



# Gnaraloo Turtle Conservation Program

Gnaraloo Bay Rookery  
Gnaraloo Cape Farquhar Rookery

Summary Findings to End 2013/14

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Photo by Nora Hajnoczky.

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Duplication of any material contained within this report must be authorised in writing by the GTCP Project Manager (Karen Hattingh) or the Gnaraloo leaseholder (Paul Richardson).



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### CONTEXT

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### GTCP FINDINGS TO END 2013/14

Table 1: Summary of sea turtle nesting activities and species composition in the Gnaraloo Bay Rookery during GTCP seasons 2008/09 – 2013/14

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## 1 CONTEXT

Gnaraloo is a wilderness tourism business and working pastoral station on the Ningaloo Coast in remote north western Australia, located approximately 150 km north of Carnarvon, immediately adjacent to the Ningaloo Marine Park and the Ningaloo Coast World Heritage Area (**NCWHA**). Gnaraloo abuts to the 65 km of coastline, including southern parts of the Ningaloo Reef and four marine sanctuary zones. The Indian Ocean borders Gnaraloo to the west (**Map 1**).



**Map 1: Location of Gnaraloo and nesting rookeries of endangered sea turtles on the Gnaraloo coastline (beaches)**



Wilderness tourism is defined by the Gnaraloo Station Trust as: 'Responsible travel to pristine, fragile and natural areas that strives to be sustainable and low impact. It respects nature, focuses on environmental and social responsibility, contributes to conservation initiatives and the protection of the area so that current and future generations may enjoy and experience the same biodiversity, resource base and opportunities as currently on offer'.

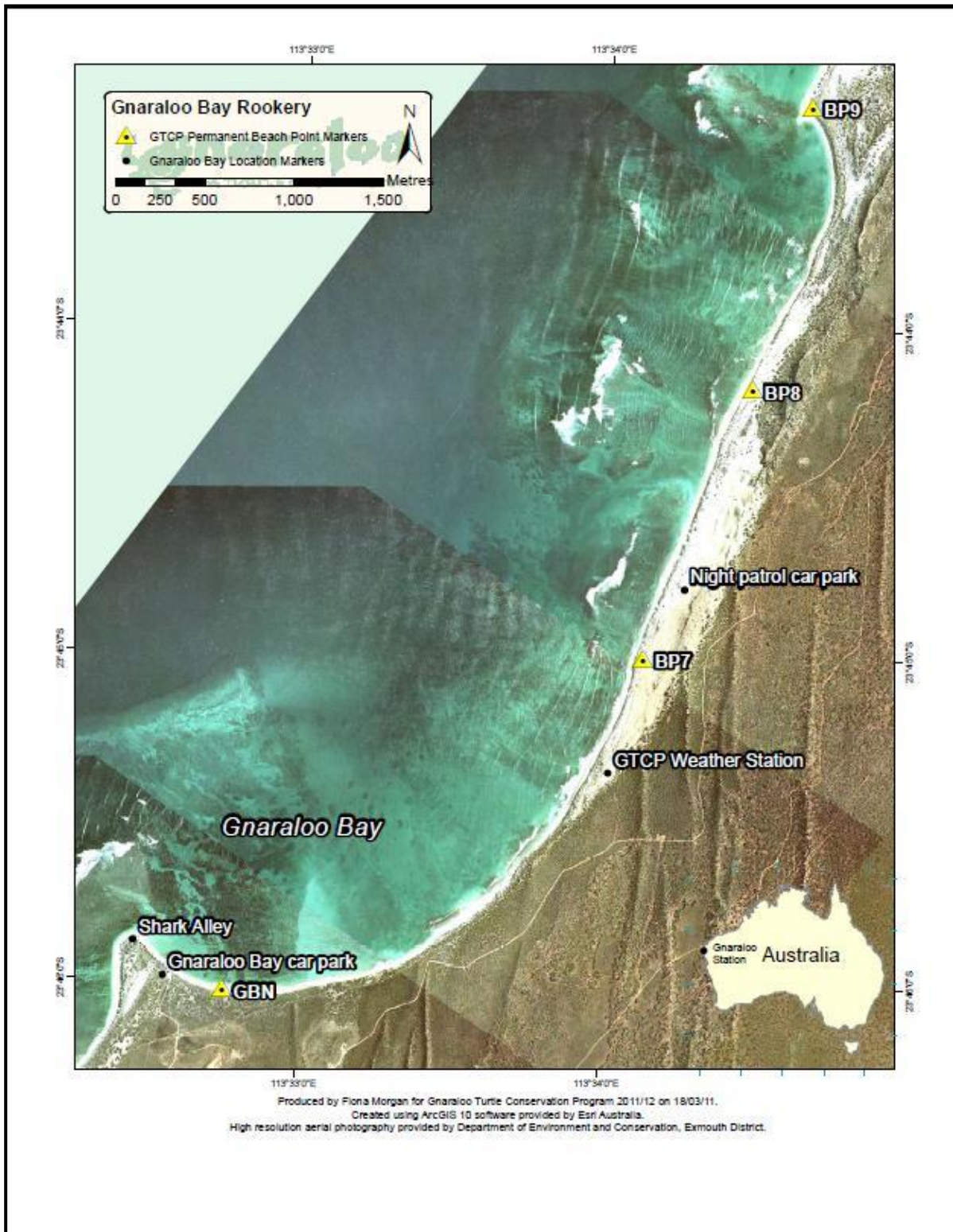
The Gnaraloo Station Trust initiated, developed and undertakes the Gnaraloo Turtle Conservation Program (**GTCP**) and the specialized Gnaraloo Feral Animal Control Program (**GFACP**). Both programs commenced on-ground in 2008. The GTCP monitors, manages and protects two significant sea turtle nesting rookeries (on beaches, not in-water) on the Gnaraloo coastline, namely the Gnaraloo Bay Rookery (**GBR**) and the Gnaraloo Cape Farquhar Rookery (**GCFR**) both of which are located in the southern section of the Ningaloo Marine Park (**Maps 2 and 3**). During 2008/09 – 2010/11, surveying by the GTCP was solely performed in the GBR, however, since 2011/12 – 2013/14 and ongoing, additional surveying of the GCFR was also included in the GTCP.

