Team Turtle CQ: FBA's Community Marine Turtle Monitoring Program

2021-22 Summary Report
August 2022

The following report was produced by FBA with the marine turtle expertise of Karl French.

FBA works for our central Queensland community to grow a sustainable, productive and profitable Fitzroy region.

FBA acknowledges the First Nations of the lands and waters within the Fitzroy region where we learn and live, and pay our respects to them, their culture and Elders past, present and emerging.

The success of Team Turtle CQ (TTCQ) is due to the many hours of volunteer effort contributed by community members of the Capricorn and Curtis Coast areas – this report is dedicated to you.

TTCQ is coordinated by FBA. Staff have a key role in training and supporting volunteers, reviewing data and co-writing reports.

Karl French, as a marine turtle specialist, supplied the summarised data and analysis to inform and co-write this report.

Version Control

Version	Date	Author	Changes
1	August 2022	Lisa Del Riccio	Document creation

Disclosure Statement

This document has been prepared with due care and diligence using the best available information at the time of publication. FBA holds no responsibility for any errors or omissions and decisions made by other parties based on this publication.

Contents

Introduction

The Central Queensland region is home to six of the world's seven marine turtle species. Three of these species – Flatback Turtle (*Natator depressus*), Green Turtle (*Chelonia mydas*) and Loggerhead Turtle (*Caretta caretta*) – nest on our region's beaches. All marine turtle species found in Australian waters are threatened with extinction, being listed as either vulnerable or endangered under both Queensland and Australian legislation. Monitoring of marine turtle activity has occurred along the Queensland coast for decades. However, a 2014 gap analysis carried out by FBA identified that the Fitzroy region provided a significant opportunity to add valuable information to this dataset: in particular, in the form of a community marine turtle monitoring program.

In 2015, an initial three-year program was established to train a network of community volunteers in turtle monitoring, under the Australian Government's Nest to Ocean Turtle Protection Program. Data collected by volunteers was submitted to the Department of Environment and Science (DES) managed Queensland Turtle Conservation Program (QTCP) database which informs and influences coastal management and threat mitigation for marine turtle species. Volunteers were trained in turtle monitoring techniques by qualified experts, with some attending training with QTCP at Mon Repos during the summer nesting season. In 2018/19, the program trialled the use of an Atlas of Living Australia (ALA) mobile phone app, BioCollect, to record data electronically. Now used every season since, this data is collected by volunteers, then quality-checked before being sent to the QTCP. By 2019/20 this citizen science program, now known as Team Turtle CQ (TTCQ), had grown into a vibrant project group with strong membership and community interest consisting of two cohesive and cooperative groups separated by location (Capricorn and Curtis Coasts). Funding provided by DES (citizen science grants) and the Great Barrier Reef Foundation over the 2019-20 and 2020-21 seasons, supported training volunteers whose verified monitoring data contributed to the QTCP, nest protection and predator control.

TTCQ currently undertakes three main types of activities: volunteer training and community engagement, turtle monitoring (citizen science beach monitoring and QTCP census), and QTCP authorised activities (nest protection, nest relocation, emergence success and tagging turtles).

This report summarises the results of the 2021-22 Team Turtle CQ program. Funding for this season's activities was provided by the Australian Government's Reef Trust through FBA's *Protecting and enhancing high value coastal ecosystems across central Queensland* project. In addition, Gladstone Ports Corporation (GPC) funded Facing Island census activities.

Volunteer Training and Community Engagement

Team Turtle CQ

Pre-season TTCQ nesting training workshops delivered in October 2021on both the Capricorn and Curtis Coasts trained new volunteers and upskilled existing volunteers. Training combined classroom marine turtle biology and ecology education with on-beach practical monitoring skills. Volunteers learn to identify tracks of locally nesting species and differentiate false crawls and no lays from successful nesting.

Volunteers were introduced to a newly created BioCollect survey designed to record both nesting and emergence data on a single survey, and to incorporate data more easily into the QTCP data format. A newly developed standalone 'No Evidence' survey was warmly received due to its simplicity and ease to upload. Training covered effective track and nest site photography which is essential to verify survey data. Possible threats to nesting success were discussed, with fox and human activity to be recorded through the Snap Send Solve app, and natural phenomena such as tidal inundation recorded through BioCollect. TTCQ Code of Conduct and compliance with the QTCP protocols was emphasised.

Emergence training was held in December 2021 virtually via Zoom in response to COVID 19 impacts. Training sessions, inclusive of both Capricorn and Curtis Coast groups, focussed on emergence monitoring tips (hatchling tracks are easy to miss) and how to align hatching data with original nest surveys. Potential nest impacts, including predation, tidal inundation and light disorientation, were explored, with recording guidelines given. Volunteers discussed concerns and issues as a group, strengthening team cohesion and cooperation.

Post-season wrap up events are an opportunity to thank TTCQ volunteers for their 5-month monitoring efforts and to share initial collated season data. Volunteers provided important local knowledge, observations and monitoring experience insights, in addition to valuable feedback on the program to inform future project adaptions. Sharing experiences and supporting each other unifies and strengthens team dynamics.

Queensland Turtle Conservation Project (QTCP)

Mon Repos Placement - DES undertakes a program of research and monitoring at Mon Repos Conservation Park each nesting season. Led by Dr Col Limpus, this program provides opportunities for volunteers to participate in research, monitoring, conservation and interpretation activities related to marine turtle biology and sand dune ecology. FBA encourages and supports TTCQ volunteer applications for these placements. Fourteen TTCQ volunteers applied for 2021-22 placements at Mon Repos. Ten volunteers attended with nine being first time participants. (Note - COVID 19 restrictions prevented several volunteers from participating). Volunteers with Mon Repos experience mentor new TTCQ volunteers and, if authorised, can undertake specialist activities (nest protection, nest relocation, nest success studies and tagging), adding to TTCQ capacity and Central Queensland region data.

QTCP Port Curtis Threatened Species - Green turtle studies. In July 2022 TTCQ volunteers with QTCP experience were invited to participate in assisting catching green turtles, practicing tagging and measuring, observing toxicology sampling and laparoscopies. Eight volunteers gained valuable local green turtle foraging knowledge and turtle handling experience. TTCQ appreciates QTCP involving volunteers in this research as it builds regional capability.

Field Trips

Field trips provide TTCQ volunteers with valuable in-field hands-on experience in monitoring and data collection. Trips were led by FBA's contracted marine turtle specialist Karl French, supported by QTCP experienced volunteers.

Stanage Bay (Alligator Bay) - In-field activities included nest monitoring, practical training in determining nest success, tagging and measuring adult turtles, nest relocation and data recording over three days.

Facing Island (Settlement Bay) Nesting Census This two-week census was timed to coincide with East Coast Flatback population peak nesting period and aligned with the standard nesting census protocols employed by the QTCP. A team comprising of Gidarjil Land & Sea Rangers and TTCQ volunteers undertook nightly nesting success monitoring of all observed nest attempts, tagging and measuring of observed adult turtles, clutch counts, nest relocations and egg measurements. Refer to Facing Island Census section in this report for full details. During the season additional Facing Island beaches were monitored, nesting and predator presence recorded. Marine debris was also collected and removed from beaches.

