FUNDACIÓN CORCOVADO
PROGRAMA DE CONSERVACIÓN DE TORTUGAS MARINAS

Investigation and Conservation of Sea Turtles Drake Bay, Osa Peninsula, Costa Rica

Final Report

2013 Season

Prepared by Dr Rob James
Program Director

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David Cooch, Òscar García Cordero
Coordinators

Program Personnel

Dr Rob James | Program Director

Rob obtained his PhD in molecular biology from University College London in 2007, for the investigation of functions of neurotransmitter receptors. He has held research management positions at the Royal College of Art and the Wellcome Trust in the UK, and has conducted research at SymbioticA at the University of Western Australia. Rob has worked as a Coordinator and Research Assistant at various conservation and wildlife projects in Latin America since 2009, and has traveled and volunteered around the world, visiting over 45 countries. Rob joined the Corcovado Foundation as Program Director in 2011.

Mario Varela Murillo | Coordinator (July-December)

Mario is a local Patrol Leader and member of ACOTPRO who has been working with the program for four years. The most enthusiastic and committed of associates, Mario was given the post of Coordinator in 2013 and trained in project management, data analysis, conservation methodology, volunteer coordination, English and computing skills, and has emerged as the member of the community most qualified to lead a locally-managed turtle project. Mario is currently working as a Research Assistant with PRETOMA in Playa Caletas, and he also manages a local ecotourism business with his family in Los Ángeles de Drake, called 'Descubre la Naturaleza'.

Saioa Eraso Rodriguez | Coordinator (July-December)

Sai is a biologist from the Basque Country who obtained her Master of Biology in 2010, with a specialization in Zoology, from the Universidad Complutense de Madrid (UCM). She has held Research Assistant positions with WIDECAST at Pacuare and Playa Blanca, and with Osa Conservation at Playa Piro in the Osa Peninsula. After working the entire 2013 season as a Coordinator with the Corcovado Foundation, Sai went on to become Coordinator at the PRETOMA project in Playa Caletas, Guanacaste.

Aida García Solà | Coordinator (September-December)

Aida is a Marine Biologist from Barcelona, Spain and a Master in Oceanography and Marine Management at Barcelona University, 2008. Her passion for sea turtles began in 2005 when she worked with a scholarship at CRAM (Centre for the recuperation of marine animals), Barcelona, rehabilitating sick Loggerhead turtles and other sea creatures. She worked in several conservation projects in Spain, Greece and Australia, before joining the Corcovado Foundation as a Coordinator in 2013. Aida continues to work with sea turtles in Costa Rica, taking up her new post as Biologist at Reserva Pacuare in February 2014.

Program Personnel continued

David Cooch | Coordinator (August-December)

David graduated from Northeastern University with a degree in Biology and a minor in Environmental Science after completing an internship at the Sea Turtle Restoration Project in San Francisco. David came to the project as a volunteer for three months in 2012, before returning in 2013 as a Coordinator.

Òscar García Cordero | Coordinator (July-September)

Òscar is a vet from Spain, who graduated at Universitat Autònoma de Barcelona in 2005. He has always been interested in wildlife animals and their rehabilitation. His first contact with sea turtles (Loggerhead turtles) was in 2003 while finishing his studies in Veterinary Medicine and working as a volunteer vet in CRAM (Centro de Recuperación de Animales Marinos), Barcelona. In 2012 he got a Master Degree in Education, with a specialization in Biology. After gaining more in field experience working as a Coordinator with the Corcovado Foundation, he hopes to continue working in environmental conservation and education.

'Así no se dice Mario'

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We extend our sincere gratitude to all of the volunteers who came to Drake Bay this year and made a difference. You know that we couldn't have done it without you, and don't forget that you are the real heroes! You set a positive example for the local people here, traveling 1000s of kilometers to bring income to their village, put food on their tables, enrich their lives through cultural exchange, and remind them of the importance of looking after this incredible gift of nature they have been bestowed.

The last season of the turtle conservation program in Drake Bay in its current format, 2013 has been the smoothest and most efficient to date, running like an oiled machine lubricated by eight years of wisdom and experience of working with the community of El Progreso. If only the turtles had nested in greater numbers – we were more than ready for them! Saludos, and… Pura Vida!

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Turtle Exits		Initial Destiny of Nests					
Nests	False Exits	Left *In Situ*	Relocated (Hatchery)	Relocated (Beach)	Poached	Predated	**Total**
86	21	9	58	9	9	1	**107**

3.1.2 Summary of Turtle Sightings

Turtle Sightings					
Total Turtle Sightings	As Percentage of Turtle Exits	Distinct Turtle Sightings	Re-Nesting 2013 Season	Re-Migrating from Previous Season	Migrating from Other Program
52	48.6%	45	11	8	0

3.1.3 Summary of Tagging of Nesting Turtles

Distinct Turtle Sightings (45)				
Of Which Nested	Arriving With Previous Tags	Leaving With Previous Tags	Leaving With New Tags	Leaving Without Tags
39	9	6	34	1
Percentage	23.1%	15.4%	87.2%	2.6%

3.1.4 Summary of Patrols and Hatchery Shifts

Patrol and Hatchery Shifts 01 July – 15 December 2013				
Night Patrol Shifts	Hatchery Shifts	ACOTPRO Shifts	ACOTPRO Donated ($)	ACOTPRO Paid ($)
361	534	355	0	7,100
		Percentage	0%	100%

3.2 Tagging of Nesting Turtles

Left Flipper		Right Flipper		Re-migrating from	Beach	Name
New Tag	Old Tag	New Tag	Old Tag			
OP1527		OP1528			DRAKE	BIENVENIDA
	YES		YES	??	DRAKE	DECONOCIDA
OP1505		OP1506			DRAKE	NARA
OP1533		OP1534	OSA02425	2010 & 2011	DRAKE	ANTIGUA
OP1520		OP1521			DRAKE	AXUN
OP1597		OP1598			DRAKE	ANNA
OP1555		OP1556			DRAKE	KURRY
OP1507	OP1773	OP1508	OP1774	2012	DRAKE	PANDIA
OP1503	OP1733	OP1504	OP1734	2012	DRAKE	COCO LOCO
OP1509	EVIDENCE	OP1510	EVIDENCE	??	DRAKE	LUNA
OP1575		OP1576			DRAKE	ILARGI
	OP1749		OP1750	2012	DRAKE	NAUFRAGIA
OP1559		OP1560			DRAKE	LUCILA
OP1552	OSA02458	OP1553		2010 & 2011	DRAKE	GANADITA
OP1581		OP1582			DRAKE	LAURA LEE
OP1537		OP1538			DRAKE	CUB MUSCH
OP1547		OP1548			DRAKE	JASON THE MAN
OP1567		OP1568			DRAKE	REVOLUCIONISTA
OP1595		OP1596			DRAKE	MIRANDA
OP1590		OP1589			DRAKE	MACADAMIA
OP1593		OP1594			DRAKE	LORALIE
OP1565		OP1566			DRAKE	CRIMSON TIDE
OP1571		OP1572			DRAKE	SASHA
OP1515		OP1516			DRAKE	OLIVA
OP1807		OP1518			DRAKE	JASMINE PETUNIA
OP1549		OP1550			DRAKE	TORTUGA TICA
	OP0454	OP1578		2011	DRAKE	SCHECTER
OP1752		OP157x			DRAKE	PASCU
OP1585		OP1586			DRAKE	GIGI
OP1591		OP1592			DRAKE	COWBERT
	??		OP1771		DRAKE	TOFINO
NG421		NG422			DRAKE	SEY
NG423		NG424			DRAKE	STEPHANIE
OP1573		OP1574			DRAKE	MARJORIE
OP1579		OP1580			DRAKE	OSCARITA
	318		322	??	DRAKE	NO NAME
OP1526		OP1527			DRAKE	NO NAME
	OP1812				DRAKE	IXCHEL

3.3 Training Activities

3.3.1 ACOTPRO Training Courses

Training Course and Post	Details
Course 1 – Antecedentes **Post – Patrol Assistant**	This course is mandatory for all members of the association and includes information regarding the history of the program, construction of the field station and hatchery, work plan and logistics, night patrols, and turtle biology. Upon completion of this course, successful candidates are certified as **Patrol Assistants** and may begin to accompany Patrol Leaders during night patrols, and Hatchery Managers during hatchery shifts. Patrol Assistants are required to assist with at least one night patrol voluntarily every 14 days, or every 7 days if they are operating a homestay house.
Course 2 – Patrullaje **Post – Patrol Leader**	This course includes information regarding work plan and logistics, responsibilities of Patrol Leaders, rules, light signals, conservation strategy, night patrols, relocation of nests, and receipt of nests by Hatchery Managers. Upon completion of this course, and extensive training in the field, successful candidates are certified as **Patrol Leaders** and may begin to lead night patrols and earn a salary.
Course 3 – Vivero **Post – Hatchery Manager**	This course includes information regarding work plan and logistics, responsibilities of Hatchery Managers, rules, light signals, relocation of nests to the hatchery, liberation of hatchlings, and exhumation of nests. This course was followed by a multiple choice examination. Upon completion of this course, and extensive training in the field, successful candidates are certified as **Hatchery Managers** and may begin to work alone in the hatchery and earn a salary.

3.3.2 Summary of ACOTPRO Leader Training

#	Member	Date Course 1	Patrol Assistant	Date Course 2	Patrol Leader Course 2	Date Course 3	Hatchery Manager Course 3
1	Alberto Rivera *	06.08.2013	Yes	23.09.2013	Yes		No
2	Alexander Jimenez	06.08.2013	Yes	25.07.2013	Yes	25.07.2013	Yes
3	Carlos Castro *	06.08.2013	Yes	03.09.2013	Yes		No
4	Cristian Obando	06.08.2013	Yes	03.08.2013	Yes	03.08.2013	Yes
5	Edin Pomares	06.08.2013	Yes	03.08.2013	Yes	03.08.2013	Yes
6	Emilce Torres	06.08.2013	Yes		No		No
7	Emilio Varela *	06.08.2013	Yes		No		No
8	Felipe Rodriguez	06.08.2013	Yes	25.07.2013	Yes	25.07.2013	Yes
9	Fernando Chavez	06.08.2013	Yes	03.08.2013	Yes	03.08.2013	Yes
10	Francisco Mendoza	06.08.2013	Yes	25.07.2013	Yes	25.07.2013	Yes
11	Geovanni Torres*	03.10.2013	Yes		No	03.10.2013	Yes
12	Hannia Arguijo *	12.09.2013	Yes		No	19.09.2013	Yes
13	Hernando Diaz *	06.08.2013	Yes	10.09.2013	Yes		No
14	Isaias Juarez	06.08.2013	Yes		No		No
15	Jhonson Villalobos	06.08.2013	Yes	25.07.2013	Yes	25.07.2013	Yes
16	Karen Villalobos	06.08.2013	Yes		No	11.11.2013	Yes
17	Lilian Jimenez *	12.09.2013	Yes		No	19.09.2013	Yes
18	Manuel Rojas	06.08.2013	Yes	25.07.2013	Yes	25.07.2013	Yes
19	Marielos Almengor	06.08.2013	Yes		No		No
20	Mario Varela	06.08.2013	Yes	25.07.2013	Yes	25.07.2013	Yes
21	Martin Diaz *	06.08.2013	Yes	03.09.2013	Yes		No
22	Maximiliano Rojas	06.08.2013	Yes	25.07.2013	Yes	25.07.2013	Yes
23	Migue Sanchez	06.08.2013	Yes	25.07.2013	Yes	25.07.2013	Yes
24	Minor Montero	06.08.2013	Yes	03.08.2013	Yes	03.08.2013	Yes
25	Olga Jimenez	06.08.2013	Yes	03.08.2013	No	03.08.2013	Yes
26	Olmer Salazar	06.08.2013	Yes	25.07.2013	Yes	25.07.2013	Yes
27	Oscar Mora *	06.08.2013	Yes		No		No
28	Pablo Bermudes *	06.08.2013	Yes	23.09.2013	Yes	19.09.2013	Yes
29	Venero Varela	06.08.2013	Yes	25.07.2013	Yes	25.07.2013	Yes
30	Victor Rojas	06.08.2013	Yes	03.08.2013	Yes	03.08.2013	Yes
31	Yaznir Salazar	06.08.2013	Yes	03.08.2013	Yes	03.08.2013	Yes
32	Yeudy Salazar	06.08.2013	Yes	03.09.2013	Yes		No
	* = new member	**Total**	**32**	**Total**	**22**	**Total**	**22**

Date, Activity and Location	Results
Thursday 25 July 2013 Course 2 - Patrullaje Course 3 - Vivero Main Camp.	10 existing Patrol Leaders and Hatchery Managers from ACOTPRO attended a refresher training session, covering Courses 2 and 3, so that they could begin their paid night patrol and hatchery shifts from Monday 29 July 2013. All 10 members were newly certified as **Patrol Leaders** and **Hatchery Managers** for the 2013 season.
Saturday 03 August 2013 Course 2 - Patrullaje Course 3 - Vivero Main Camp.	7 more existing Patrol Leaders and Hatchery Managers from ACOTPRO attended a refresher training session, covering Courses 2 and 3, so that they could begin their paid night patrol and hatchery shifts from Monday 05 August 2013. 6 members were newly certified as **Patrol Leaders** and **Hatchery Managers** for the 2013 season, and 1 was certified as a Hatchery Manager only.
Tuesday 06 August 2013 Course 1 - Antecedentes Main Camp.	29 members of ACOTPRO attended the mandatory training Course 1 and were certified as **Patrol Assistants**.
Tuesday 03 September 2013 Course 2 – Patrullaje Main Camp.	3 members of ACOTPRO (including 2 new members) attended the training Course 2 and were certified as **Patrol Leaders**.
Tuesday 10 September 2013 Course 2 – Patrullaje Main Camp.	1 new member of ACOTPRO attended the training Course 2 and was certified as a **Patrol Leader**.
Thursday 12 September 2013 Course 1 - Antecedentes Main Camp.	2 new members of ACOTPRO attended the mandatory training Course 1 and were certified as **Patrol Assistants**.
Thursday 19 September 2013 Course 3 - Vivero Main Camp.	2 new members of ACOTPRO attended the training Course 3 and were certified as **Hatchery Managers**.
Monday 23 September 2013 Course 2 – Patrullaje Main Camp.	2 new members of ACOTPRO attended the training Course 2 and were certified as **Patrol Leaders**.
Thursday 03 October 2013 Course 3 - Vivero Main Camp.	1 new member of ACOTPRO attended the training Course 3 and was certified as a **Hatchery Manager**.
Monday 14 October 2013 Course 2 - Patrullaje Course 3 - Vivero Main Camp.	All 26 local leaders (Patrol Leaders and Hatchery Managers) attended a mandatory refresher course covering important issues from Course 2 and Course 3.
Tuesday 15 October 2013 Workshop: Accounting Main Camp.	Ana Suarez from the Corcovado Foundation visited to provide the first of the training workshops for the Junta Directiva of ACOTPRO.
Tuesday 22 October 2013 Workshop: Web page Main Camp.	During this training workshop a brainstorm exercise took place with the participation of international volunteers to propose a set of improvements for the ACOTPRO website.
Tuesday 29 October 2013 Workshop: Web page Main Camp.	During this training workshop a number of issues relating to the logistics of coordinating the 2014 season, and new content was edited for the ACOTPRO website.

Date, Activity and Location	Results
Monday 11 November 2013 Course 3 - Vivero Main Camp.	1 new member of ACOTPRO attended the training Course 3 and was certified as a **Hatchery Manager**.
Tuesday 12 November 2013 Workshop: Web page Main Camp.	During this training workshop new content was edited for the ACOTPRO website and 50 images were selected from the archives of the Corcovado Foundation turtle program.

3.3.3 Summary of ACOTPRO Coordinator Training

Date, Activity and Location	Results
01 July – 15 December 2013 Main Camp and Drake Beach.	• For the 2013 turtle season, a Coordinator has been contracted from the ACOTPRO association: Mario Varela Murillo. • Mario is contracted for 30 hours per week • Mario is required to coordinate all ACOTPRO shifts and complete weekly training to prepare the documentation and infrastructure required for a future independent ACOTPRO turtle conservation project.

3.3.4 Volunteer Training Courses

Training Course and Post	Details
Course 1 – Volunteer Program	This course includes information regarding the birth of the program, objectives and organogram, orientation, role of the volunteer, area of study, accommodation, local excursions, safety and security, plan of work and logistics.
Course 2 – Turtle Biology	This course includes information regarding evolution of land, freshwater and sea turtles, the life cycle of sea turtles, nesting behavior, sea turtle species, dangers, and the ways in which we can protect nature and the environment.
Course 3 – Methodology **Post – Patrol Assistant** **Post – Hatchery Manager** **Post – Patrol Leader**	This course includes information regarding rules, light signals, census of tracks, night patrols, relocation of nests, liberation of hatchlings and nest exhumation. Upon completion of this course, volunteers are certified as **Patrol Assistants** and **Hatchery Managers** and may begin to accompany Patrol Leaders during night patrols and to work alone in the hatchery. After completing extensive training in field, Coordinators (and occasionally a small number of volunteers) are also certified as **Patrol Leaders**.

3.3.5 Summary of Volunteer Training

01 July – 15 December 2013 Course 1 - Volunteer Program Course 2 - Turtle Biology Course 3 - Methodology Main Camp.	• 65 volunteers and 5 Coordinators have completed all three training courses, and have been certified as **Patrol Assistants** and **Hatchery Managers**, and the 5 Coordinators have also been certified as **Patrol Leaders**.

3.4 Homestay Houses

#	House	Beneficiaries	Capacity	Existing/New
1	Lilian Jiménez	Lilian Jiménez or Alexander Jiménez	1	New for 2013
2	Edin Pomares	Edin Pomares	2	Existing
3	Emilio Varela	Emilio Varela, Mario Varela, or Jhonson Villalobos	6	Existing
4	Fernando Chavez	Fernando Chavez, Olga Jiménez or Alexander Jiménez	2	Existing
5	Marielos Almengor	Marielos Almengor or Alberto Rivera	2	Existing
6	Maximiliano Rojas	Maximiliano Rojas, Victor Rojas, or Manuel Rojas	4	Existing
7	Migue Sanchez	Migue Sanchez, Emilce Torres or Karen Villalobos	6	Existing
8	Olmer Salazar	Olmer Salazar or Marvin Salazar	2	Existing
9	Teresa Obando	Teresa Obando	4	Existing

3.5 Local Excursions

#	Date	Activity	Income ($)
1	03 July	Excursion to 'Descubre la Naturaleza' Project	0
2	06 July	Excursion to 'Madre Selva' project	0
3	10 July	Group tour to Isla del Caño	80
4	19 July	Group tour to Corcovado National Park (Sirena)	20
5	19 July	Excursion to 'Descubre la Naturaleza' Project	0
6	26 July	Excursion to 'Cinta Blanca' Project	0
7	02 August	Group tour to Isla del Caño	10
8	02 August	Group tour to Corcovado National Park (Sirena)	40
9	09 August	Excursion to Ganado Beach	0
10	14 August	Group tour to Corcovado National Park	70
11	16 August	Group tour to Isla del Caño	0
12	21 August	Group tour to Playa Rincón, property of Leo Ramsey	0
13	30 August	Group tour to Corcovado National Park	40
14	06 September	Group tour to Corcovado National Park	0
15	13 September	Group tour to Isla del Caño	30
16	11 October	Group tour to Isla del Caño	10
17	08 November	Excursion to 'Cinta Blanca' Project	0
18	15 November	Group tour to Corcovado National Park	10
19	12 December	Group diving tour to Isla del Caño	0
		Total	**310**

3.6 Turtle Adoptions

#	Name of Sponsor	Country	Name of Adopted Turtle	No. Of Sightings	Income ($)
1	CONFIDENTIAL	Spain	Axun	1	50
2	CONFIDENTIAL	Spain	Kurry	1	60
3	CONFIDENTIAL	UK	Luna	1	50
4	CONFIDENTIAL	USA	Laura Lee	1	50
5	CONFIDENTIAL	USA	Cub Musch	1	50
6	CONFIDENTIAL	USA	Jason the Man	1	50
7	CONFIDENTIAL	UK	Revolucionista	1	50
8	CONFIDENTIAL	Australia	Macadamia	1	50
9	CONFIDENTIAL	New Zealand	Crimson Tide	1	0
10	CONFIDENTIAL	UK	Miranda	1	50
11	CONFIDENTIAL	USA	Loralie	1	50
12	CONFIDENTIAL	USA	Gloria	1	50
13	CONFIDENTIAL	USA	Carlita	1	50

14	CONFIDENTIAL	USA	Glimmer	1	50
15	CONFIDENTIAL	USA	Cowbert	1	50
16	CONFIDENTIAL	USA	Tortuga Tica	1	50
17	CONFIDENTIAL	USA	Dorotea	1	50
18	CONFIDENTIAL	USA		0	50
19	CONFIDENTIAL	USA	Gigi	2	50
21	CONFIDENTIAL	USA		0	50
22	CONFIDENTIAL	USA		0	50
23	CONFIDENTIAL	USA		0	50
24	CONFIDENTIAL	USA		0	50
25	CONFIDENTIAL	USA		0	50
26	CONFIDENTIAL	USA	Margie B	1	50
27	CONFIDENTIAL	USA	Oliva	1	50
28	CONFIDENTIAL	USA		0	50
29	CONFIDENTIAL	USA	Fenway	2	50
30	CONFIDENTIAL	USA		0	50
31	CONFIDENTIAL	USA		0	50
32	CONFIDENTIAL	USA		0	50
33	CONFIDENTIAL	UK	Sasha	1	50
34	CONFIDENTIAL	USA		0	50
35	CONFIDENTIAL	USA		0	50
36	CONFIDENTIAL	USA		0	50
37	CONFIDENTIAL	USA		0	50
38	CONFIDENTIAL	USA		0	50
39	CONFIDENTIAL	USA		0	50
40	CONFIDENTIAL	USA	Ellie	1	50
41	CONFIDENTIAL	USA	Jasmine Petunia	1	50
42	CONFIDENTIAL	USA		0	50
43	CONFIDENTIAL	USA	Stefanie	1	50
44	CONFIDENTIAL	USA	Goldie	1	50
45	CONFIDENTIAL	USA		0	50
46	CONFIDENTIAL	USA	Sey	1	50
47	CONFIDENTIAL	USA		0	50
48	CONFIDENTIAL	USA		0	50
49	CONFIDENTIAL	USA	Sarah	1	50
50	CONFIDENTIAL	USA	Page	1	50
51	CONFIDENTIAL	USA		0	50
52	CONFIDENTIAL	USA	Noky	1	50
53	CONFIDENTIAL	USA	Henry	1	50
54	CONFIDENTIAL	USA		1	50
55	CONFIDENTIAL	Germany	Paraíso	1	50
				Total	**2,660**

3.7 Beach Preparation Activities

Date, Activity and Location	Results
04 July – 05 July 2013	• The fibreglass boat was repaired by ACOTPRO member Maximiliano Rojas, and then relocated to the beach.
06 July – 24 July 2013 Construction of hatchery. Drake Beach.	• A new hatchery for the protection of sea turtle nests was constructed behind a barrier of vegetation and sand bags in the South sector of Drake Beach, with help from Corcovado Foundation volunteers and members of ACOTPRO. • The new hatchery has dimensions of 11m by 11m and space for 120 nests, and will remain completely covered by a mosquito mesh roof until 01 October 2013.
06 July – 24 July 2013 Repair and upgrade of vigilance tower (chante). Drake Beach.	• At the beginning of the season the vigilance tower (chante) was found to be in a state of complete disrepair due to vandalism. • The chante was totally restored and upgraded with new walls and furniture with help from Corcovado Foundation volunteers and members of ACOTPRO.
24 July – 26 July 2013 Beach cleaning. Drake Beach.	• Contamination (such as plastic and other waste) was removed from Drake Beach by Corcovado Foundation volunteers.
22 July – 27 July 2013 Beach marking. Drake Beach.	• Reference posts were either repaired or replaced at 25m intervals, dividing Drake Beach into 36 sectors, each with four sub-sectors.
28 July 2013 Trail cleaning. Drake Beach.	• The trail from the runway to the North sector of Drake Beach was cleaned and a new path cut on the beach side of the bridge.
29 July – 30 July 2013 Boat dock repair. Drake Beach.	• The boat dock at the end of the runway was completely remodelled and new stairs were built, providing much safer access to the boats for volunteers and program staff.
7 August – 8 August 2013 Beach cleaning. Drake Beach.	• Contamination (such as plastic and other waste) was removed from Drake Beach by Corcovado Foundation volunteers.
10 September 2013 Hatchery roof removal. Drake Beach.	• The control sand temperature recorded by the data loggers in the hatchery showed an average temperature of 29˚C since 01 August, which is below the optimum of 30.5˚C. In an effort to increase the sand temperature in the hatchery the roof was permanently removed.
01 October – 15 October 2013 Beach cleaning. Drake Beach.	• Beach cleaning has now been incorporated into the weekly work plan so that plastic and other waste is removed every Thursday.
10 October 2013 Chante upgrade. Drake Beach.	• The chante was upgraded with new storm blinds for the peak rainy season expected in late October, to protect it from strong winds and storms.
13 December 2013 Hatchery closure. Drake Beach.	• The hatchery and chante were completely disassembled and the wood and mesh returned to the main camp. The site was cleaned and all trash was returned to the village for recycling.