The GBR is 7.5 km north and the GCFR is 30 km north of the Gnaraloo Homestead area. The GBR extends from the GTCP beach survey point named Gnaraloo Bay North (**GBN**) (-23.76708 °S; 113.54584 °E) to Beach Point 9 (**BP9**) (-23.72195 °S; 113.57750 °E), an area of approximately 7 km long. The GCFR extends from the GTCP beach survey point called Gnaraloo Farquhar South (**GFS**) (-23.64168 °S; 113.61544 °E) to Gnaraloo Farquhar North (**GFN**) (-23.57697 °S; 113.69830 °E), approximately 14 km long.

Three sea turtle species have been recorded to nest in the GBR and GCFR, generally from November to April. The predominant species found at the two nesting rookeries is the loggerhead sea turtle (*Caretta caretta*), however, there are also a few green turtles (*Chelonia mydas*) and occasional hawksbill turtles (*Eretmochelys imbricata*). Loggerhead and green turtles have been listed as endangered by *The IUCN Red List of Threatened Species* (Version 2014.2) while hawksbill turtles have been listed as critically endangered.

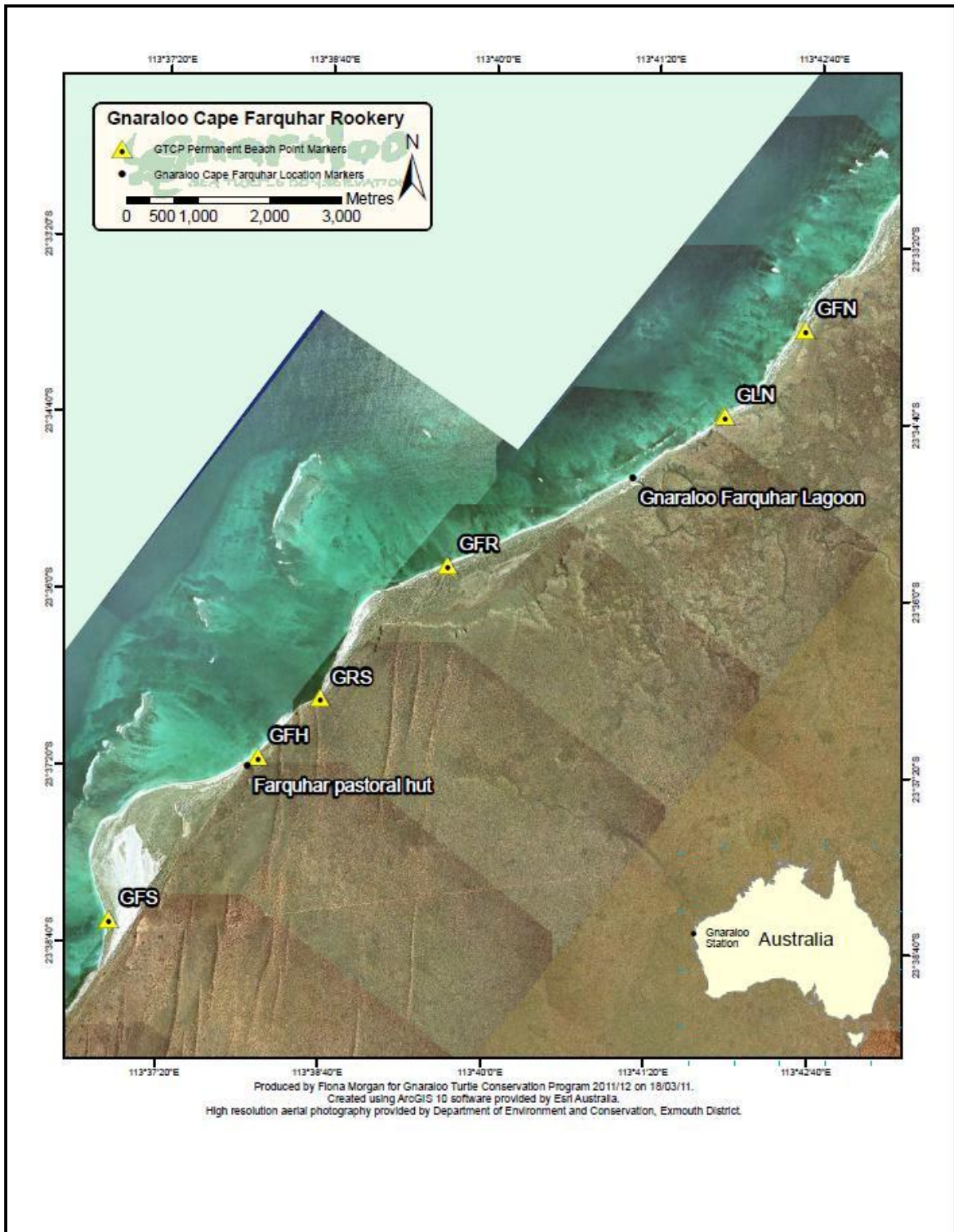
The GBR and the GCFR support and contribute to the third largest loggerhead sea turtle population in the world. The GBR is the largest confirmed mainland nesting rookery for loggerhead sea turtles in Western Australia (**WA**) (Prince, 2013), with consecutive full season surveys from 2008/09 – 2013/14 and ongoing.

The Gnaraloo loggerhead sea turtle rookeries are the most significant loggerhead rookeries in the Ningaloo Marine Park and NCWHA. The on-ground research performed by the GTCP since 2008 to monitor such rookeries constitutes the baseline on loggerhead sea turtles for the Ningaloo Marine Park.



