Proceedings of the

Third Australian Marine Turtle Symposium
Territory Wildlife Park, Berry Springs
Darwin 22 - 24 August 2016

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Warning:

Aboriginal and Torres Strait Island people are warned these proceedings may contain the name and possibly images of persons who are no longer with us.

Proceedings of the

Third Australian Marine Turtle Symposium

Territory Wildlife Park, Berry Springs

Darwin 22 - 24 August 2016

Sponsors

We thank the sponsors and volunteers who made the Third Marine Turtle Symposium and the publication of these proceedings possible.

Major Sponsors

For finances and provision of volunteers, we thank AusTurtle Inc.

For financial assistance and use of Facilities of Aquaculture Centre, we thank Research Institute for the Environment and Livelihoods Charles Darwin University.

For financial assistance and enabling secondary students to attend, we thank the Essington School.

For financial assistance and provision of the MV Flatback for a trip to Bare Sand Island flatback sea turtle rookery, we thank Sea Darwin.

Sponsors

For financial assistance that provided an open bar we are indebted with thanks to Wildlife Computers.

For financial assistance that provided an open bar we are indebted with thanks to Sea Turtle Foundation.

Acknowledgements

AusTurtle Inc is a small organisation with most of its members interstate. The “hands-on” running of the symposium relied on the generosity of many volunteers who gave their time before, during and after this symposium. Several flew from interstate to volunteer and join the local members of AusTurtle in making this event happen. We appreciate this support from Teleri Ewe, Liz Wemyss, and our local members Samantha Walker, Ella-Monique Mason, Betty Franklin, Andrew Raith and Alice Henderson.

We thank the following for their services:

The Territory Wildlife Park for the location and catering for the meals.

Total Event Services for the projection services on the big screen.

The success of the Necropsy Workshop is due to the dedication of staff from Department of Primary Industry and Fisheries for specimens. Drs Kathy Schilton, Di Barton and Ayrial Harburn for guiding and explaining the necropsy.

Staff from The Ark Animal Hospital and Dr Joel Haung (CDU) assisted with the necropsy

Department of Lands Planning and Environment made staff Ray Chatto and Rachel Groom available for the symposium.

Donations in cash and services were gratefully accepted from:

Joan Loftus

Monty C Turtle

Caring for Hedland

The Rosella Guides for kindly making the paper mache green turtle.

Welcome and Introduction

Delegates,

Welcome to the 3rd Australian Marine Turtle Symposium. The sea turtle biologists and conservationists of Australia understand your desire to make a difference to the World's sea turtles and their habitats. In 2012, the inaugural Australian sea turtle symposium brought together the active sea turtle researchers and conservationists at Buderim in Queensland. At the second symposium in Perth in 2014 the number of participants more than doubled with participants coming from Pacific and Indian Ocean regions. The Northern Territory has the honour of hosting the 3rd Australian Marine Turtle Symposium. The waters of the Northern Territory support all six species of sea turtle found in Australia. Of these, five species nest regularly on the unspoilt beaches that extend some 6,000 km from Western Australia to the Queensland border.

The Symposium offers the unique opportunity to contribute to and to support the conservation efforts of numerous individuals and organisations that recognise the value of sea turtles to the social, cultural and biological diversity of Australia. In addition to building collaboration between conservation efforts in the Pacific and Indian Oceans we welcome the opportunity to collaborate with the neighbours of our northern coastline; Papua New Guinea, Timor Leste and Indonesia.

We are delighted to have you with us for the symposium and to invite you to enjoy the friendly environment of the Territory Wildlife Park at Berry Springs on the outskirts of Darwin.

The Steering Committee:

Daniel Oades, David Waayers, Fiona Bartlett, Mark Hamann, Kiki Dethmers, Col Limpus, Kelly Howlett, Kellie Pendoley, Bob Prince, Tony Tucker, Scott Whiting, Lisa Gorman, Shael Martin, Jan Jasmine, Dion Wedd, Rachel Groom, Rochelle Ferris, Andrew Raith, Mick Guinea

Program for the 3rd Australian Marine Turtle Symposium

Sunday August 21

Participants arrive and transport from Darwin Airport to TWP

1800 Sunset Ice Breaker barbecue and beverages (sponsored by AusTurtle Inc.)

No formal activities after ice breaker, options include nocturnal spot light walk in TWP and "campfire" time!

Monday August 22

0700 Breakfast (cereal/toast and coffee/tea - serve yourself / TWP covered area)

PowerPoints loaded for the Session 1

Registration bags available for collection. Silent auction Items set up for viewing

0900 Session 1 Welcome to country by Rena Stanton Kungarakan-Warrai custodian

Formal opening- House-keeping (safety, parking, transport arrangements)

Oral Presentations: TITLE, Presenting Author, Presenting Author's Affiliation

Theme 1 Conservation Management and Policy

Session Chairs (a) Nev McLachlan (b) Katharine Robertson

0927 Session 1(a)	SHIPS, PORTS AND TURTLES, Mark Hamann, College of Marine and Environmental Sciences, James Cook University.
0939 Session 1(b)	MARINE ANIMAL STRANDINGS VOLUNTEER NETWORK, GREAT BARRIER REEF MARINE PARK, Alicia Moisel, Queensland Parks and Wildlife Service, Department of National Parks, Sport and Racing
0951 Session 1(c)	QUANTIFYING THE IMPACT OF VARANID PREDATION OF SEA TURTLE NESTS AT WRECK ROCK BEACH, DEEPWATER NATIONAL PARK, QUEENSLAND, Nev McLachlan, Juan Lei, School of Biological Sciences, The University of Queensland.
1003 Session 1(d)	INDIGENOUS RANGERS DRIVING COLLABORATION FOR MARINE TURTLE PROTECTION IN WESTERN CAPE YORK, Clinton William & Johanna Karam, Pormpuraaw Aboriginal Shire Council
10015 Session 1(e)	GREEN TURTLE REPRODUCTIVE FAILURE AND MANAGEMENT INTERVENTION AT RAINE ISLAND, Katharine Robertson, Queensland Parks and Wildlife Service, Department of National Parks, Sport and Racing.

1027 Morning Tea (33 minutes) coffee/tea/juice/water serve yourself (biscuits/cake/fruit) TWP to provide. PowerPoints loaded for the Session 2

Theme 2 Conservation Management and Policy

Session Chairs (a) Scott Whiting (b) Kelly Howlett

1100 Session 2(a) COMMUNITY-BASED DUGONG AND TURTLE MANAGEMENT IN THE TORRES STRAIT - A BRIEF OVERVIEW OF PROJECTS AND OUTCOMES TO COMPLETE THE TASK, Tristan Simpson, Torres Strait Regional Authority,

1112 Session 2(b) LISSENUNG ISLAND TURTLE EGG CONSERVATION, Angelique Amon, Lissenung Island Resort, Kavieng, Papua New Guinea.

1124 Session 2(c) PLANNING AND IMPLEMENTING FLATBACK TURTLE CONSERVATION STRATEGIES IN WESTERN AUSTRALIA, Scott Whiting, Department of Parks and Wildlife WA.

1136 Session 2(d) MARINE TURTLES AT NINGALOO: CURRENT STATUS AND ADAPTIVE MANAGEMENT, Keely Markovina, Department of Parks and Wildlife WA.

1148 Session 2(e) COMMUNITY MONITORING, CONSERVATION & SECURING THE FUTURE OF FLATBACK TURTLES (*NATATOR DEPRESSUS*) IN PORT HEDLAND, WESTERN AUSTRALIA, Kelly Howlett, Care For Hedland Environmental Association Inc.

1200 Session 2 (f) ASSESSING ANTHROPOGENIC RISKS TO HAWKSBILL TURTLES DURING THEIR INTER-NESTING PHASE AT DAMPIER ARCHIPELAGO, Clemency Whittles, School of Earth and Environment, University of Western Australia.

1212 Session 2 (g) REALIGNMENT OF SEA TURTLE ISOTOPE STUDIES NEEDED TO MATCH CONSERVATION PRIORITIES, Ryan M. Pearson, Australian Rivers Institute, Griffith University.

1224 Lunch (72 minutes) cold food sandwiches fruit coffee/tea/juice/water. PowerPoints loaded for the Session 3

Theme 3 Anatomy Physiology and Health

Session Chairs (a) Mick Guinea (b) Kimberly Finlayson

1336 Session 3 (a) FIBROPAPILLOMA DISEASE IN AUSTRALIAN MARINE TURTLES, Dr Colin LIMPUS, Qld Department of Environment and Heritage Protection.

1348 Session 3 (b) FIBROPAPILLOMA DISEASE IN AUSTRALIAN MARINE TURTLES, Dr Colin LIMPUS, Qld Department of Environment and Heritage Protection.

1400 Session 3 (c) CELL-BASED BIOASSAYS – AN ETHICAL WAY OF ASSESSING THE IMPACTS OF CHEMICALS ON MARINE TURTLES, Kimberly Finlayson, Smart Water Research Centre, Australian Rivers Institute, Griffith School of Environment, Griffith University.

1412 Session 3 (d) THE MICROBIOME OF SEA TURTLES, Franciscus Scheelings, Monash University, Biological Sciences.

1424 Session 3 (e) NOVEL APPROACHES TO DETERMINE IF EXPOSURE TO COASTAL POLLUTANTS ARE ADVERSELY AFFECTING GREEN TURTLE HEALTH AND ITS POPULATIONS OF THE GREAT BARRIER REEF- PRELIMINARY FINDINGS, Christine Hof, WWF-Australia.

1436 Session 3 (f) DOES STRESS INFLUENCE BLOOD CHEMISTRY OF NESTING FLATBACK SEA TURTLES (*NATATOR DEPRESSUS*)?, Mick Guinea, Charles Darwin University, AusTurtle Inc.

1448 Afternoon Tea (30 minutes) coffee/tea/juice/water serve yourself (biscuits/cake/fruit) TWP covered area. PowerPoints loaded for the Session 4.

Theme 4 In-water Biology

Session Chairs (a) Rochelle Ferris (b) Mat Vanderklift

1512 Session 4 (a) SUCCESSFUL TURTLE TRACKING - TAGS, TOOLS AND TIPS, Kevin Lay, Wildlife Computers.

1524 Session 4 (b) SUCCESSFUL TURTLE TRACKING - TAGS, TOOLS AND TIPS, Kevin Lay, Wildlife Computers.

1536 Session 4 (c) MALE TURTLES, SATELLITE TRACKING, OPERATIONAL SEX RATIOS, Graeme Hays, Deakin University.

1548 Session 4 (d) WAVING, NOT DROWNING: SEA TURTLES OF SOUTHERN AUSTRALIA, GROWING THE SIGHTINGS DATABASE THROUGH A PUBLIC SURVEY, Rochelle Ferris, James Cook University,

1600 Session 4 (e) THE ECOLOGY OF GREEN TURTLES IN BARDI JAWI SEA COUNTRY, Mat Vanderklift, CSIRO Oceans and Atmosphere, Floreat, Australia.

1612 Session 4 (f) MOVEMENT OF FLATBACK HATCHLINGS THROUGH THE NEARSHORE ZONE AND THE IMPACT OF ARTIFICIA L LIGHT, Phillipa Wilson, School of Environmental Systems Engineering, the UWA Oceans Institute, University of Western Australia (M470).

1624 Poster Session Poster presenters attend their posters.

THE VITAL ROLE OF CITIZEN SCIENCE IN THE COLLECTION OF LONG TERM MONITORING DATA IN THE BURNETT MARY REGION, Saranne Giudice, Burnett Mary Regional Group, Bundaberg, QLD.

EGG DEPREDATION, FLATBACK TURTLES, Julie Donehue, AusTurtle Inc., Charles Darwin University, University of Tasmania

1700 Happy Hour drinks (beer, wine, juice, water) Sponsored by Wildlife Computers

1800 Free time to dinner

1930 Dinner (meat and veg dishes dessert TWP Restaurant area or on the lawn)

2100 Pay bar open (Open Microphone: Silent Auction - what's on offer! Tall Tails and True from the Turtle Beach / cultural event)

2200 Pay Bar close

Campfire time

Tuesday August 23

0700 Breakfast (cereal/toast and coffee/tea - serve yourself / TWP covered area)

PowerPoints loaded for the Session 5

Theme 5 In-water Biology, Conservation Management and Policy

Session Chairs (a) Aub Strydom (b) Tyffen Read

0900 Session 5(a)	FORAGING ECOLOGY OF GREEN TURTLES AT NINGALOO, Jessica Stubbs, The University of Western Australia and CSIRO.
0912 Session 5(b)	USING SATELLITE TAGS AND STABLE ISOTOPES TO INVESTIGATE ECOLOGY OF TURTLES IN THE NINGALOO COAST WORLD HERITAGE AREA, Mat Vanderklift, CSIRO Oceans and Atmosphere, Floreat, Australia.
0924 Session 5(c)	SATELLITE TRACKING 20 POST-NESTING WESTERN AUSTRALIAN LOGGEREHEADS IN THE 2015-16 SEASON, Aub Strydom, Chelys Galactica,Gnaraloo Station Trust & Gnaraloo Wilderness Foundation.
0936 Session 5(d)	THE SLIP-ON HARNESS IMPROVES SATELLITE TAG DEPLOYMENT ON NESTING FLATBACKS, Andrew Raith, AusTurtle Inc.
0948 Session 5(e)	STARTING A TOURISM ACTIVITY AROUND SEA TURTLES IN NEW CALEDONIA, Tyffen Read, Aquarium des Lagons.
1000 Session 5(f)	KAKADU FLATBACKS, Rachel Martin, Kakadu National Park
1012 Session 5(g)	SINGLE SPECIES ACTION PLAN FOR THE LOGGERHEAD TURTLE (CARETTA CARETTA) IN THE SOUTH PACIFIC OCEAN – AN INITIATIVE OF THE CMS, Karen Arthur, Department of the Environment and Energy, Australian Government.