3.8 Camp Preparation Activities

Date, Activity and Location	Results
April – June 2013 Renovation of camp facilities. Main Camp.	The following repairs and modifications were carried out at the camp in the village of El Progreso: • Roof of dormitory was raised and fans were installed. • Interior ceilings were fitted to the dormitory, bathrooms, laundry area and private rooms. • Two offices were constructed at the front of the property: one for the Corcovado Foundation; one for ACOTPRO. • An additional private room was constructed at the back of the property.
20 June – 15 August 2013 Renovation of camp facilities. Main Camp.	At the beginning of the season the camp was in need of much maintenance work in order to be ready to support the program and the volunteers. • The camp was deep-cleaned. • All interior and exterior walls were painted or varnished. • The original organo-hydroponic veggie garden was deconstructed to make space for a new hydroponic patch. • New furniture was constructed for the office and private room. • Old furniture was sanded and varnished. • A new permanent structure was built in the dormitory to hang the curtains dividing each bunk area. • The bodega and other storage areas were re-painted and re-organized. • Both offices were decorated with painted logos of the Corcovado Foundation, ACOTPRO, and the local eco-tours. • Paths were cleaned and re-laid with stones and many new plants and flowers were planted. • Areas of the property where waste had been dumped by previous owners were cleaned. • The recycling reception at the front of the property was renovated. • Barbed-wired fencing was replaced around the front of the property. • The stairs and trail to the Rio Tortuga were repaired. • The existing clothes drying area was temporarily repaired.
15 July 2013 Building a new recycling sorting center. Agujitas.	• Volunteers assisted with cleaned and restoring a disused building ready for the construction of a new recycling sorting center for the village of Agujitas by the Corcovado Foundation.
24 July 2013 Painting the education center and office of the Foundation. Agujitas.	• Volunteers assisted with re-painting and renovating the interior of the Corcovado Foundation education center and office in the village of Agujitas.

16 August – 15 September 2013 Renovation of camp facilities. Main Camp.	• A new path was constructed from the front office to the rancho, bringing the North side of the property into use. • A new clothes drying house was constructed on the North side of the property. • The original (temporary) clothes drying house was deconstructed. • Bamboo from the original clothes drying house was reused to repair the well roof and the bicycle store roof. • A new path was constructed from the rancho to the barbeque zone and a new structure was built there to store and dry wood. • The main structure of the hydroponic allotment was erected. • The volleyball court was re-laid and made fit for use. • A network of trenches was constructed to improve drainage at the site, especially around the septic tank, ready for the peak rainy season.
16 September – 15 December 2013 Renovation of camp facilities. Main Camp.	• Seeds have been sowed and plants cultivated in the hydroponic allotment. Transplantation to the hydroponics boxes will take place in late October and some crops should be ready by late November. • The composter system has been relocated further from the main camp building. • A mural containing of animals of the Osa Peninsula was painted by an artist volunteer in the main camp building.

3.9 Environmental Education Activities

Date, Activity and Location	Results
17 October 2013 Environmental Education classes. Rancho Quemado.	• A number of volunteers produced classes and activities covering the bioversity of Costa Rican marine ecosystems, and the interaction between different species. • The class was given to a mixture of grades at Rancho Quemado school in two sessions.
16 November 2013 Festival del Árbol. El Progreso.	• A number of volunteers produced games, costumes, props and other equipment for this Environmental Education festival. • The volunteers assisted throughout the weekend with the coordination of the festival.
19 November 2013 Environmental Education classes. Rancho Quemado.	• A number of volunteers produced classes and activities covering the different sea turtle species. • The class was given to a mixture of grades at Rancho Quemado school in two sessions.

3.10 Festival Activities

Item	Results and Activities
Attendance	• The festival was attended by about 150 people on Saturday 7 December and 250 people on Sunday 8 December.
ACOTPRO stalls	• Thanks to a specific donation from Pro Nature to assist with the festival, ACOTPRO members were able to take advantage of rent-free space at the festival from which to sell typical food, tours and arts and crafts. • ACOTPRO had 4 stands which it sold to its members and individuals outside of the association.
Corcovado Foundation stall	• The Corcovado Foundation sold several items at its stall, including: T-shirts, hats and re-useable shopping bags.
Donated food and accommodation	• Jade Mar: 1 room for 2 persons, two nights, with breakfast. • Hotel Mirador: 1 room for 2 persons, two nights, with breakfast. • Pirate Cove: Lunch for 50 children. • Aguila de Osa: Dinner for 50 children. • La Paloma: Lunch for 50 children.
DJ and music	• Francisco Delgado of the Corcovado Foundation donated all equipment for music and was the host and DJ for the festival.
Performances by professional artists	• 3 circus/clowns
Performances by out-of-school groups	• Play by the Pumas of El Progreso • Play by the Águilas of Los Ángeles • Play by the Jaguares of Agujitas
Games and Competitions	• Grand infantile rally. • Various small games for children. • Football and volleyball tournaments.
Turtle Liberations	• Olive Ridley hatchlings were liberated in front of tourists and locals on Sunday 8 December.

4.0 Introduction

4.1 Background

Until eight years ago, the reality in Drake Bay was not different to hundreds of other beaches where the sea turtle trade was considered a source of income. In the years prior to the implementation of this conservation program, the harvesting of eggs by local poachers resulted in the loss of over 85% of the nests laid in the area each year (Sanchez F, 2006). The Olive Ridley population, the main species in this area, declined dramatically in Drake Bay to the point at which it became endangered, and the protection and recuperation of this population became essential due to its biological and ecological value.

There were several failed attempts to establish a sea turtle monitoring program at Drake Beach prior to 2006, mainly due to the low confidence of the local population regarding conservation initiatives in the area. The presence of foreigners, a fear of adopting new habits, and the enforcement of restrictions designed to protect natural resources that were previously exploited, brought about confrontation that took a long time to neutralize. In 2006, however, an urgent appeal was made to the Corcovado Foundation from locals in Drake Bay regarding the rapid disappearance of the turtle population, one which motivated the organization to reallocate resources and create a permanent program at Drake Beach. Three Field Coordinators were initially sent to initiate a conservation program designed to facilitate the recovery of the local population of nesting turtles after decades of egg poaching. The appointment of a Scientific Coordinator, with experience working on similar programs all over the world, brought about the standardization of methods and the implementation of field techniques necessary to study the population. The program was also able to take advantage of the combined knowledge and experience of the Field Coordinators, by selecting the very best ideas from other existing sea turtle programs around Latin America.

Where the Corcovado Foundation Sea Turtle Conservation Program differed from previous aborted initiatives in the region was through its recognition of the importance of achieving a balance between conservation objectives and local socioeconomic development. Conservation programs that focus solely on the biological aspects of the ecosystem are invariably doomed to failure, as conflicts arise continuously with the needs of the local population. By pursuing a policy of clarity, transparency and respect, and engagement with the local community from the outset, the program aims to empower local people and equip them with the prerequisite skills and infrastructure to take control of their own sustainable economic future, facilitated by the conservation of their natural resources.

4.2 Objectives

The Corcovado Foundation Sea Turtle Conservation Program arose from the need to work toward the protection and preservation of sea turtles and their nesting beaches in Drake Bay. The project strategy was built around the creation of a viable socioeconomic alternative to consumption of sea turtles for the local communities, while promoting environmental conservation activities at the same time. The Corcovado Foundation aims to sensitize local communities about the importance of protecting and preserving sea turtles, coupling this protection with the opportunity to increase their

incomes directly from contracted work at the conservation project and/or indirectly from the housing of volunteers in homestays, and the development of ecotourism initiatives in the area (Le-Garec A, 2010). In this way, it aims to achieve a reduction of the consumptive use of the sea turtles in Drake Bay through the preservation of this natural resource.

4.2.1 Primary Objective

- To promote the conservation and sustainable recuperation of the population of sea turtles that nests in Drake Bay, in an effort to permit its long-term survival, whilst simultaneously attending to the needs of the community with which it interacts.

4.2.2 Areas of Work

- A **Sea Turtle Conservation Program** using standardized scientific methods to promote the long-term survival of the nesting population, by protecting the turtle eggs from illegal poaching and natural predation.

- An **Environmental Education Program** to increase awareness of the negative impact of the exploitation of natural resources.

- An **Economic Development Program** led by an association of trained local conservationists, designed to foment sustainable socio-economic alternatives for the community through ecotourism and regular contracted work at the program.

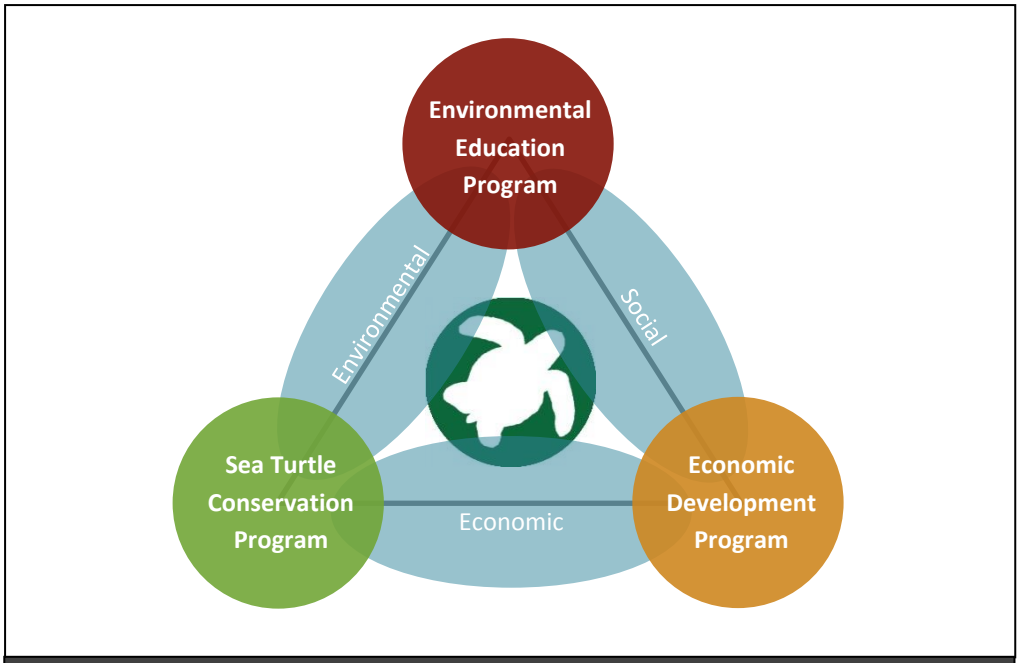


Figure 1. A diagram showing how the areas of work at the program are bound together by social, economic and environmental interests

4.3 The Corcovado Foundation and ACOTPRO

The success of the conservation effort since the program's conception in 2006 would not have been possible without the unwavering support, hard work and dedication of members of the local community. Whilst some contracted jobs were created by the Corcovado Foundation from the outset, the majority of the work conducted by local participants from 2006 to 2009 was voluntary. However, through a combination of the acquisition of specific grants, the restructuring of resources and an increase in the fee for international volunteers, local trained leaders have benefited from regular contracted work at the program, in the form of paid night patrol or hatchery shifts, since 2009. In light of this development a community association, known as ACOTPRO (Asociación Conservacionista para la Protección de la Tortuga Marina del Progreso), was conceived through the program in 2008, designed to function as a stand-alone entity that represents and manages the interests of its members. Complete with its own elected Board of Directors, legal infrastructure and bank account, ACOTPRO provides a vehicle for community-led development, self-determination, self-management and ethically-sound enterprise in the region.

Affiliation to the association, open to any member of the community over 15 years of age, is achieved through payment of a membership fee and signing of a declaration. This declaration binds each member into an enforceable code of conduct that prohibits the illegal or unregulated extraction of natural resources, and promotes the protection and non-consumption of sea turtles. Affiliation entitles members to access the free English classes offered by the program, and opens up the opportunity to become a contracted Leader or participate in the homestay network (see **Section 5.2**), but it also demands participation in the program as a volunteer, attendance at meetings, and the completion of mandatory basic training. The association typically consists of around 30 members, from the communities of El Progreso, Agujitas and Los Ángeles.

Figure 2. Members of ACOTPRO undergoing training at the Main Camp in El Progreso (**A**) and in the hatchery on Drake Beach (**B**)

As a key partner in the program, ACOTPRO works closely with the Corcovado Foundation to realize the program's objectives. The association is responsible for administering the income earned by Leaders contracted by the program, including that derived from ecotourism; for co-managing aspects of the program, such as the annual Turtle Festival; and for managing all business relating to its members, such as disciplinary matters. In 2009 and 2010, trained local leaders were required to

donate 50% of their shifts as unpaid volunteers. In 2011 this mandatory donation was reduced to 25% of shifts, and eradicated altogether for 2013. The salary paid per shift also increased dramatically from $12 in 2012 to $20 in 2013. Certification as a Patrol Leader or Hatchery Leader is dependent upon satisfactory completion of an advanced training program, which tests the scientific rigor, aptitude, and people-management skills of the candidate, and appointment of each new leader is entirely at the discretion of the Program Director. All non-leaders are required to donate shifts equivalent to 25% of the total workload of a contracted leader over the course of the season.

Whilst necessarily independent and 100% locally managed, ACOTPRO benefits from its affiliation to the not-for-profit Corcovado Foundation through the latter's promotion of the program, its recruitment of fee-paying volunteers to the community, and its access to networks of third-party donors, charities and funding bodies. This affiliation helps to bolster the association's integrity and ability to attract its own funding, and ACOTPRO successfully won a competitive grant from the Osa Community Development Fund (FACOSA) in 2012. It is anticipated that the Corcovado Foundation will hand-over control of the turtle conservation project to ACOTPRO for the 2014 season.

4.4 Volunteer Program

As with most other sea turtle conservation initiatives, the donation of time, money, labor and expertise by volunteers is a cornerstone of the program at Drake Bay, without which it could not have been established nor continue to function. The successes of the program to date are testimony to the efforts of over 400 volunteers, both international and Costa Rican, who have traveled to Drake Bay to work at the program since 2006.

Volunteers are typically individuals who approach the Corcovado Foundation directly, or are referred via a third party volunteer recruitment organization, and stay for a minimum 15-day period. These core volunteers were housed in a common dorm from 2006-2009 and a volunteer house in 2010, and since 2011 have been housed in an ACOTPRO homestay network in the village of El Progreso.

Figure 3. Volunteers undergoing training at the Main Camp in El Progreso (**A**) and on an excursion to Isla del Caño (**B**)

During 2012 a new camp was constructed for the program on land purchased for the Corcovado Foundation by a private donor, and this site also housed Program Director and Environmental Educator, the Coordinators, and some volunteers. All volunteers receive comprehensive training that incorporates orientation, turtle biology, and conservation methodology. This training equips volunteers with the skills required to partake in night patrols or to work at the hatchery, and completion of this training is a prerequisite for participation in conservation activities. Whilst all volunteers typically take part in night patrols, those who possess particular skills may also become fully capacitated Patrol Leaders and/or Hatchery Managers. All volunteers are able to participate in activities from the Sea Turtle Conservation, Environmental Education, and Economic Development components of the program, and volunteers are encouraged to take part in work that is particularly suited to their specific skills and experience.

The program offers a number of recreational activities for volunteers, which include excursions to Isla del Caño, the Corcovado National Park, and the Térraba-Sierpe National Park mangrove forest, canopy tours, kayaking, quad-biking, fishing, trekking and horse-riding trips. Consistent with the goals of the Economic Development initiative, the program makes use of local guides wherever possible and has helped to establish a number of eco-tours to local farms in the area. These micro-excursions include not only treks and day-trips but also cooking classes and working at traditional farms. At least one such excursion is planned per week for volunteers, along with a movie night and a party night. Volunteers are also encouraged to spend time with their host families, to take part in family activities and to take day trips with them where appropriate.

4.5 Sea Turtle Conservation Program

The Corcovado Foundation has operated the sea turtle conservation program in Drake Bay since 2006 under research permit INV-ACOSA-011-06, issued by the Costa Rican Ministry of Environment, Energy and Telecommunications (MINAET), as part of the Osa Conservation Area. The principal objective of the program is to promote the conservation and sustainable recuperation of the population of sea turtles that nests in Drake Bay, in an effort to permit its long-term survival. The program also aims to characterize the nesting behavior of the turtles reproducing in Drake Bay, in order to inform future conservation strategy, and to prove the effectiveness of the methodologies used, such as the relocation of nests and the use of a hatchery. The program operates standardized methods comparable to those utilized at similar projects around the world, but has also developed conservation activities that reflect the reality of the program's resources, logistical and geographical constraints, and the specific threats to which the population of nesting sea turtles are exposed in Drake Bay. Developed activities include morning patrols (census of tracks), night patrols, hatchery shifts, tagging of turtles, recording of geographic, biometric and behavioral data, relocation of nests, liberation of hatchlings, and exhumation of nests. The conservation program on Drake Beach has operated from July to December each year since 2006, and whenever logistically feasible at Ganado Beach since 2009. Drake Beach has witnessed an average of 164 turtle exits during this period each year since 2006, leaving an average of 131 nests, and the predominant nesting species is the Olive Ridley sea turtle. According to local accounts these levels represent a fraction of the number of turtles that nested in the region even just 20 years ago. Since 2006 the program has succeeded in reversing the decade-long destructive trend caused by illegal poaching that had resulted in the loss of nearly all of the nests left on the beach every year. Now, around 90% of the nests laid each year yield hatchlings that make to the sea to claim their rightful chance at survival. To date the program has tagged over 300 nesting turtles, protected hundreds of nests and released over 65,000 hatchlings into the sea.

Figure 4. A view of the hatchery from the chante (**A**) and the liberation of Olive Ridley hatchlings on Drake Beach (**B**)

The continuous presence of the personnel from the program on the beaches in Drake Bay, combined with the existence of the hatchery building and the increasing participation of members of the community in ACOTPRO, together function as a deterrent against egg poaching in the area. Data from previous seasons at the program show a comparable, and often higher, rate of reproductive success for nest relocated to the hatchery than on the beach (Sanchez F, 2006; Sanchez F, 2007; Melero D, 2008; Melero D, 2009; Melero D, 2010; González-Paredes D, 2011), and the use of a hatchery as a conservation tool is broadly supported by the scientific community (Witherington BE, 2003; Wyneken CL, 1998; Morreale SJ, 1982). As such, the relocation of nests to the hatchery is justified and will remain a priority strategy for the program until such time that the threat of egg poaching has been eliminated in the region.

4.6 Environmental Education Program

The dissemination of environmental education in the Osa Peninsula is a primary objective for the Corcovado Foundation, and the appointment of a dedicated Environmental Educator in Drake Bay has brought about the incorporation of environmental education into the curricula of local schools, before which it was all but non-existent. The Sea Turtle Conservation Program continues to assist the Corcovado Foundation in the realization of this objective by attending environmental education classes in local schools each week, helping to maintaining the out-of-school kids groups in Agujitas, Los Ángeles and El Progreso, known as The Jaguars, The Águilas and The Pumas respectively, and by developing new education activities. The program also engages with the local schools and out-of-school groups to develop materials, activities and performances for the annual Turtle Festival.

It is hoped that through these interactions with the young people from the community, the program will continue to disseminate knowledge about the natural environment, raise awareness of the plight of the sea turtles, and foster a new generation environmentally-conscious locals in Drake Bay who are committed to the conservation of their natural resources.

Figure 5. Environmental education classes at Rancho Quemado school in 2013 (**A**) and the Jaguares of Agujitas waiting to go on stage at the 2013 Turtle Festival (**B**)

4.7 Economic Development Program

The existence of the Sea Turtle Conservation Program in the village of El Progreso has transformed the lives of many of its residents. Since 2006, the program has witnessed a rapid change in the mentality of the local community with regard to the conservation initiatives, and has succeeded in creating new forms of income for the community driven by the conservation of their own natural resources. Money raised by the Corcovado Foundation each year, from donations, grants and volunteer payments, is fed directly into the community in the form of rental payments, and through regular contracted shifts for locals working as Patrol Leaders or Hatchery Managers. The program also stimulates the local economy indirectly through the purchase of consumables by program staff and volunteers in the village, and through the payment for local tours and micro-excursions. The Main Camp also provides an additional focal point for the community within which to interact, and functions as a venue for social events and meetings, including those of ACOTPRO.

