Newry Region, Sand Bay, Llewellyn Bay, and Ince Bay, and Hervey Bay-Great Sandy Strait; Table 4).

Sediment export from adjacent catchments

Eroded soil particles increase the turbidity in the receiving coastal areas and also transport particle-associated nutrients and contaminants. For the rating of sediment export from catchments to the coast we used the model estimates of the National Land and Water Resource Audit (NLWRA and CSIRO Land & Water, unpub. Data; methodology in Prosser et al. 2001) for the ratio of current to natural sediment export

(Table A3), which indicates the increase of sediment export after European settlement. The scale adopted for rating of the sediment export ratio was low= 1-5-fold, moderate= 5-12-fold, and high= >12-fold. Sediment export ratios from the adjacent catchments were rated as being low for four DPAs, moderate for two DPAs, and high for ten DPAs (Repulse Bay, Newry Region, Sand Bay, Llewellyn Bay, Ince Bay, Clairview Region, Shoalwater Bay, Port Clinton, Rodds Bay and Hervey Bay-Great Sandy Strait DPA, Table 4).

Using the individual ratings for the five risk categories a summary rating was generated using a point score system. In the first two risk categories, significant local watercourse and development close to DPA, the presence or absence of the potential pressure was scored as 0 or 1 points, respectively. The risk ratings for the remaining three categories (fertiliser and pesticide use, sediment export) of low, moderate and high were converted into 1, 2, and 3 points, respectively. In conclusion, a score of 3 to 11 points was possible.

For three DPAs the summary risk ratings were modified (Table 4) to reflect additional information that was not formally considered in the risk assessment. The fertiliser and pesticide application rates used in the risk assessment were based on the best available data, which are from 1990 and 1991-94, respectively (Table A2). In the Herbert-Burdekin area a 65% expansion of the area harvested for sugarcane has occurred during 1990-99, predominantly in the Herbert catchment (Australian Sugar Year Book 2001). Based on this recent, continued expansion of the sugar industry in the Herbert catchment the summary risk rating for the Hinchinbrook DPA was upgraded from a moderate to a high risk rating. The risks associated with the major urban, industrial and port activities to the water and habitat quality in the Cleveland Bay and Rodds Bay DPAs were considered to be significant. Consequently, the summary risk rating for the Cleveland Bay DPA, which was rated to be under low risk by general catchment activities, was upgraded to a moderate risk rating (Table 4). The risk rating for the Rodds Bay DPA was accordingly upgraded from moderate to high risk.

When the point score was 3 to 5, the habitat quality in the DPA was considered to be under low risk from upstream activities. As a result, the Shoalwater Bay and Port Clinton DPAs attain a low risk rating. Dugong Protection Areas with a point score of 6 to 8 were considered to be at moderate risk. The majority of the existing DPAs fall into this risk group, i.e. Taylors Beach, Cleveland Bay, Bowling Green Bay, Upstart Bay, Edgumbe Bay, Clairview Region, and Hervey Bay-Great Sandy Strait DPAs. DPAs with a point score of 9 to 11 were rated to be at high risk, i.e. Hinchinbrook, Repulse Bay, Newry Region, Sand Bay, Llewellyn Bay, Ince Bay, and Rodds Bay DPAs.

Table 4. Qualitative risk assessment of impacts by catchments activities on water and habitat quality in Dugong Protection Areas (DPAs) in the Great Barrier Reef World Heritage Area. For rating scales see text.

		Potential risks to water and habitat quality in DPAs					
DPA	Adjacent catchments	Significant local watercourse	Development close to DPA [#]	Fertiliser use	Pesticide use	Sediment export	Summary risk rating
Hinchinbrook	Herbert River		Ingham U, Port Hinchinbrook M, Dungeness AC	moderate	high	low	high*
Taylors Beach	Herbert River	Cattle Creek	Lucinda P	moderate	high	low	moderate
Cleveland Bay	Black, Ross River	Barratta Creek	Townsville U, P, M	low	low	low	moderate*
Bowling Green Bay	Haughton River		-	high/mod.	high	low	moderate
Upstart Bay	Burdekin River	Elliot River	Molongle Ck AC	low	low	moderate	moderate
Edgecumbe Bay	Don River	Gregory River	Bowen U, M	low	moderate	moderate	moderate
Repulse Bay	Proserpine, O'Connell River		Proserpine U	high/mod.	high	high	high
Newry region	Pioneer River	St Helens River	-	high/mod.	high	high	high
Sand Bay	Pioneer River		Mackay U, P, M	high/mod.	high	high	high
Llewellyn Bay	Plane Creek		Hay Pt. P	high/mod.	high	high	high
Ince Bay	Plane Creek		Hay Pt. P	high/mod.	high	high	high
Clairview	Styx River	Carmila Creek		low	low	high	moderate
Shoalwater Bay	Shoalwater Creek		-	low	low	high	low
Port Clinton	Waterpark, Fitzroy River		-	low	low	high	low
Rodds Bay	Calliope, Boyne River Baffle Creek	Auckland Creek	Gladstone U, P, M	low	low	high	high*
Hervey Bay-Great Sandy Strait	Kolan, Burnett, Burrum, Mary Rivers		Maryborough U, Hervey Bay M	moderate	moderate	high	moderate

[#]U= urban area, P= port or loading facility, M= marina, AC= access channel; *= modified summary rating, see text.