1024 Morning Tea (30 minutes) coffee/tea/juice/water serve yourself (biscuits/cake/fruit) TWP to provide. PowerPoints loaded for the Session 6

Theme 6 Nesting Biology

Session Chairs (a) Mick Guinea (b) Rachel Groom

1100 Session 6(a)	USE OF LOW OXYGEN TO DELAY DEVELOPMENT IN TURTLE EGGS AND PREVENT MOVEMENT-INDUCED MORTALITY, Richard Reina, Monash University.
1112 Session 6(b)	MAIZAB KAUR (BRAMBLE CAY) - TWO YEARS OF SURVEY OUTCOMES ON THE TORRES STRAIT'S LARGEST GREENT TURTLE ROOKERY, Tristan Simpson, Torres Strait Regional Authority.
1124 Session 6(c)	NESTING SEA TURTLES OF THE NORTHERN TERRITORY, Ray Chatto, DLPE NT
1136 Session 6(d)	BEACH SUBSIDENCE FROM OIL AND GAS EXTRACTION, Mick Guinea, Charles Darwin university, AusTurtle Inc.
1148 Session 6(e)	MARINE TURTLE MANAGEMENT IN THE NORTHERN TERRITORY, Rachel Groom, DLPE NT
1200 Session 6 (f)	Video presentation, SALTWATER SECRETS, Jacqui Taylor, Marine Conservation Society

1230 Lunch (60 minutes) cold food sandwiches fruit coffee/tea/juice/water.

1335 Symposium Excursion: busses depart 1345 from TPW car park for the The Horticulture and Aquaculture Centre at Charles Darwin University

Amongst its other obligations and duties, the Centre accepts sea turtles that are awaiting release. These animals have come to the Centre from The Ark Animal Hospital and Department. At present it contains “Hef” the adult male hawksbill that was hatched and raised in captivity. It is hoped he will be released into the wild.

In addition, there are flatback and olive ridley hatchlings that have come into the centre from this Bare Sand Island this year. They were recovered from the bottom of hatched nests where they were either trapped or too weak to be released. They are held under a rescue permit and will be released in the near future.

1545 Depart CDU

1645 Formal close of Proceedings and invitation to the evening meal

1700 Poster Session 30 Minutes. Poster presenters attend their posters. Poster votes counted, Silent Auction ends/

1700 Happy Hour drinks (beer, wine, juice, water) (Sponsored by Sea Turtle Foundation)

1800 Free time to dinner

1930 Dinner (meat and veg dishes dessert TWP Restaurant area or on the lawn)

2030 Presentation Poster Winners etc

2100 Pay bar open

2200 Pay Bar close

Campfire time

Wednesday 24 August

0700 Breakfast (cereal/toast and coffee/tea - serve your self TWP to provide

0800 Workshop 1. Tagging -problem solving -new and old techniques (Col Limpus)

0845 Morning Tea (Serve yourself coffee/tea biscuits - Urn with water provided)

0900 Workshop 2. Ethics what’s it all about! (Dr Joel Huang Animal Welfare Officer)

1000 Workshop 3. Sea Turtle Necropsy (Dr Kathy Shilton (DPIF) and Arc Animal Vets)

1300 Lunch TWP

1400 Finalisation of workshops, feed-back and assessments, future directions.

1445 Afternoon Tea (Serve yourself coffee/tea biscuits - Urn with water provided)

1700 End of symposium and Workshops.

1800 Demob from the TWP Symposium presenters and participants in the Third Marine Turtle Symposium

Extended Abstracts - Contents

Extended Abstracts

Anatomy Physiology and Health

DOES STRESS INFLUENCE BLOOD CHEMISTRY OF NESTING FLATBACK SEA TURTLES (NATATOR DEPRESSUS)?

Author(s): Michael L. Guinea, Nirmala W. Nath, Dean J. Wright, Andrew M. Raith

Email of Presenting Author: mick_guinea@bigpond.com

Affiliation: Charles Darwin University, AusTurtle Inc

Abstract:

Flatback Sea Turtles, Natator depressus, forage for molluscs and other invertebrates over the continental shelf of northern Australia. At least four discrete meta-populations use separated nesting sites on mainland Australia and coastal islands. Satellite tracking suggests the meta-populations mix on the feeding grounds and are therefore exposed to similar environmental conditions. The northern populations, which are the focus of this study, nest in the winter months, June to August, or throughout the year. Few reports address the physiology of Flatback Sea Turtle blood, and none address the usefulness of blood chemistry in assessing health. Efforts to use blood chemistry to assess the health of individual sea turtles and that of the population are hampered by boundary parameters such as size, sex and fasting condition.

In the 2013 and 2014 breeding season, 31 blood samples were collected using a 21g needle from the lateral cervical sinus of female Flatback Sea Turtles after nesting on Bare Sand Island (12.538373S, 130.416713E), Northern Territory. In 2013 the turtles were restrained during sample collection. In 2014 the turtles were unrestrained. The blood sample (4 ml) was divided into Lithium Heparin and EDTA blood tubes, chilled and transported to Berrimah Veterinary Laboratories (BVL) in Darwin. Analysis of the blood samples started within 24-hours of collection with the Packed Cell Volume determined from the EDTA tubes. Plasma from the heparinized samples was analysed for proteins, enzymes, electrolytes and other compounds (Table 1). The boundary parameters in this study were constrained by the samples being taken from all individuals of the same sex, same gene pool, being adult turtles, and of presumed similar fasting regime by being collected at night after laying and returning to the water. Significant differences were found in concentrations of Alanine, Aminotransferase (ALT), Creatinine, Glucose, Magnesium, Phosphorus, Urea and Uric Acid in the blood of animals that were restrained in 2013 and others of unrestrained turtles in 2014 (Figure 1). These results (Appendix 1) suggest restrained turtles undergo stress which is evident in elevated levels of Alanine, Creatinine, Glucose, Magnesium, Phosphorus, Urea, Uric Acid and decreased Aminotransferase (ALT). These results are compared with published results from healthy Green and Hawksbill Sea Turtles with much wider boundary parameters that feed in the seas of northern Australian on a variety of plants and animals. The significant differences in blood chemistry highlight the importance of “no-stress” treatment of the sea turtle before and during blood collection. Stress is an important boundary parameter previously overlooked or masked by post analysis statistical manipulation. Published values for juvenile (Whiting et. al. 2007) and adult Green Sea Turtles, Chelonia mydas, (Flint et al. 2010) and Hawksbill, Eretmochelys imbricata, from northern Australia (Whiting et. al. 2014) could be affected by stress induced from turtle rodeo capture. We recommend a standard period of rest for all turtles caught by stressful methods before blood sample collection.

Analyses were conducted at Berrimah Veterinary Laboratory, DPIF NT. Sea Darwin and G-tek Australia kindly provided transport. The assistance of AusTurtle Inc. volunteers is appreciated. Permits by NT Parks and Wildlife (47834) and AEC approval at CDU (A11028) are acknowledged.

References:

Flint M. et. al. 2010 Development and application of biochemical and haematological reference intervals to identify unhealthy green sea turtles (*Chelonia mydas*). The Veterinary Journal 185: 299-304.

Whiting S.D. et. al. 2007 Blood chemistry reference values for two ecologically distinct populations of foraging green turtles, eastern Indian Ocean. Comp. Clin. Pathol. 16:109-118.

Whiting S.D. et. al. 2014 Plasma biochemical and PCV ranges for healthy, wild immature hawksbill *Eretmochelys imbricata* sea turtles. Veterinary Record doi 10.1136/vr101396.

Table 1. The combined results for 31 post nesting female Flatback Sea turtles in 2013 and 2014

Sample	**Blood paramater**	**Value (mean ± sd.)**
Turtle size	Curved Carapace Length	85.8 ± 2.6 cm
Blood	Packed Cell Volume	0.31 ± 0.04
	Glucose	3.94 ± 0.95 mmol/L
	Total Bilirubin	19.38 ± 12.02 µmol/L
Liver and Cardiac Enzymes		
	Alanine Aminotransferase	14.68 ± 12.91 units/L
	Aspartate Aminotransferase	172.35 ± 68.4 units/L
	Alkaline Phosphatase	77.58 ± 37.87 units/L
	Gamma Glutamyl Transferase	2.97 ± 1.56 units/L
	Creatinine Phosphokinase	673.48 ± 555.51 units/L
Proteins		
	Total Protein	44.55 ± 10.39 g/L
	Albumin	17.38 ± 5.08 g/L
	Globulin	27.16 ± 6.83 g/L
	Albumin/Globulin ratio	0.66 ± 0.13)
Kidney Function		
	Creatinine	20.97 ± 8.4 µmol/L
	Urea	1.00 ± 0.58 mmol/L
	Uric Acid	70.2 ± 14.72 µmol/L
Electrolytes		
	Sodium	144.90 ± 2.84 mmol/L
	Potassium	4.45 ± 0.43 mmol/L
	Chloride	106.20 ± 3.2 mmol/L
	Calcium	4.2 ± 2.45 mmol/L
	Phosphorus	3.3.2 ± 1.10 mmol/L
	Magnesium	2.54 ± 0.28 mmol/L

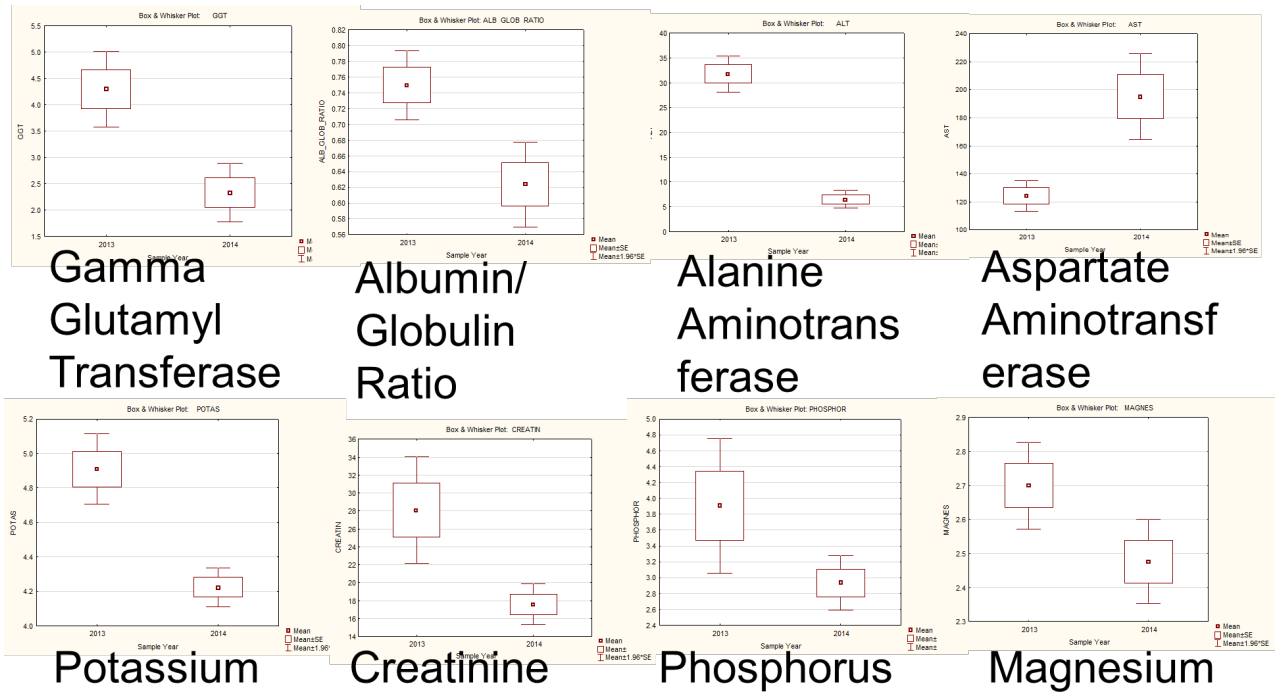

Figure 1. Significant differences in blood chemistry between restrained (2013) and unrestrained (2014) nesting sea turtles reveals a possible operator-induced and previously obscured boundary parameter. **Appendix 1** Blood chemistry data for post-nesting flatback turtles with Primary Tag Numbers and carapace dimensions. Units are provided in text.

