Port of Skardon River: Marine habitat resources survey April / May 2002

Final report to Ports Corporation of Queensland

Authors: **Anthony Roelofs**
Michael Rasheed
Ross Thomas
Project Coordinator: **Bob Brunner**

Marine Ecology Group
Northern Fisheries Centre
Department of Primary Industries
PO Box 5396 Cairns Qld 4870

PORTS CORPORATION QUEENSLAND

Queensland Government
Department of Primary Industries

cRc Reef Research Centre

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The Department of Primary Industries, Queensland has taken all reasonable steps to ensure the information contained in this publication is accurate at the time of the survey. Seagrass distribution and abundance can change seasonally and between years, and readers should ensure that they make appropriate enquiries to determine whether new information is available on the particular subject matter.

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Enquiries should be directed to:

The authors
Northern Fisheries Centre,
PO Box 5396
Cairns, QLD 4870 Australia

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Executive Summary

This report provides the results of a survey and review of current knowledge of marine habitat resources in the Skardon River area. The Queensland Government designated the Port of Skardon River in early 2002 and assigned management of the port under the Transport Infrastructure Act to the Ports Corporation of Queensland (PCQ). To assist in developing oil spill response plans and environmental management plans for the new port, a broad-scale survey of the marine habitat resources within the port limits of Skardon River and a fine-scale survey in the vicinity of existing port infrastructure was conducted in April/May 2002. The Skardon River area encompassed a diverse range of ecologically important marine habitats. Many of these habitats such as mangroves, saltpans, rock bars and marine swamps are likely to be of high importance to local fisheries. Only one small seagrass meadow was found in the survey area although evidence from past surveys indicates that seagrass distribution in the area may be variable and at times cover a more extensive area. We suggest the PCQ manage this part of the Skardon River intertidal bank as a potential seagrass area.

The Skardon River is part of a small estuarine system. This places the intertidal benthic communities and the fringing mangrove, saltpan and marine swamp habitats at greater risk from impacts such as oil spills as pollutants would be able to reach more of the sensitive habitats in less time than in open larger estuaries. Environment strategies developed for the Port of Skardon River will need to include rapid emergency response times as a priority.

This survey identified several areas that may require fine-scale mapping if port development proceeds. Subtidal rock bars and shoals are found adjacent to the main river channel. Other benthic habitats such as algae beds and deep holes may also occur in these areas. Subtidal areas outside the immediate port facility were beyond the scope of this study and may require fine-scale habitat surveys if dredging is required.

The complex and ecologically important intertidal communities in the Skardon River such as mangroves and marine swamps would be highly susceptible to oil spills. Oil spill contingency planning should consider these habitats as high priority for protection.

Background

Recent mining developments in the Skardon River area have led to the requirement for a new port in the area. There are existing basic port facilities comprising a barge landing ramp and walkway (Plate 1). The facility has recently changed hands and is now owned and operated by Minerals Corporation who are developing a kaolin mine and export facility. The Ports Corporation of Queensland (PCQ) is responsible for management of the new Port of Skardon River.

To assist in the ongoing management of the new port, PCQ required a habitat inventory (GIS mapping) of the river to provide a baseline of environmental resources of the port before export operations commenced. PCQ commissioned the Marine Ecology Group DPI to produce a broad-scale habitat inventory of the Skardon River in April 2002.

The project was funded by Minerals Corporation and coordinated by PCQ. The sampling design of the survey had two components:

1. A **broad-scale survey** of the intertidal waters within the Skardon River port limits including the adjacent marine swamp areas.
2. A **fine-scale subtidal survey** of benthic resources within a 500-metre radius of the barge ramp operated by Minerals Corporation.

The survey had the following objectives:

1. To provide a broad-scale Geographic Information System (GIS) of marine habitat resources of the Skardon River, Cape York for use in the formation of an oil spill contingency plan and a Environmental Management Plan.
2. To identify habitats in the Skardon River study area that require a more fine-scale level of resource assessment.
3. To conduct a fine scale survey and provide a GIS of subtidal marine habitat resources of an area within a 500-metre radius of the barge ramp operated by Queensland Kaolin.

