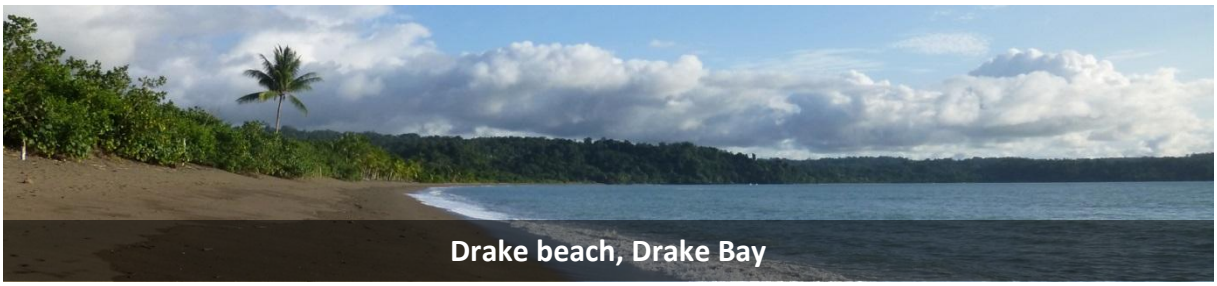
FUNDACIÓN CORCOVADO
PROGRAMA DE CONSERVACIÓN DE TORTUGAS MARINAS

Investigation and Conservation of Sea Turtles
Drake Bay and Río Oro National Wildlife Refuge

Osa Peninsula, Costa Rica

Final Report to Rufford Foundation

01 June 2015 – 31 May 2016



Drake beach, Drake Bay

Río Oro beach, Río Oro National Wildlife Refuge

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Program Director

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Research Assistants

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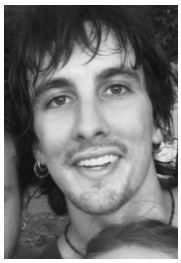
Rob obtained his PhD in molecular biology from University College London in 2007 and subsequently held research management positions at the Royal College of Art and the Wellcome Trust in the UK. He worked as a Coordinator and Research Assistant at various conservation and wildlife projects in Latin America from 2009 onward, and joined the Corcovado Foundation as Program Director in 2011. In 2014 he co-founded the Foundation's non-profit hostel, Drake Bay Backpackers.

Aida García Solà | Coordinator

Aida completed her Masters in Oceanography and Marine Management at Barcelona University, Spain, in 2008. She worked with a scholarship at CRAM Barcelona in 2005, rehabilitating sick Loggerhead turtles, and has worked in several conservation projects in Spain, Greece and Australia. Aida worked as the Biologist at Reserva Pacuare throughout the first half of 2014 and 2015, and has been a Coordinator at the Corcovado Foundation program in 2013, 2014 and 2015.

Elías Fernández Couso | Coordinator



Elías graduated in 2011 with a degree in Marine Biology from the University of Santiago de Compostela in Galicia, Spain, and worked as a researcher at the Azores islands in 2011-2012. In 2014 he worked as a Research Assistant at the Iniciativa Carey del Pacífico Oriental (ICAPO) in Estero Padre Ramos in Nicaragua, under the supervision of former Corcovado Foundation Program Director, David Melero. Elías joined the program as Coordinator in 2014 and again in 2015.

Eva Horcajo Berná | Research Assistant

Eva graduated in 2014 with a Bachelors degree in Marine Biology from Universidad de Alicante, Spain. She has worked as a Research Assistant at Reserva Pacuare, Costa Rica, in both 2013 and 2015, and has volunteered at Cabo Verde Natura 2000. Eva joined the Corcovado Foundation program as Research Assistant in July 2015.

Thomas Koblinger | Research Assistant

Thomas obtained his Masters degree in Applied Limnology from the University of Natural Resources and Life Sciences in Vienna, Austria, in 2014. He has worked as a Research Assistant at the Iniciativa Carey del Pacífico Oriental (ICAPO) in the Bahía de Jiquilisco Biosphere Reserve in El Salvador, and at the Wild Macaw Association in Punta Banco, Costa Rica. Thomas joined the Corcovado Foundation program as Research Assistant in July 2015.

Alberto García Baciero | Research Assistant

Alberto graduated in 2014 with a Bachelor degree in Biology from Complutense University of Madrid and with a specialty in Marine Biology from University of Alicante, both in Spain. In 2015, he worked at three different sea turtle conservation projects in Costa Rica: with leatherbacks at the Estación las Tortugas (Pacuare), with green turtles at Sea Turtle Conservancy and finally with olive ridley and green turtles at the Corcovado Foundation.

Lucy Southworth | Research Assistant

Lucy graduated in 2015 with a Bachelors degree in Fine Art from Bath Spa University, England. She volunteered in the Yucatan Peninsula, Mexico with GVI's Mesoamerican Barrier Reef project, collecting data on fish and coral in 2011. Lucy joined the Corcovado Foundation program as a volunteer in September 2015 and began working as a Research Assistant in November 2015.

Alice Shepherd | Research Assistant

Alice graduated in 2015 from Norwich University of the Arts with a degree in Fine Art, specializing in Environmental Sculpture. She has a keen interest in environmental issues and hopes to work again conservation in the future. Alice volunteered at The Costa Rica Animal Rescue Centre and the Corcovado Foundation, and joined the program as a Research Assistant in October 2015.

Michael Penz | Research Assistant

Michael graduated from AGI High School in Innsbruck, Austria, in 2014. He joined the Corcovado Foundation sea turtle conservation program in December 2015 as a volunteer and was trained as a Research Assistant. Michael has applied to study Marine Biology at Ludwig Maximilians University in Munich, Germany, and hopes to begin in October 2016.

'Se fue, se fue; se perdió, se perdió'

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Contents

5.0 Conservation Methodology

6.0 Results and Discussion

List of Figures

1.0 Executive Summary

1.1 SUMMARY OF RESULTS FROM MONITORING ACTIVITIES ON DRAKE BEACH

1.1.1 Summary of Turtle Crawls

Turtle Crawls (Olive Ridley)			Initial Destiny of Nests				
Total Crawls	Nests	False Crawls	Relocated (Hatchery)	Relocated (Beach)	Left *In Situ*	Poached	Predated
149	107	42	86	10	4	7	0
%	71.8	28.2	80.4	9.3	3.7	6.5	0.0

Turtle Crawls (Pacific Green)			Initial Destiny of Nests				
Total Crawls	Nests	False Crawls	Relocated (Hatchery)	Relocated (Beach)	Left *In Situ*	Poached	Predated
2	0	2	0	0	0	0	0
%	0.0	100.0	0.0	0.0	0.0	0.0	0.0

1.1.2 Summary of Turtle Sightings

Nesting Turtle Sightings (Olive Ridley)					
Total Nesting Turtle Sightings	As Percentage of Nests	Total Unique Turtle Sightings	Re-Nesting 2015-16 season	Re-Migrating Previous Season	Migrating from Other Program
50	46.7%	46	4	5	0

1.2 SUMMARY OF RESULTS FROM MONITORING ACTIVITIES ON RÍO ORO BEACH

1.2.1 Summary of Turtle Crawls

Turtle Crawls (Olive Ridley)			Initial Destiny of Nests				
Total Crawls	Nests	False Crawls	Relocated (Hatchery)	Relocated (Beach)	Left *In Situ*	Poached	Predated
4,187	2,990	1,197	0	173	2,798	43	5
%	71.4	28.6	0.0	5.8	93.6	1.4	0.2

Turtle Crawls (Pacific Green)			Initial Destiny of Nests				
Total Crawls	Nests	False Crawls	Relocated (Hatchery)	Relocated (Beach)	Left *In Situ*	Poached	Predated
138	44	94	0	0	44	1	0
%	31.9	68.1	0.0	0.0	100.0	2.3	0.0

1.2.2 Summary of Turtle Sightings

Nesting Turtle Sightings (Olive Ridley)					
Total Nesting Turtle Sightings	As Percentage of Nests	Total Unique Turtle Sightings	Re-Nesting 2015-16 season	Re-Migrating Previous Season	Migrating from Other Program
1,304	43.6%	1,179	124	0	2

Nesting Turtle Sightings (Pacific Green)					
Total Nesting Turtle Sightings	As Percentage of Nests	Total Unique Turtle Sightings	Re-Nesting 2015-16 season	Re-Migrating Previous Season	Migrating from Other Program
25	56.8%	14	5	0	0

1.3 SUMMARY OF PATROLS AND HATCHERY SHIFTS ON DRAKE BEACH

Patrol and Hatchery Shifts 20 July 2015 – 13 January 2016					
Night Patrol Shifts (4 hours)	Hatchery Shifts (6 hours)	CF Shifts	ACOTPRO Shifts	Of which Donated ($)	Of which Paid ($)
226	648	256	618	$6,120	$3,150
	%	29.3%	70.7%	66.0%	34.0%

At Drake beach, locals were contracted by the Corcovado Foundation (CF) from the association ACOTPRO

1.4 SUMMARY OF PATROLS AND HATCHERY SHIFTS ON RÍO ORO BEACH

Patrol and Hatchery Shifts 20 July 2015 – 31 January 2016			
Night Patrol Shifts (4 hours)	Hatchery Shifts (6 hours)	CF Shifts	LAST Shifts
1,046	0	550	496
	%	52.6%	47.4%

At Río Oro beach, locals were contracted by Latin American Sea Turtles (LAST)

1.5 TRAINING ACTIVITIES

1.5.1 ACOTPRO Training Courses

Training Course and Post	Details
Course 1 – Antecedentes **Post – Field Assistant** 10 July 2015	This course is mandatory for all members of ACOTPRO and includes information regarding the history of the program, work plan and logistics, night patrols, and turtle biology. Upon completion of this course, members are certified as **Field Assistants** and may begin to accompany Patrol Leaders during night patrols, and Hatchery Managers during hatchery shifts. Field Assistants are required to assist voluntarily with at least one night patrol or hatchery shift per week.

Course 2 – Patrullaje **Post – Patrol Leader** 10 July 2015	This course includes information regarding work plan and logistics, responsibilities of Patrol Leaders, rules, 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** 10 July 2015 06 September 2015	This course includes information regarding work plan and logistics, responsibilities of Hatchery Managers, rules, relocation of nests to the hatchery, liberation of hatchlings, and excavation of nests. 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.

1.5.2 Summary of ACOTPRO Training

#	Name	Sex	Field Assistant	Patrol Leader	Hatchery Manager
1	Alberto Rivera	M	✓	✗	✓
2	Alejandro Sánchez	M	✓	✓	✓
3	Alexander Jiménez	M	✓	✓	✓
4	Álvaro Mendoza (N)	M	✓	✗	✓
5	Carlos Castro (C)	M	✓	✓	✓
6	Diego Mendoza (N)	M	✓	✗	✓
7	Edin Pomares	M	✓	✗	✓
8	Emilce Torres	F	✓	✗	✓
9	Evelin Sánchez	F	✓	✓	✓
10	Francisco Mendoza (C)	M	✓	✓	✓
11	Isaias Juarez	M	✓	✗	✓
12	Jhonson Villalobos	M	✓	✗	✓
13	Liliam Jiménez	F	✓	✗	✓
14	Marielos Almengor	F	✓	✗	✓
15	Maximiliano Rojas	M	✓	✓	✓
16	Miguel Chinchilla	M	✓	✓	✓
17	Migue Sánchez	M	✓	✓	✓
18	Teresa Obando	F	✓	✗	✓
	Total		**18**	**8**	**18**

C = ACOTPRO Coordinator
N = New member for 2015-16

1.5.3 LAST Training Courses

Training Course and Post	Details
Course – Capacitación **Post – Patrol Leader (full-time)** 06 August – 08 August 2015	LAST conducted a three-day training course which was attended by local candidates for the post of full-time Patrol Leader, members of the association COTORCO, park rangers from the Osa Conservation Area (ACOSA) and Coordinators from the Corcovado Foundation. The aim of the course was to establish standardized methodology and conservation strategy for the 2015-16 season in Río Oro and Carate beaches, and select three local candidates for the post of Patrol Leader.

1.5.4 Summary of LAST Training

#	Name	Sex	Patrol Leader
1	Wilberth Villachica (C)	M	✓
2	Wilson	M	✓
3	Oscar	M	✓
4	Justin	M	✓
5	Jafet	M	✓
6	Maikol	M	✓
		Total	**6**

C = LAST Coordinator

1.5.5 Volunteer Training Courses

Training Course and Post	Details
Course 1 – Volunteer Program Training provided upon arrival	This course includes information regarding the nature of the program, objectives, role of the volunteer, area of study, accommodation, local excursions, safety and security, plan of work and logistics.
Course 2 – Turtle Biology Training provided upon arrival	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 the environment through responsible use of resources, waste management and sustainable tourism.
Course 3 – Methodology Training provided upon arrival **Post – Field Assistant** **Post – Hatchery Manager** **Post – Patrol Leader**	This course includes information regarding rules, morning patrols, night patrols, relocation of nests, liberation of hatchlings and nest excavation. Upon completion of this course, volunteers are certified as **Field Assistants** and **Hatchery Managers** and may begin to accompany **Patrol Leaders** during night patrols and to work alone in the hatchery during the daytime. Occasionally it is possible for a long-term volunteer to become a **Patrol Leader**, but only after demonstrating the required skills and completing extensive training in the field.

1.5.6 Summary of Volunteer Training

Training Course and Post	Details
Course 1 - Volunteer Program **Course 2 - Turtle Biology** **Course 3 - Methodology** 01 July – 31 January 2016	During the period 01 July – 31 January 2016, a total of 193 international volunteers completed all three training courses, and all were certified as **Field Assistants** and **Hatchery Managers**. The following six volunteers were also certified as **Patrol Leaders**: 1. Adam Pickles 2. Ivan Prol Cacabelos 3. José María Céspedes Baines 4. Alice Shepherd 5. Lucy Southworth 6. Michael Penz

1.6 BEACH CLEANING

1.6.1 Summary of Beach Cleaning Activities

#	Date	Beach	Length	No. of males	No. of females
1	10 July 2015	Drake	3.6 km	2	7
2	18 July 2015	Río Oro	4.8 km	5	12
3	29 July 2015	Drake	3.6 km	2	8
4	19 August 2015	Drake	3.6 km	4	10
5	15 September 2015	Río Oro	4.8 km	2	6
6	22 September 2015	Drake	3.6 km	0	7
7	03 November 2015	Río Oro	4.8 km	2	4
8	14 November 2015	Drake	3.6 km	3	8
9	11 December 2015	Drake	3.6 km	2	5

2.0 Background

2.1 SOCIO-ECONOMIC CONTEXT

The Corcovado Foundation (CF) is committed to the conservation and sustainable development of the Osa Peninsula, which is considered the country's last wilderness frontier and one of the most biodiverse places on Earth. This remote corner of the country harbors 2.5% of the biodiversity of the entire planet in an area half the size of Rhode Island. It is also the only remaining region along the Pacific coast of Costa Rica where 'eco-tourism' is still the predominant tourism model, yet it currently stands on the precipice of an inevitable expansion of the industry over the next decade which has the potential to either gravely threaten or positively guarantee the integrity of the local natural heritage (CREST 2010).

By enhancing the protection of a keystone endangered species and demonstrably lucrative source of revenue from eco-tourism: the sea turtle, the Program utilizes a proven model of community-led conservation (Le-Garec 2010, James 2014[b], James 2015) to reduce the consumptive use of sea turtles while facilitating the development of responsible tourism initiatives in Drake Bay and Río Oro.

The Osa Peninsula is located in the second poorest province of Costa Rica. The primary sector (agriculture and livestock) is the main source of income for communities, estimated at 52.6% of labor occupancy. The human development index for the Osa Peninsula is estimated to be 0.67% and the poverty rate 40.4% (PNUD Costa Rica). There are few economic options available to those residents who do not have access to the skilled jobs offered by the bourgeoning tourism industry, and the extractive use of local natural resources to generate income (especially through logging, gold panning, hunting and egg poaching) is commonplace and unsustainable.

The CF has a proven track record of creating viable socio-economic alternatives to local residents in the Osa Peninsula. In 2005, the CF built five new ranger stations bordering the Corcovado National Park, created over 50 new permanent jobs, and contracted 75 employees (55% of the workforce of ACOSA) from 2005 to 2007. So far the CF has administered over $3,000,000 in funds to support the protected areas of ACOSA. Between 2010 and 2014, the Program in Drake Bay awarded $27,147 in salaries to local Coordinators and Patrol Leaders (most of whom were former egg poachers), over $3,000 in equipment grants to the local sea turtle conservation association, and generated $63,324 in income for homestay houses in return for providing accommodation and food to international volunteers (James 2014[b], James 2014).

2.2 VOLUNTEER PROGRAM

The CF sea turtle conservation volunteer program has operated since July 2006 and offers placements to volunteers that are able to commit to a minimum of one week of work. The placements are open to anyone over the age of 18 with basic knowledge of English or Spanish, and no prior experience of volunteering or working with turtles is required. Families are also welcomed, and minors are able to participate in work activities under the supervision of their parent or guardian. Placements are available from 01 July – 15 December (Drake beach), and from 01 July – 31 January (Río Oro beach). The program is closed for five months from 01 February until 30 June.

The program headquarters are based at Drake Bay Backpackers, a non-profit hostel created by the CF in 2014 especially to support its environmental programs. All new volunteers initially stay at the hostel while they receive their training and orientation, after which they may choose to work at either (or both) of the two conservation sites: Drake beach and Río Oro beach.

Volunteers take part in various activities, including night patrols, working at the hatchery, relocating nests, recording scientific data, tagging of turtles, nest excavations, liberation of hatchlings, construction activities, environmental education and ecotourism activities. Each volunteer is assigned a free day each week, and the program offers a range of tours and activities organized through the hostel. At the Drake beach site, volunteers typically stay in private rooms in homestay houses in the village of El Progreso. At Río Oro beach, volunteers stay in mixed dorms in a tented camp provided by the Hacienda Río Oro eco-lodge. All accommodation options include three meals per day and the provision of laundry facilities.

Since 2006, the program has welcomed over 400 volunteers from over 40 countries and continues to expand in size each year. Volunteers are recruited either directly through the CF website and social media pages, or through partnerships with university departments and third-party volunteer placement organizations, including Máximo Nivel, Working Abroad, University of Costa Rica (UCR), University for Peace (UPAZ), SEE Turtles, Intercoined, CAS and others.

2.3 DRAKE BEACH

In Drake Bay, the harvesting of eggs by local poachers over the last three decades resulted in the loss of over 85% of the nests laid in the area each year (Local accounts 2006, Sánchez 2006). The nesting sea turtle population declined dramatically to the point at which it became critically endangered, and the protection and recuperation of this population became essential due to its biological and ecological value. The main species that nests in Drake Bay is the Olive Ridley sea turtle (*Lepidochelys olivacea*) (peak nesting season: August – November), although a small number of Pacific Green (*Chelonia mydas*) and Hawksbill (*Eretmochelys imbricata*) turtles have been registered nesting on Drake beach (James 2011, James 2012, James 2013). A mean of 129 nests per season have been registered since 2006, with a density of 3.8 nests/100m of beach per season.

Since 2006, the Program in Drake Bay has protected 90% of sea turtle nests, tagged over 350 nesting turtles and released over 71,000 hatchlings into the Pacific Ocean. Through the establishment of a dedicated community association, ACOTPRO, and the implementation of environmental education in local schools, the Program has also succeeded in changing the attitudes of local people toward their natural resources (Le-Garec 2010, James 2014[b]). With support from the CF, ACOTPRO has now developed its own homestay network, volunteer program and community-based tours, and the association is preparing to assume long-term responsibility for the conservation effort in Drake Bay. The continuous presence of program personnel on Drake beach, combined with the existence of the hatchery and the increasing participation of members of the community, together function as a deterrent against egg poaching in the area. Data from previous seasons at the program show a comparable or higher rate of reproductive success for nest relocated to the hatchery than on the beach (James 2015) and the use of a hatchery as an emergency conservation tool is broadly supported by the scientific community (Witherington 2003, Wyneken 1998). As such, the relocation of nests to the hatchery is justified on Drake beach and will remain a priority strategy for the program, until such time that the threat of egg poaching has been eliminated in the locality.

2.4 RÍO ORO BEACH

According to preliminary studies, the beaches (from North to South) of Carate, Río Oro, Pejeperro and Piro receive between 2,000 and 4,000 nesting turtles each season, of which Río Oro beach receives between 50-70%, purportedly owing to its favorable inclination and sand grain size, minimal driftwood and an absence of light pollution (Drake 1996, Govan 1998, Bedoya & Nahill 2000, Sánchez 2005, Sánchez 2006[b], Malaver Montenegro 2008). Presently, Carate beach is monitored by the local conservation association, COTORCO, with support from the CF, while Pejeperro beach and Piro beach are periodically monitored by Osa Conservation (Bernal Castro 2013).

All four sea turtle species found in the East Pacific are reported to nest in the region: principally Olive Ridley (*Lepidochelys olivacea*) and Pacific Green (*Chelonia mydas*) turtles, but also Leatherback (*Dermochelys coriacea*) and Hawksbill (*Eretmochelys imbricata*) turtles in much smaller numbers. The Olive Ridley turtle is by far the most abundant (peak nesting season: July – January), and between 1994 and 1998 an average of just 2% of nests laid were identified as belonging to the Pacific Green turtle (peak nesting season: November – March) (Drake 1996, Govan 1998). However, this proportion has risen considerably ever since. While contemporary data on Río Oro beach is lacking, on the adjacent beaches it is reported that 300 (22%) of the nests identified from July 2012 to June 2013 belonged to Pacific Greens (Bernal Castro 2013). Given Río Oro beach's historical superiority in terms of nesting frequency, it was hoped that Río Oro beach might be the most important nesting habitat for the Pacific Green sea turtle in the region.

Without knowledge of the reproductive output of sea turtles nesting on Río Oro beach and their mortality drivers, it is difficult to understand the overall importance of this region to the East Pacific Olive Ridley and Green turtle stocks and to effectively target management efforts. To tackle this knowledge gap, during 2015-16 the program will describe the temporal and spatial nesting environment, quantify the hatching and emergence success of nests, identify the factors that affect hatching and emergence rates (for example: poaching, unsustainable predation, beach erosion etc) and propose management strategies that might mitigate mortality and increase hatching success in the region. Until these baseline data have been collected and analyzed, the use of a hatchery on Río Oro beach remains unjustified.

Río Oro beach is located within one of ACOSA's protected areas, known as the Río Oro National Wildlife Refuge (RONWR). However, a lack of government funding has limited the capacity of ACOSA to respond to the numerous environmental threats posed by illegal human activities that affect the 4,305 km^2 within its jurisdiction, and the agency has had to prioritize the tackling of hunting, gold panning and illegal logging. ACOSA specifically invited the CF to establish a sea turtle conservation project in the RONWR to address the urgent need to protect the nesting population, but also to assist with the training of their personnel and local stakeholders, such as COTORCO, in sea turtle conservation methodology. The CF successfully obtained funding to establish a conservation program in Río Oro beach, with major funding sourced from Pacsafe and the Rufford Foundation; however, it was unable to secure funds to assist with the wider regional objectives during 2015-16.

In 2015, the NGO Latin American Sea Turtles (LAST) obtained funding from the NGO Costa Rica Por Siempre (CRXS) to develop standardized indicators (PROMEC 2007, Fonseca 2014) for the creation of a regional sea turtle database and project network, but also to contract local workers to assist with the conservation of sea turtles in Río Oro beach. This development has resulted in the creation of a highly effective collaboration between the CF and LAST at Río Oro beach.

The complementary aims of the two programs have permitted the creation of a framework whereby the CF provides international Coordinators, volunteers and some infrastructure and consumables, while LAST contracts four full-time local Patrol Leaders, and pays for some equipment and transportation costs. The two organizations assumed joint responsibility for the conservation of the Río Oro beach and agreed to share data and intellectual property rights, albeit temporarily during the period of the CRXS grant (August 2015 until January 2016). The CF became the sole organization responsible for the protection of the beach from 01 February 2016 onward.

2.5 PROGRAM GOALS AND OBJECTIVES

2.5.1 Mission

To promote the conservation and sustainable recuperation of the sea turtles that nest in the Osa Peninsula, while simultaneously attending to the needs of the local communities through the creation of viable socio-economic alternatives to the consumptive use of this resource.

2.5.2 Vision

The program envisions a united and inclusive community association taking a leading role in managing the conservation of sea turtles nesting on their beaches, using standardized methodology specifically tailored to the Osa Peninsula, with their members benefiting financially from associated responsible eco-tourism enterprises. The traditional practice of poaching sea turtle nests would be rejected by the community, and measures adopted universally to minimize their disturbance and couple the preservation of their nesting habitat to the economic development of the area.

2.5.3 Specific Objectives for the 2015-16 Nesting Season

Volunteer Program

1.1	Increase the number of volunteers participating in the program by at least 30%
1.2	Reconfigure volunteer program to include new Río Oro site.
1.3	Create at least two new partnerships with third party volunteer organizations and increase volunteer intake from existing partners.
1.4	Provide all volunteers with training in both sea turtle conservation and responsible tourism.
1.5	Support the Environmental Education program in the delivery of activities.
1.6	Evaluate volunteer experience and maintain ranking above 95% excellent or very good.
1.7	Generate at least $15,000 in income for homestay houses in the village.