Facing Island Emergence Monitoring Two three-day trips involved excavation of emerged clutches, emergence success counts and stage of development assessments of egg embryos. This was carried out for nests observed laid during the census period (refer Facing Island Nesting Census section in this report for full details) plus opportunistic counts for other marked (and emerged) nests at both Settlement Bay and Northern Ocean Beach.

Community Interaction

FBA's TTCQ program aims to increase general community education and involvement in turtle conservation. Each season the program focusses on a different location to increase local community participation and stewardship, with Stanage Bay the focus of the 2021-22 season.

Stanage Bay Marine Turtle Information Session - An educational presentation and Q & A session at the Plum Tree Store/Crab Pot bar in November 2021 shared marine turtle and TTCQ monitoring information. While the session was well received, residents are yet to commit to local monitoring which would be the ideal outcome.

Table 1. Volunteers attending TTCQ 2021-22 events

Volunteer Training and Engagement Events		
Location	**Total**	**New**
Curtis Coast Nesting Training	17	8
Capricorn Coast Nesting Training	38	16
Zoom Emergence Training (combined)	21	3
Stanage Bay Field Training	8	5
Stanage Bay Community Engagement	6	6
Facing Island Nesting Field Trip	9	3
Facing Island Hatching Field Trip	6	-
QTCP Mon Repo Placement	10	9
Curtis Coast Feedback/ Wrap Up	10	-
Capricorn Coast Feedback/Wrap Up	21	-
QTCP Port Curtis Threatened Species Ops	8	8
TOTAL	**154**	**58**

Team Hatchlings is the volunteer youth arm of TTCQ that works to share marine turtle conservation with community, especially youth. Hatchlings engage Capricorn Coast youth through interactive activities at events and by producing resources to educate and promote positive behaviour change. The negative effects of light pollution on marine turtles are a particular focus – Turtles About, so Lights Out! Team Hatchlings are involved in the planning of activities and resources, as well as event and resource facilitation and community engagement. Team Hatchlings collaborates with Traditional Custodians, Darumbal & Woppaburra, on this initiative. This initiative is supported by FBA and TTCQ volunteers with activities currently funded through the Great Barrier Reef Foundation.

FBA maintain and build positive valuable relationships with project partners. We continue to work closely with Gladstone Regional and Livingstone Shire Councils, collaborating on beach signage, responsible beach 4WD behaviour, reducing light impacts on nesting and hatchling turtles, and fox control work. TTCQ's Traditional Custodian engagement continued in the 2021-22 season, with Darumbal TUMRA, Port Curtis Coral Coast Trust (PCCC) and Woppaburra TUMRA all involved in partnership meetings. Gidarjil Land and Sea Rangers again joined TTCQ monitoring on Facing Island. Discussions are ongoing with Darumbal TUMRA, PCCC and Woppaburra TUMRA on future monitoring and training opportunities. TTCQ liaises with Queensland Parks & Wildlife Service (QPWS) on nest predation and pest animal controls, sharing monitoring data and local observations. A partnership with Gladstone Parts Corporation supports Facing Island monitoring, technical support and logistics.

FBA continues to raise awareness of marine turtle conservation in the local community through events, communications, media opportunities and social media campaigns. TTCQ attends school Citizen Science events -

Gladstone Citizen Science Festival (April 2022) and, Central Queensland STEM Expo (April 2022), sharing TTCQ messaging with the next generation of beach stewards.

Turtle Monitoring

TTCQ 2021-22 monitoring activity can be divided into two categories: citizen science beach monitoring and QTCP census on Facing Island. QTCP authorised activities (nest protection, nest relocation, emergence success and tagging turtles) are undertaken across both categories. All validated data is submitted to the QTCP database, held by DES. Citizen science beach monitoring is discussed within this section, with Facing Island census reported in its own section within this report.

TTCQ citizen science surveys are conducted by trained and registered volunteers on rosters to ensure maximum beach coverage. Beaches are walked (or accessed by vehicle or marine vessel where necessary) to survey for turtle tracks and nest attempts. Data is provided in one of three ways:

- For low density nesting areas, data is submitted via the BioCollect App. Photos of tracks and nests are uploaded, facilitating confirmation of species, nest success and habitat on the beach. In many instances nest attempts are then verified by a QTCP experienced team member.
- For higher density nesting, data is submitted via the QTCP bulk nesting data sheet. This means that it is not possible to verify nesting success until either the nest emerges, it is predated or is located and counted by an authorised team member. Some nest attempts can be notoriously difficult to verify even with experience, especially if it is weathered or walked over. Nest attempts are either coded as 'Confirmed nest' or 'Questionable nest' (i.e. doubt exists as to success of nest crawl) and 'no lay'.
- Lack of turtle activity is recorded through a new separate 'No Evidence' survey on BioCollect. This process has made it easier to identify which beaches had no nesting and determine if this was a result of a lack of survey effort or a genuine lack of nesting activity.

A small number of nest activity reports are submitted through FBA's website by members of the general public, validated through photographic evidence and uploaded to BioCollect.

Beach Coverage and Volunteers

The number of beaches surveyed by volunteers increased this season, primarily due to additional Wop-Pa (Great Keppel Island) beach surveys received from island residents participating in TTCQ. Likewise, the number of monitored Facing Island beaches increased, with local resident involvement in the TTCQ program. However, coverage remained poor or declined due to access issues and low local participation at some beaches. These included:

- Byfield National Park (9 Mile section) beaches were not surveyed.
- Farnborough Beach north of Bangalee and Keppel Sands south to the mouth of the Fitzroy River were inadequately surveyed. This is due to requiring 4WD vehicle access and significant time to survey Farnborough Beach, and beach erosion restricting access to Keppel Sands beaches.
- Stanage Bay (Alligator Bay) surveys rely on the FBA field study and two TTCQ volunteer families travelling independently on a monitoring trip. Langham Beach was partially monitored by a local resident with data yet to be supplied to the project.
- Lilley's Beach and Wild Cattle Island access remain restricted by tides and the 4WD access required.

A total of 1,281 'No Evidence' surveys were uploaded to BioCollect - a mixture of daily and weekly reports. Most of these reports came from the Capricorn and Curtis Coasts. Active volunteer numbers participating in our turtle monitoring program continues to rise each season, and while this increase is welcomed, TTCQ aspires for quality data over high quantity of volunteer numbers. The adjunct Team Hatchlings project has given volunteers an opportunity to contribute to other activities that do not involve beach monitoring.