**Map 2: The Gnaraloo Bay Rookery**





**Map 3: The Gnaraloo Cape Farquhar Rookery**



The GTCP aims to collect reliable high quality baseline data on sea turtle nesting activities along the Gnaraloo coastline to identify trends, to inform responsible management activity to protect these endangered marine species and their critical coastal nesting habitats, for biodiversity conservation and to promote the long term survival of sea turtle populations. In addition, the GTCP trains young scientists for professional careers, engages the community to increase awareness of conservation issues and knowledge-shares its findings for protection of the Gnaraloo sea turtle rookeries. The GTCP has established important baseline data on loggerhead sea turtles (for the seasons 2008/09 – 2013/4 and ongoing) for the Gnaraloo coastline in the NCWHA which was an area with little existing scientifically verified sea turtle information.

The online Species Profile and Threats Database (**SPRAT**) of the Australian Government for loggerhead sea turtles states that there is no data on the trends for the Western Australian genetic stock, nor have the threatening processes been quantified for the stock (Ref. [http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon\\_id=1763](http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1763), 4 December 2013). Limpus (2008), however, suggests that it is highly probable that egg loss to foxes (and vehicle traffic) in recent years has exceeded the sustainable level of loss for the Western Australian loggerhead turtle population. Limpus (2008) also suggests that much of the egg predation is likely to occur on those Western Australian beaches most likely to produce female hatchlings, adding a further long-term complication to future population dynamics.

A Department of Parks and Wildlife, WA (**DPAW**) (then Department of Environment and Conservation) publication (DPAW, 2012) stated that the NCWHA is internationally recognised for its important wildlife such as nesting sea turtles and that foxes, feral cats and wild dogs have a significant impact on various threatened species including turtles. It continued by stating that fox predation in the NCWHA causes up to 70 % mortality of sea turtle nests on beaches in the World Heritage area.

At the start of the GFACP at Gnaraloo in 2008, there was 100 % predation of sea turtle nests by feral animals (predominantly foxes) in certain locations in the GBR (Butcher and Hattingh, 2013). The GFACP has been extremely successful in reducing and controlling the threats posed by feral animals (including foxes, feral cats and wild dogs) to nests of endangered sea turtles in the GBR, resulting in 100 % protection of such nests from feral predation in the GBR for the past four consecutive years from 2010/11 – 2013/14. This amounts to roughly 47,000<sup>1</sup> eggs of endangered loggerhead turtles being protected from feral predation in the GBR by the GFACP each consecutive year since 2010/11.

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<sup>1</sup> GTCP seasons 2008/09 - 2013/14 recorded an average of 359 loggerhead nests per season in the GBR. There is an average of 130 eggs per loggerhead clutch. Hence, there is an average of 46,670 eggs in loggerhead nests in the GBR each season. For the calculation, impacts on loggerhead nests by factors other than feral predation [such as by native predators (e.g. ghost crab disturbance and predation) and environmental impacts (e.g. shifting dunes, tides and cyclones)] were not included as the percentage impacts of these are unknown.





In total, roughly 188,000 eggs of loggerhead turtles have been protected from feral predation in the GBR by the GFACP during 2010/11 – 2013/14.

The GTCP and the GFACP target matters of national environmental significance (**MNES**) under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (**EPBC Act 1999**): namely nationally significant species (threatened fauna in the category of endangered and vulnerable reptiles, being sea turtles) and key threatening processes (being feral predation of sea turtle eggs and hatchlings by European red fox, feral cat and wild dog).

The GTCP and GFACP align with and action recommendations from *Australia's Biodiversity Conservation Strategy 2010 – 2030* and national recovery and threat abatement plans for sea turtles, including:

- *Recovery Plan for Marine Turtles in Australia;*
- *North-west Marine Bioregional Plan;*
- *Marine Reptile Species Group Report Card;* and
- *Fox Threat Abatement Plan.*

Loggerhead, green and hawksbill turtles are each identified as a *Conservation Value* and occur in *Biologically Important Areas* in the *North-west Marine Region* of Australia. Fourteen national level recovery plans identify wild dogs as a known or potential threat to native mammal, bird and reptile species that are listed under the EPBC Act 1999. Listed native species known to be threatened by wild dog predation include sea turtles.

The national recovery and threat abatement plans for sea turtles require the following:

- identification and protection of habitats that are critical for turtle survival;
- program development to monitor key turtle populations;
- management of factors impacting on successful turtle nesting; and
- communication of results and education of stakeholders.

The GTCP and GFACP enact this on-ground through the following activities:

- supporting recovery of sea turtle populations and threat abatement for species listed in the EPBC Act 1999 as MNES;



- identifying previously unknown significant coastal nesting rookeries and critical habitat for endangered loggerhead sea turtles on the Gnaraloo coastline;
- developing and managing an annual on-ground monitoring program of the seasonal sea turtle nesting and feral predation activities in the coastal sea turtle rookeries on the Gnaraloo coastline (daily for 4 months from 1 November – 28 February, with Day and Night Surveys, during consecutive years);
- based on the GTCP and GFACP survey data and findings, annually identifying and undertaking required management activities (year round) to protect the Gnaraloo sea turtle rookeries from threats (human and feral predation) that may impact successful sea turtle nesting;
- initiating, developing and managing an extensive annual training plan (year round) of graduate scientific professionals at career entry level as future leaders and decision-makers in the field, including a seasonal scientific internship program;
- initiating, developing and executing an extensive annual communication and education plan that includes a landholder, primary and high schools, community groups and organisations and the general public (on a local, national and international level), to raise awareness and participation with the work and to freely knowledge-share results with Government (State and Federal), universities and sea turtle experts (Australia and worldwide).

The area of habitat at Gnaraloo with improved condition for threatened and migratory species due to works under the GTCP and GFACP is ~90,000 hectares (~220,000 acres), which includes terrestrial areas (coastal and inland) on the entire Gnaraloo Station.

The sea turtle track monitoring methodology used by the GTCP is based on that of the *Ningaloo Turtle Program (NTP)* in Exmouth, a community based partnership between the DPAW and the Cape Conservation Group.