A significant ecotourism initiative at the program has been the development of a Turtle Tour, whereby tourists staying in Agujitas pay to participate in a special night patrol. Responsibility for the administration and coordination of this tour was passed from the Corcovado Foundation to ACOTPRO in 2012 and it is hoped that in the future this tour will generate substantial income for the association, allowing the program to become more self-sufficient.

During 2014, it is hoped that responsibility for many other aspects of the program will be passed from the Corcovado Foundation to ACOTPRO, and that the latter will establish its own volunteer program and begin to generate sufficient income from volunteer payments to pay its own Patrol Leaders and Hatchery Managers. The Corcovado Foundation is committed to facilitating this transition in partnership with MINAET, and other stakeholders, such that the Sea Turtle Conservation Program achieves its long-term sustainable economic development objectives

5.0 Preparations

5.1 Main Camp

The main camp was constructed for the program in 2012 based on an extension of an existing building in the village of El Progreso, which was purchased for the Corcovado Foundation by a private donation. The camp features a 12-bed dorm, a private cabin, two bathrooms, two showers, two private rooms, a lockable storeroom, bike storage area and kitchen, and a multi-purpose communal rancho area. During the first month of the season the facilities at the new camp were enhanced with help from Corcovado Foundation volunteers. The camp was re-painted and decorated throughout, new interior ceilings and fans were installed, pine wood was built around the bathrooms and dorm areas, and electrical sockets were installed in the dorm. Fire prevention and safety features were also enhanced, with three fire extinguishers installed along with new signage and a new emergency exit. At the front of the property, two offices were constructed and decorated: one for the Corcovado Foundation; one for ACOTPRO, and an additional private cabin at the back of the property. The garden areas of the property were extensively cleaned and remodelled, and many new plants and flowers were planted to demarcate various zones. A permanent hydroponic allotment was built and continues to be used to grow tomatoes, cucumber, lettuce, basil, cilantro, peppers, broccoli and cauliflower.

Figure 6. The Main Camp under construction during June and July 2012

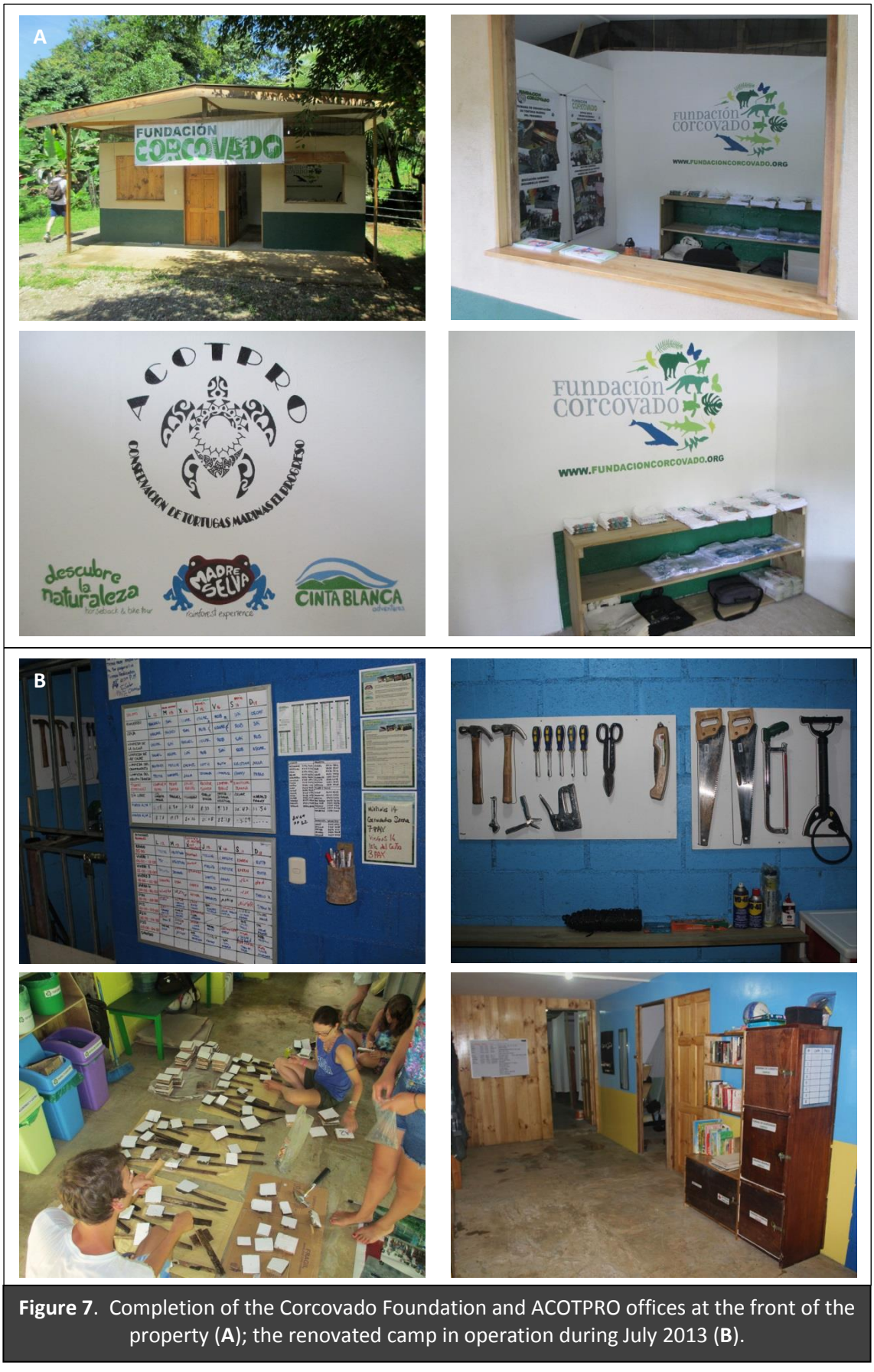


Figure 7. Completion of the Corcovado Foundation and ACOTPRO offices at the front of the property (**A**); the renovated camp in operation during July 2013 (**B**).

Figure 8. Improvements to the garden area showing newly constructed private room (**A**), the renovated dormitory (**B**), new plants and external paintwork (**C**), new barbed-wire fencing (**D**) and renovated recycling reception at the front of the property (**E**).

5.2 Homestay Houses

Nine local houses have now been established as ACOTPRO homestays: the houses of Edin Pomares, Emilio Varela, Fernando Chavez, Lilian Jiménez, Marielos Almengor, Maximiliano Rojas, Migue Sanchez, Olmer Salazar and Teresa Obando. In order for more individuals to benefit from the homestay system, ACOTPRO have begun to divide income from one household between the family members who are ACOTPRO associates. As a result, 16 members have received income this year so far from housing volunteers, up from nine in 2012.

Figure 9. Nine ACOTPRO homestays are now available in the village of El Progreso

5.3 Hatchery and Chante

The hatchery for the 2013 season was constructed with help from Corcovado Foundation volunteers and members of ACOTPRO. First, the vegetation covering the sand was cleared and the perimeter of the hatchery, 11m x 11m, was marked. Ditches were dug around the demarked area, into which the perimeter posts and lower level of the mesh wall were sunk. The sand inside the hatchery area was screened using metal filters to remove stones, roots, eggs, nests old shells and other waste, after which the exterior mesh walls and mosquito net roof were completed, enclosing the hatchery space.

At the beginning of the season, the chante was found to be in a considerable state of disrepair, due to vandalism during the first part of the year. During July the building was completely restored, with new wooden walls, mosquito mesh on the windows, plastic on the ceiling an outer walls, waterproof storm blinds, and new furniture, including a hammock, mattress, table, shelves, a garbage bin and a tool storage facility.

Figure 10. The chante interior and hatchery upon completion (**A**), timelapse photo of the construction of the chante (**B**) and hatchery (**C**).

5.4 Turtle Adoption Scheme

The Turtle Adoption Scheme, established in 2011, continues to be promoted primarily through Facebook, posters at hostels in Costa Rica, or by word of mouth from volunteers and visitors to the program. This year a total of 55 turtles were adopted raising $2,660 in donations for the program. Each sponsor typically donates $50 to name one of the untagged turtles that comes to nest on Drake Beach, immediately receiving a certificate of adoption and fact sheet. When a new turtle becomes assigned to them the sponsor then receives a report with details of the first sighting of their turtle, including tag numbers and biometric data. Subsequently, the sponsor is sent a new report every time their turtle is spotted on the beach, and whenever one of their nests hatches.

5.5 New Training Materials

For the 2013 season, a number of new training materials were developed and existing ones improved. The training presentations for volunteers and courses for members of ACOTPRO were improved with new images and more concise text, and modified with the simplified methodology used in the hatchery in 2013. A brand new Hatchery Manual was produced in English and Spanish (see **Figure 11**), containing complete protocols for relocation, liberation and exhumation of nests, temperature management guidelines, maps, instructions on managing boats and changing shifts, troubleshooting and much more. The manual was designed to improve training and provide reassurance for volunteers working at the hatchery, and to function as a standard protocol manual for a future community-led project.

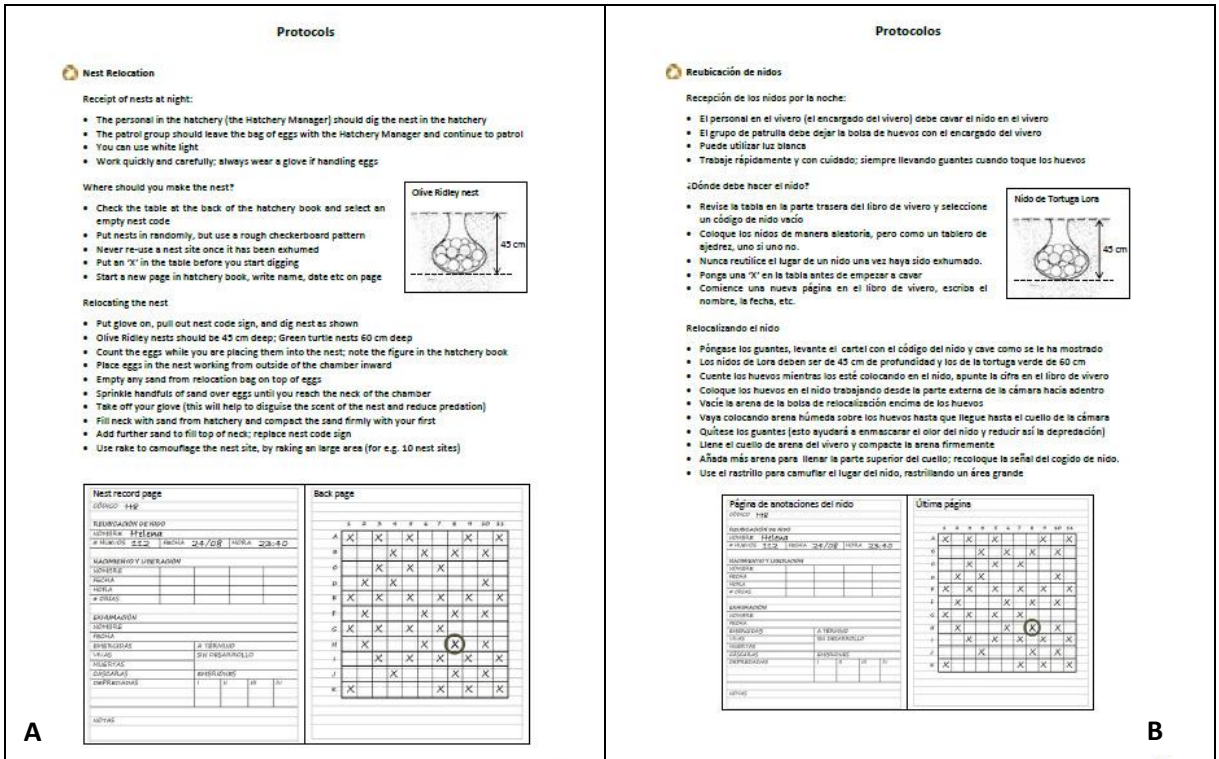


Figure 11. Page from the new Hatchery Manual in English (**A**), and Spanish (**B**).

6.0 Study Area

6.1 The Osa Peninsula and Corcovado National Park

The Osa Peninsula is located in southwestern Costa Rica, in the Puntarenas Province, on the Pacific Ocean, at 8.55°N 83.5°W. The main feature of the peninsula is the Corcovado National Park, which covers one third of its land mass, an area of 425 km², a protects a number of endemic species. The park was established in October 1975 by the then President Daniel Oduber in response to a petition from researchers regarding the threat posed by a planned major logging operation.

Famously referred to by *National Geographic* as 'the most biologically intense place on Earth', the park is home to all four Costa Rican monkey species, jaguars, pumas and ocelots, Baird's tapir, crocodiles, spectacled caimans, bull sharks, two-toed and three-toed sloths, agoutis, giant anteaters, great curassows, black hawks, spectacled owls, the harpy eagle, hummingbirds, golden orb spiders, otters, raccoons, collared and white-lipped peccary, Northern tamandua, silky anteaters, poison dart frogs, several species of snake (including the venomous Fer-de-Lance and Bushmaster), and over 8000 insect species, including at least 220 species of butterflies. Four species of sea turtle (Olive Ridley, Pacific Green, Hawksbill, and Leatherback) also nest on the beaches of the park. The protected region features at least 13 different vegetation types, including montane forest, cloud forest, prairie forest, alluvial plains forest, swamp forest, palm swamp, freshwater herbaceous swamp and mangrove, harboring over 2000 plant species, including over 500 different types of tree. The park may be accessed via three ranger station entrances, San Pedrillo in the North West, Los Patos in the North East, and La Leona in the South East, whereas the remote coastal Sirena Ranger Station at the heart of the park may be accessed by boat, light aircraft, or on foot.

Figure 12. Map of Costa Rica showing Osa Conservation Area (**gray**) and Osa Peninsula (**inset**)

6.2 Drake Bay

Drake Bay is located on the Pacific coast of Southwest Costa Rica, 19 kilometers (12 miles) to the north of the Corcovado National Park on the Osa Peninsula, 8° 42' N, 83° 40' W. Drake Bay is a remote area that becomes inaccessible by road for most of the wet season (September to November), and is more commonly accessed by boat or plane, especially by tourists. The three main communities in the area are Agujitas (approx. 1,000 inhabitants), the main tourism hub often referred to as 'Drake Bay'; El Progreso (approx. 250 inhabitants), a residential village home to the Drake Bay Aerodrome; and Los Angeles (approx. 180 inhabitants) (INEC, 2010). Primary sector (agriculture and livestock) is the main source of income for communities, which reaches 52.60% of labor occupancy. The human development index estimated for this area is 0.67% and the poverty rate is 40.4% (PNUD, 2010).

The main hub of Agujitas features several hotels, bars and restaurants, a primary and secondary school, a police station, several small shops (pulperías) and a boat landing area. A trail to the South passes numerous beaches and rocky headlands and a scattering of remote high-end eco-lodges, and ultimately reaches the San Pedrillo ranger station and entrance to the Corcovado National Park. To the North the main road to the mainland passes the uninhabited Drake Beach, crossing the Drake River and passing the village of El Progreso toward Rincón de Osa and the main highway.

6.3 Turtle Nesting Beaches

During the 2013 season, seven kilometers of coast on the Northwest side of the Osa Peninsula were monitored by the conservation program. The study area is demarcated by the mouths of the River Sierpe and the River Drake, encompassing two turtle nesting beaches beach known as Drake Beach and Ganado Beach.

Drake Beach is located between the mouth of the River Drake to the South (8º43'52''N, 83º38'56''W) and Punta Ganadito to the North (8º41'56''N, 83º39'12''W), and represents the principal focus of the conservation effort at the program. This 3.6 km beach is normally divided into two sectors during the rainy season by an additional mouth of the River Drake that is formed further upstream in front of the Drake Bay Aerodrome, when heavy rainfall causes the water level in the estuary to rise and break open the beach. The North sector is approximately 1.5 km in length and may be accessed via a track at its far North end, or by a pedestrian bridge over the estuary. The South sector, where the hatchery is located, is approximately 2.1 km in length and may be accessed via the estuary by boat, or by foot during low tide. The nature and configuration of the estuary changes frequently during the rainy season, as each storm brings about changes in the formation of sand banks and the strength and direction of currents. As such crossings to the South sector, and hence the hatchery, can become highly technical and inherently dangerous for prolonged periods of time during the nesting season.

Ganado Beach is located to the north of Drake Beach, and extends 2.9 km from the mouth of the estuary beyond Punta Ganadito in an approximate North-South orientation up to a rocky point before the mouth of the River Sierpe. The estuary, which is part of the Térraba-Sierpe National Park, is tidal and is characterized by strong fluctuating currents that make access to the beach logistically complicated. Ganado Beach is also much steeper than Drake Beach, with softer sand, and the high tide line is found high up amongst the vegetation, making it a much more difficult beach to patrol.

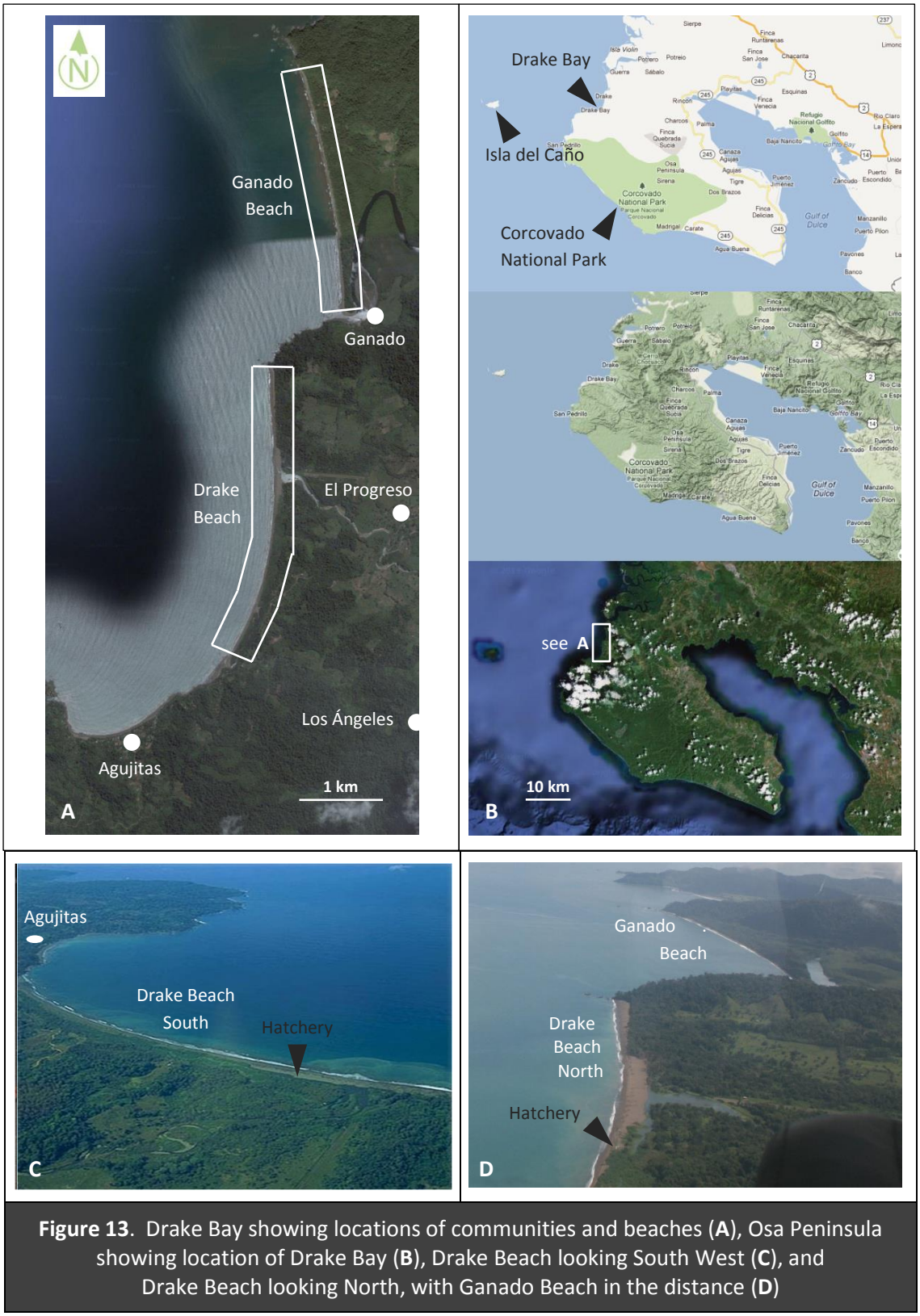


Figure 13. Drake Bay showing locations of communities and beaches (**A**), Osa Peninsula showing location of Drake Bay (**B**), Drake Beach looking South West (**C**), and Drake Beach looking North, with Ganado Beach in the distance (**D**)

7.0 Sea Turtle Biology

For millions of years, sea turtles have roamed the oceans of the planet, and have been an important source of food throughout most of human history. Sea turtles and their eggs are easily taken and animals can be kept alive for relatively long periods, providing a source of fresh meat. They have been used not only as food but as oil products, leather and jewelry, and for medicinal purposes. Consideration of the historical perspective of the human use of sea turtles and our impact on their populations thus enhances our understanding and their conservation needs. The life of sea turtles can be described in phases according to their development and growth. Slow-growing animals that reach sexual maturity only after 15-25 years, sea turtles are highly migratory, occupying very different habitats throughout their life cycle. This characteristic makes them even more vulnerable to various threats and makes the task of optimizing conservation strategy even more complex.

7.1 Sea Turtle Species

Modern sea turtles comprise seven species in six genera organized into two families. The family Cheloniidae includes six of the seven species, characterized by the possession of a hard shell (carapace) formed from scutes: the Loggerhead (*Caretta caretta*), Green (*Chelonia mydas*), Hawksbill (*Eretmochelys imbricata*), Kemp's Ridley (*Lepidochelys kempii*), Olive Ridley (*Lepidochelys olivacea*) and Flatback (*Natator depressus*) turtles. The family Dermochelyidae includes only one species of sea turtle: the Leatherback (*Dermochelys coriacea*). Four of these species of sea turtle nest in the Costa Rican Pacific (†see **Figure 14**) and potentially could do so again in Drake Bay.