Animal #	Primary Tag	Year	CCL	CCW	SODIUM	POTAS	CHLOR	CREATIN	UREA	GLUCOSE	TOT BILI	ALT	AST	ALP	GGT	CK	PROTEIN	Albumin	Globulin	ALB_GLOB_RATIO	CALCIUM	PHOSPHOR	MAGNES	URIC_ACID	HAE_PCV
1	KI58356	2013	85.3	70.8	143	4.9	101	38	1.9	2.6	26	28	114	51	5	350	46	20	26	0.8	4.36	3.35	2.5	73.1	0.36
2	K56717	2013	85.5	70.4	144	4.8	106	42	1.3	3.8	17	34	168	138	5	223	48	21	28	0.8	5.28	4.32	2.7	73.8	0.31
3	K52689	2013	85.1	67.9	139	4.9	102	29	2.3	4.4	11	28	113	54	6	1178	31	13	17	0.8	3.97	3.72	2.7	60.8	0.25
4	KI58138	2013	87.7	70.4	145	5	104	28	0.7	4	18	33	116	60	5	339	51	23	29	0.8	7.3	5.02	2.9	105	0.3
5	KI58206	2013	85.9	70.9	145	4.4	103	25	0.5	3.3	36	35	114	70	3	337	54	21	32	0.7	4.67	3.1	2.5	91.6	0.34
6	QA35262	2013	77.8	66.5	147	4.7	108	33	1.8	3.6	16	37	117	52	3	1690	63	27	36	0.8	11.8	7.11	3.1	91.3	0.3
7	KI58006	2013	85.4	71.7	147	5	107	37	1.7	4.8	10	19	110	92	5	305	37	13	23	0.6	3.24	3.22	2.5	57.2	0.32
8	K56789	2013	84	71.5	147	4.9	107	16	0.8	3.6	10	30	117	92	3	271	34	14	20	0.7	2.96	2.98	2.6	65.3	0.25
9	QA35368	2013	86.8	74.8	145	4.8	107	16	1.9	4.2	13	34	138	232	5	268	44	19	25	0.8	5.27	4.04	2.9	63	0.36
10	K56744	2013	86.8	69.6	147	5.7	109	17	0.1	3.5	17	40	136	59	3	158	38	15	23	0.7	3.12	2.18	2.6	70.2	0.32
11	K56786	2014	88.3	71.6	150	4.1	107	25	0.1	3.4	28	6	420	58	1	593	57	22	35	0.6	4.68	3.64	3.2	94	0.37
12	QA35356	2014	83.4	64.2	143	4.2	107	14	1.7	3.8	13	10	200	71	4	425	34	12	21	0.6	2.49	1.71	2.6	58	0.26
13	K92002	2014	89.8	74	141	4.4	102	16	0.5	4.8	16	7	130	57	2	216	42	16	26	0.6	3.26	3.09	2.6	55.1	0.28
14	K56755	2014	88.7	75.2	144	4.7	107	20	1	5.3	10	10	170	65	4	388	36	14	21	0.7	2.75	2.96	2.3	55.6	0.31
15	QA35436	2014	84	68.5	146	4.8	110	17	1.1	3.7	9	9	130	101	1	1030	36	13	23	0.6	3.57	2.81	2.5	68.2	0.24
16	K56687	2014	86	73.3	146	4.3	111	11	1.4	5.9	8	7	140	54	3	341	38	13	24	0.5	2.65	2.49	2.6	58.6	0.32
17	KI58397	2014	85.8	71.2	144	4.3	107	14	1.2	2.1	10	3	140	78	3	1103	32	13	19	0.7	2.71	2.55	1.9	83.6	0.25
18	QA35440	2014	87.4	71.7	141	4.1	103	14	0.3	2.6	11	4	200	42	2	467	34	16	19	0.8	2	2.51	1.9	51.6	0.31
19	K42771	2014	86.4	72.5	142	4.2	104	17	1	4.3	24	4	220	66	1	480	49	20	30	0.7	3.09	3.05	2.5	55.9	0.33
20	QA35446	2014	82.6	68.9	140	3.7	99	33	1.1	3.6	20	14	200	63	2	2594	58	24	34	0.7	4.16	3.83	2.5	101	0.35
21	K19281	2014	83.9	67.6	144	4.5	103	10	1	3.4	71	5	240	142	6	1454	42	14	28	0.5	3.02	2.34	2.3	60.3	0.35
22	K92034	2014	81	66.1	143	4.4	107	19	1.8	3.9	14	2	190	92	0	1592	32	14	18	0.8	3.41	2.89	2.2	76.9	0.24
23	K8105	2014	84.6	73.5	142	4.3	102	24	0.5	4.3	21	1	280	55	3	709	45	17	27	0.6	3.22	3.08	2.4	58.2	0.29
24	K51219	2014	89.5	76	144	4.1	106	14	0.6	3.9	16	3	160	53	2	466	34	13	21	0.6	2.07	2.43	2.3	57.5	0.31
25	K8076	2014	85.6	73.3	144	4.1	106	17	0.3	5.2	28	4	260	112	2	240	46	17	29	0.6	4.33	3.14	2.5	61.4	0.31
26	KI58243	2014	85.3	71.5	147	4	106	15	0.7	5	18	2	140	62	2	734	45	16	29	0.6	3.29	3.17	2.6	65.3	0.3
27	T94333	2014	91.7	76.5	148	3.9	109	14	0.8	1.4	29	18	270	95	3	455	58	12	47	0.3	3.88	2.8	2.7	56.2	0.38
28	K56636	2014	86	72.2	148	4	112	19	0.8	3.9	22	5	130	60	1	1159	50	17	34	0.5	3.79	2.42	2.4	71.2	0.36
29	K56586	2014	86.4	69.8	148	4.4	110	24	1.2	4.6	14	7	100	47	2	538	75	35	40	0.9	13.1	5.78	2.9	83.6	0.4
30	K56562	2014	86	71.5	151	4.3	111	16	0.2	5	14	5	180	70	2	440	44	17	28	0.6	2.88	2.37	2.5	79.4	0.34
31	K45673	2014	86.7	73.2	147	3.9	109	16	0.9	4.1	31	11	200	62	3	335	48	18	30	0.6	3.71	2.51	2.6	73	0.33

Anatomy Physiology and Health

NOVEL APPROACHES TO DETERMINE IF EXPOSURE TO COASTAL POLLUTANTS ARE ADVERSELY AFFECTING GREEN TURTLE HEALTH AND ITS POPULATIONS OF THE GREAT BARRIER REEF- PRELIMINARY FINDINGS

Author(s): Christine Hof[1], Ian Bell[2], Mark Flint[3], Jochen Mueller[4], Colette Thomas[5], Christie Bentle[6], Andrew Simmonds[7], Ryan Turne[8], Caroline Gaus[9]

Email of Presenting Author: chof@wwf.org.au

Affiliation: WWF- Australia[1], DEHP[2] , VetMARTI, UQ[3], ENTOX, UQ[4], TropWATER, JCU[5], GBRMPA[6], DISITI[7],

Abstract:

The current condition and outlook of the Great Barrier Reef (GBR) in Queensland, Australia is poor. With the threat of its World Heritage status being downgraded to 'in danger', coastal development and poor water quality continues to be recognised as the biggest threat to the GBR. Since 2010, green sea turtles (*Chelonia mydas*) unexplained mass stranding mortalities, high incidence of disease and poor health has been observed in several GBR locations. Although suspected causes include poor water quality and pollutants, the toxicological and causal link between a wide range of coastal pollutants from land and marine based sources and the health of marine wildlife is poorly understood.

As proposed sentinel indicators of environmental health and internationally listed as endangered, green turtles are ideal models to determine the effect of exposure to complex chemical mixtures on their health, survival and biological function. Displaying strong site fidelity and a low trophic status, the chemical exposure and health of subadult green turtles is expected to closely reflect the suite of chemicals present in local sediment, seagrass and water.

The aim of the four-year Rivers to Reef to Turtles epidemiological project is to investigate associations between coastal pollutants and turtle health. In the two years, the study characterised the chemical exposure of external (water, sediment and seagrass) and internal (turtle blood and scute) samples and evaluated green turtle health in three northern GBR sites: Upstart Bay (agriculturally influenced; 2012 mass stranding), Cleveland Bay (industrial/urbanised) and Howick Group of Islands (control; where pollutant input is low or absent).

A total of 2423 turtles were caught and assessed at the three sites for demographic, body mass index, and general health information with a subset evaluated for clinical pathology in comparison to established haematology and blood biochemistry reference ranges. As opposed to targeting a small set of selected pollutants, subadult blood and scute samples were analysed using a novel approach that combines in vitro cell based bioassays and a range of organic chemical and trace element analytical screening methods to evaluate chemical exposure. Sediment, seagrass and water samples were also analysed using both non-target organic chemical and targeted trace element analysis.

Preliminary results show significant differences in: (1) chemical mixture profiles in the water, sediment, green turtle blood and scutes at each site; and (2) the clinical health status of the three turtle populations. Initial results also indicate the presence of metabolites that have been associated with oxidative stress in other species. For turtles exposed to these elevated metabolite concentrations there was a correlating elevated count of white cells. Further investigation is needed to examine possible links between chemical exposure and systemic stress related responses. To address this,

future research will focus on determining the toxicokinetic distribution and toxicodynamic effect of pollutants.

This project will contribute to the establishment of baselines for pollutant exposure in green turtles, and in the long term, establish novel and cost-effective bio-monitoring tools and approaches that can be used to look at cause and effect of coastal pollutants on the health of marine turtles and their inshore habitats.

PHOTO ACKNOWLEDGEMENT: CHRISTINE HOF / WWF-AUSTRALIA

Anatomy Physiology and Health

THE MICROBIOME OF SEA TURTLES

Author(s): T. Franciscus Scheelings[1], Richard Reina[1], Marcel Klaassen[2]

Email of Presenting Author: titus.scheelings@monash.edu

Affiliation: Monash University, Biological Sciences[1], Deakin University, Centre for Integrative Ecology[2]

Abstract:

Residing on, and within every metazoan species, is a diverse and complex metropolis of microorganisms known collectively as the microbiome. The occupation of higher organisms by eukaryotic and prokaryotic colonists has been a key factor in driving evolution and radiation of life on Earth. The greatest concentration of microbes are found within the gastrointestinal tract, where they have forged an indispensable symbiotic relationship with their hosts. Metabolites formed by intestinal microbial activity are directly responsible for a number of physiological functions such as digestion, immune system health, behaviour, and protection against tumour formation and viral infections.

The composition of the microbiome is affected by intrinsic and extrinsic factors such as genetics, diet, and environment. Under conditions of stress, such as environmental degradation or general poor health, the microbiome becomes malleable and changes in its composition may have ramifications for fitness of individuals.

Categorisation of microbial communities are rare in reptiles and non-existent in marine turtles. The aim of this project is to determine the composition of the microbiome in sea turtles and explore factors that may result in its alteration. This research forms the next important step in understanding the physiology of sea turtles and determining why some populations are struggling in the face of their changing environments.

Anatomy Physiology and Health

CELL-BASED BIOASSAYS – AN ETHICAL WAY OF ASSESSING THE IMPACTS OF CHEMICALS ON MARINE TURTLES

Author(s): Kimberly Finlayson, Frederic Leusch, Jason van de Merwe

Email of Presenting Author: kimberly.finlayson@griffithuni.edu.au

Affiliation: Smart Water Research Centre, Australian Rivers Institute, Griffith School of Environment, Griffith University

Abstract:

The long-lived nature of marine turtles and their high trophic level results in the bioaccumulation of organic and inorganic compounds within tissues, making them important indicators of pollution in aquatic systems. Organic or inorganic contaminants have been quantified in all species of marine turtles worldwide. However, very little is known about how these contaminants impact on turtle health which is valuable information for identifying populations at risk. To date, the effects of relatively few contaminants have been investigated for a small number of toxicological endpoints, driven largely by the logistical and ethical constraints of conducting direct exposure experiments on these large, protected animals.

Vitro exposure experiments using cell lines established from turtle tissue provide an ethical, reproducible, cost-effective method to identify threats of environmentally relevant contaminants to marine turtles. However, in vitro studies are often carried out using a cell line of one individual turtle, which overlooks any variation that naturally occurs in the population, potentially returning inaccurate results.

This study uses a number of primary skin fibroblast cell lines established from green turtles to investigate individual variation in cell sensitivity to a number of organic and inorganic compounds found in turtles and turtle habitats.

The results will provide direction for further toxicological studies involving turtle cells lines and will allow more robust and meaningful risk assessments to be conducted for marine turtles, assisting conservation and management strategies worldwide.

Our results also support the use of marine turtle cell cultures as an ethical and reliable method for investigating toxicological effects of environmental contaminants.

