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

Environmental Performance Report December 2018

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

Cover photos: Duke et al 2017, Limpus et al 2018,Wildlife Unlimited 2017,

#1446314

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Acronyms

ASSMP	Acid Sulfate Soil Management Plan
BPAR	Benthic Photosynthetically Active Radiation
CCL	Curved Carapace Length
DCMP	Dredge Construction Management Plan
DDT	Dichlorodiphenyltrichloroethane
DFT	Dugong Feeding Trails
DES	Department of Environment and Science formerly referred to as Department of Environment and Heritage Protection
DMP	Dredge Management Plan
DoEE	Department of the Environment and Energy (formerly known as the Department of Environment (DoE))
EHP	Department of Environment and Heritage Protection now referred to as Department of Environment and Science
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
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
HCB	Hexachlorobenzene
NVDI	Normalised Difference Vegetation Index
PCB	Polychlorinated Biphenyl
ToR	Terms of Reference
WBDDP	Western Basin Dredging and Disposal Project
WBRA	Western Basin Reclamation Area
WQMP	Water Quality Management Plan

Executive Summary

The 2018 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 2018 EPR covers the period from 1 November 2017 to 31 October 2018 and includes the outcomes of the studies conducted under the ERMP. The report also provides an overview of the seagrass monitoring program 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's (GPC's) ERMP webpage.

As mentioned in the 2017 EPR, many ongoing projects came to an end in 2017 with reports finalised and approved by the ERMPAP in 2018. The information from these reports have been included in this current EPR.

Status updates on the following key monitoring programs pertaining to Condition 36 are being reported:

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. The study concluded that around 140-162 adult Australian humpback dolphins (*Sousa sahulensis*) and 100-163 adult Australian snubfin dolphins (*Orcaella heinsohni*) used the ERMP survey area between May and September each year.

Low levels of genetic diversity were noted for both species, with little to moderate gene flow from nearby populations (Whitsundays and Great Sandy Strait). Variable levels of heavy metals and organochlorides were detected in the biopsy samples collected from both species of dolphins. Stable isotope assessments to determine the trophic levels and similarities in diet, highlighted that the humpback dolphin may have a broader trophic level than the snubfin dolphin.

Dugong feeding trail ecology and habitat use on intertidal banks of Port Curtis and Rodds Bay

No dugongs were opportunistically tagged during the green turtle health assessment monitoring conducted from April to October 2018. This is the third year where no dugongs could be tagged. However, dugongs were sighted near Pelican Banks and Wild Cattle Islands. The ERMPAP has determined that due to the small population of dugongs in the ERMP study area, no dedicated project on dugongs needs to be commissioned. Anecdotal observations of dugongs, along with the continuation of the opportunistic tagging during other ongoing field studies, would provide relevant information on dugongs.

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. A comparison of full versus partial nesting census at Avoid and Curtis Islands was conducted during the 2016-2017 season, which highlighted that though some parameters associated with nesting success could be measured with higher confidence during the full nesting census, the logistics and costs associated with deploying a team for the full nesting season was not commensurate with the outcomes.

A two week mid-season census was conducted at all the three islands in 2017-2018. The nesting flatback turtle population at each island showed normal demographic features for the Eastern Australian flatback stock in terms of female size, clutch size and egg size.

Inter-nesting habitat use by Flatback Turtles off the Curtis Island Coast

This study commenced in 2013 and ended in 2015. The final project report was approved by the ERMPAP in 2018. The study involved deploying satellite tags to examine the movement patterns of female turtles nesting at Curtis Island to understand the extent to which flatback turtles used the Port of Gladstone and Port of Rockhampton. In all, 30 turtles were tagged during the monitoring period. All of the 30 turtles spent some of their time within the waters of the Port of Gladstone and, in 2015, one turtle spent its first re-nesting period (between clutches 1 and 2) within the Port of Rockhampton.

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. The final project report was approved by the ERMPAP in 2018. A total of 35 satellite tags were deployed during field trips in May 2014, July 2015, May-October 2016 and May 2017 to track movements of green turtles in the ERMP area. The study concluded that about 94% of the tracked turtles remained within the ERMP area for the duration they were tracked, demonstrating high site fidelity. The passage between Curtis and Facing islands and the offshore reefs adjacent to the islands were found to be an important habitat for green turtles, often used to move between Pelican Banks and the offshore reefs.

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 of a four-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. Field surveys were undertaken in April, May June-July, September and November in 2017 and during April, May, June-July and September-October in 2018. 401 turtles were captured in 2017 with the majority of captures occurring at Pelican Banks, followed by Boyne Estuary and Facing Island. The report for the 2018 surveys will be received outside of the current reporting period.

Annual summer survey of the migratory shorebirds

2018 was the last year of the single annual summer survey of migratory shorebirds, which commenced in 2013. In the current reporting period, 154 roosts were surveyed over six days (inclusive of one stand-by day) in February 2018. A total of 12,986 migratory shorebirds consisting of 19 species were recorded during the high tide roost surveys. This was 8% fewer than the equivalent figure from February 2017, but 5% more than the long-term summer average.

Monitoring the survival and recovery of shorelines, specifically tidal wetlands (mangroves/saltmarsh/saltpans)

The high resolution mapping and change detection of shoreline habitats, including mangroves, saltmarsh and saltpans, commenced in March 2015 and will continue through to 2021. Progress was made in three major areas in 2017 and 2018. These included: further development of mapping of tidal wetland habitats throughout the Port Curtis Port Alma (PCPA) study area, specifically the detailed display of the extent of key vegetation types (mangroves, saltmarsh and saltpans), mangrove canopy condition and mangrove forest biomass, coupled with further processing of prior boat and aerial shoreline survey data in preparation for its eventual display and reporting online, and the development of the operational manual for the upload of data to the ShoreView online facility under development. The 2018 report is yet to be finalised.

Monitoring seagrass seed bank density and viability within Port Curtis

The study to quantify temporal variation in the seagrass seedbank density and viability commenced in 2014 and came to an end in 2017. The study involved the 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. The study recorded the highest proportion of viable seeds at both Pelican Banks North and Rodds Bay. High levels of variability in both the total number of seeds and seed viability were observed. The final report for this study was approved by the ERMPAP in 2018.

<u>The following seagrass study was conducted in accordance with the WBDDP Water Quality Management Plan (WQMP) and was not funded under the ERMP:</u>

Annual long term monitoring of seagrass

Long-term mapping of seagrass in Port Curtis and Rodds Bay continued from 2002. In the current reporting period, annual mapping of seagrass occurred in November 2017.

In 2017, seagrasses in Port Curtis and Rodds Bay remained in an overall poor condition. Two very heavy rain events in March and October 2017 contributed to conditions that prevented any substantial seagrass recovery during 2017. The total area of seagrass mapped in the monitoring area was above the long-term average, slightly up from 2016. The biomass and species composition of the largest seagrass meadow at Pelican Banks improved from 2016. The final report from this study was received in 2018.

Environmental approvals and management plans

Following consultation with the Department of Environment and Science (DES) 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 auditing and reporting obligations under the ASSMP were made in the current reporting period in consultation with the DES. No changes to the ERMP document or the ERMPAP Terms of Reference (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 m^3 of seabed material that was placed at sea (5.1 million m^3) and within the WBRA (17.5 million m^3). 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) and headed by an Independent Chair (Conditions 25 and 26). The ERMP requires research commitments relating 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 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 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 three projects required in response to unforeseen events or following an emergency situation.

The ERMP is overseen by the ERMPAP. Terms of Reference (ToR) for the ERMPAP have been developed and approved by the Department of Environment and Energy (DoEE). The ERMPAP ToR 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 ToR were last amended in 2016. The outcomes and findings of the ERMP have been reported in the annual EPRs (CQG Consulting 2011, 2012 and 2013, GPC EPR 2014, 2015, 2016 and 2017). 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:

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To date, seven reports (CQG Consulting 2011, 2012, 2013, GPC EPR 2014, 2015, 2016 and 2017) covering the period from 22 October 2010 to 31 October 2017 have been submitted DoEE.

The 2018 EPR is the eighth 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 2017 to 31 October 2018. 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) has 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 2017-2018

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 Australian humpback dolphin (*Sousa chinensis*)[1], henceforth being referred to as the humpback dolphin, and the Australian snubfin dolphin (*Orcaella heinsohni*), referred to as the snubfin dolphin, in the Port Curtis and Port Alma regions, through population estimates, 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 (Cagnazzi 2018) which was approved by the ERMPAP in 2018.

http://gpcl.com.au/EnvironmentDocuments/ERMP_Report_Australian_Snubfin_and_Australian_Humpback_Dolphins_CA14000085-DOCSCQPA1397086.pdf

Findings

The project provided the first population estimates of two coastal dolphin species for the entire ERMP survey area following the completion of the WBDDP in 2013. 249 groups of humpback dolphins, 122 groups of snubfin dolphins and 15 groups of bottlenose dolphins (*Tursiops aduncus*) were observed in the study area. During the five survey periods for the duration of the project, a total of 9,383 km was surveyed. Snubfin dolphins were encountered primarily in the Port Alma section of the ERMP area, and humpback dolphins were sighted throughout the entire ERMP area.

Nuclear DNA markings of 35 snubfin and 29 humpback dolphins revealed a low level of genetic diversity across all the locations (Port Curtis, Port Alma and Whitsundays). Analysis of contemporary migration rates revealed that the large majority of humpback dolphins in Port Curtis and Port Alma are resident (>72 %) with very low migration rates (<7.8%).