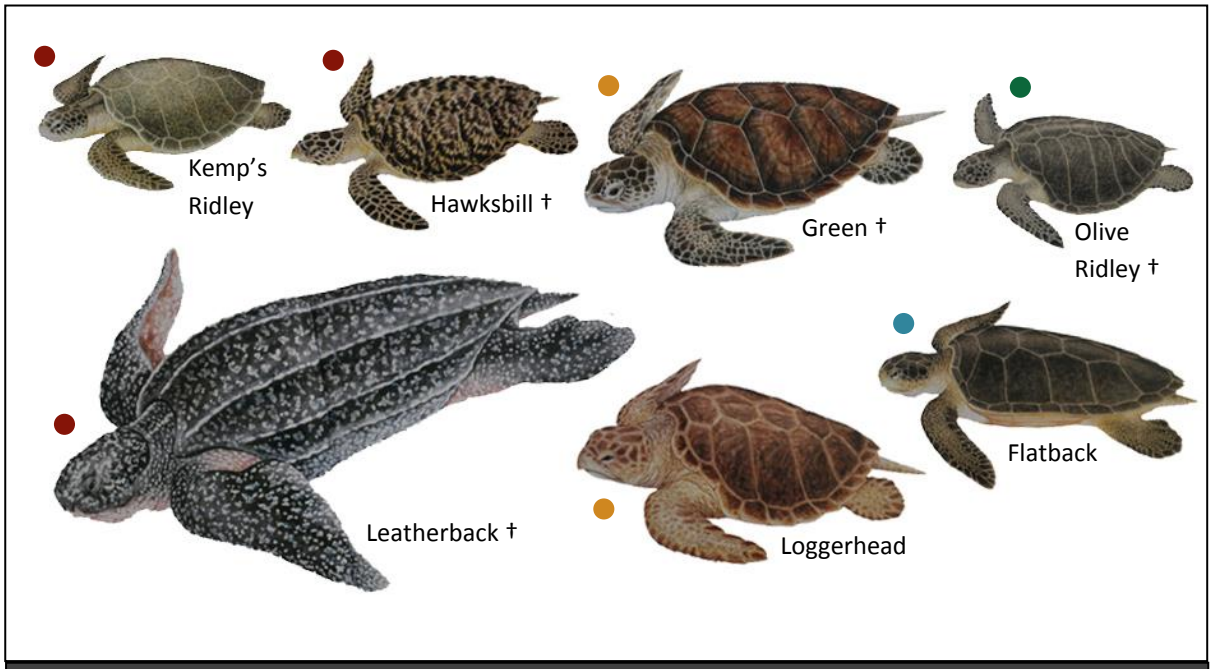


Figure 14. The seven extant species of sea turtle, showing IUCN Red List status: critically endangered (**red**), endangered (**amber**), vulnerable (**green**) and data deficient (**blue**)

7.1.1 Olive Ridley sea turtle (*Lepidochelys olivacea*)

A Cheloniidae family member, the Olive Ridley belongs to the Lepidochelys genus, which is the only genus of sea turtle containing more than one extant species: the Olive Ridley *(Lepidochelys olivacea)* and the closely related and critically endangered Kemp's Ridley (*Lepidochelys kempii*). Both Ridleys are distinctive for being the smallest extant sea turtles, with adult carapace lengths ranging from 60-75 cm, weighing between 35 and 45 kilos. Both possess a carapace that is wider than it is long, which exhibits a unique and variable scute configuration, with between six and nine central scutes and a variable and occasionally asymmetrical lateral scute count ranging from five to nine on each side. The carapace of the adult Olive Ridley sea turtle is olive green in color and highly arched, especially in females. Adults possess either one or two claws on each flipper, which are especially pronounced in males who use them to clamp on to the carapace of the female during mating. The Olive Ridley is known in Costa Rica as the Tortuga Lora, or parrot turtle, on account of its parrot-like beak.

The Olive Ridley is widely regarded to be the world's most abundant sea turtle, listed as 'vulnerable' on the International Union for Conservation of Nature And Natural Resources (IUCN) Red List (Leary T, 2010), with a global distribution throughout the tropical and warm waters of the Pacific, Indian, and Atlantic Oceans and the Caribbean Sea. The Eastern Pacific population is distributed from the Galapagos Islands and Chile in the South, up to California in the North, and during the inter-breeding season individuals may migrate thousands of miles looking for suitable feeding areas. This species is carnivorous and feeds mainly on shrimp but also on crabs, small fish and jellyfish.

Eastern Pacific Olive Ridley turtles lay their eggs on sandy beaches from Panama in the South up to the department of Sonora in Mexico in the North, normally close to the mouths of estuaries where salinity is low and turbidity is high. Both Ridleys are able to spawn synchronously with other turtles of the same species during a phenomenon known as an arribada, where more than half a million individuals may nest during a period of a few days. Olive Ridley arribadas still occur on certain beaches in Mexico, Nicaragua, Costa Rica (at Nancite and Ostional beaches) and Panama, and also in India and Sri Lanka in the Indian Ocean, but the frequency and density of these events has declined dramatically in the last 20 years (Honarvar S, 2008; Cornelius SE, 1991). The nesting season in the Central Pacific runs from June until December, and individuals are observed to return to the same beach, or neighboring beach, to nest each time, returning from between every 1-3 years. The Olive Ridley is fast and typically spends no more than 30-40 minutes to complete the nesting process before returning to the sea. This species typically lays between 75 and 125 eggs, returning up to three times each season, with and inter-nesting period of around 13-22 days and an incubation period of 45-70 days.

7.1.2 Green sea turtle (*Chelonia mydas*)

The Green sea turtle is the second largest member of the family Cheloniidae, and possesses a teardrop-shaped carapace around 90 cm in length with five central and four pairs of lateral scutes. Individual adults typically weight between 100-190 kg, with large paddle-like front flippers exhibiting just one claw. Its range extends throughout tropical and subtropical seas around the world, with two distinct populations in the Atlantic and Pacific Oceans. The Pacific Green turtle, also known as the Black turtle due its darker carapace coloration, was originally thought to represent a distinct species named *Chelonia agassizii* (Bocourt MF, 1868), later denoted as a sub-species *Chelonia mydas* ssp. *agassizii*. This taxonomical distinction has now become redundant since the two populations, whilst exhibiting phenotypic differences, have been demonstrated to be genetically indistinct (Karl SH, 1999; Dutton PH, 1996; Bowen BW, 1993) and both are now denoted as *Chelonia mydas*.

The East Pacific population is distributed from Chile in the South up to Alaska in the North, and nesting sites are scattered throughout the entire region. *Chelonia mydas* is listed as 'endangered' by the IUCN Red List (Leary T, 2010) and is protected from exploitation in most countries. Unlike the other members of the family Cheloniidae, Green sea turtles are herbivorous and feed almost exclusively on seagrasses, and adults spend most of their time in shallow, coastal waters with lush seagrass beds.

Female Green sea turtles usually mate every two to four years, but may return to lay eggs up to seven times in one season, with and inter-nesting period of around 9-15 days and an incubation period of 45-75 days. The East Pacific nesting season typically runs from July to October.

7.1.3 Hawksbill sea turtle (*Eretmochelys imbricata*)

The Hawksbill sea turtle belongs to the family Cheloniidae and, like the Green sea turtle, possesses a carapace with five central and four pairs of lateral scutes. It is easily distinguishable from other species however on account of its sharp curving beak, overlapping scutes, and serrated margins. Adult Hawksbills typically weigh around 70 kg, with a carapace around 85 cm in length, often highly patterned with an characteristic combination of light and dark streaks and mottled brown colors radiating to the sides. Each front flipper possesses two claws. As with the Olive Ridley sea turtle, nesting females of this species leave an asymmetrical track behind in the sand, as they are light enough to crawl with an alternating gait. The Green and Leatherback sea turtles by contrast leave characteristically heavy, symmetrical tracks behind.

Adult Hawksbill sea turtles typically inhabit tropical coral reefs, where they are known to feed on sponges, but are also able to survive in the open oceans and even in lagoons and mangroves. *Eretmochelys imbricata* has been listed as 'critically endangered' by the IUCN Red List since 1996 (Leary T, 2010). The species has a global distribution yet is found highly concentrated in specific tropical and subtropical regions, such as the Caribbean, East Africa and the Indonesian archipelago. The East Pacific population was thought to have become largely extinct, but it is now recognized that a residue remains sparsely distributed from Chile in the South to Mexico in the North.

Female Hawksbills usually mate every two to four years and typically return to nest up to four times in one season, laying an average of 140 small eggs each time. The inter-nesting period for this species is around 14 days, with an incubation period of 55-70 days. The East Pacific nesting season typically runs from May to November.

7.1.4 Leatherback sea turtle (*Dermochelys coriacea*)

The largest of all living sea turtles and the only extant species of the family Dermochelyidae, and thus of the genus *Dermochelys*, the Leatherback typically grows to around two meters in length, weighing 300-600 kg, and possesses a carapace around 1.5 meters long. Unlike all other living sea turtles the carapace of the Leatherback does not contain scutes and instead exhibits five flexible ridges running along the anteroposterior axis, covered by skin and oily flesh. Claws are also uniquely absent from both pairs of flippers, the largest in proportion to its body among all extant sea turtles. *Dermochelys coriacea* exhibits several features believed to permit survival in cold waters and at extreme depths, including significant deposits of brown adipose tissue, and an extensive network of counter-current heat exchangers (Davenport J, 2009; Penick DN, 1998; Goff GP, 1988). Leatherbacks are thus unique among reptiles in that they are able to maintain their body temperature above that of their immediate environment.

This Leatherback is listed as 'critically endangered' on the IUCN Red List (Leary T, 2010) yet has the widest population distribution or any extant sea turtle, extending across all tropical and subtropical oceans and into the Arctic Circle. Adults feed almost exclusively on jellyfish and will migrate many thousands of kilometers across the Pacific and Atlantic oceans between cold water feeding areas and tropical nesting sites. The Eastern Pacific population has nesting sites in Mexico and at three beaches in Costa Rica, and a nesting season that runs from December to March.

Females Leatherbacks typically mate every three to four years but can return to nest up to 10 times per season. They exhibit a much lower degree of beach fidelity compared to other sea turtle species, and often vary their choice of nesting location even within one season. The inter-nesting period for this species is around 10 days, with an incubation period of 50-78 days, and nests typically contain around 70 eggs along with 30 smaller unfertilized eggs, thought to represent a protective adaptation that reduces the impact of nest predation.

7.2 Life Cycle

Despite marked differences in migration patterns, diet, longevity and the frequency of nesting seasons, all seven species of sea turtle share a similar life cycle, summarized in **Figure 15**. Upon breaking out of their shells using their beak and claws, hatchlings may spend several days slowly awakening and climbing out of the nest to reach the surface, as they deplete the last of the energy stored in their yolk sack. Hatchlings typically emerge from the nest en masse during the night, when they are more protected from predators such as birds, and crawl instinctively towards the sea, attracted by the light from the moon and stars reflected on the surf.

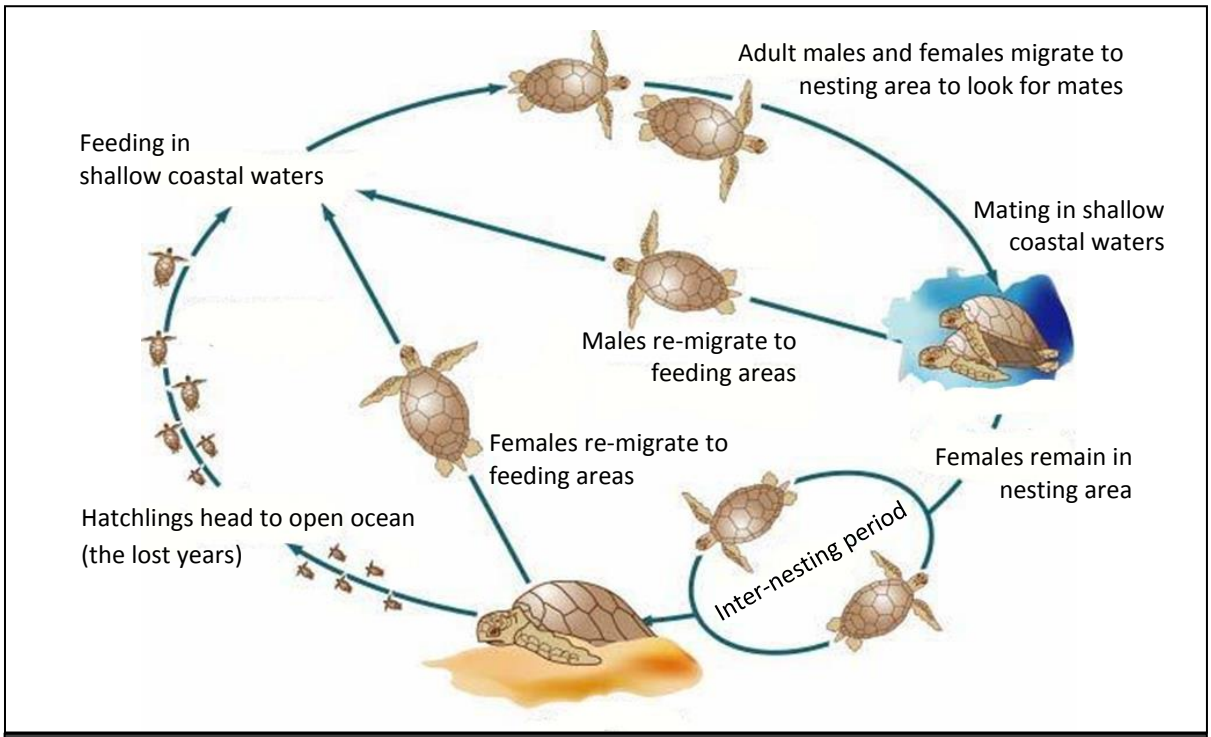


Figure 15. The generalized life cycle of the sea turtle

Once in the ocean, the hatchlings begin their solitary life and spend perhaps the next 15-25 years alone at sea as they grow into sexually mature adults. It is known that some species swim out to floating kelp beds in the open ocean, where they are thought to hide and feed for perhaps the first five years of their lives. For other species, like the Olive Ridley sea turtle, we simply don't know for sure where they go, and for that reason this period is sometimes referred to as the 'lost years'.

After migrating sometimes huge distances across the oceans as juveniles, sexually mature sea turtles typically return from feeding areas to the region where they were born in order to mate. Sea turtles are highly promiscuous, and each female will mate with several males during the mating season. It is thought that females are able to store sperm for long periods of time, perhaps even for an entire season, and appear to have control over if and when their eggs are fertilized. After fertilization, and during each inter-nesting period, females will remain close to the nesting area until each clutch is ready to deposit on the beach, and some species are thought to return to the very same beach that they were born on to nest. While females may wait several years before returning to nest again, males are thought to migrate from feeding areas to nesting areas every year in order to mate.

7.3 Nesting Behavior

Despite differences in the frequency of nesting seasons, the number of nests laid per season, and the inter-nesting period, females from all seven species of sea turtle exhibit essentially the same nesting behavior, summarized in **Figure 16**.

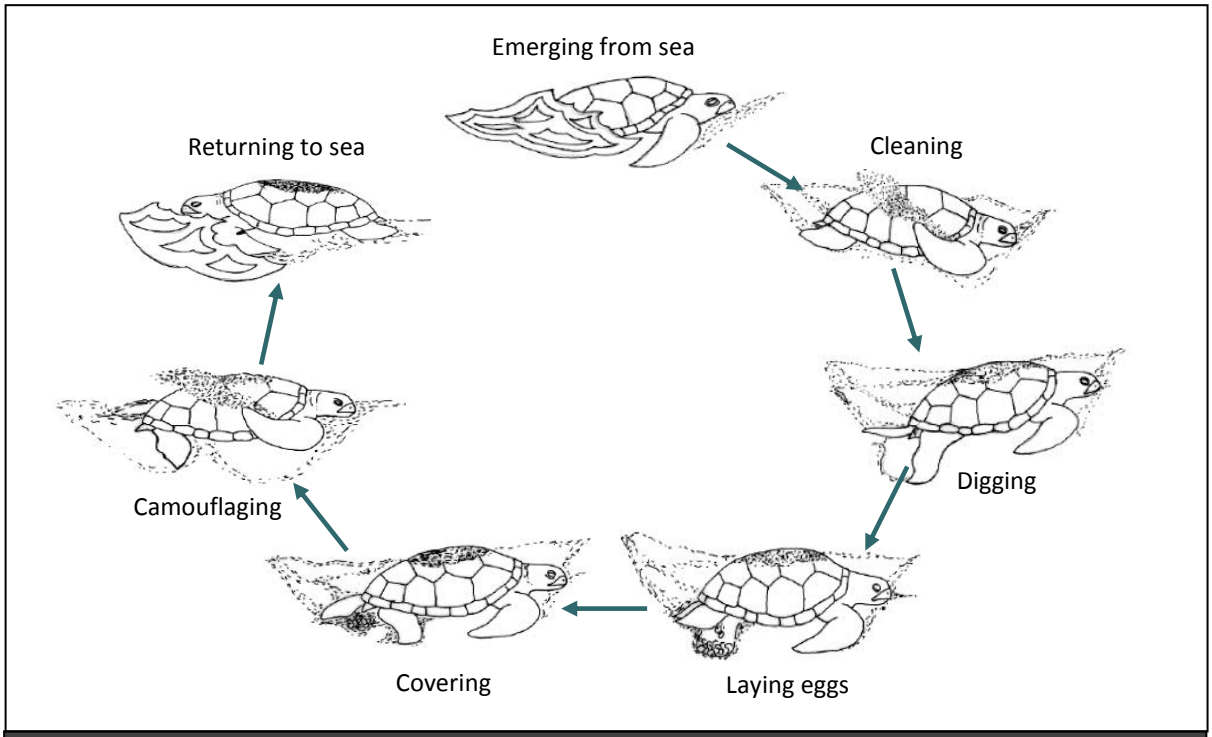


Figure 16. The generalized nesting behavior of the female sea turtle

Females emerge from the sea and crawl up the beach, typically as far as the high tide line, and begin to remove debris such as sticks from their chosen nesting spot with their front flippers, often creating a marked depression in the sand. Next females will begin to dig a hole in the sand with their hind flippers, carving out a narrow cylindrical neck with a wider chamber at the base. The depth a volume of the nest depends upon the species, and is roughly proportional to the size of the animal, for example: where the Olive Ridley typically builds a nest around 43 cm deep, the Pacific Green turtle prefers to build a nest around 63 cm deep. After laying their eggs into the chamber, females will then cover the site with sand and compact it down using their hind flippers, after which they will camouflage the area by flicking loose sand over the nesting site with their front flippers before returning to the sea. Some species are observed to move around during this process and to camouflage at several distinct sites, spending a long time out of the ocean; others, such as the Olive Ridley, tend to spend a minimal amount of time on the beach. At any point during the process, females may decide against nesting at the initially chosen site and abandon it in favor of searching for a preferred spot, or may simply return back to ocean without nesting at all. The latter is commonplace and is referred to as a 'false exit'.

7.4 Threats to Survival

At first glance, sea turtles appear to be built to last. Indeed turtles have survived in more or less their present form for some 200 million years, evolving around the same time as the dinosaurs but outliving them by 65 million years so far. The protective carapace of the sea turtle means that adults have very few natural predators, and it is the secret of their survival. The story is very different for young sea turtles though and only 1 in every 1000 eggs is thought to survive to become a sexually mature adult. Nests are at the mercy of the changing tides and beach erosion, and eggs are consumed by natural predators such as raccoons, crabs, ants, flies and fungi. Once out of the nest birds, crabs, raccoons, coyotes, iguanas, and snakes are able to pick off scores of baby turtles whilst they are crawling toward the sea, especially if a nest hatches during the day, and in the ocean infant and juvenile turtles are preyed upon by fish, sharks and crocodiles. Despite this apparently high infant mortality rate, sea turtles have successfully evolved for millions of years in balance with the ecosystems and food chains with which they interact.

The story of the interaction between humans and turtles is long and convoluted, and sea turtles have been used for eggs, meat, carapace, oil, leather or other products since at least 5000 BC (Frazier J, 2003). But whilst such consumptive use by ancient and indigenous peoples, such as the Mesoamerican Mayas and other Amerindians, was relatively sustainable, sea turtle utilization became unsustainable with the onset of the colonial era during which millions of turtles were caught and kept alive as a long-term fresh food source for ships' crews, and for export to European markets. Today, intentional capture of sea turtles continues using nets, harpoons and traps in feeding grounds, along with incidental capture by indiscriminate fishing practices, such as 'long-lining', causing drastic declines in global populations (Seminoff J¸ 2002; Jackson JBC, 2001; Spotila JR, 2000). Shrimping nets are a particular menace for the Olive Ridley sea turtle, and it is a now a legal requirement in many countries that such nets are equipped with a Turtle Excluder Device (TED), a gate mechanism that permits the ejection of large animals from the net.

The majority of sea turtle nesting sites are located in tropical regions, often in countries with developing economies where the turtle trade, whilst illegal, is still considered an income source. At nesting beaches in Central America, such as those of Drake Bay, decades of systematic egg poaching by locals, and the introduction of domestic animals such as dogs that dig up and consume nests, has

resulted in the near eradication of certain nesting species, such as the East Pacific Leatherback and Hawksbill turtles, and has caused the population of Olive Ridley turtles, the most abundant species in the region, to become endangered.

Irresponsible tourism, including the riding of horses or quad bikes on beaches, where they can destroy nests, and the construction of beachfront hotels and businesses, has led to the large-scale destruction of sea turtle nesting habitat worldwide. Light pollution from such development has an especially negative impact, as light dissuades females from emerging from the sea to nest and causes newly-born hatchlings, who inherit an instinct to head to the brightest part of the beach, to crawl towards hotels and street lighting instead of the white surf of the ocean. Boats transporting tourists to and from remote sites on 'eco-tours' also frequently collide with and kill sea turtles coming up to the surface to breathe. Consumption of illegal turtle products by locals and tourists continues to pose a massive threat, by fueling a buoyant black market and incentivizing poaching. Such products include 'tortoise shell' jewelry, made from the carapace of the Hawksbill turtle, and high quality boot material, produced from sea turtle skin. In Central America the eggs of the Olive Ridley turtle are considered to be a particular delicacy, consumption of which is commonly believed to act as an aphrodisiac.

Perhaps the most lethal man-made geo-biological disaster of the last 60 years however has been caused by the disposal of non-biodegradable plastics in rivers all over the world, ultimately destined for the oceans where they will take hundreds or maybe even thousands of years to break down. Fine suspensions of plastic particulates on the surface of the oceans choke and smother marine reptiles and, enticed by their shiny colorful and organic appearance, turtles increasingly eat or become tangled in plastic waste and discarded fishing gear, usually with deadly consequences. The Leatherback turtle is particularly exposed to this threat since it is thought to confuse plastic bags with its principal food source, jellyfish, and it is estimated that a third of all Leatherback turtles have ingested plastic (Mrosovsky N, 2009).

Like many reptiles, all extant species of sea turtle exhibit temperature-dependent sex selection (TSD), whereby the gender of hatchlings is dependent upon the temperature of the nest during a specific 'thermo-sensitive period' of development (Godley BJ, 2001; Wibbels T, 1998; Spotila JR, 1987; Standora EA, 1985; McCoy CJ, 1983). Reliance upon TSD means that sea turtles are potentially extremely vulnerable to increases in sand temperature caused by global warming, which may begin to skew their population demographics so that they are more females than males, leading to consequences that are difficult to predict. Research over the coming years aims to identify the most vulnerable species, and a scientific consensus may emerge that recommends a strategy of reducing temperatures in sea turtles hatcheries in order to counteract the effects of global warming, in an effort to buy some time for such species to adapt (Mitchell NJ, 2010).