Drake Beach

2.1	Prepare the beach so that it is suitable for the monitoring of nesting sea turtles.
2.2	Maintain incidence of egg poaching below 10% of nests.
2.3	Characterize the structure of the nesting population and quantify the hatching and emergence success of *in situ* and *ex situ* nests.
2.4	Relocate at least 75% of nests *ex situ* to the hatchery.
2.5	Obtain eclosion rates above 75% and a sex ratio of close to 50% for *ex situ* nests in the hatchery.
2.6	Train at least ten members of the community as Field Assistants, and contract at least five as paid Patrol Leaders.

Río Oro Beach

3.1	Establish new field station at the Río Oro site.
3.2	Prepare the beach so that it is suitable for the monitoring of nesting sea turtles.
3.3	Maintain incidence of egg poaching below 20% of nests.
3.4	Characterize the structure of the nesting population and quantify the hatching and emergence success of at least 50 *in situ* nests.
3.5	Relocate vulnerable nests *ex situ* to safer locations on the beach.
3.6	Support Patrol Leaders contracted by LAST and assist with their training.

3.0 Study Area

3.1 THE OSA PENINSULA AND CORCOVADO NATIONAL PARK

The Osa Peninsula is located in southwestern Costa Rica, in the Puntarenas Province, on the Pacific Ocean. 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.

3.2 SEA TURTLE NESTING BEACHES

During the 2015-16 season the program was responsible for the monitoring and protection of sea turtles nesting on 8.4 km of coastline on the Osa Peninsula, at Drake beach (3.6 km) and Río Oro beach (4.8km), and supported community-led conservation efforts on a further 6.0 km, at Ganado beach (3.0km) and Carate beach (3.0km), operated by ACOTPRO and COTORCO, respectively (see **Figure 1**).

3.2.1 Drake Beach

Drake beach is located between the mouth of the River Drake to the South and Punta Ganadito to the North. 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, where the hatchery is located, is approximately 1.5 km in length and may be accessed via public road at its far North end, or by a pedestrian bridge over the estuary which is accessible only from the runway of the Drake Bay Aerodrome. The South sector 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 can become highly technical for prolonged periods of time during the nesting season.

Figure 1. Map of Costa Rica showing the five main sea turtle nesting beaches outside of the Corcovado National Park in the Osa Peninsula (**inset**)

Drake beach is located in the village of El Progreso de Drake, a community of around 200 residents and an important center of community-based tourism in the region. The village contains three grocery stores (pulperías), two small restaurants (sodas), a school, two churches, a bar, a community center and soccer field, and Drake Bay Airport. It is also home to the largest of the beaches in Drake Bay and a river system home to thousands of species of bird, and it is surrounded by mountainous primary rainforest (see **Figure 2**).

The village is home to the Corcovado Foundation's non-profit hostel, Drake Bay Backpackers, which also functions as the headquarters of the sea turtle program. The local sea turtle community association, ACOTPRO, which was established in 2010 with support from the Corcovado Foundation, has an office at the premises from which it administers its homestay network, a sea turtle tour, and a fledgling volunteer program. Through ACOTPRO, the sea turtle program engages with around 10 households, corresponding to over 60% of the families in the village.

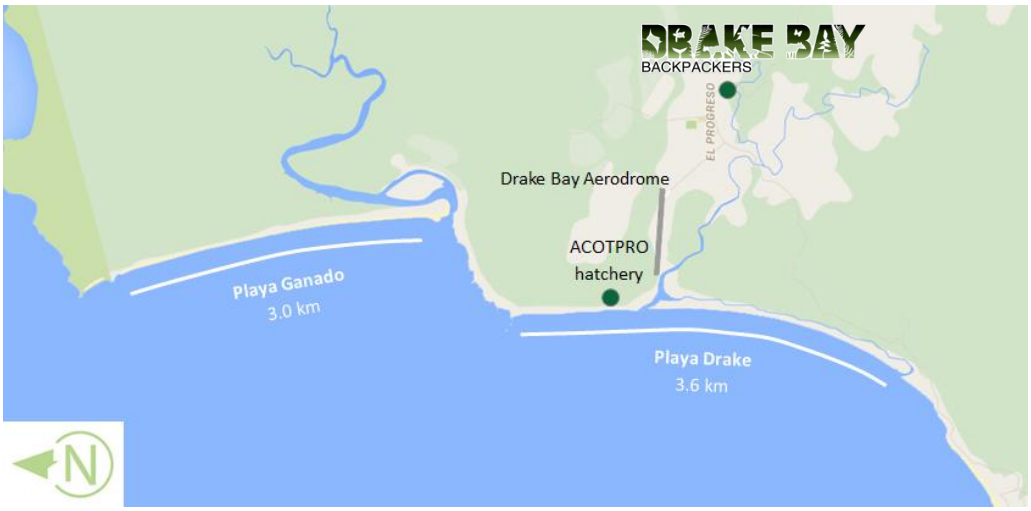

Figure 2. Map of the Drake Bay area, showing Drake beach, Ganado beach and the program headquarters at Drake Bay Backpackers

3.2.2 Río Oro Beach

Río Oro beach is located around 35km West of the town of Puerto Jiménez and corresponds to a 4.8km stretch of coastline between Carate beach and Pejeperro beach, primarily accessible via a public road linking the highway 245 to the Río Oro school. The border of Río Oro beach and Carate beach is arbitrarily demarcated in front of the Laguna Pejeperrito, a body of fresh water with several river tributaries that has remained isolated from the ocean for at least the last four years. While Laguna Pejeperrito has historically formed a mouth into the sea during heavy rainfall in the rainy season, it is thought unlikely to do so during the 2015-16 season. The hatchery operated by COTORCO for nests on Carate beach is located around 600m to the North West of the Río Oro beach/ Carate beach border (see **Figure 3**).

The border of Río Oro beach and Pejeperro beach is demarcated in front of the larger Laguna Pejeperro, which breaks the beach open during the rainy season to form a broad tidal estuary. At the time of writing the lagoon remained isolated from the ocean but is expected to have opened the beach by September 2015, the mouth of this estuary thereafter corresponding to the South West boundary of Río Oro beach.

The public road and Río Oro school site offers the most direct access to the beach, just South East of the Río Oro river. At the time of writing the river mouth has yet to break through the beach but is expected to do so during September 2015. The swelling of the river has currently formed a large body of water which has to be crossed on foot in order to access the beach, but once the river mouth forms this area will quickly drain and access to the South sector of the beach will become less complicated. Thereafter, to access the North sector of Río Oro beach patrol groups will need to ford the river mouth on foot by the sea. This factor may make the North sector inaccessible during high tides and/or heavy rainfall, especially during the peak rainy season in October.

The nearest community is the small village of Carate, home to perhaps 80 residents, principally staff from hotels and farm workers, many of whom are members of the community turtle conservation association, COTORCO. The program staff and volunteers are currently housed at the Hacienda Río Oro eco-lodge in the area historically known as Agua Buena. There are very few private houses in this area and most residents are employed and housed by the Hacienda and other local farms. There are small communities of gold miners/panners operating illegally in the area, living in unofficial settlements upstream of the Carate and Río Oro rivers. The Río Oro school is attended by seven students. There are plans to relocate the school itself to the village of Carate so that it is more accessible to these students. It is anticipated that the school site in Río Oro will thereafter become the field station for the sea turtle program.

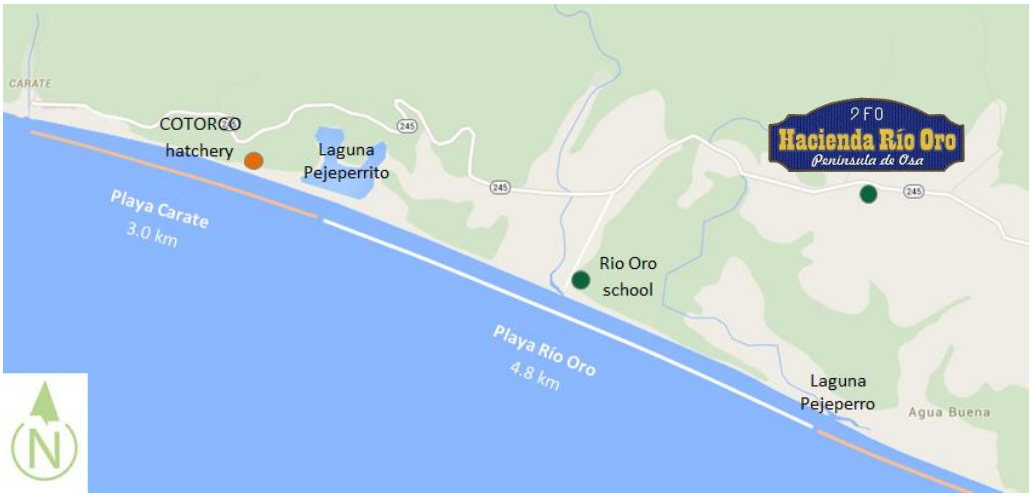

Figure 3. Map of the Río Oro area, showing Río Oro beach, Carate beach, Pejeperro beach and the program headquarters at Hacienda Río Oro

4.0 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.

4.1 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 4**) and potentially could do so again at Drake beach and Río Oro beach.

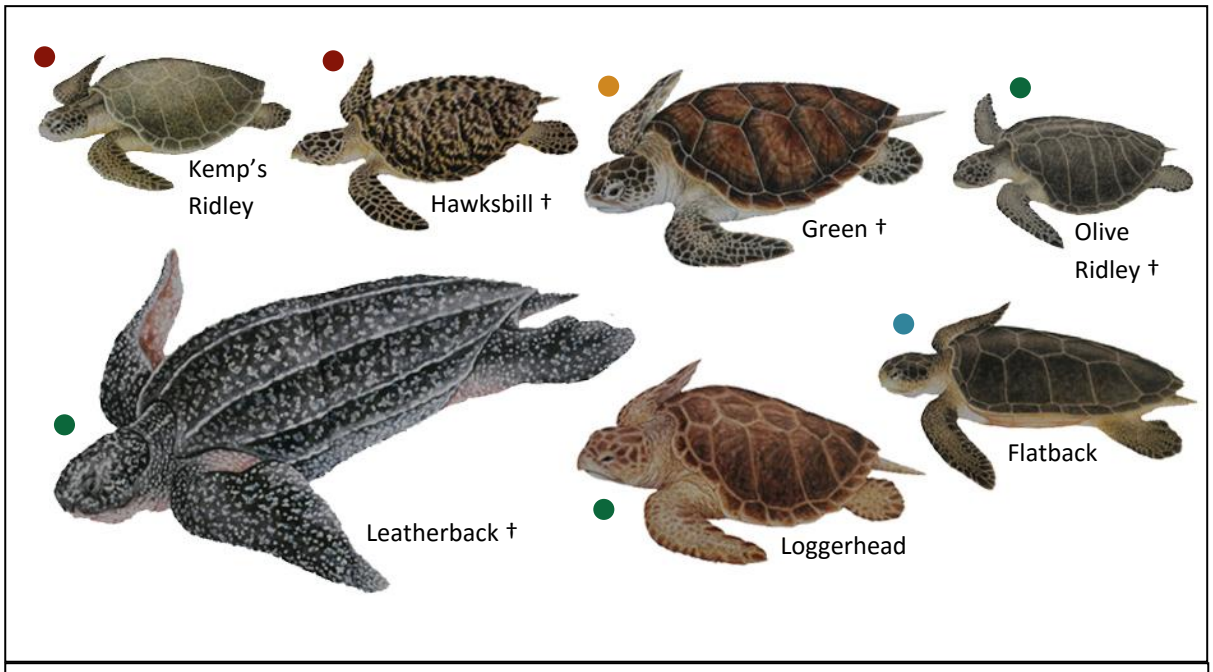

Figure 4. The seven extant species of sea turtle, showing IUCN Red List status: critically endangered (**red**), endangered (**amber**), vulnerable (**green**) and data deficient (**blue**)

4.1.1 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 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 2008, Cornelius 1991). The nesting season in the Central Pacific typically runs from July until January, and individuals are observed to return to the same beach, or neighboring beach, to nest each time, returning 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 75-125 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.

The Olive and Kemp's Ridley – uniquely among sea turtle species – are apparently able to delay nesting until conditions are favorable, and their predisposition toward synchronized nesting behavior is dramatically demonstrated during Olive Ridley arribada events (Fonseca 2015, Valverde 2012). Arribadas in the eastern Pacific generally coincide with the 3rd quarter lunar phase, and there is substantial evidence to suggest that environmental – rather than social – cues may be responsible for inducing these simultaneous nesting events (Plotkin 1997, 1995). Evidence for reproductive synchrony in *solitary* Olive Ridley populations, however, is largely absent from the literature.

4.1.2 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 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 (Bowen 1993, Dutton 1996, Karl 1999) 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 (Seminoff 2004) 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 sea grasses, and adults spend most of their time in shallow, coastal waters with lush sea grass 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 November to March.

4.2 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 5**.

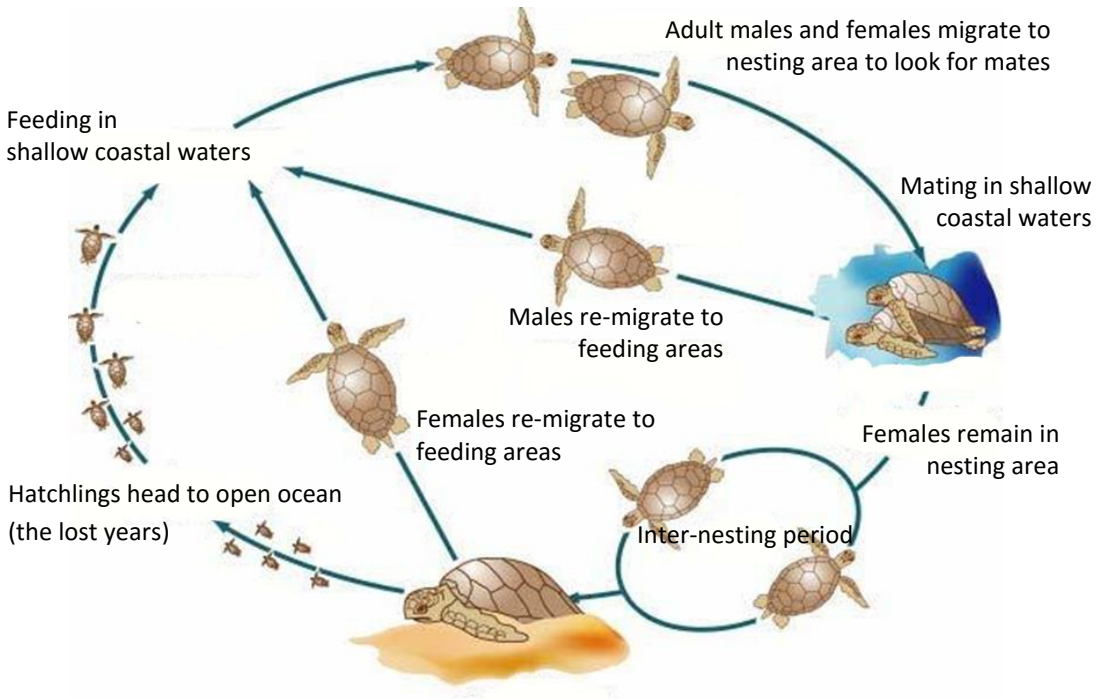

Figure 5. The generalized life cycle of the sea turtle

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. 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.

4.3 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 6**.

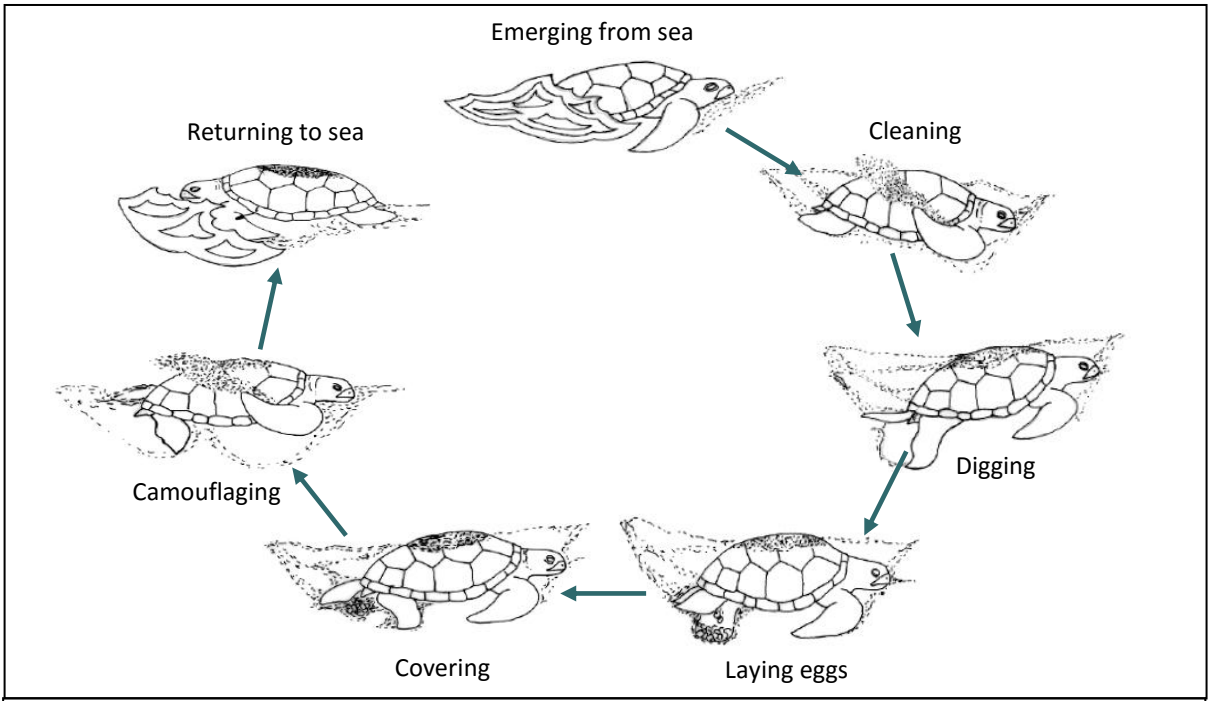

Figure 6. The generalized nesting behavior of the female sea turtle

Females emerge from the sea and crawl up the beach, typically between the high tide line and the vegetation, 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 crawl'.

4.4 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 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 (Spotila 2000, Jackson 2001, Seminoff 2004). 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 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 (McCoy 1983, Standora 1985, Spotila 1987, Wibbels 1998, Godley 2001). 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 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 (Bouchard 2000, Jackson 2001). Each species also fulfills a specific ecological role, such as the Green turtle for example, which consumes vast quantities of sea grass 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 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.

5.0 Conservation Methodology

5.1 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 program has development and implemented standardized methods (Chacón 2007) with which to register turtle crawls 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 Río Oro beach (4.8 km).

5.1.1 Census of Tracks (Drake beach only)

A morning patrol of the beaches is conducted from 05:00 each day (tides permitting) 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. Thereafter, the census is conducted routinely to evaluate the work of the night patrols, and to locate new tracks from turtles that were missed or that emerged after the night patrols had left the beach. The census is typically performed by two volunteers, and is followed by a hatchery vigilance shift which terminates at 12:00 noon.

5.1.2 Night Patrols

Night patrols of the beaches are conducted every night during the nesting season (weather and tides permitting). At Drake beach, patrol groups arrive to the beach on foot or on bicycles, whereas in Río Oro beach the group arrives by car. Two patrol shifts are typically deployed each night: the first from 20:00 until 00:00; the second from 00:00 until 04:00. In Drake beach, the group divides into two teams: one to patrol the North sector (1.4 km); the other to patrol the South sector (2.2 km). In Río Oro beach, the group typically divides into four teams, each covering 1.2 km: two on the North sector and two on the South. White light is never used during night patrols, so as not to deter other turtles from crawling from the sea. Red light is used when necessary for orientation and when working with a nesting turtle, and night patrol teams are required to wear dark, unreflective clothing.

5.1.3 Hatchery Shifts (Drake beach only)

The hatchery is co-managed by ACOTPRO and is the main focus of the scientific research conducted at the program. The site is occupied 24 hours per day by either an ACOTPRO member or two volunteers who have been certified as Hatchery Managers. Hatchery vigilance 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.

5.2 REGISTRATION CRITERIA

All turtle crawls from the sea are registered and 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 'excavated'.

5.3 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 crawl are registered by not tagged. The series of tags used at this program, manufactured by the National Band and Tag Company USA (NBTC), are shared with LAST, Osa Conservation and COTORCO and each tag number is preceded by the prefix OP, OSA, NG or JG.

Nesting turtles are tagged in the second or third scale on the posterior edge of each flipper. Olive Ridley turtles are ideally tagged whilst they are laying eggs, since this causes the least discomfort to the animal, whereas Green turtles are tagged immediately afterward. 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. Olive Ridleys nesting are typically tagged on just one flipper, whereas Green turtles are tagged twice, once on each flipper. This strategy has arisen since tagging all Olive Ridleys nesting on Río Oro beach with two tags would be prohibitively expensive. Also, the longer inter-migratory period (and increased IUCN threat status) of the Pacific Green turtle demands that two tags be applied to nesting females, in order to maximize the chances of these turtles being identified again in the future.

5.4 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, the activity of the turtle upon detection, 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 on Drake beach are recorded in a separate hatchery data book.

5.5 NEST RELOCATIONS (DRAKE BEACH)

Due to the continued threat of illegal egg poaching on Drake beach, the relocation of turtle nests either to the hatchery or another location on the beach is a priority strategy, since nests left *in situ* are extremely vulnerable and almost certain to be poached. Nests discovered during night patrols on Drake beach are always relocated *ex situ*, whereas nests found during the census are left *in situ* so as not to unduly disrupt the development process.

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

Nests discovered during night patrols on Drake beach are always relocated to the hatchery unless prohibited by poor weather or visibility during the patrol. Eggs are removed from the nest and placed in a plastic bag, ideally while being laid, but may also be removed once the turtle has already left the nesting site. Eggs are then taken to the hatchery where the Hatchery Manager builds the new nest and records the biometric data in the hatchery data book. 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.

5.6 NEST RELOCATIONS (RÍO ORO BEACH)

Since there are no contemporary baseline data yet for Río Oro beach, the incidence of poaching and/or predation are yet to be ascertained and the use of a hatchery is not yet justified. Nests discovered during night patrols on Río Oro beach are always left *in situ*, unless they have been laid in a vulnerable location on the beach. Nests are considered vulnerable if laid in zone 1 (below the high tide line), or between sectors 23 and 28 (the area corresponding to the potential span of the mouth of the Río Oro river). Nests are relocated *ex situ* according to the methodology described in **Section 5.5** and buried above the high tide line at alternative locations on the beach.

Unlike in Drake beach, nest sites are not camouflaged by the patrol groups; instead, and a large cross is drawn through the tracks to indicate that the nest has been registered. In order to obtain data pertaining to the reproductive success of *in situ* nests, a sample of nests is marked so that they may be located again in order to perform a nest excavation. Nests are marked by introducing a piece of wood tethered to a labeled plastic bottle inside the nest – the bottle remaining on the surface of the sand in order to permit future detection and identification.

5.7 HATCHLING LIBERATIONS (DRAKE BEACH ONLY)

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. 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. It the uncommon case of a nest hatching during the day time, hatchlings are kept in a bucket in the shade at the hatchery during the day and released at sunset.

5.8 EXCAVATIONS

The 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. Excavations are carried out on all nests for which the location is precisely known, including those relocated *ex situ* to the hatchery or the beach, those left *in situ* at the time of discovery. Excavations are typically carried out within 72 hours of hatching.

Biometric data pertaining to each excavated 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 (Crastz 1982). 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.

5.9 DETERMINATION OF SEX RATIO

The sex ratios of all nests in the hatchery are estimated using the indirect method. Cycling incubation temperatures from control dataloggers (HOBO Pendant Temperature UA-001-08/64 [accuracy ±0.47 °C]) located in the hatchery and on the beaches are converted to a constant temperature equivalent (CTE) corresponding to the end of the first third of the nest incubation period (Merchant-Larios 1997, Wibbels 2003). The CTE is used with a non-linear development rate function and published information on pivotal temperatures for Olive Ridley (Wibbels 1998) and Pacific Green (Ackerman 1997) turtles to estimate offspring sex ratios.

6.0 Results and Discussion

6.1 VOLUNTEER PROGRAM

6.1.1 Reconfiguration of the Program

During the period of this interim report (01 July 2015 – 31 January 2016), a total of 193 international volunteers came to work at the program. All volunteers were certified as Field Assistants and Hatchery Managers, and six volunteers were also certified as Patrol Leaders.

