

Western Basin Dredging and Disposal Project (EPBC 2009/4904)

Environmental Performance Report December 2017

For the attention of : The Department of the Environment and Energy



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Acronyms

ASSMP	Acid Sulfate Soil Management Plan
BPAR	Benthic Photosynthetically Active Radiation
CCL	Curved Carapace Length
DFT	Dugong Feeding Trails
DMP	Dredge Management Plan
DoEE	Department of the Environment and Energy (formerly known as the Department of Environment (DoE))
EA	Eastern Australian
EHP	Department of Environment and Heritage Protection
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i>
EPR	Environmental Performance Report
ERMP	Ecosystem Research and Monitoring Program
ERMPAP	Ecosystem Research and Monitoring Program Advisory Panel
FFMP	Flora and Fauna Management Plan
GPC	Gladstone Ports Corporation
NVDI	Normalised Difference Vegetation Index
ToR	Terms of Reference
WBDDP	Western Basin Dredging and Disposal Project
WBRA	Western Basin Reclamation Area
WQMP	Water Quality Management Plan

Executive Summary

The 2017 Environmental Performance Report (EPR), has been prepared to comply with the following conditions of the Western Basin Dredging and Disposal Project (WBDDP) *Environmental Protection and Biodiversity Conservation Act* (EPBC Act) Approval 2009/4904:

Condition 36

Ecosystem and Research Monitoring Program (ERMP)

The person taking the action must submit to the Minister an Annual Environmental Performance Report covering the following topics:

- a) Dolphins, dugong and marine turtles, and other megafauna;*
- b) Migratory shorebirds; and*
- c) Seagrass.*

Condition 37

ERMP

12 Months from the date of approval, a report must be submitted outlining the initial environmental activities for the 12 month period. The report is to be called the Environmental Performance Report and must be submitted within 42 days of the 12 month activity period. The Environmental Performance Report must include proposed environmental management improvements to be implemented through the DCMP, WQMP and other Plans as relevant. Reports are required Annually from thereafter.

The 2017 EPR covers the period from 1 November 2016 to 31 October 2017 and includes the outcomes of the studies conducted under the ERMP. The report also provides an overview of the seagrass monitoring programs being conducted as a compliance requirement under the post dredging phase of the WBDDP Water Quality Management Plan (WQMP).

Information presented in this report has been collated from the project reports submitted by the service providers and approved by the ERMP Advisory Panel (ERMPAP). A copy of all approved reports received in the current period will be submitted along with this report and also published on the Gladstone Ports Corporation (GPC) ERMP webpage.

In 2017, a number of ERMP projects were completed. In accordance with the ERMPAP Terms of Reference (ToR), any final report submitted under the ERMP needs to be reviewed by an external reviewer recommended by the Panel. Hence many of the project reports are under various stages of finalisation. The information from these reports will be included in the 2018 EPR.

The following key monitoring programs pertaining to Condition 36 were in progress in the current reporting period:

Increase Understanding of the Status of Australian snubfin and Australian humpback Dolphins Within Port Curtis and Port Alma

The survey of dolphins in Port Curtis and Port Alma (also referred to as the ERMP area) to gain information on population dynamics, genetics, toxicology and diet pattern commenced in 2014 and ended in 2017. Progress of this project had been reported in the 2014 to 2016 EPRs. The fourth progress report was submitted and approved by the ERMPAP in 2017. The final report for this project has been submitted to GPC and as at 31 October 2017, is under review by the Panel. The findings and conclusions from this project will be included in the 2018 EPR.

Dugong Feeding Trail Ecology and Habitat Use on Intertidal Banks of Port Curtis and Rodds Bay

Dugong feeding trail (DFTs) studies were commissioned by the ERMPAP from May 2015 to November 2016 to trial quantification of DFTS in Port Curtis and Rodds Bay using advanced photogrammetry. The study was successful in extracting DFTs and providing information on habitat usage by dugongs extending even to large seagrass meadows. The final report for this project has been approved by the ERMPAP. Whilst this study has provided insight into a new technique for assessment of habitat usage by dugongs, the ERMPAP has recommended that the project will not be extended any further under the ERMP as EPBC approval condition requirements have already been addressed.

No dugongs have been opportunistically tagged during the green turtle health assessment monitoring conducted from April to October 2017. Dugong sightings were reported near Pelican Banks. This is the second year where no dugongs could be tagged. The ERMPAP will review the program and recommend alternate programs if necessary in 2018.

Marine Turtle Nesting Populations: Avoid, Peak and Curtis Island Flatback Turtles

Surveys for monitoring nesting success under the ERMP at Avoid and Peak Islands started in 2013 and at Curtis Island from 2015 onwards. The ERMPAP recommended that a full season nesting census be conducted on Curtis and Avoid Islands for one (1) monitoring period. This was conducted during the 2016-2017 nesting season where five (5) months of continuous monitoring occurred on Curtis and Avoid Islands from November 2016 to March 2017. Peak Island was monitored for only the partial census.

A field report approved by the ERMPAP in May 2017, provided a summary of activities conducted during the nesting census. Final reports for all the three (3) islands inclusive of comparison of full vs partial census results have been submitted to GPC and as at 31 October 2017, are under review by the ERMPAP. The findings and conclusions from the studies will be included in the 2018 EPR.

Interesting Habitat Use by Flatback Turtles off the Curtis Island Coast

This study commenced in 2013 and ended in 2015. In each of the seasons, GPS satellite tags were deployed on eleven (11) flatback turtles to understand the extent to which the interesting turtles used the ERMP region. As reported in the 2016 EPR, two (2) tags had to

be removed due to harness malfunction in 2015. These tags were attempted to be deployed during the turtle nesting season in 2016/2017. This exercise could not be carried out, hence the tags were deployed on sub-adult green turtles in May 2017.

Progress of this project had been reported in the 2015 and 2016 EPRs. The final report on interesting habitat use by flatback turtles is under review by the ERMPAP and details will be presented in the 2018 EPR.

Increase Understanding of Green Turtle Habitat usage in the Port Curtis and Port Alma Region: using Satellite Telemetry

This study commenced in 2014 and came to an end in May 2017. A total of 35 satellite tags were deployed during field trips in May 2014, July 2015, May and October 2016 and May 2017 to track movement of green turtles in the ERMP area. Progress of this project had been reported in 2014 to 2016 EPRs. As at 31 October 2017, the final report is under review by the ERMPAP, and details from the study will be included in the 2018 EPR.

To Determine the Composition, Size, Sex, Maturity, Growth rates, survivorship, recruitment and general health of the green turtle population in Port Curtis

2016 was the first year of a four (4) year study focussing on gathering information on movements, courtship behaviour, gender maturity, diet and general health of foraging green turtles in the intertidal and sub-tidal waters of Port Curtis. An annual report for the 2016 surveys was approved by the ERMPAP in early 2017.

In 2017, field trips were conducted in April-May, June-July and September at Pelican Banks off the southeast corner of Curtis Island, Wiggins Island, Quoin Island, eastern shore of Facing Island and the Boyne Estuary.

Annual Summer Survey of the Migratory Shorebirds

The annual summer surveys for estimating abundance of migratory shorebirds in the ERMP area commenced in 2014 and will continue till 2018 following which, they will be replaced by more intensive surveys (five (5) per year) during 2019 and 2020. In the current reporting period, 154 roosts were surveyed over five (5) days in February 2017. A total of 14,003 migratory shorebirds, consisting of 21 species was recorded during the high tide roost surveys. The total bird count was 21% more than the results recorded in February 2016; and 14% more than the summer average calculated from nine (9) surveys conducted over the life of the project from 2011-2017. The final report for this project has been approved by the ERMPAP.