Anatomy Physiology and Health

FIBROPAPILLOMA DISEASE IN AUSTRALIAN MARINE TURTLES

Author(s): COLIN J. LIMPUS[1], KARINA JONES[2], MILANI CHALOUPKA[3],

Email of Presenting Author: col.limpus@ehp.qld.gov.au

Affiliation: Qld Department of Environment and Heritage Protection[1]

College of Public Health, Medical and Veterinary Sciences, JCU[2]

Ecological Modelling Services Pty Ltd

Abstract:

Fibropapillomatosis (FP) pre-existed with marine turtles in the South West Pacific before turtle research began in 1960s. The first Australian record of FP green turtle epidemic occurred in 1974-1975 at Airlie Beach, Queensland. Veterinary and genetic studies during 1972-1998 concluded that FP tumours sampled from foraging loggerheads and greens in Moreton Bay, Queensland, Australia, were similar to the tumours observed on Hawaiian greens and a high degree of relatedness among herpesvirus sequences from Australia, Barbados, and Pacific Mexico with those previously identified from all turtle species. FP tumours occur on foraging greens at numerous sites throughout the eastern Indian Ocean and South West Pacific ; on foraging loggerheads at numerous Australian sites from the eastern Indian Ocean to the South West Pacific, but at lower frequency than with greens. Numerous foraging hawksbills populations have been examined in the eastern Indian Ocean and South West Pacific , with FP only recorded at very low frequency in Moreton Bay.

Mark-recapture studies of greens dominated by the Southern Great Barrier Reef (sGBR) genetic stock have been conducted at multiple foraging study sites in central and southern Queensland using standard turtle rodeo and beach jumping capture and titanium flipper tags. The frequency of FP tumoured turtles has remained relatively similar within each study site but markedly different among study sites across decades of monitoring.

A qualitative generalisation from examination of FP frequency at all study sites in eastern Queensland, is that FP tumour frequency is low in coastal embayments with relatively unaltered catchments and highest in coastal embayments with water quality reduced and with associated catchments altered. FP tumoured turtle frequency is trivial at offshore coral reefs. FP tumours occur with all age classes except for turtles that have recently recruited from foraging in the open ocean pelagic habitats to benthic foraging in coastal waters. It is concluded that turtles are infected with FP after recruitment to residency in coastal foraging areas.

A CMR analysis of greens from sGBR stock of all age classes and both sexes foraging in Moreton Bay during 1990-2014 concluded: (1) prevalence was variable across decades with juvenile prevalence increasing from about 2% in the early 1990s, peaking at about 20% in the mid 2000s and declining to about 10% by 2014; (2) prevalence with large immature turtles and adults declined from about 14% in the early 1990s to near zero in 2014; (3) apparent survival probability was age class and disease-state dependent with high apparent survival probability across all age classes for turtles not presenting with FP tumours. Adults had highest survival probability); (4) turtles with FP tumours had lower apparent survival probabilities of about 0.07; (5) prevalence was age class dependent with higher prevalence among juveniles, recovery rate following being recorded with FP tumours was not age class dependent; (6) good recovery occurred across all age classes; (7) this population with the highest frequency of FP in Queensland has increased robustly across 25 years of CMR study with an approximate tripling of the foraging population.

Finally, there has been a comparable increase in annual size of nesting populations at index beaches for this sGBR genetic stock over 5 decades.

Community Monitoring

COMMUNITY MONITORING, CONSERVATION & SECURING THE FUTURE OF FLATBACK TURTLES (NATATOR DEPRESSUS) IN PORT HEDLAND, WESTERN AUSTRALIA

Author(s): Kelly Howlett, Dr David Waayers

Email of Presenting Author: kellyhowlett35@hotmail.com

Affiliation: Care For Hedland Environmental Association Inc, Imbricata Pty Ltd

Abstract:

The Flatback Turtle (Natator depressus) is the only species of marine turtle endemic to Australia. Port Hedland is 1,800km north of Perth in the resource rich Pilbara region of Western Australia. Local Aboriginal rock carvings depicting turtles have been dated to approximately 8,000 years of age.

Much has changed in the Port Hedland area from the late 1960s with the lifting of the iron ore export embargo and subsequent dredging and transformation of the mangrove harbour. Today, Port Hedland is the largest bulk tonnage export harbour in Australia; and with a population of 18,000 people, Port Hedland and its associated beach areas are a far cry from what they once were.

Each of Port Hedland's two nesting beaches represents a unique monitoring and management opportunity for research. Both beaches are predisposed to a number of threatening factors that could detrimentally affect the turtles nesting in the area: high level of disturbance by people (direct contact, off road vehicles, tourism, disturbance of nests and Indigenous take, harbour dredging); and residential lighting and feral animal predation.

The monitoring methods used are track identification and mark/recapture. These methods, used in a community monitoring program setting, have enabled the documentation of seasonality, numbers, inter-nesting rates, recruitment rates, spatial distribution, successful nests, hatchling emergence, hatchling orientation and any apparent disturbance such as nest predation by the European Red fox or human disturbance such as off road vehicles and inappropriate people-turtle interactions.

The year 2017 is the thirteenth season of research monitoring under the program which has delivered quantifiable data and enabled input into local management decisions. The first ten years of data from the program (2004-2005 to 2013-2014) has recently been analysed and is being compared to other studies in Port Hedland and the broader Pilbara region.

Conservation Management and Policy

INDIGENOUS RANGERS DRIVING COLLABORATION FOR MARINE TURTLE PROTECTION IN WESTERN CAPE YORK

Author(s): Robert Morris[1], Johanna Karam[2], Warren Strevens[3], Louise Stone[4], Phillip Mango[5], Chris Hannocks[6],

Email of Presenting Author: ranger@pormpuraaw.qld.gov.au

Affiliation: Pormpuraaw Aboriginal Shire Council[1]

Western Cape Turtle Threat Abatement Alliance/Cape York NRM[2]

Injinoo Ranger Base, c/- Northern Peninsula Area Regional Council[3]

Mapoon Aboriginal Shire Council[4]

Nanum Wungthim Land Sea Management, Napranum Aboriginal Shire Council[5],

Kowanyama Aboriginal Land and Natural Resources Management Office[6]

Abstract:

In recent years, Indigenous Land and Sea Rangers from communities along the west coast of Cape York Peninsula have continued to increase their efforts to monitor and protect sea turtles and their nests. In 2013, Indigenous Ranger groups made a formal commitment to work together on a regional approach to monitoring and threat management for endangered Flatback, Olive Ridley and Hawksbill turtles by forming the Western Cape Turtle Threat Abatement Alliance (WCTTAA).

Through their collaboration as part of WCTTAA, member groups are better able to attract funding; address regional threats to turtles at a landscape scale; support the efficient use of funding across groups for on-ground turtle protection work; align monitoring methods; engage scientific advisors and facilitate ranger exchange and mentorship.

Historical data is limited, however, some research suggests that previously 70% or more of nests were being destroyed by pigs in areas of western Cape York. During 2015, WCTTAA Ranger groups removed almost 4,000 pigs from approximately 800,000 hectares of their country.

Through a combination of these pig control activities, increased human presence and protection of individual turtle nests during 2015, Ranger groups reduced nest predation within their mainland census sites to less than 15% of recorded nests. Of the 1,400 nests recorded on these beaches, less than 1% were predated by pigs. Mainland beaches monitored by these rangers cover almost 100 km of coast along western Cape York Peninsula.

Conservation Management and Policy

COMMUNITY-BASED DUGONG AND TURTLE MANAGEMENT IN THE TORRES STRAIT - A BRIEF OVERVIEW OF PROJECTS AND OUTCOMES TO COMPLETE THE TASK

Author(s): Tristan Simpson, Belinda Norris, Don Whap, Harry Seriat,

Email of Presenting Author: tristan.simpson@tsra.gov.au

Affiliation: Torres Strait Regional Authority

Abstract:

Since 2008, the Torres Strait Regional Authority (TSRA) has worked with communities and local government stakeholders to develop and implement 14 community based Dugong and Turtle (D&T) Management Plans in the Torres Strait. Respectively, these plans detail the objectives, concerns, priorities and traditional management regulations for the continued sustainable and cultural harvest of turtle and dugong for each community. They are a blend of cultural and western management systems which: support community control and empowerment; respect cultural values and traditional knowledge; conserve natural and cultural values; and develop collaborative partnerships with relevant expertise to assist in implementation.

What does Community-Based D&T Management entail for the TSRA Land and Sea Management Unit? The projects and activities undertaken by TSRA Land and Sea Management Unit to support, facilitate and progress the objectives of Community-Based D&T Management Plans are broad in scope, diverse and in some cases very challenging and culturally sensitive. The TSRA Land and Sea Management Unit has specific roles and responsibilities outlined in the management plans that are delegated to various project areas, primarily the Sea Team and Rangers. Additionally, many projects are reliant on collaborative partnerships, engagement of expertise and supportive stakeholders and through all projects a key mandate is the capacity building of Torres Strait Islanders, including Traditional Owners to support informed management decision making.

This presentation will briefly outline the numerous projects and activities undertaken by the TSRA LSMU and their outcomes, specifically over the last two years, to demonstrate the extent of work completed and the quantity of work yet to be accomplished.

Conservation Management and Policy

QUANTIFYING THE IMPACT OF VARANID PREDATION OF SEA TURTLE NESTS AT WRECK ROCK BEACH, DEEPWATER NATIONAL PARK, QUEENSLAND

Author(s): Juan Lei1, David Booth[1], Nev McLachlan[2], Bev McLachlan[2],

Email of Presenting Author: nevbevmclachlan@gmail.com

Affiliation: School of Biological Sciences, The University of Queensland[1]

TurtleCare Volunteers, Queensland Inc.[2]

Abstract:

Wreck Rock beach located just south of Agnes Waters, Queensland, is adjacent to Deepwater National Park and hosts 80-90 nesting loggerhead turtles each nesting season. Goanna predation of nests has become more common since fox predation control measures were introduced in the 1990's.

Goanna activity on nesting dunes, nest predation and various types of nest protection were monitored and trialled during the 2014-2015 and 2015-2016 nesting seasons on Wreck Rock beach. Two species of goanna patrolled the dunes; the yellow spotted goanna (*Varanus panoptes)* was the most numerous; and the lace monitor (*Varanus varius),* visited sea turtle nests less often. Goanna dune activity and predation of turtle nests was much greater in 2014-2015 compared to 2015-2016; with the predation rate of unprotected nests being 91.0% in 2014-2015 and just 12.5% in 2015-2016. Large male yellow-spotted goannas were the most common nest predator and the only individuals observed to open nests; but once a nest was opened, smaller yellow-spotted goannas and lace monitors also took turtle eggs from nests.

Four nest protection methods were trialled: hot chilli powder; red flags; aluminium cages; and plastic mesh. Hot chilli powder and red flags did not deter goanna predation of sea turtle nests. However, when properly fitted, both aluminium cages and plastic mesh prevented goanna predation of sea turtle nests. A lot less effort is required to fit and remove plastic mesh compared to aluminium cages, so plastic mesh is recommended if nest protection is required against goanna predation and other larger mammalian predators, such as dogs and pigs which were not present on Wreck Rock beach during the trials.

Conservation Management and Policy

MARINE ANIMAL STRANDINGS VOLUNTEER NETWORK, GREAT BARRIER REEF MARINE PARK

Author(s): Alicia Moisel

Email of Presenting Author: alicia.moisel@npsr.qld.gov.au

Affiliation: Queensland Parks and Wildlife Service, Department of National Parks, Sport and Racing

Abstract:

Rescuing and rehabilitating sick or injured wildlife is important from an animal welfare perspective but it requires significant resources and does not achieve long-term conservation outcomes. Over recent years, the Queensland Parks and Wildlife Service (QPWS) has worked hard to harness public interest and enthusiasm and build community capacity to respond to marine turtle stranding incidents in the Great Barrier Reef (GBR). This allows QPWS to focus resources on broader conservation initiatives rather than the welfare of individual animals.

In close collaboration with the Great Barrier Reef Marine Park Authority, the Sea Turtle Foundation, and turtle rehabilitation centres across the GBR, QPWS has committed significant time and resources towards community stranding response training, including face-to-face training and the development of an online training program. The QPWS now has a network of over 400 volunteers trained in marine turtle stranding response, including members of the public, conservation groups, Traditional Owners and Indigenous Ranger groups. Volunteers now respond to approximately 60% of strandings in the GBR, up from 18.5% in 2012-2013.

The current direction is reflected in the QPWS Field Management Program business planning framework to ensure the investment in community stewardship will continue to see conservation returns by allowing QPWS to focus resources on operations that assist directly with marine turtle conservation, such as the Raine Island Recovery Project.