For the 2015-16 season, the program was reconfigured in order to incorporate the new conservation site at Río Oro beach. New volunteer orientation manuals and training presentations were produced in English and Spanish to reflect this expansion of the program (see **Annexes 1-4**). All new volunteers initially stayed at the hostel in El Progreso while they received their training and orientation, and all volunteers participated for at least some of their placement at the Drake beach site. All volunteers participating for two weeks or more were offered the option to also work at the Río Oro beach site in week-long placements (or multiples thereof). In order to facilitate the exchange of volunteers between the two sites, the program provided a free transfer using the hostel vehicle each Thursday (3 hours each way). Of the 193 volunteers, 124 (64%) chose two work at both conservation sites, the remainder working solely at Drake beach.

6.1.2 Volunteer Recruitment

Since 2006, the number of volunteers coming to work at the program has generally increased each year, with the 2014 season reaching a new record of 93 volunteers (see **Figure 7**). During 2015, however, a total of 193 were recruited – an increase of 108% from 2014.

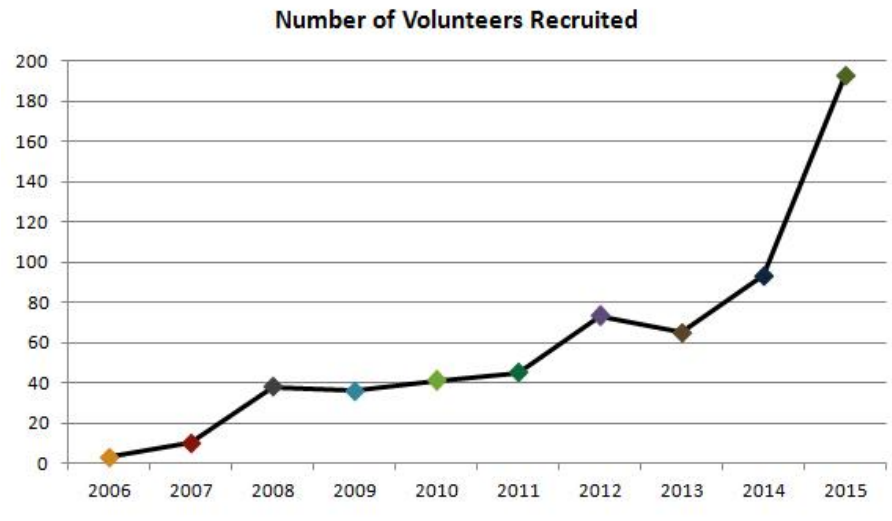

Figure 7. The number of volunteers recruited by the program each season from 2006-2015

Volunteers were recruited through a total of seven organizations during 2015, including directly through the CF website and social media pages (see **Figure 8**). The partner responsible for providing the most volunteers was Máximo Nivel (44%), followed by direct recruitment through the CF (33%) and Working Abroad (19%). The number of volunteers recruited from both Máximo Nivel and Working Abroad increased in 2015 compared to 2014, by 150% and 200%, respectively. Two new partnerships were also established with Volunteers en el Mundo and First Hand Volunteers.

#	Name of Organization	Number of Volunteers	%
1	Máximo Nivel / IVHQ	85	44%
2	Corcovado Foundation (direct)	64	33%
3	Working Abroad	36	19%
4	Volunteers en el Mundo *	4	2%
5	First Hand Volunteers *	2	1%
6	Intercoined	1	0.5%
7	CAS	1	0.5%

* New partner for 2015

Figure 8. The number of volunteers recruited from each volunteer organization during the 2015-16 season

The nationalities of volunteers recruited during the 2015-16 season show a similar profile to that observed during previous seasons (see **Figure 9**), with the USA, Canada, Spain, UK, Germany and Australia constituting the top six countries of origin. The proportion of volunteers coming from the USA has increased notably, however, from 26% (mean: 2006-2014) to 44% in 2015.

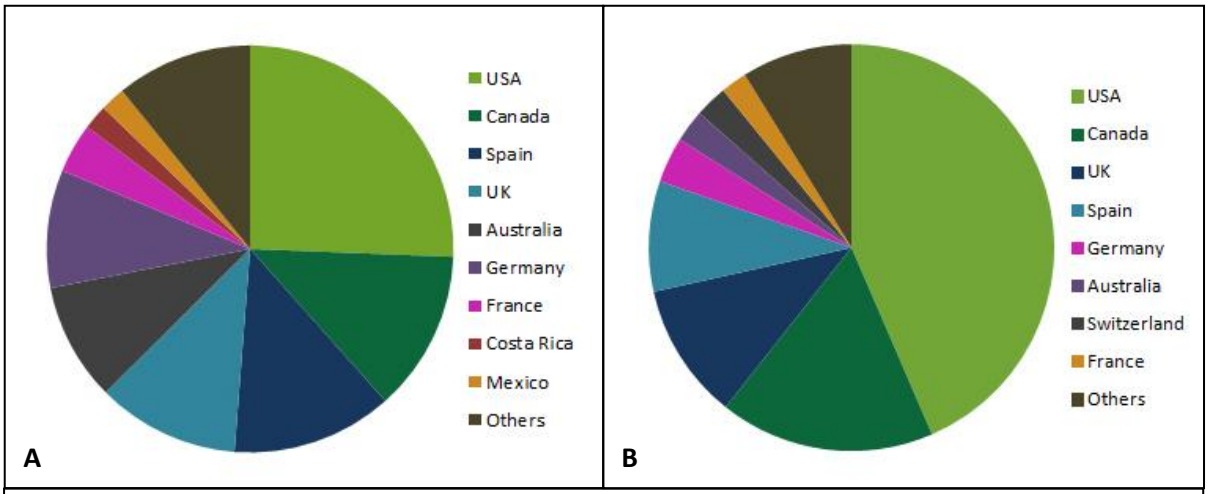

Figure 9. The nationalities of volunteers from 2006-2014 (**A**) and in 2015 (**B**).

The age of volunteers during the 2015-16 season ranged from 12 to 68 years, while the median age was 22, decreasing from 25 in 2014. The length of volunteer placements during this season ranged from 4 days to 73 days, with a median stay of 11 days, increasing from 10 days in 2014.

6.1.3 Volunteer Experience

As part of the routine evaluation of the quality of the volunteer program, the experience of volunteers is constantly monitored by means of a feedback survey completed upon departure (see **Annex 5**). The results from key indicators are summarized in **Figure 10**, while the complete set of comments from volunteers can be found in **Annex 6**. A blog written by the volunteers at the program may also be found at: http://cfseaturtles.blogspot.com/.

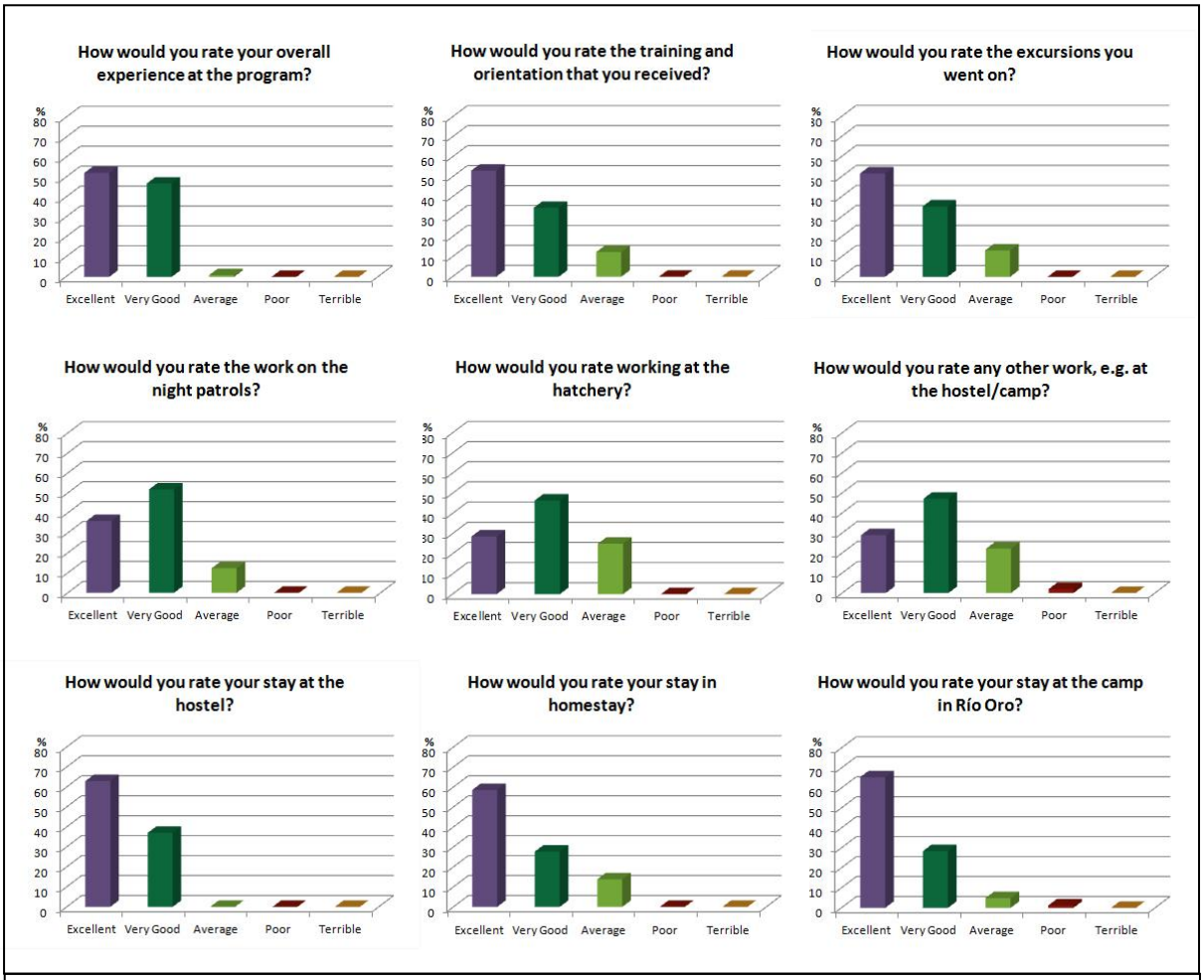

Figure 10. Summary of key indicators from volunteer feedback during the 2015-16 season

Analysis of this feedback reveals that 99% of volunteers rated their overall experience as very good or excellent. This is a major improvement on the 2014 season, where 90% of volunteers rated their overall experience as such. Regarding the work at the program, volunteers above all preferred night patrols (88% very good or excellent), followed by working at the hatchery (79%), and lastly working at the camp/hostel (such as planning, construction, decorating, cleaning and environmental education activities) (76%).

There is no doubt that the abundance of sea turtles nesting on Río Oro beach has contributed to the increase in the ranking of the night patrols from 81% in 2014 to 88% in 2015. At Drake beach volunteers typically see 1-2 turtles nesting each week, whereas at Río Oro beach volunteers routinely see 10 or more turtles nesting during every patrol shift.

The hostel provides the most popular option for accommodation at the program, with 100% of volunteers ranking it as very good or excellent, compared to 86% for homestays at the Drake beach site and 94% for the tented accommodation provided at the Río Oro beach site. The improvement of facilities at the hostel since 2014 has undoubtedly played a role in improving the overall volunteer experience at Drake beach, since the space now features several ranchos with hammocks and sofas, a garden with volleyball and a river trails, a large kitchen, a cinema screen and sound system and free wi-fi internet.

Comparison of the feedback in **Figure 10** with that published in the interim report in September 2015 shows that improvements were made in several areas of the program during the last five months. The percentage of volunteers rating the following indicators as excellent increased markedly during this period: overall experience, training and orientation, night patrols and the accommodation in Río Oro. A slight reduction of excellent ratings was observed, however, for the tours and excursions, accommodation in the hostel, and accommodation in homestay.

Key recommendations from volunteers in 2015 included:

- to improve the coordination of the homestay network and volunteer arrival procedures
- to divide larger groups up and better distribute the work
- to be more strict with the local leaders with their attendance and adherence to work protocols
- to develop more daytime activities at the Río Oro beach site
- to increase the diversity of the food provided in Río Oro
- to install mosquito nests in all homestays
- to conduct regular checks on the condition of homestays
- to improve the clarity of information provided by partner organizations to their volunteers
- to increase collaboration with the environmental education program
- to diversify the work activities available at the hostel/camp at the Drake beach site

The complete set of comments from volunteers can be found in **Annex 6**, while a list of recommendations for the 2016-17 season can be found in **Section 8.0**.

6.1.4 Homestay Houses

During the period 01 July 2015 – 31 January 2016, a total of 151 (78%) volunteers were housed for at least some of their volunteer placement in a homestay house in El Progreso at the Drake beach site. The total income for homestay houses during this period was $31,940, which corresponds to an 18% increase from the 2014 season and a new record for the volunteer program (see **Figure 11**).

There are now a total of 10 homestay houses available in the village of El Progreso, housing from 2-12 volunteers per house. One additional house was accepted into the homestay network in 2015.

Name	2010	2011	2012	2013	2014	2015	Total
Antonio Ortega *	$0	$0	$0	$0	$0	$1,880	$1,880
Alexander Jiménez	$0	$0	$0	$835	$1,962	$0	$2,797
Edin Pomares	$0	$1,784	$957	$1,288	$4,356	$2,720	$11,105
Emilce Torres	$0	$0	$0	$1,160	$0	$0	$1,160
Emilio Varela	$0	$0	$0	$1,203	$0	$0	$1,203
Evelyn Sánchez	$0	$0	$0	$0	$990	$2,580	$3,570
Fernando Chavez	$0	$0	$474	$1,259	$0	$0	$1,733
Francisco Mendoza	$0	$0	$0	$0	$0	$2,760	$2,760
Jhonson Villalobos	$0	$0	$821	$1,175	$2,070	$2,800	$6,865
Karen Villalobos	$0	$0	$0	$736	$2,574	$0	$3,310
Lilian Jiménez	$0	$0	$0	$693	$1,944	$3,400	$6,037
Marielos Almengor	$0	$0	$962	$2,108	$1,620	$4,600	$9,290
Mario Varela	$0	$0	$0	$722	$0	$0	$722
Marvin Salazar	$0	$0	$0	$835	$0	$0	$835
Maximiliano Rojas	$1,491	$800	$1,092	$1,769	$4,068	$1,040	$10,260
Migue Sánchez	$0	$1,128	$821	$1,245	$4,080	$5,800	$13,074
Olga Jiménez	$0	$0	$0	$594	$0	$0	$594
Olmer Salazar	$0	$0	$887	$0	$0	$0	$887
Roger Rodriguez	$0	$0	$0	$0	$2,376	$0	$2,376
Teresa Obando	$0	$3,475	$1,050	$0	$1,044	$4,360	$9,929
Venero Varela	$1,528	$801	$884	$0	$0	$0	$3,214
Victor Rojas	$0	$0	$0	$1,075	$0	$0	$1,075
Yasmin Pomares	$0	$588	$0	$0	$0	$0	$588
	$3,019	**$8,576**	**$7,947**	**$16,698**	**$27,084**	**$31,940**	**$95,264**

* new homestay house for 2015

Figure 11. Income received by homestay houses each season from 2010-2015

6.2 DRAKE BEACH

6.2.1 Preparation of the Beach and Hatchery

Preparation of the hatchery site for the 2015-16 season began in June and was planned and coordinated by the local turtle association, ACOTPRO. For the first time in the history of the program, ACOTPRO was responsible for managing the facility and for obtaining the appropriate permission from the Ministry for the Environment (MINAE) and the local municipality. Construction of the hatchery was completed on 04 August and the first nest was relocated to the site on the same date. An official inspection of the site by MINAE took place on 16 August, at which point the facility was approved for use during the 2015-16 season. The hatchery closed on 15 January 2016 upon excavation of the last nest to hatch.

The location of the hatchery is distinct from previous seasons, when the facility was constructed on a flat area of sand behind a natural barrier of vegetation in sector 18. While this site was ideal in the sense that it was located in middle of the beach and in the sector of highest overall nesting frequency (James 2014), access to the site often became logistically complicated by the necessity to cross the tidal estuary of the Drake river. Daytime hatchery shifts were especially demanding on resources, as it was often necessary to send trained staff or locals to assist with transferring volunteers to and from the hatchery site. The new location in sector 9, in the northern sector of Drake beach, is accessible on foot all year round via the bridge from the runway of the Drake Bay Aerodrome. As such, the new site is favorable in terms of access, but less favorable in terms of proximity to the sectors of the beach with the highest nesting frequency.

In order to construct the enclosure, vegetation was removed from the site and the perimeter of the hatchery, 12m x 12m, was marked. Trenches 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 were completed, enclosing the hatchery space. An additional 'rancho' structure was built alongside the enclosure to provide shelter for those working at the hatchery site.

Figure 12. Preparation of the field station on Drake beach

The hatchery enclosure provided sites for up to 144 nests, each allocated $1m^2$ and marked by a small sign displaying a nest code. This system is distinct from that used by most turtle conservation projects, which typically adopt the use of a grid made from string to mark out the nest sites and a labeling system using flagging tape. The use of nest code signs has proved to be more effective with the local Hatchery Managers in Drake beach, and ensures that it is not possible to ascertain the location of freshly relocated nests from the hatchery site, as no information regarding the contents of the nest sites is associated with the nest code signs.

From 05 July until 15 July, groups of volunteers removed all visible trash from Drake beach and placed numbered reference posts at 25m intervals in order to mark the sectors and sub-sectors of the beach. Night patrols began on 15 July and finished on 08 November 2015.

6.2.2 Summary of Turtle Crawls

During the period 01 July 2015 – 31 January 2016, a total of 151 tracks were registered on Drake beach, 149 of which were made by Olive Ridley turtles, and 2 (false crawls) by Pacific Green turtles. Of these 149 Olive Ridley crawls, 107 (71.8%) were nesting events and 42 (28.2%) were false crawls (see **Figure 13**). Of these 107 nests, 86 (80.4%) were relocated *ex situ* to the hatchery, 10 (9.3%) were relocated *ex situ* on the beach, 4 (3.7%) were left *in situ*, and 7 (6.5%) were poached. 50 (46.7%) of the 107 nesting turtles were sighted while nesting, of which 39 (36.4%) returned to the sea with tags in place (see **Annex 7** for a complete list of tag numbers).

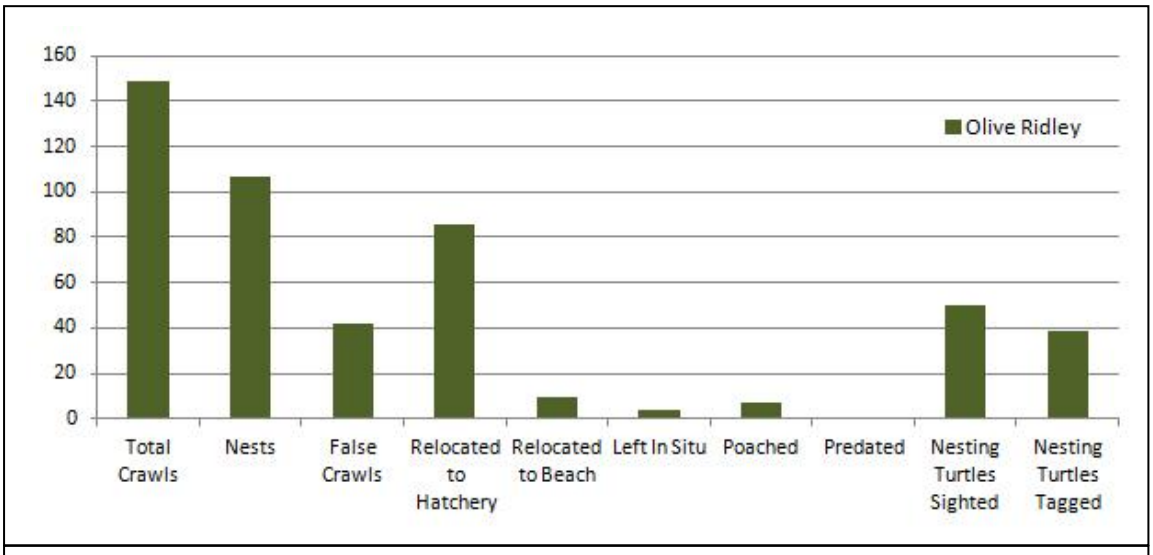

Figure 13. Summary of sea turtle crawls and nests on Drake beach from 01 July 2015 – 31 January 2016

Figure 14A shows that the number of nests registered in 2015 (107) was below the seasonal average since 2006 (mean: 127.2 nests). These data are indicative of a general decline in the number of turtles nesting on Drake beach; however, it remains too early to draw any firm conclusions until the beach has been monitored for at least one generation period (15-20 years). The proportion of nesting turtles seen by patrol groups was considerably higher from 2010-2015 (mean: 48.1%) than from 2006-2009 (mean: 24.5%) (see **Figure 14B**), while the percentage of nests successfully

relocated to the hatchery was also much higher from 2010-2015 (mean: 72.7%) than from 2006 2009 (mean: 33.9%), peaking in 2014 with 84% of nests relocated (see **Figure 14C**). The incidence of nest poaching has been reduced from a mean of 11.5% from 2006-2009, to 8.7% from 2010-2015 (see **Figure 14D**). These data are indicative of the successful optimization of night patrol methodology on Drake beach since 2010.

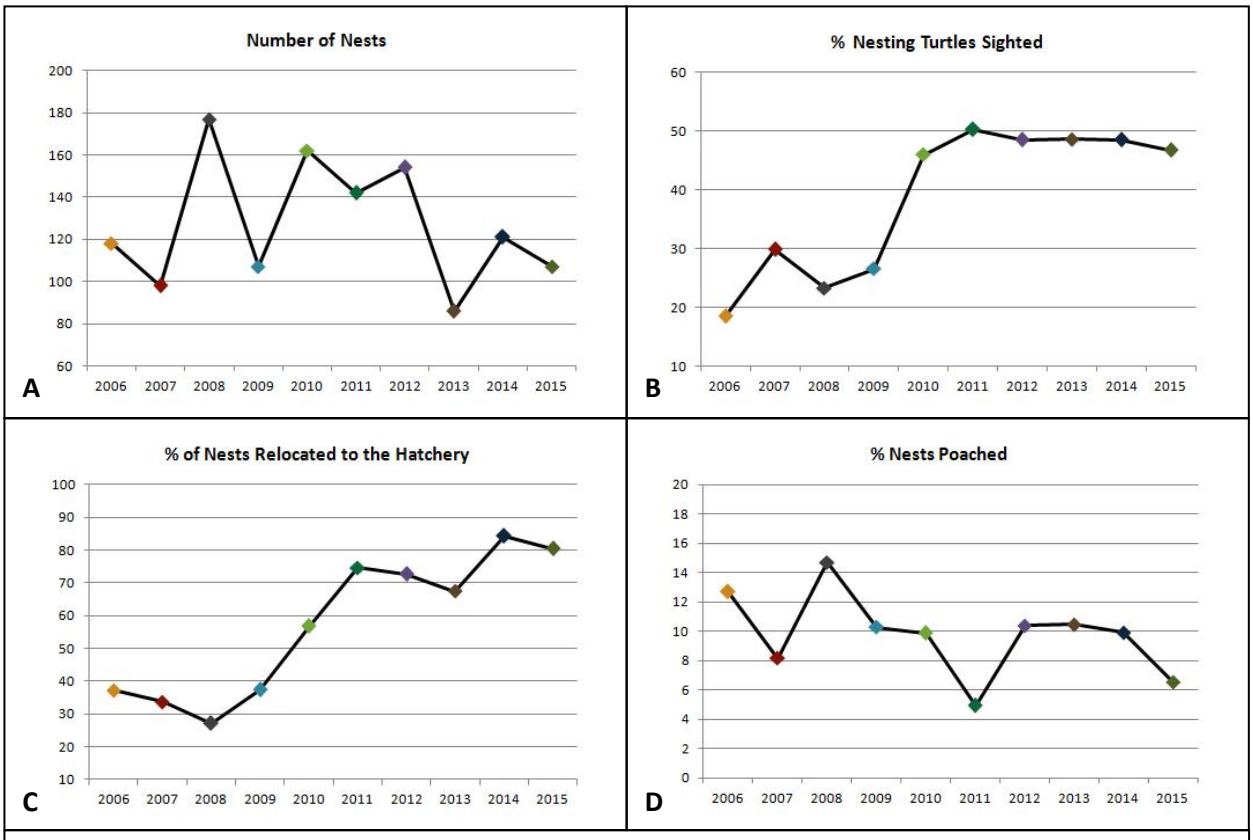

Figure 14. Number of nests (**A**), percentage of nesting turtles sighted (**B**), percentage of nests relocated to the hatchery (**C**), and percentage of nests poached (**D**), from 01 July – 31 December 2006-2014 on Drake beach

6.2.3 Temporal Distribution

Analysis of the frequency of nesting events registered on Drake beach during the 2015 season reveals a typical distribution. However the number of nests registered in each 15-16 day period remaining below the mean from 2006-2014 through the entire season (see **Figure 15**). Nesting frequency peaked during the period 16 August – 15 September 2015.