Migratory Shorebird Monitoring—Understanding Ecological Impact

This project commenced in 2014 and came to an end in 2017. The objective of this study was to estimate the carrying capacity and determine the size of the migratory shorebird population in Port Curtis and Port Alma. The study highlighted that about 20,000 migratory shorebirds use the ERMP area. Individual birds show high site fidelity both within and between non-breeding seasons. Based on estimates of food density, the ERMP area appeared to be operating close to its carrying capacity. The study concluded that the ERMP

area is currently ecologically healthy with respect to migratory shorebirds, but is potentially vulnerable to any further reductions in quality or quantity of shorebird habitat. The final report for this project submitted in 2017 has been approved by the ERMPAP.

Monitoring the survival and recovery of shorelines, specifically Tidal Wetlands Mangroves/Saltmarsh/Salt pans

This program commenced in March 2015. In the current reporting period, boat-based surveys were undertaken by the Gidarjil Rangers for the Boyne River in March 2017. No aerial field surveys were conducted but the data from the 2015 survey was processed and partly analysed. A public access online data archive functional prototype website the “ShoreView” online facility was developed displaying mangrove condition in the ERMP area. Updated assessment of data and observations of shoreline change and condition in the ERMP area show notable issues with shoreline retreat and erosion in some areas. Annual progress report for this project was submitted in 2017 and has been approved by the ERMPAP.

Monitoring Seagrass Seed Bank Density and Viability within Port Curtis

This study to quantify temporal variation in the seagrass seedbank density and viability commenced in 2014 came to an end in 2017. The study involved analysis of sediment cores containing *Zostera muelleri* subsp. *capricorni* (hereon referred to as *Z. muelleri*) seedbanks collected and stored from 2011 to 2014 as well as new cores collected between 2015 and 2017. Biannual assessments of seed bank viability were also conducted in February and May between 2015 and 2017 (Reported in 2016 EPR). As at 31 October 2017, the final report is under review by the Panel, hence details from this study will be included in the 2018 EPR.

The following seagrass studies were conducted in accordance with the WBDDP Water Quality Management Plan (WQMP) and were not funded under the ERMP:

Gladstone Permanent Transect Quarterly Seagrass Monitoring

Quarterly monitoring of seagrass at seven (7) permanent transects had continued since the completion of the WBDDP and came to an end in November 2016. The primary goal of the seagrass permanent transect monitoring was to detect significant shifts in seagrass condition in the context of dredging activity. The program provided a detailed description of seagrass abundance and interannual variability in inner, mid and outer harbour locations within Port Curtis and Rodds Bay. In summary, major rainfall and river flow events prior to, during, and following dredging impacted permanent transect site locations; however any interactive effect of dredging with significant storm and river flow events was unable to be determined, due to its co-incident timing. The final report from this study was received in 2017.

Annual Long Term Monitoring of Seagrass

Longterm mapping of seagrass in Port Curtis and Rodds Bay continued from 2002. In the current reporting period, annual mapping of seagrass occurred in November 2016.

In 2016, the overall condition of seagrass in Port Curtis and Rodds Bay reduced from 2015. Mixed results were observed for individual meadows with the Western Basin, the Narrows and South Trees area in better condition. Meadows in the inner harbour, mid harbour and Rodds Bay remained in poor condition. Causes for decline could not be determined as environmental conditions remained favourable in 2016 with relatively low rainfall and benthic light remaining above locally derived threshold. The final report from this study was received in 2017.

Environmental Approvals and Management Plans

Following consultation with the Department of Environmental Heritage and Protection (EHP) on 12 November 2013, the WBDDP Dredge Management Plan (DMP), WQMP and the Flora and Fauna Management Plan (FFMP) were relegated to a dormant state and will remain so until the initiation of further dredging under this approval.

The Acid Sulfate Soil Management Plan (ASSMP) is still active and has obligations pertaining to the management of the Western Basin Reclamation Area (WBRA). Changes to monitoring and reporting obligations under the ASSMP were made in the current reporting period in consultation with EHP. No changes to the ERMP document or the ERMPAP ToR were made in the current reporting period.

1.0 Introduction

1.1 Project Overview

To facilitate the significant development of the Port of Gladstone, GPC obtained approvals from the State and Commonwealth Government in 2010 to extend, deepen and widen existing shipping channels and create new berth facilities through the WBDDP. Stage 1A of the Project commenced on 20 May 2011 and was completed on 18 September 2013. This involved dredging of 22.5 million m³ of seabed material that was placed at sea (5.1 million m³) and within the WBRA (17.5 million m³). The WBDDP was subject to substantial environmental monitoring (water quality, seagrass, Benthic Photosynthetically Active Radiation (BPAR), marine megafauna, shorebirds, tidal wetlands etc.) as required under the various approval conditions. Post completion of dredging activities, a number of environmental monitoring programs are still in progress.

1.2 Ecosystem Research and Monitoring Program

The EPBC Act approval 2009/4904 required the development, implementation and funding of a Port Curtis and Port Alma ERMP (Condition 27 to 33) overseen by an Advisory Panel (the ERMPAP) headed by an Independent Chair (Conditions 25 and 26). The ERMP requires research commitments related to the marine megafauna (Conditions 33a to 33f), migratory shorebirds (33g to 33k), seagrass and other marine communities (Conditions 33l to 33m).

The ERMP was structured to execute projects through a tiered approach. Tier one (1) programs comprised desktop reviews to collate existing information and identify gaps in knowledge pertaining to the ERMP area. Appendix 1 shows the boundary of the ERMP area. Tier two (2) projects consisted of on-ground monitoring programs designed to comply with conditioned requirements of the EPBC Act approval. The ERMP also has provisions for Tier 3 projects required in response to unforeseen events or following an emergency situation.

The ERMP is overseen by the ERMPAP. ToR for the ERMPAP have been developed and approved by the Department of Environment and Energy (DoEE). These outline the roles of the ERMPAP as well as the processes for project development including tender selection and review and approval of project reports. The outcomes and findings of the ERMP have been reported in the EPRs (CQG Consulting 2011, 2012 and 2013, GPC EPR 2014, 2015 and 2016). The ERMP, ERMPAP ToR and EPRs are available on the GPC's website (link below).

<http://www.gpcl.com.au/environment/ermp>

1.3 Environmental Performance Report

EPRs have been prepared to comply with the following conditions of the WBDDP EPBC Act Approval 2009/4904:

Condition 36

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Condition 37

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To date, six (6) reports (CQG Consulting 2011, 2012, 2013, GPC EPR 2014, 2015, 2016) covering the period from 22 October 2010 to 31 October 2016 have been submitted to DoEE.

The 2017 EPR is the seventh report and as required under the approval conditions, discusses the outcomes of the monitoring programs pertaining to marine megafauna (dolphins, dugongs, marine turtles), migratory shorebirds, seagrass and tidal wetlands that were conducted between 1 November 2016 to 31 October 2017. A list of all reports generated in the current reporting period and approved by the ERMPAP is appended (Appendix 2). A timeline of the ERMP has been attached (Appendix 3) to this report.

Information on seagrass monitoring as required under the WBDDP WQMP (outside the ERMP funding) have also been added to this report in addition to an overview of the ERMPAP meetings conducted during the reporting period and an update on the status of the WBDDP approvals and management plans.

2.0 Progress of the ERMP in 2016-2017

2.1 Marine Megafauna

2.1.1 Dolphins

Increase understanding of the status of Australian snubfin and Australian humpback dolphins within Port Curtis and Port Alma

Overview

The objective of the study was to increase the understanding of the status of the Indo-Pacific humpback dolphin (*Sousa chinensis*)¹ henceforth being referred to as the Australian humpback dolphin and the Australian snubfin dolphin (*Orcaella heinsohni*) in the Port Curtis and Port Alma regions, through population estimates using a mark recapture technique, population genetics, toxicology and estimates of dietary intake. The project commenced in August 2014 and ended in 2017 with the submission of the final project report. The 2014 to 2016 EPRs discussed the project objectives, and tracked the progress of the project. The fourth progress report summarising data collected during the 2016 surveys has been approved by the ERMPAP (link below). The final Project report is under review by the ERMPAP and details will be included in the 2018 EPR.