The ecological consequences of the impending extinction of sea turtles could be severe. Sea turtles are keystone species in coastal and oceanic marine ecosystems, and the natural predation of their eggs transfers vital nutrients from marine to terrestrial ecosystems (Jackson JBC, 2001; Bouchard SS, 2000). Each species also fulfills a specific ecological role, such as the Green turtle for example, which consumes vast quantities of seagrass and keeps it cut short, permitting the continued growth of the grass and the survival of the myriad species of fish, shellfish and crustaceans that call it home (Aragones LV, 2006). The extinction of sea turtles would also bring about the collapse of the very ecotourism industry intended to facilitate their conservation, resulting in the loss of revenue and jobs within developing communities where they are desperately needed.

8.0 Methodology

8.1 Monitoring of Nesting Beaches

The monitoring of the population of nesting females is a core activity that is absolutely required in order to inform any sea turtle conservation strategy, without which it would be impossible to know the frequency with which turtles are nesting, nor any changes in that frequency over time. Since 2006 the Sea Turtle Conservation Program in Drake Bay has development and implemented standardized methods with which to register turtle exits throughout the nesting season each year, record the distribution of species, characterize the behavior of nesting turtles, calculate the reproductive success of each nest, and evaluate the effectiveness of the conservation methodology. These activities are realized through daily excursions to the two nesting beaches monitored by the program: Drake Beach (3.6 km) and Ganado Beach (2.9 km).

8.1.1 Census of Tracks

A morning patrol of the beaches is conducted from 05:30 each day throughout the entire nesting season, to search for and record the location of tracks in the sand left by nesting turtles emerging from and returning to the sea. The census is used initially to establish the beginning the nesting season, and hence the initiation of night patrols, and then routinely to evaluate the work of the previous night patrols, or to locate new tracks from turtles that were missed or that emerged after the night patrol had left the beach. The census may be performed by a member of program staff, local Patrol Leader, or a fully capacitated international volunteer.

8.1.2 Night Patrols

Night patrols of the beaches are conducted every night from the beginning of the nesting season until the close of the program on 15 December. Two patrol shifts are deployed each night: the first from 20:00 until 00:00; the second from 00:00 until 04:00. For each night patrol shift at Drake Beach, two teams are routinely sent out: one to patrol the North sector (1.4 km); the other to patrol the South sector (2.2 km), which are separated by a river mouth that opens up during the rainy season. Each night patrol team is led by a by a member of program staff, local Patrol Leader, or a fully capacitated international volunteer, accompanied by at least one other volunteer. Lights of any color (but especially white) are known to disturb nesting turtles, and as such white light is never used during night patrols, so as not to deter other turtles from exiting the sea. Dim red light is only used when strictly necessary when working with a nesting turtle, and night patrol teams are required to wear dark, unreflective clothing.

8.1.3 Hatchery Shifts

The vigilance tower (chante) beside the hatchery, located on the South sector of Drake Beach, is occupied 24 hours per day, from the day that the first nest is relocated there, until the close of the program on 15 December. The hatchery is co-managed by ACOTPRO and is the main focus of the scientific research conducted at the program. Many of the methods developed for the hatchery are quite complex and data has to be recorded carefully, therefore the chante is always occupied by an

individual who has undergone a specific hatchery training course and has been certified as a Hatchery Manager, whether that be a by a member of program staff, local Patrol Leader/Hatchery Manager, or a fully capacitated international volunteer. Hatchery shifts are six hours long, and run from 00:00-06:00, 06:00-12:00, 12:00-18:00, and 18:00-00:00 each day.

8.2 Registration Criteria

All turtle exits from the sea are registered according to the criteria shown in **Figure 17**. All geographic and biometric data pertaining to nests are recorded in a central database, which is used to monitor the initial and ultimate destiny of each nest registered at the program, both in the hatchery and on the beaches. The initial destiny of a nest may be recorded as 'left *in situ*', 'relocated to hatchery', 'relocated to beach', 'poached' or 'predated', whereas the ultimate destiny of a nest might be 'hatched', 'poached', 'predated', 'lost', and/or 'exhumed'. For the purposes of simple analyses the total number of nests is calculated as the sum of all nests registered, regardless of their initial destiny, and the total number of exits is calculated as the sum of all nests plus all false exits.

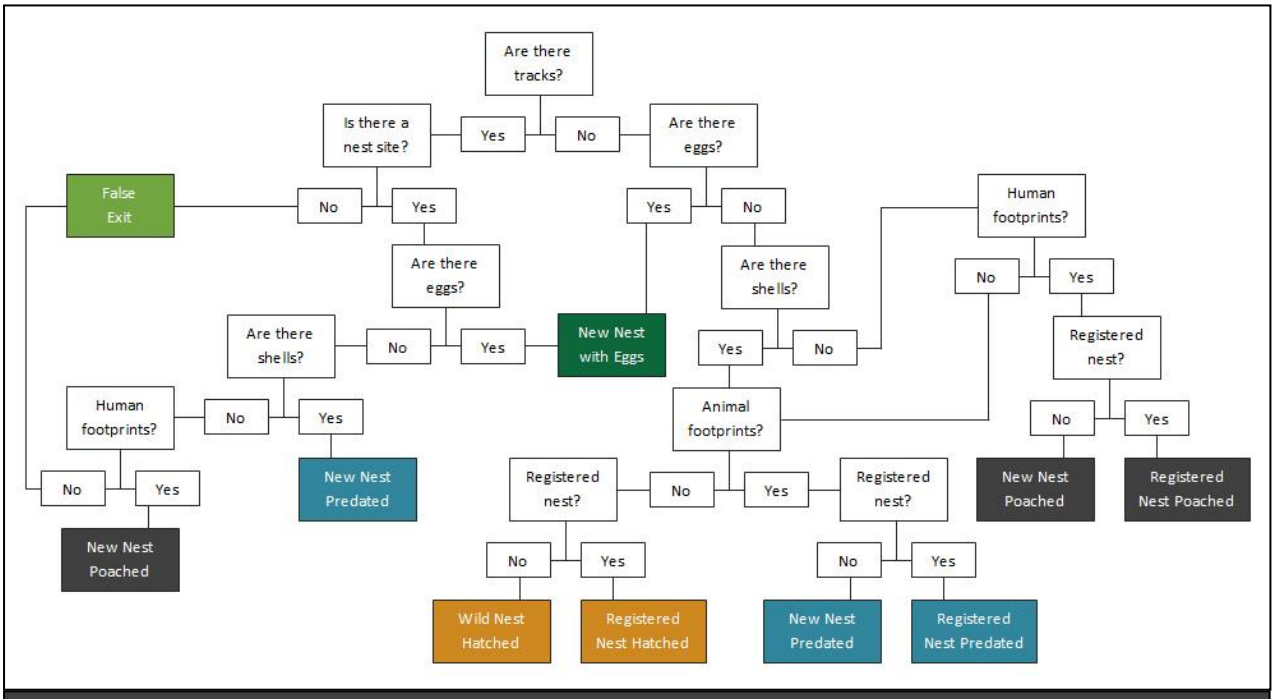


Figure 17. Registration criteria used at the program to determine the destiny of nests

8.3 Tagging of Nesting Turtles

In order to effectively monitor any nesting sea turtle population, it is necessary to tag nesting females so that they may be positively identified in the future. Females encountered on the beaches during night patrols at this program are only tagged if they have laid a nest, and so those females sighted whilst performing a false exit are not tagged. The series of tags used at this program, manufactured by the National Band and Tag Company USA (NBTC), are shared with Friends of the Osa, Costa Rica, and each unique tag number is preceded by the prefix OP, NG or OSA.

Nesting turtles are tagged on the skin found in between the first and second scales on the posterior edge of each flipper, or between the second and third scales if the former location has been tagged previously. Turtles are ideally tagged whilst they are laying eggs, since this causes the least discomfort to the animal; however, it is sometimes necessary to tag a turtle if she is discovered whilst already covering a nest or returning to the sea, since the tagging turtles that have laid nests is a priority. Re-nesting or re-migrating females with pre-existing tags are not newly tagged, unless an existing tag has become deformed or dislodged, or the skin has become damaged as the result of a poorly applied tag. Nesting females who have been correctly tagged leave the beach with two tags securely in place, one on each flipper.

8.4 Recording of Biometric Data

Biometric data pertaining to nesting female turtles, and/or their nests and tracks, are recorded during night patrols, using bespoke field data capture forms. These data include the time, date and location of the discovery, the species, orientation and activity of the turtle, the numbers of any pre-existing or newly applied tags, the dimensions of the carapace, and details of any damage or distinguishing features of the turtle (if sighted). Other data include the average width of the tracks, depth of the nest, number of eggs, and the initial destiny of the nest. Biometric data pertaining to nests relocated to the hatchery are recorded in a separate hatchery data book, which is stored in the chante, and include the time, date and location of the relocated nest, the diameter and weight of a random sample of 10 eggs, and the predicted hatch date.

8.5 Nest Relocations

Due to the continued threat of illegal egg poaching in Drake Bay, the relocation of turtle nests either to the hatchery or another location on the beach is a priority strategy, since nests left *in situ* and un-camouflaged are extremely vulnerable and almost certain to be poached. Nests discovered during night patrols are always relocated, whereas nests found during the census may only be relocated if the period since the nest was laid is known to be less than three hours, since movement of eggs after this period may disrupt the first stages of embryo development.

Regardless of whether a nest is relocated or left *in situ*, a large area of sand encompassing both the nest location and tracks – even those of a false exit – are thoroughly camouflaged by combing the sand flat, so that no information regarding the location or contents of the nest, the time of nesting, nor the species of turtle, may be easily ascertained from the site by poachers.

8.5.1 Relocation of Nests to the Hatchery (Drake Beach only)

Nests discovered during night patrols on Drake Beach are always relocated to the hatchery (until it becomes unavailable from 15 October onwards to allow for decommissioning and deconstruction at the close of the program on 15 December), unless there is some logistical obstacle during the patrol that precludes such relocation. Such obstacles may include the close proximity of an electrical storm, or the lack of availability of a boat to cross eggs from the North sector of the beach to the South, where the hatchery is located. Eggs are removed from the nest and placed in a plastic bag ideally whilst being laid, but may also be removed once the turtle has already left the nesting site. In order

to locate eggs after the turtle has left, the site is examined and a stick is used to probe the area until the soft sand above the egg chamber is located. Eggs are then taken to the hatchery where the dedicated Hatchery Manager may build the new nest and record the biometric data alone, while the patrol team returns to the beach to continue patrolling. New nests are built to a depth of 45 cm, for Olive Ridley and Hawksbill turtle nests, or 60 cm, for Pacific Green turtle nests, and include an egg chamber at the bottom, mimicking that built by the nesting turtles themselves. Digital thermometers (dataloggers) (HOBO Pendant Temperature UA-001-08/64) are routinely deployed in nests relocated to the hatchery, in order to monitor the incubation temperature at various nest locations during the course of the season.

8.5.2 Relocation of Nests to the Beach

Nests discovered during night patrols on Ganado Beach are always relocated to another location on the beach, as are those found after 15 October on Drake Beach. Eggs are removed from the nest and placed in a plastic bag ideally whilst being laid, but may also be removed once the turtle has already left the nesting site. In order to locate eggs after the turtle has left, a line is drawn in the sand around the nest site and a stick is used to probe the area until the soft sand above the egg chamber is located. After camouflaging the original site, eggs are then taken to a new location in another sector of the beach, taking care to walk by the sea or the vegetation to decrease the chances of footsteps being subsequently tracked by a poacher. The Patrol Leader then works alone without light to build a new nest in the sand, after which the location of the site is carefully triangulated by measuring the distance from the nest to the nearest reference posts to the North and the South, plus a third measurement to an easily identified immovable object, such as a palm tree, in a neighboring sector. New nests are built to a depth of 45 cm, for Olive Ridley and Hawksbill turtle nests, or 60 cm, for Pacific Green turtle nests, and include an egg chamber at the bottom, mimicking that built by the nesting turtles themselves. A small piece of flagging tape displaying the unique nest code is also included in the neck of the nest, and care is taken to remove gloves and use fresh sand from the new site to cover the nest, so that the scent from the eggs may not be detected by predators. Finally, the new nest site and any footprints are carefully camouflaged. Digital thermometers (dataloggers) (HOBO Pendant Temperature UA-001-08/64) are routinely deployed in nests relocated to the beach, in order to monitor the incubation temperature at various nest locations during the course of the season.

8.6 Liberations

The liberation of hatchlings routinely takes places in the hatchery, where nests are born in a controlled environment, but some activities may also be carried out on wild nests or those relocated to the beach, should the birth of the nest be witnessed. In the hatchery, the birth of each nest is carefully monitored by the Hatchery Manager, and the number of hatchlings emerging from the nest is recorded, along with the dimensions and weight of a random sample of 10 hatchlings. As soon as these biometric data have been recorded, the hatchlings are placed in a bucket and transferred to the beach where they are allowed to migrate to the sea of their own accord, whilst still being supervised in order to minimize predation by birds, crabs or other predators on the beach.

8.7 Exhumations

The exhumation (excavation) and analysis of the contents of hatched nests is an activity that is crucial for the determination of the reproductive success of each nest, the incidence of poaching or natural predation, and the effectiveness of the conservation methodology used at the program. Exhumations are carried out on all known nests each season, including those relocated to the hatchery or the beach, those left *in situ* at the time of discovery, and also any wild nests founded to have hatched on the beach during the season. Exhumations are typically carried out within 3-4 days after the hatch date.

Biometric data pertaining to each exhumed nest are recorded, including the number of dead or live hatchlings remaining in the nest, the number of empty shells, the number of whole eggs containing partially, fully, or un-developed embryos, and the stages of development that such embryos have reached, according to a nominal four-phase scale of development. Any eggs or embryos found to be partially or fully predated are recorded as such, including details of which animal may be responsible for the predation, such as crabs, ants, flies or fungi. Any anomalies, such as abnormal development, deformation, albinism or twins, are also recorded.

Figure 18. A local Hatchery Manager conducting a hatchling liberation (**A**), and Corcovado Foundation volunteers conducting a nest exhumation (**B**)

8.8 Determination of Sex Ratio

The sex ratios of all Olive Ridley nests in the hatchery were estimated using the indirect method, based on mean temperature during the thermo-sensitive period at the end of the first third of the incubation period (Wibbels T, 2003; Merchant-Larios H, 1997; Mrosovsky N, 1980). The pivotal temperature (PT) for this species has been reported as 30.5 °C for Playa Nancite on the Pacific coast of Costa Rica (Wibbels T, 1998). Mean temperatures above the above the PT produce a greater proportion of female hatchlings, reaching 100% at 32.0 °C; mean temperatures below the PT produce a greater proportion of male hatchlings, reaching 100% at 27.0 °C (McCoy CJ, 1983; Wibbels T, 1998). A linear function between 27.0-30.5 °C and 30.5-32.0 °C was used to estimate the sex ratio of nests in the hatchery, based on the mean temperature registered by dataloggers (HOBO Pendant Temperature UA-001-08/64 [accuracy ±0.47 °C]) at the end of the first third of the incubation period for each nest.

9.0 Results and Discussion

9.1 Monitoring of the Nesting Turtle Population

9.1.1 Summary of 2013 Nesting Season (Drake Beach)

During the period 15 July to 15 December 2013 the sea turtle program registered 107 turtle exits on Drake Beach, of which 86 were nesting events and 21 were false exits. The total number of exits and nests is the lowest registered for any season since the program began in 2006.

The data shown in **Figure 19** and **Figure 20** show that the 2013 season was the poorest to date in terms of turtle nesting, but was otherwise successful in terms of conservation efficiency and performance. For example, 67% of nests were relocated to the hatchery, which is similar to the percentage achieved from 2010-2012 (mean: 68.1%), and much higher than from 2006-2009 (mean: 34%). The data in **Figure 21A** also show that the proportion of turtles sighted as a percentage of turtle exits was much higher during from 2010-2013 (mean: 49%) than from 2006-2009 (mean: 25%), indicative of the successful optimization of night patrol methodology on Drake Beach since 2010. The data in **Figure 21B** show that the incidence of poaching in 2013 (10.5%) was maintained close to the average since 2006 (10.2%).

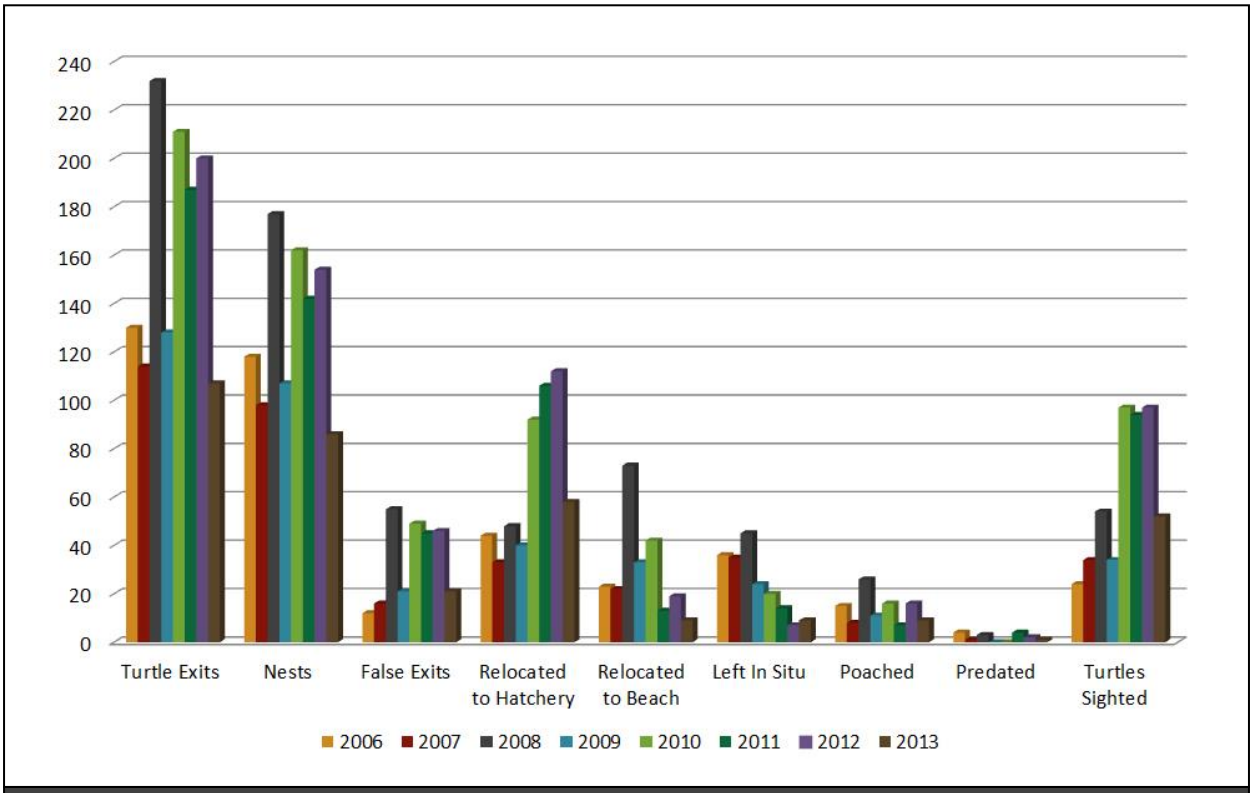


Figure 19. Summary of turtle exits from July-December 2006-2013 on Drake Beach

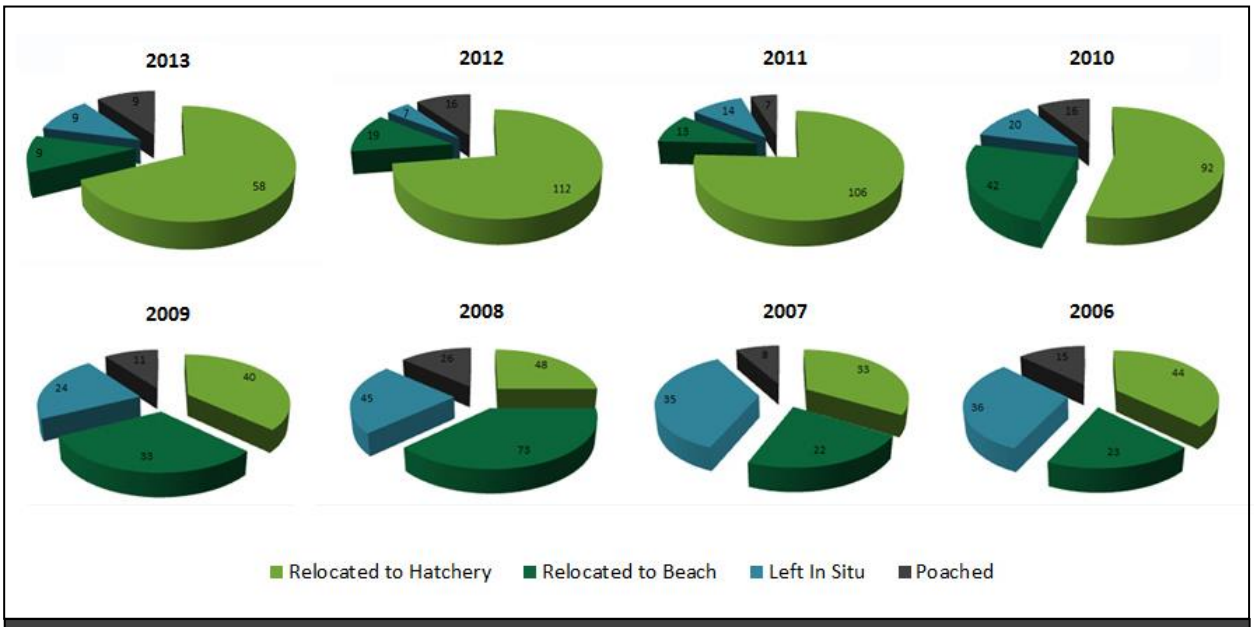


Figure 20. Initial destiny of turtle nests registered from July-December 2006-2013 on Drake Beach.