Toxicology analysis of trace and heavy metals, metalloids and persistent organic pollutants by: (a) biopsy sampling and analysis of specimens from humpback and snubfin, and (b) analysis of tissues collected opportunistically from the carcasses of these species from this region was conducted between 2014 and 2016. A total of 35 samples (18 snubfin dolphins and 17 humpback dolphins) were analysed for Polychlorinated Biphenyls (PCBs), Dichlorodiphenyltrichloroethane (DDTs) and Hexachlorobenzene HCB. The sum of all PCBs (ΣPCBs) was highly variable, ranging from 516 (HD-21164) to 222,511 ng/g lw (HD-21264). DDT levels ranged from 1,552 ng/g lw in HD-21264) to 74,195 ng/g lw in HD-21271. No significant difference was found in organochlorine levels between male and female snubfin dolphins. The findings suggested that agricultural and industrial-related activities in the

[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 sahulensis*).

region have contributed to an increase in dolphin exposure to organic contaminants over the five year period between 2010-2011 and 2014-2015. However, it was also noted that both flooding and cyclone activity increased significantly during the period, potentially contributing to an increased influx of sediments, nutrients and other known contaminants into coastal waters.

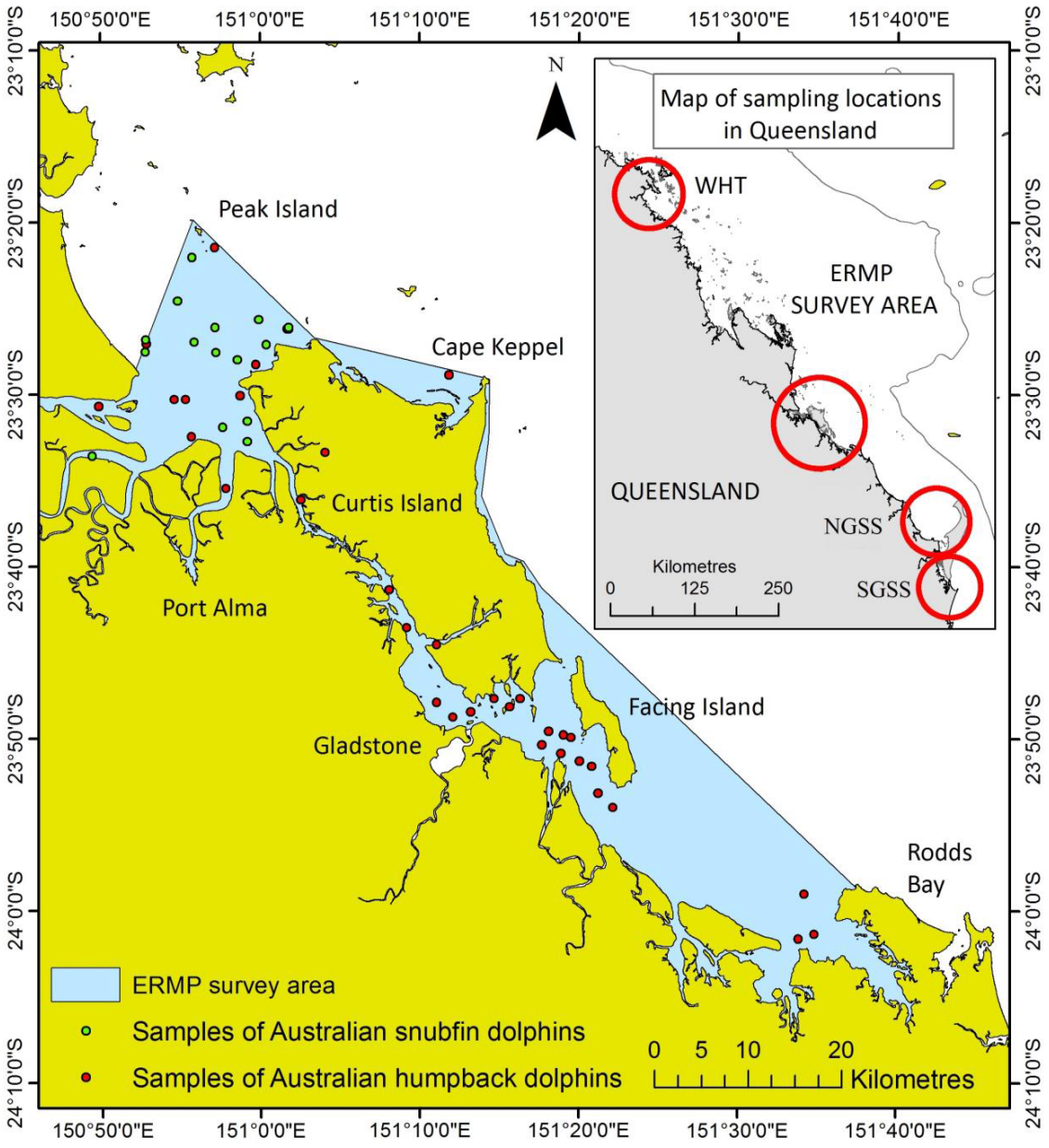


Figure 1: Map of humpback and snubfin dolphin biopsy samples collected in the ERMP survey

SGSS = Southern Great Sandy Strait, NGSS= Northern Great Sandy Strait, and WHT = Whitsundays

A total of 22 skin samples of snubfin dolphins (11 females, 10 males and one unknown), 10 humpback dolphins from Port Curtis (eight females, two males) and seven from Port Alma (six females and one male) (Figure 1) were analysed for heavy metals.

No significant difference in concentration of heavy metals was found in the skin samples of humpback dolphins at both Port Alma and Port Curtis, nor between sexes of snubfin dolphins.

The study provided valuable insight into the toxicological status of a wild population of small cetaceans, while also acknowledging that its results only offer a limited snapshot of the risk for dolphins in the ERMP area.

Stable isotopes were extracted from skin samples of 31 of adult snubfin and 23 humpback dolphins. No significant difference was found in $\delta_{13}C$ and $\delta_{15}N$ values in samples of humpback dolphins from Port Alma, Port Curtis and Rodds Bay. The interspecific similarities in $\delta_{15}N$ and differences in $\delta_{13}C$ isotopic composition found in this study suggest that snubfin and humpback dolphins feed at similar trophic levels, but differ in the sources of basal resources in their diet. Specifically, snubfin dolphins were found to be more enriched in $\delta_{13}C$, which is indicative of foraging in more inshore, benthic habitats than humpback dolphins. The findings in this study highlight the importance of coastal and estuarine environments for these species of dolphins. The overall diversity of diet patterns suggests that these animals may be somewhat resistant to losses in prey abundance of some species.

In summary, this project was successful in providing substantial new information on abundance, movement patterns, genetics and population structure, feeding preferences and accumulation of common contaminants in humpback and snubfin dolphins within the ERMP survey area.

2.1.2 Dugongs

2.1.2.1 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 is planned to continue to 2019 on an opportunistic basis during the health assessment studies of green turtles. Two dugongs were tagged in 2014 and one 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. In 2018, no dugongs could be tagged due to high water turbidity, though sighting of dugongs occurred adjacent to Wild Cattle Island (Figure 2).

Figure 2: Locations where dugongs were observed in 2017

The ERMPAP has advised that due to the small population of dugongs in the study area, targeted investigations on habitat usage by dugongs is not necessary. The Panel further recommended that efforts to opportunistically tag dugongs should continue for the duration of field surveys for green turtle health assessment project. Additionally, ancillary sightings of dugongs during other projects should be noted.

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 flatback turtle nesting population. These studies commenced in 2013 at Avoid and Peak Islands and in 2015 at Curtis Island, came to an end in 2017. During 2016/17, a full season nesting census (continuous monitoring for 14 weeks) was conducted on Curtis and Avoid Islands and a partial (4 week- 2 weeks nesting and 2 weeks hatchling) census on Peak Island.

In 2017, following ERMPAP recommendation, the partial nesting census was extended for three more years (2017-2018, 2018-2019 and 2019-2020) at all the three islands.

Three reports pertaining to this project were finalised during the current reporting period:

http://gpcl.com.au/EnvironmentDocuments/ERMP_Marine_Nesting_Populations_2016-17_Breeding_Season_CA12000291-DOCSCQPA1421369.pdf

http://gpcl.com.au/EnvironmentDocuments/ERMP_Flatback_Turtle_2017-18_Breeding_Season_at_Curtis_Peak_and_Avoid_Islands_CA12000291-DOCSCQPA1435455.pdf

http://gpcl.com.au/EnvironmentDocuments/ERMP_Estimation_of_population_size_and_comparison_of_the_flatback%20turtle_CA12000291-DOCSCQPA1420974.pdf

Findings

Comparison between partial (4 weeks) and total census (14 weeks) conducted on Curtis and Avoid islands in 2016-17 concluded that, there were no significant differences between results for the following parameters: adult female nesting success, size of nesting females, remigration interval, incubation period to emergence, incubation success of eggs, and hatchling emergence success. The only parameter that showed a marginal difference between mid-season and whole-season census was the proportion of new recruits to the nesting population at Curtis Island (12% and 27% respectively) (Table 1). The authors recommended that while long-term total census across entire breeding seasons may result in higher confidence limits, the increased costs and logistical constraints of staffing teams on islands for 14 plus weeks of continuous monitoring may not be a cost effective proposition (Limpus et al 2017a).

Table 1: Comparative data from the census of flatback turtle nesting populations in central and south Queensland during the 2016-2017 breeding season.