<http://staging.gpcl.com.au/EnvironmentDocuments/FourthProjectReportIncreaseUnderstandingoftheStatusoftheAustralianSnubfinan.pdf#search=dolphin>

Survey Locations

The study area for population estimates of the Australian humpback dolphin and Australian snubfin dolphin encompassed 1147 km² in Port Curtis and Port Alma, including open, shallow inshore waters and intricate estuarine systems between Peak Island in the north and Turkey Beach in the south. In addition, 400 km of line transects were surveyed to collect secondary data on groups of dolphins (Figure 1).

Methodology

A stratified survey sampling design was developed to increase survey efficiency and ensure a uniform coverage of the study area. The study area was divided into five strata with rather different physical characteristics: Outer Fitzroy River, Inner Fitzroy River, Eastern Curtis Island, Port Curtis and Rodds Bay.

¹ Following the recent morphological and molecular revision of the genus *Sousa*, humpback dolphins found in the waters of the Sahul Shelf from northern Australia to southern New Guinea that were previously included as Indo-Pacific humpback dolphins (*Sousa chinensis*) have now been determined to be a distinct species, renamed the Australian humpback dolphin (*Sousa sahalensis*).

Findings

During the five (5) survey periods for the duration of the project, a total of 3,448 km was surveyed. 87 humpback dolphin groups, 49 snubfin dolphin groups, one (1) mixed-species group of humpback and snubfin dolphins, seven (7) groups of bottlenose dolphins, three (3) single dugongs and one (1) mother-calf pair were observed.

Snubfin dolphins were encountered primarily in the Port Alma section of the ERMP area, and Humpback dolphins were sighted throughout the entire ERMP area.

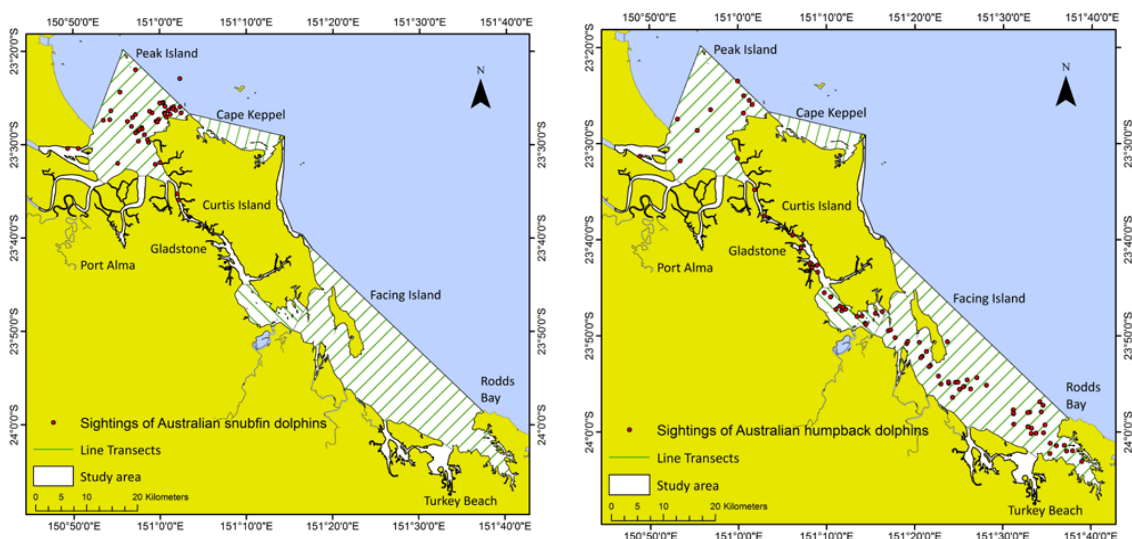


Figure 1. Distribution of groups of Australian snubfin (left) and humpback dolphins (right) sighted in the ERMP survey area during boat-based surveys using line transects in 2016.

A total of 35 dolphin blubber samples (humpback dolphins = 17; snubfin dolphins = 18) were analysed for an extensive suite of organochlorine compounds (OCs) and 39 skin samples (humpback dolphins = 17; snubfin dolphins = 22) were analysed for heavy metals. Discussion on the toxicology results will be included in the final project report. Summary of analytical results against project deliverables is presented in Table 1.

Table 1. Summary of data collection and status of the analyses against the project schedule.

Project Status	Genetic analysis	Stable Isotopes	OCs	Heavy Metals	Project schedule	Expected completion
All samples target/analysed	70/69	40/51	36/36	36/39	09/2016	Completed
Snubfin dolphin target / analysed	~30/36	~20/31	~18/18	~18/22	09/2016	Completed
Humpback dolphin target / analysed	~40/33	~20/23	~18/18	~18/17	09/2016	Completed

2.1.2 Dugongs

2.1.2.1 Dugong Feeding Ecology and Habitat Use on Intertidal Banks of Port Curtis and Rodds Bay

Overview

The aim of this research project was to identify and quantify DFTs to gain an understanding of dugong ecology and habitat use. Field surveys for this project commenced in May 2015 and continued on a quarterly basis to November 2016. To examine the longevity of trails between the regular quarterly surveys, a sub-set of smaller areas where DFTs had been mapped were reassessed two (2), four (4) and eight (8) weeks following the August 2015 survey.

The final project report was delivered in early 2017 and has been approved by the ERMPAP (link below). Whilst this study has provided insight into a new technique for assessment of habitat usage by dugongs, the ERMPAP has recommended that the project will not be extended any further under the ERMP as EPBC approval condition requirements have already been addressed.

http://gpcl.com.au/EnvironmentDocuments/ERMP_Dugong_feeding_ecology_and_habitat_use_on_intertidal_banks_of_Port_Curtis_and_Rodds_Bay_FINAL_2017.pdf#search=dugong

Survey Locations

Four (4) intertidal seagrass monitoring locations were selected as key meadows for quarterly assessment of DFTs; Pelican Banks, Wiggins Island, South Trees and a representative meadow in Rodds Bay. All sites were located within the Rodds Bay Dugong Protection Area and were selected on the basis of the results of the past five (5) years study of DFTs, some of which was undertaken as part of the seagrass monitoring for the WBDDP.

Methodology

A new method was successfully developed to quantify DFTs using low-level aerial photography and next generation photogrammetry (structure from motion) techniques and software. This enabled the production of orthomosaics of the target areas with less than 5 cm pixel resolution suitable for identifying dugong feeding scars or trails. This allowed the effective examination of dugongs feeding over large “meadow” scales and a tool to address knowledge gaps around the temporal and spatial use of intertidal seagrass habitat and its relationship to weather, season and changes to seagrasses.

Findings

The program provided a method and baseline information on the use of seagrass meadows by dugongs against which the impact of future developments in the region can be assessed. Results highlighted the importance of intertidal seagrass meadows as foraging habitat for the dugong population of Port Curtis and Rodds Bay. All meadows sampled, showed dugong feeding activity throughout the year with no consistent temporal patterns among sites. Sites

closer to the port (Wiggins Island, South Trees and Pelican Banks) had higher levels of feeding than the two (2) Rodds Bay meadows though a greater level of dugong feeding activity was observed at the deeper areas of the meadows (Rodds Bay South). In general, DFTs were positively correlated with increased seagrass presence and above ground biomass.

An analysis of the longevity of DFTs indicated that trails were unlikely to persist between quarterly sampling events with the majority of trails indistinguishable between two (2) and ten (10) weeks after being first recorded.

Due to the low number of dugongs tagged under the opportunistic tagging of dugongs (two (2) in 2014 and one (1) in 2015), no correlation between the DFTs and movement of dugongs could be made.