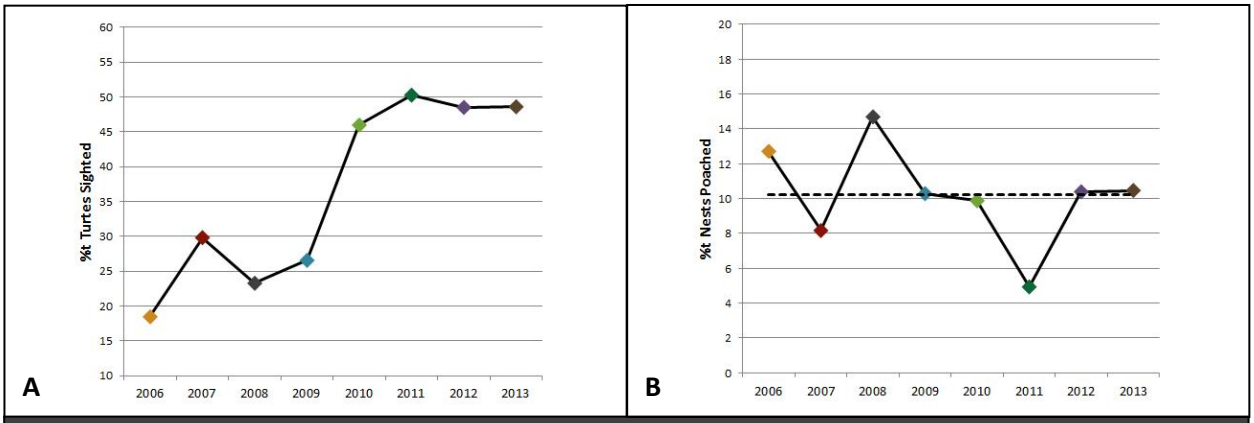


Figure 21. Percentage of turtles sighted by night patrols (**A**), and the percentage of nests poached showing mean (**dashed**) (**B**), from July-December 2006-2013.

9.1.2 Seasonal Temporal Distribution

Analysis of the frequency of nesting events registered on Drake Beach during the 2013 season reveals a temporal distribution comparable to 2009 and 2007, albeit with fewer turtle exits. The data presented in **Figure 22** show that the program registered record low numbers of nests between 16 August and 30 September, and again from 16-31 October, and from 16-30 November. **Figure 22A** shows the temporal distribution of nesting events for each year since 2006 overlaid, whilst **Figure 22B** compares each year to the mean distribution.

9.1.3 Seasonal Spatial Distribution

Comparison of the spatial distribution of nests left on Drake Beach from 01 July to 15 December each season since 2006, shown in **Figure 23**, while highlighting considerable variability between each season, uncovers some season-specific trends. Comparison of the 2013 distribution to the mean from 2006-2013 in particular shows an apparent increased incidence of nesting in the northern sector of the beach (North of the mouth of the Drake River).

The mean distribution also shows that the most popular nesting sites are found in sectors 17 and 18. This factor, combined with the favorable terrain and central location with respect to the entire length of the beach, justifies the choice of site for the hatchery in sector 18.

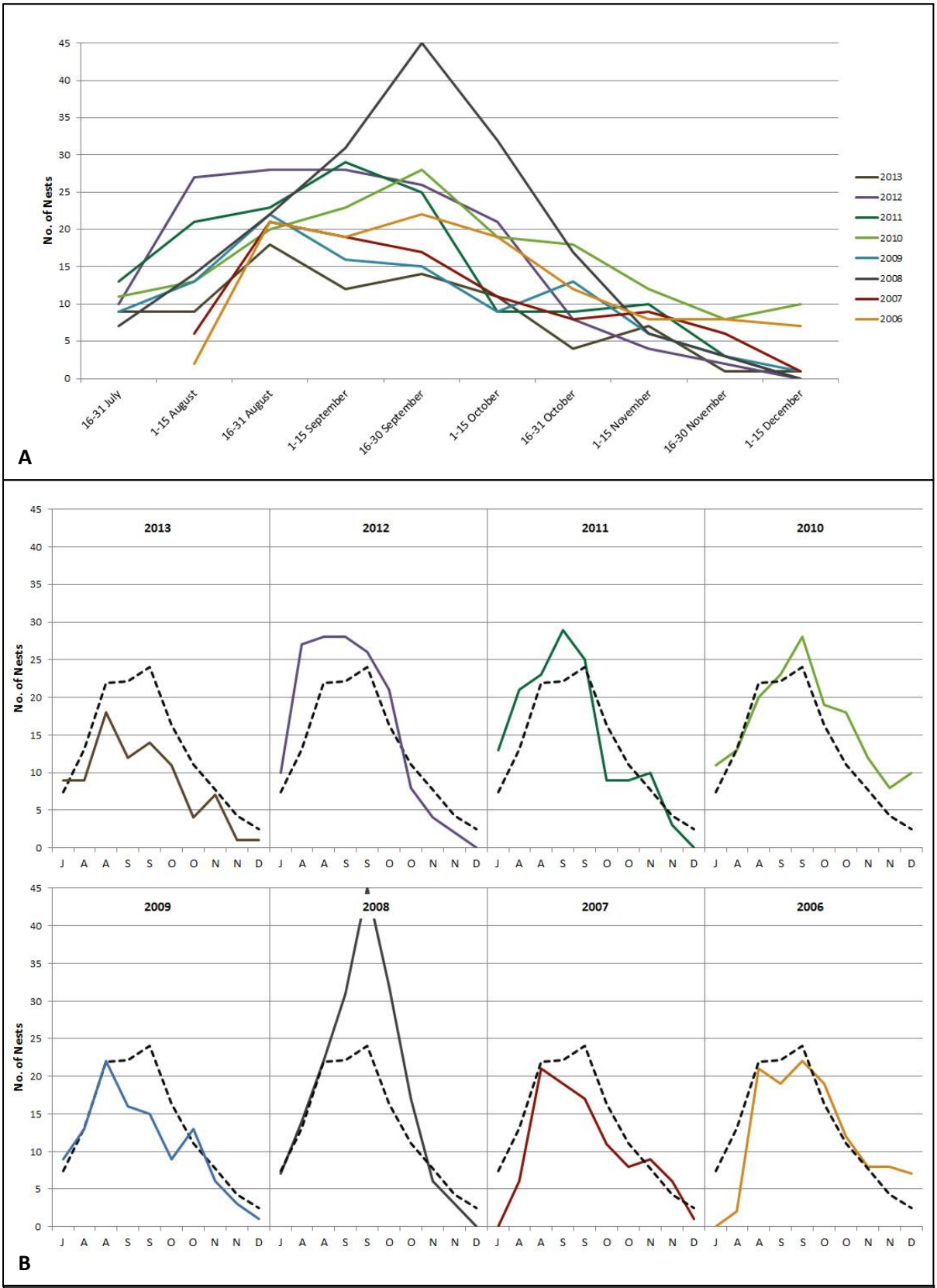


Figure 22. Temporal distribution of nests from July-December 2006-2013 on Drake Beach (**A**), and as compared to the mean distribution (dashed) (**B**)

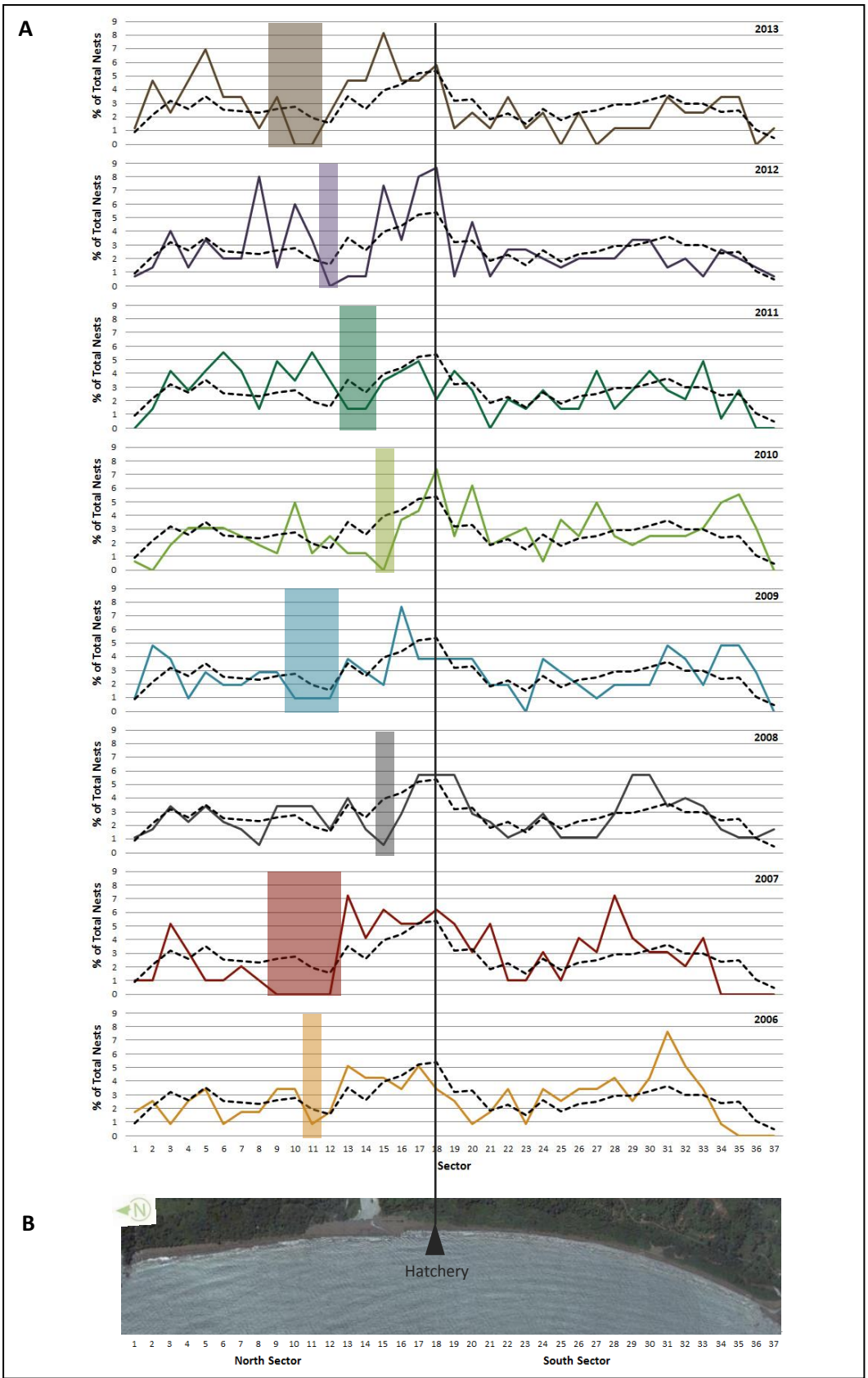


Figure 23. Spatial distribution of nests compared to mean distribution (**dashed**) July-December 2006-2013 on Drake Beach, showing approximate range of river mouth each year (**A**), and map of Drake Beach showing location of hatchery (**B**).

9.2 Nesting Behavior

9.2.1 Summary of Nesting Behavior

Of the 107 turtle exits registered on Drake Beach in 2013, 21 were false exits (20%). This is similar to the proportion observed in 2012 (23%), 2011 (24%), 2010 (23%) and 2008 (24%), but higher than that in observed in 2009 (16%), 2007 (14%) and 2006 (9%), suggesting that the incidence of false exits is season-specific and influenced by hitherto unidentified factors. Of the 86 nests registered on Drake Beach in 2012, 97.7% were found at or above the level of the high tide line, with 24.4% found in amongst the vegetation. Of the 45 Olive Ridley turtles seen nesting on Drake Beach during this period, 70% were found to be nesting facing East, with their back to the sea, while 15% were seen nesting facing the sea, 15% were found facing South, and none were found facing North.

9.2.2 Spatial Distribution

The data in **Figure 24A** show an apparent increase in the incidence of nesting in the northern sector of the beach from 2006-2013, in terms of the percentage of total nests laid on North Beach each season. The R^2 value of 0.41 generated suggests that this increase, while quite feasibly caused by a real change in nesting behavior, is not especially compelling statistically.

Figure 24B, however, shows that if these data are plotted according to nest *density*, taking into account the length of North Beach each season, the increase generates a much more convincing R^2 value of 0.72. While care should be taken not to interpret this as necessarily revealing an underlying cause, these data are indicative of a causal factor for the increase, which may be a change in nesting behavior and an increased preference for nesting on the North side of the river mouth.

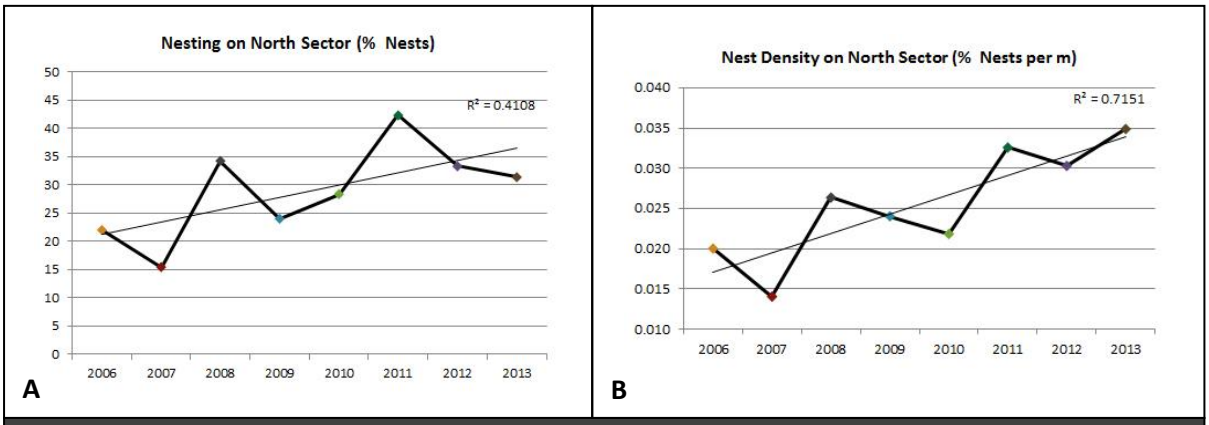


Figure 24. Nesting on North Beach, shown as a percentage of total nests laid (**A**), and as the percentage of total nests per m of beach (**B**), from July-December 2006-2013.

9.2.3 Re-Nesting and Re-Migration

Of the 45 distinct turtles registered, 9 turtles were found to have been tagged previously at the program (re-migrating), in 2011 (3), 2012 (3), and from unknown years (3), representing 23.1% of distinct turtle sightings. The data in **Figure 25** show that this value is higher than for any other year apart from 2010, bringing some relief that a downward trend has apparently been halted. The interpretation of these data should be treated with caution, since their collection is often impaired by human error; for example, it is likely that on many occasions turtles emerge with evidence of previous tags and are not identified as such by Patrol Leaders. Also, since the patrol groups only see around 49% of the nesting turtles each season, it is likely that other re-migrating individuals are missed. Nonetheless, this result may indicate that the situation may not be deteriorating as feared in 2012, and there are grounds for hope that more sea turtles will return to Drake Beach in the future.

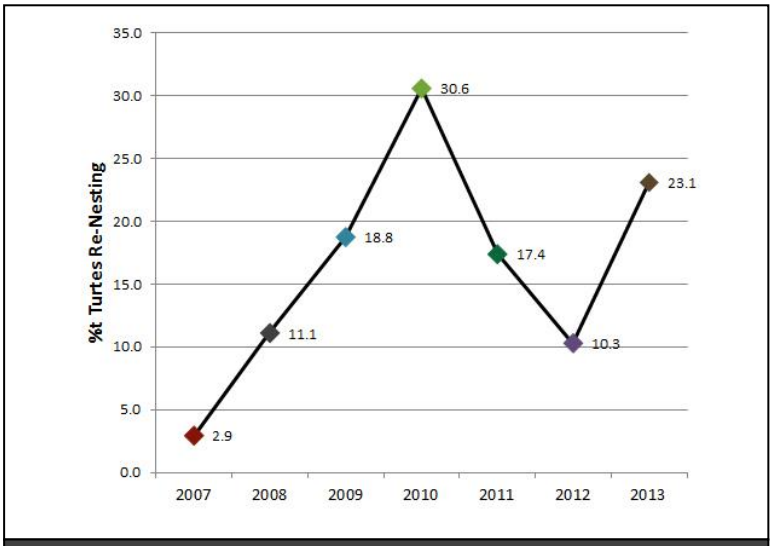


Figure 25. Turtles re-migrating from previous seasons, as a percentage of distinct turtle sightings, from July-December 2007-2013

9.2.4 Summary of Lunar Phases

In order to analyze the relationship between turtle exits and lunar phase, the percentage of total turtle exits was plotted according to the days of the lunar cycle for each season since 2006. The data shown in **Figure 26** show that, despite considerable seasonal variability, the mean temporal distribution during the course of the 29.5 day lunar cycle possesses some conserved features. The summary of the data in **Figure 27** shows that the mean temporal distribution is distinct from the linear distribution predicted by the null hypothesis. There are three notable sustained peaks in the distribution, at days 4-6 (waxing crescent), days 19-20 (waning gibbous), and at days 28-29 (waning crescent). The former two peaks correspond to the days of the spring tides, and the increase over days 19-20 is found to be statistically significant (t-student, $p<0.05$). These data appear to corroborate local claims that more turtles nest a few days either side of the full or new moon, and may be reliably used to predict peaks in the number of turtles nesting during night patrols.

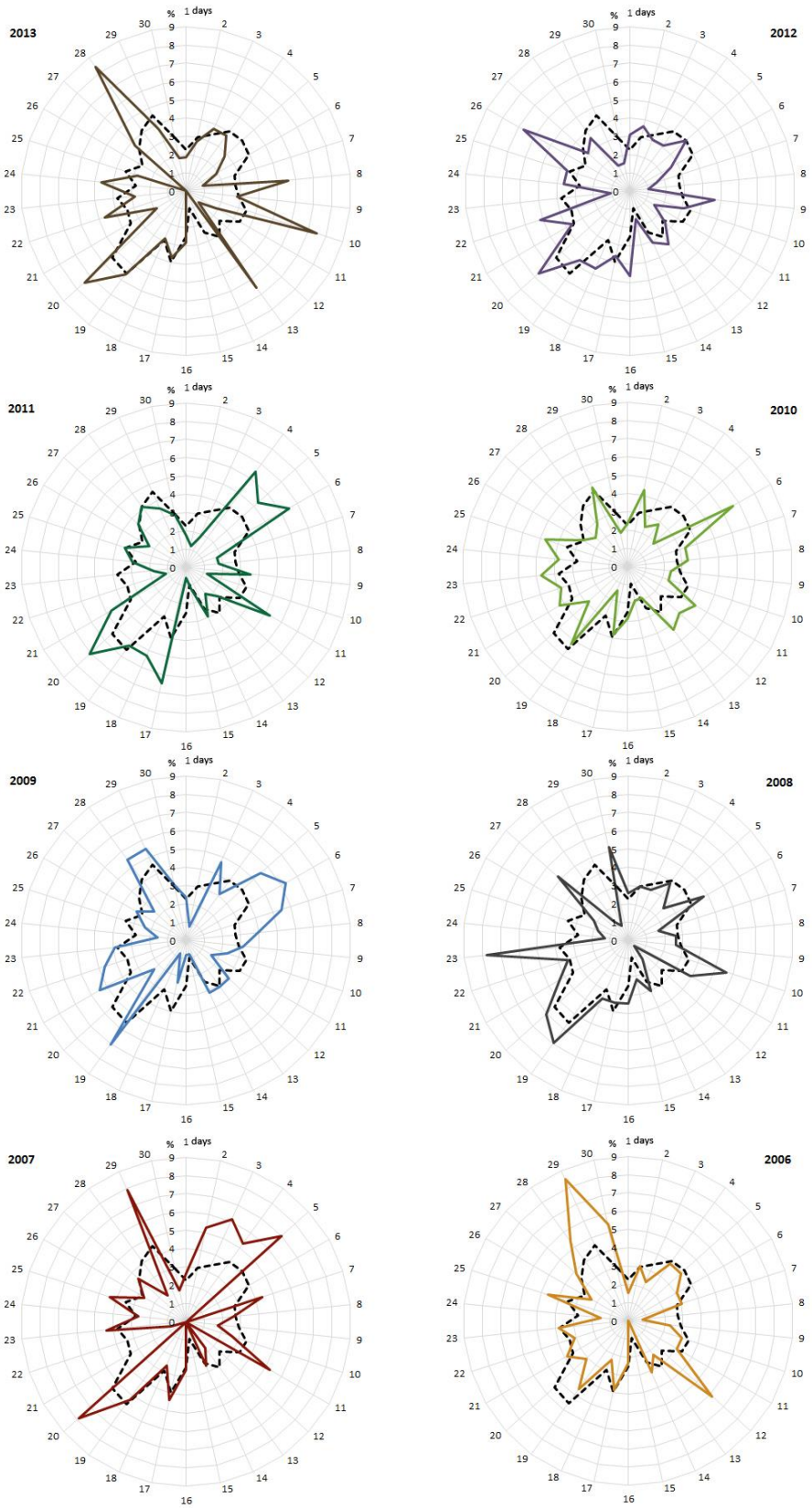


Figure 26. Percentage of total turtle exits in relation to days of the lunar cycle, from July-December 2006-2013 on Drake Beach, showing mean distribution (**dashed**).

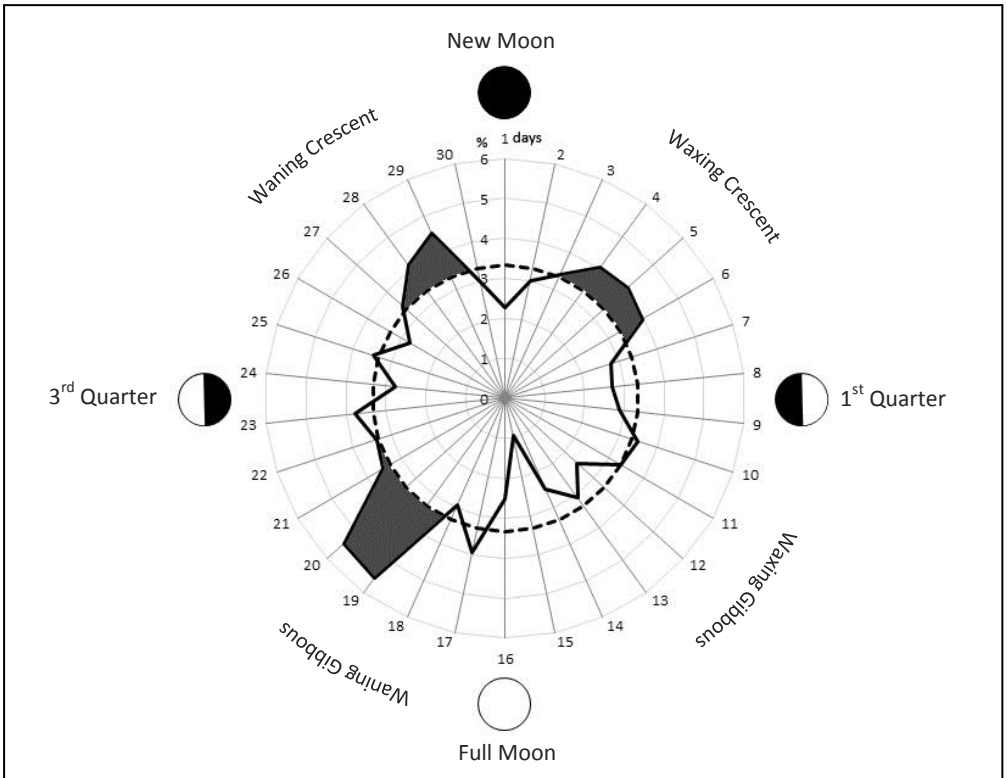


Figure 27. Mean percentage of total turtle exits in relation to days of the lunar cycle, from July-December 2006-2013 on Drake Beach, showing distribution predicted by null hypothesis (**dashed**) and three sustained peaks (**gray**).