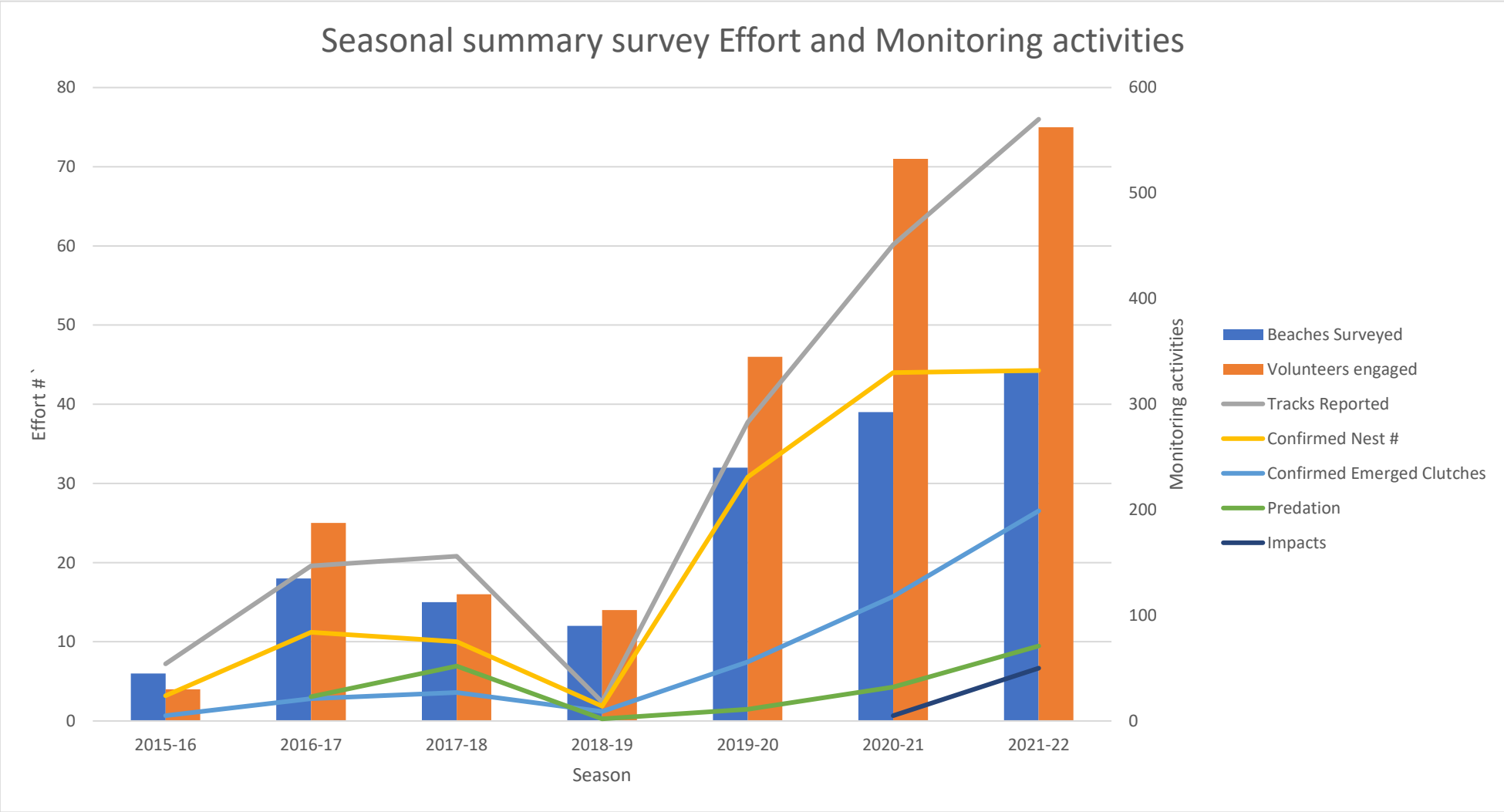
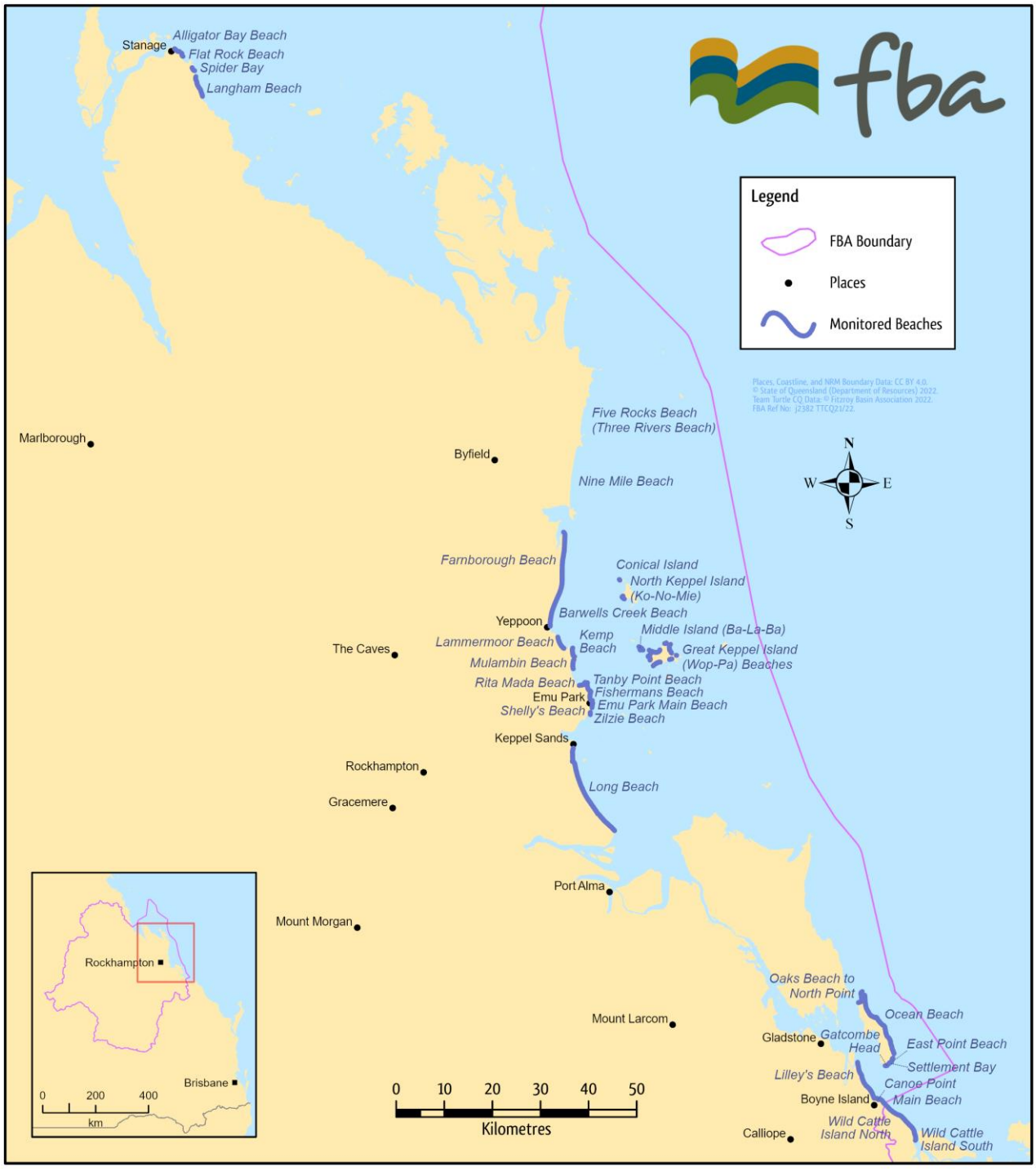


Figure 1. Seasonal summary survey Effort & Monitoring activities since inception in 2015. (Note: 2018-19 season was unfunded)



Distribution of Team Turtle CQ Activities in 2021-22

Team Turtle CQ Monitoring Activities on Facing Island 2021-22

General Observations

Storm surges associated with tropical lows resulted in higher-than-average tides and significant erosion on exposed beaches such as Farnborough, Wild Cattle South and Facing Island's Ocean Beach. Erosion banks on these beaches were observed to prevent turtles accessing dunes to safely lay above tidal reach, increasing the inundation risk of low laid nests. Wild weather, storms, rising tides and high winds may obscure nesting activity, false crawls and turnarounds, hampering identification and reporting and hindering location of nests for later emergence success monitoring. This was an issue on Wop-Pa, Farnborough Beach (North) and Northern Ocean Beach, Facing Island. Significant heavy rainfall early in the season stabilised sand for excavation of egg chambers, and likely cooled the sand, minimising heat induced mortality during incubation.