As this study only collected detailed data on the distribution of DFTs in the post dredging environment (2015-2016) quantitative comparisons of the potential impact of the WBDDP on the use of intertidal seagrass meadows by dugongs could not be made.

Seagrass monitoring surveys in Port Curtis noted the presence of DFTs in intertidal seagrass survey sites providing qualitative evidence of dugong usage in these areas over the last six (6) years, including the period before the WBDDP. The study indicated that following the WBDDP, dugongs were accessing similar meadows to those they were using prior to WBDDP.

Significant seagrass loss in Central and Northern Queensland due to extreme weather events, flooding and cyclones in 2010-2011 made it difficult to identify any potential impacts to dugong feeding activity that may have occurred during the dredging program.

2.1.2.2 Increase understanding of dugong ecology and habitat use in Port Curtis, including Rodds Bay -Opportunistic tagging of dugongs in Port Curtis

Overview

Opportunistic tagging of dugongs is being undertaken to gain information on the movement of dugongs in the Port Curtis region. The study commenced in 2014 and was planned to continue until 2019 on an opportunistic basis during the health assessment studies of green turtles. Two (2) dugongs were tagged in 2014 and one (1) in 2015. No dugongs could be tagged in 2016 due to unfavourable underwater visibility. In 2017, dugongs were sighted close to Pelican Banks during green turtle health assessment surveys but none were encountered at locations where they could be tagged. The ERMPAP is currently reviewing this project and will recommend whether this study should continue on an opportunistic basis as planned till 2019 or be replaced with some other project.

2.1.3 Marine Turtles

2.1.3.1 Marine Turtle Nesting Populations: Avoid, Peak and Curtis Island – Flatback Turtles

Overview

Studies are being conducted on Avoid, Peak and Curtis Islands to monitor the Eastern Australian (EA) flatback turtle nesting population at a reference index beach towards the northern extent of the population’s nesting range. These studies commenced in 2013 at Avoid and Peak Islands and in 2015 at Curtis Island, to be continued till 2017.

The ERMPAP recommended that the four (4) weekly (partial nesting) census be extended to a full nesting census for one (1) season. This was conducted during the 2016-17 season on Curtis and Avoid Islands with the standard four (4) weekly census on Peak Island.

A field report was received and approved by the ERMPAP in 2017 which provided a summary of activities conducted (Table 2) during the 2016-2017 survey period.

Survey locations

Curtis and Avoid Islands were monitored continuously from November 2016 to March 2017. A mid-season partial census was carried out at Peak Island between 24 November – 7 December 2016 for nesting and 23 January – 1 February 2017 for hatching success.

Field activities

Table 2: Summary of field activities conducted on Avoid, Curtis and Peak Island during the 2016-2017 nesting census

Avoid Island

Activity	Total
Nesting females	~92
Tracks observed	~420
Clutches laid	~300
Nests excavated for assessing incubation	~300
Orientation data - nesting females	~94
Orientation data - hatchling fans	~159

Curtis Island

Activity	Total
Nesting females encountered	~52
Tracks observed	~249
Clutches laid	~178

Nests excavated for assessing incubation success	~169
Orientation data - nesting females	~42
Orientation data - hatchling fans	~109

Peak Island

Activity	Total
Nesting females encountered	~214
Tracks observed	~361
Clutches laid recorded at laying	~209
Nests excavated for assessing incubation success	~158
Orientation data - nesting females	~48
Orientation data - hatchling fans	~3

Findings

Findings from the nesting census conducted on Curtis, Peak and Avoid Islands have been presented in an annual report which is currently under review by the ERMPAP. The results will be presented in the 2018 EPR.

2.1.3.2 Internesting habitat use by flatback turtles off the Curtis Island coast

Overview

The aim of this project was to assess the behaviour and habitat usage of the ERMP study area by internesting flatback turtles. The project commenced in November 2013 and was completed in November 2015. The progress of this project has been reported in the 2014 to 2016 EPRs. As reported in the 2016 EPR, two (2) tags had to be removed due to harness malfunction in 2015. These tags were attempted to be deployed during the turtle nesting season in 2016/2017. This exercise could not be carried out, hence the tags were deployed on sub-adult green turtles in May 2017. The final project report submitted in 2017 is under review by the ERMPAP. Results of this study will be presented in the 2018 EPR.

2.1.3.3 Increase understanding of Green Turtle Habitat usage in the Port Curtis and Port Alma Region: using Satellite Telemetry

Overview

This study commenced in 2014 and was completed in 2016. The aim of the project was to gain an understanding of the habitat utilisation by the marine turtles within Port Curtis and Port Alma specifically the green turtles, through deployment of satellite tags. The progress of this project has been reported in the 2014 to 2016 EPRs.

The final report for this study submitted in 2017 is under review by the ERMPAP hence the findings will be presented in the 2018 EPR.

2.1.3.4 To determine the composition, size, sex, maturity, growth rates, survivorship, recruitment and general health of the green turtle population in Port Curtis

Overview

This study commenced in 2015 and fieldwork is proposed to continue till 2019. The aim of this study is to obtain information on the size, sex, maturity, growth rates, survivorship, recruitment and general health of the green turtle population in Port Curtis and Narrows. In the current reporting period, the first annual report (covering the 2016 survey period) and the field plan for the 2017 survey were approved by the ERMPAP. The year two (2) annual report is under review by the ERMPAP.

Survey Locations

Integrated monitoring of foraging green turtles in Port Curtis was conducted within inter-tidal and subtidal waters at six (6) main sites within the Port: Pelican Banks off the southeast corner of Curtis Island, Wiggins Island, Quoin Island, eastern shore of Facing Island and the Boyne Estuary.

In 2017, field trips were conducted in April-May, June –July and September.

Methodology

The standard methodology developed for the capture of turtles via turtle rodeo has been followed during the field trips. Standardised EHP data collection for turtle identification, tagging, measurement of Curved Carapace Length (CCL), weight and assessment of health status of all turtles have been conducted. Sex determination and breeding status were also determined for a selection of turtles.

Findings

A total of 328 green turtles were captured during the four (4) surveys conducted in 2016. Of these, 17 turtles were recaptured on one (1) or more occasions. Most turtles were captured on the Pelican Banks (n = 162, 49.4%), followed by Boyne River Estuary (n = 53, 16.2%) and Facing Island (n = 51, 15.5%). Other captures were made near Quoin Island, Western Basin and Boyne River at Benarby.

Data analysis from the 2016 survey showed that the turtles were displaying shifts in the forage areas in response to seasonal availability of food resources. Seagrass, mangroves and a range of algal species were the primary food resources identified. A large difference in diet was observed between turtles at the different study sites. Most juvenile turtles were caught foraging in the shallow intertidal areas around mangroves or rocky reefs during high tide levels. Larger turtles were caught in deeper water at Pelican Banks or Wiggins Island. The study revealed some important information on the use of Port Curtis by foraging green turtles such as: the population is dominated by immature turtles; it is not a significant courtship area and the turtles are exposed to a diverse range of anthropogenic impacts for example, recreational vessel strike, entanglement and ingestion of fishing line. Fibropapilloma tumours and poor body conditions were also observed in about 9% of green turtles in various locations of the Port.

In addition to green turtles, three (3) loggerhead turtles and one (1) hawksbill turtle were also observed in the study area. Sightings of other marine mammals included presence of dolphins in Auckland Creek and near Quoin Island and dugongs near Pelican Banks.

Details of the 2017 field trips will be included in the 2018 EPR.