The Gnaraloo Station Trust appoints a seasonal scientific field research team of 2 – 6 persons each year under the *GTCP Scientific Internship Program*, for 6 months full time. The field team is appointed from Australia and worldwide through a competitive recruitment process. Team members are required to all have previous graduate degrees, such as a Bachelor of Science (BSc), or higher qualifications such as Honours and Masters degrees (which is preferred), in science and they often also have previous sea turtle tracking experience on other turtle programs in Australia and overseas. The field team is responsible for daily field data collection in the monitored rookeries; field data management, processing and analysis [including data Quality Assurance / Quality Control (**QA/QC**)]; scientific reporting and other program duties, including execution of the annual GTCP Communication and Education Plan. Survey work includes daily turtle track monitoring with Day and Night Surveys, turtle



species identification, turtle nesting activity determination, data collection on turtle nest locations through use of GPS equipment, and recording of turtle nest disturbance and predation by feral species and environmental factors. Feral animal tracks are also monitored daily to report on the presence of threats in monitored rookeries for adaptive management activity. The field team receives various training pre-season, including on NTP turtle track monitoring protocols, feral animal track identification, remote survey work, 4WD driving, First Aid, field based and commercial office work. All work by the field team is co-ordinated and managed by an onsite based GTCP Program Assistant and offsite GTCP Project Manager, an experienced environmental scientist, who also manages Gnaraloo's Environmental Office.

The GTCP operates under an annual research licence issued by DPAW under the *Wildlife Conservation Act 1950* (WA).

Following is the summary results of the GTCP monitoring season 2013/14.





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## 2 GTCP FINDINGS TO END 2013/14

### 2.1 Turtle track monitoring in the GBR

GBR Day Surveys were conducted for 120 consecutive days, between 1 November 2013 and 28 February 2014. The first nest was dug on 8 November 2013 and the last nest was dug on 24 February 2014. Daily track monitoring recorded a total of 652 nesting activities [inclusive of Nests, Unsuccessful Nesting Attempts (**UNA**), U Tracks and Unidentified Nesting Activities (**Ua**)], of which 434 were Nests (of all turtle species). Researchers observed three nesting activity peaks, which occurred on 13 December 2013, 3 January 2014 and 24 January 2014, with the highest peak being on 13 December. An analysis of five seasons (2009/10 – 2013/14)<sup>2</sup> of GTCP data indicated that sea turtle nesting activities in the GBR generally peak in the two weeks during 27 December to 9 January.

Loggerhead sea turtles were responsible for 629 of the total nesting activities in the GBR (652 total), of which 421 were Nests. It is estimated that 84 loggerhead females (clutch frequency 5) nested in the GBR this season, constituting 97 % of the rookery's nesting turtles. Green turtles accounted for 10 of the total nesting activities in the GBR, of which 6 were Nests. It is likely that only 1 green turtle utilized the GBR for nesting purposes, thus making up 1 % of all nesting turtles in the rookery (clutch frequency 6). Hawksbill turtles had 6 of the total nesting activities in the GBR, with 5 being Nests. It is estimated that 2 hawksbill turtles utilized the GBR this season, constituting 2 % of all species in the rookery (clutch frequency 2.5). The remaining 7 of the total turtle nesting activities (of which two were Nests) in the GBR could not be identified with regards to species.

GTCP season 2013/14 observed that in all three Sub-sections in the GBR, Nests were of greatest occurrence, followed by UNA, U Tracks and Ua. In each Sub-section, the average percentage of Nests, UNA, U Tracks and Ua were relatively the same: Nests composed approximately 65.5%, UNA 21.5%, U Tracks 12 % and Ua 1 %.

GBR Night Surveys occurred in three separate blocks during 11 November 2013 - 15 January 2014. A total of 39 Night Surveys were conducted, generally occurring one hour before high tide and five hours following high tide. Of the turtles and nesting activities recorded during Night Surveys, 74 turtles were identified in regards to species and 71 nesting activities were observed and categorized. Night Survey results determined that daily track monitoring had an accuracy of

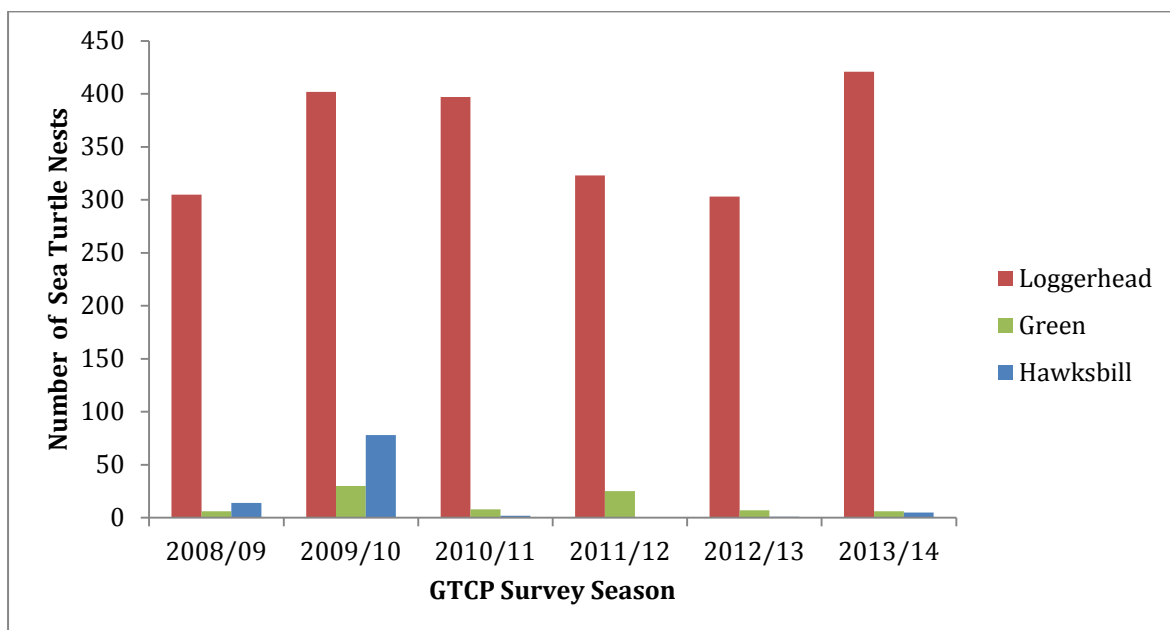
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<sup>2</sup> GTCP season 2008/09 was not included in this analysis as monitoring commenced on 7 December 2008, not 1 November as during subsequent GTCP seasons.