Conservation Management and Policy

SHIPS, PORTS AND TURTLES

Author(s): Mark Hamann[1], Kerstin Daff[1], Col Limpus[2], Natalie Wildermann[1]

Email of Presenting Author: mark.hamann@jcu.edu.au

Affiliation: College of Marine and Environmental Sciences, James Cook University[1]

Queensland Department of Environment and Heritage, Brisbane[2]

Abstract:

Australia's geographic isolation from the major world markets and suppliers, results in a heavy reliance on shipping for trading purposes. This, and the demand that China has placed on Australia for iron ore and coal, has aided the increase in shipping activity by 130% between 1998 and 2009. Shipping in coastal areas poses a wide variety of risks to coastal and marine ecosystems: waste disposal at sea, introduction of foreign organisms through ballast water, groundings (physical damage, chemical spills, marine debris), boat strike, oil spills and noise are among the most well-known.

However, despite the potential impacts to marine and coastal habitats and species, there are few studies that aim to quantify the risk of an incident, or the consequences to the species or habitats, should an incident occur. To address this, we obtained vessel location data from the Modernised Australian Ship Tracking and Reporting System (MASTREP) between 2013 and 2015. We used GIS to compare the ship locations with important habitats and locations for flatback turtles to examine the likelihood of an impact. Our preliminary assessment of the data revealed that around 15% of the inter-nesting habitats and close to half of the migratory pathways for flatback turtles co-occurred with shipping intensity of >1000 ship movements per year. Despite the overlap there is no documented evidence that rates of ship strike are high, or that they have increased. It could be that turtles are good at avoiding vessels. These datasets and results will aid managers in understanding the risks turtles face under existing and potential shipping and port development.

Conservation Management and Policy

MARINE TURTLES AT NINGALOO: CURRENT STATUS AND ADAPTIVE MANAGEMENT

Author(s): Keely Markovina[1], Andrea Whiting[2],

Email of Presenting Author: keely.markovina@dpaw.wa.gov.au

Affiliation: Department of Parks and Wildlife[1], Independent Consultant[2]

Abstract:

Green turtles (*Chelonia mydas*), Loggerhead turtles (*Caretta caretta*) and Hawksbill turtles (*Eretmochelys imbricata*) nest within the Ningaloo Coast World Heritage Area. The Ningaloo Turtle Program (NTP) was established in 2002 as a collaborative effort between the Department of Parks and Wildlife and the Cape Conservation Group with the aim of predicting long-term trends in marine turtle populations along the Ningaloo coast. Under the NTP, national, international and local community volunteers undertake annual turtle track monitoring on designated beaches recording nesting, false crawls, disturbance, predator presence, tag sightings, turtle rescues and mortalities; and conduct a trend analysis every three years.

The analysis in 2016 showed that although there was a large annual variation in the estimated number of annual tracks and nests, there were no significant long-term increases or decreases in predicted nesting abundance for any species. Annual nesting success rates remained stable, with hawksbill turtles always exhibiting the highest rate (average 50.4%), followed by loggerheads (44.9%) and then greens (28.5%). The peak nesting period occurs between late December and early January. The annual numbers of nesting females are estimated to be 15,000 – 34,000 green turtles; 990 – 2,760 loggerhead turtles; and 350 – 790 hawksbill turtles.

Adaptive management responses that have been implemented include: public education turtle activities, the development of the Turtle Watcher's Code of Conduct, carpark adjustments, signage, enforcement patrols, and targeted introduced predator control programs.

Introduced predator management includes trapping and 1080 baiting for foxes and cats, and tracking introduced predators. Trapping confirmed that cats at Ningaloo will prey upon turtle hatchlings after the discovery of remains in the stomach contents of a dissected cat. Introduced predator monitoring indicates management success.

Proposed future development for the NTP includes: the continued development of a media intern position utilizing social media as an education tool; an increased focus on examination of targeted hatched nests to validate track and nest identification techniques; and the opportunity for a post-graduate student to work in collaboration with NTP on turtle nest and hatchling predation.

Conservation Management and Policy

GREEN TURTLE REPRODUCTIVE FAILURE AND MANAGEMENT INTERVENTION AT RAINE ISLAND

Author(s): Dr Andrew Dunstan, Katharine Robertson

Email of Presenting Author: katharine.robertson@npsr.qld.gov.au

Affiliation: Queensland Parks and Wildlife Service, Department of National Parks, Sport and Racing

Abstract:

Raine Island is the largest remaining green turtle rookery and nesting site for 90% of the northern Great Barrier Reef green turtle population. However nesting success and hatching success is low. Nesting success is around 20%, with failure being attributed to dry sand causing nest collapse and high-density nesting resulting in frequent inter-turtle nesting disturbance. This failure causes repeated re-nesting efforts on successive nights depleting energy reserves. Hatching success is low, from 20% to 56%, with embryonic death mostly occurring in early development. Tidal inundation at nest level is widespread and is being investigated as a major cause of hatching failure.

Management intervention works to improve the reproductive success of green turtles at Raine Island was trialled in 2014 by re-profiling the nesting beach area. This raised the height of the nesting area above inundation and produced a more gradual slope. Two nesting seasons of data were collected comparing the re-profiled trial area with non-modified nesting beach areas. The trial sector profile remained stable during the two nesting seasons. Nesting success was higher in the trial area in the 2014-15 season; however no difference was found in hatching success between trial and control areas. However, results from the 2015-16 season show that hatching success of eggs in the trial area was 80.7% compared to 61.8% in non-modified beach areas.

Conservation Management and Policy

REALIGNMENT OF SEA TURTLE ISOTOPE STUDIES NEEDED TO MATCH CONSERVATION PRIORITIES

Author(s): Ryan M. Pearson[1], Jason P. can de Merwe[2], Colin J. Limpus[3], Rod M. Connolly[1],

Email of Presenting Author: ryan.pearson2@griffithuni.edu.au

Affiliation: Australian Rivers Institute, Griffith University[1]

Australian Rivers Institute, Griffith University[2]

Threatened Species Unit, Department of Environment and Heritage Protection[3]

Abstract:

For effective management and conservation of marine turtles, understanding the geographical distribution of turtles within each of their 58 regional management units (RMUs) could enhance conservation and management, especially for populations that are the most threatened. Stable isotope analyses can be used, potentially, to assess quickly foraging distributions across large proportions of a nesting population, with high numbers of turtles at low cost and effort relative to satellite telemetry or mark-recapture. Isotope techniques have become popular in the past decade and currently show an increasing trend in the number of papers published per year. We quantitatively (N = 84) assessed the current state of knowledge in the isotope ecology of sea turtles and identified key knowledge gaps where a methodological basis is missing, and where sub-populations are in need of geographical isotope assessment. Of isotope studies that infer a geographic origin, by far the most have been conducted in RMUs listed as 'least concern' by the IUCN and at a rate many times higher than those considered threatened. This is a testimony to the effectiveness of good research and management in these areas, but suggests a need to realign the focus of isotope ecology towards more threatened RMUs. This is the first review of isotope studies of sea turtles and helps to refocus future isotope research on sea turtles to prioritise conservation outcomes in Australia and throughout the world.

Conservation Management and Policy

ASSESSING ANTHROPOGENIC RISKS TO HAWKSBILL TURTLES DURING THEIR INTER-NESTING PHASE AT DAMPIER ARCHIPELAGO

Author(s): Clemency Whittles[1], Scott Whtiting[2], Bryan Boruff[1],

Email of Presenting Author: 20364924@student.uwa.edu.au

Affiliation: School of Earth and Environment, University of Western Australia[1].

Marine Sciences Program, Department of Parks and Wildlife[2].

Abstract:

Rosemary Island, located in the Dampier Archipelago supports one of the largest Hawksbill turtle rookeries in Western Australia. The Archipelago is subject to a high level of human activity, largely associated with the mining and resource sector of the Pilbara region. This study aims to identify the inter-nesting behaviour of nesting Hawksbill turtles at Rosemary Island and assess anthropogenic risks to the nesting population. In September 2015, seven satellite transmitters were attached to Hawksbill turtles, post-nesting on primary index beaches at Rosemary Island. To identify core and common use areas, home range analysis was applied using data obtained from satellite transmitters. Analysis was undertaken using ArcMap (version 10.3) and an extension of ArcMap, Geospatial Modelling Environment (GME), to apply kernel density estimates and delineate both 50% and 95% utilisation distributions. A spatial risk assessment was applied by overlaying quantified threat layers with delineated home ranges. Threat layers were ranked on their level of exposure to Hawksbill turtles within the archipelago and the likely consequence of impact, determined by the level of exposure. In doing so, areas of high risk were identified and used to guide the implementation of an improved conservation management approach in the Archipelago.

Conservation Management and Policy

LISSENUNG ISLAND TURTLE EGG CONSERVATION

Author(s): Angelique Amon

Email of Presenting Author: info@lissenung.com

Affiliation: Lissenung Island Resort, Kavieng, Papua New Guinea

Abstract:

Lissenung Island Resort is a SCUBA diving resort, approximately 20 minutes by boat from Kavieng, New Ireland Province, Papua New Guinea. A conservation program focusing on Hawksbill eggs commenced three years ago, the last season was the most involved and the most successful.

The consumption of sea turtle meat and eggs remains a significant concern in Papua New Guinea. While education is obviously the preferred way to change this, other immediate conservation efforts are more successful in the short term. Lissenung Island Resort management relocates nests from nearby nesting beaches to our island, where the clutches are reburried and hatchlings released immediately on emergence.

This presentation explains the processes for turtle egg conservation; provides statistics and observations; highlights problems faced; and aims for improvement to the program through education. Whilst a higher number of Greent Turtles were sighted during our dives, the vast majority of sea turtles hatching in the resort area were Hawksbill Turtles.

Conservation Management and Policy

SINGLE SPECIES ACTION PLAN FOR THE LOGGERHEAD TURTLE (CARETTA CARETTA) IN THE SOUTH PACIFIC OCEAN – AN INITIATIVE OF THE CMS

Author(s): Karen Arthur[1], Colin Limpus[2],[3], , Narelle Montgomery[1], , Melanie Virtue[4]

Email of Presenting Author: Karen.Arthur@environment.gov.au

Affiliation: Department of the Environment, Australian Government[1]. Queensland Department of Environment and Heritage Protection[2], Convention on the Conservation of Migratory Species Conference of the Parties Appointed Scientific Councillor for Marine Turtles[3]. UNEP/CMS[4].

Abstract:

Loggerhead turtles nesting in eastern Australia and New Caledonia form a discrete genetic stock - the South Pacific subpopulation. This stock is in serious decline. Loggerhead hatchlings from this stock spend approximately 16-years in waters of the South Pacific Ocean travelling as far as the waters off Peru, Chile and Ecuador before returning to the Coral Sea -Tasman Sea region of the South West Pacific. Throughout their range, Loggerhead turtles are exposed to a variety of threats including: fisheries bycatch; entanglement in, and ingestion of, marine debris; climate variability; terrestrial predation of nests; light pollution; and changes to water table levels at nesting beaches. To address these threats and to reverse the decline in this stock, the Convention on the Conservation of Migratory Species (CMS) adopted the Single Species Action Plan for the Loggerhead Turtle (*Caretta caretta*) in the South Pacific Ocean (Loggerhead SSAP). The development of the Plan was led by the Australian Government and Dr Col Limpus, the CMS COP-appointed Councillor for Marine Turtles in conjunction with representatives of all range states. In unanimously adopting the Loggerhead SSAP at the 11th Conference of the Parties in November 2014, the CMS urged South Pacific Parties and other Parties with fishing fleets operating in the South Pacific Ocean to implement relevant provisions of the Plan. The CMS also encouraged other Parties to provide technical and/or financial support to activities outlined in the Loggerhead SSAP and invited other relevant organisations to support the implementation of the Plan. Implementation of the Loggerhead SSAP is being overseen by a committee of Range State representatives appointed by their respective governments.

Conservation Management and Policy

PLANNING AND IMPLEMENTING FLATBACK TURTLE CONSERVATION STRATEGIES IN WESTERN AUSTRALIA.

Author(s): Scott Whiting[1], Tony Tucker[1], Sabrina Fossette[1], Liz Grant[1], Florian Mayer[1], Corrine Severin[1], Ryan Douglas[1], Holly Raudino[1], Nicola Mitchell[2], Oliver Berry[3], Blair Bentley[2], Jamie Tedeschi[2], Nancy Fitzsimmons[4], Kellie Pendoley[5], Michele Thums[6], Phillipa Wilson[2], Joanne King[7], Jessica Stubbs[2], Erina Young[7], Leah Person[1], Kelly Howlett[8], John Stuart[7], Carolyn Williams[1], Craig Williams[1], Stuart Field[1], Ben Corey[1], Danny Barrow[1], Miriuwung Gajerrong Rangers[9], Balanggarra Rangers[10], Wunambal Gaambera Rangers[11], Dambimangari Rangers[12], Nyul Nyul Rangers[13], Bardi Jawi Rangers[14], Yawuru Rangers[15], Karajarri Rangers[16], Nyangumarta Rangers[17], Ngarla Rangers[18] and Alan Kendrick[1].