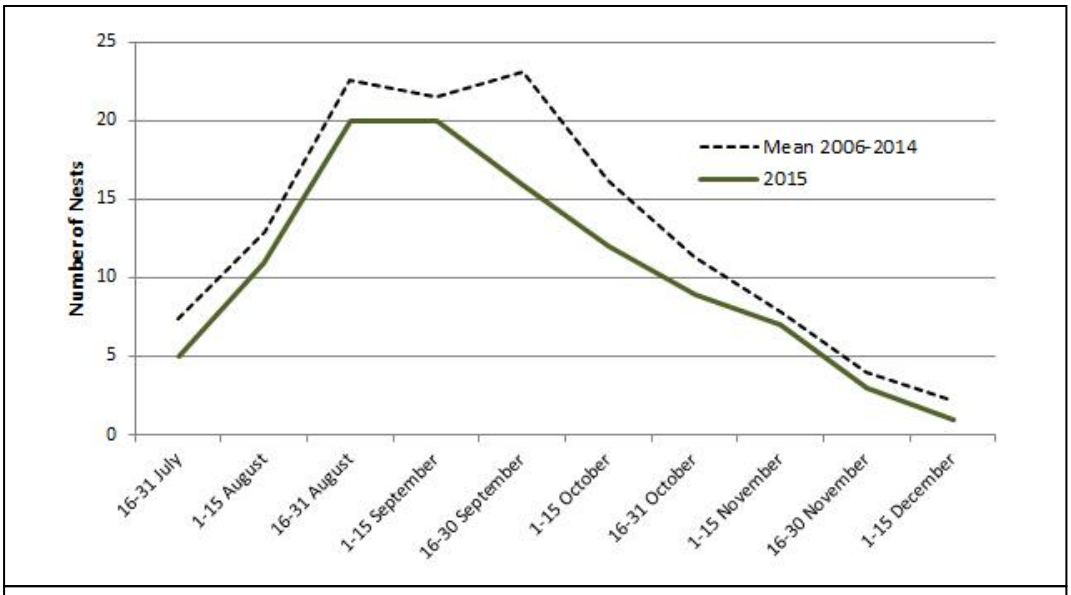

Figure 15. Temporal distribution of turtle nests registered from 01 July – 31 December 2006-2015 on Drake beach

6.2.4 Spatial Distribution

Comparison of the spatial distribution of nests registered on Drake beach from 01 July to 31 December 2015 with the mean from 2006-2014, shown in **Figure 16**, reveals a typical distribution for the 2015 season apart from the high nesting density observed in sectors 4 and 11.

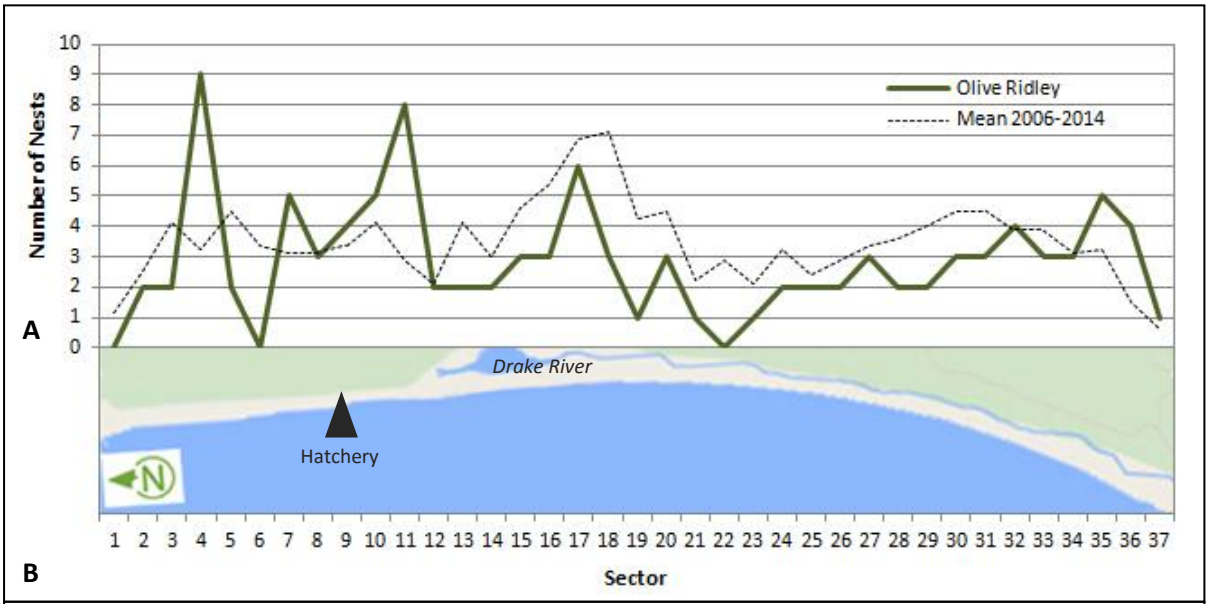

Figure 16. **A**. Spatial distribution of on Drake beach nests from 01 July – 31 December 2015 compared to mean distribution from 2006-2014 (**dashed**).
B. Map of Drake beach showing new location of hatchery.

6.2.5 Analysis of Nesting Behavior

The data shown in **Figure 17A** suggest that the upward trend in the proportion of turtles nesting in zone 3 reported in 2014 may be less compelling that previously thought (R^2=0.67). These data may, however, still be consistent with a long-term change in nesting behavior. The reason behind this putative change is unknown, but is unlikely to be related to human error since the zone assignment is well understood and recorded by patrol leaders. One possibility is that it could be related to the narrowing and steepening of the beach that appears to have taken place since 2009. The data shown in **Figure 17B** suggest that the upward trend in the density of nests in the North sector of Drake beach, reported in 2013, may also be less compelling that previously thought (R^2=0.52). These data may, however, still be consistent with a long-term change in nesting behavior.

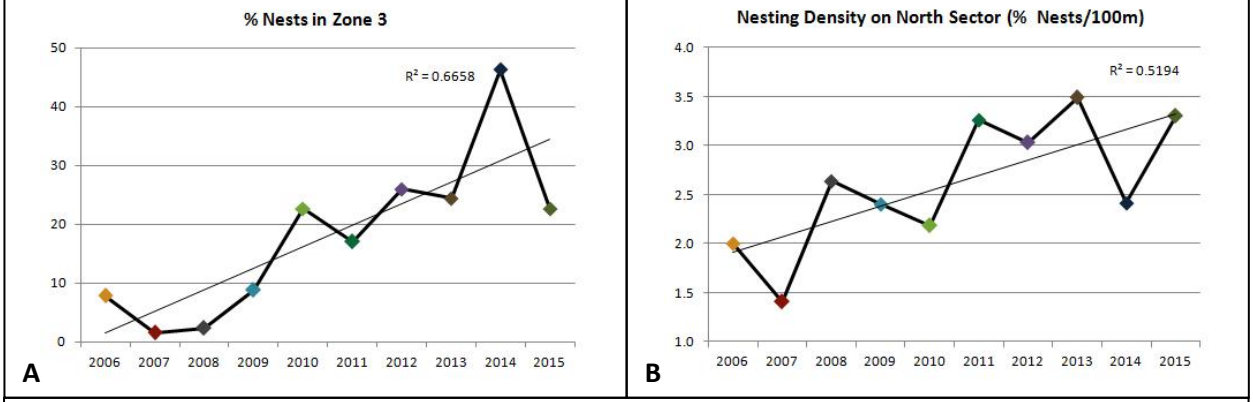

Figure 17. Percentage of nests laid in zone 3 (**A**) and nesting density of North sector (**B**), from July-December 2006-2014 on Drake beach

6.2.6 Re-Nesting and Re-Migration

Of the 50 unique turtles registered, 5 (10.0%) turtles were found to have been tagged previously at the program (re-migrating). The data in **Figure 18** show a reassuring trend of an increasing proportion of nesting turtles re-migrating to Drake beach since 2007 (R^2=0.76).

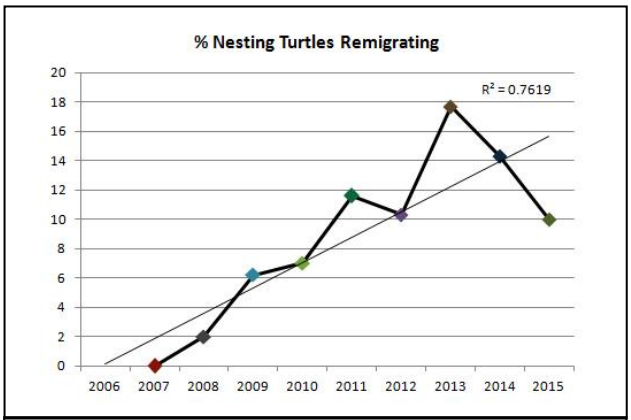

Figure 18. Nesting turtles re-migrating to Drake beach from July-December 2007-2015

6.2.7 Analysis of Lunar Phases

In order to analyze the relationship between turtle exits and lunar phase, the percentage of turtle nests registered on each day of the lunar cycle was plotted as a mean from 2006-2015. The data in **Figure 19** show a sustained peak in the distribution at days 3-4 (waning crescent), which correspond to the days of the peak spring tide. These data are indicative of an environmental cue affecting the nesting behavior of the solitary Olive Ridley sea turtles on Drake beach.

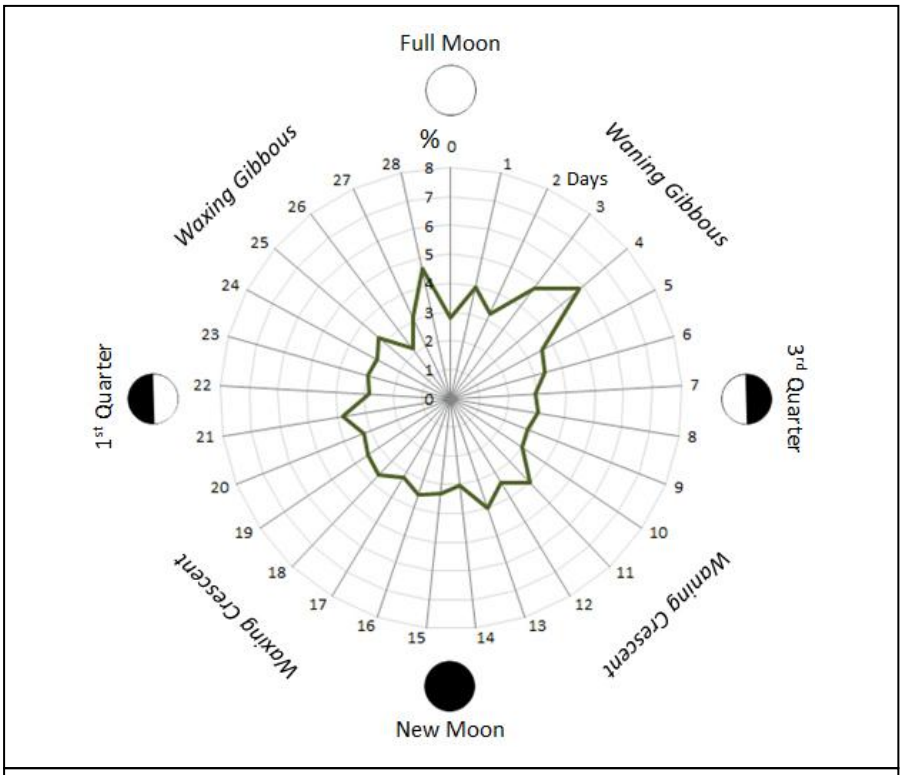

Figure 19. Mean percentage of nests registered on each day of the lunar cycle, from July-December 2006-2015 on Drake beach

6.2.8 Analysis of Sand Temperatures

In order to monitor changes in sand temperatures, control dataloggers were deployed on Drake beach (sector 17) and in the hatchery during the course of the season. The mean constant temperature equivalent (CTE) data for 15-16 day periods, summarized in **Figure 20**, show that sand temperatures were highest from 16 September through 15 October. The data also show that on average the hatchery remained 0.9°C hotter than the beach, which is similar trend to that observed during previous seasons. Mean CTEs in the hatchery remained above the pivotal temperature (PT) for Olive Ridley turtles (30.5°C, Wibbels 1998) throughout the season, except from 16-30 November. Mean CTEs on the beach also remained above the PT, except from 16 October through 30 November. These data imply a natural female bias on Drake beach during 2015, which is inconsistent with the male bias reported previously (James 2014, 2013, 2012, 2011; González-Paredes 2011; Melero 2010). This change in bias is likely due to the extremely dry and hot weather brought about by the strong El Niño effect during 2015, and as such is likely to represent a rare anomaly.

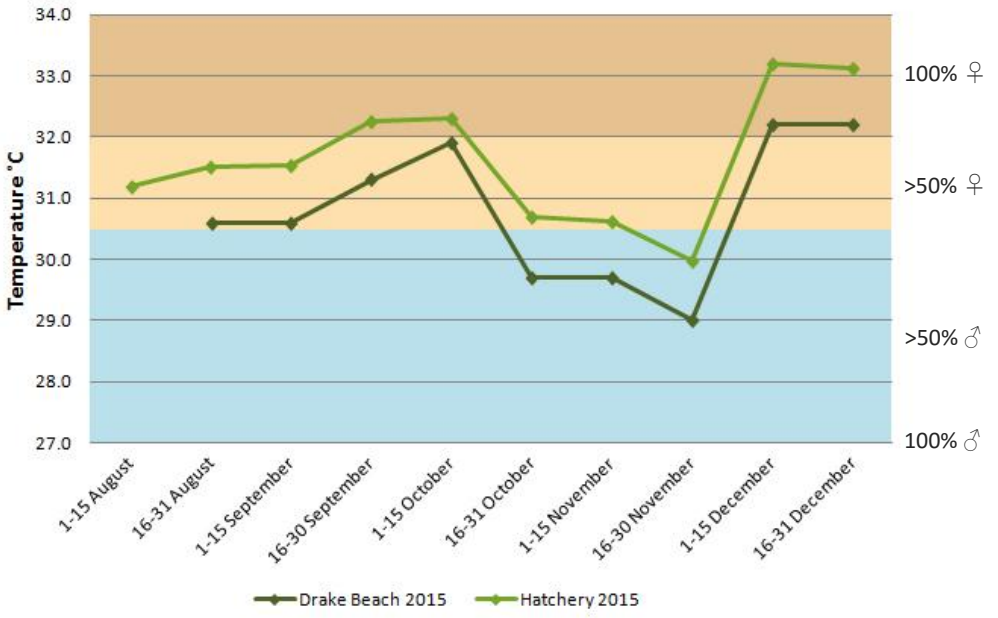

Figure 20. Mean sand temperatures (CTEs) [accuracy ±0.47 °C] in the hatchery and on Drake beach (sector 17), showing pivotal temperature range for Olive Ridley turtles, from 01 August – December 2015

6.2.9 Determination of Sex Ratio

The sex ratio for each nest in the hatchery was estimated according the indirect method described in **Section 5.9**. Analysis of these data shows that a male bias was estimated to occur in just 11.8% of nests in the hatchery during 2015 – a much lower proportion than in 2014 (52.8%), 2013 (72.4%), 2012 (66.1%) and 2011 (71.4%). Of the 5,696 hatchlings liberated from the hatchery during 2015, 4,586 (80.5%) were estimated to be female, and 1,110 (19.5%) were estimated to be male.

6.2.10 Determination 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 **Figure 21** show that the reproductive success in the hatchery in 2015 was lower than in any other year apart from 2008, with a mean emergence rate of just 67.5%. Reproductive success was also lower in the hatchery than for nests excavated on the beach, for the first time since 2009. These data suggest sub-optimal conditions in the hatchery during 2015, most likely resulting from the relocation of the hatchery to sector 9, a site where the sand was discovered to be much finer and easier to compact that at the original location in sector 18.

	Beach			Hatchery		
Year	% Mean Eclosion	% Mean Emergence	n	% Mean Eclosion	% Mean Emergence	n
2015	**73.9**	**70.0**	6	**71.7**	**67.5**	85
2014	n/a	n/a	n/a	80.3	78.0	89
2013	n/a	n/a	n/a	78.9	76.8	58
2012	86.4	71.1	7	86.9	84.8	110
2011	71.2	54.8	6	74.2	70.0	106
2010	76.2	73.9	11	80.4	78.4	92
2009	81.6	77.3	24	75.2	73.3	40
2008	76.7	73.0	48	62.6	61.4	48
2007	75.4	68.1	n/a	85.8	83.1	n/a
2006	81.8	75.8	n/a	89.2	85.2	n/a
Mean	77.9	70.5		78.5	75.8	

Figure 21. Reproductive success of nests on the beach and in the hatchery from 01 July – 31 December 2006-2015 on Drake beach

6.2.11 Summary of Biometric Data

Biometric data from nesting females during 2015 on Drake beach are summarized in **Figure 22**.

Olive Ridley Nesting Females (n= 42), Tracks (n= 98), Depth (n= 68), Clutch Size (n= 96)					
Nesting Female	Carapace (curved)		Width of Track (cm)	Depth of Nest (cm)	Clutch Size (eggs)
	Length (cm)	Width (cm)			
Median	67.0	70.0	67.5	43.0	98
Range	59.0 73.0	62.0 77.0	51.0 88.0	29.0 52.0	6 130

Figure 22. Biometric data from nesting turtles from 01 July – 31 December 2015 on Drake beach

6.3 RÍO ORO BEACH

6.3.1 Preparation of the Beach and Field Station

The original proposal for the creation of a new field station was to secure funds in order to build a dedicated facility located on the site of the Río Oro primary school. While this still remains the long-term objective of the program, the budget ultimately approved for 2015 by Pacsafe was not sufficient to permit development of the site this season, and no matching funds were found.

As an alternative in the interim, bespoke facilities were built at an existing eco-lodge located 5km from the school site at Hacienda Río Oro. While the configuration of the facilities was specified by the program, most of the cost was met by the Hacienda Río Oro. In return, the program rents the use of the property, paying a fixed cost per person staying at the site. This cost covers the provision of three meals per day and daily transportation to and from the school site in order to efficiently carry out beach patrols. Facilities include a coordinator tent platform and workshop area, two volunteer dorm tent platforms, laundry facilities, a chill-out area with hammocks, and a dining area.

While the Hacienda offers a perfectly adequate alternative to a dedicated field station, providing high-quality accommodation and an agreeable atmosphere for volunteers, the solution is not ideally suited to the long-term protection of Río Oro beach by the program. As such, the program continues to seek funds in order to construct a dedicated facility at the Río Oro school site in 2016-17.

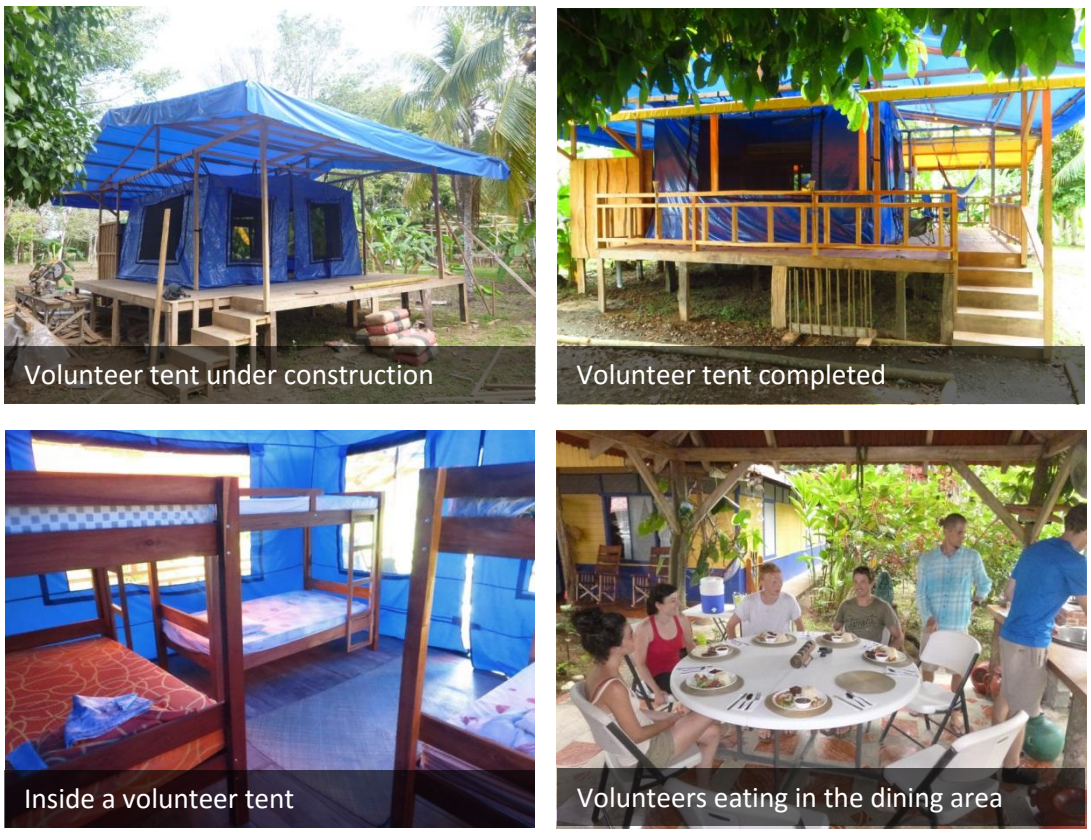

Figure 23. Construction and use of new facilities at the Hacienda Río Oro

Preparation of the beach began on 18 July 2015, when the program participated in a regional beach cleaning activity in collaboration with COTORCO, Osa Conservation and Frontier. Around 200 volunteers participated in the operation to remove waste from over 20 km of coastline, from Piro beach in the South to La Leona beach in the North. From 19 July until 29 July, groups of volunteers removed all additional trash from Río Oro beach and placed numbered reference posts at 50m intervals in order to mark the sectors and sub-sectors of the beach. Night patrols began on 20 July.

6.3.2 Summary of Turtle Crawls

During the period 20 July 2015 – 31 January 2016, a total of 4,325 sea turtle crawls were registered on Río Oro beach, 4,187 (97%) of which were made by Olive Ridley sea turtles, and 138 (3%) by Pacific Green sea turtles.

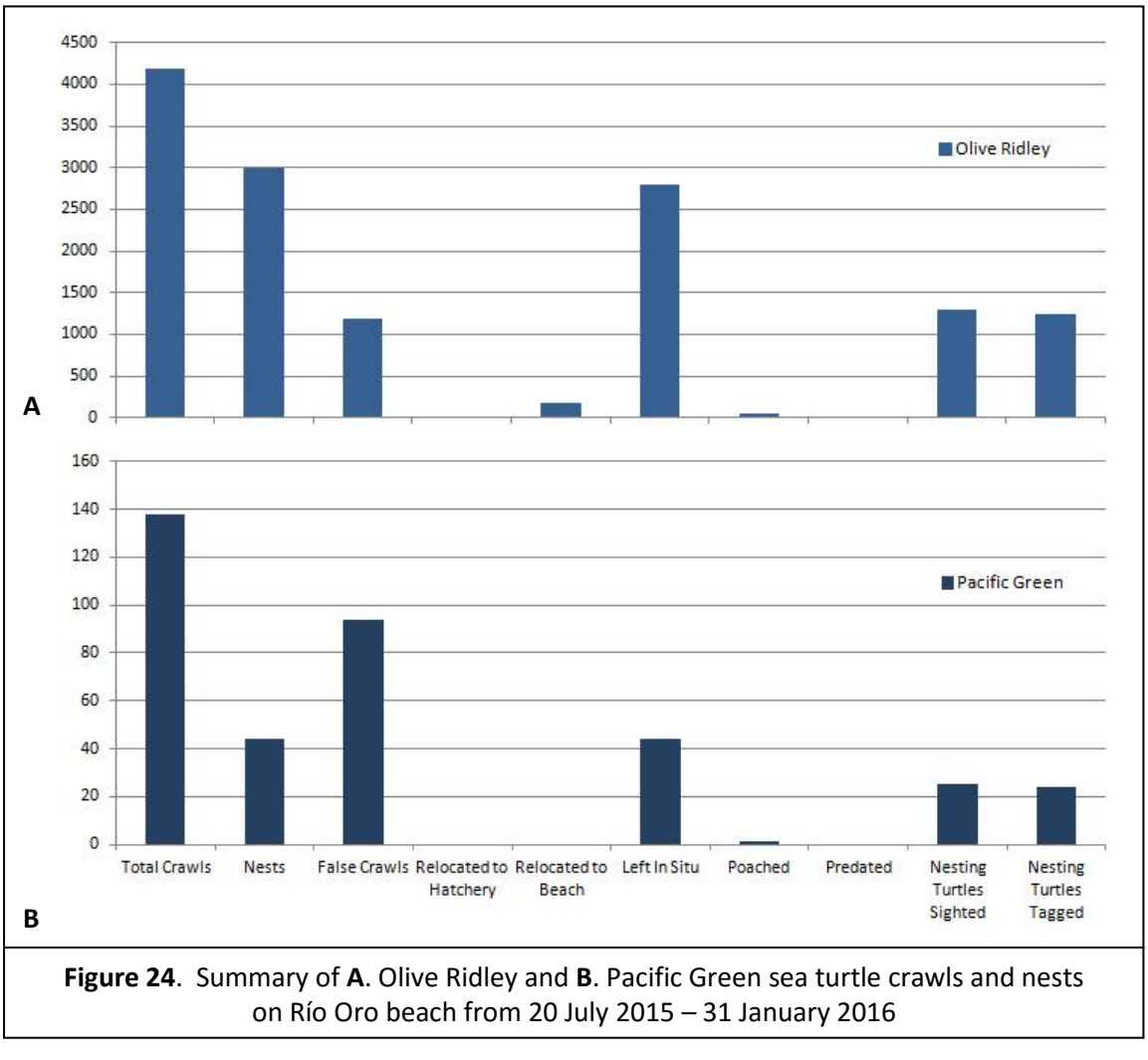

Figure 24. Summary of **A**. Olive Ridley and **B**. Pacific Green sea turtle crawls and nests on Río Oro beach from 20 July 2015 – 31 January 2016

Of the 4,187 Olive Ridley crawls, 2,990 (71.4%) were nesting events and 1,197 (28.6%) were false crawls (see **Figure 24A**). Of these 2,990 nests, 2,798 (93.6%) were left *in situ*, 173 (5.8%) were relocated *ex situ* on the beach, and 43 (1.4%) were poached. 1,304 (43.6%) of the 2,990 nesting turtles were sighted while nesting, of which 1,242 (41.5%) returned to the sea with tags in place.