98.6 % (i.e. a margin of error of 1.4 %) for Species Identification (**SI**). Nesting Activity Determination (**NAD**) had 78.9% accuracy (i.e. a margin of error of 21.1%). During the last three GTCP seasons (2011/12 – 2013/14), 75 % of the turtle emergences witnessed by GTCP field researchers were concentrated in the 22:00 - 02:00 time period. However, the amount of available data was insufficient to establish the temporal distribution of turtle emergences during night hours in the GBR. There was no correlation found between high tide and turtle emergence time for the last three seasons (2011/12 - 2013/14). Nesting success observed during Night Surveys in Sub-section BP8 – BP9 during 2013/14 was 70.4 %.

GBR Sampled Nest Surveys were completed on a selection of nests that were chosen at random, hereafter referred to as ‘Sampled Nests’ (n = 60) which was monitored daily for predation (by native and feral animals) and impacts by environmental factors. Season 2013/14 recorded 32.2 % of Sampled Nests as disturbed (only) by Ghost Crabs and 45.8 % of Sampled Nests showed signs of predation (i.e. disturbance and predation) by Ghost Crabs (n = 59; one Sampled Nest was washed away by storms and thus could not be observed for crab disturbance and predation data). There was no evidence of feral animal disturbance or predation on any Sampled Nests. Of the 60 Sampled Nests, 30 % were impacted by environmental factors, including inundation by tides, erosion by tides and suffocation by sand dunes.

Refer to **Figure 1** for the total number of sea turtle Nests and species composition in the GBR during seasons 2008/09 – 2013/14.



**Figure 1: Total number of sea turtle Nests and species composition in the Gnaraloo Bay Rookery during GTCP seasons 2008/09 – 2013/14**

Refer to **Table 1** for a summary of sea turtle nesting activities and species composition in the GBR during GTCP seasons 2008/09 – 2013/14.

**Table 1: Summary of sea turtle nesting activities and species composition in the Gnaraloo Bay Rookery during GTCP seasons 2008/09 – 2013/14**

		2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
<b>Loggerhead</b> <i>Caretta caretta</i>	<b>Number of nests</b>	305 <sup>1</sup>	402	397 <sup>2</sup> Range 353–441 <sup>4</sup>	323 Range 271–375 <sup>4</sup>	303 Range 264–342 <sup>4</sup>	421 Range 333–509 <sup>4</sup>
	<b>Number of females</b>	61 <sup>3</sup> Range 38–153	80 <sup>3</sup> Range 50–201	79 <sup>3</sup> Range 50–199	65 <sup>3</sup> Range 40–162	61 <sup>3</sup> Range 38–152	84 <sup>3</sup> Range 53–211
	<b>Percentage species composition</b>	90 % <sup>5</sup>	69 % <sup>5</sup>	97.5 % <sup>5</sup>	94 %	97 %	97 %
<b>Green</b> <i>Chelonia mydas</i>	<b>Number of nests</b>	6 <sup>6</sup>	30	8 Range 7–9 <sup>4</sup>	25 Range 21–29 <sup>4</sup>	7 Range 6–8 <sup>4</sup>	6 Range 5–7 <sup>4</sup>
	<b>Number of females</b>	1 <sup>7</sup>	5	1	4	1	1
	<b>Percentage species composition</b>	1.5 % <sup>5</sup>	4 % <sup>5</sup>	1.25 % <sup>5</sup>	6 %	1.5 %	1 %
<b>Hawksbill</b> <i>Eretmochelys imbricata</i>	<b>Number of nests</b>	14 <sup>8</sup>	78 <sup>9</sup>	2	0	1	5
	<b>Number of females</b>	6 <sup>10</sup>	31	1	0	1	2
	<b>Percentage species composition</b>	8.5 % <sup>5</sup>	27 % <sup>5</sup>	1.25 % <sup>5</sup>	0 % <sup>5</sup>	1.5 % <sup>5</sup>	2 % <sup>5</sup>
<b>Unidentified species</b>	<b>Number of nests</b>	11	12	14	0	2	2
<b>Total of all nests</b>		<b>336</b>	<b>522</b>	<b>421</b>	<b>348</b>	<b>313</b>	<b>434</b>
<b>Total of all nesting activities (inclusive of Nest, UNA, U Track and Ua)</b>		<b>685</b>	<b>813</b>	<b>801</b>	<b>769</b>	<b>699</b>	<b>652</b>