Email of Presenting Author: scott.whiting@dpaw.wa.gov.au

Affiliation: 1.Department of Biodiversity, Conservation and Attractions, WA, 2. University of Western Australia, 3. CSIRO, 4 Griffith University, 5. Pendoley Environmental, 6. AIMS, 7. Murdoch University, 8.Care for Hedland, 9.Miriuwung and Gajerrong Corporation, 10. Balanggarra Aboriginal Corporation, 11. Wunambal Gaambera Aboriginal Corporation, 12. Dambimangari Corporation, 13. Nyul Nyul, 14. Bardi Jawi, 15. Yawuru Corporation, 16. The Karajarri Traditional Lands Association, 17. Nyangumarta Warrarn Aboriginal Corporation, 18. Wanparta Aboriginal Corporation

Abstract:

The Northwest Shelf Flatback Turtle Program (NWSFTCP) and the Western Australian Marine Science Institution (WAMSI) Turtle Project are two regional-scale research and conservation programs led by the Department of Biodiversity, Conservation and Attractions (DBCA). The NWSFTCP has developed a Strategic Conservation Plan based on knowledge gaps, prioritised pressures and communication and education needs. This is delivered through a combination of Departmental staff, postgraduate students, consultants and collaborators. Administration and coordination of the NWSFTCP is assisted by an Advisory Committee and associated Scientific Expert Panel. Knowledge gaps include: definition of stock/management units, connectivity between nesting and foraging grounds, of the locations of key habitats (foraging grounds, mating areas and internesting locations), age to maturity, diet, neonate biology and the quantification of impacts from pressures. High priority pressures include: artificial light, predation of eggs and hatchlings by foxes, dogs and cats and increasing temperatures. Moderate pressures include habitat modification, marine debris and sea level rise. The development of a comprehensive monitoring program is the current focus of the NWSFTCP. Education and communication needs have been described through a communication plan and include the development of a website and targeted stakeholder education. The WAMSI Turtle Project 1.2.2 is due for completion at the end of 2017 and has progressed most major components, including mapping nesting along the Kimberley coast through aerial photography and on-ground surveys, egg collection and their laboratory incubation as part of climate change impact modelling, collection of genetic material for stock delineation and knowledge sharing with Indigenous partners. The WAMSI project includes all species but delivers an understanding of the seasonality and distribution of the Kimberley's widespread flatback nesting. Knowledge transfer leading to management outcomes is delivered through advice to marine park and terrestrial reserve planners, development assessments and advice to the Office of the Environment Protection Agency and collaborative working relationship with on-ground managers including local, State and Commonwealth Government and Indigenous partners.

Conservation Management and Policy

SATELLITE TRACKING 20 POST-NESTING WESTERN AUSTRALIAN LOGGEREHEADS IN THE 2015-16 SEASON

Author(s): Aub Strydom[1], Karen Hattingh[2], Scott Whiting[3], Tony Tucker[3]

Email of Presenting Author: Aub.Strydom@uqconnect.edu.au

Affiliation: Chelys Galactica[1],

Gnaraloo Station Trust & Gnaraloo Wilderness Foundation[2],

Marine Science Program - Department of Parks and Wildlife WA[3],

Abstract:

Loggerheads nest on a 450 km span of the Western Australian coast from November to March each year. The northernmost known significant nesting occurs at 21.6°S, on the Muiron Islands near Exmouth, and extends on the mainland in scattered rookeries down the Ningaloo coast. Numbers peak at the southern end of their nesting range at 25.5°S, on Dirk Hartog Island in Shark Bay, where about 75% of the total population's nesting occurs on a 5km string of beaches east from Cape Inscription Lighthouse.

The only previous study of post-nesting WA Loggerheads using satellite trackers, was when nine were deployed at Cape Range National Park, at approximatley 22°S, in the 2006-7 season. (Mau *et al*. 2008).

In 2015-16, twenty Argos enabled PTT trackers were successfully attached to post-nesting Loggerheads across this range, to examine re-nesting intervals and inter-nesting habitat, post-nesting migration routes, and their home foraging locations and ranges. Skin biopsy samples were taken and preserved for later DNA and stable isotope analysis.

Ten trackers were deployed in December 2015 and January 2016, central to their nesting range at Gnaraloo Bay 23.7°S and Cape Farquhar Bay 23.6°S, on Gnaraloo Station. This was an extension to the annual program that has been undertaken since 2006, involving all-of-season surveys of turtle nesting and a complementary fox-baiting program; conducted by the Gnaraloo Station Trust and Gnaraloo Wilderness Foundation.

In January 2016, five trackers were deployed at South Muiron Island, where flipper tagging and census surveys were conducted in the 1990's. Another five were deployed at Dirk Hartog Island where an annual mid-season census with flipper tagging has been conducted almost continuously since 1993-94.

Here we give an overview of the 20 turtles from the current 2015-16 season, their post-nesting movements, migration paths and final destinations.

References:

Mau *et al.* 2008 "Satellite Tracking of Loggerhead Turtles (*Caretta caretta*) at Ningaloo Marine Park."

Conservation Management and Policy

STARTING A TOURISM ACTIVITY AROUND SEA TURTLES IN NEW CALEDONIA

Author(s): Tyffen Read

Email of Presenting Author: tyffen.read@aquarium.nc

Affiliation: Aquarium des Lagons

Abstract:

New Caledonia is the second most important nesting site for Loggerhead turtles (*Caretta caretta*) in the South Pacific. Tourism involving emblematic species is becoming more and more popular around the world. The environmental agency of the South province of New Caledonia has assigned the Aquarium des Lagons to assess the development of this type of tourism in New Caledonia. A pilot study during the next nesting season will be run as well as an assessment of the importance of sea turtles in the different activities that are proposed to tourists. First results show that 60% of aquatic companies use sea turtles on their website and Facebook to attract tourists. During a willingness to pay questionnaire, 90% of people questioned said they would be interested in attraction around sea turtles. It is expected that 5000 people will participate in turtle walks that will be organised in Bourail during the pilot study.

Education and Advocacy

THE VITAL ROLE OF CITIZEN SCIENCE IN THE COLLECTION OF LONG TERM MONITORING DATA IN THE BURNETT MARY REGION

Author(s): Saranne Giudice

Email of Presenting Author: saranne.giudice@bmrg.org.au

Affiliation: Burnett Mary Regional Group, Bundaberg, QLD

Abstract:

Poster Presentation.

The coast of the Burnett Mary region includes beaches that accommodate some of the most important marine turtle nesting sites in Queensland, supporting significant breeding populations including the endangered Loggerhead turtle (*Caretta caretta)*. The management of marine turtles in the region is challenging. Not only are marine turtles migratory, long-lived and slow maturing animals with a complex biology but there are multiple and diverse stakeholders in the region, across council boundaries, with conflicting values and priorities for management. Marine turtles are threatened by multiple pressures across their distribution and a lack of long-term data can make the impact of threats at the species and population level difficult to determine.

The Burnett Mary Regional Group support a number of volunteer community groups with long-term monitoring projects. The monitoring work of the community group "Turtlecare Volunteers" at Wreck Rock beach was instrumental in assisting the identification of a 50 to 80% decline in nesting loggerhead turtles in Queensland between the mid 1970's and 1990. This ultimately led to the compulsory introduction of turtle excluder devices into the Queensland trawl fishery. Volunteers and community groups also play an important role building knowledge and awareness in the community through school visits and community talks. By building relationships and strengthening partnerships in the community, the work of these groups is helping to break down barriers and enable the community to work collaboratively towards a common conservation goal. The passion, commitment and time invested by these groups is an invaluable contribution to successful conservation outcomes and an enduring legacy for marine turtles into the future.

In-water Biology

MALE TURTLES, SATELLITE TRACKING, OPERATIONAL SEX RATIOS

Author(s): Graeme Hays

Email of Presenting Author: g.hays@deakin.edu.au

Affiliation: Deakin University

Abstract:

Often sea turtle studies focus on nesting females and ignore males. We have been trying to address the lack of information about males using a number of complementary approaches. Boat surveys were used to look at the arrival time of males and females on the breeding grounds and to estimate operational (breeding) sex ratios. Male turtles were captured at sea and equipped with Fastloc-GPS Argos satellite tags. These deployments revealed the extent of male turtle movements and also their remigration intervals. The surveys found that males breed more frequently than females. Energetic considerations suggest that this finding will apply across species and will serve to reduce the concerns surrounding the high female skews in hatchling production that have been widely reported. We hope to find collaborators to extend these types of study to Australian breeding areas. Robust satellite tags and methods of attachment have ensured that minimum length of deployments are now greater than 9 months with some tags still functioning after 4 years.

In-water Biology

FORAGING ECOLOGY OF GREEN TURTLES AT NINGALOO

Author(s): Jessica Stubbs[1,2], Nicola Mitchell[1], Richard Pillans[2], Sabrina Fossette[1], Mat Vanderklift[2]

Email of Presenting Author: jessica.stubbs@research.uwa.edu.au

Affiliation: The University of Western Australia[1], CSIRO[2]

Abstract:

The Ningaloo Coast World Heritage Area (WHA) in Western Australia supports high abundances of foraging and nesting green turtles, yet there is little ecological data on this threatened species within the area. The WHA is also important for recreational activities, tourism and the resources industry, so understanding how turtles use the resources in the area is vital for effective management of this population.

Our research used stable isotope analysis to provide insights into the diet and habitats of green turtles in the Ningaloo WHA. Blood and skin samples were taken from green turtles foraging and nesting at Ningaloo. Samples were also taken from potential food items in the area for comparison. Preliminary stable isotope analyses of multiple tissue types suggest that seagrass and algae form a major proportion of the diet of green turtles at Ningaloo. The preliminary analyses also indicate differences in isotope signatures between turtles of different sizes.

Additional sampling for further, more comprehensive stable isotope analyses will be conducted over the course of the project. The resulting dietary information will be integrated with satellite tracking data to determine important food sources and foraging areas for green turtles at Ningaloo.

In-water Biology

USING SATELLITE TAGS AND STABLE ISOTOPES TO INVESTIGATE ECOLOGY OF TURTLES IN THE NINGALOO COAST WORLD HERITAGE AREA

Author(s): Mat Vanderklift[1], Richard Pillans[1], Jessica Stubbs[1], Tony Tucker[2], Scott Whiting[2], Andrew Revill[1]

Email of Presenting Author: mat.vanderklift@csiro.au

Affiliation: CSIRO Oceans and Atmosphere, Floreat, Australia[1]

Department of Parks & Wildlife, Kensington, Australia[2]

Abstract:

Ecologists are getting better at analysing data generated by tags and measurements of stable isotopes in ways that yield more robust inferences. For marine wildlife, we need spatial and temporal information about habitat use that improves population models and directly influences management decisions. Satellite tags provide multiple types of information about the movement of individual animals, and stable isotope mixing models now incorporate error and so understand that the data reflect processes that occur over varying lengths of time. We use data from satellite tags and measurements of stable isotope ratios of different tissues with different turnover rates to study the ecology of green turtles (*Chelonia mydas*) in the Ningaloo Coast World Heritage Area. δ15N of different tissues (plasma, red blood cells, skin) are highly correlated, but deviate from simple predictions. δ13C of all tissues are poorly correlated. The stable isotope data predict that turtles are largely resident within relatively small areas (less then a few square kilometres) at Ningaloo. We test these predictions with known patterns from individuals tagged with satellite and acoustic tags. Preliminary data from 14 satellite-tagged individuals indicate high residency by animals captured outside the nesting season and variable movements of nesting females. Movement extents of individuals range from negligible (less than a few kilometres) to hundreds of kilometres.

In-water Biology

THE ECOLOGY OF GREEN TURTLES IN BARDI JAWI SEA COUNTRY

Author(s): Mat Vanderklift[1], Richard Pillans[2], Tony Tucker[3], Daniel Oades[4], Phillip McCarthy[4], Kevin George[4], Trevor Sampi[4], Dwayne George[4], Chris Sampi[4], Zac Edgar[4], Kevin Dougal[4], Azton Howard[4],

Email of Presenting Author: mat.vanderklift@csiro.au

Affiliation: CSIRO Oceans and Atmosphere, Floreat[1]

CSIRO Oceans and Atmosphere, Brisbane[2]

Department of Parks & Wildlife, WA[3]

Bardi Jawi Rangers, One Arm Point, Australia[4]

Abstract:

Bardi Jawi Sea Country in the Kimberley, Western Australia is managed for sustainable use of natural resources. Green turtle (goorlil) are an important resource for food and are part of the cultural identity of the Bardi Jawi people. Sustainable use of goorlil is a key objective of the Bardi Jawi Indigenous Protected Area management plan. We have been studying the ecology of goorlil, using stable isotopes, stomach contents and satellite tracking, to provide knowledge that helps underpin sustainable use. Goorlil captured in Bardi Jawi Sea Country appear to rely heavily on the seagrass (*Thalassia hemprichii)*. The movements of 10 satellite tagged individuals from a wide range of sizes indicates that, while some individuals remain in Bardi Jawi Sea Country for extended periods, several individuals have moved up to hundreds of kilometres away. The seagrass meadows of Bardi Jawi Sea Country are an important habitat for goorlil, and the movements of goorlil extend beyond the Sea Country, into areas managed by other groups.