Of the 138 Pacific Green turtle crawls, 44 (31.9%) were nesting events and 94 (68.1%) were false crawls (see **Figure 25B**). Of these 44 nests, all were left *in situ*, one (2.3%) of which was later found to have been poached. 25 (56.8%) of the 44 nesting turtles were sighted while nesting, of which 24 (54.5%) returned to the sea with tags in place (see **Annex 7** for a complete list of tag numbers).

6.3.3 Temporal Distribution

Analysis of the frequency of nesting events registered on Río Oro beach during the 2015-16 season shows that Olive Ridley nesting peaked during the period 1-15 October (see **Figure 25A**), with 276 nests registered between 5-6 October alone. The distribution also reveals three notable peaks in nesting frequency during the first two weeks of the months of September, October and November. These data indicate that Río Oro beach is a site of major solitary Olive Ridley nesting.

The temporal distribution of Pacific Green turtle nests on Río Oro beach shows that nesting peaked during the periods 1-15 August, 1-15 September and throughout December (see **Figure 25B**). This atypical distribution is indicative of low-intensity nesting and suggests that Río Oro beach is not a major site of Pacific Green turtle nesting.

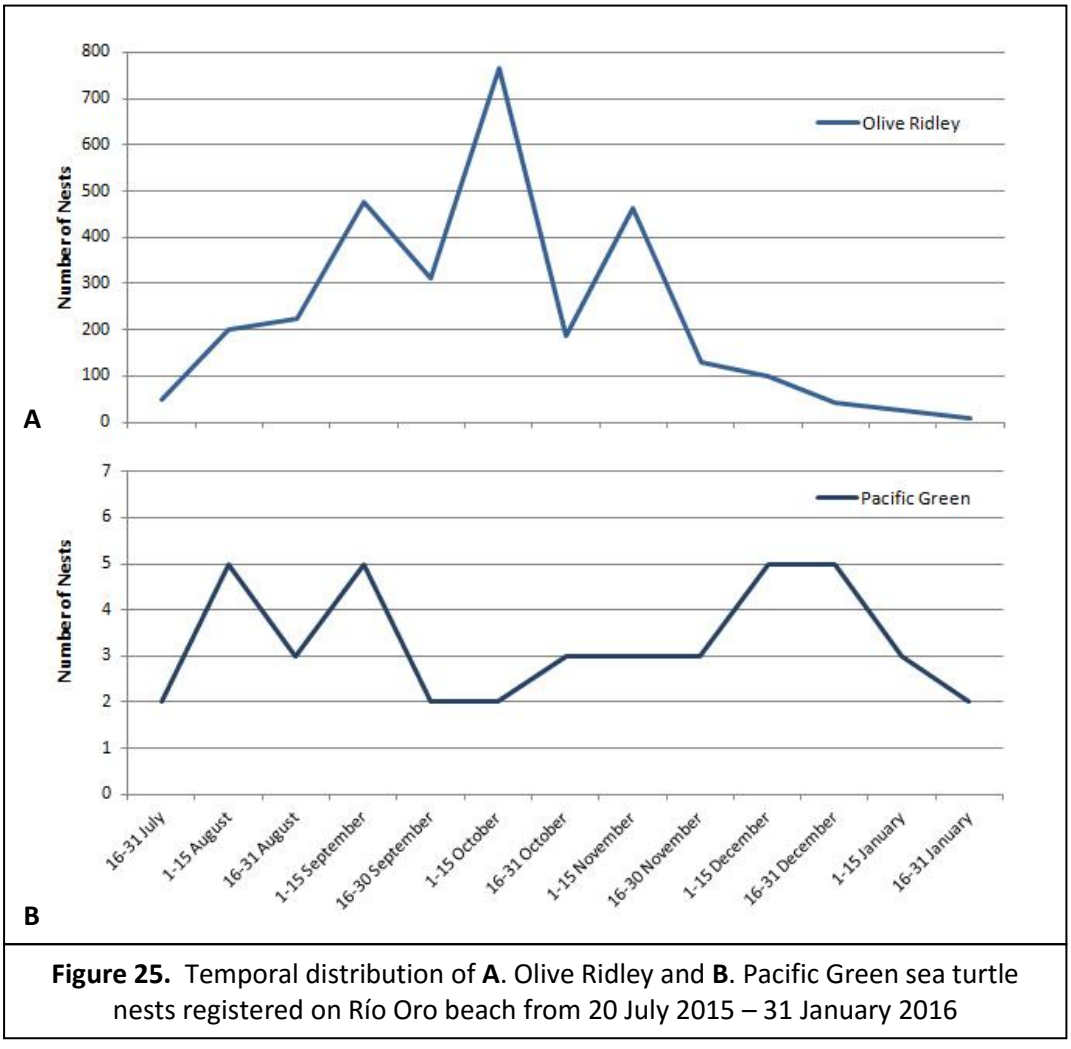

Figure 25. Temporal distribution of **A**. Olive Ridley and **B**. Pacific Green sea turtle nests registered on Río Oro beach from 20 July 2015 – 31 January 2016

6.3.4 Spatial Distribution

Analysis of the spatial distribution of nests registered on Río Oro beach from 20 July to 31 December reveals more or less uniform Olive Ridley nesting density across all 48 sectors (see **Figure 26A**), although nesting was slightly more intense in the southern half (sectors 25-48, density = 64.5/100m) compared to the northern (sectors 1-24, density = 58.5/100m). The highest nesting density was registered in sectors 28 and 29, immediately to the South of the zone where the Río Oro river typically forms a mouth.

The spatial distribution of Pacific Green turtle nests during this period is sporadic and indicative of low-intensity nesting (see **Figure 26B**). It is not possible to draw any conclusions from these data.

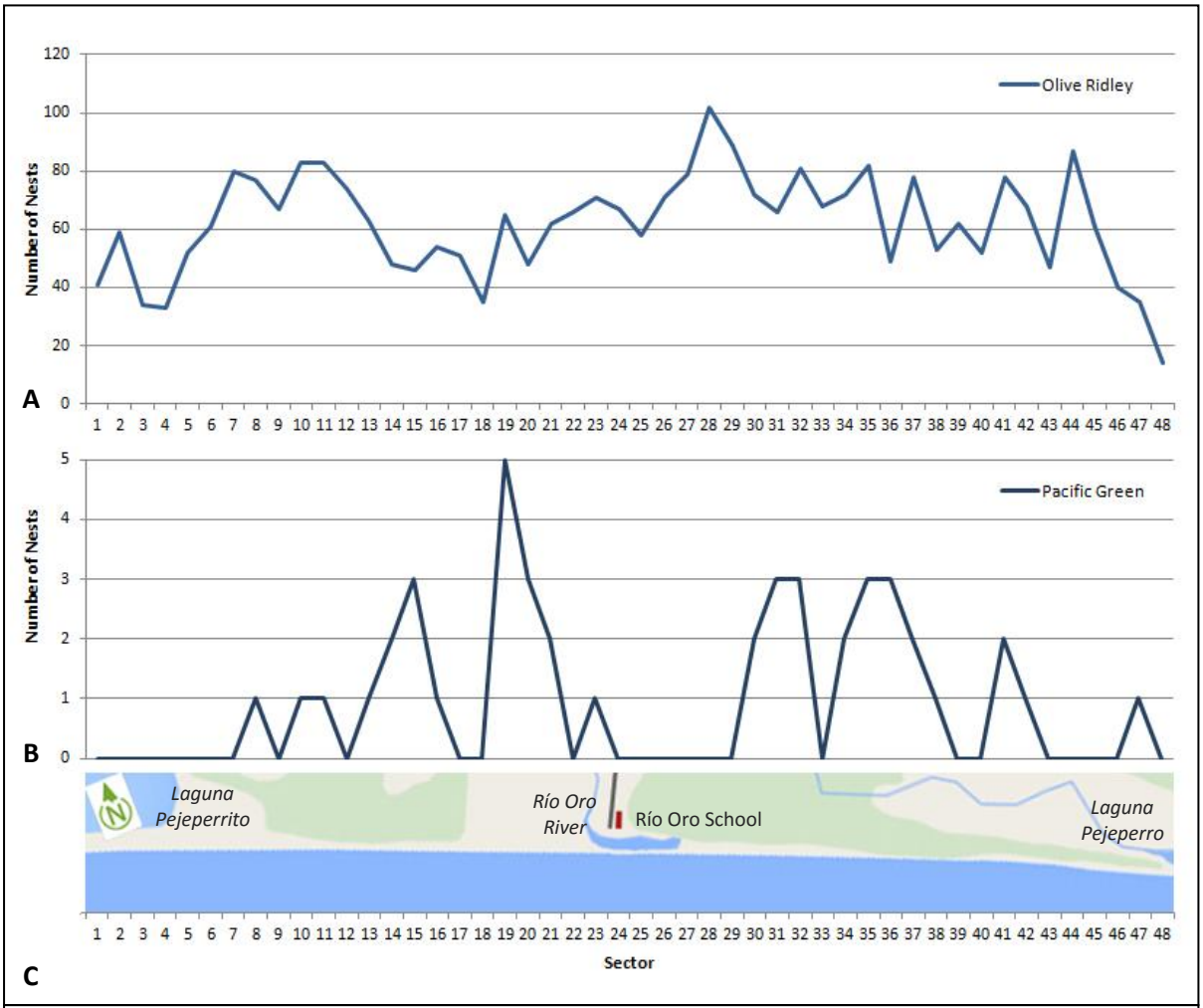

Figure 26. Spatial distribution of **A**. Olive Ridley and **B**. Pacific Green sea turtle nests registered on Río Oro beach from 20 July 2015 – 31 January 2016. **C**. Map of Río Oro beach showing location of Río Oro school, Río Oro river, Laguna Pejeperrito and Laguna Pejeperro

6.3.5 Analysis of Nesting Behavior

Río Oro beach was not routinely monitored from 2009-2014; however, three reports exist from monitoring that took place in 2005, 2006 and 2008, published by PRETOMA, the Corcovado Foundation and WIDECAST, respectively (Sánchez 2005, Sánchez 2006[b], Malaver Montenegro 2008). Comparison of these historical data with those from Piro, Pejeperro and Carate beaches (Barquero-Edge 2015, Bernal Castro 2013, 2012; Saborío 2010) shows that that Río Oro beach has always been a site of substantial Olive Ridley nesting in the region (see **Figure 27**). However, these data also suggest that the relative superiority of Río Oro beach in this respect may have increased dramatically over recent years. In 2005 and 2006, for example, fewer nests were registered on Rio Oro beach than Pejeperro beach. Analysis of the data from July to December 2015, by contrast, reveals that 49.5% of all Olive Ridley nests registered in the Osa Peninsula during this period were laid on Río Oro beach. Nesting density was also around three times higher on Río Oro beach (61.5 nests/100m) than on any other beach in the region (Pejeperro = 25.1 nests/100m; Piro = 20.6 nests/100m; Carate = 21.2 nests/100m; Drake = 3.0 nests/100m).

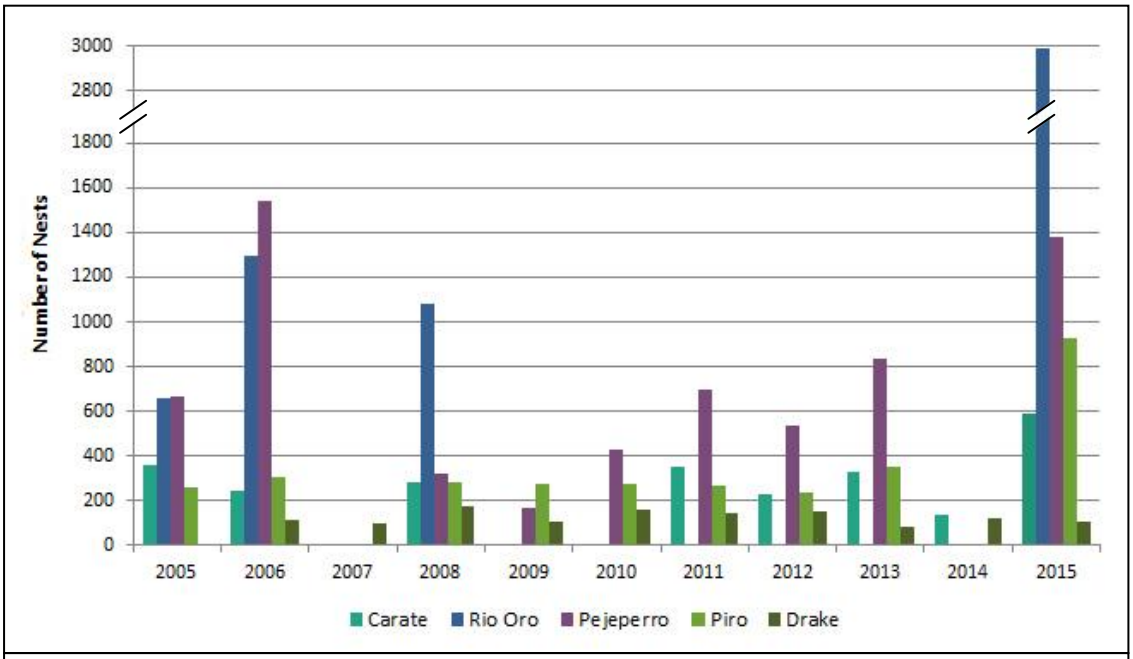

Figure 27. Number of Olive Ridley nests registered on five major nesting beaches in the Osa Peninsula each season, from 2005 to 2015. Río Oro beach was not monitored from 2009-2014. All other gaps correspond to data that are currently irretrievable

6.3.6 Analysis of Lunar Phases

In order to analyze the relationship between turtle exits and lunar phase, the percentage of turtle nests registered on each day of the lunar cycle during the 2015-16 season was plotted. The data in **Figure 28** show a very strong peak in the distribution at days 7-9 (waning crescent). Indeed, 24.9% of all Olive Ridley nesting took place on these three days of the cycle on Río Oro beach during 2015-16.

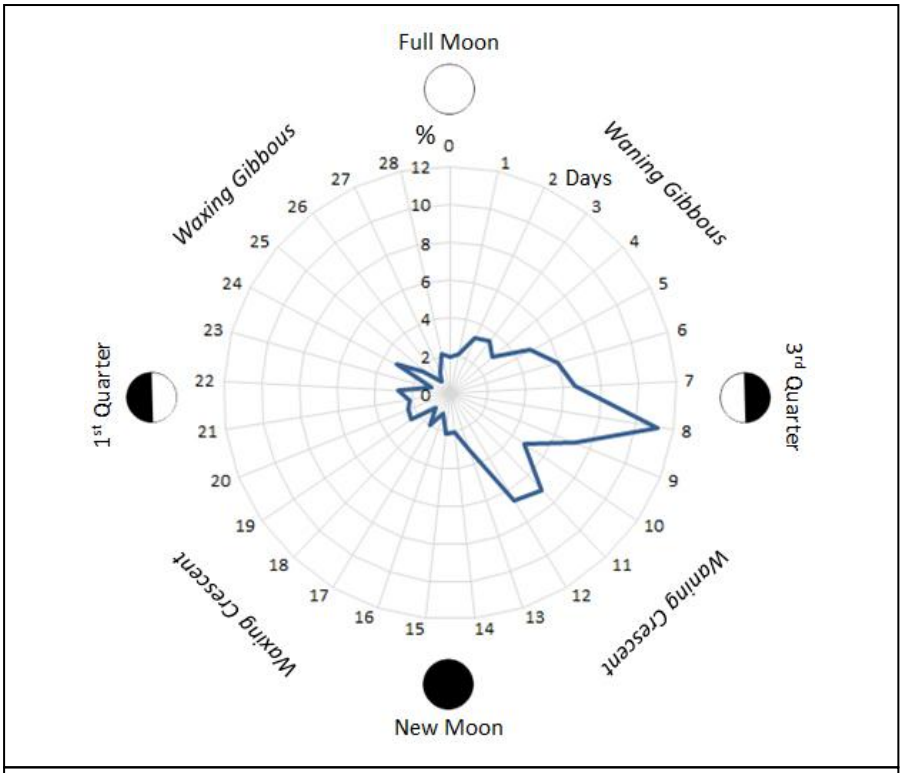

Figure 28. Mean percentage of nests registered on each day of the lunar cycle on Río Oro beach from 20 July 2015 – 31 January 2016

While the specific day of the lunar cycle corresponding to the highest nesting intensity is distinct on Drake beach (day 4, see **Figure 19**) and Río Oro beach (day 8), both can be said to approximately coincide with the 3rd quarter lunar phase. Increased nesting frequency during this phase was reported previously (James 2015, Plotkin 1997, 1995), and so further analysis was conducted to compare the temporal distribution of Olive Ridley nesting on several beaches on the Pacific coast of Costa Rica.

Alignment of the temporal distribution of solitary Olive Ridley nesting during the 2015 season on Río Oro beach (**Figure 29A**) and Corozalito beach (**Figure 29B**) in the Nicoya Peninsula, reveals that the three major peaks in nesting frequency occurred on almost exactly the same day of the lunar cycle and with a similar intensity. Further analysis was conducted to investigate whether this strong synchrony was just a season-specific anomaly or a more general trend.

The data in **Figure 29C** correspond to the mean dataset from Río Oro beach (2015, n=2,591), Corozalito beach, Nicoya Peninsula (mean: 2009-2015, n=10,223), and San Miguel beach, Nicoya Peninsula (mean: 2010-2012, n=1,004). These data support the notion that the increased nesting is observed during the third quarter of the lunar cycle for solitary Olive Ridley turtles on the Pacific coast of Costa Rica.

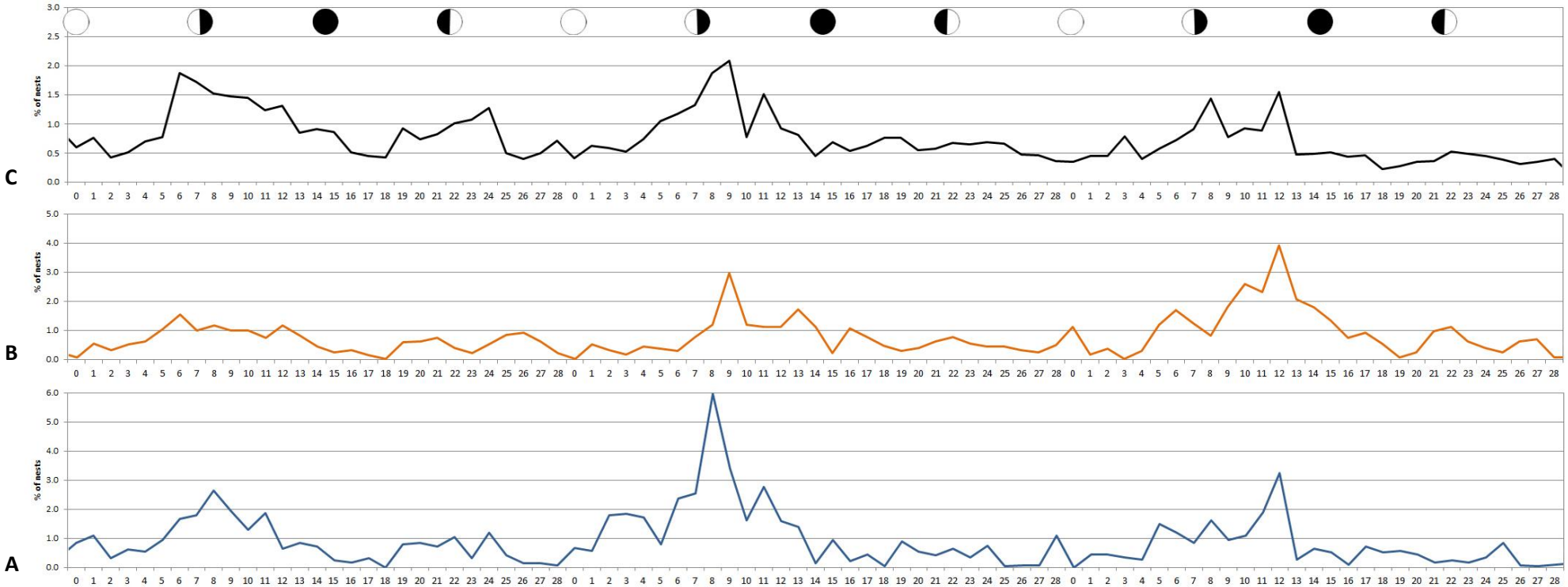

Figure 29. Percentage of solitary Olive Ridley nests laid on each day of the lunar cycle, plotted linearly over three lunar cycles (3rd, 4th and 5th of each nesting season): **A**. Río Oro beach (2015) and **B**. Corozalito beach, Nicoya Peninsula (2015). **C**. Mean of multiple datasets: Río Oro beach (2015, n=2,591); Corozalito beach, Nicoya Peninsula (mean: 2009-2015, n=10,223); and San Miguel beach, Nicoya Peninsula (mean: 2010-2012, n=1,004).
Data from Corozalito and San Miguel beaches used with kind permission from PRETOMA (Arauz Vargas 2015).

The data shown here seem to provide compelling evidence for coordinated nesting behavior and suggest than nesting is synchronized between geographically distinct populations that presumably do not interact socially during inter-nesting periods. However, despite this apparent synchrony on days 7-9 of the lunar cycle, 75.1% of nesting events on Río Oro beach during 2015-16 took place on other days of the cycle, implying the existence of two behaviorally distinct sub-populations.

In order to search for potential morphological differences between Olive Ridley turtles nesting on days 7-9 of the cycle and turtles nesting on all other days, biometric data from these two sub-populations were analyzed. The plots shown in **Figure 30** show the relationship between curved carapace length (CCL) and curved carapace width (CCW) for 'synchronized' (day 7-8, **Figure 30A**) and 'non-synchronized' (any other day, **Figure 30B**) nesting turtles.

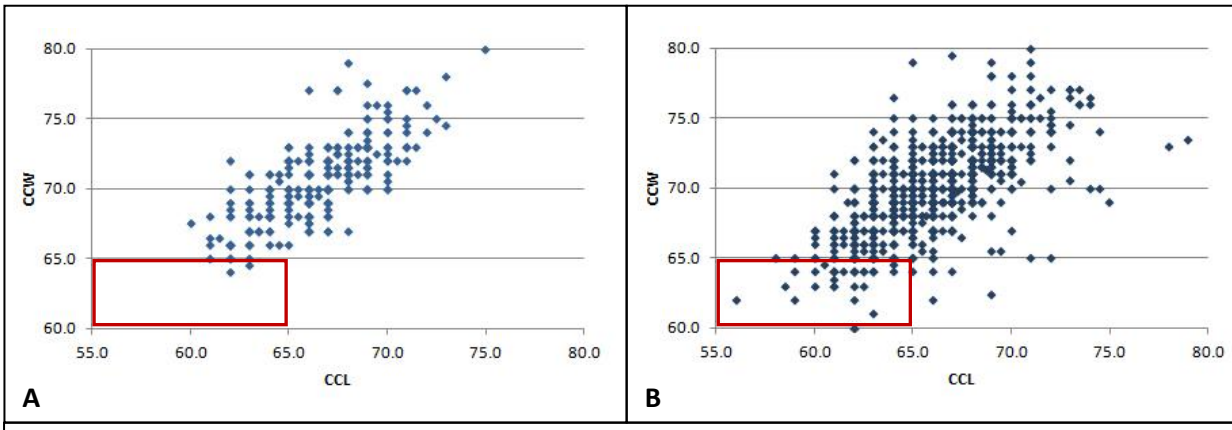

Figure 30. Scatter plots showing relationship between curved carapace length (CCL) and curved carapace width (CCW) for **A**. 'synchronized' and **B**. 'non-synchronized' nesting turtles

Comparing the roundedness of the carapaces (roundness index =(CCL/CCW)*100)) of the turtles in the two datasets reveals near identical means but greater variance in the 'non-synchronized' dataset ('synchronized' mean= 94.2, s.d.= 2.7, n= 264; 'non-synchronized' mean= 94.3, s.d.= 3.4, n= 988). Interestingly, the plots show that a much smaller proportion of turtles with small carapaces (CCL<65.0cm; CCW<65.0cm) are found in the 'synchronized' (0.76%) dataset than the 'non-synchronized' (3.44%) dataset (see red boxes in **Figure 30**), suggesting that smaller, younger females are less predisposed to participating in the synchronized nesting events. It is tempting to hypothesize that the ability of female Olive Ridley turtles to delay nesting until conditions are favorable increases with maturity, and as such fewer younger turtles are able to synchronize their oviposition with environmental factors. However, due to the greater variance in the 'non-synchronized' dataset, statistical analysis of a much larger sample of turtles nesting on a number of geographically distinct beaches would be necessary in order to draw any conclusions about this phenomenon.