Plate 1 Port facility and kaolin processing plant at Skardon River, May 2002

Study site

The study site is an area bounded by the Skardon River port limits and the tidal reaches of the Skardon River system (Figure 1). The Skardon River is located on the northwestern side of Cape York Peninsula, approximately 120 km north of the Port of Weipa. The river is in the wet-dry tropical region of Australia and is subject to severe tropical cyclones (November to April). The Skardon River lies within an area identified as one of Queensland's major wetland aggregations (Stanton 1975) and has been included in a Directory of Important Wetlands in Australia by Environment Australia (Perry 1995).

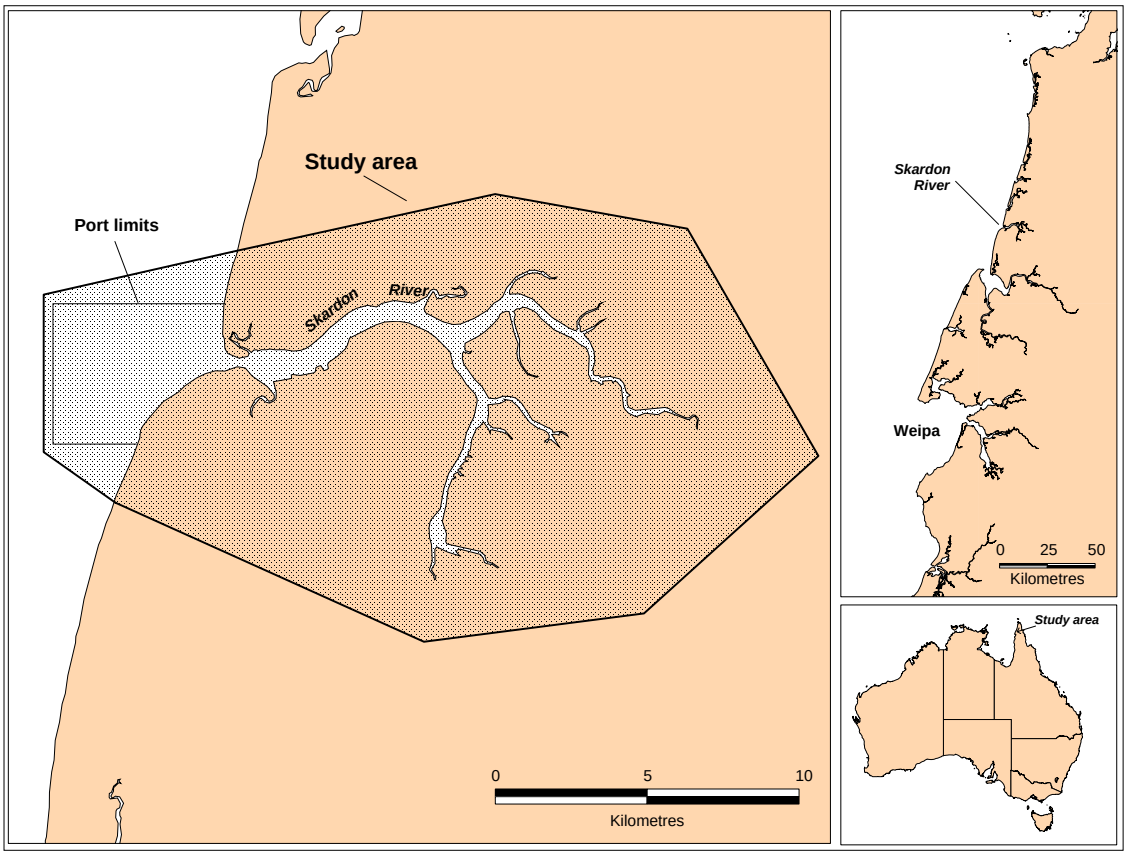


Figure 1. Locality map showing Skardon River study area.

Methods

Marine plant, riparian vegetation and habitat survey

Broad-scale survey of Skardon River port limits

The broad-scale survey area included the intertidal areas within the port limits of the Skardon River as well as the nearby saltpans and swamps (Figure 1). These low lying habitats are likely to be an important fisheries resource, providing nursery and forage areas for prawn and fish species such as barramundi. These areas are also likely to be inundated by water during flood events and could be influenced by activities in the port during the wet season. The survey did not provide maps of subtidal areas unless these habitats were clearly determined from the air during the helicopter survey.