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**Notes to Table 1:**

- 1 Number of loggerhead nests for 2008/09 was updated as issued GTCP Report 2008/09 tallied a green turtle nest and an Unidentified species nest as loggerhead nests in the total loggerhead nest count for the season. Furthermore, GTCP researchers 2008/09 included data for Sub-section BP9 - BP10 (23 nests), which since 2009/10 falls outside the perimeter of the monitored Gnaraloo Bay Rookery (**GBR**), being GBN – BP9 only.
- 2 Number of loggerhead nests for 2010/11 was updated as issued GTCP Report 2010/11 included five loggerhead nests that had GPS coordinates outside of the designated GBR perimeter (GBN – BP9). Note: GTCP season 2009/10 commenced on 13 November 2010 and ended on 7 February 2011, therefore nest numbers stated may be conservative.
- 3 Number of female loggerhead turtles for 2008/09 – 2013/14 was recalculated using an average clutch frequency of 5 (Tucker, 2009; Rees *et al.*, 2010; & Scott, 2006). The female loggerhead turtle range is based on a clutch frequency of 2 - 8 times per season (Tucker, 2009).
- 4 The range for the number of nests for 2010/11 – 2013/14 was determined using the data comparisons between GBR Day Surveys and GBR Night Surveys. Resulting from this, the margin of error calculated for Nesting Activity Determination for 2010/11 – 2013/14 was 11%; 16.2%; 13%; and 21% respectively.
- 5 The percentage species composition for 2008/09 – 2010/11 was updated as issued GTCP Reports 2008/09, 2009/10 and 2010/11 reported "Percentage of species composition" reflecting all nests, including those of Unidentified species. The values have been updated based solely on nests of identified species. All values have been rounded.
- 6 Number of green nests for 2008/09 was updated as issued GTCP Report 2008/09 conducted beach patrols in GBR from 1 December 2008 to 29 March 2009, which since 2009/10 is no longer the surveyed time period. Data collection since 2009/10 runs annually from 1 November to 28 February. Two green turtle nests were found outside of this survey period (i.e. 1 November to 28 February) and hence have been excluded from the summary. Therefore, the nest number in the table and graph is conservative, as no data was collected during the season 2008/09 for the month of November. In addition, GTCP researchers 2008/09 included data for Sub-section BP9 - BP10 (two nests), which since 2009/10 falls outside the perimeter of the monitored GBR, being GBN – BP9 only.
- 7 Green turtle clutch frequency per season is estimated to be 6 (Limpus *et al.*, 2001). Due to updated green nest numbers for 2008/09, the number of female green turtles for 2008/09 was also updated.
- 8 Number of hawksbill nests for 2008/09 was updated as issued GTCP Report 2008/09 included data for Sub-section BP9 - BP10 (six nests), which since 2009/10 falls outside the perimeter of the monitored GBR, being GBN – BP9 only.
- 9 While issued GTCP Report 2009/10 included a total of 78 hawksbill nests, most of these are likely to be a data collection error resulting from confusion of loggerhead nesting tracks with hawksbill nesting tracks. The same may have occurred during 2008/09. To combat re-occurrence of species identification mistakes, the GTCP season 2010/11 initiated a new component, namely 'Data verification through night surveys' which is ongoing for data QA/QC purposes.
- 10 Number of female hawksbill turtles is calculated based on the ratio of 2.5 nests to 1 hawksbill (Santos *et al.*, 2013 & Witzell, 1983).



## 2.2 Turtle track monitoring in GCFR

GCFR Day Surveys were conducted four times during 2013/14, for four consecutive days per survey, occurring on: 20 - 23 December 2013, 3 - 6 January 2014, 20 - 23 January 2014 and 7 - 10 February 2014. GCFR Day Surveys recorded a total of 71 new nesting activities (of which 50 were Nests) and 280 old nesting activities. Both loggerhead and green turtle tracks were observed; however, there was no evidence of hawksbill turtle activity.

GCFR Day Surveys during 3 - 6 January 2014 recorded the highest number of new nesting activities compared to other three GCFR surveys during Season 2013/14. The time period of the high number of nesting activities in the GCFR appears to coincide with the peak period identified in the GBR.

During the four surveys, the GCFR Sub-sections 2 and 3 (which combined is 7.1 km in length) of compatible length to the GBR, had 68 new nesting activities, while the GBR, during those same survey days, had 81 nesting activities.

## 2.3 MERI monitoring of Gnaraloo Feral Animal Control Program

The Gnaraloo Station Trust has undertaken the GFACP since 2008 in order to protect the sea turtle rookeries at Gnaraloo from feral animal predation, particularly from European red foxes (*Vulpes vulpes*), but also from wild dogs and feral cats. The GFACP is separate but complimentary to the GTCP.

The GTCP measures the success (i.e. the extent of quantifiable positive on-ground outcomes and protection provided to three nationally environmental significant<sup>3</sup> sea turtle species) of the GFACP each year through a self imposed Monitoring, Evaluation, Reporting and Improvement (MERI) link between the GTCP and GFACP.

The GTCP independently surveys the effectiveness of the GFACP in monitored sea turtle nesting rookeries on Gnaraloo each season. Scientific GTCP field researchers formally track, record and report on evidence of any feral activity [presence (via tracks and scats), disturbance (such as digging into nests) and / or predation (e.g. turtle eggshell fragments, whole turtle eggs or yolky turtle eggshells present at the surface or an exposed egg chamber)] in monitored rookeries, 7 days a week for 4 consecutive months during the annual turtle nesting period (via a

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<sup>3</sup> The GTCP and the GFACP target MNES under the EPBC Act 1999 (refer 'Context' and Abbreviations).



specially developed data sheet and electronic monitoring logs). Monitoring results are communicated in writing (via GFACP MERI Monitoring Logs with GPS details and associated photo evidence) by the GTCP to Gnaraloo's feral animal control contractor, Animal Pest Management Services (**APMS**), in real time with a request to focus future scheduled site feral animal control events on the specifically recorded feral species and locations of activity. APMS acts on the feedback to undertake targeted corrective action at Gnaraloo and adjust, where required, the targeted species and areas, bait type used, bait placement strategy and control methodology used.

The seasonal GTCP field research team is present in monitored rookeries on Gnaraloo's coastline from 1 November to 28 February each year. The GTCP has developed specific training, procedures, protocols and data sheets for its field staff in predator track identification in monitored rookeries for the required daily monitoring of the results and outcomes of the GFACP.

APMS supported the MERI monitoring by the GTCP during 2013/14 via office and field based training and written assessment of the scientific GTCP field research team in predator track identification. This allowed the GTCP team to confidently identify and distinguish with accuracy between fox, feral cat and wild dog tracks (which is not always easy in windblown locations such as on the Gnaraloo coastline). Additional support and technical advice was provided to the GTCP by APMS during the season where predator tracks were difficult to identify.