A. Nesting females

Parameter and rookery	Census method		Significant Difference
	Mid-season	Whole season	
Adult female nesting success			
• Curtis Is	63.9%, CI = 12.1%	73.1%, CI = 5.8%	No
• Peak Is	53.1%, CI = 4.9%	-	-
• Avoid Is	68.3%, CI = 4.6%	70.5%, CI = 8.5%	No
Proportion 1st time tagged turtles in the adult nesting population = presumed new recruits to breeding			
• Curtis Is	12%, CI = 10%	27%, CI = 12%	Marginal
• Peak Is	12.6%, CI = 4.4%	-	-
• Avoid Is	18.4%, CI = 8.7%	23.9%, CI = 8.7%	No
Size of nesting females (cm)			
• Curtis Is	94.0, SD = 2.55	93.9, SD = 2.5; n = 46	No
• Peak Is	93.1, SD = 2.7; n = 203	-	-
• Avoid Is	93.3, SD = 1.7; n = 76	93.6, SD = 2.5; n = 76	No
• Woongarra Coast	-	94.5, SD =2.8; n = 10	-
Remigration interval (yr)			
• Curtis Is,	-	3.66, SD = 1.55; n = 35	-
• Peak Is	3.0, SD = 1.4; n = 184	-	-
• Avoid Is	2.4, SD = 0.9, = 63	2.32, SD = 0.9; n = 69	No
• Woongarra Coast	-	3.43, SD = 1.27; n = 7	-

B. Eggs

Rookery and parameter	Census method		Significant difference
	Mid-season	Whole season	
Clutches laid per female per season			
• Curtis Is	Not measurable	2.65, SD = 0.92; n = 40	-
• Peak Is	Not measurable	-	-
• Avoid Is	Not measurable	2.73, SD = 1.0; n = 92	-
• Woongarra Coast	Not measurable	3.3, SD = 0.68; n = 10	-
Incubation period to emergence (d)			
• Curtis Is	47.4, SD =2.16; n = 29	48.1, SD = 2.64; n = 122	No
• Peak Is	52.7, SD = 3.82; n = 21	-	-
• Avoid Is	50.2, SD = 2.67; = 60	49.6, SD = 2.53; n = 172	No
• Woongarra Coast	-	50.0, SD = 3.26; n = 27	-
Incubation success of eggs			
• Curtis Is	89.0%, SD = 15.8%; n = 37	83.4%, SD = 20.7%; n = 151	No
• Peak Is	88.4%, SD = 8.78% n = 36	-	-
• Avoid Is	73.7%, SD = 31.06% n = 80	74.8%, SD = 28.98%; n = 325	No
• Woongarra Coast	-	67.7%, SD = 22.48%; n = 30	-
Hatchling emergence success			
• Curtis Is	85.7%, SD = 15.87%	80.2%, SD = 21.20%	No
• Peak Is	86.7%, SD = 11.47% n = 36	-	-
• Avoid Is	71.4%, SD = 32.10% n = 80	74.8%, SD = 28.98% n = 325	No
• Woongarra Coast	-	56.1%, SD = 23.91% n = 30	-

In the 2016-2017 nesting census, a total of 41 individual nesting flatback turtles and 43 clutches of eggs were recorded at Curtis Island during the two-week census period (24 November–7 December 2016). Over the entire breeding season, 49 individual flatback turtles, 223 nesting crawls and 163 clutches were recorded. A total of 214 individual nesting flatback turtles and 209 clutches of eggs were recorded at Peak Island during the two-week nesting period census. At Avoid Island during the mid-season census period a total of 88 individual flatback turtles, 112 nesting crawls, and 79 clutches were recorded. Over the entire breeding season 92 individual flatback turtles, 394 nesting crawls and 269 clutches were recorded. A summary of observations at all three islands for 2016-2017 is presented in Table 2 (Limpus et al 2017b).

Table 2: Summary of data collected on flatback turtles, nesting at three index rookeries, Curtis, Peak and Avoid Islands, during the 2016-17 two-week, mid-season monitoring.

Data Collected (mean)	Curtis Island	Peak Island	Avoid Island
# turtles - total	41	214	88
Mean tracks/night	4.5 (4.1)	25.6 (18.8)	8.0 (4.0)
# clutches - total	43	209	79
Nesting success %	73.1	53.1	72.1
% new recruits	12.0	12.6	18.4
Female CCL	93.9 (92.5); n = 46	93.9 (2.7); n = 178	93.6 (2.5); n = 76
Remigration interval (yr)	3.7 (1.6); n = 35	2.96 (1.4) n = 184	2.41 (0.91); n = 63
Clutch size	52.6 (8.4); n = 40	50.4 (6.2); n = 17	42 (6.1); n = 8
Egg Size-cm n = # clutches	5.2 (0.13); n = 3	5.2 (0.13); n = 14	4.8 (0.71); n = 10
Egg Size- weight n= # clutches	76.3 (4.7); n = 3	76.0 (5.5); n=14	72.0 (5.1); n = 10
Incubation success %; n = # clutches	89.0 (15.8); n = 37	88.8 (8.8); n = 36	73.7 (31.2); n = 80
Emergence success %; n = # clutches	85.7(15.9); n = 37	86.7 (11.5); n = 36	71.4 (32.2); n = 80
Incubation duration (census nests); n = # clutches	47.4 (2.2); n = 29	52.7 (3.8); n = 21	50.2 (2.7); n = 60
# clutches laid/female	2.7 (0.9); n = 46	n/a	2.7 (1.0); n = 92

During the 2017-2018 nesting season, a total of 28 individual nesting flatback turtles and 35 clutches of eggs were recorded at Curtis Island during the two-week census period (24 November–7 December 2017). Over the entire breeding season, 43 individual flatback turtles, 168 nesting crawls and 138 clutches were recorded. A total of 232 nesting crawls from 158 individual nesting flatback turtles and 157 clutches of eggs were recorded at Peak Island during the two-week census period. At Avoid Island, during the mid-season census period, 88 nesting crawls and 62 clutches were recorded. A summary of observations at all the three islands for 2017-2018 is presented in Table 3 (Limpus et al 2018).

Table 3: Comparison of reproductive parameters (± standard deviation) recorded for flatback turtles, nesting at the three central Queensland index rookeries during the mid-season census period: 24 November to 7 December 2017.

Parameters that are considered to be indicative of poor population performance are shaded

Data Collected	Curtis Island	Peak Island	Avoid Island
# turtles – total	28	158	>46
Mean tracks/night ± SD	3.4 ± 2.2	16.6 ± 10.8	6.3 ± 5.3
# clutches – total	35	157	62
Nesting success	72.9%	67.7%	67.1%
New recruits to breeding population	21.4%	10.8%	23.9%
Female CCL (cm)	94.1 ± 2.7; n = 28	93.9 ± 2.9; n = 152	92.9 ± 2.90; n = 64
Mean remigration interval (yr)	3.0 ± 1.7; n = 24	2.83 ± 1.2; n = 137	2.60 ± 0.96; n = 53
Mean eggs/clutch	51.4 ± 9.98; n = 21	52.0 ± 8.7; n = 17	49.7 ± 6.9; n = 3
Mean egg diameter (cm); n = # clutches	5.1 ± 0.13; n = 14	5.1 ± 0.16; n = 17	5.2 ± 0.08; n = 3
Mean egg weight (g); n= # clutches	75.2 ± 5.0; n = 14	75.1 ± 6.2; n=17	78.8 ± 2.1; n = 3
Incubation duration from census nests; n = # clutches	47.5 ± 1.7; n = 31	47.8 ± 2.7; n = 32	46.7 ± 1.3; n = 7
Hatching success; n = # clutches	74.7 ± 19.0%; n = 33	55.9 ± 23.3%; n = 61	62.0 ± 36.2%; n = 49
Emergence success; n = # clutches	64.2 ± 26.1%; n = 33	39.1 ± 26.6%; n = 61	56.9 ± 36.7%; n = 49

2.1.3.2 Inter-nesting habitat use by flatback turtles off the Curtis Island coast

Overview

The aim of this project was to examine the movement patterns of female flatback turtles nesting at Curtis Island to understand the extent to which the turtles used the Port of Gladstone and Port of Rockhampton regions during their inter-nesting period. Eleven flatback turtles were caught each year between 2013 and 2015 on South End Beach, Curtis Island after they completed their first round of nesting. They were each fitted with a satellite tag configured to transmit GPS location and depth via satellite.

The progress of this project has been reported in the 2014 to 2017 EPRs. As reported in the 2016 EPR, two 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, and the tags were deployed on sub-adult green turtles in May 2017. The final report from this project was approved by the ERMPAP in 2018.

http://gpcl.com.au/EnvironmentDocuments/ERMP_InterNesting_habitat_use_by_flatback_turtles_off_the_Curtis_Island_Coast_2013-2015_CA13002463-DOCSCQPA1380400.pdf

Findings

Tracking of the tagged flatback turtles revealed that the size of the core habitat used by the thirty turtles during the inter-nesting period ranged from 6 to 458 km^2 (50%) and 51 to 1501 km^2 (95%). The mean area used by the turtles showed little variability between years (Figure 3). All of the 30 turtles spent some of their time within the waters of the Port of Gladstone and, in 2015, one turtle spent its first internesting period (between clutches 1 and 2) within the Port of Rockhampton. 20 turtles that used the Port of Gladstone spent at least some of their time within 100 m of vessel transit lanes. 10 turtles (all from 2014) used the passage between Curtis and Facing Islands to move to and from the nesting beach and the sheltered waters inside of the Port of Gladstone (Hamann et al 2017a).

Based on the home range analysis, the waters immediately offshore of Curtis and Facing Islands, the waters along the southern coast of Facing Island and the waters between Facing Island and the mainland were deemed as important habitat for inter-nesting flatback turtles. It would be reasonable to assume that adult female flatback turtles will be present in these areas from October to January each year.

Vessel strike was not considered as a key issue for the interesting female flatback turtles as none of the tracked turtles were found to be injured from vessel interaction during the survey period.