In-water Biology

MOVEMENT OF FLATBACK HATCHLINGS THROUGH THE NEARSHORE ZONE AND THE IMPACT OF ARTIFICIAL LIGHT

Author(s): Phillipa Wilson[1,2], Michele Thums[2], Scott Whiting[3], Kellie Pendoley[4], Mark Meekan[2], Charitha Pattiaratchi[1],

Email of Presenting Author: phillipa.wilson@research.uwa.edu.au

Affiliation: School of Environmental Systems Engineering, the UWA Oceans Institute, University of Western Australia (M470)[1]

Australian Institute of Marine Science, UWA Oceans Institute (MO96)[2]

Marine Science Program, Department of Parks and Wildlife[3]

Pendoley Environmental Pty Ltd.[4]

Abstract:

Conservation of marine turtle populations requires a detailed understanding of their life history as well as the threats that may impact on their survival. Artificial light has been identified as a major threat to marine turtle populations in Western Australia, yet we know little about how it influences hatchling in-water behaviour and survival. In addition, there is a paucity of information on the natural cues they use to disperse offshore and to what extent artificial light interferes with this. To this end, we investigated the in-water movement patterns of ninety flatback hatchlings in the nearshore waters off Thevenard Island using acoustic transmitters and a passive acoustic receiver array. Hatchlings were released in the presence and absence of artificial light (metal halide and high pressure sodium), located on a boat anchored offshore and oceanographic instruments were placed in the study area to measure currents and directional waves. Turtle tracks were reconstructed to calculate: (1) the bearing of their offshore tracks; (2) their speed; and, (3) the time they spent in the nearshore zone in relation to light treatments and oceanographic parameters.

The metal halide light strongly attracted about 85% of hatchlings and caused them to linger in nearshore waters 125% longer than in the ambient treatment. For some individuals it acted as a light trap; they never left the light spill until the light was turned off. The high pressure sodium light also attracted hatchlings (about 70%) and caused them to linger 50% longer than in the ambient treatment. Hatchlings moved offshore using a relatively consistent bearing in the absence of artificial light. The bearing that hatchlings took to move offshore in the light treatments was relatively consistent until they reached the light, at which point they became confused by the light and their path became tortuous.

This study provides evidence that artificial lighting at sea is influencing the orientation and behaviour of flatback hatchlings during their initial offshore migration. These results can be used by decision makers to inform and assist managing marine turtle populations when their habitats coincide with locations of offshore lighting.

In-water Biology

WAVING, NOT DROWNING: SEA TURTLES OF SOUTHERN AUSTRALIA, GROWING THE SIGHTINGS DATABASE THROUGH A PUBLIC SURVEY

Author(s): Rochelle Ferris

Email of Presenting Author: Rochelle.Ferris@my.jcu.edu.au

Affiliation: PhD Candidate - James Cook University

Abstract:

The southern distribution of sea turtle species is a shifting line on maps across the globe. Monitoring species like Green Turtles (*Chelonia mydas*) and Hawksbills (*Eretmochelys imbricata*) across a large area is logistically expensive but important to compare against future changes. Although reliable data exists for strandings and in-water surveys continue, many sightings by the general public go unreported. This community survey project was designed to harness these unreported sightings and contribute to our understanding of how healthy marine turtles are using inshore marine habitat across southern Australia. The survey was launched in July 2016 using the online platform 'Survey Monkey" and can be found at https://www.surveymonkey.com/r/Sea_Turtles_Southern_Australia. Results from the first week of promotion and collection by social media show encouraging results (n = 30) from participants ranging from commercial and recreational fisherfolk, recreational divers, canoe, kayak, Stand Up Paddleboard users, surfers and beach walkers from all southern states except Western Australia. Sightings of sea turtles were identified across New South Wales from Byron Bay in the north and Jervis Bay in the south. The survey will continue until June 2017 with media coverage planned during school holidays when visitation rates to the coastline increases. The results from this public survey will contribute to a wider dataset of sea turtle foraging and nesting activity in NSW. A review and rationalisation of all data capture methods in NSW and data connectivity with neighbouring states will also help sustain a long-term sea turtle reporting and monitoring program.

Nest Hatching Success

EGG DEPREDATION, FLATBACK TURTLES

Author(s): Julie Donehue[1,2,3], Christine Giuliano[1], Mick Guinea[1,2], Ella-Monique Mason[1,2], Scott McDonald[1,2], Andrew Raith[1,2], Liz Wemyss[1], Dean Wright[1],

Email of Presenting Author: j.kd@live.com.au; austurtle@austurtle.org.au

Affiliation: AusTurtle Inc.[1], Charles Darwin University[2], University of Tasmania[3]

Poster Presentation

Abstract:

Flatback sea turtles (*Natator depressus*) have a restricted global distribution and are considered endemic to the Australian Continental Shelf. Nesting is limited to mainland and island beaches of northern Australia (Limpus 2007). Marine turtles are long-lived, slow to mature and impacted by a number of threats. Flatback turtles are listed as Vulnerable; marine; migratory under the national EPBC Act 1999. The global IUCN listing is Data Deficient (DEP 2016).

Females nest on sandy tropical beaches, laying an average 2.8 clutches per season. The egg chamber has approximately 50 eggs. After a 50 day incubation period the hatchlings emerge from the nest and run down the beach to the sea (AusTurtle Inc.). Egg depredation results in less hatchlings emerging from the nest and may threaten the viability of wild populations of Flatback turtles.

Flatback sea turtles nest annually on Bare Sand Island, 50 km west of Darwin, in the Northern Territory of Australia. Since 1996, researchers and volunteers have monitored individual turtles, populations and nest hatching success on the Island. The remote uninhabited Island is relatively free from human and environmental threats to flatback sea turtles. Egg depredation, as a threatening process, could impact on flatback turtle populations.

Analysis of the data revealed that hatchling mortality through egg depredation in 2016 was 26% of the total eggs for the season (June/July), an increase from 2% of depredated eggs in 2015. Egg depredation and incomplete formation of the egg was observed to be primarily caused by the creeping vine, Goat's foot Convolvulus (*Ipomoea pes-caprae*). The vine attaches to the outside of the turtle eggs and robs the eggs of moisture.

In 2016, there was below average rainfall and wind events (BOM), thus the vine maintained a stronghold as the dominant vegetation in the dune nesting habitat. As the vine is a primary dune stabliser, removal would degrade the nesting environment. Annual monitoring of egg depredation of flatback turtles on Bare Sand Island aims to assess the impact on nest hatching success.

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Nesting Biology

MAIZAB KAUR (BRAMBLE CAY) - TWO YEARS OF SURVEY OUTCOMES ON THE TORRES STRAIT'S LARGEST GREENT TURTLE ROOKERY

Author(s): Belinda Norris, , Tristan Simpson, , Aaron Ketchell

Email of Presenting Author: tristan.simpson@tsra.gov.au

Affiliation: Torres Strait Regional Authority

Abstract:

The northern Great Barrier Reef (nGBR) green turtle (*Chelonia mydas*) population is one of seven separate breeding aggregations of Australia. The primary rookeries of the nGBR green turtle population are well known and include Raine Island, Moulter Cay, No.7 and No. 8 Sandbanks, Maizab Kaur (Bramble Cay) and Dauar Island of the Torres Strait. In addition, the Torres Strait is home to the largest continuous sea grass bed of Australia, potentially the world; a vitally important foraging ground for green turtles.

Monitoring of the nGBR green turtle population within the Torres Strait was first undertaken during the 1974 to 1975 breeding season at Maizab Kaur, with ongoing monitoring of consecutive breeding seasons until the 1979 to 1980 season. Since then, monitoring of the nGBR green turtle population was limited until James Cook University (JCU) led a monitoring program of Maizab Kaur and Dauar Island that spanned from 2006 to 2014 inclusive. During this time, the Torres Strait Regional Authority (TSRA) collaborated with communities and the local government to develop and implement 14-community based Dugong and Turtle Management Plans in the Torres Strait. It also collaborated with JCU on the annual monitoring of marine turtle rookeries to build internal knowledge and capacity; and supported and participated in the QLD DEHP Raine Island Turtle Recovery Project.

In 2015, the TSRA LSMU reviewed its marine turtle monitoring methods to align with those utilised in adjacent regions, primarily Raine Island, to increase the effectiveness of research and management outcomes of marine turtles for the northern Great Barrier Reef. Subsequently, the TSRA LSMU also obtained its own Animal Ethics and DEHP Permits to lead and undertake marine turtle monitoring in the Torres Strait. Two breeding seasons have now been monitored and analysed at Maizab Kaur. The results provide greater insight into the nesting population and rookery to identify any issues or concerns that impact on the nesting and incubating green turtles for the purposes of collaborative management and mitigation with Traditional Owners, expertise and stakeholders.

Nesting Biology

USE OF LOW OXYGEN TO DELAY DEVELOPMENT IN TURTLE EGGS AND PREVENT MOVEMENT-INDUCED MORTALITY

Author(s): Sean Williamson, Richard Reina, Roger Evans,

Email of Presenting Author: richard.reina@monash.edu

Affiliation: Monash University

Abstract:

Relocation of turtle eggs for research or conservation purposes is associated with significant risk as turtle eggs suffer from movement-induced mortality. The standard protocol involves chilling the eggs to between 6-10°C to slow the rate of embryonic development, but this technique can result in death of embryos if the temperature falls outside this range. Our research recently discovered that sea turtle eggs placed into low oxygen (hypoxia) up to 12 hours after oviposition will remain undeveloped for at least 3 days until they are exposed to air, without any significant reduction in hatching success. We investigated a variety of methods for transporting eggs under hypoxic conditions to determine the most effective and field-friendly methods. Olive ridley eggs were divided among four different treatments after oviposition. These were: 1) perspex containers containing nitrogen; 2) ziploc plastic bags containing nitrogen; 3) vacuum sealed plastic bags; and, 4) a control treatment where eggs remained in air. All eggs remained in the respective treatments for 3-days before being placed into incubators to complete development. We then assessed the average time taken to form a white spot, the hatching success and hatchling morphology of each treatment group. The majority (98.3%) of the eggs formed a white spot, but there was a significant difference in the average time taken for the white spot to form between treatments. Eggs in the vacuum sealed bags took on average 2.4 days longer to form a white spot than the control eggs, while eggs in the perspex and ziploc bag treatments took, on average, 3.3 days longer than the controls; showing that the development of eggs had been delayed. This study demonstrates that plastic and vacuum bags can be used for maintenance of hypoxia in turtle eggs, thus allowing a simple and cost-effective method for transportation of eggs for conservation and research purposes.

Nesting Biology

BEACH SUBSIDENCE FROM OIL AND GAS EXTRACTION

Author(s): Mick Guinea

Email of Presenting Author: mick_guinea@bigpond.com

Affiliation: Charles Darwin University, AusTurtle Inc.

Abstract:

Removal of natural gas and oil from porous sands causes the overlying rock layers to subside or compact in the area directly above the hydrocarbon reserve. In off-shore oil and gas extraction the sea floor lowers. The extent of the subsidence depends on many factors inherent to the operation, including the nature of sediments and rock and rate of extraction. Examples are provided using historical data from existing hydrocarbon reserves in Louisiana, USA and Venice, Italy, where the rate of subsidence of the land surface was directly related to the rate of hydrocarbon and water extraction. Sandy Islet, Scott Reef, on the Northern Australian continental shelf is the only known sea turtle nesting beach in Australia positioned directly above a hydrocarbon reserve. Being a low sand cay, Sandy Islet is threatened by rising sea levels due to global warming and thermal expansion of tropical waters and increased cyclone activity and intensity. Subsidence of the island by compaction and compression of the underlying strata pose another threat during hydrocarbon extraction. Extraction of hydrocarbons onshore will likely prduce similar compaction that could lower the shore in the immediate area. Such subsidence of the narrow beaches often backed by cliffs could drastically alter existing nesting areas that are used by sea turtles. Examples of the narrow cliff-backed beaches of the Northern Territory will be used to highlight this threat to the northern Australian coastline.

Nesting Biology

KAKADU FLATBACKS

Author(s): Rachel Martin

Email of Presenting Author: rachel.martin@environment.gov.au

Affiliation: N/A

Abstract:

Kakadu National Park, Northern Territory, have carried out surveys on flatback turtles on Field Island for the last 20 years. My talk covers the results from the 2015 turtle surveys and some overall information on Kakadu's Turtle Program.

Included in the 2015 survey results are: nest data logger results, nest fate, 4 satelite tags and the overall numbers for turtle nesting.