Nesting Observations

Marine turtle nesting fluctuates seasonally, with variations in season nesting numbers to be expected.
All three locally nesting species were reported again this season, Flatbacks being the predominant species with Greens and Loggerheads also recorded. A total of 570 tracks were reported with a maximum of 478 nests. 332 confirmed nests were recorded. This is recorded as the minimum number of nest attempts in Table 2. A confirmed nest *(Laid X)* is one that has been verified either by inspection by an experienced TTCQ volunteer (photo verification included) or has been surveyed as predated or exposed or successfully emerged. In previous seasons, nest data has included both confirmed nest (*Laid X)* and undetermined nest (*Laid ?)* surveys. However, as more TTCQ volunteers develop skills and obtain the necessary authorisations to investigate nest success the data will shift towards differentiating between confirmed (*Laid X)* and unconfirmed (*Laid ?*) nests. This is a more accurate representation of the minimum number of nests actually laid. 199 emerged nests were reported. Emerged nests are those from which hatchlings successfully emerge from the egg chamber without being predated. TTCQ volunteers are unable to cover all beaches daily so there are areas where nest numbers recorded may be an underestimate. This is particularly true of Stanage Bay, Keppel Bay Islands, Facing Island and localities such as Farnborough Beach North, Lilley's Beach, and Wild Cattle Island.

Summary of Nest Impacts and Predation

Predation and impact data recording was adapted this 2021-22 season to identify individual impacts such as predation or environmental impact (flooding/erosion, light and heat impacts) more accurately. While impacts have been recorded in the past, as TTCQ develops more experience and a skilled volunteer base, more in-depth data may be collected. This adds to the picture of impacts on nests and helps guide management decisions.

To maintain a stable marine turtle population, at least 70% of nests need to successfully emerge (Recovery Plan for Marine Turtles in Australia 2017; DES 2021) Across the TTCQ footprint recorded impacts on nests exceeded this 70% threshold, however not all impacts resulted in complete loss of the clutch and the measure of confirmed nests is as described a minimum.

- Predation - Fox predation has fallen significantly on the Capricorn Coast with only one unsuccessful predation attempt on a meshed nest reported this season. Predation of nests was significant for the Curtis Coast with close to 50% of clutches lost to either fox or dog predation. Predator Exclusion Devices (PEX) were compromised in several instances on Wild Cattle Island.
- Light - There were reports of localised light impacts on hatchlings at Stanage Bay, Capricorn Coast's Lammermoor North, Fishermans Beach and Coconut Point. Hatchlings at Tannum Main Beach ended up in a toilet block and carpark in response to light disorientation. At Zilzie Beach, an adult appeared disorientated returning to the water.
- Tidal inundation - Wave run up on nests were reported regularly and flooding and erosion loss of clutches accounted for approximately one third of clutches lost on Stanage Bay's Langham Beach.
- Human interference - There was evidence of human interference on two nests on the Capricorn Coast.

Photo: Capricorn Coast TTCQ volunteer training event

Table 2 - TTCQ 2021-22 Location Summary of turtle activity

Location	Tracks	Flatback Track	Green Track	Loggerhead Track	Total Laid (X)	Total Laid (?)	Total No Lay	Nests (max)	Nests (min)	Emerged Nests	Total Predation	Total Impacts
Stanage	85	85	0	0	75	3	7	78	75	21	1	16
Keppels	57	46	7	4	45	3	9	48	45	33	0	5
Capricorn	47	43	4	0	36	1	10	37	36	28	7	16
Curtis	37	35	2	0	27	5	5	32	27	15	15	10
Facing	344	331	12	1	149	134	61	283	149	102	48	3
Totals	**570**	**540**	**25**	**5**	**332**	**146**	**92**	**478**	**332**	**199**	**71**	**50**

Table 2a - Turtle Activity 2021-22 per beach surveyed – Stanage Bay

Beach	Tracks	Nests/sp			Total Nests (X + ?)	Nests Emerged	PEX installed	Nest Relocations	Predation					Other Impacts				Emergence Success Counts	No evidence surveys (Oct-Mar)
		Flatback	Green	Logger					Unsuccess.	Goanna	Fox	Dog	Unidentified	Human Interf.	Erosion/Flood	Heat Impacts	Light Impacts		
Alligator Bay-Stanage	54	47			47	10	0	0				1			2		4	0	0
Langham Bch – Stanage	31	31			31	11	0	0							10				0
TOTALS	**85**	**78**	**0**	**0**	**78**	**21**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**12**	**0**	**4**	**0**	**0**

Note - Species identification not confirmed however predominant nesting in this area is of Flatback Turtles and observed nests on Alligator Bay appeared consistent with Flatback nests.

Table 2b - Turtle Activity 2021-22 per beach surveyed – Keppel Bay Islands

Beach	Tracks	Nests/sp			Total Nests (X + ?)	Nests Emerged	PEX installed	Nest Relocations	Predation					Other Impacts				Emergence Success Counts	No evidence surveys (Oct- Mar)
		Flatback	Green	Logger					Unsuccessful	Goanna	Fox	Dog	Unidentified	Human interference.	Erosion/Hlood	Heat Impacts	Light Impacts		
Ko-No-Mie	3	3			3	1	0	0										0	0
Wop-Pa - Fishermans Bch																			0
Wop-Pa - Putney Bch																			2
Wop-Pa - Leekes Bch	31	16	6	3	25	18	0	0							5			7	2
Wop-Pa - Second Bch	2	2			2	2	0	0										2	0
Wop-Pa - Svendsens/Palm Bch	2	2			2	1	0	0										0	0
Wop-Pa - Butterfish Bay Bch	5	4			4	4	0	0										4	0
Wop-Pa -Wreck Bay Bch	3	3			3		0	0										0	0
Wop-Pa - Long Bch	8	6	1		7	6	0	0										4	2
Other Keppel Group Islands	3	2			2	1												0	0
TOTALS	**57**	**38**	**7**	**3**	**48**	**33**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**17**	**6**