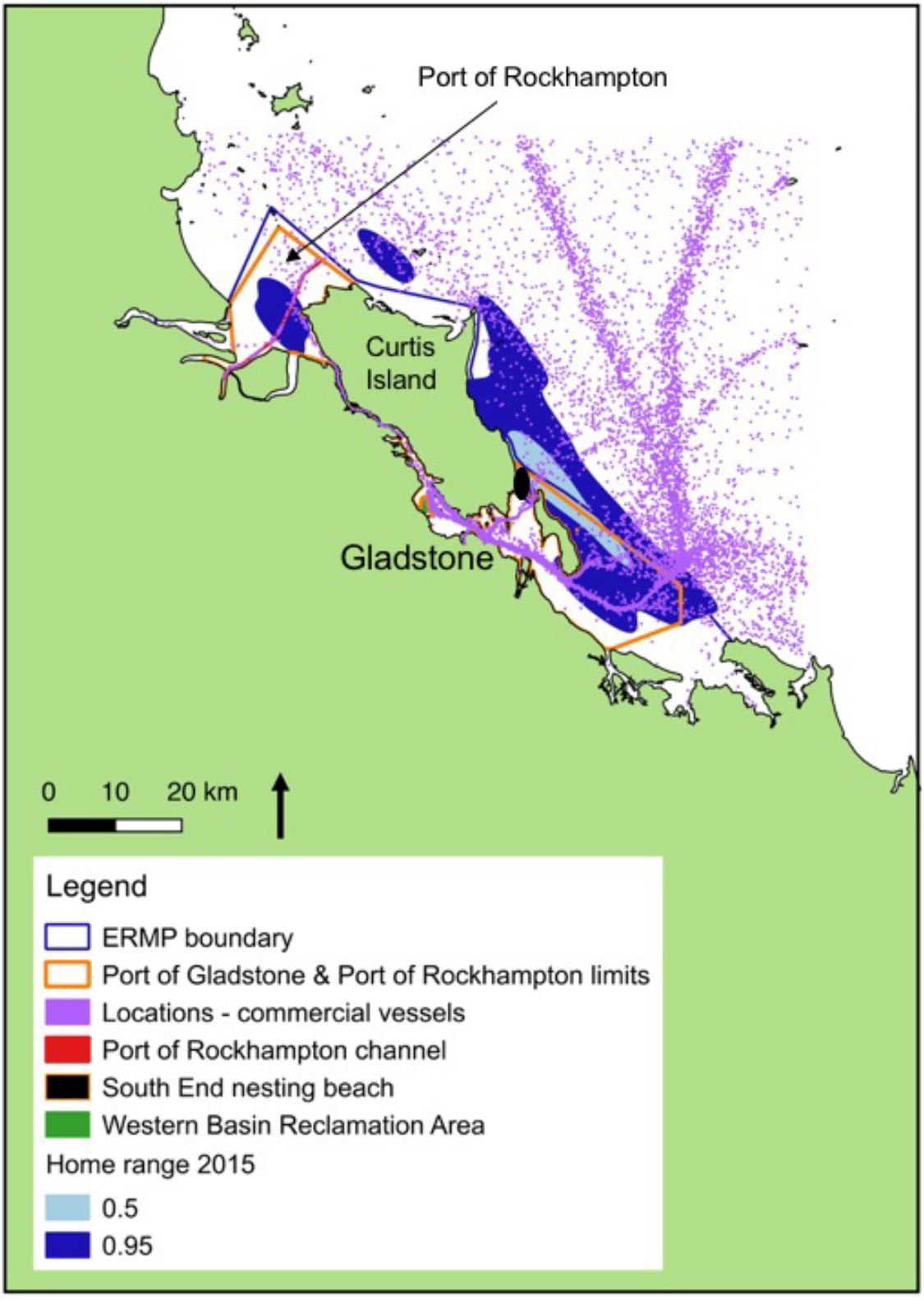


Figure 3: Habitat use areas for 11 flatback turtles tracked during their inter-nesting period(s) during November and December 2015

The dark and light blue areas indicate habitat that the turtles used 95% and 50% of their time respectively

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 2017. 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 2017 EPRs.

Between 2014 and 2017, 35 green turtles were caught from intertidal habitats in the Port of Gladstone. Each turtle was weighed, measured and examined for external signs of disease and injury, gender and reproductive stage determination, following which, each turtle was tagged with standard titanium flipper tags in the axillary tagging position on the front flippers or on the hind flipper if the front flipper was too thick. The tags were configured to transmit GPS location, water temperature and depth and data were received from thirty-four of the turtles. The final project report was approved by the ERMPAP in 2018.

http://gpcl.com.au/EnvironmentDocuments/ERMP_Increase_the_understanding_of_Green_Turtle_Population_in_Port_Curtis_Annual_Report_2017_CA14000241-DOCSCQPA1421006.pdf

Findings

Analysis of tracking data of the tagged green turtles showed that most (25) of the 34 tracked turtles returned to the same area in which they were captured, and then remained there for the rest of the tracking period, demonstrating a high degree of fidelity to foraging habitat (Figure 4). Four turtles returned to an area close to where they were initially caught and then shifted habitats, implying they have the ability to move if resource availability changes. Three turtles did not return close to the area in which they were caught, and each of these moved out of the Port of Gladstone. Home range area ranged from 2 to 81 km^2 with a mean across all years of 15 km^2. This is similar to the home ranges recorded for green turtles at other sites in Queensland (Hamann et al 2017b).

In summary, the project provided very important information on habitat usage by foraging green turtles in the ERMP area including the Narrows. Of the 34 tracked turtles, nine used habitats within an estuary system. Five of those turtles had moved to the estuary habitat (Figure 5) after they had spent at least a month foraging on the Pelican Banks or within the Western Basin. Two turtles were caught close to the Boyne River estuary and they both remained in that habitat, one turtle (in 2016) moved upstream approximately 12 km and remained upstream for most of the period it was tracked. The two individual turtles that did not return to their initial capture habitat both moved to estuary habitats and remained there for the duration of tracking.

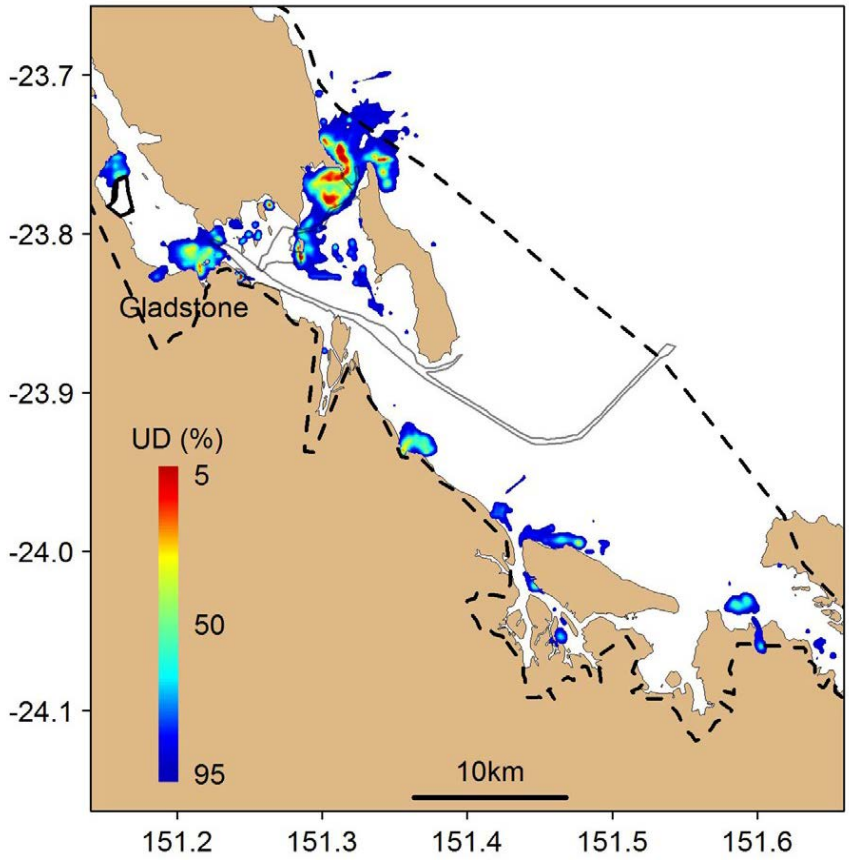


Figure 4: Combined home ranges of 34 green turtles caught and tracked from waters within the Port of Gladstone and ERMP region.

Percent Utilisation Distributions (UD) refers to the percent of time each 100 m grid is used by the turtles during the tracking period

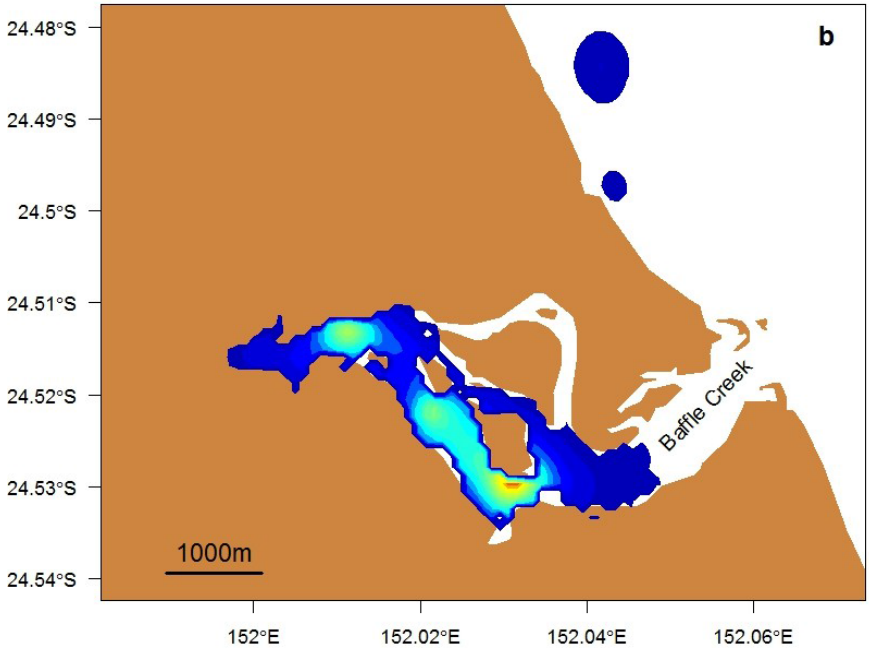


Figure 5: Example from our dataset of one of the green turtle's home range use within an estuary system. Colours represent percent UD as per Figure 4.