SUCCESSFUL TURTLE TRACKING - TAGS, TOOLS AND TIPS

Author(s): Kevin Lay

Email of Presenting Author: tags@wctags.com

Affiliation: Wildlife Computers

Abstract:

Tracking sea turtles requires a lot of planning for a successful outcome. The animal behaviour and physiological response data captured through the use of our Wildlife Computers innovative tracking and archival tags are a direct result of the tag chosen and its pre-deployment set up. To ensure that the most appropriate tag and configuration is used to address research requirements, a range of dedicated sea turtle tags are presented along with information on the associated Wildlife Computers Portal. The Portal is a comprehensive collection of tools to configure tags, retrieve, decode, display and share Argos satellite and other types of data. My presentation shows how the Web Portal features adds value to turtle research projects; saving time and effort in analysing and displaying results while ensuring the data is preserved in a backed-up secure, clear and usable format.

Nesting Biology

THE SLIP-ON HARNESS IMPROVES SATELLITE TAG DEPLOYMENT ON NESTING FLATBACKS

Author(s): Andrew Raith, Mick Guinea, Samantha Walker and Ella-Monique Mason

Email for correspondence: austurtle@austurtle.org.au

Affiliation: Charles Darwin University, AusTurtle Inc.

Abstract:

The problem of attaching satellite tags to flatback turtles with their waxy carapace that defies adhesives was first tackled in Australia using a harness to carry the tag (Sperling and Guinea 2004). These original harnesses were hand made and hand sown and were individually fitted to the turtles. They proved most effective for their purpose which was to track nesting females during their internesting period of about 14 days (Guinea *et al.* 2006). They were to be removed from the turtles on the next nesting attempt and attached to new individuals to record their internesting locations.

Samples of the harness provided to other researchers were then outsourced for commercial manufacture. the commercially produced harness suffered from poor workmanship, inferior materials, dubious quality control, of variable and inconsistent size. Straps needed to be stretched causing fraying and damage to the edge of the turtle's carapace. Deployment required at least four people to lift the turtle onto a crate for harness attachment (Figure 1) and restraining the turtle during attachment (Figure 2) with another four-person lift to place the turtle on the beach. Lifting such a weight was a concern for industry and institutions with strict occupation health and safety guidelines for lifting.

To overcome the limitations on lifting and possible injury to researchers and turtles, we developed a Slip-on harness that could be fitted without lifting the turtle. It was attached as the turtle crawled back to the sea after nesting. Minimal restraint could be used if needed. The harness was made from UV and salt resistant webbing (25 x 1700 mm) and UV and salt resistant acrylic sheet (6 x 220 x 220 mm). The webbing had two 25 mm stainless steel rings stitched into one end forming a double O-ring buckle. The acrylic sheet was cut to size, bent to conform with the carapace shape and all edges polished by a flame and lined with rubber mat that did not compress at depth. The attachment surfaces of the acrylic and the transmitter were scarified before being glued with Sikaflex® 291 marine adhesive. The open end of two straps passed through slits in the acrylic plate forward either side of the neck; two passed laterally in the mid-section and two passed to the rear of the turtle. The respective buckles were dorsal to the plate and double thickness of webbing was in contact with the acrylic plate (Figure 3). A steel plate formed by six 25 mm mild steel rings welded in a 2 by 3 arrangement formed the plastron plate (Figure 4) through which the straps passed to join at the buckles at the acrylic plate supporting the tag.

To attach the harness all the straps were attached loosely to the buckles through the plastron plate. The harness was held in front to the turtle as she crawled towards the water after nesting. The side and rear straps were held wide for the turtle to crawl into the anterior straps. Straps were then tightened, and the acrylic platform placed in the appropriate position. Straps were then cut to length and secured with a webbing lock of mild steel. The rear straps were held in position by webbing lock of extended length or crossed over on the carapace and secured with a single webbing lock. The harness and straps were then coated with antifouling paint (Figure 5) and allowed to dry, to touch, before allowing the turtle to make its way to the water (Figure 6).

Two post-nesting flatbacks left Bare Sand Island on 19 September 2015. Turtle 1, 120869, travelled 5967 km in 337 days and Turtle2, Ev, travelled 1986 km in 93 days before their respective signals ceased (Figure 7).

Figure 1. Harness Attachment using a crate in 2001.

Figure 2. Restraining turtle while bending staples over Velcro straps in 2001.

Figure 3. Dorsal surface of the harness on model turtle in 2016.

Figure 4. Ventral view of harness showing the plastron rings in 2016.

Figure 5. Applying Antifouling paint in 2016.

Figure 6. Turtle heading to water in 2016.

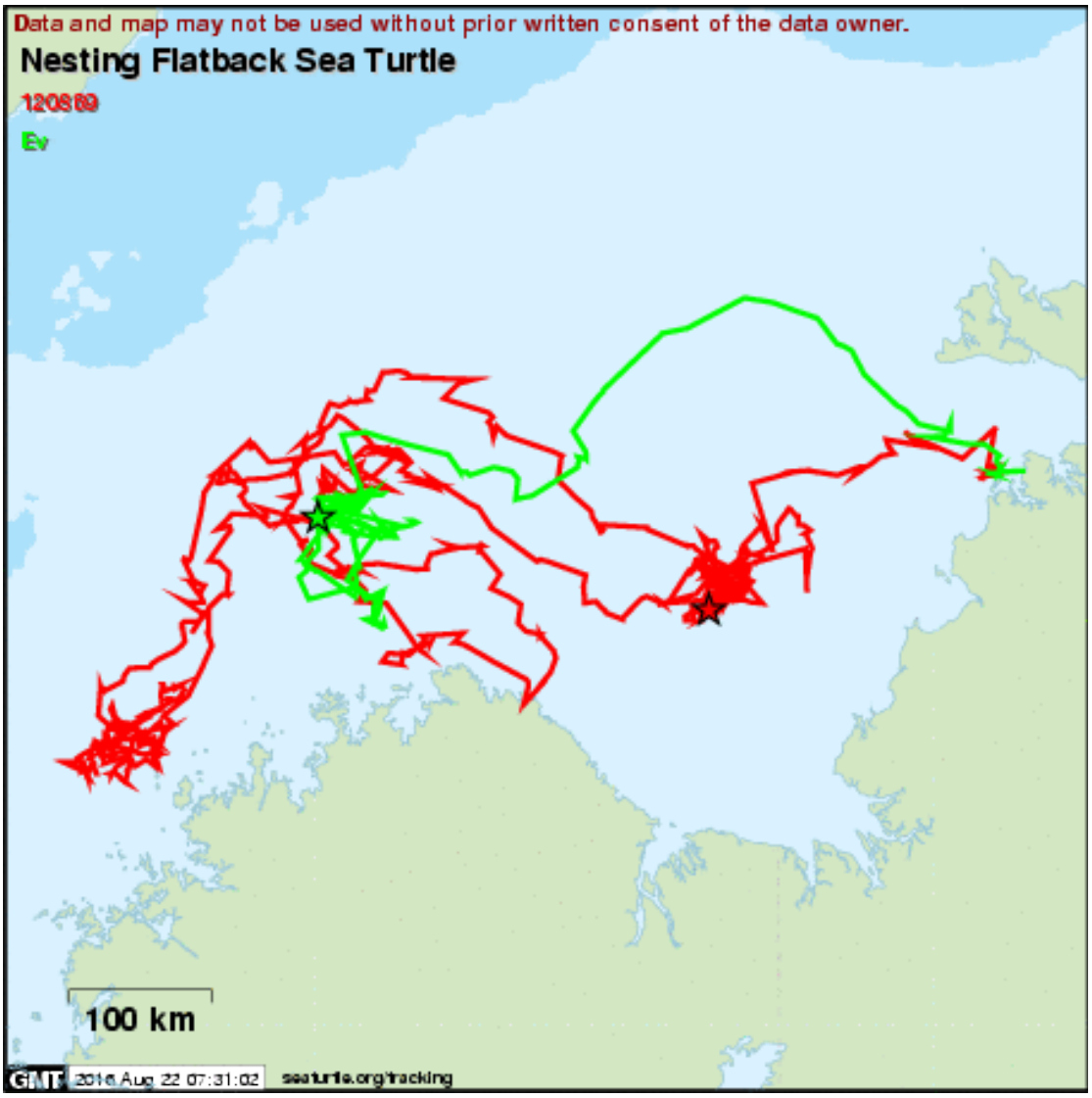

Figure 7. Satellite tracks of post-nesting flatback turtles 120869 and Ev fitted with the slip-on harness.

Acknowledgement:

We acknowledge the contribution of Cardno Ecology lab and Inpex for the donation of the satellite tags. Parks and Wildlife NT for Scientific Permit, 54991, and the Animal Ethics Committee of Charles Darwin University for animal ethics authorisation, A11028. The Rosella Guides with their leader Sam Walker kindly make the paper mache green turtle used to demonstrate the slip-on harness.

References:

Guinea, M.L. Sperling, J.B. & Whiting, S.D. 2006 Flatback sea turtle inter-nesting habitat in Fog Bay NT. In Proceedings of 23rd Annual Symposium of Sea Turtles Biology and Conservation p. 229.

Sperling, J. B. and Guinea, M. L. 2004. A harness for attachment of satellite transmitters on Flatback Turtles. *Marine Turtle Newsletter* 103:11-13.

Delegate Feed back

Please fill this sheet and detach it and place it at the registration desk at the conclusion of the symposium. Thank you

	Topic	1	2	3	4	5 strongly agree
1	The 3rd ASTS provided me with new information and/or skills				3	2
2	The 3rd ASTS has given me greater understanding of sea turtle research and conservation in Australia				2	3
3	The 3rd ASTS has given me greater understanding on the pressures on sea turtle in Australia				3	2
4	The oral presentations were interesting and useful				2	3
5	The extended tea breaks and lunch breaks were useful for networking				2	3
6	The poster presentations were useful and could be expanded		1		3	1
7	Extra time for questions would be useful at the end of each presentation		2	2	1	
8	The information provided by the organizing committee and website was clear		1	1	3	
9	The catering was sufficient in quality and quantity					5
10	The venue was suitable					5
11	If you stayed at TWP were the facilities adequate					2
12	I would recommend the next ASTS to others				1	4
13	There was enough time to interact and socialise					5
14	The workshops were a useful				2	1

Short Answers

What is the most appropriate format for oral presentations? Is 10 minutes with 2 minutes for questions adequate?

1. yes
2. yes
3. yes
4. Yes Excellent
5. Yep

What improvement would you suggest for future symposia?

1. Better communication with participants
2.
3. Repeating tagging workshop for new volunteers. Alternate workshops (choices) for scientific / non-scientific / methodology. Increase the number of presentations with a choice of sessions and topics
4.
5.

What was the highlight for you of the 3rd ASTS?

1. Presentations and networking: catering fantastic
2.
3. Having everything in one venue (including accommodation). Col's history of tagging and use of tags – very informative for "non-scientists" / volunteers
4. Nothing in particular – everything in general
5.

Please add any other comments on the 3rd ASTS

1.
2.
3. Good to have lots of informative sessions and presentations for the "non-scientists" i.e. volunteers and community group workers. - If there was a list of all the delegates and where they came from, just on a notice board. - It is time to start documenting the dates, locations of previous symposia so every delegate gets the picture. – Advertise / promote need for variety of topics in both scientific and non-scientific fields (some people thought beforehand that it would all be "above their heads"
4. With the outdoor screen, larger font would have been better on screen. -a list of attendees and their origins on display. – keep a balance between scientific and volunteer. – All sessions need a microphone for the speaker.
5.

Review of Third Australian Marine Turtle Symposium

The venue for the symposium was chosen because it provided a comfortable relaxed atmosphere conducive to mixing and mingling with fellow delegates in a natural environment. The Territory Wildlife Park opened its doors to us, provided a guided night walk through the park, provided open access during the days, facilitated camping and provided all meals, morning and afternoon teas and beverages for the three days. It was hoped the informal surrounding with many shady trees and use of the facilities of the park would provide break out areas where interested groups could meet and still be within vision and earshot of the presentations. This relaxed atmosphere increased as the symposium progressed.

Some delegates used the camping facilities and were rewarded with the night sounds of Night Jars, Bush Stone-Curlews and dingoes with a dawn chorus lead by the Orange-footed Scrubfowl.

The symposium had 77 delegates and 38 presentations with 34 Extended Abstracts submitted. Two posters were included in the abstracts. Only five delegate feedback forms were received. These have been reproduced in the accompanying table. Most either agreed or strongly agreed with the statements. The simple short answer responses emphasised the need to have sessions for the scientists and others for the non-scientists. Science is a way of thinking and developing a reproducible methodology. The scientific approach is developed in all of us and the perceived division is unfortunate. Perhaps we should adopt more appropriate terminology to be more inclusive in future symposia.

Points to consider in future symposia:

- Be inclusive in terminology for the diverse nature of the delegates.
- Encourage indigenous participation.
- Ensure there is a theme to the presentations.
- Poster sessions should be encouraged with a formal poster presentation time.
- Allow plenty of time for networking, socializing and meeting delegates from different areas.
- Social events and ice breakers are an important part of the symposium.
- Keep an eye on budgets and pledges.


23 . 08 . 201


24 . 08 . 2016

Proceedings of the

Third Australian Marine Turtle Symposium

Territory Wildlife Park, Berry Springs

Darwin 22 - 24 August 2016