Table 2c - Turtle Activity 2021-22 per beach surveyed – Capricorn Coast

Beach	Tracks	Nests/sp			Total Nests (X + ?)	Nests Emerged	PEX Installed	Nest Relocations	Predation					Other Impacts				Emergence Success Counts	No evidence surveys (Oct-Mar)
		Flatback	Green	Logger					Unsuccessful	Goanna	Fox	Dog	Unindent.	Human Interference	Erosion/ Flood	Heat	Light		
Farnborough North	2	1	1		2	2	0	0										2	8
Farnborough South	7	4	1		5	4				1								4	10
Barwell's Ck Bch Bangalee	0				0														63
Yeppoon Main Bch	0				0														3
Fishermans Bay Wave Pt	0				0														86
Cooee Bay Bch	0				0														87
Lammermoor Bch North	3	3			3	3									2		1	3	91
Lammermoor Bch South	1	1			1	1	1	1										1	83
Kemp Bch	1	0			0														151
Mullambin Bch	3	3			3	1							1		2				19
Kinka Bch	0				0														9
The Haven/Tanby Bch	3	2	1		3	2	2	1						1	1			3	62
Fishermans Bch Emu Park	10	7	0		7	6	5	2				1	1		2		1	6	78
Emu Park Main Bch	5	4			4	3	3	1						1	1			3	46
Ladies Bch Emu Park	0				0														22
Shelly's Bch Emu Park	0				0														47
Steps Bch	0				0														5
Coconut Pt/Muskers Bch	4	4			4	2	2	1							2		1	3	49
Zilzie Bch	8	4			4	4	4	2	3								1	4	110
TOTALS	**47**	**33**	**3**	**0**	**36**	**28**	**17**	**8**	**3**	**1**	**0**	**1**	**2**	**2**	**10**	**0**	**4**	**29**	**1029**

Table 2d - Turtle Activity 2021-22 per beach surveyed – Curtis Coast

Beach	Tracks	Nests/sp			Total Nests (X + ?)		Nests Emerged	PEX Installed	Nest Relocations	Predation					Other Impacts				Emergence Success Counts	No evidence surveys (Oct-Mar)
		Flatback	Green	Logger						Unsuccessful	Goanna	Fox	Dog	Unidentified	Interference Human	Erosion/Flooding	Heat Impacts	Light Impacts		
Lilley's Beach Boyne Island	5	5			5		3	2	0			2				1			2	21
Canoe Point Tannum Sands	2	1	1		2		1	1	0			1							1	89
Tannum Sands Main Beach	7	6	1		7		5	0	0				1			2		2	4	75
Wild Cattle Island North	22	17			17		6	9	1	1		10				3	1		13	58
Wild Cattle Island South																				0
Other - Quoin Island	1	1			1		0									1				0
TOTALS	**37**	**30**	**2**	**0**	**32**		**15**	**12**	**1**	**1**	**0**	**13**	**1**	**0**	**0**	**7**	**1**	**2**	**20**	**243**

Table 2e - Turtle Activity 2021-22 per beach surveyed – Facing Island

Beach	Tracks	Nests/sp			Total Nests (X + ?)	Nests Emerged	PEX Installed	Nest Relocations	Predation					Other Impacts				Emergence Success Counts	No evidence surveys (Oct-Mar)
		Flatback	Green	Logger					Unsuccessful	Goanna	Fox	Dog	Unidentified	Interference Human	Erosion/Flooding	Heat Impacts	Light Impacts		
Oaks Beaches	1	1			1	0												0	0
Ocean Beach North	119	100	9		109	42	0	0		7					1			49	0
Ocean Beach South	28	14			14		0	0										0	0
East Point Beach	22	17			17													0	6
Little Settlement (East)	13	10			10													0	4
Settlement Bay	157	125	2	1	128	60	4	2	2	39					2			50	3
Gatcombe Heads	3	3			3													0	
Observation Point	1	1			1													0	
TOTALS	**344**	**271**	**11**	**1**	**283**	**102**	**4**	**2**	**2**	**46**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**99**	**13**

Emergence Success

Adjunct to TTCQ activities, some QTCP trained volunteers have authority to excavate emerged nests and investigate emergence success. This helps quantify successful incubation and identify heat induced mortality (from increased sand temperature during incubation and emergence) and impacts of storm surge and wave run up on incubating nests. Emergence success counts are usually performed 48 hours after the nest has emerged. Where a nest had not emerged after an extended period following the due date they were also excavated on the assumption that the nest had not incubated successfully. If the egg chamber had been compromised by a predator, the counts are not valid and the data is discounted due to the possibility of eggs having been removed or eaten.

Table 3 Flatback turtle clutch size and emergence success
Comparisons for Facing Island, Capricorn Coast, Wop-Pa and Curtis Coast beaches - 2021-22 season

	Facing Island		Capricorn Coast		Wop-Pa		Curtis Coast	
	Number of Eggs	Emergence success %	Number of Eggs	Emergence success %	Number of Eggs	Emergence Success %	Number of Eggs	Emergence success %
Min	20	0	20	0	50	36	39	66.67
Max	70	100	64	100	73	98.43	59	100
Average	50.14	78.67	50.33	80.73	59.92	83.48	50.58	92.08
Nests Counted	94		27		13		12	

Table 4 Average clutch size and percent emergence success
TTCQ locations (all seasons where reported).

	Facing Island			Capricorn Coast			Wop-Pa			Curtis Coast		
	# of eggs	% Emerg	Count	# of eggs	% Emerg	Count	# of eggs	%Emerg	Count	# of eggs	% Emerg	Count
2016/17	53.24	72.44	18									
2017/18	53	86.2	10	49.75	77.28	12						
2019/20	53.83	81.36	6	49.84	78.6	25						
2020/21	53.28	89.89	53	50.6	82.65	30				54	94.14	6
2021/22	50.14	78.67	94	50.33	80.73	27	59.92	83.48	13	50.58	92.08	12
Count	5	5		4	4	4	1	1	1	2	2	2
Max	53.83	89.89		50.6	82.65	30	59.92	83.48	13	54	94.14	12
Min	50.14	72.44		49.75	77.28	12	59.92	83.48	13	50.58	92.08	6
Avg	52.7	81.71		50.13	79.82	23.5	59.92	83.48	13	52.29	93.11	9
Std Dev	1.4619	6.7522		0.4039	2.3648	7.9373				2.4183	1.4566	4.2426

Note: - 2016/17 Curtis Coast data included Facing Island, 2020-21 Capricorn Coast data included Wop-Pa

In comparison to long term QTCP census locations at Peak Island and Curtis Island, clutch size (number of eggs) and percent emergence success is comparable. The 2018-19 season on Peak Island (off the southern Capricorn Coast) data indicated an average clutch size of 51.6 eggs and an emergence success of 73.11% for twenty-nine nests, while Curtis Island (immediately north of Facing Island) reported 52.06 eggs and emergence success of 77.99% from sixty-five nests (Limpus et al 2019).

Tagged Turtles

Tagging of marine turtles is a major component of developing population estimates using a mark-recapture methodology. With several long-term QTCP monitoring beaches within the TTCQ footprint, it is likely that over time that some tagged animals may be encountered, especially as volunteers gain more experience and participate in additional research activities.

Within the scope of regular TTCQ activities, one tagged animal was encountered this season – a green turtle nesting at Canoe Point on the Curtis Coast (QB17762). Volunteers with appropriate authority tagged two new individuals at Stanage Bay's Alligator Bay, and two individuals were tagged nesting on Capricorn Coast beaches. Facing Island tagging is detailed in the Facing Island Census section of this report.