2.2 Migratory Shorebirds

2.2.1 Annual Summer Survey of the Migratory Shorebirds

Overview

The annual summer survey of the migratory shorebirds commenced in 2014 and will continue till 2018 in accordance with the conditions of the EPBC Act Approval Condition 33(i) which states “*Single Annual Summer Surveys (October-March) covering the major high tide roost sites from years three to eight with a repeat of the comprehensive surveys during years nine and ten*”. The 2017 annual shorebird monitoring summer survey was carried out on the full moon spring tide from 11 to 15 February 2017. The report has been approved by the ERMPAP (link below).

http://staging.gpcl.com.au/EnvironmentDocuments/Annual_Shorebird_Surveys_Annual_Summer_Survey_Report_February_2017.pdf#search=annual%20survey

Survey locations

A total of 154 roosts were surveyed over five (5) days at Cheetham Saltworks, Port Curtis, Fitzroy Estuary, North Curtis, Colosseum Inlet and Mundoolin Rocks, Rodds Peninsula, Mainland shoreline and the Western Basin Reclamation Area (WBRA).

Methodology

Shorebirds counts followed the Shorebirds 2020 Procedure and were recorded on a modified version of Shorebirds 2020 Datasheet. Data for 36 migratory species listed in the EPBC guidelines were collected and abundance estimates of ten (10) species of non-migratory shorebirds were also recorded. Roost surveys were conducted two (2) hours

either side of the high tide, and were accessed by boat. The count was conducted by wading ashore to a suitable location. The foraging survey for each site was conducted on the same day as the roost survey, on either side of the low tide.

Timing for the survey was determined using Australian Government guidelines for significant impact assessment on migratory shorebirds, recommendations from previous surveys conducted from 2011 to 2013 and advice from the ERMPAP.

Findings

A total of 14,003 migratory shorebirds consisting of 21 species were recorded during the high tide roost surveys (Figure 2 and Table 3,). The bird count was approximately 21% more than the equivalent figure from February 2016; and was 14% higher than the summer average calculated from nine (9) surveys conducted in January and February over the life of the project; 2011-2017. A total of 3079 birds comprising 16 species was counted at low tide (Table 4). The increase in the total abundance of migratory shorebirds compared to the previous year was mostly due to a 229% increase in the number of Terek Sandpipers. Other species that returned an increase in abundance compared to 2016 were Sand Plover, Red-necked Stint and Whimbrel. These increases were partially offset by a decrease in the abundance of Great Knots.

A total of three (3) Curlew Sandpipers and one (1) Whimbrel were recorded on the WBRA during the high tide survey. No migratory shorebirds were recorded on the bund wall.

A summary of the use of roosts during the February 2017 surveys conducted for this project showed there were 23 roosts with a mean abundance >100. Of the nine (9) roosts with mean migratory shorebird abundance >400, seven (7) were located in the north of the study area at Shell Point, Curlew Spit, Yellow Patch, Curtis Island Southend and Mundoolin Rocks.

A total of 1223 non-migratory birds of eight (8) species were recorded during the high tide roost counts. This compares with 757 birds of eight (8) species recorded in February 2016.

The 2017 survey indicated that the total abundance of the migratory shorebirds had not declined since the start of monitoring in 2011.

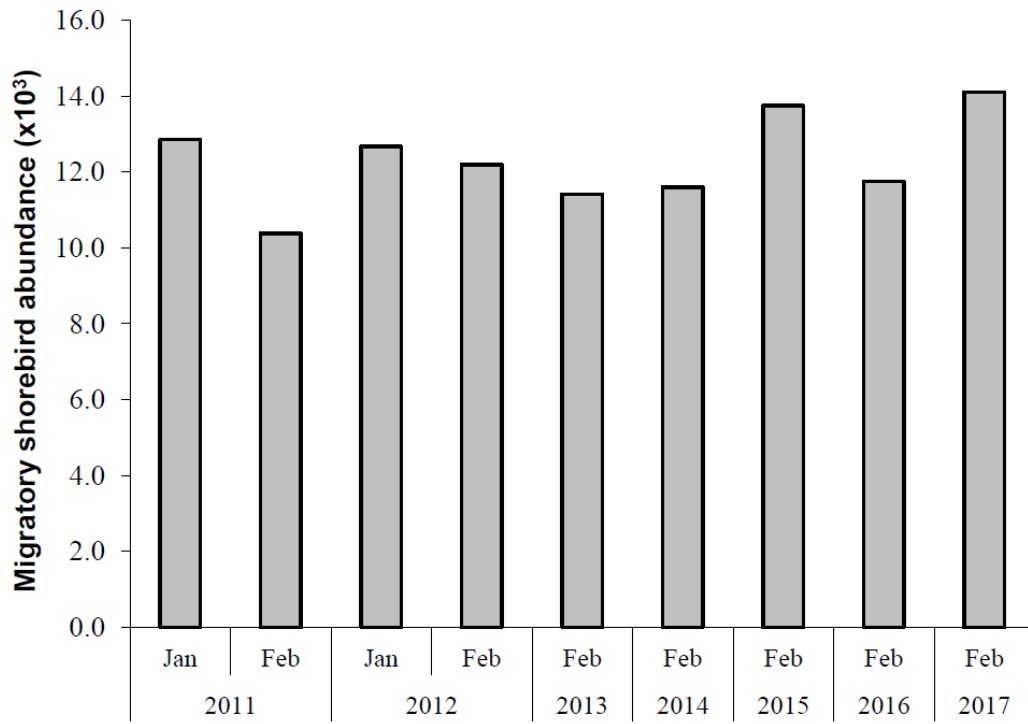


Figure 2: Total abundance of migratory shorebirds in summer on the Curtis Coast (excluding Cheetham Salts)

Table 3: Summary of roost counts for migratory birds at each location.

	PC	FE	NC	M-C	RP	SW*	Total
Pacific Golden Plover	3	50	0	31	0	0	84
Grey Plover	5	29	25	14	19	0	92
Double-banded Plover	0	0	0	5	0	0	5
Lesser Sand Plover	125	261	535	0	77	0	998
Greater Sand Plover	258	308	415	0	3	0	984
Latham's Snipe	0	0	0	0	0	0	0
Black-tailed Godwit	0	1	0	0	0	0	1
Bar-tailed Godwit	633	359	834	819	138	0	2783
Little Curlew	0	0	0	0	0	0	0
Whimbrel	466	11	611	202	44	0	1334
Eastern Curlew	298	30	51	227	179	0	785
Terek Sandpiper	322	198	911	352	199	0	1982
Common Sandpiper	0	0	0	0	0	0	0
Grey-tailed Tattler	183	25	603	341	66	0	1218
Wandering Tattler	0	0	0	0	0	0	0
Common Greenshank	12	0	54	6	0	5	77
Marsh Sandpiper	0	2	0	0	0	8	10
Ruddy Turnstone	3	0	0	40	5	0	48
Great Knot	140	238	162	29	2	0	571
Red Knot	0	7	1	0	0	0	8
Sanderling	0	0	7	0	0	0	7
Red-necked Stint	179	2201	262	46	92	0	2780
Sharp-tailed Sandpiper	10	2	3	0	0	1	16
Curlew Sandpiper	8	90	6	0	0	10	114
Broad-billed Sandpiper	0	106	16	0	0	0	122
Unidentified medium wader	0	8	0	0	0	0	8
Total abundance	2645	3926	4496	2112	824	24	14027
Total species	15	17	16	12	11	4	21

PC = Port Curtis including the Mainland Shoreline and WBRA, FE = Fitzroy Estuary, NC = North Curtis Island, MC = Mundoolin-Colosseum, RP = Rodds Peninsula.

*The Cheetham Salt Works was surveyed at mid-tide.