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 with the first field survey conducted in 2016. 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. The year 2 (2017) annual report was approved by the ERMPAP in 2018.

In year 3 (2018), field trips were conducted in April-May, June-July and September. The annual report for 2018 will be submitted outside the current reporting period and findings will be discussed in the 2019 EPR.

http://gpcl.com.au/EnvironmentDocuments/ERMP_Increase_the_understanding_of_Green_Turtle_Population_in_Port_Curtis_Annual_Report_2017_CA14000241-DOCSCQPA1421006.pdf

Findings

A total of 367 green turtles were captured during the four surveys conducted in 2017. Of these, 34 turtles were recaptured on one or more occasions. Most turtles were captured on the Pelican Banks (74%), followed by the Boyne River Estuary (20%) and Facing Island (4%). Other captures were made near Quoin Island, Western Basin and Boyne River at Benaraby. At the mouth of the Boyne River, the accessible turtles were strongly biased to small immature turtles. Although large turtles were seen in the adjacent deeper waters, they were not easily captured by the turtle rodeo method. The turtles continued to display differences in diet among the study sites. The population was strongly biased to females as has been typical of green turtles at all foraging areas previously sampled in eastern Queensland. Approximately 5% of the adult females and 38% of the males were estimated to have prepared for breeding during the 2017-2018 season.

There were significant differences in body condition (as an index of health measured via length-weight analysis) between males and females for large turtles (approximately Curved Carapace Length (CCL >88 cm) but no significant differences in body condition among the smaller turtles (approximate CCL <88 cm). Summary of observations from the 2017 survey is presented in Table 4 (Limpus et al 2017c).

Details of the 2018 field trips will be included in the 2019 EPR.

Table 4: Summary of green turtles captured by tagging history and study areas in Port Curtis and adjacent waterways for 2017

Month	Pelican Banks			Quoin Island			Facing Island			Western Basin			Boyne Estuary			Boyne River Benaraby			TOTAL
	New tagging	recapture from Port Curtis, (within year recapture)	Migration recapture from a breeding area	New tagging	recapture from Port Curtis, (within year recapture)	Migration recapture from a breeding area	New tagging	recapture from Port Curtis, (within year recapture)	Migration recapture from a breeding area	New tagging	recapture from Port Curtis, (within year recapture)	Migration recapture from a breeding area	New tagging	recapture from Port Curtis, (within year recapture)	Migration recapture from a breeding area	New tagging	recapture from Port Curtis, (within year recapture)	Migration recapture from a breeding area	
April-May	27	12	-	-	-	-	-	2	-	-	-	-	31	10	-	-	-	-	83
June	45	14 (2)	-	1	1	-	9	3	-	1	-	-	5	1 (3)	-	-	-	-	80 (5)
September	75	24 (7)	1	1	-	-	1	-	-	-	-	-	23	5 (8)	-	-	-	-	129 (15)
November	54	17 (14)	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75 (14)
TOTAL	201	67 (23)	4	3	1	-	10	5	-	1	-	-	59	16 (11)	-	-	-	-	367 (34)

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 2013 and continued until 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 10". The 2018 annual shorebird monitoring summer survey was carried out on the full moon spring tide over five days from 31 January - 5 February 2018. Poor weather forced a stand down day on 4 February. 2018 marked the completion of the single annual summer surveys, to be replaced by comprehensive surveys (5 surveys each year) in 2019 and 2020.

The 2018 report was approved by the ERMPAP in 2018.

http://gpcl.com.au/EnvironmentDocuments/ERMP_Report_for_Migratory_Shorebird_Monitoring_Annual_Summer_Survey_2018_CA12000284-DOCSCQPA1397266.pdf

Findings

A total of 150 roosts were surveyed over six days at Port Curtis, Rodds Peninsula, Mainland Shoreline and the Western Basin Reclamation Area, North Curtis Island, Fitzroy Estuary, Mundoolin Rocks and Colosseum Inlet (Figure 6), following the Shorebirds 2020 Procedure. 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.

The total number of EPBC Act-listed migratory shorebirds at high tide roost counts in February 2018 was 12,986 consisting of 19 species. This figure is 7.3% fewer than was recorded in February 2017 (14,003 birds). Two species recorded in 2017 were not recorded in the current survey. These were Broad-billed Sandpiper and Double-banded Plover. The composition of the 10 most abundant species differed from 2017 with the Grey Plover replacing the Curlew Sandpiper.

The distribution of large roosts across the Curtis Coast was skewed to the north of the survey footprint. There were two roosts with >1000 birds. These were Deception Point (2236 birds) and Shell Point (1018 birds) both located in the Fitzroy Estuary. There were four roosts in the

500-999 birds class. These were Yellow Patch sandbar (962 birds) and Yellow Patch entrance mangrove (603 birds) at North Curtis Island; and Curtis Island Southend claypan (767 birds) and the Western Basin Reclamation Area (708 birds) in Port Curtis. There were a further 18 roosts with 100-499 birds: eight in Mundoolin-Colosseum-Rodds, four each at North Curtis Island and Port Curtis and two in the Fitzroy Estuary.

A total of 731 migratory shorebirds, consisting of five species (Red-necked Stint, Lesser Sand Plover, Eastern Curlew, Whimbrel and Ruddy Turnstone) were recorded during high tide counts on the mainland shoreline including the WBRA. A total of 707 of these were Red-necked Stints recorded from the WBRA. This is the highest count from the WBRA during the project. Two species exhibited substantial increases from 2017. These were the Red-necked Stint (24%) and Grey-tailed Tattler (20%). Red-necked Stint counts have exhibited the greatest range of any species during the project (860-3854) (Tables 5 and 6).

The mean abundance of migratory shorebirds on the Curtis Coast in summer, calculated from the 10 surveys in January and February 2011-2018 was 12,355 birds with a range of 10,387 to 14,003. The lower bound of the range is 84 % of the mean and the upper bound is 114 % of the mean.

The total abundance of migratory shorebirds present on the Curtis Coast in early February each year does not appear to have declined since the program began in 2011 (Figure 7). Three species of migratory shorebird (Lesser Sand Plover, Red-necked Stint and Terek Sandpiper) are resident on the Curtis Coast in summer, but commence migratory movements in the first half of February. Two of these species (Red-necked Stint and Terek Sandpiper) have exhibited considerable variation in abundance between years. The 2018 counts for all three species were within the range recorded in previous years. Shorebird abundance at sites that were subject to construction disturbance generally appeared lower than at the beginning of the project but few data were collected prior to the commencement of construction. There appear to be changes in the distribution of birds at roosts in the upper harbour and the WBRA (Wildlife Unlimited. 2018).