Nest Protection

Turtle eggs are vulnerable to predation by a range of native and introduced predators, including goannas, dingoes, wild dogs, pigs and foxes. Two main methods of reducing nest predation are through protecting nests directly by installing Predator Exclusion Devices (PEX) and conducting predator control (usually limited to feral animals). Both methods were utilised in the 2021-22 season. TTCQ volunteer observations play an important role in identifying predation as it occurs and sharing this information with the relevant stakeholder. With experience, volunteers can act upon predator sightings and activity and adapt nest protection strategies as required.
Turtle nests are also vulnerable to tidal inundation and beach erosion. Nest relocation to higher ground protects nests from this threat.

Predator Exclusion Devices (PEX)

Nest protection methods adhere to protocols established by the QTCP and are selected based on predator type, ease of monitoring the protected nest and the level of public usage of the target beach.
Predator exclusion devices include:

- 50mm plastic garden trellis mesh (approx. 1m^2) with every second bar removed over the egg chamber to facilitate emergence of the larger flatback hatchlings,
- Heavy duty plastic industrial barrier mesh (approx. 1m^2) with mesh spacing of approximately 75mm

Installation - the 1m^2 mesh is centred over the egg chamber with edges turned down to prevent tunnelling from the sides. The mesh is pegged down and buried to avoid detection.

A total of 33 predator exclusion devices were deployed this 2021-22 season:

- Four on Facing Island (Settlement Bay) in response to goanna predation
- Twelve on Curtis Coast Beaches (primarily Wild Cattle Island) in response to fox/dog predation
- Seventeen on Capricorn Coast beaches in response to past fox predation.

PEX were compromised in several instances on Wild Cattle Island. Similar damage to the mesh has not been observed with fox predation on the Capricorn Coast and further evidence will need to be collected to determine whether we are dealing with several foxes, or a combination of foxes and dogs. Discussion with QPWS is on-going about installation of monitoring cameras on Wild Cattle Island nests. The loss of nests was very disheartening for volunteers who monitor the island.

Fox control - den detection and trapping

Foxes are recognised as significant local predators of turtle nests, with some exhibiting learned behaviour to locate and predate multiple nests within a home range. Partnership continues with Livingstone Shire Council (LSC), Gladstone Regional Council (GRC) and QPWS across multiple tenures to suppress fox populations to reduce pressure along known turtle rookery sites and shorebird habitat.

Fox den detection was carried out within parks and reserves from Corio Bay to Zilzie in the LSC area (five days), and at Boyne Island and Tannum Sands within the GRC area (three days) in August 2021. Fox den detection dogs locate active dens which are then fumigated by a qualified contractor. This is a cost-effective method of fox control that avoids the need for poison baiting in public areas (e.g., along beaches) and is highly target specific. LSC extended their search area range to 280 hectares, finding a total of 16 active dens - 10 dens located in areas covered in previous seasons (the number of active dens within this area declines each year) and six dens in the newly extended range. GRC located and fumigated one active den at Tannum Sands, and successfully trialled cage

trapping from January to April 2022, catching two foxes at Tannum Sands. A GRC 'Spot a Fox' campaign encouraging the public to report fox sightings, together with monitoring cameras on Tannum Sands beaches, provides valuable information on fox movement aiding management strategy.

Nest Relocations

In response to the threat of inundation and erosion several nests were relocated to higher locations by suitably authorised TTCQ volunteers. There is an initial window of two hours after being laid when eggs can be moved safely with minimal impact, provided egg rotation is minimised. Later in the incubation period, when the embryo has developed sufficiently, the eggs may also be moved, again provided rotation is minimised.

A total of eleven nests were relocated, eight on the Capricorn Coast, one on the Curtis coast and two on Facing Island.

Photo: Fox detection dog Rocky indicating a den (credit Tom Garrett, SQ Landscapes)

Photo: PEX installation – fox and goanna (credit TTCQ volunteer)

Table 5 Summary of Survey Effort and monitoring Activities since 2015 *(NR = Not Recorded) + Some volunteers reported more than once (if they covered several locations).*

Season	Location	Beaches Surveyed	Vols engaged	Tracks Reported	Confirmed Nest	Emerged Clutches	Predation					Impacts			
							Unsuc	Goa	Fox	Dog	Unid	Human	Flood	Heat	Light
2015-16	Capricorn Coast	3	4	10	5	2			1						
	Curtis Coast – including	2	CVA+3	5	3	1			1						
	Facing	1		39	16	2		15							
	Total	**6**	**4**	**54**	**24**	**5**	**0**	**15**	**2**	**0**	**0**	**0**	**0**	**0**	**0**
2016-17	Capricorn Coast	7	16	23	15	11			4						
	including Byfield	1	1	4	NR	NR									
	Curtis Coast including	3	1	10	3	NR			1						
	Facing	1	2	10	3	NR									
	Facing Island	4	2	97	62	20		18							
	Keppel Bay Islands	2	3	3	1	NR									
	Total	**18**	**25**	**147**	**84**	**31**	**0**	**18**	**5**	**0**	**0**	**0**	**0**	**0**	**0**
2017-18	Capricorn Coast	6	9	30	12	11			3						
	Curtis Coast	3	1	6	1	NR									
	Facing Island	5	5	95	59	13		46							
	Stanage Bay/Byfield	1	1	25	3	3			3						
	Total	**15**	**16**	**156**	**75**	**27**	**0**	**46**	**6**	**0**	**0**	**0**	**0**	**0**	**0**
2018-19	Capricorn Coast	8	10	13	10	8			1						
	Curtis Coast	2	2	1	Nil	NR									
	Stanage Bay/Byfield	1	1	3+	3+	1				X					
	Keppel Bay Islands	1	1	1	1	NR									
	Total	**12**	**14**	**15**	**11**	**9**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**
2019-20	Capricorn Coast	13	23	37	32	24			9						
	Curtis Coast	5	6	3	2	NR									
	Facing Island	5	3	103	82	6		X		X					
	Stanage Bay/Langham	2	4 + 3 FBA	123	107	26									
	Byfield	3	3+QPWS	6	3	NR									
	Keppel Bay Islands	4	4	8	6	NR									
	Total	**32**	**36**	**280**	**232**	**56**	**0**	**0**	**9**	**0**	**0**	**0**	**0**	**0**	*0*
2020-21	Capricorn Coast	11	27	48	38	21			1				3		
	Curtis Coast	5	13	33	19	7			3	3			1		
	Facing Island	6	11	187	137	59		X		23					
	Stanage Bay/Langham	4	10	140	108	15									