Table 4: Summary of low tide foraging counts for migratory shorebirds at each survey location

	PC	FE	NC	M-C	RP	Total
Pacific Golden Plover	0	0	0	11	0	11
Grey Plover	0	5	1	0	0	6
Lesser Sand Plover	5	42	20	5	0	72
Greater Sand Plover	14	25	18	20	0	77
Black-tailed Godwit	2	0	0	0	0	2
Bar-tailed Godwit	171	194	94	168	168	795
Whimbrel	64	23	40	59	41	227
Eastern Curlew	43	4	2	34	103	186
Terek Sandpiper	39	58	0	10	31	138
Grey-tailed Tattler	15	8	1	1	0	25
Common Greenshank	1	1	0	3	0	5
Ruddy Turnstone	0	0	1	0	0	1
Great Knot	59	12	2	32	0	105
Red Knot	0	1	0	0	0	1
Red-necked Stint	236	459	0	16	4	715
Curlew Sandpiper	0	8	0	0	0	8
Sand Plover spp.	1	16	0	0	0	17
Unidentified medium wader	0	18	0	9	0	27
Unidentified small wader	5	644	0	1	11	661
Total abundance	655	1518	179	369	358	3079
Total species	11	13	9	11	5	16

PC = Port Curtis including the mainland foreshore, FE = Fitzroy Estuary, M-C = Mundoolin Colosseum, RP = Rodds Peninsula

2.2.2 Migratory Shorebird Monitoring – Understanding Ecological Impact

Overview

The objective of this study was to estimate the carrying capacity and determine the size of the migratory shorebird population in Port Curtis and Port Alma. This project was completed in 2017 and the final report approved by the ERMPAP (link below).

[http://staging.gpcl.com.au/EnvironmentDocuments/ERMP_Migratory_shorebird_monitoring_Understanding_Ecological_Impact_CA12000284_\(CA130019\)_2017_Final_report_PDF.PDF#search=uniquest](http://staging.gpcl.com.au/EnvironmentDocuments/ERMP_Migratory_shorebird_monitoring_Understanding_Ecological_Impact_CA12000284_(CA130019)_2017_Final_report_PDF.PDF#search=uniquest)

Survey locations

Mapping of all tidal flats were conducted in Port Curtis and Port Alma and benthic sampling conducted at Cattle Point in the Fitzroy Delta, Pelican Banks in Port Curtis and at Rodds Bay. Radio tracking of migratory shorebirds was conducted at Mundoolin Rocks (Rodds Bay), South End (Curtis Island) and Facing Island (Port Curtis).

Methods

A comprehensive field study of shorebirds was undertaken in the ERMP Survey Area, combining bird counts, sampling of benthic prey availability and tracking the movements of birds. The intertidal substrata was mapped across the whole ERMP Area, and empirically linked to patterns of exposure with the tidal cycle and benthic prey availability.

The data collected was used to:

- (i) build models that estimated the tidal flat extent at any point in time;
- (ii) understand the temporal dynamics of food availability for the birds in relation to daily, lunar and seasonal cycles; and
- (iii) determine the number of birds the ERMP Survey Area can support.

During the project about 1,000 person-days were spent in the field, during which 1,865 benthic core samples (over two (2) seasons) were collected and processed. Approximately 200 videos of foraging birds were recorded, 10 shorebird surveys were conducted, 101 birds were tagged and 35 birds radio-tracked via handheld receivers, an automated receiver array, and from aircraft transects over the Survey Area.

Findings

The study revealed that about 20,000 migratory birds use the ERMP study area with a number of migratory birds using this area as a transit to travel further south. Individual birds demonstrated high site fidelity both within and between non-breeding seasons. Much of the highest quality intertidal foraging habitat was observed to be available for a limited time, with only 10% -25% of the intertidal habitat exposed at half-tide thus limiting foraging area availability. Subject to a number of assumptions in the analysis, the site appeared to be operating close to its carrying capacity, as only marginal availability of food was estimated for most species than currently required by the birds. Prey items favoured by the birds occurred at low density by International standards, showed low digestible content, and were notably patchy across space and over the tidal cycle. Overall, the study concluded that the site was currently ecologically healthy with respect to migratory shorebirds, but is potentially vulnerable to any further reductions in quality or quantity of shorebird habitat.

2.3 Mangroves

2.3.1 Monitoring the survival and recovery of shorelines, specifically Tidal Wetlands Mangroves/Saltmarsh/Salt pans

Overview

The aim of this program is to monitor the changes in the shoreline habitat condition for a period spanning six (6) years. The objectives of the project are: to generate high resolution maps of tidal wetlands in the ERMP area through Normalised Difference Vegetation Index (NVDI) mapping of tidal wetlands; undertake shoreline condition monitoring; and launching of a public access data entry portal for display of current and past mapping. This project was approved by the ERMPAP in 2014, work commenced in mid-November 2014 and will

proceed till 2021. The third progress report has been approved by the ERMPAP in 2017 (link below).

[http://gpcl.com.au/EnvironmentDocuments/ERMP_Port_Curtis_and_Port_Alma_Coastal Habitat Archive and Monitoring Program Annual Report 2016-17.pdf#search=tidal%20wetlands](http://gpcl.com.au/EnvironmentDocuments/ERMP_Port_Curtis_and_Port_Alma_Coastal_Habitat_Archive_and_Monitoring_Program_Annual_Report_2016-17.pdf#search=tidal%20wetlands)

Survey Locations

Boat-based surveys were undertaken by the Gidarjil Rangers for the Boyne River for two (2) days in March 2017.

Methodology

The timing of boat surveys were determined so as to maximise favourable light conditions in conjunction with the midday period of neap tides; to observe exposed tidal wetlands and their vegetation at low tide while being able to navigate safely. The survey crew operated two (2) cameras along with a portable GPS device to record the survey track. The cameras were synchronised for time reference, with GPS records.

The prototype “ShoreView” website was designed and released. This website was developed using the latest design techniques to provide a platform that is both desktop and mobile friendly and is available for public access. The site provides links to the package of “ShoreView” data portals which provide image management (Figure 3) including the display views for “ShoreView.”

Findings

Preliminary examination of 3,236 oblique images from within the three (3) core sampling areas Port Alma, Port Curtis (including Western Basin) and Rodds Bay, demonstrated that fringe mangrove forest was present within 85% of images. The Port Alma region had the highest extent of mangrove cover with ~97% of shoreline assessed having fringe forest present. The lowest shoreline fringe mangrove forest cover extent was in the Western Basin Area (~74%). Shoreline erosion was the dominant process in the target area between 2011 and 2015, with a mean net shoreline movement of -1.67 (± 0.1) m. A total of 31% of all transects showed some degree of erosion and mangrove retreat, with only 11% of transects showing mangrove shoreward expansion. Nearly half (43%) of transects with mangrove retreat were within the Western Basin region. This pattern was similar for locations identified as having extreme mangrove retreat (>1.5 standard deviations from the mean).

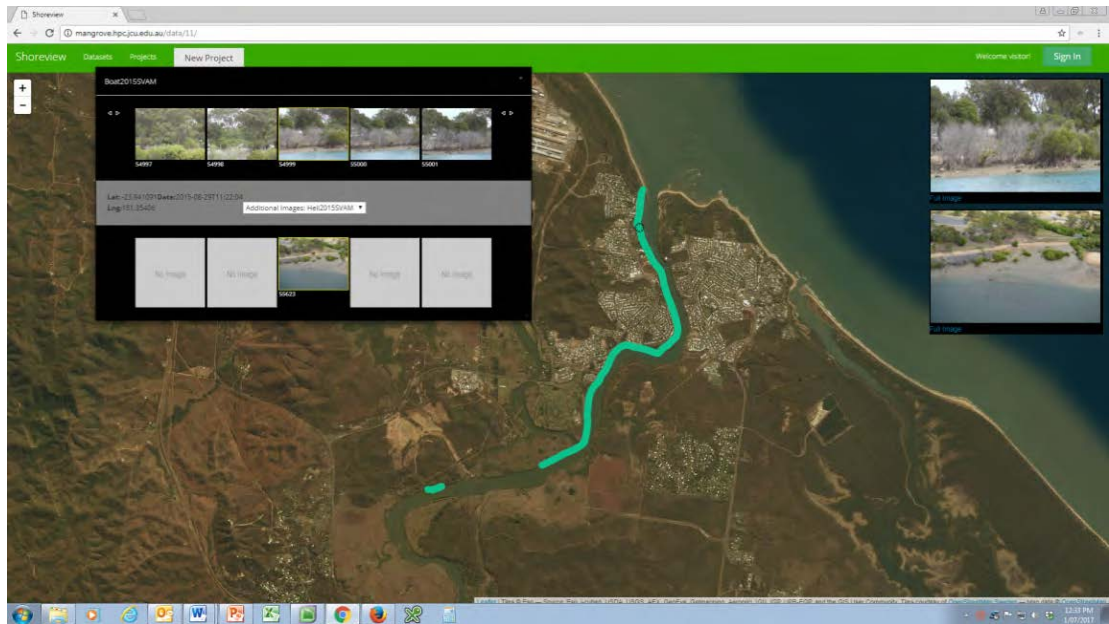


Figure 3: ShoreView Display Portal image data along with survey tracks in the Boyne River estuary case study.