This baseline survey of the marine resources in the Port of Skardon River was conducted by DPI staff between April 30 and May 6, 2002 using a combination of aerial, water and land-based surveys. Fifty two ground truth sites (including twenty three underwater video sites) were sampled in the survey area (Map 1).

An aerial survey by helicopter was used to map the extent of habitats in the intertidal regions, mangrove areas and swamp/saltpans. The geographical location of sites and areas was recorded using a differential Global Positioning System (dGPS). The survey included ground-truthing of habitats for flora and fauna species where appropriate. Photographs and digital video footage of the survey area were also taken.

Each habitat sampling site incorporated a 10 m section of riverbank. All mangroves, marine grasses and succulents within this 10 m frontage were identified to species in the field. Where positive identifications could not be made, samples were collected for later identification. Voucher specimens of species were also collected to confirm field identifications. Other vegetation types present such as terrestrial grasses and terrestrial forest were described. The percentage cover of the site comprised by each species or vegetation type was estimated and recorded for each site. The percentage of each site comprised of other features such as open unvegetated bank was also estimated.

At each site, bank sediment, presence of snags, structural habitat features (mud banks, rocky outcrops, deep holes, sandbars) and disturbances were recorded. A description of the zonation of vegetation and general site characteristics was recorded and a photographic record taken of each site. All site information was recorded on a habitat assessment form.

The distribution of intertidal seagrass and other benthos was sampled using a modified version of helicopter based mapping and sampling techniques developed for the Ports of Weipa, Karumba and Mourilyan (Roelofs *et al.* 2001, Rasheed *et al.* 2000). Exposed habitats were flown over at low tide to determine the presence of seagrass, algae and other benthos. Where benthos other than bare substrate was present, the habitat type and sediment categories were ground truthed from the helicopter while hovering less than a metre above the ground (Plate 2).

The boundaries of intertidal seagrass meadows were mapped while flying directly over the meadow edge and the position fixed using a dGPS. Seagrass meadow characteristics including species present (identified according to Kuo and McComb 1989), species composition, above-ground biomass, % cover, algae species (identified according to Cribb 1996 or grouped into broad categories), % algae cover, sediment type were collected at ground truth sites scattered 0.5 to 1.0 km apart within the seagrass meadows while hovering above the habitat. Benthic invertebrates were grouped into broad categories (hard and soft corals, ascidians, hydroids, bryozoans, anemones, sponges, mussels, and other benthic macro invertebrates) and the percent cover of each category estimated for each site. Site positions were recorded using a dGPS.

Plate 2 Helicopter based habitat mapping and sampling techniques used during the Skardon River marine resources assessment.

Fine-scale subtidal survey port facility area

The fine scale subtidal survey assessed the benthic resources within a 500 metre radius of the barge ramp operated by Minerals Corporation. Subtidal seagrass, algae and other benthos distribution and cover were sampled using an underwater camera system with a real time video feed to a TV monitor.

At each subtidal sampling site the camera was deployed vertically in a fixed frame that displayed a 0.25 m^2 area of the bottom (Plate 3). Three replicate deployments of the camera and a Van Veen sediment grab (approximately volume - 1 litre) were used at each site (approximately 10 m x 10 m area). Ground truth sites were located every 100-200 m along transects that extended for 500m up and 500m down stream of the port loading facility. At each site, an observer identified seagrass, algae and benthic macro-invertebrates while viewing the monitor. The Van Veen grab was used to confirm the presence of any benthic macro-invertebrates, algae or seagrass identified on the camera monitor, to determine presence of seagrass rhizome, and to assess sediment type.

At each seagrass sampling site, seagrass meadow characteristics including seagrass species composition, above-ground biomass, % seagrass cover, % algae cover, water depth (boat only), sediment type, time and dGPS fixes were recorded.

Depths were recorded with an echo sounder to the nearest decimetre and converted to depths (m) below mean sea level (dbMSL), correct to tidal plane datum for the localities surveyed. Field descriptions of sediment categories from hand or Van Veen grab samples were recorded for each site. Sediment categories used were mud, sand, shell, gravel, rubble, rock and reef. Sediment categories were determined by the dominant sediment type (eg. sand/mud = more sand than mud). A portable dGPS unit was used in the field to determine geographic position (± 5 metres) of all sampling sites.