Season	Location	Beaches Surveyed	Vols engaged	Tracks Reported	Confirmed Nest	Emerged Clutches	Predation					Impacts			
							Unsuc	Goa	Fox	Dog	Unid	Human	Flood	Heat	Light
	Byfield	*1*	*2*	*2*	*1*	*NR*									
	Keppel Bay Islands	*12*	*8*	*41*	*27*	*16*		*1*					*1*		
	Total	***39***	***71***	***451***	***330***	***118***	***0***	***1***	***4***	***26***	***0***	***0***	***5***	***0***	***0***
2021-22	*Capricorn Coast*	*19*	*34*	*47*	*36*	*28*	*3*	*1*		*1*	*2*	*2*	*10*		*4*
	Curtis Coast	*6*	*14*	*37*	*27*	*15*	*1*		*13*	*1*			*7*	*1*	*2*
	Facing Island	*8*	*10*	*344*	*149*	*102*	*2*	*46*					*3*		
	Stanage Bay/Langham	*2*	*10*	*85*	*75*	*21*				*1*			*12*		*4*
	Byfield		*2*												
	Keppel Bay Islands	*9*	*10*	*57*	*45*	*33*							*5*		
	Total	***44***	***80***	***570***	***332***	***199***	***6***	***47***	***13***	***3***	***2***	***2***	***37***	***1***	***10***

Photo (L): Emerged flatback nest (credit FBA)
Photo (R): Flatback hatchlings (credit Karl French)

Recommendations

Previous versions of Team Turtle CQ's season report have included recommendations to improve the TTCQ program. Much of these recommendations emerge from wrap-up events with volunteers and end of season workshops with key stakeholders involved in supporting the program.

This process of evaluation and continual improvement is now built into the program delivery of TTCQ and has become an ongoing, collaborative process.

The recommendations from the 2020-21 Summary Report continue to be relevant to 2021-22 and included:

- Improving data and data collection; for ease of reporting, accuracy and alignment to QTCP datasets
- Building volunteer capacity and opportunities
- Targeting recruitment of volunteers for specific monitoring locations
- Strengthening partnerships for delivery, including welcoming partnership with First Nations
- Continuing current threat reduction activities (predator related)
- Pursuing activities to mitigate against additional threats (e.g., light glow)

The associated improvements made this past season against these recommendations are reflected throughout this report. Progress on each of the recommendations has been achieved and the Team Hatchlings CQ project on the Capricorn Coast, as well as the Facing Island Census on the Curtis Coast have been key outcomes of this continuous improvement.

The data collected by the program is recognised by the QTCP as being a valuable complement to the State-wide datasets on turtle nesting behaviour, associated threats and emergence outcomes.

The focus for the 2022-23 Season will be to continue expanding and adapting activities that meet the recommendations above, ensuring that the program retains its professionalism, its data quality and consistency, relevance for key stakeholders and community. The longevity of the program is considered critical to the positive impact that can be achieved for turtles along our region's coastlines.

Photo: Flatback turtle nesting on Facing Island (credit FBA)

Facing Island Nesting Census – Settlement Bay

Facing Island is a long (approximately15km), predominantly low, coastal island separating the harbour of Port Curtis from the open ocean and the southern Great Barrier Reef. It was identified, along with adjacent Curtis Island to the north, as having significant nesting areas for Flatback turtles as early as 1969-70 (Limpus 1971). Nesting is primarily located on the eastern and southern beaches with only occasionally nesting reported elsewhere on the Island. There is an area of medium density nesting at the northern most end of Ocean Beach (approximately 1.5km long) with scattered nesting occurring at several locations further south, presumably where breaks in the offshore rock platform allow access. Settlement Bay at around 600 metres in length on the southern end of the island hosts a medium density nesting population. Regular but scattered nesting is also reported on adjacent beaches. Limited nesting occurs on the western and northern sides of the island.

Settlement Bay was identified as a possibly significant nesting aggregation in 1997 with surveys conducted from 1998 - 2003 (Clifton and Bell, 2000; Clifton and Limpus, 2001,2002; Limpus and Gilmore,1998; Limpus *et al* 1999). There are no further known surveys of Facing Island nesting until TTCQ began monitoring the island in 2015 undertaking small scale surveys, installing nest protection and using it as a training area to upskill volunteers in QTCP methods. TTCQ community engagement in 2021 recruited two residents as volunteers who provide regular reports on both Northern Ocean Beach and Settlement Bay respectively. This 2021-22 season was the first organised nesting census of Settlement Bay in almost 20 years, providing a snapshot of nesting within a discrete area. As pressure on marine turtles and their habitat continues, with significant new coastal and island developments in the past decade occurring in the Gladstone region, it was timely that nesting surveys on Facing Island be resumed.

Method

Settlement Bay beach was surveyed daily from the 26 November to 10 December 2021, coinciding with the peak period for nesting of flatback turtles of the East Coast population. The beach was monitored for two - three hours either side of the evening high tide or longer, depending on turtle activity. On late afternoon and early morning high tides, the team covered both tides.

Thirty metre sectors were established to facilitate measuring out of laid nests. This allows clutches to be located after incubation to perform emergence success counts. Nightly activities involved checking for tags and tag scars, tagging and measuring nesting adult females, quantifying nest success and where possible performing clutch counts, egg measurements and nest relocations if necessary. Early morning surveys of the beach were undertaken daily, checking for activity post evening monitoring. This also allowed the team to check for emerged nests and predator activity. All activities followed standard QTCP protocols as described in Limpus *et al* (2019).

In February 2022, TTCQ revisited Facing Island over two weekends to perform emergence success counts. Nests marked during the census period were excavated, as were marked nests from local TTCQ volunteers, at both North Ocean Beach and Settlement Bay. Where possible, the stage of development of unhatched embryos was assessed as this can help identify the stage at which the nest was impacted.

Facing Island Census Results

Two local island volunteers have been collecting data for TTCQ at both northern Ocean Beach and Settlement Bay since October 2021, recording tracks species and marking nests. From their records, nesting commenced in mid-October and was over by mid-late January 2022. Their data adds to that collected during the two-week census period. This section (following) of the report is primarily focused on data collected during the census activities.

Nesting Activity, Tagging and Recaptures

A total of 103 tracks were recorded during the census period. Of these, 60 tracks were recorded on Settlement Bay. All except one were flatback turtles, the exception being one recapture green turtle. No loggerhead turtles were recorded during the census period (loggerheads and additional greens were reported in the non-census period.) Nesting crawls were reported from Ocean Beach North and South, East Point Beach and the small beach east of Settlement Point. Over the 14-night census period the average nesting crawls equalled four turtles/per night (range 0-11).

A total of 22 animals were tagged for the first time, and a further four individuals had tag scars on the front flippers, indicating they had been previously tagged and had lost their tags. These individuals were checked for Passive Integrated Transponders (PIT) tags, but none were found, and thus original tagging history could not be ascertained. A further six animals were recaptures, either bearing titanium flipper tags, or in the case of one flatback, a PIT tag implanted above the shoulder. Of these, all the flatbacks were traced back to past seasons at Facing Island. We currently do not have an origin for the recaptured green turtle. The PIT tag identified the turtle as being tagged during the first QTCP census of Facing Island in 1998 (Limpus et al, 1999). After nearly two decades turtles originally tagged on Facing Island are still returning to nest, supporting observations of a high fidelity to nesting beaches. A second recapture flatback was first tagged nesting on Settlement Bay in 2019. Inter-nesting interval in flatbacks (the period between individual nesting seasons) is in the order of 2.2 years (Limpus 2007). As such, it is likely that this is the first season she has nested since 2019.