9.3 Monitoring of Sand Temperatures

9.3.1 Summary of Sand Temperatures

In order to monitor changes in sand temperature throughout the 2013 season, dataloggers (HOBO Pendant Temperature UA-001-08/64) were deployed at various locations on the beach and in the hatchery during the course of the season. Control dataloggers were in position on Drake Beach North (sector 3), Drake Beach South (sector 17), Drake Beach South (sector 30) and the hatchery from August until December, while other dataloggers were placed within clutches of eggs to monitor the temperature of nests in the hatchery, as in previous seasons.

The temperature data summarized in **Figure 28** show that the southern sector 17 (min: 28.1°C; max: 30.0°C) and southern sector 30 (min: 26.6°C; max: 28.9°C) steadily cooled relative to the northern sector 3 (min: 28.9°C; max: 31.2°C) during the season. This trend may be attributed to the migration of the sun southward during the period August to December, since the mountains at Punta Agujitas cast shadows on southern sectors increasingly earlier in the afternoon than on northern sectors as the season progresses. Indeed, the lowest sand temperatures are observed on South sector 30, which is exposed to the fewest hours of sunlight of the three sectors analyzed.

This observation broadly implies that the natural male bias for Olive Ridley turtle reproduction known to exist on Drake Beach (James R, 2012; James R, 2011; Melero D, 2010) is probably more extreme for nests incubating in southern sectors than in northern ones.

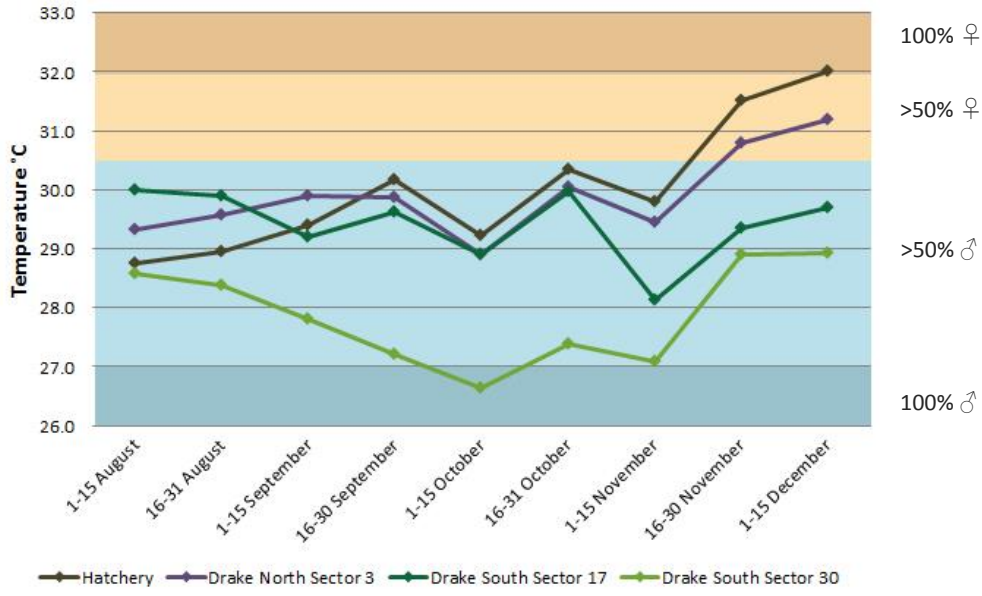


Figure 28. Mean sand temperatures [accuracy ±0.47 °C] at control locations in the hatchery and on Drake Beach, showing pivotal temperature range during thermo-sensitive period, from 01 August - 15 December 2013.

9.3.2 Monitoring and Management of Nest Temperatures in the Hatchery

In order to emulate the success of the management of sand temperatures in the hatchery during 2012 (considered an 'ideal' model season), when the hatchery was kept entirely shaded with a mosquito mesh roof from the beginning of the season until 01 October, a similar strategy was adopted for 2013. Monitoring of sand temperatures in the hatchery, however, quickly revealed that 2013 was a naturally much cooler season than 2012, and so the roof was removed on 10 September 2013 to try to elevate the sand temperatures in the hatchery earlier. The data in **Figure 28** show that this strategy was successful, in that sand temperatures inside the hatchery increased relative to those in the neighboring beach sector 17 from 10 September onward.

The graph in **Figure 29** compares mean nest incubation periods, plotted according to nest hatch date, with mean sand temperatures in the hatchery from 01 August to 15 December in 2012 (model season) and in 2013. **Figure 29B** shows that temperatures were generally lower during the 2013 season than in 2012, the hatchery remaining on average 0.3°C cooler than the 2012 hatchery. However, unlike in 2012, the 2013 season was extremely dry and lacked a prolonged period of heavy rain in October, and so a big dip in sand temperatures was avoided. As a result, mean sand temperatures in the 2013 hatchery were successfully maintained within 1.76°C of the optimum nest temperature for Olive Ridley sea turtles (30.5 °C (Wibbels T, 1998) throughout the entire season.

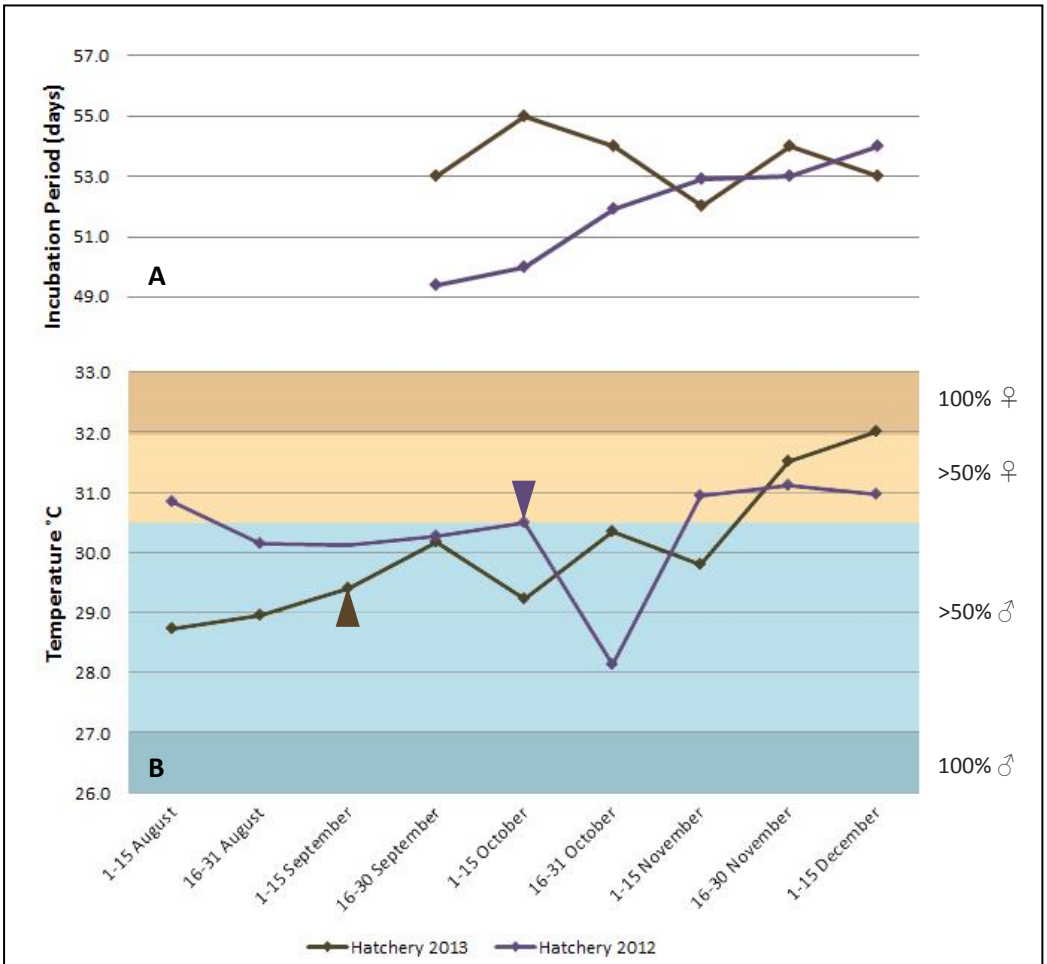


Figure 29. Mean incubation period for nests in the hatchery in days (**A**), and mean sand temperatures [accuracy ±0.47 °C] at control locations in the hatchery, showing pivotal temperature range during thermo-sensitive period (**B**), from 01 August - 15 December in 2012 and 2013. Arrows indicate date at which the roof was removed from the hatchery each year.

Figure 29A shows that the mean incubation period for nests in hatchery increased in a temperature-dependent manner throughout the nesting season during 2012 and 2013. As a result of the lower sand temperatures in 2013, the mean incubation period was longer in 2013 (min: 52.0; max: 55.0; mean 53.5 days) than in 2012 (min: 49.4; max: 54.0; mean 51.9 days). A notable decrease in incubation period was observed during the period 1-15 November 2013, attributable to the removal of the shading roof from the hatchery two months earlier.

9.3.3 Determination of Sex Ratio

The sex ratio for each nest in the hatchery was estimated according the indirect method described in **Section 8.8**. Analysis of these data shows that a male bias was estimated to occur in 72.4% of nests in the hatchery during 2013. This result is higher than that obtained using the same methodology during the 2012 (66.1%) season, but similar to that of the 2011 (71.4%) and 2010 (66.7%) seasons

(James R, 2012; James R, 2011; González-Paredes D**,** 2011). This result reinforces the notion that ambient temperatures were unusually high during the 2012 season. Of the 4,463 hatchlings liberated from the hatchery during 2013, 2,674 were estimated to be male (59.9%), and 1,789 female (40.1%), which is reasonably close to desired 50% optimum and indicative of the successful management of hatchery sand temperature, given the cooler weather experienced in 2013.

9.4 Reproductive Success

9.4.1 Summary of Reproductive Success

In order to determine the reproductive success of a particular nest, the percentage of hatchlings successfully performing eclosion (hatching from the egg) or emergence (climbing out from the nest) was calculated. The data in **Table 1** show that the 2013 season yielded an average reproductive success in the hatchery. Unfortunately, due to the extremely low number of nests laid during 2013, an insufficient number of nests were incubated on the beach in order to reliably determine eclosion and emergence rates for the beach.

	Beach			Hatchery		
Year	% Mean Eclosion	% Mean Emergence	n	% Mean Eclosion	% Mean Emergence	n
2013	n/a	n/a	n/a	78.9	76.8	58
2012	86.35	71.07	7	86.94	84.82	110
2011	71.17	54.78	6	74.16	69.98	106
2010	76.2	73.86	11	80.41	78.39	92
2009	81.63	77.29	24	75.21	73.26	40
2008	76.71	72.99	48	62.61	61.39	48
2007	75.41	68.07	n/a	85.78	83.12	n/a
2006	81.8	75.8	n/a	89.2	85.2	n/a
Mean	78.5	70.6		79.1	76.6	

Table 1. Reproductive success of nests in the beach and the hatchery from July-December 2006-2013 on Drake Beach

9.5 Biometric Data

9.5.1 Nesting Species

Of the 86 nests registered at the program on Drake Beach this season, 83 (96.5%) were laid by Olive Ridley sea turtles, two were laid by a Hawksbill turtle (2.3%), and one (1.2%) by a Pacific Green sea turtle. This is the first time in the history of the program that baby Hawksbill turtles have been positively identified and incubated in the hatchery at Drake Beach (see **Figure 30**). Unfortunately the nesting female Hawksbill and Green turtles were not found during night patrols.

Figure 30. Species of sea turtle liberated by the program from 2006-2013.

9.5.2 Summary of Biometric Data

Biometric data registered for nesting females 2013 on Drake Beach are summarized in **Table 2**. The largest number of eggs ever discovered in an Olive Ridley nest at the program, with 145 eggs, was registered during 2013.

Olive Ridley n= 45 Nesting Females					
Nesting Female	Carapace (curved)		Width of Track (cm)	Depth of Nest (cm)	No. of Eggs in Nest
	L (cm)	W (cm)			
Median	66.0	69.0	69.5	42.3	97
Range	57.0 73.0	61.0 74.0	52.0 87.0	35.0 50.0	8 145

Table 2. Summary of biometric data registered from July-December 2013 on Drake Beach.

10.0 Conclusions

10.1 Volunteer Program

Volunteer intake for the 2013 season (70 volunteers) was comparable to that of 2012 (73 volunteers) (see **Figure 31**). However, the average duration of volunteer placements increased from 20 days in 2012 to 24 days in 2013, and many more volunteers registered for long-term places (4 weeks or more) than in any other year. In addition the pricing for the camp and homestay accommodations was equalized and it became mandatory for all volunteers to spend at least a week in homestay. As a result, nearly all volunteers chose to remain in homestay, leading to a dramatic increase in income for the houses in the homestay network. This season the homestay network earned 221% of the amount earned throughout the entire 2012 season, and far more than in any other year (see **Table 3**).

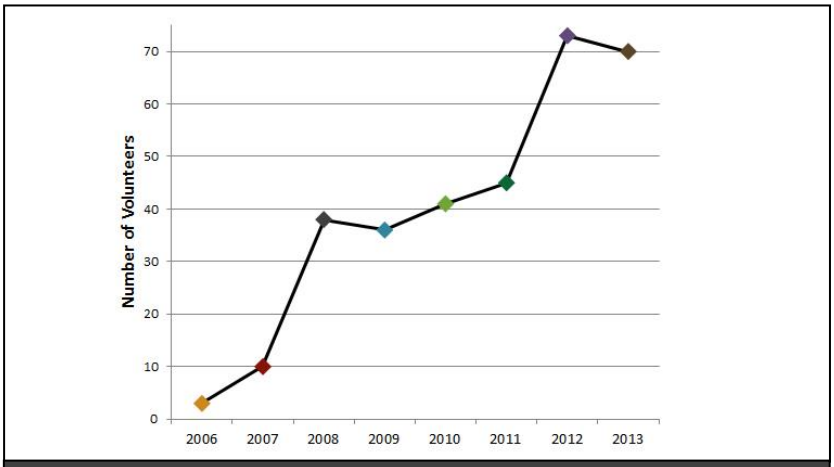


Figure 31. Number of volunteers participating in the program from 2006-2013.

The construction of a dedicated camp for the program in the village of El Progreso in 2012 transformed the volunteer experience and permitted the centralization of program activities in a single location. In addition to the improved facilities available to volunteers at the camp in 2012, the site also provided many leisure activities, including a trail to the swimmable Río Tortuga, a barbeque and outdoor tables, and a volleyball court. The camp also functioned as a venue for environmental education and community activities, and permitted the participation of volunteers in sustainable living activities such as recycling, composting, gardening and horticulture. 2013 has seen the camp develop even more, through the installation of new facilities, the construction of dedicated offices for the program and for ACOTPRO, and through many small improvements that have enhanced the volunteer experience, such as the installation of Wi-Fi internet.

The experience of volunteers was evaluated using anonymous feedback forms distributed to participants before their departure (see **Section 11** for complete evaluation). Of those surveyed, 96% rated their overall experience as very good or excellent, while 94% and 62% similarly rated their accommodation in homestay and at the camp, respectively.

Nombre	2010	2011	2012	2013
Alberto Rivera	0	0	0	697,500
Alexander Jiménez	0	0	0	472,500
Edin Pomares	0	945,607	507,000	997,500
Emilce Torres	0	0	0	510,000
Emilio Varela	0	0	0	607,500
Fernando Chavez	0	0	251,000	637,500
Jhonson Villalobos	0	0	435,000	697,500
Karen Villalobos	0	0	0	397,500
Lilian Jiménez	0	0	0	375,000
Marielos Almengor	0	0	510,000	427,500
Mario Varela	0	0	0	390,000
Marvin Salazar	0	0	0	375,000
Maximiliano Rojas	790,000	423,914	579,000	945,000
Migue Sanchez	0	597,651	435,000	592,500
Olga Jiménez	0	0	0	622,500
Olmer Salazar	0	0	470,000	0
Teresa Obando	0	1,841,651	556,500	0
Venero Varela	810,000	424,721	468,500	0
Victor Rojas	0	0	0	577,500
Yasmin Pomares	0	311,831	0	0
Subtotal (₡)	1,600,000	4,545,375	4,212,000	9,322,500
			Total (₡)	19,679,875
			Total ($)	**39,360**

Table 3. Income for homestay houses from 01 July – 15 December 2010-2013.

Regarding the work at the program, volunteers above all preferred working at the hatchery (91% very good or excellent), followed by night patrols (90%), and lastly work at the camp, such as planning, construction, decorating, cleaning and environmental education activities (62%).

Living and working at the camp was probably less popular in 2013 than in 2012 because there was much more work to do at the camp this season, and the nature of the gardening and construction activities offered was often physically demanding. The constant work activity at the camp probably created a less relaxing atmosphere for those wishing to enjoy downtime there; but a difficult balance had to be struck between offering extra work to those volunteers that wanted it – and respite for those that didn't – simultaneously at the same location. Living at the camp probably appeared less good value this season too, since those lodging at the camp had scheduled cleaning chores and cooking duty to attend to, while for the same price those lodging in homestay had private rooms, no cleaning duties, and three meals per day provided for them. However, this was intentional, as the objective in 2013 was to have as many of the volunteers staying in homestay as possible, and to that end the policy of normalizing accommodation prices was demonstrably successful.

Volunteers were more enthusiastic about the excursions offered by the program this year than in 2012, with 91% rating them as very good or excellent. This improvement was likely due to the diversification of tours offered, competitive pricing, and improved logistics and tourist information. These changes were implemented, along with many others, in response to recommendations from volunteers participating in the program in 2012.

Key recommendations from volunteers in 2013 included: the need to improve training and orientation (as always); to move the camp closer to the beach (!); to provide more training at the beach; to ensure that volunteers pull their weight and do their fair share of work; to improve coordination of activities through meetings with volunteers; to be more strict with the local leaders with their attendance and adherence to work protocols; to consider sending at least two volunteers to the hatchery per shift; to continue to provide Spanish lessons for volunteers; to purchase better tools and resources; to organize more meals for all volunteers at the camp for those living in homestays; to arrange a weekly turtle quiz night, to provide better first aid; to keep dogs out of the camp; and improve information regarding appropriate clothes and footwear for excursions.

10.2 Sea Turtle Conservation Program

10.2.1 Summary

The eighth season of the Corcovado Foundation Sea Turtle Conservation Program was successful in addressing its core objectives: to promote the long-term survival of the nesting population, by protecting the turtle eggs from illegal poaching and natural predation; to characterize the nesting behavior of the turtles reproducing in Drake Bay, in order to inform future conservation strategy; and to prove the effectiveness of the methodologies used, such as the relocation of nests and the use of a hatchery.

The program ultimately registered 107 turtle exits on Drake Beach during, which is the fewest registered in any season in the history of the program. The reasons for this marked drop in turtle nesting events are unknown, but it may be due to an as yet un-characterized long-term migration cycle, since such cycles appear especially dramatic when the overall population of nesting turtles is small. However, the reduction may have occurred as a result of unfavorable nesting conditions or climate in Drake Bay, for reasons not currently understood, or because of the low availability of food in feeding zones during the first six months of the year, causing females to defer their migration to reproduce until the next year. The reduction may also be due to a large-scale loss of adult turtles in 2013 through illegal fishing practices, poisoning, contamination, or another lethal man-made impact on the population. The latter, mercifully, seems less likely, as an increased proportion of the turtles registered in 2013 were re-migrating to Drake Beach – a trend that would not be expected following an indiscriminate loss of life within the population. Other (but not all) turtle conservation projects in the Pacific coast of Costa Rica have similarly reported reductions in turtle nesting activity in 2013, so it seems likely that the reduction occurred as a result of a long-term migration cycle or climate-induced change in reproductive behavior.

The weather during the 2013 season was extremely dry, although notably cooler than in 2012, with almost no discernable extended rainy period. The mouth of the Drake River also remained between sectors 9-12 for the entire season, which simplified the logistics of night patrols and hatchery shifts considerably compared to previous seasons. Due to the destruction of the North Beach sand bank from section 9-12 by the river mouth, new trails had to be cut through the jungle to reach North

Beach, and night patrols in this sector covered just 900m of beach, making them a little tedious. However, volunteer feedback showed an increase in the quality of night patrol experiences compared to 2012, indicative of good management of expectations and workloads for volunteers.

10.2.2 Hatchery

The hatchery performed satisfactorily well during the 2013 season, with eclosion (78.9%) and emergence (76.8%) rates consistent with the historical averages at the program (79.1% and 76.6%, respectively), and mean sand temperature in the hatchery was successfully maintained within 1.76°C of the optimum nest temperature for Olive Ridley sea turtles for the entire nesting season. The successful monitoring and management of sand temperatures in the hatchery resulted in an estimated sex ratio of 59.9% male and 40.1% female, which, although less equal than that obtained in 2012, is perfectly acceptable in a location with a natural male bias.

10.3 Environmental Education Program

During the 2013 season, the Environmental Education component of the program achieved its general objective: to raise awareness of the importance of conserving natural resources and how young people may contribute to conservation efforts. The sea turtle program helped to coordinate several activities with the Environmental Education program during the season, with Coordinators Sai Eraso and Aida García frequently seconded to support the Environmental Educator. Volunteers and Coordinators from the turtle program also created and taught several classes in the school in Rancho Quemado (see **Section 3**), and assisted with the three out-of-school groups, the 'Pumas' of Progreso, 'Jaguars' of Agujitas and 'Águilas' of Los Ángeles, with whom they produced three plays that were performed during the Turtle Festival.

The 2013 Turtle Festival took place on Drake Beach South on Saturday 7 and Sunday 8 December. The Festival enjoyed excellent weather, was extremely well organized, and all of the activities that had been planned took place (see **Section 3**). The event was attended by an estimated 150 people on Saturday and over 250 people on Sunday, which is similar to previous years. The Festival featured one hatching liberation on Sunday afternoon, marking the close of the Festival and the turtle season.