Plate 3 Underwater video camera used to survey seagrass, algae and other benthos in the Skardon River survey.

Geographic Information System

All survey data were entered onto a Geographic Information System (GIS) for presentation of seagrass species distribution and abundance and other benthic habitats. The GIS was created in Mapinfo® using information gathered during the survey. Habitats presented in the GIS include seagrass (2002 and 1986 DPI data), mangrove, saltpan, marine swamp, oyster beds and rock bars (Maps 1 and 2):

A variety of methods were used to determine seagrass meadow and other benthic habitat boundaries. These included rectified topographic maps (courtesy Beach Protection Authority), and aerial photography taken from the helicopter during the survey assisted with mapping. Where possible, habitat boundaries were mapped in the field using a dGPS from a low level helicopter.

Results

Broad-scale survey of Skardon River port limits

The mouth of the Skardon River is bordered by sand dunes vegetated with mostly *Casuarina* sp. woodland, tussock grasslands and heath (Plate 4). The intertidal region is comprised of extensive sand bars that border the main channel of the river. No surface benthic communities were observed on the sand bars although during the aerial survey the sand areas were noted to contain many schools of baitfish and larger predatory fish including barramundi (*Lates calcarifer*). There were many large snags in the form of driftwood and fallen trees along the foreshore of the Skardon River mouth, especially on the southern side. No seagrass was identified growing within the intertidal region of the river mouth bounded by the port limits. Although subtidal regions at the mouth of the Skardon River were not surveyed, it is also unlikely that seagrass would be growing below intertidal depths within the port limits. This area appears to be highly dynamic and is subject to shifting sand bars, has high wind and wave energy exposure and moderate tidal flows (estimated up to 3.0 knots during high rainfall ebb tides (1994)).

Plate 4 Mouth of the Skardon River, May 2002

Extensive fringing mangrove and scattered saltpan habitats were identified along the Skardon River from coastal areas to upper freshwater sections during the survey (Map 1). Mangrove distribution at the Skardon River was more extensive and continuous than the study by Danaher (1995). Typical fringing mangrove areas along the Skardon River included *Rhizophora stylosa* and *R. apiculata*, *Ceriops tagal*, *Bruguieria gymnorhiza* and *B. parviflora*, *Sonerratia* sp, *Avicennia marina*, *Xylocarpus granatum* and *X. moluccensis* and *Excoecaria agallocha*. We identified a narrow band of *Sonneratia* sp. in areas mapped as gaps in the mangrove fringe by Danaher (1995). Some examples of this species were also noted to have a stunted growth form that has not been noted in previous surveys by Danaher (1995) or recent DPI mangrove surveys of the east and west coast of Cape York (Sheppard *et al.* 2000, 2001, 2002) (Plate 5). The range of mangrove species identified (Table 1) was similar to previous studies for the Skardon River (Danaher 1995, Perry 1995) and is typical for this region of the Cape York Peninsula (Bunt *et al.* 1982).

Plate 5 Stunted *Sonneratia* sp. mangrove in the Skardon River, May 2002

Plate 6 Saltpan habitat at Skardon River showing succulents, marine grasses and fringing mangroves, May 2002

The region has small scattered areas of saltpans at the landward margins of the mangroves (Map 1). These areas were characterised by mostly bare hyper saline sandy soils with patches of salt adapted plants (Samphires/Pigfaces – *Halosarcia* sp.; Marine grasses – *Sporobolus* sp., *Fimbristylus* sp. *Tecticornia* sp.) and were bordered by a suite of mangrove species including, *Excoecaria* sp. and *Avicennia* sp (Plate 6). Some saltpans were also fringed by *Acacia* sp. Beyond the saltpans and tidal flats were extensive areas of sedgeland or marine swamp. These sedgelands grow above the tidal reaches and are seasonally flooded (Perry 1995) (Map 1). Species that have been recorded in these swamp areas include the sedge *Eleocharis* sp., Marine Couch - *Xerochloa* sp. and *Fimbristylus* sp., and emergent trees and shrubs including *Melaleuca* sp. and *Grevillea* sp. (Perry 1995). Elsewhere the vegetation comprised mostly open woodland forest.