The objectives of the MERI link between the GTCP and GFACP is informed adaptive management, integration of the two programs for most effective and efficient on-ground protection of the Gnaraloo sea turtle rookeries, on-ground response in real time to control identified feral animal presence in the rookeries, to improve or maintain the results of the program and to objectively demonstrate and report on the effectiveness of the GFACP.

The GTCP season 2013/14 recorded 0 % predation of sea turtle nests by feral animals in the GBR from 1 November 2013 – 28 February 2014. This amounted to roughly 47,000 eggs of endangered loggerhead sea turtles being protected from feral predation in the GBR during 2013/14.

The GFACP MERI Monitoring Logs 2013/14 show that feral animal activity in the GBR during the GTCP monitoring period of 1 November 2013 – 28 February 2014 included feral cat tracks (14) and wild dog tracks (14 with an additional 4 dog tracks which was assumed to be from Gnaraloo guests) (i.e. present with no disturbance or predation of turtle nests). Feral animal activity in the GCFR during the GTCP 16 survey days included wild dog tracks (1) (i.e. present with no disturbance or predation of turtle nests). There was zero fox presence (tracks) or fox activity (disturbance or predation of turtle nests) during the GTCP monitoring periods 2013/14 in the two



monitored rookeries due to the success of the GFACP 2013/14. This is significantly different from previous years as MERI monitoring by the GTCP recorded fox presence (via tracks with no disturbance or predation of turtle nests) in both rookeries as recently as the previous sea turtle nesting season 2012/13.

Whilst no fox presence (tracks) or fox activity (disturbance or predation of turtle nests) was observed by the GTCP in the GBR and the GCFR during 2013/14, APMS had 80 baits taken on Gnaraloo Station during 2013/14 which was assumed to be by foxes and feral cats. The assumption was based on a reduction of fox tracks station wide<sup>4</sup> on Gnaraloo post baiting and bait take by foxes and feral cats (i.e. APMS observed that wild dogs were not taking baits on Gnaraloo due to the availability of higher quality food sources such as kangaroos, sheep and goats). Hence foxes were present on Gnaraloo Station during 2013/14, but were not recorded (fox presence or activity) in the GBR and the GCFR. This finding contrasts with previous seasons in which fox presence, disturbance and predation of sea turtle nests (eggs and hatchlings) were observed in the monitored rookeries, specifically prior to the commencement of the GFACP in 2008/09 and during the initial years of and work by the GFACP (2008/09 – 2009/10).

It is hypothesized that the reduction in fox numbers may be causing a meso-predator release since the number of feral cat and wild dog tracks has been increasing on Gnaraloo as the number of fox tracks has decreased (**Figure 2**). Hence, APMS is now placing more emphasis on trapping and baiting for feral cats and wild dogs.

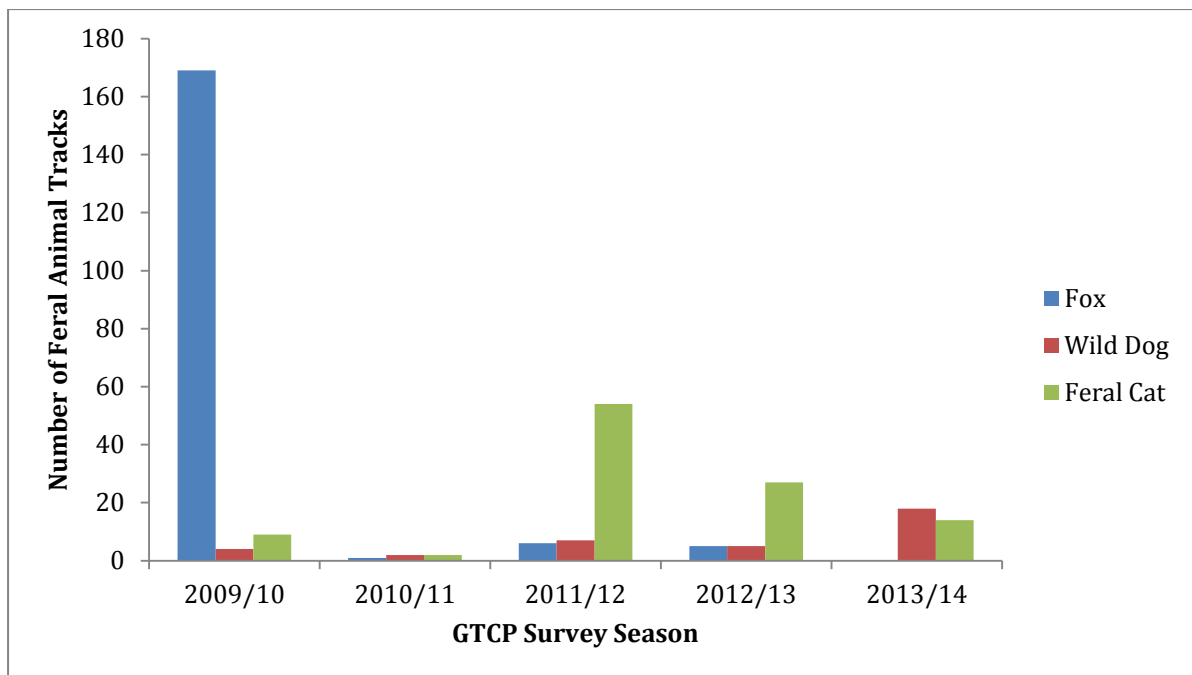
Without the MERI monitoring activity by the GTCP, the demonstrable data and statistic of roughly 47,000 eggs of endangered loggerhead sea turtles being protected from feral predation in the GBR during 2013/14 could not have been known.

Removing the presence of feral animals does not only help the nesting sea turtle populations at Gnaraloo, but also protects many unstudied species of native fauna such as small to medium sized mammals, ground nesting birds, reptiles and insects, including at and around the significant inland Lake MacLeod wetland system. The Lake MacLeod wetland system has been proposed for listing under *The Convention on Wetlands (Ramsar, Iran, 1971)* (**Ramsar Convention**) as a Wetland of International Significance.