Twenty-four missed tracks were recorded for the census period, despite efforts by the team to cover the most likely period for nesting around the peak of the evening high tide. It is possible that the team's monitoring activities on the beach led to the high number of missed turtles. Turtles survey the beach from offshore and can be reluctant to emerge from the water if there are lights or activity on the beach. As there is minimal shielding vegetation behind Settlement Bay, any activity on the beach may be spotted easily from offshore, especially when backlit by sky-glow. Nesting attempts after the team had left the beach, including around low tide, on what is a primarily a deserted dark beach may indicate a heightened wariness of human activity. There was one recorded incident where a turtle returned to the water in response to researchers' lights whilst processing another turtle. A total of 37 confirmed and one unconfirmed nests were laid during the census period. This equates to a nesting success outcome of a little over 63%. This total includes the one recorded green turtle which laid during the census period.

Photo: Settlement Bay clutch count

Size of Nesting Turtles

Average curved carapace length as measured for the encountered flatback turtles for this census period was 93.2cm (Std. Dev. 2.5, Range 88.4 - 97.4cm). This is comparable for past averages at Facing Island of 93.6cm (Clifton and Limpus, 2002).

Table 6 Nightly Nesting Summary for Settlement Bay Census Period – Flatbacks
(2nd entry for 6 Dec represents sole green turtle nesting recorded)

Date	Nightly Track Count	Nightly Clutches Laid	Clutches Predated or Collected	Clutches emerged	Nesting turtles Dying or Dead	Tagged Turtles	
						New	Recaptures
26-Nov 2021	0	0	0	0	0	0	0
27-Nov 2021	0	0	0	0	0	0	0
28-Nov 2021	11	6	0	0	0	2	1
29-Nov 2021	8	4	0	0	0	1	1
30-Nov 2021	8	2	0	0	0	2	2
1-Dec 2021	5	2	0	0	0	2	1
2-Dec 2021	10	9	0	0	0	5	3
3-Dec 2021	7	4	0	0	0	5	1
4-Dec 2021	1	1	0	0	0	1	0
5-Dec 2021	2	2	1	0	0	0	0
6-Dec 2021	4	4	3	0	0	3	1
7-Dec 2021	0	0	1	0	0	0	0
8-Dec 2021	3	2	1	0	0	1	1
9-Dec 2021	0	0	0	0	0	0	0
6-Dec 2021	1	1	0	0	0	0	1

Clutch Counts and Egg Measurements

During the census 13 clutches of flatback eggs were counted. The average clutch size was 51.62 with a range of 39-70 eggs. This is comparable to average clutch counts across the region in the range of 49.75-53.83. A small number of clutches had a sample of 10 eggs measured and weighed (four flatback clutches/one green clutch). Average maximum egg diameter was 5.324cm and minimum was 5.219cm and average weight was 73.2 g. Whilst this was performed more as a training opportunity, values are comparable, if not slightly larger, than recorded for other rookeries (Limpus 2007).

Predators and Predation

In past seasons goannas have been a significant predator of turtle nests on Settlement Bay; however, from the 2018 season wild dogs were identified as the major threat to turtle nests on the island. A control program initiated by GPC saw the problem reduced over the past two seasons and there was no evidence of dog predation on nests this season at Settlement Bay. However, as the dog numbers have been reduced, the goanna population is once again rising, and goannas were reported to be investigating the nests from the end of October. During the census period, goanna tracks were present on the beach, but no predation was observed until just prior to the end of the survey period when goannas, over a period of four nights, began to target several nests. Nests that had been relocated by the team were meshed to prevent goanna predation but as the beach cannot be patrolled daily it is risky to install PEX due to the likelihood of damage to the mesh or entanglement of hatchlings during emergence.

Other Impacts

Despite significant sky-glow over the island (especially on the overcast nights), there was no disorientation of adult turtles recorded.

It is possible that one or two nests laid at the foot of the beach access track were lost due to inundation and erosion due to the heavy rainfall prior to the start of the census period. Nests reported for this area were unable to be located.

Despite stormy weather and tidal surge that affected other beaches on the island (Ocean Beach had significant erosion banks in many parts), Settlement Bay appeared not to suffer greatly from erosion this season. As no significant erosion bank was formed, dune vegetation provided good cover and helped stabilise the dunes for the most part.

Emergence Success Monitoring

The team visited the island over two extended weekends in February 2022. Census nests that had been measured out were located and excavated, as were nests identified by TTCQ volunteers both at Settlement Bay and northern Ocean Beach. In total 94 emergence counts were performed across the island. Only nests which had not been predated were included in these counts due to the possible loss of eggs to predators. Of the 37 nests recorded during the census period, a total of 21 were excavated, the rest either being predated or unable to be located (due to the density of nesting activity in some sectors of the beach). The average percent successful emergence was 75.15% with a range from 0-100 percent. Two nests completely failed to incubate.

Compared to past seasons heat induced mortality was not encountered. Root incursion into nests was observed . Two instances of hatchlings being trapped in the predator exclusion mesh were reported. The stage of development of unhatched eggs was recorded where possible. Early stages of embryological development can be difficult to detect especially when combined with putrefaction of the embryo/egg. Extended time since laying compound this making identification of developmental stages difficult.. A predominance of early/mid stage mortality can point to flooding and late-stage mortality (as the embryos pip from the shell) may indicate heat-induced mortality. There was no significant pattern to the clutches excavated to be able to make conclusions for this season's census period.

Conclusion

The nesting population on Facing Island's Settlement Bay appears of a comparable size to that reported for Curtis Island's South End beach. Determining the size of a nesting population is difficult with sea turtles as they show considerable seasonal variation in nesting numbers. Additionally, they do not nest annually, and their longevity and slow attainment of sexual maturity requires long term monitoring to determine trends in their natural populations (Parmenter and Limpus, 1995).

As a census beach, Settlement Bay has the advantage that it is a discrete, short beach, making it suitable to be surveyed on foot with a small team. Nesting density is also relatively high as a factor of the beach length.

Predation of clutches by goannas is an ongoing problem at Settlement Bay and there may be issues with erosion during strong south easterly weather events. The beach, however, fared well this season in comparison to many others across the region in terms of weather impacts. Limited and difficult access and no designated camping areas in the south of Facing Island may deter visitors to the beach providing for a reasonable level of protection for the nesting turtles.

Past surveys identified the area as a significant nesting location and recent recaptures of animals tagged in those early surveys indicate a long-term fidelity to the nesting beaches here. As turtles are slow growing, long lived and slow to reach sexual maturity, it is difficult to quantify how the population is faring based on a single year's survey.

Due to pressures on marine turtles and reported declines in populations, loss of quality habitat and impacts associated with climate change, it is recommended that further monitoring of the Facing Island populations is continued. The importance of being able to follow individual animals long term is critical to understanding marine turtle populations. Should surveys on Facing Island continue, it would be beneficial to commence PIT tagging of flatbacks as an insurance against the loss of flipper tags. Light impact assessments could be commenced, and further predator exclusion activities performed.

Photo (L): Facing Island egg measurements (credit Karl French)
Photo (R): Facing Island monitoring - Contracted turtle specialist, TTCQ volunteer and Gidarjil Land and Sea Ranger

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