2.4 Seagrass

2.4.1 Monitoring Seagrass Seed Bank Density and Viability within Port Curtis

Overview

The aim of this project was to understand the resilience of seagrass in Port Curtis to stressors and its capacity to recover from impact, through monitoring of changes in the seed bank density and viability of *Z. muelleri*. This project was approved by the ERMPAP in 2013 and work commenced in 2014. The seed bank density measurement had been in progress since 2012, outside the ERMP funding, the current study analysed additional sediment cores to complement the information already being collected.

In the current reporting period, seedbank density and viability assessments were conducted in February and May 2017. The field reports for the two (2) surveys have been approved by the ERMPAP. In a letter dated 13 December 2016 (ERMPAP Chairman’s Letter No.7) the Chair advised that the seagrass density and viability project has addressed the compliance requirement under the ERMP, hence no further funding under the ERMP would be allocated towards extending this study.

The final project report is under review by the ERMPAP.

Survey Locations

Biannual monitoring to assess viability of the seed bank was conducted in the Pelican Banks North, Wiggins Island and Rodds Bay (control site) areas of Port Curtis in February and May 2017.

Findings

Field report from the February survey completed on 11 February 2017 stated that samples at all designated locations had been collected and viability testing had been completed.

Field report from the May survey conducted on the 26 and 27 of May 2017, mentioned preliminary observations on viability of the seeds. Pelican Banks and Rodds Bay showed some viable seeds but Wiggins Island showed an absence of viable seeds.

Details of the study will be reported in the 2018 EPR following approval of the final project report by the ERMPAP.

The following seagrass monitoring studies were conducted in the current reporting period in fulfillment of the compliance conditions as outlined in the approved WBDDP WQMP but are not funded by the ERMP.

2.4.2 Long-Term Seagrass Monitoring in Port Curtis and Rodds Bay: Quarterly Permanent transect monitoring 2009-2016

Overview

The aim of this study was to monitor seagrass meadows quarterly in Port Curtis at permanent transect sites that were established as part of the WBDDP. These sites have been assessed quarterly since the completion of dredging with the last survey being conducted in November 2016. The final report for this study was submitted in June 2017.

Survey Locations

Seagrass cover was monitored at the following locations: Fisherman's Landing, Wiggins Island, the Narrows in the inner harbour and Pelican Banks north and south, Facing Island in the outer harbour and the out of Port reference at Rodds Bay.

Methodology

Each of the monitoring locations was sampled quarterly over the spring low tides in February, May, August and November 2016. Four (4) metrics were used to determine changes in seagrass meadows across spatial and temporal scales;

- Abundance and community composition (seagrass health);
- Elemental content of plants (seagrass tissue nutrients);
- Meadow reproductive status (seagrass resilience); and
- Sexual above-ground productivity and asexual growth (seagrass productivity).

To assess the above-ground biomass, observers assigned a rank describing the above-ground biomass of seagrass for each quadrat while referencing a set of photographs of seagrass plots for which the aboveground biomass had previously been measured.

Findings

Seagrasses at permanent transects in Port Curtis and Rodds Bay showed distinct seasonal trends as well as significant inter-annual changes in seagrass percent cover, above-ground biomass and species composition. Significant declines in seagrass abundance occurred at all sites during the monitoring program, particularly following the 2010/2011 flood event. Some sites showed substantial recovery, particularly in the outer harbour, however inner harbour sites have yet to recover to pre-flood levels. Declines in Pelican Banks North and Pelican Banks South seagrass cover over the course of the program were explained by a positive relationship with mean monthly light levels at the sites and negatively by three (3) month cumulative river flow. Additional factors such as sediment dynamics and grazing pressure which were not monitored in the program may have been potential drivers for seagrass decline at these locations.

Gladstone seagrasses are capable of the production of flowers, fruits and seeds. However this varied substantially between meadows and time of year. It is likely that propagule limitation at some sites may be inhibiting seagrass recovery following losses such as at Pelican Banks.

The primary goal of the seagrass permanent transect sites was to detect significant shifts in seagrass condition in the context of dredging activity. The program spans the pre-, during, and post-dredge phases providing a detailed description of seagrass abundance at both inner and outer harbour locations within Port Curtis with varying proximity to dredge activity and covers the range of species and meadow types typical throughout the wider Gladstone region. In summary, major rainfall and river flow events prior to, during, and following dredging did impact permanent transect site locations; however any interactive effect of dredging with significant storm and river flow events was unable to be determined, due to its co-incident timing.

2.4.3 Seagrasses in Port Curtis and Rodds Bay - Annual long term monitoring

Overview

Seagrasses have been monitored on an annual basis (in November each year) in Port Curtis and Rodds Bay since 2002 for changes in biomass (density), area and species composition. In addition to these core meadows, since 2009 all seagrasses within the Western Basin have been mapped biannually (June and November) to determine the total distribution of seagrasses at both the low (June) and the peak season (November) for seagrass growth. From 2015 to 2018, the seagrass meadows will be mapped annually in accordance with the post dredging seagrass monitoring program. In the current reporting period annual mapping of seagrass occurred in November 2016.

Survey Locations

A total of 1,860 sites were surveyed in the Port Curtis and Rodds Bay seagrass annual monitoring survey area in November 2016. The meadows were grouped under The Narrows (Black Swan), Grahams Creek (Upper and Lower), Western Basin (14 individual meadows including Wiggins Island), inner harbour (11 individual meadows including South Trees Inlet),

mid harbour (15 individual meadows including Pelican Banks) and outer harbour (three (3) individual meadows including Rodds Bay).

Methodology

At each survey site seagrass characteristics including seagrass percent cover, species composition, above-ground biomass, percent algal cover, depth below mean sea level (for subtidal meadows), sediment type, time and position (latitude and longitude) were recorded.

Two sampling techniques were used:

1. Intertidal areas: helicopter survey; and
2. Shallow subtidal areas: boat-based free diving/grab survey;

Findings

The overall condition of seagrasses in Port Curtis and Rodds Bay in November 2016 was poor.

It is important to note that meadows can be classified as being in poor condition if any one (1) of the three (3) key indicators (biomass; area; species composition) were poor, even if the other two (2) indicators had improved.

The results were mixed for individual meadows and regions within the survey area. In the Western Basin, the Narrows and South Trees areas, most meadows were in better condition than in 2015, however many meadows in the inner harbour, mid harbour and Rodds Bay zones remained in poor or very poor condition. There was no clear relationship between distance from anthropogenic activities and seagrass condition with many of the meadows in improved condition closest to port activity and some areas further away declining. In 2016, significant decline in biomass for the largest and most stable seagrass meadow in the Port Curtis region, Pelican Banks was observed. The reasons for the decline in Pelican Banks seagrass could not be determined. Monitoring of light and climate drivers in 2016 showed a generally favourable environment for seagrass growth. At no time during the seagrass growing season did light fall below the locally derived threshold of $6 \text{ mol m}^{-2} \text{ day}^{-1}$. High levels of herbivory from dugong and turtle, potential changes to sediment structure, and the cumulative impacts of multiple stressors over multiple years may provide possible explanations but require further investigation.