10.4 Economic Development Program

During the 2013 season, the Economic Development Program achieved its general objective: to foster socio-economic alternatives that permit the community to generate income through conservation-dependent initiatives, such as ecotourism. All 32 ACOTPRO members received basic training, including 10 that joined the association in 2013, and 26 members became certified as Patrol Leaders and/or Hatchery Managers (see **Figure 32**). The amount paid to local leaders also increased dramatically to $20 per shift, which also resulted in a decrease in the number of locals contracted, a decrease in the number of shifts carried out (355) compared to 2012 (579), and the cancellation of the sister conservation project at neighboring Ganado Beach. Local contracted leaders have now earned $24,710 since 2010, earning $5,926 in 2010, $4,736 in 2011, $6,948 in 2012, and $7,100 in 2013.

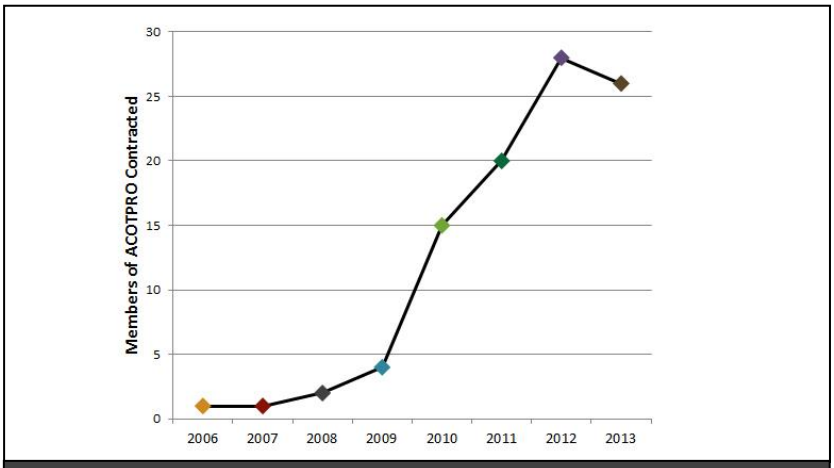


Figure 32. Number of locals contracted by the program, from 2006-2013

This season a total of 55 turtles were adopted, raising $2,660 for the program, and it is anticipated that this scheme will be more heavily promoted in order to raise funds for the next season. It is hoped that between 70 and 100 turtles may be adopted during 2014, raising a potential $5,000 or more for the program.

During 2013, responsibility for a number of aspects of the program was handed to ACOTPRO in order to begin the process of transferring control of the program to this local organization. This process was augmented through the employment of a local Coordinator from the association, Mario Varela, and through the provision of a number of participatory workshops by the program to develop tools for ACOTPRO's own volunteer program and conservation project. Workshops were provided to improve the website of ACOTPRO, develop a plan for the division of responsibilities between members of the association, develop basic protocols for the coordination of volunteers, and to provide training in good accounting practices. New training materials were also provided to ACOTPRO by the program in 2013, including a bilingual Hatchery Manual, and training videos for nest relocations and exhumations.

Mario Varela was responsible for coordinating all local shifts, managing the data from night patrols and the hatchery, coordinating volunteer activities, and was trained in project management, data analysis, conservation methodology, volunteer coordination, English and computing skills throughout the season. Mario's highly commendable work represented a big step forward in the level of involvement of local people in the coordination of the program, and Mario has emerged as the member of the community most qualified to lead a locally-managed turtle project.

Unfortunately, despite the extra tools, encouragement and training made available to the directors of ACOTPRO by the program throughout the season, and the provision of a paid Coordinator position for one of their members, the directors did not take the initiative to take more control of the program in 2013. The coordination of the construction and management of the hatchery, the management of the homestay network, and the organization of the annual Turtle Festival remained in the hands of the Corcovado Foundation. It is hoped, however, that should funding for the 2014 be acquired, that resources can be invested once again in training the directors of ACOTPRO so that one day they might take the initiative and responsibility to manage their own community-led program with the support and supervision of the Corcovado Foundation.

11.0 Volunteer Feedback

Question	Responses
Do have any comments or recommendations regarding the work at the program?	Vivero: more additional duties besides of the normal work.
	Generally great: direction and teamwork. Learned a lot of new staff and took on new challenges.
	It will be great do a volunteers meeting every week.
	I would recommend to be a bit more on top of the local patrol leaders.
	Night patrols are good but with a turtle would it be better. I think it is not necessary to go the north beach patrol five or six times. If the turtles needed longer time to lay eggs.
	Too much free time, I got bored some days.
	No, I think the program is fantastic. I enjoyed a lot. I wish I was here longer.
	Camp work at times was good but sometimes annoying. I found that a lot of the time when I did put extra effort in it was either not notice or not appreciated. There were times I did other peoples chores and I didn't get a thank you. It did affect my work etc later on in the program but I did like the fact that there was stuff to do and I enjoyed seeing the camp develop.
	Ensure that people are all doing their fair share of, as when one person works less, it can create animosity.
	It was great to see some baby turtles and to release them into the sea.
	The work you do is so great so move forward and never give up.
	Not so many activities out of the program or for the camp.
	The camp is so far away from de beach. The nights at the hatchery were so long. We should work more with the community.
	Good variety of work.
	I enjoyed the variety of work. Tough work sometimes but felt good to see the results.
	Work is tedious but rewarding. Perhaps more guidance on the camp work. The staff care very much about the program.
	Some of the task given didn't fell like it was related to the turtles and more towards making the camp site more ascetically appealing.
	Tell volunteers to bring long socks for boots.
	Keep the camp work chilled, hard bits in small doses, on hot days with lots of water breaks encouraged
	I can see that a lot of thought has gone into the project. It runs smoothly for such complex logistics. I like the emphasis on learning about the community as well as the turtles
	I learned a lot.
	I loved doing the manual labor. The hatchery was one of my favorite types of work.
	For the orientation it would be nice to have a little more information directly at the place.

Do have any comments or recommendations regarding accommodation?	Group lunches once a week. I felt quite bored of the Costa Rican food and it´s nice to have moments like this.
	Family was very welcoming-glad we stayed at homestay the whole time. Everyone in the village is so friendly
	Staying in a homestay gave me a great opportunity to learn more about the culture and Spanish language. My family was lovely.
	Homestay was an amazing experience. A great way to get to know the community. A great family and the camp too.
	The family, especially the mother, she works hard to try make me happy and comfortable.
	We got too much food.
	They were a good family but they gave to us to much food.
	I think it is great to have to volunteers stay in homestay I was immersed in true Costa Rican life. I was apprehensive about it at first but loved every minute.
	Max´s house was awesome. They are an amazing family and were very accommodating. I will definitely miss them. My dorm room at camp got very damp and the curtain often got wet due to rain. My bed was very comfortable. Look into getting a washing machine, bucket cold wash is very difficult to do and rather harsh on my clothes. But otherwise I did enjoy being at camp, specially hot showers and not eating rice every day.
	Thanks for Migue´s family.
	Our room was clean and the family was really polite and just wonderful, everything. Casa de Migue - I would always come back, always really friendly and the food was great.
	The family we stayed with is so sweet. They accept us as their babies, they took care about us and worried.
	Really good family.
	The camp was AMAZING. I loved learning how to cook. Homestay was okay.
	The family was nice and I would recommend, Nevertheless I was not really part of their family live.
	Too much food.
	Loved the food.
	Edin and Yerlani were amazing, they were the perfect host.
	Perfect mach for me! Lilian is great and cooks really well.
	I would recommend to stay as long as possible in homestay. I guess sleeping in the dorm becomes a little bit annoying after a couple of weeks.
	I stayed at Fernando's house and the family was great. Lots of food and very accommodating of the sometimes inconvenient meal times required by volunteering duties.
	The camp was very welcoming and accommodations comfortable. Tasks and chores were given out in a clear and organized manner. Great teamwork.
	The family was great.
	It was really nice having other volunteers at my home stay to help with transitioning.

Do have any comments or recommendations regarding excursions?	Pricey!
	Excursion was good but quite expensive.
	Varied and well organized. Enjoyed excursions involving local community.
	PN Corcovado-small and late lunch, for poor knowledge about organization. Isla del Caño-the guide was so selfish and he didn't care about us very well.
	PN Corcovado-the lunch was so small, but the guide was great. Isla del Caño- I didn't like the guide.
	They were a bit pricey especially since I work with the SA Rand. But I enjoyed all of them and would recommend them to anyone. I`m sad I never got to go horse-riding though.
	Finca de Felipe was great wonderful, amazing experience to walk through rivers and jungle.
	Would be helpful to be advised in advance of arrival of suitable footwear.
	Very very enjoyable.
	Loved the excursion to Caño Island, however coz there was 1x diver the site they took us to was too deep for snorkeling.
	The guide were great and very helpful.
	I wish we had done more excursions all together as a group.
	Loved it all.
	Expensive, but very good. There are some very nice options for excursions.

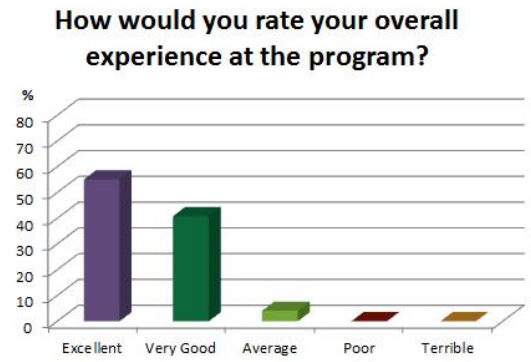
Do have any comments or recommendations regarding the Coordinator and/or Assistants?	The assistant was not really enthusiastic. Besides that it was hard to understand her.
	Grow a mustache.
	Friendly and always there to help. Answered any questions I had.
	Very friendly and helpful. They made me feel very welcome and part of the team.
	Rob, Sai and Oscar were all very welcoming and knowledgeable. Professional leaders with experience.
	Good job.
	More professionalism required in certain areas.
	I would like to get more information about biology of turtles.
	The assistants took seriously their job. They walk too fast during the night patrols. I enjoyed the patrol with Rob.
	Rob was an awesome coordinator without him I doubt my experience here would have been as enjoyable. He enjoys his job and definitely puts his all in to find work for volunteers. The assistants in the beginning were very hard to get along with from my part but in the end Sai opened up and Aida and Dave were very friendly. I will miss all of them.
	I think the coordinators and assistants would benefit from a weekly meeting to focus on the tasks for that week.
	Very nice people.
	Really good Spanish lessons with Rob.
	The coordinator is a great guy. He inspired by his ideas, motivation to work and love to the environment.
	Excellent assistants. Good organization and always something fun to do.

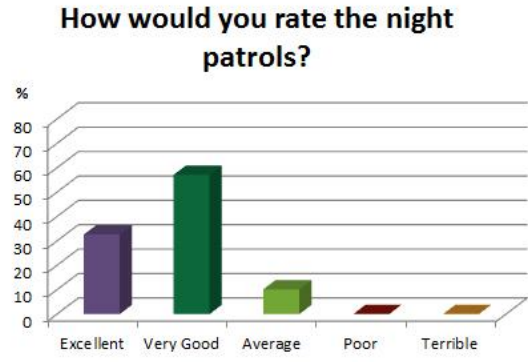
	Excellent, friendly and open-minded assistants. They helped us to feel part of the project and enjoy here.
	Super super friendly and welcoming.
	Amazing guys.
	Professional and knowledgeable.
	Oscar is the best, his veggie-burgers are beautiful.
	You have all been amazing. Only I suggestion would be maybe have a meeting each morning with everyone to go over what needs to be done and run through things that have happened during the week.
	Oscar and Sai were wonderful.
	Briefing everyone in the morning about what you want done that day.
	The coordinator is great. I loved both assistants. Aida is such a hard worker and did a really outstanding job.
	Good job! Thank you very much.
	Good job.
	Great assistants. Well-coordinated program, but sometimes it seems a little bit chaotic.
	Rob, Aida and Dave were great. Helpful and welcoming and willing to take the though the Corcovado Foundation goals and objectives despite my short stay.
	Rob was welcoming, friendly and extremely helpful as we made arrangements to come here, and also when we arrived Rob and the assistants clearly work hard and have created a positive, passionate team of volunteers. They also have made a clear and successful effort to integrate themselves and the organization into the local community.

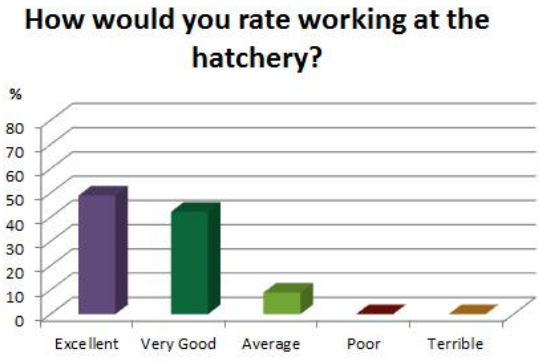
Do have any comments or recommendations regarding the local Patrol Leaders?	While the majority of then take their work seriously, make sure everyone of then knows exactly what they should do when encountering a turtle or a nest.
	Some are lazy, long rest on night patrols.
	Some of the locals Patrol leaders were quite lazy on our night patrols.
	Despite the language, I felt comfortable with all local leaders and confident in their knowledge of the subject.
	Better training. Making clear the importance of the volunteers: respect.
	If they spoke a little bit English, would it be better, coz I don't speak Spanish.
	I enjoyed the night patrols.
	The local patrol leaders were great, they always made effort to talk to me even though we couldn't understand each other. Martin, Minor, Victor, Manuel were all awesome to patrol with.
	Varied in their styles, some are lazier and others are excellent leaders (Chico is very good).
	Good people, was never a problem of communication or safety.
	Always nice and helpful patrol leaders. Maybe sometimes better to have an English speaking patrol leaders.
	They are friendly and charming. I felt safety to patrol with them.
	They are great but they need to work hard with their organization.
	Personally, I should be more strict with the patrol leaders.
	Super friendly.

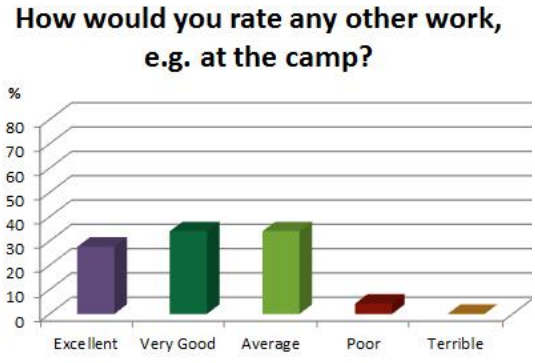
	Very enjoyable to work it them.
	Some require more education regarding the program and what to do when eggs/turtles are found. I think all the patrol leaders should have the number for the hatchery and coordinators if some issues can be easily resolved.
	It would be helpful if the patrols had more training/knowledge.
	All really nice, sometimes felt they didn't know what they were doing.
	I became good friends with a few locals, which really helped my Spanish.
	We didn't get a chance to interact with the locals.
	No complaints. All friendly. Max easiest to understand.
	Most of them are nice, but some should not patrol with each other.

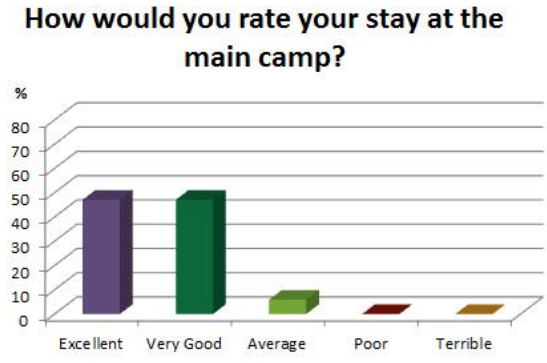
Do have any comments or recommendations regarding any other aspect of the program?	Weekly turtle class would be fun.
	No, just if someone tells you that is going to help you cross the river and that never happens. It's frightening.
	Really enjoyed our stay. Wish it could have been longer. Camps in good location within village but quite far from the beach .
	A really enjoyable time and rewarding. Wish I could have stayed much longer.
	Improved delegation of tasks other than patrol-vivero would produce great productivity in completion of to do list.
	They are doing a great job, and they try to improve some things that are not doing well. I think that some volunteers and some locals need motivation.
	Keep the dogs out of the camp, they really smell and they have diseases. The patrol backpackers smell some times.
	Transport in the area sucks balls. But I guess that's the roads and just general Osa life.
	Happy to see the camp basics are specified to individuals.
	Please put a small towel for hands near the sink.
	Great to stay and I really recommend, but not so many turtles this year.
	Thanks for having such an excellent program.
	Overall, it was a good program. Better organized than others I had heard of.
	Better resources and equipment at the camp site. If we are using it daily the equipment shouldn't be hazardous, wire, cutters, broken.
	Encouraging the rules/on-site working more strictly for volunteers. Sometimes volunteers seemed lost/slacked off and to lack of direction/motivation.
	More first aid. Encourage people wearing closed shoes during camp work.
	I like the weather-by-the-month page on the website.
	Working in the project is great, but after a long time it can become monotonous.
	I had the most amazing time of my life. Completely unforgettable. This change me for the better.
	I would prefer having hatchery shifts with two people instead of being alone all night.

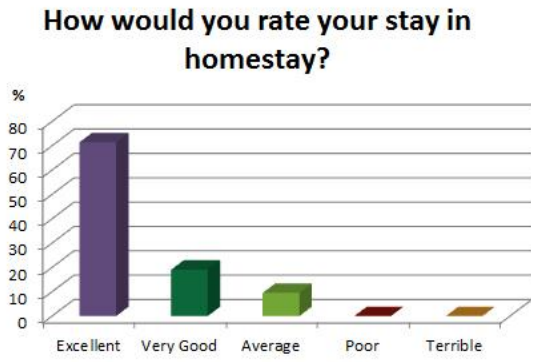












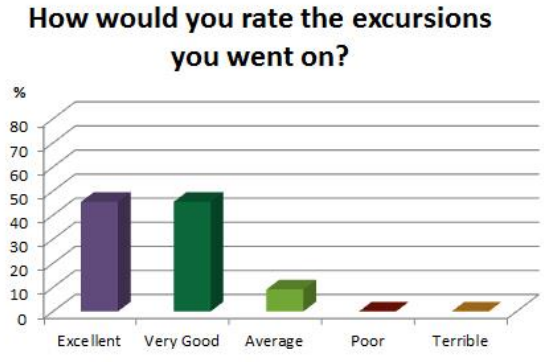


Figure 33. Summary of volunteer feedback from 2013

12.0 Recommendations

Program Structure	Recommendations
ACOTPRO	• During 2013, responsibility for some aspects of the program was passed to ACOTPRO, such as the coordination of local patrol shifts, and the Corcovado Foundation is committed to pursuing this transition to local control. In 2014, ACOTPRO should be responsible for coordinating all conservation activities and shifts, the homestay network, and the recruitment and coordination of their own volunteers, with continued support, advice and training from the Corcovado Foundation.
Corcovado Foundation in Drake Bay	• The role of the Foundation in Drake Bay during 2014 should be limited to supporting ACOTPRO in their new role assuming the responsibility of protecting sea turtles from poachers, while simultaneously establishing the new Sea Turtle Conservation Program in Río Oro.
Corcovado Foundation in Río Oro	• MINAET has invited the Corcovado Foundation to lead an effort to protect the turtle population in the Río Oro Wildlife Refuge – possibly the most important sea turtle nesting beach in the Osa Peninsula – and emulate the successes of Drake Bay in the community of Río Oro. • The delivery of this program represents a significant expansion of the community-led model practiced by the Corcovado Foundation, and at least a 20-fold increase in the number of sea turtles protected by the organization. • The main focus of the Foundation efforts should be: 1. To reduce the poaching of turtle eggs and other natural resources in Río Oro. 2. Replicate successes from Drake Bay in Río Oro. 3. To promote the concept of natural heritage conservation among the local communities of Drake Bay and Río Oro through environmental education. 4. To generate income for the members of the community involved in the turtle conservation efforts, so that they see their efforts rewarded.

Personnel	Recommendations
Coordinators	• Time should be divided equally between Drake Bay and Río Oro for the Program Director, in order to support ACOTPRO in Drake Bay, and also direct the new program in Río Oro. The Program Director should be predominantly based at Drake Bay, however, where there is internet and telephone coverage. • An experience turtle project Coordinator should be based at Río Oro, responsible for the delivery of the conservation and volunteer coordination activities.

Research Assistants	• At least one, but ideally two, Research Assistants should be based at Río Oro, to support the Coordinator in the delivery of the conservation and volunteer coordination activities.
Volunteers	• Volunteer places should be offered predominantly at Río Oro, but some may be seconded to Drake Bay if it emerges that ACOTPRO require extra help, and only if resources are available to ensure satisfactory supervision and the coordination of their activities. • The accommodation at Río Oro will be basic and remote, and so the cost of volunteering there should reflect that. A price of $15 per night, including food and lodging, is recommended. • The cost of volunteering in Drake Bay should remain the same, at $25 per night, and it should remain mandatory to stay in homestay for at least 7 nights.

Activity/Item	Recommendations
Hatchery Strategy	• For the 2014 season, neither conservation project in Río Oro nor Drake Bay should manage a hatchery. This will help to simplify the methodology and logistics for ACOTPRO in Drake Bay, and reduce the cost of their program. At Río Oro, it is required that preliminary data be gathered and permission be sought from MINAET during this first season, before a hatchery may be constructed.
Patrol Strategy	• At both sites, two night patrols of the beach should be conducted every night from the beginning of the nesting season in July until the close of the program at the end of December.
Relocation Strategy	• Wherever possible, nests should be relocated to other locations on the beach, and the location of a large sample of these nests should be recorded so that they may be exhumed.
Anti-Poacher Strategy	• Continue to engage with and offer alternatives to poachers, through training and contracted work at the program. • Adopt a policy of verbal warnings followed by reporting to MINAET regarding poachers who repeatedly offend. • Minimize use of light signals; use poacher routes by vegetation. • Leave some nests un-camouflaged to waste time of poachers. • During peak nesting season morning patrol should start at 4am to close poaching window.
Volunteer Program	• The project at Río Oro will require the establishment of administration tools, including: 1. Volunteer program promotion materials, such as website content, orientation manuals. 2. Volunteer training material, such as training presentations, workshops. 3. Volunteer coordination tools, such as databases, emails, forms, transport guidelines, protocols. • Update information on all websites with Orientation Manual. • Seek additional volunteer sites and organizations.

Camp at Río Oro	• The camp site at Río Oro will require the following installations: Water supply — to be obtained from disused school building Dorm tent(s) — containing bunk beds Living space tent — containing kitchen, storage and living spaces Secure bodega — to store equipment and materials Secure safe — to store computers, phones, money etc Fuel store — to safely and securely store gas and gasoline Generator house — to safely and securely store the generator Bathrooms — toilet and shower cubicles Septic tank — required, unless toilet waste is to be burned Composter — to process food waste
Camp at Drake Bay	• The camp at Drake Bay will require the following installations: Laundry room — required to complete the facilities at the camp New flooring — the current cement flooring requires a permanent replacement, such as ceramic tiles

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