For more information on the GFACP, refer to Butcher *et al.*, 2013.

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<sup>4</sup> Excluding the area south of 3Mile Camp which is a bait exclusion area due to the possible presence of dogs of Gnaraloo guests. Spotlight transects at night and shooting are used by APMS as measures to control feral animals in this area.



**Figure 2: Number of feral animal tracks in the Gnaraloo Bay Rookery during GTCP Seasons 2009/10 - 2013/14**

## 2.4 Community engagement

The GTCP successfully undertook a significant amount of activities under the GTCP Communication and Education Plan during the season 2013/14 throughout Western Australia, Victoria and overseas to promote the importance of sea turtle conservation. The outreach had many positive results including positive feedback of quality work and new partnerships being created between the GTCP and the wider community.

Community engagement activities undertaken by the GTCP during 2013/14 included the following:

- design, development and use of a new GTCP Invitation Flyer for community participants and schools and a new large colour GTCP GFACP Poster (combined, hard copies of these were distributed as well as being viewed online by 8,859 persons);
- onsite information briefings, meetings and escorted beach survey patrols were conducted by the scientific GTCP field research team during the sea turtle nesting season for community participants, a school group, government agencies (from WA and Australia), external turtle scientists and other interested parties at Gnaraloo (67 persons in total, including the school group of 13 students and teachers from Nagel Catholic College,

Geraldton in WA);

- offsite presentations to 27 primary and high schools and 5 other community groups such as Carnarvon Radio, Geraldton Spirit Radio, the Western Australian Museum - Geraldton, esri Australia, and Keep Australia Beautiful Tidy Towns Committee (DPAW) (to 1,525 persons in total, not including the audience of the radio broadcasts) during March – April 2014). Additional presentations were provided in Victoria to 21 primary and high schools (to 2,997 students in total) during April – June 2014 by a GTCP researcher after the sea turtle nesting season;
- significant work was undertaken on the web including new conservation pages on the Gnaraloo website on sea turtles and feral animal control; on the GTCP's Facebook site with Field diaries, photos and videos during the season (total of 1,434 'Likes' during 2013/14 from Australia and all over the world) and an educational presentation about the GTCP was posted on the web (YouTube, Facebook and Gnaraloo website);
- GTCP data sets from season 2008/09 – 2013/14 were shared with various West Australian, Australian and international scientific sea turtle databases (online);
- presentations about the GTCP and GFACP were given at various conferences and forums, including at the Mapping our World Exhibition in Canberra (21 November 2013); the WA State NRM Conference 2014 in WA (7 – 9 May 2014) and the 16th Australasian Vertebrate Pest Conference in Brisbane (26 – 29 May 2014);
- various media articles (print, online and radio) in West Australia, South Australia, Israel and globally (Wikipedia);
- design, development and use of two new GTCP clothes ranges (research and merchandise) for promotional purposes. All proceeds from sales of the new GTCP merchandise range is being retained by the Gnaraloo Station Trust as a not-for-profit funding mechanism for self-funding the GTCP and the GFACP during periods of no external financial support to the programs;
- design, development and use of a new GTCP GFACP project vehicle wrap for promotional purposes.

### 3 ABBREVIATIONS

APA	American Psychological Association (Reference citation style used in Gnaraloo Documents)
APMS	Animal Pest Management Services
BP9	Beach Point Marker 9 (-23.72195 °S; 113.57750 °E)
DPAW	Department of Parks and Wildlife, Western Australia
EPBC Act 1999	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
GBN	Gnaraloo Bay North (-23.76708 °S; 113.54584 °E)
GBR	Gnaraloo Bay Rookery
GCFR	Gnaraloo Cape Farquhar Rookery
GFACP	Gnaraloo Feral Animal Control Program
GFN	Gnaraloo Farquhar North (-23.57697 °S; 113.69830 °E)
GFS	Gnaraloo Farquhar South (-23.64168 °S; 113.61544 °E)
GTCP	Gnaraloo Turtle Conservation Program
MERI	Monitoring, Evaluation, Reporting and Improvement
MNES	Matters of National Environmental Significance under the EPBC Act 1999
NCWHA	Ningaloo Coast World Heritage Area
NAD	Nesting Activity Determination
NTP	Ningaloo Turtle Program
QA/QC	Quality Assurance / Quality Control
Ramsar Convention	<i>The Convention on Wetlands (Ramsar, Iran, 1971)</i>
SI	Species Identification
SPRAT	Species Profile and Threats Database (Commonwealth)
Ua	Unidentified Nesting Activity
UNA	Unsuccessful Nesting Attempt
WA	Western Australia



## 4 GLOSSARY

Day Survey	Morning turtle activity monitoring of the Gnaraloo Bay Rookery and / or Gnaraloo Cape Farquhar Rookery.
Disturbance	Sighting of digging or burrowing into a turtle nest, without the presence of turtle eggshell fragments or whole turtle eggs at the surface.
Nesting Success	Percentage of Nests dug, out of all identified nesting activities ( Nest, UNA, U Track) observed during Night Surveys.
Night Survey	Night turtle activity monitoring in the Gnaraloo Bay Rookery.
Predation	Evidence of mortality at a turtle nest (e.g. turtle eggshell fragments, whole turtle eggs or yolky turtle eggshells present at the surface or an exposed egg chamber).
Sampled Nests	A proportion of the total number of sea turtle nests in GBR, which are surveyed daily for disturbance, predation and environmental impacts.
Season	The annual period of works under the GTCP and GFACP from 1 July – 30 June, e.g. GTCP season 2008/09 was from 1 July 2008 – 30 June 2009. The annual on-ground GTCP survey period has been standardized as occurring from 1 November to 28 February (to coincide with the sea turtle nesting period at Gnaraloo).

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