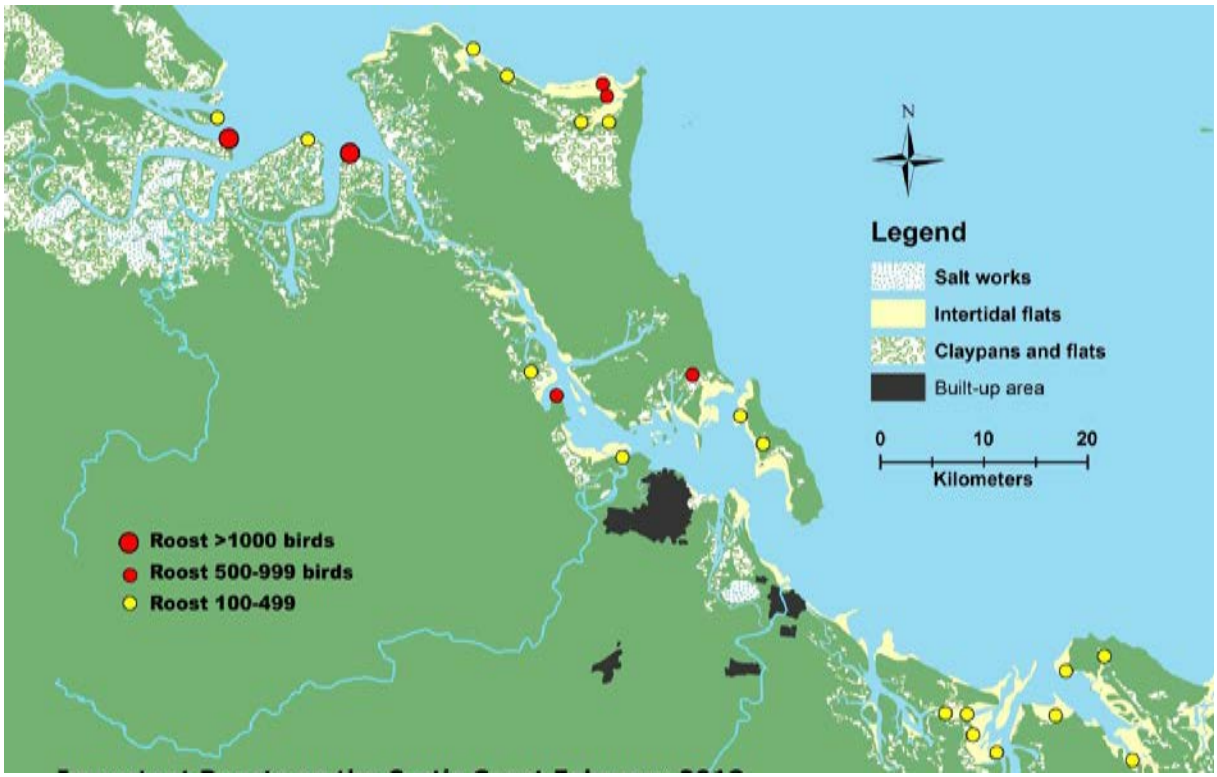


Figure 6: Important roosts on the Curtis Coast in February 2018

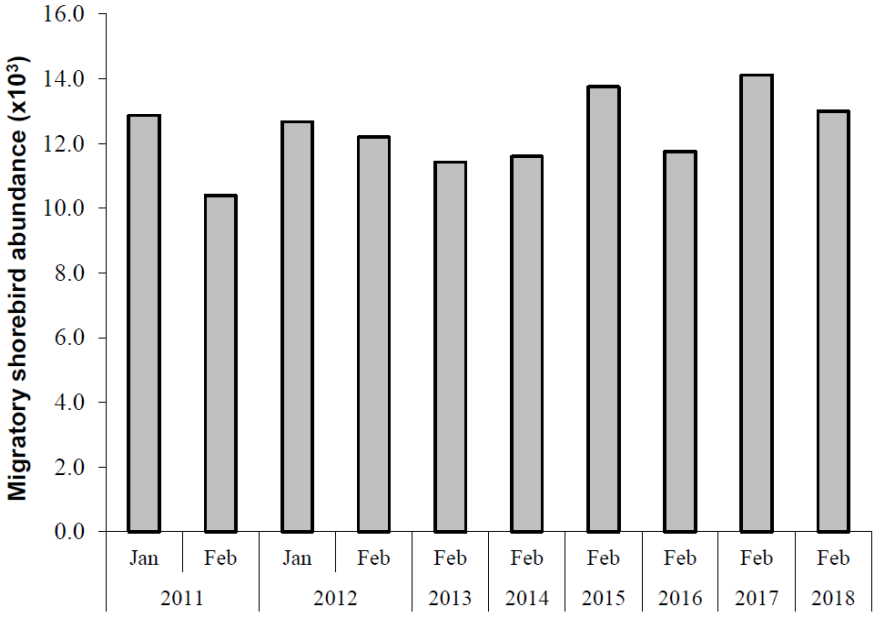


Figure 7: Total abundance of migratory shorebirds in summer on the Curtis Coast

Table 5: Summary of roost counts for migratory birds at each location for 2018

	PC	FE	NC	M-C	RP	SW	Total
Pacific Golden Plover	13	3	2	0	3	0	**21**
Grey Plover	7	3	73	50	0	0	**133**
Double-banded Plover	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Lesser Sand Plover	137	293	314	189	28	0	**961**
Greater Sand Plover	87	24	205	6	0	0	**322**
Latham's Snipe	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Black-tailed Godwit	0	0	1	0	0	0	**1**
Bar-tailed Godwit	742	232	769	521	180	0	**2444**
Little Curlew	0	0	0	0	0	0	**0**
Whimbrel	428	14	516	98	37	0	**1093**
Eastern Curlew	305	8	89	190	152	0	**744**
Terek Sandpiper	236	162	210	402	206	0	**1216**
Common Sandpiper	0	0	0	0	0	0	**0**
Grey-tailed Tattler	176	16	734	442	97	0	**1465**
Common Greenshank	11	0	29	21	0	0	**61**
Marsh Sandpiper	0	5	0	0	0	0	**5**
Ruddy Turnstone	8	0	1	25	0	0	**34**
Great Knot	60	44	174	72	3	0	**353**
Red Knot	4	0	6	0	0	0	**10**
Sanderling	0	0	5	0	0	0	**5**
Red-necked Stint	907	2407	20	72	29	0	**3435**
Sharp-tailed Sandpiper	5	10	5	0	0	0	**20**
Curlew Sandpiper	0	74	0	1	0	0	**75**
Broad-billed Sandpiper	0	0	0	0	0	0	**0**
Sand Plover spp.*	100	36	0	0	0	0	**136**
Tattler/Terek spp.*	30	0	0	0	0	0	**30**
Unidentified small wader*	0	370	0	0	52	0	**422**
Total abundance	**3256**	**3701**	**3153**	**2089**	**787**	**0**	**12986**
Total species	**15**	**14**	**17**	**13**	**9**	**0**	**19**

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

*This class represents multiple species so is not reflected in the count of total species.

Table 6: Summary of low tide foraging counts for migratory shorebirds at each survey location for 2018

	PC	NC	RP	Total
Lesser Sand Plover	6	14	1	**21**
Greater Sand Plover	10	2	0	**12**
Bar-tailed Godwit	84	22	0	**106**
Whimbrel	28	10	2	**40**
Eastern Curlew	70	1	33	**104**
Great Knot	8	0	0	**8**
Terek Sandpiper	3	0	0	**3**
Grey-tailed Tattler	23	8	0	**31**
Common Greenshank	0	6	0	**6**
Red-necked Stint	176	10	1	**187**
Sand Plover spp.*	0	13	0	**13**
Total abundance	**408**	**86**	**37**	**531**
Total species	**9**	**8**	**4**	**10**

PC = Port Curtis including the mainland foreshore, NC = North Curtis Island, RP = Rodds Peninsula

*This class represents multiple species so is not represented in the count of total species

2.3 Mangroves

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

Overview

The aim of this program is to monitor the changes in the shoreline habitat condition for a period spanning six 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 until 2021.

In 2017-18, progress was made in three major areas inclusive of 1) further development of mapping of tidal wetland habitats throughout the PCPA study area, specifically in the detailed display of the extent of key vegetation types (mangroves, saltmarsh and saltpans), mangrove canopy condition and mangrove forest biomass, coupled with 2) further processing of prior boat and aerial shoreline survey data in preparation for its eventual display and reporting online, and 3) the development of the operational manual for the upload of data to the ShoreView online facility under development.

The fourth progress report is under review and information will be included in the 2019 ERPR.

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 commenced in 2014 and was completed in 2017. 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.

The final project report was approved by the ERMPAP in 2018.

http://gpcl.com.au/EnvironmentDocuments/ERMP_Seagrass_Seedbank_Density_and_Viability_CA14000163_FINAL-DOCSCQPA1385687.pdf

Findings

Seed bank examinations at Pelican Banks North, Wiggins Island and Rodds Bay (Figure 8) revealed that *Z. muelleri* seed bank was present at all sites for all sampling occasions, however the seasonality and inter-annual change in seed abundance varied between sites and times. While seeds were present, they were not always viable and for some sites and times this resulted in the absence of a viable seed bank. There was a general trend for viable seeds to be found at deeper depths within the sediment cores and an overall decline in the seed bank across all sites during 2016 and 2017.

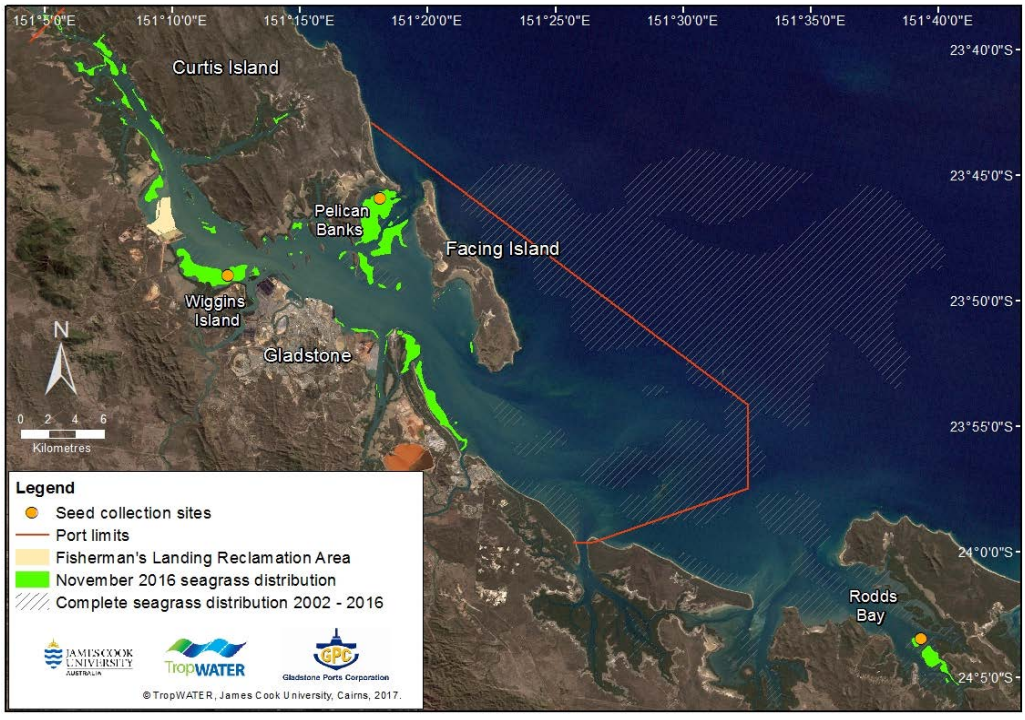


Figure 8: Zostera muelleri seed collection sites in Port Curtis and Rodds Bay with seagrass distribution for 2016

Long-term (2011-2017, inclusive of pre ERMP funded study) assessment of seedbank density revealed that seed bank density generally declined over time at all sites, despite varying degrees of temporal variation. At Pelican Banks North, seed bank density varied significantly among years. Seed bank density peaked in 2011 (773 + 112 seeds m^{-2}) and was lowest in 2017 (57 + 34 seeds m^{-2}). At Rodds Bay, the decline in seed bank density was more temporally variable, with significant variation among sampling dates. The greatest seed bank densities (>1300 seeds m^{-2}) were recorded earlier in the study (August and November 2011, May 2012), and the lowest densities (<200 seeds m^{-2}) were recorded later in the study (August 2013, February and May 2017). At Wiggins Island, seed bank density varied significantly annually and among sampling months (Figures 9A,B and C). Seed bank density declined from a peak of 821 ± 181 seeds m^{-2} in 2014 to just 85 ± 38 seeds m^{-2} in 2017. Seed bank density halved between the general May peak (603 ±108 seeds m^{-2}, all years) and August decline (300 ± 56 seeds m^{-2}, all years) (Reason et al 2017).