Only one small isolated *Halodule uninervis* (narrow form) seagrass meadow was identified in the Skardon River (Plate 7, Map 1). The meadow was located approximately 2.4 km north of the port facilities on a sand/mud bank in a side creek of the Skardon River. A seagrass meadow identified near the mouth of Skardon River by the DPI in 1986 (Map 1) was not present in the 2002 survey.

Intertidal benthic communities were sparse throughout the survey area. The only notable features in the broad-scale survey were aggregations of oyster beds, *Sarcostrea* sp., (Plate 8) and patches of isolated algae beds (filamentous green algae (Chlorophyta)) along some intertidal mud banks. Oyster beds were identified on the southern bank from the near the mouth of Skardon River to just upstream of the port facility (Maps 1 & 2). A small bed was also identified at the mouth of a small creek on the opposite bank to the barge ramp. There were a few rock bars just visible at low tide in some of the side branches of the Skardon River and one was identified along the main channel. There were no rock bars within a 1 kilometre radius of the port facility.

Plate 7 *Halodule uninervis* (narrow form) seagrass meadow in the Skardon River, May 2002

Plate 8 Oyster beds in the Skardon River, May 2002

Fine-scale survey of port facility area

The fine-scale subtidal survey included twenty-three sites sampled by underwater video and 7 sites by helicopter and boat to describe the benthic marine communities and intertidal habitat within 500 metres of the port facility (Map 1). No seagrass was found within fine-scale survey area.

The survey identified a mostly bare mud/sand/shell/gravel substrate with very sparse benthic invertebrate cover within the area. A small bed of mixed red and brown (Rhodophyta and Phaeophyta) algae was found on a rocky substrate on the opposite side of the river to the port facility (Map 2). Other algae present were filamentous green (Chlorophyta) and red turf algae.

Sponges and bryozoans were the only subtidal benthic invertebrates identified near the port facility however these were present at only a few sites and never covered more than 10 % of the area of each site (Map 2).

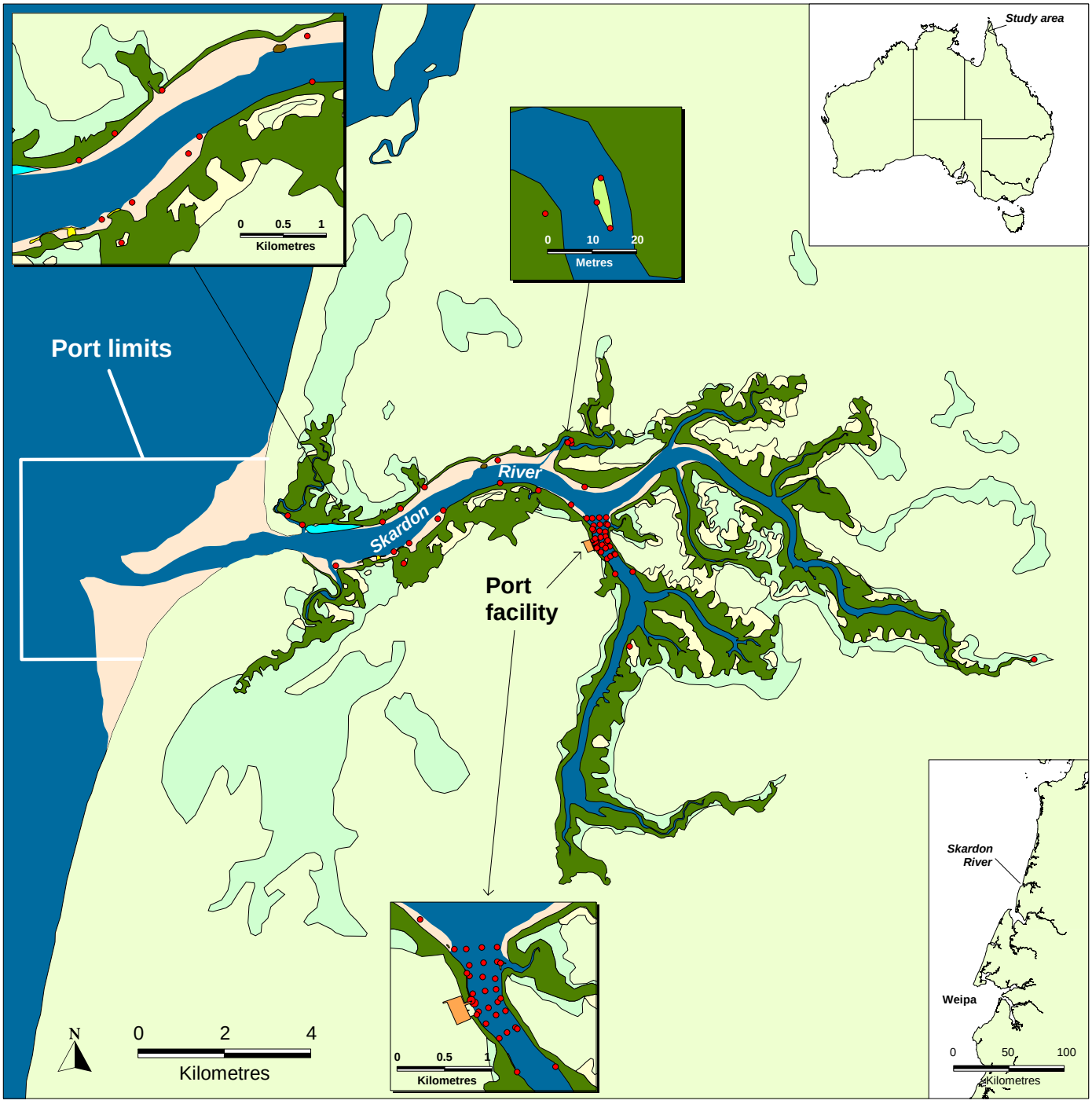
Approximately 300 metres of mangroves had been previously cleared along the foreshore area for the port facility. Marine couch, terrestrial plants and grasses occupy the cleared area and there has been some recolonisation of the cleared intertidal areas by mangroves (mostly *Rhizophora stylosa*) (Plate 1). Oyster beds were identified on rocks within the intertidal zone adjacent to this cleared area and in a small bed on the opposite shore to the barge landing (Plate 9). The bank sediment within this cleared area is comprised of mud, sand, shell and gravel (in order of dominance).