3.0 ERMPAP meeting highlights

In the current reporting period, three (3) meetings were held in November (2016), February and May (2017) The May (2017) meeting was a teleconference. The agenda of these meetings primarily focussed on:

- Updates on results and findings of ERMP surveys and research;
- Trends and issues arising from results and findings of ERMP surveys and research;
- Further monitoring or research requirements;
- Ongoing projects and compliance with ERMP conditions;
- Resolutions for advice to GPC and subsequently DoEE; and
- ERMP budget and financial update.

In the current reporting period, three (3) letters of recommendations pertaining to ERMPAP governance and changes in scope of projects (dated 13 December 2016, 31 March 2017 and 2 August 2017) were sent to GPC by the Chair of the ERMPAP. The letters of recommendations and GPC's response to these recommendations were forwarded to DoEE on 19 December 2016, 31 May 2017 and 12 September 2017 respectively.

4.0 Amendment/ Revisions of Management Plans

The WBDDP DMP, WQMP and FFMP continue to remain in a dormant state. Only the ASSMP remains active with obligations pertaining to the on-going maintenance of the WBRA in the form of ground water monitoring and third party audits.

Since completion of Stage 1 dredging, biannual third party audits of the ASSMP have been conducted to ensure compliance and reports submitted to EHP. The last third party audit was conducted on 6 December 2016. No issues were identified in this audit. All outstanding issues had been closed out in previous audits.

In a letter dated 22 March 2017, EHP consented to the following changes in obligations pertaining to the ASSMP:

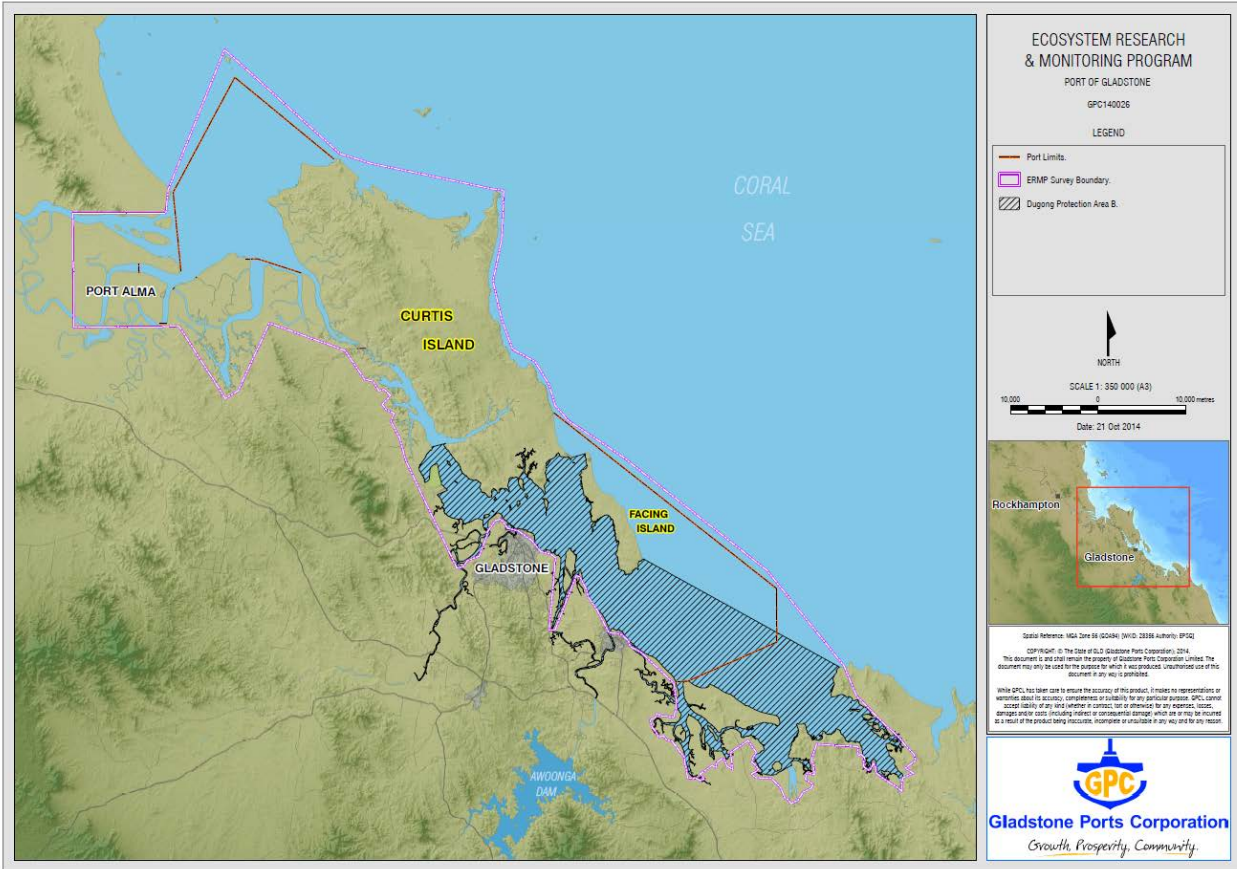
- Removal of all groundwater monitoring loggers;
- Third party audits of the WBRA to be replaced by biannual inspections by GPC; and
- Quarterly reporting to be replaced by Annual Reporting.

In response to the above advise the following actions were implemented:

- All groundwater loggers have been removed in July 2017;
- Manual groundwater monitoring at 28 groundwater bores continues on a monthly basis; and
- Internal inspections by GPC have been undertaken on 6 June, 20 July, 4 September and 8 November 2017.

No changes to the ERMP or the ERMPAP ToR were made in the current reporting period.

Appendix 1. Geographical boundary of the ERMP



Appendix 2 Reports Approved by the ERMPAP in 2016-2017

1. Increase understanding of the status of the Australian snubfin and Australian humpback dolphins within Port Curtis and Port Alma- Progress Report 4 (eDocs# 1301348).
2. Port Curtis and Port Alma Coastal Habitat Archive and Monitoring Program 2016-2017 Annual Report Monitoring the survival and recovery of shorelines, specifically Tidal Wetlands (Mangroves/Saltmarsh/Salt pans) (eDocs# 1364467).
3. Inter-nesting habitat use by flatback turtles off the Curtis Island coast – 2016-2017 nesting season-Field Plan (eDocs# 1296216).
4. Inter-nesting habitat use by flatback turtles off the Curtis Island coast – 2016-2017 nesting season-Field Report (eDocs# 1334303).
5. Gladstone Ports Corporation Report for Migratory Shorebird Monitoring Port Curtis and the Curtis Coast Annual Summer Survey – 2017 (eDocs# 1322758).
6. Dugong Feeding Ecology and Habitat Use on Intertidal Banks of Port Curtis and Rodds Bay Final Report (eDocs# 1327459).
7. Annual Report: Migratory Shorebird Monitoring – Understanding Ecological Impact (CA12000284)- Final Report , 2017 (eDocs# 1337268).
8. Increase the understanding of the Green Turtle Population In Port Curtis- Year 1 (2016) Annual Report. (eDocs# 1320577).

Seagrass Monitoring Studies outside the ERMP

9. Long Term Seagrass Monitoring in Port Curtis and Rodds Bay: Quarterly Permanent Transect Monitoring Progress Report 2009 to 2016 (eDocs# 1358800).
10. Seagrasses in Port Curtis and Rodds Bay 2016:Annual long-term monitoring, (eDocs# 1348563).

Appendix 3 - ERMP timeline