6.3.7 Analysis of Sand Temperatures

In order to monitor changes in sand temperatures, control dataloggers were deployed on Río Oro beach (sectors 21 and 34). The mean constant temperature equivalent (CTE) data for 15-16 day periods on Río Oro beach and Drake beach, summarized in **Figure 31**, show that sand temperatures were highest from 1-15 October 2015 and throughout December 2015. The data also show that on average Río Oro beach remained 0.5°C hotter than Drake beach.

Mean CTEs on Río Oro beach remained above the pivotal temperature (PT) for Olive Ridley turtles (30.5°C, Wibbels 1998) throughout the season, except from 16-30 November 2015. These data imply a natural female bias on Río Oro beach during 2015. In the absence of reliable data from previous seasons, it is impossible to conclude any general or season-specific trends regarding the thermal profile of this beach. However, given the similarity of the datasets from Río Oro and Drake beaches, it is reasonable to hypothesize that Río Oro also typically exhibits a male bias, and that 2015 was an anomalous season characterized by dry and hot weather brought about by a strong El Niño effect.

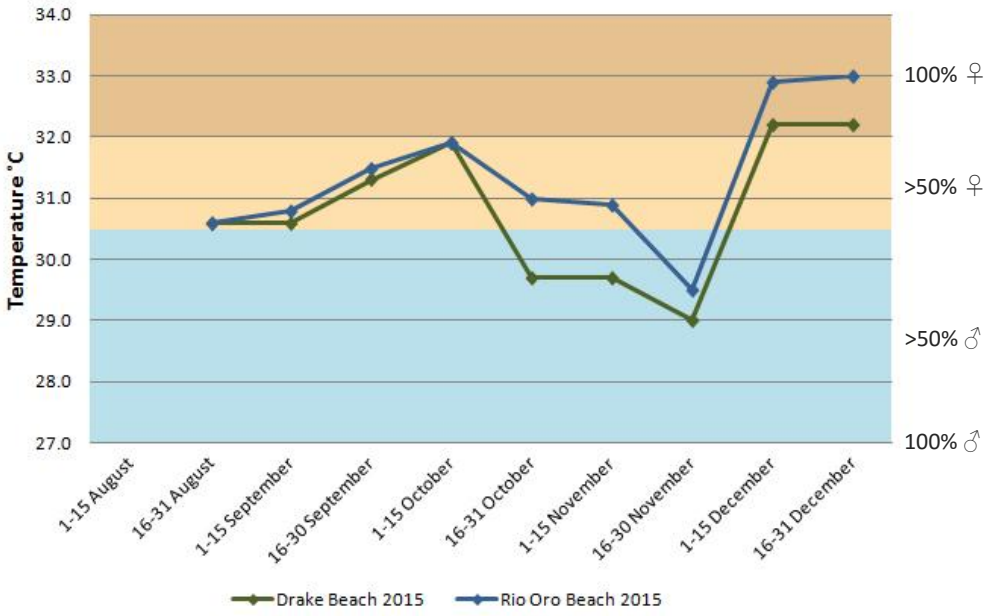

Figure 31. Mean sand temperatures (CTEs) [accuracy ±0.47 °C] on Río Oro beach (mean: sectors 21 and 34) and on Drake beach (sector 17), showing pivotal temperature range for Olive Ridley turtles, from 01 August – December 2015

6.3.8 Determination of Sex Ratio

A sample of 524 Olive Ridley nests was excavated and analyzed on Río Oro beach, of which 144 qualified for reliable thermal profiling. The sex ratio for each of these nests was estimated according the indirect method described in **Section 5.9**. A female bias was estimated to occur in 77.8% of these 144 nests, and an estimated 7,959 (72.5%) of the 10,978 hatchlings emerging from this sample were calculated to have been female.

A sample of 6 Pacific Green nests was excavated, all of which qualified for thermal profiling. Based on the putative pivotal temperature for this species (Ackerman 1997) it is estimated that a female bias occurred in 100% of these nests.

6.3.9 Determination 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 from a sample of 524 Olive Ridley and 6 Pacific Green nests. The data in **Figure 32** show that the reproductive success for Olive Ridley nests was higher on Río Oro beach than on Drake and Carate beaches during 2015. These data provide evidence to suggest that Río Oro beach may provide ideal nesting habitat for Olive Ridley sea turtles, possibly thanks to favorable inclination and sand grain size (Drake 1996).

Beach	% Mean Eclosion	% Mean Emergence	n
Drake (Olive Ridley)	73.9	70.0	6
Río Oro (Olive Ridley)	81.0	76.1	524
Río Oro (Pacific Green)	90.5	90.3	6
Carate (Olive Ridley)	61.0	60.0	n/a

Figure 32. Reproductive success of nests on Río Oro, Drake and Carate beaches from 01 July – 31 December 2015

6.3.10 Summary of Biometric Data

Biometric data from nesting females during 2015-16 on Río Oro beach are summarized in **Figure 33**.

A Olive Ridley Nesting Females (n= 1,269), Tracks (n = 270), Depth (n= 0), Clutch Size (n= 156)

Nesting Female	Carapace (curved)		Width of Track (cm)	Depth of Nest (cm)	Clutch Size (eggs)
	Length (cm)	Width (cm)			
Median	66.0	70.0	71.0	n/a	99
Range	54.0 79.0	55.0 80.0	52.0 96.0	n/a n/a	4 131

B Pacific Green Nesting Females (n= 30), Tracks (n= 13), Depth (n= 0), Clutch Size (n= 3)

Nesting Female	Carapace (curved)		Width of Track (cm)	Depth of Nest (cm)	Clutch Size (eggs)
	Length (cm)	Width (cm)			
Median	83.3	79.8	90.0	n/a	87
Range	69.0 97.5	69.0 90.0	77.0 98.0	n/a n/a	67 120

Figure 33. Biometric data from nesting **A**. Olive Ridley and **B**. Pacific Green sea turtles from 20 July 2015 – 31 January 2016 on Río Oro beach

7.0 Conclusions

7.1 VOLUNTEER PROGRAM

7.1.1 Status of Specific Objectives

Specific objective for 2015-16		Status at end of 2015-16 season
1.1	Increase the number of volunteers participating in the program by at least 30%.	A total of 193 volunteers were recruited during the 2015-16 season, an increase of 108% in recruitment compared with the 2014 season.
1.2	Reconfigure volunteer program to include new Río Oro site.	New volunteer orientation manuals and training presentations were produced in English and Spanish to reflect the expansion of the program (see **Annexes 1-4**). All volunteers were trained at the Drake beach site and offered the chance to work at both sites. At Río Oro beach, placements were one week long (or multiples thereof) and exchanges took place 1-2 times per week using the hostel vehicle.
1.3	Create at least two new partnerships with third party volunteer organizations and increase volunteer intake from existing partners.	Volunteers were recruited through seven organizations during 2015-16, including two new partners: Volunteers en el Mundo and First Hand Volunteers. The partner responsible for providing the most volunteers was Máximo Nivel (44%), followed by direct recruitment through the CF (33%) and Working Abroad (19%). The number of volunteers recruited from both Máximo Nivel and Working Abroad increased in 2015 compared to 2014, by 150% and 200%, respectively.
1.4	Provide all volunteers with training in both sea turtle conservation and responsible tourism.	All 193 volunteers completed all three training courses, and all were certified as Field Assistants and Hatchery Managers. Six were also certified as Patrol Leaders.
1.5	Support the Environmental Education program in the delivery of activities.	Volunteers assisted in the preparation of games and activities for the 'Festival de Agua', which was hosted by the Environmental Education program in El Progreso on 29 and 30 August 2015, and assisted with organizing and managing the event on the day. Around 10% of volunteers also assisted with the 'Pumas' youth group in El Progreso. However, more could have been done to foster increased collaboration between the Sea Turtle Conservation and Environmental Education program during 2015-16.
1.6	Evaluate volunteer experience and maintain ranking above 95% excellent or very good.	Of the volunteers surveyed, 99% rated their overall experience as excellent or very good, a major improvement on the 2014 season (90%). A blog written by the volunteers at the program may be found at: http://cfseaturtles.blogspot.com/.
1.7	Generate at least $15,000 in income for homestay houses in the village.	The total income for homestay houses during the 2015-16 season was $31,940, which corresponds to an 18% increase from the 2014 season and a new record for the volunteer program.

7.2 DRAKE BEACH

7.2.1 Status of Specific Objectives

Specific objective		Current status
2.1	Prepare the beach so that it is suitable for the monitoring of nesting sea turtles.	Reference posts were placed in position, trails and infrastructure (bikes, boats, trails and docks) repaired, and a field station constructed. The hatchery contained sites for up to 144 nests, although just 86 were ultimately relocated there. ACOTPRO was responsible for constructing and managing the site, and for the incubation of nests and release of hatchlings. The reproductive success in the hatchery during 2015-16 was lower than in any other year apart from 2008, and lower than for nests excavated on the beach, for the first time since 2009. These data suggest sub-optimal conditions in the hatchery, likely due to small sand grain size and proximity to roots. Drake beach was cleaned on six occasions during the 2015-16 season.
2.2	Maintain incidence of egg poaching below 10% of nests.	The proportion of nests poached by the end of the 2015-16 season was just 6.5%, which is the second best result in the history of the program on Drake beach, after 2011.
2.3	Characterize the structure of the nesting population and quantify the hatching and emergence success of *in situ* and *ex situ* nests.	The program successfully registered 100% of sea turtle crawls and nests on Drake beach from 01 July 2015 – 31 January 2016. The number of nests registered (107) was below the seasonal average since 2006. Nesting was exclusively by Olive Ridley turtles, although two false crawls by Pacific Green turtles were registered. Nesting frequency peaked during the period 16 August – 15 September 2015, and nesting density was highest in sectors 4 and 11. The reproductive success rates of nests, both in the hatchery (n= 86) and on the beach (n= 6), were successfully determined.
2.4	Relocate at least 75% of nests *ex situ* to the hatchery.	The proportion of nests relocated to the hatchery during the 2015-16 season was 80.4%, which is the second highest proportion in the history of the program on Drake beach, after 2014.
2.5	Obtain eclosion rates above 75% and a sex ratio of close to 50% for *ex situ* nests in the hatchery.	Reproductive success for nests on the beach (73.9% eclosion; 70.0% emergence) was slightly below the seasonal average since 2006, while success in the hatchery (71.7% eclosion; 67.5% emergence) was the lowest in the history of the program on Drake beach, apart from 2008. Of the 5,696 hatchlings liberated from the hatchery during 2015, 4,586 (80.5%) were estimated to be female, and 1,110 (19.5%) were estimated to be male. This is the strongest female bias produced in the hatchery since thermal profiling began in 2010, and is indicative of poor hatchery management by ACOTPRO as measures were not taken to reduce the temperature. However, the thermal profile of the beach also showed a large, putative female bias during the 2015-16, thanks to the hot and dry conditions resulting from the El Niño effect, and as such conditions in the hatchery can be argued to have adequately emulated the natural environment of the beach.
2.6	Train at least ten members of the community as Field Assistants, and contract at least five as paid Patrol Leaders.	Eighteen members of ACOTPRO were trained as Field Assistants and Hatchery Managers, and eight were contracted as Patrol Leaders. As anticipated, affiliation of new members was limited during the 2015-16 season, with only two new members joining.

7.3 RÍO ORO BEACH

7.3.1 Status of Specific Objectives

3.1	Establish new field station at the Río Oro site.	Bespoke facilities were built at an existing eco-lodge located 5km from the school site at Hacienda Río Oro. The site was fully operational from 17 July 2015 – 31 January 2016.
3.2	Prepare the beach so that it is suitable for the monitoring of nesting sea turtles.	Reference posts were placed in position, trails produced and access to the beach made safe. For the last five months of monitoring, access was made available via the private property of Derek Ferguson, which improved the security situation considerably. The provision of a vehicle by the Hacienda also permitted safe and reliable transportation of patrol groups to the field site. Thanks to the dry conditions caused by the El Niño effect, none of the three bodies of water (Laguna Pejeperrito, Laguna Pejeperro nor Rio Oro) opened to the sea during the 2015-16, which made access and logistics on the beach much more manageable than anticipated. It is unlikely that these factors will be so favorable during future seasons. Río Oro beach was cleaned on three occasions during the 2015-16 season.
3.3	Maintain incidence of egg poaching below 20% of nests.	The proportion of nests poached by the end of the 2015-16 season was just 1.4%, which represents a major achievement for the program. However, assuming that the 144 marked nests that were not recovered were also poached, the rate may be closer to 6.4%. Data from neighboring beaches and personal communications from local residents suggest that the rate of poaching prior to 2015 was over 30%.
3.4	Characterize the structure of the nesting population and quantify the hatching and emergence success of at least 50 *in situ* nests.	The program successfully registered at least 95% of sea turtle crawls and nests on Río Oro beach from 20 July 2015 – 31 January 2016. The number of Olive Ridley nests registered (2,990) was much higher than expected and accounted for 49.5% of all nests of this species registered in the Osa Peninsula during this period. These data suggest that Río Oro beach is the most important site for Olive Ridley nesting in the South Pacific of Costa Rica, and represents a high-priority site for the conservation of this species. A total of just 44 Pacific Green nests were registered, which was much fewer than expected and a much smaller number than that reported on the neighboring Pejeperro beach (269). These data suggest that, while still making a substantial contribution to the Pacific Green turtle stock, Río Oro beach is not major site of Pacific Green nesting. Olive Ridley nesting frequency peaked during the period 1-15 October 2015, and nesting density was highest in sectors 28 and 29. The reproductive success rates of a sample of nests on the beach (n= 524) were successfully determined.
3.5	Relocate vulnerable nests *ex situ* to safer locations	A total of 173 vulnerable nests laid in zone 1 or between sectors 23 and 28 were successfully relocated to safer locations on Río Oro beach.
3.6	Support Patrol Leaders contracted by LAST and assist with their training.	The LAST project at Río Oro beach was ultimately successful in its objectives, despite being dependent upon the CF program in order to operate. The collaboration was highly productive, however, and the increased manpower permitted more complete coverage of the beach during night patrols and undoubtedly helped to reduce the incidence of poaching. CF Coordinators and volunteers accompanied LAST Patrol Leaders on night patrols and helped to promote rigor and enforce discipline within the LAST team, and the collaborative environment facilitated the productive exchange of knowledge, experience and methodology.

8.0 Recommendations

Theme	Detail
Conservation Program	
Study Area	The program should complete the transfer of responsibility for the Drake beach site to the community association ACOTPRO for the 2016 season. The long-term objectives for the program with this community have been achieved and, despite much uncertainty about whether or not ACOTPRO is responsible enough to run their own program, it is clear that the association wants to try to operate without assistance from the CF on Drake beach in 2016. The CF program should focus all effort on protecting Río Oro beach, as this is demonstrably the most important nesting beach in the Osa Peninsula.
Methodology	The program should continue with existing methodology at the Rio Oro site, as this has been demonstrably successful during 2015-16. However, given the low recovery rate of marked nests, nests destined by excavation should no longer be marked with plastic bottles, as this has left them vulnerable to being poached and/or contributing to plastic pollution in the sea. Instead, nests destined for excavation should be relocated *ex situ* beside reference posts and a log kept of their distance from these fixed markers. Nests should not be visibly labeled in any way. There is no justification for the use of a hatchery in Río Oro, given the low incidence of poaching and the low nesting frequency of Pacific Green turtles.
Volunteer Program	
Headquarters	Until funding is secured to build a dedicated field station at Río Oro, the site at Hacienda Río Oro should be expanded in order to provide enhanced facilities to staff and volunteers and a headquarters for the sea turtle program.
Cost	To date, no financial support has been secured from funding bodies for the 2016-17 season, while the operations costs of the program have increased considerably. It is highly recommended that the cost of participation at the program is increased to $35 per day, or $30 per day for long-term volunteers. The program must take this step in order to decrease dependence on grants and donations and become more self-sufficient and sustainable.
Placements	The minimum volunteer placement of 14 nights should be more strictly enforced in order to reduce the strain on the Coordinators and Assistants. An exception should be made for 10-day volunteers provided by Máximo Nivel, as this represents a major source of volunteer labor that the program cannot afford to exclude. The program should close at the end of December, rather than the end of January, given the low level of nesting during January.
Arrivals and Departures	All volunteers should arrive at the Hacienda Río Oro at the beginning of their placements. The program should provide free transportation from Puerto Jiménez to the Hacienda Río Oro on Tuesdays. Volunteers should be transferred to Drake Bay Backpackers for the last days of their placement in order to take advantage of the tours offered, and to get some rest and enjoy free time in a location with more tourism and trekking options available to them. It should be recommended, therefore, that volunteers arrive via Puerto Jiménez, and leave via Drake Bay from Drake Bay Backpackers. The information about the 2016 program has already been updated on the CF website to reflect these changes, including a downloadable arrivals and departures document.
Training and Orientation	The program should receive volunteers on Tuesdays only, providing training on Wednesdays. This will help to streamline the training and orientation process, reduce strain on the Coordinators and Assistants, and permit the further expansion of the program.
Pase Pura Vida	It is recommended to offer this transportation option only for departures from Drake Bay, in order to reduce the complexity of the information offered to volunteers, and of the administration of the volunteer program.

Staff Structure, Responsibilities and Specifications	
Structure	Given the departure of the Program Director, Rob James, and the reconfiguration of the program, the following staff structure is recommended: 1. Administrator, responsible for managing the volunteer program (arrivals, departures, payments etc). 2. Principal Investigator (PI), responsible for all field operations, the recruitment of assistants, research permits, and data capture and management. 3. 3x Research Assistants (or 'Field Coordinators') responsible for providing coordinating activities and supporting the PI in managing daily operations in the field.
Specifications	All staff should be biologists with some previous experience of working with turtles. They must be able to speak English and Spanish and have a clean driving license.
Tours and Promotions	
Sea Turtle Tour	A sea turtle tour, similar to that developed in Drake Bay, should be created at Río Oro beach. Local guides should be contracted and the tour promoted at the hotels in Puerto Jiménez, Matapalo and Carate, if necessary in collaboration with COTORCO.
Artisanal Gold Mining Tour	Efforts should be made to reach out to the community of illegal gold miners operating in the Río Oro river. Participation in the sea turtle conservation should be encouraged, and – where appropriate – training and salaries offered. An artisanal gold tour should be developed, with the support of MINAE and the CF, in order to decrease the impact and intensity of the mining activities, as has been achieved elsewhere in the Osa Peninsula. The program could assist the community in the development and promotion of the tour and help with accessing the eco-tourism and volunteer market.
Turtle Adoption Scheme	This scheme already exists but should be updated to better function with the new configuration of the program. The scheme should be promoted on social media platforms, the new CF website, and at local hotels and tourism operators.
Program Promotion	It is recommended that a volunteer or staff member devotes time to developing links to university departments, schools and tourism organizations in order to develop group packages, internships and 'service learning' school group placements.

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Volunteer Feedback Form

First name	
Last name	
Age	
Number of days at the program	

If a question is not applicable, just leave it blank.

How would you rate your overall experience at the program?	☐ Excellent ☐ Very Good ☐ Average ☐ Poor ☐ Terrible
How would you rate the training and orientation that you received?	☐ Excellent ☐ Very Good ☐ Average ☐ Poor ☐ Terrible
How would you rate the night patrols?	☐ Excellent ☐ Very Good ☐ Average ☐ Poor ☐ Terrible
How would you rate working at the hatchery?	☐ Excellent ☐ Very Good ☐ Average ☐ Poor ☐ Terrible
How would you rate any other work, e.g. at the hostel/camp?	☐ Excellent ☐ Very Good ☐ Average ☐ Poor ☐ Terrible
Do have any comments or recommendations regarding the work at the program?	

How would you rate your stay at the hostel?	☐ Excellent ☐ Very Good ☐ Average ☐ Poor ☐ Terrible
How would you rate your stay at the camp in Río Oro?	☐ Excellent ☐ Very Good ☐ Average ☐ Poor ☐ Terrible
How would you rate your stay in homestay?	☐ Excellent ☐ Very Good ☐ Average ☐ Poor ☐ Terrible
Do have any comments or recommendations regarding accommodation?	

How would you rate the tours or excursions you went on?	☐ Excellent ☐ Very Good ☐ Average ☐ Poor ☐ Terrible
Do have any comments or recommendations regarding tours or excursions?	

Do have any comments or recommendations regarding the Coordinators and/or Assistants?	

Do have any comments or recommendations regarding the community or local Patrol Leaders?	

Do have any comments or recommendations regarding any other aspect of the program?	

How did you hear about the program?	
Would you recommend the program to a friend?	☐ Yes ☐ No
Have you made friends with us on Facebook?	☐ Yes ☐ No

We take every piece of feedback into consideration when planning the next season, and we will try to implement any improvements that you have recommended.

All feedback is used anonymously. Individual comments may be used for promotional purposes (on our website for example) but will never appear alongside your name.