Plate 9 Oyster bed opposite the port facility at Skardon River, May 2002

Table 1 Known vegetation of the Skardon River port area identified during the 2002 marine habitat resource survey and literature review.

Vegetation type	Common name	Identified during 2002 Survey	Source
Seagrass			
Halodule uninervis (narrow form)		✓	Roelofs *et al.* 2002; Coles *et al.* 2002
Mangroves			
Rhizophora stylosa	Red mangrove	✓	Danaher 1995; Perry 1995
Rhizophora. apiculata	Tall-stilted mangrove	✓	Danaher 1995; Perry 1995
Ceriops tagal	Yellow mangrove	✓	Danaher 1995; Perry 1995
Bruguieria gymnorhiza	Large-leaved orange mangrove	✓	Danaher 1995; Perry 1995
Bruguieria parviflora	Small-leaved orange mangrove	✓	Danaher 1995; Perry 1995
Sonerratia sp	Mangrove apple	✓	Danaher 1995; Perry 1995
Avicennia marina	Grey mangrove	✓	Danaher 1995; Perry 1995
Xylocarpus granatum	Cannonball mangrove	✓	Danaher 1995; Perry 1995
Xylocarpus moluccensis	Cedar mangrove	✓	Danaher 1995; Perry 1995
Excoecaria agallocha	Blind-your-eye mangrove	✓	Danaher 1995; Perry 1995
Osbornia octodonta	Myrtle mangrove	✓	Danaher 1995; Perry 1995
Aegialitis annulata.	Club mangrove	✓	Danaher 1995; Perry 1995
Lumnitzera racemosa	Black mangrove	✓	Danaher 1995; Perry 1995
Nypa fruticans	Mangrove palm		Danaher 1995; Perry 1995
Heritiera littoralis	Looking-glass mangrove		Danaher 1995; Perry 1995
Acrostichum speciosum	Mangrove fern	✓	Danaher 1995; Perry 1995
Aegiceras corniculatum	River mangrove		Danaher 1995; Perry 1995
Hibiscus tiliaceus	Native Hibiscus	✓	Danaher 1995; Perry 1995
Samphires			
Halosarcia spp.	Pigface	✓	Cited in Perry 1995
Fimbristylis spp.		✓	Danaher 1995
Tecticornia australasica		✓	Danaher 1995
Suaeda arbusculoides	Samphire bush	✓	Danaher 1995
Sarcocornia quinqueflora	Tree samphire		Danaher 1995
Marine Grasses			
Sporobolus virginicus	Salt couch	✓	Danaher 1995
Sphaeranthus indicus			Cited in Perry 1995
Xerochloa sp.			Cited in Perry 1995
Terrestrial forest			
Melaleuca spp.		✓	Danaher 1995; Perry 1995
Grevillea spp.		✓	Danaher 1995; Perry 1995
Casuarina equisetifolia	Sheoak	✓	Danaher 1995; Perry 1995
Acacia spp.			Danaher 1995; Perry 1995
Sedgeland		✓	
Eleocharis sp.	Sedge		Danaher 1995; Perry 1995