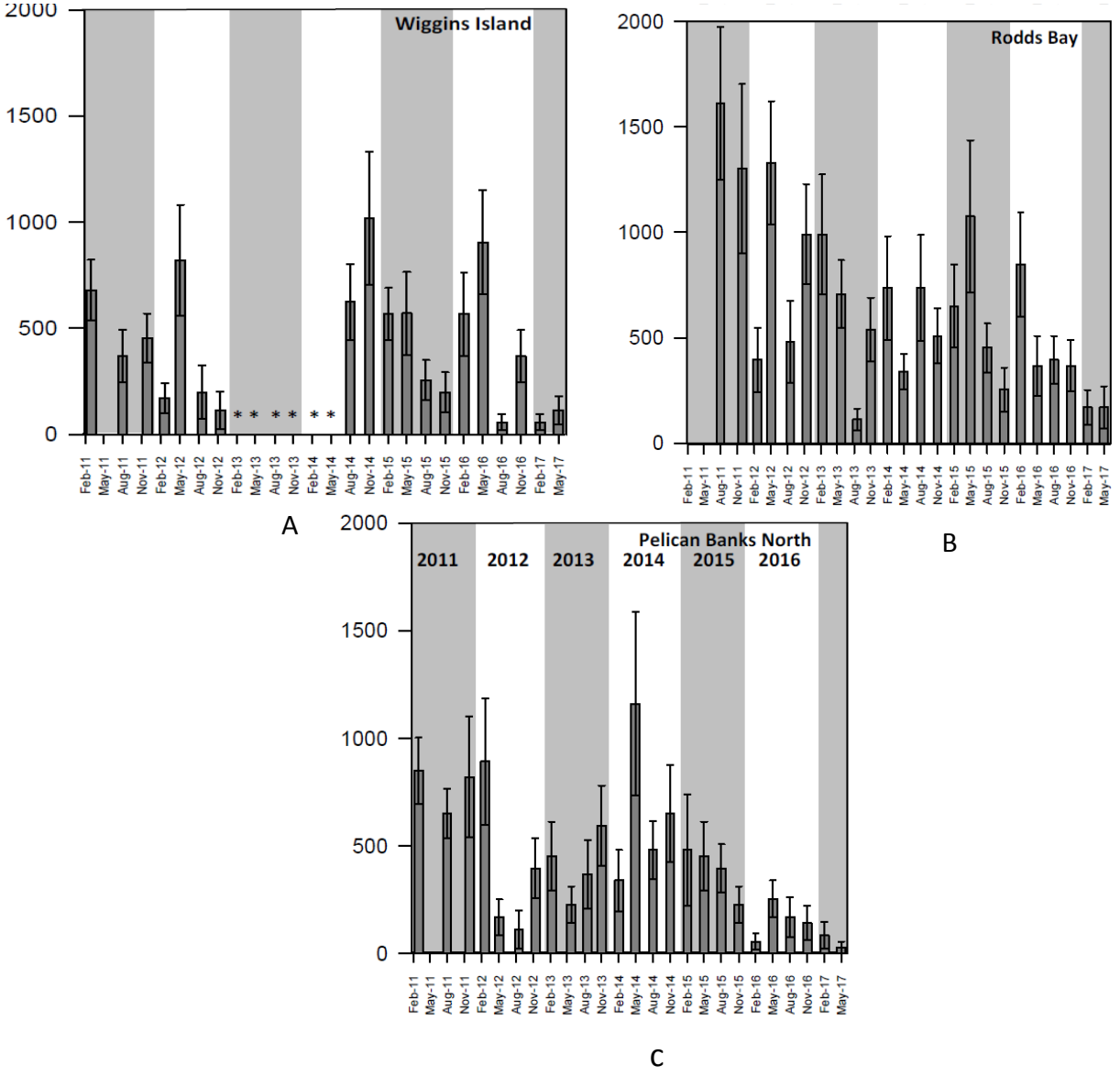


Figure 9: Mean seed bank density (± SE) at (A) Pelican Banks North, (B) Rodds Bay and (C) Wiggins Island from February 2011 until May 2017. **Wiggins Island data were not collected in 2013 due to access issues associated with port development preventing sampling*

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

2.4.2 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 are being mapped annually in accordance with the post dredging seagrass monitoring program. In the current reporting period, annual mapping of seagrass occurred for 14 meadows from 2 -9 November 2017.

A total of 1,739 sites were surveyed in the Port Curtis and Rodds Bay seagrass annual monitoring survey area in November 2017. The meadows were grouped under The Narrows (Black Swan), Graham 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 individual meadows including Rodds Bay).

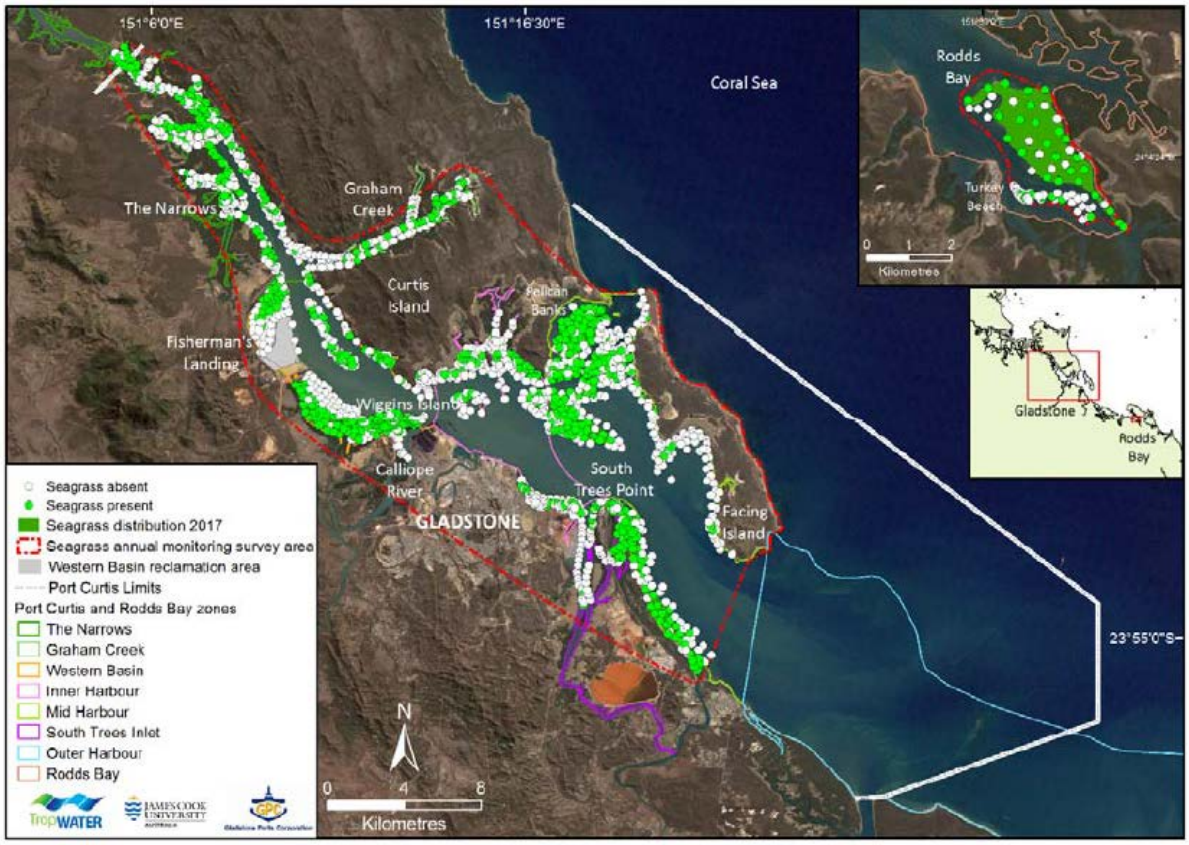


Figure 10: Sites surveyed in Port Curtis and Rodds Bay, November 2017

Findings

The overall condition of seagrasses in Port Curtis and Rodds Bay in November 2017 was poor. Two large rainfall and river flow events in March and October 2017 were likely to have contributed to conditions that prevented any substantial seagrass recovery during 2017.

Improvement of seagrass biomass and composition was observed at Pelican Banks in 2017 resulting in the meadow moving from a score of very poor to poor. The lightest portion of the meadow continues to be in the southern sector where seagrass biomass is extremely low. While the improvements are a positive sign, the meadow is still a long way from regaining its full biomass and area. Given its historical importance as the most stable seagrass meadow in the region, a continued trajectory of recovery in the future remains a key to marine environmental health in Port Curtis.

Meadows at a greater distance from port, urban and industrial activity at Rodds Bay had further declines and remained in a very poor state in 2017. These meadows have been in a poor state since substantial declines occurred between 2008 and 2009.

In 2017, a review of how meadow scores were aggregated led to a slight modification from previous years' reports. This change was applied to correct an anomaly that resulted in some meadows receiving a zero score due to species composition, despite having substantial area and biomass.

Dugong feeding trails (DFTs) were found in 12 of the 15 meadows in which they were previously recorded in 2016; from the Western Basin, Mid Harbour, South Trees Inlet, and Rodds Bay zones. The highest number of sites with recorded DFTs was found at Pelican Banks (Meadow 43) and Wiggins Island (Meadow 5). Overall, DFT presence suggests a similar level of herbivory from dugongs as recorded in previous annual surveys (Chatrand et al 2018).

3.0 ERMPAP meeting highlights

In the current reporting period, three meetings were held in November (2017) and February and May (2018). 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, two letters of recommendations pertaining to ERMPAP governance and changes in scope of projects (dated 10 January 2018 and 18 April 2018) 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 8 February and 3 May 2018 respectively.