Thank you for volunteering with us!

facebook.com/cfseaturtles

Question	Comments
Do have any comments or recommendations regarding the work at the program?	Volunteering here was amazing and seeing the turtles and learning about them was such a great experience. I absolutely loved it here and I will miss it so much
	I absolutely loved everything about volunteering here. It's been a really eye opening experience. I will miss this place
	The night shifts could be smaller, then taken turns by other groups every few hours
	I loved watching the turtles lay eggs. Our coordinators (Eva + Elias) were fantastic at showing us how to properly document the turtles
	This was an amazing place. We felt very comfortable and knew our purpose, very well organized
	I think if there was a list of things that needed to be done and volunteers could pick and choose on their own more would get done. There was a lack of communication about the extra work
	Creo que es un programa muy bueno pero que falla en algunos aspectos como el hecho de que en todo julio no haya tortugas o que la mayor parte del trabajo como voluntario sea pintar. Yo me lo he pasado muy bien pero me hubiera gustado leer sobre esto en el manual del voluntario porque así ya sabes a lo que vienes
	Muy buena experiencia. Muy buena relación entre compañeros y con coordinadores y locales
	It was a bit sad to see that nests were already poached at 19.30 at Rio Oro. Should patrols perhaps start earlier?
	Everything was an excellent experience except our arrival. Stood on the beach 15 minutes not knowing what to do. When we finally got to hostel we were greeted very briefly and then sent immediately to our homestay where we stayed in our room not knowing what came next. A nicer welcome would have made the experience perfect
	Fantastic experience
	Creo que no está muy claro que el voluntario va a trabajar en el hostal. Sé que al ayudar el hostal ayudamos al futuro del proyecto pero si es así, el proyecto debería ser comunitario no solo tortugas. El trabajo era cansado después de una mañana en la playa (y más con censo)
	No bad comments at all. You made my stay and experience in Costa Rica great. Thanks :)
	Email pics! Kristyzabowski@gmail.com
	the work is fair and all though it can be a lot, it is rewarding
	loved the Censo
	try to collect more funds for things like tools in order to fully utilize workers
	More equipment for the volunteers to use, and work with, so that more can get done. More organization when working at the beach (hatchery)
	I wish it was better explained that early on most work occurs at the hostel opposed to the hatchery. I thought it was a truly awesome experience though! I wish everyone got the opportunity. More avocados! =)

	All of the tasks and duties that we completed during the 7 days here were a combination of hostel work + turtle care work. Because I was here early in the season (7-3 -7-10) and only for a week we did not have any turtle interaction. I knew previously that this would be the case, but I'm glad I was able to help prepare for the turtle hatchery. One recommendation is to assign or allow volunteers a specific project to complete over their stay here. For example, if you have a volunteer who is a teacher, have her/him design lesson plans for the education site of the organization.
	Fortunately, we were able to have a really good experience at Rio Oro patrolling and were able to see a lot of turtles. At Drake, they are fine however, Maximo Nivel should be more honest on the reality of seeing turtles at least in July.
	Night patrols at Rio Oro better than Drake. Maybe give locals (leaders) a chance to experience this and see more turtles/ get more experience with the encounters? Work at the hostel was OK, but could be more varied, not only painting
	There was a lack of communications concerning the tasks we had to do during the day. This should be better explained. We were always waiting for some tasks to do because the coordinators were so busy.
	Be sure that everybody is very necessary for the night patrol because sometimes I thought we were too much people and we didn't do anything, just a presence.
	The night patrols were cancelled quite a few times which was a bit frustrating. Given our circumstances we were very lucky to see a turtle. I'm sad for those who didn't.
	It was great as is
	Las patrullas y el trabajo construyendo el vivero fueron muy buen ejercicio. No hice mucho trabajo afuera de esos aparte de pintar, que sería difícil hacerse más que normal.
	Chico colando con las manos apesta!
	Night patrols varied quite a lot according to with whom it was done. Best night patrol experience was at Rio Oro with the local ones
	Some of the extra work felt like busy work. It could have been done with many fewer people, but the rest of us were brought along to make us feel like we were doing something. Perhaps fewer people should go or there could be more work for everyone
Do have any comments or recommendations regarding accommodation?	Everything was beautiful and perfect, everyone is nice and very helpful
	Everything was excellent. Everyone was extremely hospitable, especially at Rio Oro
	My only issue was that, on the first night in my homestay, I was put alone in a house while everyone else in my group got paired together. I wish I had someone else there.
	The tent camp were in perfect conditions. The homestay family were exceptional and kind. It was very comfortable
	La experiencia en los homestay es muy enriquecedora. Rio Oro está bien pero no hay mucho que hacer
	Me encanto la experiencia en el homestay. No cambiaría nada de las casas, aprendí una forma de vida muy diferente
	Mosquito nets for Rio Oro. Toño y Emerita are great hosts
	I appreciated Miguel when he cooked for us- he tried to make a variety of dishes for us whereas with Teresa it was always rice/beans and a salad. A mirror in bathroom would've been good for contact lenses

	Accommodation was lovely everywhere with amazing people
	Great
	Mosquito nets at Rio Oro would be great!
	More planning and organizing needed at Rio Oro to schedule/structure volunteer work (right now is very lax) although I'm not complaining!
	the tents need a little better attention or approach in Rio Oro because on the first day, there were already rips
	The family was nice, the kids were adorable!
	most amazing family ever, Edin and Yirlani are two of the most generous, kind, and accommodating people I have ever met
	Awesome place! More avocados! Less giant terrifying insects! =)
	I appreciated the cleanness of the hostel and the meals. I appreciated that everyone had certain tasks and jobs in order for the hostel to run smoothly. I was very pleased! Thank you to all who made my stay comfortable and pleasant :)
	Both Migue and Marielos were great hosts. Their families were very welcoming and friendly despite our lack of Spanish. I understand the difficulties on organizing the volunteer stay. However, our hosts I felt were given very little indication or notice of changes to volunteers staying.
	Very nice family! (Evilin) food was always similar, every meal
	Rio Oro- a beautiful place to stay but loads of insects! Maybe more pre-warning about this. Also, way too much food, even with small portions! . Homestays (Marielos and Migue) both nice places to stay and very welcoming. Migue and family are wonderful hosts. Very friendly people and wonderful Spanish teachers :)
	Very nice family! (Evilin)
	Staying with Elva and her family was lovely. They were incredibly welcoming and made us very comfortable. It would have been nice to go to Rio Oro for a few days to see more turtles given their season is so advanced, but I understand time was too tight.
	Lilliam was so sweet. She made great meals. She works so hard. She takes care of all the children plus John and I.
	Más comida!! En serio, era excelente en cualquiera de los tres lugares.
	Arañas no!
	Homestay is such a great way to get to know more about local people and their way of living
	This family (Edin's) is the best one
	All the accommodation should have mosquito nets for the volunteers
	Me ha encantado la familia de Migue y estar en su casa. Lo sugiero a todos, pero me hubiera gustado darles el dinero directamente a ellos para saber que llega todo.
Do have any comments or recommendations regarding excursions?	We went to Caño Island and it was a great experience and so mucho fun everyone should do it
	Tell EVERYONE about Caño Island!!
	I loved the kayaking tour!
	I can't thank Elias and Eva enough. They gave us true adventures and worked very good. The snorkel experience was amazing

	Solo hice un tour en Rio Oro que disfruté{e mucho pero encontré{e un poco caro. Toda la gente que ha hecho tours en el hostal están encantados
	El tour del parque corcovado demasiado caro…no sé si volvería a hacerlo
	It's great that they are part of the program
	went on a canopy tour- very good
	The tours were all great and very exciting. I especially loved the snorkeling
	Thank you very much because we had to say what we would like to do and you organized it!
	Both the snorkeling and Corcovado tours were excellent. They were fairly expensive, but given they were full days they were worth the price.
	Isla del caño muy bonito y precio razonable para lo que se ve/hace. P.N Corcovado caro…
	Madre Selva was a great tour. We saw river otters, poisonous frogs, a poisonous snake and lizards. The waterfall was great. So much fun
	1. Isla del Caño excelente 2. P.N Corcovado muy caro para ser voluntarios :(
	No tuve mucha suerte en la excursión a Caño Island, no se podía ver mucho a causa de la lluvia y no pasamos mucho tiempo en el agua. Sin embargo, vimos una ballena con su cria
	AWESOME!!!! Rio Oro- horseriding. Snorkeling- Drake Bay
	I very much enjoyed them Felix was wonderful and added a special element to the excursion
	Felix- snorkeling was great, high energy. Rio Oro- horseback kayak= great day!!
	The form of payment could be better- through debit/credit
	The snorkeling was great. Corcovado was sad we didn't get to see very much
	Our tour guide for Corcovado wasn't very good. His name was Alberto, don't use him
	I loved the snorkeling!
	Maybe that the tour offers can offer special prices for the volunteers
	The waterfall visit was one of my favorite excursions, along with the snorkeling on the reef at Caño Island! Great!
	Snorkeling at Caño was great! Loved horseriding and kayak at Rio Oro too. Maybe more planned group excursions for free time.
	It's really nice that everything was organized. Thank you Marvin
	I want to marry Felix and run away to Caño island snorkeling was so amazing. Make it longer!
	Mas monos!
	Great that excursions can be arranged in such a short notice. They were quite expensive though, but well organized
	Get out of Drake Bay for the excursions
	Algunos más baratos/gratis que hagamos todos juntos

Do have any comments or recommendations regarding the Coordinator and/or Assistants?	Eva and Elias were so wonderful and helpful, they made this trip one to never forget and went above and beyond to show us the Pura Vida life
	Eva and Elias were amazing guides and hosts, they really made the trip
	Very good
	Eva + Elias always went above and beyond both as conservationists and hosts. They were welcoming, knowledgeable and happy. They made this trip special.
	No- they were exceptional
	Elias & Eva were wonderful! Really made the trip interesting and fun
	Me he sentido muy a gusto con todos los asistentes y coordinadores. Todos me han hecho sentir bienvenida en el programa
	Muy buena gente, abierta y divertida. Elias es como George de la jungla! (gracias por la fruta!)
	Trabaje con Aida, Elias y Thomas. Los 3 son geniales y muy atentos
	Doing a great job and wonderful persons!
	Great people!
	You people are amazing dedicating your lives to save species. I admire your passion, work ethic and all the kindness you show despite the revolving door of volunteers
	They are all very kind and I always felt safe if they were around
	AWESOME!!!!
	Elias and Tom were great to have at Rio Oro, very helpful and attentive to anything we needed =)
	Elias and Thomas were great leaders, never too controlling- treated volunteers as equals not subordinates
	They were awesome!!
	Elias and Aida are great
	No. All fabulous! Aida and Elias were awesome coordinators and made me feel comfortable, safe and excited during my stay. Marvin was always offering a helping hand.
	They are all great. Thomas especially is very knowledgeable and passionate about conservation and wildlife. He is a valuable assistant to the team.
	In Drake, they had too many things to manage and they couldn't deal with all the volunteers… but REALLY NICE! Thank you! <3 They had a big knowledge about protection of sea turtles
	The communication for the work and his time or what we will exactly do could be better to know if we have to take good shoes or something to eat with. But the coordinators and assistants are very lovely and I spent a really great time with you! Thank you!
	Aida and Elias were always extremely helpful. I wasn't exactly clear on the coordinators or what their distinct roles were, but they were very friendly.
	Planear más actividades en grupo para poder relacionarse más….
	Rob, Aida, Philipe, Marvin, Miguel, and Johanson were all great. Very pleasant
	All lovely!
	Un trato genial! Quizá buscaría la manera de digitalizar la pizarra… hoy en día todo el mundo tiene acceso a internet y podría chequearse a distancia o que aparecieran avisos de los cambios…una app Mobile sería de gran ayuda y utilidad

	No inventes! Pero no, me caían bienes todos. Siempre sabían como animar a la gente a trabajar, pero sabían como relajar también. Que professionals!
	Excelentes
	So smiley! They were both inspiring and helpful! But give them more avocados! Oh! They were very informative!
	Thank you everybody were really friendly and I learned so much new things and got new friends as well
	No, they were all really "amable" and did really care about the volunteers :)
	Elias and Eva were great, especially Elias knew how to make everything fun and exciting. Rob was also awesome and very welcoming
Do have any comments or recommendations regarding the local Patrol Leaders?	Awesome, full of energy
	I liked the times when we got to work with/interact with the community
	The community embraced us and trusted us like family
	Me ha gustado mucho conocer a los locales, todos son muy acogedores. Me hubiera gustado hacer m{as actividades con ellos
	Me han encantado todos, son muy buena gente aunque no estén todos trabajando al máximo
	Aida you are great- I feel your love for turtles and you are a super hard worker
	Great people!
	Everyone in the community seems great and everyone I personally dealt with was kind and caring
	Lovely community & people
	We did not interact much with local patrol leaders; however, the community was welcoming, kind, friendly and very hard-working at hatchery.
	Make sure they are free for patrols/arrange an alternative between themselves if not. Otherwise, great :) more encouragement for good local patrol leaders
	Chico was the Patrol Leader on our patrol and he was fantastic. Elias was also a leader and very knowledgeable. Several leaders didn't show up for other patrols, which was unfortunate.
	Ha sido muy buena experiencia y el convivir en una casa local ha sido muy buena. Repetiría
	Two of our patrols were cancelled because our guides didn't wake up at 12 am.
	Una experiencia 10! (cuando aparecían :D)
	They are not always reliable because sometimes they were saying they couldn't come to the patrol 5 min before. During the patrol: OK
	.- more organization at the hatchery. - more of an effort to incorporate local poachers into the program, while preventing them from being involved if they refuse
	Eran muy simpáticos, me hacían sentir como si estuviera en casa, siempre me sentía aceptado
	Inmejorables
	Before Rio Oro local patrol leaders had a little bit stressful experience :) about night patrolling
	The patrol leaders could be more on time and getting the bicycles for volunteers for going to the beach was the best idea ever :)
	Todos muy agradables y cercanos!

Do have any comments or recommendations regarding any other aspect of the program?	The program should stick to the 18+ rule, having younger people seemed to drag everyone down
	I would suggest that you stick to the 18+ rule. Having a highschooler in our midst proved difficult at times
	Considero que el programa tiene un alto porcentaje de peso de trabajo para la comunidad y si esto se viera reflejado en el manual del voluntario facilitaría la estancia a muchos voluntarios.(para saber cuál es el trabajo que se supone que tienen que hacer aquí)
	Solo tengo buenas palabras, gracias por la experiencia!!
	Wonderful to be able to stay with a local family.
	Keep up the amazing work especially educating the kids an involving the community. Love the turtle plaques on the houses! That's the future- the kids!
	Keep on being awesome! You made my stay in Costa Rica a wonderful one and one I won't soon forget!
	Rio Oro- amazing! Cira- words cannot describe how kind, caring and accommodating she is!
	It probably would have been a better experience at a different point in the season. So I wish that was conveyed by Maximo. I would prefer to go directly through your foundation in the future.
	Would it be possible to bring children (school kids) to the beach with us for on site education?
	Transportation and pick-ups were extremely well coordinated and very much appreciated. Thank you Marvin
	More turtle/conservation related activities during the day? Community education/beach cleans/ research and data collection in community.
	Rio Oro: At least, one small activity should be organized per day. Because, otherwise, we get really bored. More communication. Transmit the information before. Feeling kind of useless during the patrols because the people from WIDECAST were lagging but didn't even hide the tracks. Thank you <3! It was a great time
	Rio Oro: organize at least one thing per day to do because it is a bit boring. There are nothing to do. More infos about the place before.
	It would have been nice to cut out the time spent with Maximo Nivel (Training was a bit redundant) so we would have more time with the program. It would also have been very helpful to know where we would be placed and who we would be staying with before coming to Costa Rica
	I loved this experience. I want to come back
	Ha sido una experiencia que ha cambiado mi perspectiva; aunque se diga mucho esta frase, es verdad. Gracias por todo
	I'm glad that I went to Rio Oro otherwise wouldn't have seen any turtles. But why breakfast needs to be in Rio Oro always at 8.00 even though there isn't that much to do on day time and you have slept maybe only 3 hours?

Left Flipper		Right Flipper		Re-nesting	Re-migrating	Species	Beach
Old Tag	New Tag	Old Tag	New Tag				
	OP2242	XXX760			EVIDENCE	OLIVE RIDLEY	DRAKE
	OP2252	OP1751			EVIDENCE	OLIVE RIDLEY	DRAKE
	OP2204		OP2203			OLIVE RIDLEY	DRAKE
	OP2205		OP2206		EVIDENCE	OLIVE RIDLEY	DRAKE
	OP2207		OP2208	2015		OLIVE RIDLEY	DRAKE
	OP2209		OP2210			OLIVE RIDLEY	DRAKE
	OP2215		OP2216			OLIVE RIDLEY	DRAKE
	OP2219		OP2220			OLIVE RIDLEY	DRAKE
	OP2221		OP2222			OLIVE RIDLEY	DRAKE
	OP2226		OP2227			OLIVE RIDLEY	DRAKE
	OP2229		OP2228			OLIVE RIDLEY	DRAKE
	OP2230		OP2231			OLIVE RIDLEY	DRAKE
	OP2234		OP2235			OLIVE RIDLEY	DRAKE
	OP2236		OP2237			OLIVE RIDLEY	DRAKE
	OP2212		OP2238			OLIVE RIDLEY	DRAKE
	OP2240		OP2241			OLIVE RIDLEY	DRAKE
	OP2244		OP2245			OLIVE RIDLEY	DRAKE
	OP2246		OP2246			OLIVE RIDLEY	DRAKE
	OP2254		OP2255			OLIVE RIDLEY	DRAKE
	OP2264		OP2265			OLIVE RIDLEY	DRAKE
	OP2278	OP0413	OP2279		2012	OLIVE RIDLEY	DRAKE
	OP2284		OP2283			OLIVE RIDLEY	DRAKE
	OP2298		OP2292			OLIVE RIDLEY	DRAKE
	OP4201		OP4202	2015		OLIVE RIDLEY	DRAKE
	OP4203		OP4204			OLIVE RIDLEY	DRAKE
	OP4205		OP4206			OLIVE RIDLEY	DRAKE
			OP4208			OLIVE RIDLEY	DRAKE
	OP4209		OP4210	2015		OLIVE RIDLEY	DRAKE
	OP4213		OP4214			OLIVE RIDLEY	DRAKE
	OP4215		OP4216	2015		OLIVE RIDLEY	DRAKE
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	OP4223		OP4224			OLIVE RIDLEY	DRAKE
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			5450			OLIVE RIDLEY	RÍO ORO
			5451			OLIVE RIDLEY	RÍO ORO
			5452			OLIVE RIDLEY	RÍO ORO
			5453			OLIVE RIDLEY	RÍO ORO
			5454			OLIVE RIDLEY	RÍO ORO
			5455	2015		OLIVE RIDLEY	RÍO ORO
			5456			OLIVE RIDLEY	RÍO ORO
			5457			OLIVE RIDLEY	RÍO ORO
			5460			OLIVE RIDLEY	RÍO ORO
			5463			OLIVE RIDLEY	RÍO ORO
			5464			OLIVE RIDLEY	RÍO ORO
			5466			OLIVE RIDLEY	RÍO ORO
			5467			OLIVE RIDLEY	RÍO ORO
			5469			OLIVE RIDLEY	RÍO ORO
			5470			OLIVE RIDLEY	RÍO ORO
			5472			OLIVE RIDLEY	RÍO ORO
			5473	2015		OLIVE RIDLEY	RÍO ORO
			5474			OLIVE RIDLEY	RÍO ORO
			5475			OLIVE RIDLEY	RÍO ORO
			5477			OLIVE RIDLEY	RÍO ORO
			5478			OLIVE RIDLEY	RÍO ORO
			5480			OLIVE RIDLEY	RÍO ORO
			5481			OLIVE RIDLEY	RÍO ORO
			5482			OLIVE RIDLEY	RÍO ORO
			5483			OLIVE RIDLEY	RÍO ORO
			5485			OLIVE RIDLEY	RÍO ORO
			5486			OLIVE RIDLEY	RÍO ORO
			5488			OLIVE RIDLEY	RÍO ORO
			5489			OLIVE RIDLEY	RÍO ORO
			5490			OLIVE RIDLEY	RÍO ORO
			5491			OLIVE RIDLEY	RÍO ORO
			5497			OLIVE RIDLEY	RÍO ORO
			5498			OLIVE RIDLEY	RÍO ORO
			5500			OLIVE RIDLEY	RÍO ORO
			5801			OLIVE RIDLEY	RÍO ORO
			5803			OLIVE RIDLEY	RÍO ORO
			5804			OLIVE RIDLEY	RÍO ORO
			5805			OLIVE RIDLEY	RÍO ORO
			5806			OLIVE RIDLEY	RÍO ORO
			5807	2015		OLIVE RIDLEY	RÍO ORO
			5808			OLIVE RIDLEY	RÍO ORO
			5809			OLIVE RIDLEY	RÍO ORO
			5810			OLIVE RIDLEY	RÍO ORO
			5811			OLIVE RIDLEY	RÍO ORO

			5812			OLIVE RIDLEY	RÍO ORO
			5814			OLIVE RIDLEY	RÍO ORO
			5815			OLIVE RIDLEY	RÍO ORO
			5816			OLIVE RIDLEY	RÍO ORO
			5817	2015		OLIVE RIDLEY	RÍO ORO
			5818			OLIVE RIDLEY	RÍO ORO
			5819			OLIVE RIDLEY	RÍO ORO
			5820			OLIVE RIDLEY	RÍO ORO
			5821	2015		OLIVE RIDLEY	RÍO ORO
			5822			OLIVE RIDLEY	RÍO ORO
			5823			OLIVE RIDLEY	RÍO ORO
			5824			OLIVE RIDLEY	RÍO ORO
			5825			OLIVE RIDLEY	RÍO ORO
			5827			OLIVE RIDLEY	RÍO ORO
			5828	2015		OLIVE RIDLEY	RÍO ORO
			5829			OLIVE RIDLEY	RÍO ORO
			5830			OLIVE RIDLEY	RÍO ORO
			5831			OLIVE RIDLEY	RÍO ORO
			5833			OLIVE RIDLEY	RÍO ORO
			5834			OLIVE RIDLEY	RÍO ORO
			5835			OLIVE RIDLEY	RÍO ORO
			5836			OLIVE RIDLEY	RÍO ORO
			5837			OLIVE RIDLEY	RÍO ORO
			5838			OLIVE RIDLEY	RÍO ORO
			5839			OLIVE RIDLEY	RÍO ORO
			5840			OLIVE RIDLEY	RÍO ORO
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			5842			OLIVE RIDLEY	RÍO ORO
			5843			OLIVE RIDLEY	RÍO ORO
			5844	2015		OLIVE RIDLEY	RÍO ORO
			5845			OLIVE RIDLEY	RÍO ORO
			5846			OLIVE RIDLEY	RÍO ORO
			5847			OLIVE RIDLEY	RÍO ORO
			5848			OLIVE RIDLEY	RÍO ORO
			5849			OLIVE RIDLEY	RÍO ORO
			5850			OLIVE RIDLEY	RÍO ORO
			5851			OLIVE RIDLEY	RÍO ORO
			5852			OLIVE RIDLEY	RÍO ORO
			5853			OLIVE RIDLEY	RÍO ORO
			5854			OLIVE RIDLEY	RÍO ORO
			5855			OLIVE RIDLEY	RÍO ORO
			5856			OLIVE RIDLEY	RÍO ORO
			5857	2015		OLIVE RIDLEY	RÍO ORO
			5859			OLIVE RIDLEY	RÍO ORO

			5860			OLIVE RIDLEY	RÍO ORO
			5861			OLIVE RIDLEY	RÍO ORO
			5862			OLIVE RIDLEY	RÍO ORO
			5863			OLIVE RIDLEY	RÍO ORO
			5864			OLIVE RIDLEY	RÍO ORO
			5865			OLIVE RIDLEY	RÍO ORO
			5867			OLIVE RIDLEY	RÍO ORO
			5868			OLIVE RIDLEY	RÍO ORO
			5869			OLIVE RIDLEY	RÍO ORO
			5872			OLIVE RIDLEY	RÍO ORO
			5873			OLIVE RIDLEY	RÍO ORO
			5874			OLIVE RIDLEY	RÍO ORO
			5875			OLIVE RIDLEY	RÍO ORO
			5876			OLIVE RIDLEY	RÍO ORO
			5877			OLIVE RIDLEY	RÍO ORO
			5878			OLIVE RIDLEY	RÍO ORO
			5879			OLIVE RIDLEY	RÍO ORO
			5880			OLIVE RIDLEY	RÍO ORO
			5881			OLIVE RIDLEY	RÍO ORO
			5882			OLIVE RIDLEY	RÍO ORO
			5883			OLIVE RIDLEY	RÍO ORO
			5884			OLIVE RIDLEY	RÍO ORO
			5885			OLIVE RIDLEY	RÍO ORO
			5886			OLIVE RIDLEY	RÍO ORO
			5887	2015		OLIVE RIDLEY	RÍO ORO
			5888			OLIVE RIDLEY	RÍO ORO
			5889			OLIVE RIDLEY	RÍO ORO
			5890			OLIVE RIDLEY	RÍO ORO
			5891			OLIVE RIDLEY	RÍO ORO
			5892			OLIVE RIDLEY	RÍO ORO
			5893			OLIVE RIDLEY	RÍO ORO
			5894			OLIVE RIDLEY	RÍO ORO
			5895			OLIVE RIDLEY	RÍO ORO
			5896			OLIVE RIDLEY	RÍO ORO
			5897			OLIVE RIDLEY	RÍO ORO
			5898			OLIVE RIDLEY	RÍO ORO
			5899			OLIVE RIDLEY	RÍO ORO
			7018			OLIVE RIDLEY	RÍO ORO
			5001			OLIVE RIDLEY	RÍO ORO
			5170			OLIVE RIDLEY	RÍO ORO
			5447			OLIVE RIDLEY	RÍO ORO
			5471			OLIVE RIDLEY	RÍO ORO
			5499			OLIVE RIDLEY	RÍO ORO
		ASVO5428			EVIDENCE	OLIVE RIDLEY	RÍO ORO

			JG140			OLIVE RIDLEY	RÍO ORO
			JG301	2015		OLIVE RIDLEY	RÍO ORO
			JG303			OLIVE RIDLEY	RÍO ORO
			JG305			OLIVE RIDLEY	RÍO ORO
			JG306	2015		OLIVE RIDLEY	RÍO ORO
			JG307			OLIVE RIDLEY	RÍO ORO
			JG308			OLIVE RIDLEY	RÍO ORO
			JG309			OLIVE RIDLEY	RÍO ORO
			JG311			OLIVE RIDLEY	RÍO ORO
			JG313			OLIVE RIDLEY	RÍO ORO
			JG315			OLIVE RIDLEY	RÍO ORO
			JG316			OLIVE RIDLEY	RÍO ORO
			JG317	2015		OLIVE RIDLEY	RÍO ORO
			JG318			OLIVE RIDLEY	RÍO ORO
			JG319	2015		OLIVE RIDLEY	RÍO ORO
			JG321			OLIVE RIDLEY	RÍO ORO
			JG322			OLIVE RIDLEY	RÍO ORO
			JG324			OLIVE RIDLEY	RÍO ORO
			JG325			OLIVE RIDLEY	RÍO ORO
			JG326	2015		OLIVE RIDLEY	RÍO ORO
			JG329			OLIVE RIDLEY	RÍO ORO
			JG330	2015		OLIVE RIDLEY	RÍO ORO
			JG331			OLIVE RIDLEY	RÍO ORO
			JG332			OLIVE RIDLEY	RÍO ORO
			JG333			OLIVE RIDLEY	RÍO ORO
	JG310		JG334			OLIVE RIDLEY	RÍO ORO
			JG335			OLIVE RIDLEY	RÍO ORO
			JG336	2015		OLIVE RIDLEY	RÍO ORO
			JG337	2015		OLIVE RIDLEY	RÍO ORO
			JG338			OLIVE RIDLEY	RÍO ORO
			JG339	2015		OLIVE RIDLEY	RÍO ORO
			JG340			OLIVE RIDLEY	RÍO ORO
			JG341	2015		OLIVE RIDLEY	RÍO ORO
			JG343			OLIVE RIDLEY	RÍO ORO
			JG346	2015		OLIVE RIDLEY	RÍO ORO
			JG347			OLIVE RIDLEY	RÍO ORO
			JG348	2015		OLIVE RIDLEY	RÍO ORO
	JG328		JG349			OLIVE RIDLEY	RÍO ORO
			JG350			OLIVE RIDLEY	RÍO ORO
			JG351	2015		OLIVE RIDLEY	RÍO ORO
			JG353			OLIVE RIDLEY	RÍO ORO
			JG354			OLIVE RIDLEY	RÍO ORO
			JG356			OLIVE RIDLEY	RÍO ORO
			JG357			OLIVE RIDLEY	RÍO ORO