MAP 1 Location of the Port facility, habitat sampling sites, mangrove, seagrass, saltpan and swamp areas, and intertidal banks at Skardon River, May 2002



LEGEND

- Habitat sampling site
- Mangroves
- Seagrass meadow (DPI 2002)
- Seagrass meadow (DPI Oct 1986)
- Saltpan
- Marine swamp
- Intertidal sand and mud banks
- Oyster beds
- Rock bar

Source:
A. Roelofs, M. Rasheed & R. Thomas (2002)
The Port of Skardon River:
Assessment of Marine Resources - May 2002.
Queensland Fisheries Service.

Sampling dates: 30 April - 5 May 2002

Funded by the Ports Corporation of Queensland

Produced by the Marine Ecology Group,
Queensland Fisheries Service, DPI.
Northern Fisheries Centre, Cairns, 2002.

MAP 2

Algae, bryozoa and sponge cover at each habitat sampling site within 500 metres of the Port facility at Skardon River, May 2002

LEGEND

- Mangroves
- Oyster covered rocks
- Saltpan
- Marine swamp
- Intertidal sand and mud banks

N

0 0.25 0.5

Kilometres

Source:
A. Roelofs, M. Rasheed & R. Thomas (2002)
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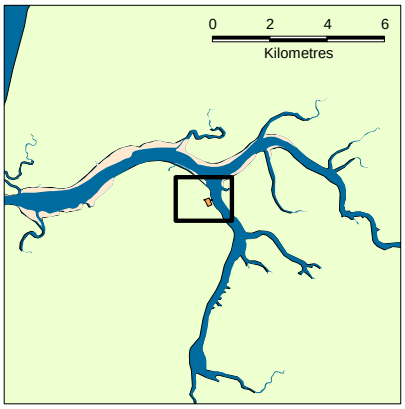