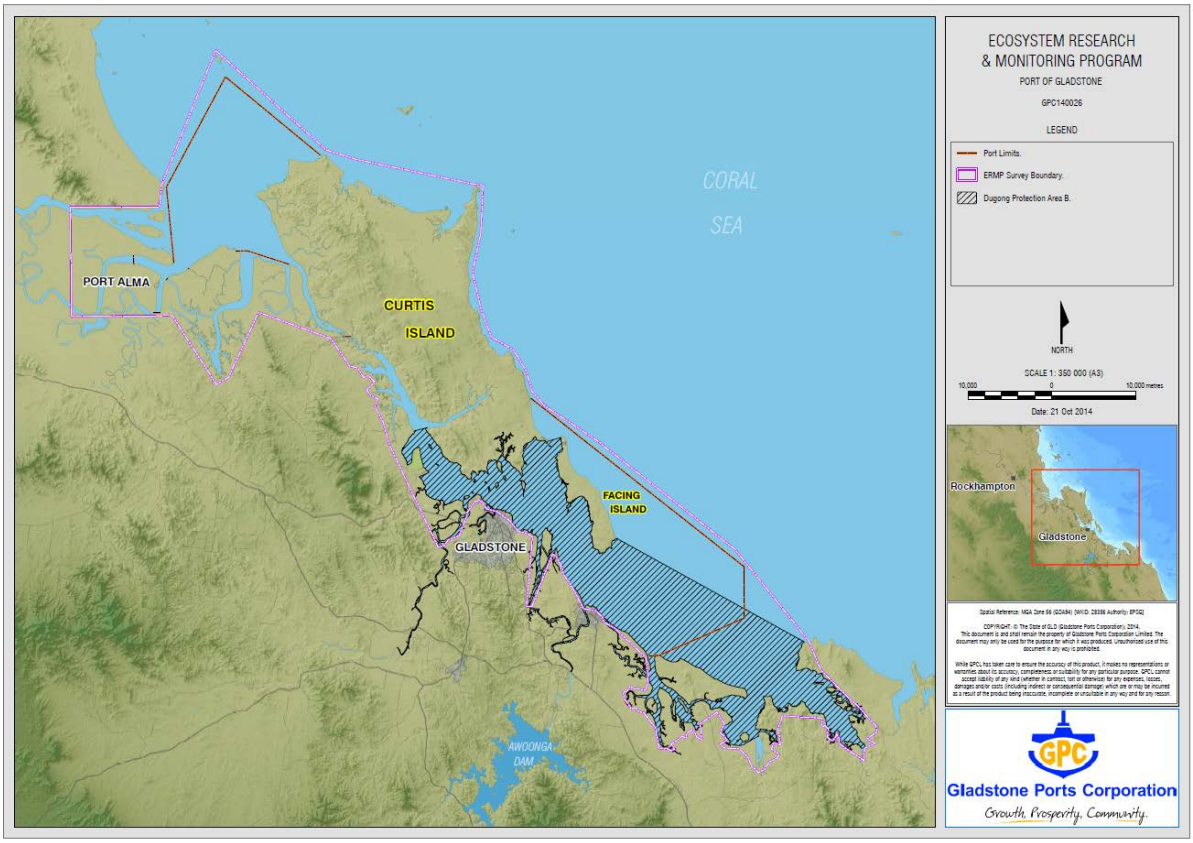
4.0 Amendment/ Revisions of Management Plans

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.

Groundwater monitoring at 28 borewells continue on a monthly basis at the WBRA. The 2017 Annual report on groundwater monitoring was submitted to the DES in February 2018.

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 2017-2018

1. Cagnazzi, D. (2017). Increase understanding of the status of the Australian snubfin and Australian humpback dolphins within Port Curtis and Port Alma Final Project Report (CA14000085). Report produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of the Gladstone Ports Corporation Ecosystem Research and Monitoring Program. 124 pp. (Edocs 1397086).
2. Colin J. Limpus, Milani Chaloupka, Nancy N. Fitzsimmons, John M. Sergeev and Takahiro Shimada (2017a). Estimation of population size and comparison of the benefits of mid-season census and whole of breeding season census of flatback turtle reproduction in eastern Australia. Brisbane: Department of Environment and Heritage Protection, Queensland Government. Report produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of Gladstone Ports Corporation's Ecosystem Research and Monitoring Program 30 pp. (Edocs 1420974).
3. Colin J. Limpus, Nancy N. FitzSimmons, John M. Sergeev, Janine Ferguson, Fiona Hoffmann, Andrea Phillot, Lucy Pople, Ally Ross, Bill Tompkins, Trevor Turner and Laura Wenk (2017b). Marine turtle nesting populations: flatback turtle, *Natator depressus*, 2016-2017 breeding season at Curtis Peak and Avoid Islands. Brisbane: Department of Environment and Heritage Protection, Queensland Government. Report produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of Gladstone Ports Corporation's Ecosystem Research and Monitoring Program. 70 pp. (Edocs 1421369).
4. Colin J. Limpus, Nancy N. Fitzsimmons, Fiona Hoffmann, Erwin Hoffmann, Jaz Laws, Duncan J. Limpus, Maree Mclaren, John M. Sergeev, Felicity Shapland and Trevor Turner (2018). Flatback Turtle, *Natator depressus*, 2017- 2018 Breeding Season, at Curtis, Peak and Avoid Islands. Brisbane: Department of Environment and Science, Queensland Government. Report produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of Gladstone Ports Corporation's Ecosystem Research and Monitoring Program. 67 pp. (Edocs 1435455).
5. Colin J. Limpus, Nancy N. FitzSimmons, Kimberley Finlayson, Christabel Harmonn, Allan McKinnon, John M. Sergeev and Takahiro Shimada. (2017c). Increase the Understanding of the Green Turtle Population in Port Curtis: Annual Report for 2017. Brisbane: Department of Environment and Science, Queensland Government. Report produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of Gladstone Ports Corporation Ecosystem Research and Monitoring Program. 29 pp. (Edocs 1421006)
6. Hamann M., Wildermann N. Williams G, Daff K. and Limpus C.J. (2017a) Final report on inter-nesting habitat use by flatback turtles off the Curtis Island coast - 2013 to 2015. Report produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of Gladstone Ports Corporation's Ecosystem Research and Monitoring Program. 27 pp. (Edocs 1380400)
7. Hamann M., Limpus C.J., Shimada T., and Preston S. (2017b) Final report on green turtle habitat use in Port Curtis 2014 to 2017. Report produced for the Ecosystem

Research and Monitoring Program Advisory Panel as part of Gladstone Ports Corporation's Ecosystem Research and Monitoring Program. 25 pp. (Edocs 1413693)

8. Reason, C. L., Rasheed, M. A., Carter, A. B. & Jarvis, J. C. (2017). Port Curtis Seagrass Seed Bank Density and Viability Studies - Final Report. Report produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of Gladstone Ports Corporation's Ecosystem Research and Monitoring Program. Centre for Tropical Water & Aquatic Ecosystem Research (TropWATER) Publication 17/40, James Cook University, Cairns, 36 pp. (Edocs 1385687)
9. Wildlife Unlimited 2018. Gladstone Ports Corporation Report for Migratory Shorebird Monitoring, Port Curtis and the Curtis Coast Annual Summer Survey – 2018. Report produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of Gladstone Ports Corporation's Ecosystem Research and Monitoring Program. 82 pp (Edocs 1397266)

Seagrass Monitoring Studies outside the ERMP

10. Chartrand K., Rasheed M. and Carter A. 2018. Seagrasses in Port Curtis and Rodds Bay 2017: Annual long-term monitoring. Centre for Tropical Water & Aquatic Ecosystem Research (TropWATER),Publication 18/14, James Cook University, Cairns, 88 pp.(Edocs 1415549)

Appendix 3 ERMP timeline

ERMP timeline	2011	2012	2013	2014	2015	2016	2017	2018	2019		2020		2021	
Projects									Jan to June	July to Dec	Jan to June	July to Dec	Jan to June	July to Dec
Baseline Studies														
Baseline Light Monitoring of Marine Turtles														
Shorebird Monitoring														
Marine Megafauna and Acoustic Monitoring														
Tier 1 gap Analysis Studies														
Central Queensland Corals and Associated Benthos: Monitoring review and gap Analysis														
Migratory Shorebird Monitoring Review														
Research, monitoring and management of seagrass ecosystems adjacent to port developments in central Queensland: Literature Review and Gap analysis														
Review of Water Quality Studies														
Review of Coastal Dolphins in Central Queensland, particularly Port Curtis and Port Alma regions														
Status of the dugong population in the Gladstone area														
Monitoring of Coastal Sea turtles Reports 1-6														
Loggerhead														
Green														
Hawksbill														
Olive Ridley														

ERMP timeline	2011	2012	2013	2014	2015	2016	2017	2018	2019		2020		2021	
Projects									Jan to June	July to Dec	Jan to June	July to Dec	Jan to June	July to Dec
Flatback														
Leatherback														
Tier 2 Projects - Ongoing														
Green Turtle population and Health study														
Monitoring Seagrass Seedbank Density and Viability within Port Curtis														
Monitoring the survival and recovery of shorelines, specifically Tidal Wetlands (Mangroves/Saltmarsh/Saltpans)														
Dugong feeding ecology and habitat use (dugong feeding trail assessment)														
Dugong tagging in collaboration with Green Turtle tagging and turtle population and health studies														
Migratory Shorebird Monitoring: Understanding Ecological Impact														
Migratory Shorebird Survey														
Dolphin Monitoring														
Turtle Nesting Populations on Curtis, Peak and Avoid Islands														
Green Turtle Satellite Telemetry														
Flatback Turtle Satellite Telemetry														
Green Turtle Blood analysis														
Monitoring of Coastal Lighting Effects on Marine Turtles – Pendoley Environment														
Aquatic Ambient Noise Monitoring – Blue Planet Marine														
Planned														
Humpback Dolphins biopsy studies														

ERMP timeline	2011	2012	2013	2014	2015	2016	2017	2018	2019		2020		2021	
Projects									Jan to June	July to Dec	Jan to June	July to Dec	Jan to June	July to Dec
Review of Strandnet														
Assessment of megafauna in shipping channels														
Shorebird – Correlating Numbers														
ERMP Synthesis Report														
	Completed													
	In progress													
	Planned but timing and duration to be determined													
	Current position in timeline													