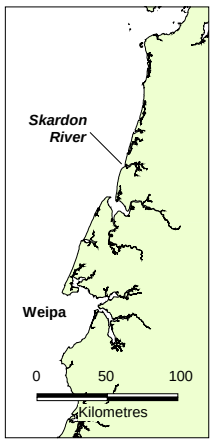

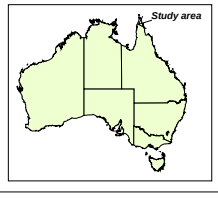

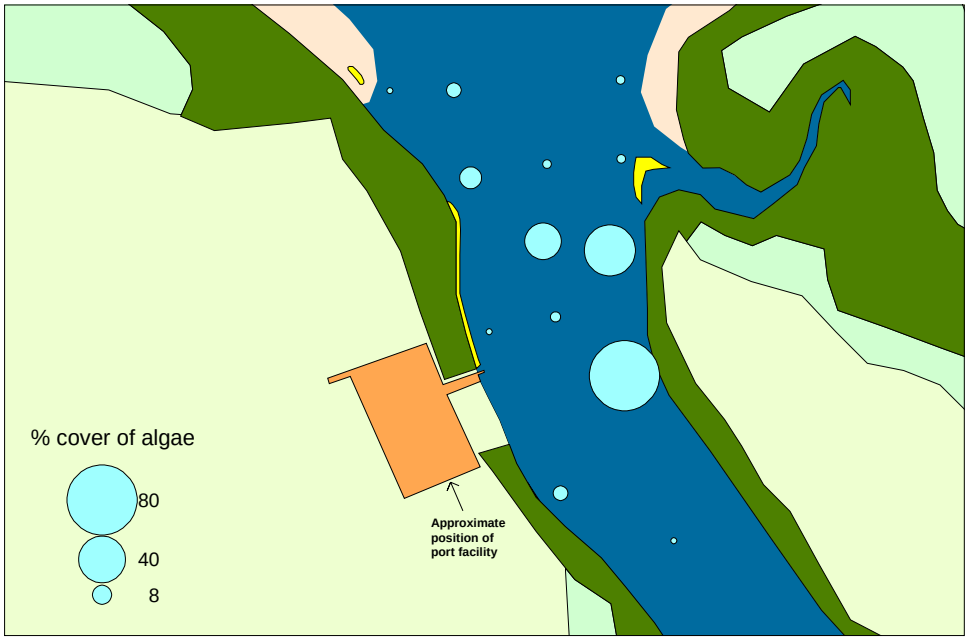

Discussion

The Skardon River has high wilderness values and is an important breeding area for estuarine crocodiles and green turtles (Perry 1995). The region has been identified as lying within one of Queensland's major wetland aggregations (Stanton 1975). The Skardon River region is also noted as containing some of the best representative areas of *Melaleuca quinquenervia* open forest on Cape York Peninsula (Neldner and Clarkson 1995 cited in Perry 1995). This study has confirmed the extensive network of mangroves, wetlands and saltpan areas that can be found at the Skardon River and has added to the existing knowledge on the distribution of mangrove, seagrass, algae and benthic communities found in the region.

Although only a single small isolated *Halodule uninervis* (narrow form) seagrass meadow was found in the Skardon River, the confirmed presence of another *Halodule uninervis* (narrow form) meadow identified by DPI in October 1986 suggests seagrass distribution in this system is variable between years and perhaps seasons. *Halodule uninervis* meadows have been found to be variable in other locations on western Cape York, such as the Love and Kirke Rivers (Rasheed 2000). These meadows appear to be susceptible to impact following flooding events that commonly occur in the region. *Halodule uninervis* is capable of producing long-lived seeds that can lay dormant in the sediments (McMillan 1981). This "seed-bank" may allow recovery of theses meadows during favourable conditions for seagrass growth. It is likely that the loss of the seagrass meadow identified in 1986 is only temporary and that part of the river may still contain a viable seed bank. We suggest the PCQ manage this part of the Skardon River intertidal bank as a potential seagrass area.

Intertidal benthic communities which include sand and mud banks, algae beds, seagrass areas, oyster beds and rock bars were identified in the Skardon River and are important to the local ecology and fisheries. The oyster beds adjacent to the port facility may be at high risk from impacts such as pollutant spills and physical disturbances through boat activities. The rock bar 5.5 km upstream from the mouth of the Skardon River is also in a position of risk especially from potential ship groundings, oil spills and dredging, due to its close proximity to the narrow river channel. Fine scale surveys of these ecologically important sub-tidal areas may be required as part of developing oil spill contingency and preliminary dredging plans for the port.

The Skardon River is part of a small estuarine system. This places the intertidal benthic communities and the fringing mangrove, saltpan and marine swamp habitats at greater risk from impacts such as oil spills as pollutants would be able to reach more of the sensitive habitats in less time than in open larger estuaries. Environment strategies developed for the Port of Skardon River will need to include rapid emergency response times as a priority.

The benthic communities identified in close proximity to the barge ramp and loading facility area are at a particular risk from impacts associated with port operations. Although oyster and algae beds were the only major habitats identified near the port facility, the sand and mud banks and their associated infauna are also important to the overall ecology of the system. Mangroves adjacent to the port facilities would be at risk of impact if shore facilities were expanded beyond their present extent. There was no intertidal seagrass found near the port facilities, although ephemeral species such as *Halophila ovalis* and *Halodule uninervis* (narrow) may sometimes be present. It is unlikely that seagrass would grow in the subtidal areas of this section of the river.

Biota found in the intertidal zone of the Skardon River (which includes mangroves, seagrass, algae and oysters) is at a high risk from impacts such as pollutant spills, channel dredging and groundings of vessels. The distribution maps and the GIS of these communities at Skardon River presented in this report and CD-ROM will assist port managers in developing a strategic plan for the placement of port infrastructure, dredging channels and emergency response procedures.

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