			JG358	2015		OLIVE RIDLEY	RÍO ORO
			JG359			OLIVE RIDLEY	RÍO ORO
	JG345		JG360	2015		OLIVE RIDLEY	RÍO ORO
			JG361			OLIVE RIDLEY	RÍO ORO
			JG362			OLIVE RIDLEY	RÍO ORO
			JG363			OLIVE RIDLEY	RÍO ORO
			JG365			OLIVE RIDLEY	RÍO ORO
			JG366			OLIVE RIDLEY	RÍO ORO
			JG367			OLIVE RIDLEY	RÍO ORO
			JG369			OLIVE RIDLEY	RÍO ORO
			JG370			OLIVE RIDLEY	RÍO ORO
			JG371			OLIVE RIDLEY	RÍO ORO
			JG372			OLIVE RIDLEY	RÍO ORO
			JG373			OLIVE RIDLEY	RÍO ORO
			JG374			OLIVE RIDLEY	RÍO ORO
			JG375	2015		OLIVE RIDLEY	RÍO ORO
	JG304		JG376			OLIVE RIDLEY	RÍO ORO
			JG378	2015		OLIVE RIDLEY	RÍO ORO
			JG379			OLIVE RIDLEY	RÍO ORO
			JG380			OLIVE RIDLEY	RÍO ORO
			JG381			OLIVE RIDLEY	RÍO ORO
			JG382	2015		OLIVE RIDLEY	RÍO ORO
			JG383	2015		OLIVE RIDLEY	RÍO ORO
			JG384			OLIVE RIDLEY	RÍO ORO
			JG385			OLIVE RIDLEY	RÍO ORO
			JG386			OLIVE RIDLEY	RÍO ORO
			JG387			OLIVE RIDLEY	RÍO ORO
			JG388			OLIVE RIDLEY	RÍO ORO
			JG390			OLIVE RIDLEY	RÍO ORO
			JG392	2015		OLIVE RIDLEY	RÍO ORO
			JG393	2015		OLIVE RIDLEY	RÍO ORO
			JG394			OLIVE RIDLEY	RÍO ORO
			JG395			OLIVE RIDLEY	RÍO ORO
			JG396			OLIVE RIDLEY	RÍO ORO
			JG397	2015		OLIVE RIDLEY	RÍO ORO
			JG398			OLIVE RIDLEY	RÍO ORO
			JG399			OLIVE RIDLEY	RÍO ORO
			JG400			OLIVE RIDLEY	RÍO ORO
			JG401	2015		OLIVE RIDLEY	RÍO ORO
			JG402			OLIVE RIDLEY	RÍO ORO
			JG403			OLIVE RIDLEY	RÍO ORO
			JG404			OLIVE RIDLEY	RÍO ORO
			JG405			OLIVE RIDLEY	RÍO ORO
			JG406			OLIVE RIDLEY	RÍO ORO

			JG407	2015		OLIVE RIDLEY	RÍO ORO
			JG408			OLIVE RIDLEY	RÍO ORO
			JG411	2015		OLIVE RIDLEY	RÍO ORO
			JG412			OLIVE RIDLEY	RÍO ORO
			JG413			OLIVE RIDLEY	RÍO ORO
			JG414	2015		OLIVE RIDLEY	RÍO ORO
			JG415			OLIVE RIDLEY	RÍO ORO
			JG416			OLIVE RIDLEY	RÍO ORO
			JG417	2015		OLIVE RIDLEY	RÍO ORO
			JG418			OLIVE RIDLEY	RÍO ORO
			JG419	2015		OLIVE RIDLEY	RÍO ORO
			JG420			OLIVE RIDLEY	RÍO ORO
			JG421			OLIVE RIDLEY	RÍO ORO
			JG423			OLIVE RIDLEY	RÍO ORO
			JG424			OLIVE RIDLEY	RÍO ORO
			JG425			OLIVE RIDLEY	RÍO ORO
			JG426			OLIVE RIDLEY	RÍO ORO
			JG427			OLIVE RIDLEY	RÍO ORO
			JG428	2015		OLIVE RIDLEY	RÍO ORO
			JG429	2015		OLIVE RIDLEY	RÍO ORO
			JG430			OLIVE RIDLEY	RÍO ORO
			JG431			OLIVE RIDLEY	RÍO ORO
			JG432			OLIVE RIDLEY	RÍO ORO
	JG409		JG433	2015		OLIVE RIDLEY	RÍO ORO
			JG434	2015		OLIVE RIDLEY	RÍO ORO
			JG436			OLIVE RIDLEY	RÍO ORO
			JG438			OLIVE RIDLEY	RÍO ORO
			JG439			OLIVE RIDLEY	RÍO ORO
			JG441			OLIVE RIDLEY	RÍO ORO
			JG442			OLIVE RIDLEY	RÍO ORO
			JG443			OLIVE RIDLEY	RÍO ORO
			JG444			OLIVE RIDLEY	RÍO ORO
			JG445			OLIVE RIDLEY	RÍO ORO
			JG447			OLIVE RIDLEY	RÍO ORO
			JG448	2015		OLIVE RIDLEY	RÍO ORO
			JG449			OLIVE RIDLEY	RÍO ORO
			JG45X			OLIVE RIDLEY	RÍO ORO
			JG450			OLIVE RIDLEY	RÍO ORO
			JG451			OLIVE RIDLEY	RÍO ORO
			JG452			OLIVE RIDLEY	RÍO ORO
			JG453	2015		OLIVE RIDLEY	RÍO ORO
			JG455			OLIVE RIDLEY	RÍO ORO
			JG456			OLIVE RIDLEY	RÍO ORO
			JG457			OLIVE RIDLEY	RÍO ORO

			JG458			OLIVE RIDLEY	RÍO ORO
			JG459			OLIVE RIDLEY	RÍO ORO
			JG460			OLIVE RIDLEY	RÍO ORO
			JG461			OLIVE RIDLEY	RÍO ORO
			JG463			OLIVE RIDLEY	RÍO ORO
	JG344		JG464			OLIVE RIDLEY	RÍO ORO
			JG465			OLIVE RIDLEY	RÍO ORO
			JG466	2015		OLIVE RIDLEY	RÍO ORO
			JG467			OLIVE RIDLEY	RÍO ORO
			JG468			OLIVE RIDLEY	RÍO ORO
			JG469			OLIVE RIDLEY	RÍO ORO
			JG470			OLIVE RIDLEY	RÍO ORO
			JG472			OLIVE RIDLEY	RÍO ORO
			JG473	2015		OLIVE RIDLEY	RÍO ORO
			JG474			OLIVE RIDLEY	RÍO ORO
			JG475			OLIVE RIDLEY	RÍO ORO
	JG446		JG476			OLIVE RIDLEY	RÍO ORO
			JG477			OLIVE RIDLEY	RÍO ORO
			JG478	2015		OLIVE RIDLEY	RÍO ORO
			JG480			OLIVE RIDLEY	RÍO ORO
			JG481			OLIVE RIDLEY	RÍO ORO
			JG482			OLIVE RIDLEY	RÍO ORO
			JG483			OLIVE RIDLEY	RÍO ORO
			JG485	2015		OLIVE RIDLEY	RÍO ORO
			JG486			OLIVE RIDLEY	RÍO ORO
			JG487	2015		OLIVE RIDLEY	RÍO ORO
			JG488			OLIVE RIDLEY	RÍO ORO
			JG489			OLIVE RIDLEY	RÍO ORO
			JG490			OLIVE RIDLEY	RÍO ORO
			JG491			OLIVE RIDLEY	RÍO ORO
			JG492	2015		OLIVE RIDLEY	RÍO ORO
			JG493			OLIVE RIDLEY	RÍO ORO
			JG494			OLIVE RIDLEY	RÍO ORO
			JG495			OLIVE RIDLEY	RÍO ORO
			JG496			OLIVE RIDLEY	RÍO ORO
			JG497			OLIVE RIDLEY	RÍO ORO
			JG498			OLIVE RIDLEY	RÍO ORO
			JG499			OLIVE RIDLEY	RÍO ORO
	JG484		JG545			OLIVE RIDLEY	RÍO ORO
			OP2132			OLIVE RIDLEY	RÍO ORO
			OP2137			OLIVE RIDLEY	RÍO ORO
			OP2139			OLIVE RIDLEY	RÍO ORO
			OP2145			OLIVE RIDLEY	RÍO ORO
			OP2147			OLIVE RIDLEY	RÍO ORO

			OP2148			OLIVE RIDLEY	RÍO ORO
			OP2149	2015		OLIVE RIDLEY	RÍO ORO
			OP2150	2015		OLIVE RIDLEY	RÍO ORO
			OP2153			OLIVE RIDLEY	RÍO ORO
			OP2154			OLIVE RIDLEY	RÍO ORO
			OP2157			OLIVE RIDLEY	RÍO ORO
			OP2166			OLIVE RIDLEY	RÍO ORO
			OP2169	2015		OLIVE RIDLEY	RÍO ORO
			OP2170			OLIVE RIDLEY	RÍO ORO
			OP2171			OLIVE RIDLEY	RÍO ORO
			OP2172	2015		OLIVE RIDLEY	RÍO ORO
			OP2175			OLIVE RIDLEY	RÍO ORO
			OP2176			OLIVE RIDLEY	RÍO ORO
			OP2177			OLIVE RIDLEY	RÍO ORO
			OP2178			OLIVE RIDLEY	RÍO ORO
	OP2144		OP2180			OLIVE RIDLEY	RÍO ORO
			OP2183	2015		OLIVE RIDLEY	RÍO ORO
			OP2184			OLIVE RIDLEY	RÍO ORO
			OP2185			OLIVE RIDLEY	RÍO ORO
			OP2186			OLIVE RIDLEY	RÍO ORO
	OP2187		OP2188			OLIVE RIDLEY	RÍO ORO
	OP2166		OP2189			OLIVE RIDLEY	RÍO ORO
			OP2190			OLIVE RIDLEY	RÍO ORO
			OP2191			OLIVE RIDLEY	RÍO ORO
			OP2192			OLIVE RIDLEY	RÍO ORO
			OP2193			OLIVE RIDLEY	RÍO ORO
			OP2194			OLIVE RIDLEY	RÍO ORO
			OP2195			OLIVE RIDLEY	RÍO ORO
			OP2196			OLIVE RIDLEY	RÍO ORO
			OP2197			OLIVE RIDLEY	RÍO ORO
			OP2266			OLIVE RIDLEY	RÍO ORO
			OP2269			OLIVE RIDLEY	RÍO ORO
			OP2270			OLIVE RIDLEY	RÍO ORO
			OP2271			OLIVE RIDLEY	RÍO ORO
			OP2272			OLIVE RIDLEY	RÍO ORO
			OP2273			OLIVE RIDLEY	RÍO ORO
			OP2274			OLIVE RIDLEY	RÍO ORO
			OP2275			OLIVE RIDLEY	RÍO ORO
			OP2281			OLIVE RIDLEY	RÍO ORO
			OP2282	2015		OLIVE RIDLEY	RÍO ORO
			OP2285			OLIVE RIDLEY	RÍO ORO
			OP2286			OLIVE RIDLEY	RÍO ORO
			OP2287			OLIVE RIDLEY	RÍO ORO
			OP2288			OLIVE RIDLEY	RÍO ORO

			OP2291	2015		OLIVE RIDLEY	RÍO ORO
			OP2295			OLIVE RIDLEY	RÍO ORO
			OP2296			OLIVE RIDLEY	RÍO ORO
			OP2297	2015		OLIVE RIDLEY	RÍO ORO
			OP2299			OLIVE RIDLEY	RÍO ORO
			OP2300			OLIVE RIDLEY	RÍO ORO
			OP250			OLIVE RIDLEY	RÍO ORO
			OP2528			OLIVE RIDLEY	RÍO ORO
OP2551		OP2552			EVIDENCE	OLIVE RIDLEY	RÍO ORO
OP2554		OP2553			EVIDENCE	OLIVE RIDLEY	RÍO ORO
			OP3191			OLIVE RIDLEY	RÍO ORO
			OP3501			OLIVE RIDLEY	RÍO ORO
			OP3502			OLIVE RIDLEY	RÍO ORO
			OP3503			OLIVE RIDLEY	RÍO ORO
			OP3504			OLIVE RIDLEY	RÍO ORO
			OP3505			OLIVE RIDLEY	RÍO ORO
			OP3506			OLIVE RIDLEY	RÍO ORO
			OP3507			OLIVE RIDLEY	RÍO ORO
			OP3507			OLIVE RIDLEY	RÍO ORO
			OP3508			OLIVE RIDLEY	RÍO ORO
			OP3509			OLIVE RIDLEY	RÍO ORO
			OP3510			OLIVE RIDLEY	RÍO ORO
			OP3511			OLIVE RIDLEY	RÍO ORO
			OP3512			OLIVE RIDLEY	RÍO ORO
			OP3513			OLIVE RIDLEY	RÍO ORO
			OP3514			OLIVE RIDLEY	RÍO ORO
			OP3515			OLIVE RIDLEY	RÍO ORO
			OP3516			OLIVE RIDLEY	RÍO ORO
			OP3517			OLIVE RIDLEY	RÍO ORO
			OP3518			OLIVE RIDLEY	RÍO ORO
			OP3519			OLIVE RIDLEY	RÍO ORO
			OP3520			OLIVE RIDLEY	RÍO ORO
			OP3522			OLIVE RIDLEY	RÍO ORO
			OP3523			OLIVE RIDLEY	RÍO ORO
			OP3524			OLIVE RIDLEY	RÍO ORO
			OP3525			OLIVE RIDLEY	RÍO ORO
			OP3526			OLIVE RIDLEY	RÍO ORO
			OP3529			OLIVE RIDLEY	RÍO ORO
			OP3531			OLIVE RIDLEY	RÍO ORO
			OP3533			OLIVE RIDLEY	RÍO ORO
			OP3534			OLIVE RIDLEY	RÍO ORO
			OP3535			OLIVE RIDLEY	RÍO ORO
			OP3536			OLIVE RIDLEY	RÍO ORO
			OP3537			OLIVE RIDLEY	RÍO ORO

			OP3538			OLIVE RIDLEY	RÍO ORO
			OP3539			OLIVE RIDLEY	RÍO ORO
			OP3539			OLIVE RIDLEY	RÍO ORO
			OP3540			OLIVE RIDLEY	RÍO ORO
			OP3541			OLIVE RIDLEY	RÍO ORO
			OP3542			OLIVE RIDLEY	RÍO ORO
			OP3543			OLIVE RIDLEY	RÍO ORO
			OP3544			OLIVE RIDLEY	RÍO ORO
			OP3545			OLIVE RIDLEY	RÍO ORO
			OP3546			OLIVE RIDLEY	RÍO ORO
			OP3547			OLIVE RIDLEY	RÍO ORO
			OP3548			OLIVE RIDLEY	RÍO ORO
			OP3550			OLIVE RIDLEY	RÍO ORO
			OP3552			OLIVE RIDLEY	RÍO ORO
			OP3553			OLIVE RIDLEY	RÍO ORO
			OP3554			OLIVE RIDLEY	RÍO ORO
			OP3555			OLIVE RIDLEY	RÍO ORO
			OP3556			OLIVE RIDLEY	RÍO ORO
			OP3557			OLIVE RIDLEY	RÍO ORO
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			OP3561			OLIVE RIDLEY	RÍO ORO
			OP3563			OLIVE RIDLEY	RÍO ORO
			OP3564			OLIVE RIDLEY	RÍO ORO
			OP3565			OLIVE RIDLEY	RÍO ORO
			OP3566			OLIVE RIDLEY	RÍO ORO
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			OP3569			OLIVE RIDLEY	RÍO ORO
			OP3570			OLIVE RIDLEY	RÍO ORO
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			OP3573			OLIVE RIDLEY	RÍO ORO
			OP3574			OLIVE RIDLEY	RÍO ORO
			OP3575			OLIVE RIDLEY	RÍO ORO
			OP3576			OLIVE RIDLEY	RÍO ORO
			OP3577			OLIVE RIDLEY	RÍO ORO
			OP3578			OLIVE RIDLEY	RÍO ORO
			OP3579			OLIVE RIDLEY	RÍO ORO
			OP3580			OLIVE RIDLEY	RÍO ORO
			OP3581			OLIVE RIDLEY	RÍO ORO
			OP3582			OLIVE RIDLEY	RÍO ORO
			OP3583	2015		OLIVE RIDLEY	RÍO ORO

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			OP3585			OLIVE RIDLEY	RÍO ORO
			OP3586			OLIVE RIDLEY	RÍO ORO
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			OP3594			OLIVE RIDLEY	RÍO ORO
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			OP3603			OLIVE RIDLEY	RÍO ORO
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			OP3638			OLIVE RIDLEY	RÍO ORO
			OP3639	2015		OLIVE RIDLEY	RÍO ORO
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			OP3641			OLIVE RIDLEY	RÍO ORO
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			OP3645	2015		OLIVE RIDLEY	RÍO ORO
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			OP3647			OLIVE RIDLEY	RÍO ORO
			OP3648			OLIVE RIDLEY	RÍO ORO
			OP3649			OLIVE RIDLEY	RÍO ORO
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			OP3765			OLIVE RIDLEY	RÍO ORO
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			OSA04269			OLIVE RIDLEY	RÍO ORO
			OSA04270			OLIVE RIDLEY	RÍO ORO
			OSA04272			OLIVE RIDLEY	RÍO ORO
			OSA04273			OLIVE RIDLEY	RÍO ORO
			OSA04274			OLIVE RIDLEY	RÍO ORO
			OSA04275			OLIVE RIDLEY	RÍO ORO
			OSA04276			OLIVE RIDLEY	RÍO ORO
			OSA04277			OLIVE RIDLEY	RÍO ORO
			OSA04278			OLIVE RIDLEY	RÍO ORO
			OSA04279			OLIVE RIDLEY	RÍO ORO
			OSA04279			OLIVE RIDLEY	RÍO ORO
			OSA04280			OLIVE RIDLEY	RÍO ORO
			OSA04281			OLIVE RIDLEY	RÍO ORO
			OSA04282			OLIVE RIDLEY	RÍO ORO
			OSA04283			OLIVE RIDLEY	RÍO ORO
			OSA04284			OLIVE RIDLEY	RÍO ORO
		VA406			EVIDENCE	OLIVE RIDLEY	RÍO ORO
	OP2159					OLIVE RIDLEY	RÍO ORO
	OSA 04255					OLIVE RIDLEY	RÍO ORO
	OSA04264					OLIVE RIDLEY	RÍO ORO
	5026					OLIVE RIDLEY	RÍO ORO
	JG376					OLIVE RIDLEY	RÍO ORO
	OP3532					OLIVE RIDLEY	RÍO ORO
	JG373					OLIVE RIDLEY	RÍO ORO
	OP2166					OLIVE RIDLEY	RÍO ORO

	4146		4140			PACIFIC GREEN	RÍO ORO
	JG323		JG323	2015		PACIFIC GREEN	RÍO ORO
	JG342		JG479	2015		PACIFIC GREEN	RÍO ORO
	OP2152		OP2151	2015		PACIFIC GREEN	RÍO ORO
	OP2198		OP2199			PACIFIC GREEN	RÍO ORO
	OP3857		OP3729	2015		PACIFIC GREEN	RÍO ORO
	OP3551		OP3799			PACIFIC GREEN	RÍO ORO
	OP3867		OP3854			PACIFIC GREEN	RÍO ORO
	OP3812		OP3863			PACIFIC GREEN	RÍO ORO
	OP3869		OP3871	2015		PACIFIC GREEN	RÍO ORO
	OSA04209		OSA04207			PACIFIC GREEN	RÍO ORO
	OSA04242		OSA04256			PACIFIC GREEN	RÍO ORO
	OSA04232		OSA04259			PACIFIC GREEN	RÍO ORO

Baseline data reveal importance of Río Oro National Wildlife Refuge to the East Pacific Olive Ridley (*Lepidochelys olivacea*) sea turtle stock.

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[1] Corcovado Foundation Lon Willing Ramsey Jr. [2] Latin American Sea Turtles (LAST)

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Abstract

Previous studies had identified the Río Oro National Wildlife Refuge (RONWR), Osa Peninsula, Costa Rica, as a site of major solitary Olive Ridley nesting[1][2][3][4][5][6]. Ease of access via a public road meant that these nests were especially vulnerable to being poached, and yet the refuge was left abandoned without routine protection for many years. A new program established by the Corcovado Foundation in 2015 aims to provide long-term monitoring and protection of the site. From 01 August through 31 December 2015, 2,951 Olive Ridley nests were registered on Río Oro beach (density = 61.5/100m), corresponding to 49.5% of all nests registered for this species on the five major nesting beaches in the Osa Peninsula. Nesting peaked at the beginning of October, and nesting frequency was observed to increase markedly during the third quarter phase of three consecutive lunar cycles. Analysis of a sample of 524 nests revealed a hatching rate of 81.0%, comparable to that of neighboring beaches, and much higher than that reported for beaches on which arribadas take place[7][8]. These data demonstrate that the RONWR makes a greater contribution to the Olive Ridley sea turtle stock than any other site in the South Pacific of Costa Rica.

Figure 1. Map of Costa Rica showing the five major sea turtle nesting beaches located outside the Corcovado National Park in the Osa Peninsula (inset).

Methods

Río Oro beach was cleaned and marked with reference posts at 100m intervals, delimiting 48 distinct sectors, from Laguna Pejeperrito (adjacent to Carate beach) to Laguna Pejeperro (adjacent to Pejeperro beach). Río Oro beach was monitored continuously from 20 July 2015 through 25 January 2016 by means of daily night patrols and/or morning censuses of nests and tracks, during which temporal, spatial and biometric data pertaining to turtles and nests were recorded as described previously[9]. A total of 1,202 Olive Ridley sea turtles were marked with tags (#681 INCONEL) displaying the prefix OP, OSA or JG. Nests were left to incubate *in situ* unless found below the high tide line (zone 1), in which case they were relocated to a nearby alternative site above this line (zone 2). A sample of 314 nests was marked using labeled plastic bottles tethered to pieces of wood buried alongside the nests. A sample of 524 nests was excavated and analyzed, as described previously[9], of which 200 were previously marked, of which 144 qualified for reliable thermal profiling. Cycling incubation temperatures from dataloggers (HOBO Pendant Temperature UA-001-08/64 [accuracy ±0.47 °C]) buried at control locations on the beach (sectors 21 and 34) were converted to a constant temperature equivalent (CTE) for each day. These data were used to predict offspring sex ratio, based on the CTE one third of the way through the incubation period, using published pivotal temperatures for this species in Costa Rica[10]. The number of days since the previous full moon (0-28) was calculated for each *solitary* (non-arribada) nesting event on the beaches of Río Oro (2015), Corozalito (2009-2015), and San Miguel (2010-2012). The proportion of nests laid on each day of the lunar cycle was calculated as the percentage of the total number of nests in the sample. Alignments were made of datasets from multiple seasons, from which mean data were generated.

Results

Turtle Crawls			Initial Status of Nests			Final Status of Nests					Reproduction Rate		Estimated Sex Ratio	
Total Crawls	Total Nests	False Crawls	Marked (M)	Left *In Situ*	Relocated *Ex Situ*	M Recovered	M Not Recovered	Lost to Poaching	Lost to Predation	Total Excavated	Mean Hatching Rate	Mean Emergence Rate	Female	Male
4,187	2,951	1,236	314	2,759	173	200	114	44	4	524				
%	70.5	29.5	10.6	93.5	5.9	63.7	36.3	1.5	0.1	17.8	81.0	76.1	72.5	27.5

Figure 2. Summary of Olive Ridley turtle crawls and nests registered on Río Oro beach from 01 August through 31 December 2015, showing initial and final status of nests, the reproduction rate based on a sample of 524 excavated nests, and the estimated sex ratio based on a sample of 144 excavated nests.

Beach	Length (km)	Nests (n)	Nests (%)	Density (n/100m)	Poaching (%)	Hatching (%)	Emergence (%)	Organization
Carate	2.8	593	9.9	21.2	4.0	61.0	60.0	COTORCO
Río Oro	**4.8**	**2,951**	**49.5**	**61.5**	**1.5**	**81.0**	**76.1**	Corcovado Foundation
Pejeperro	5.5	1,382	23.2	25.1	21.1	-	-	Osa Conservation
Piro	4.5	927	15.6	20.6	36.1	-	-	Osa Conservation
Drake	3.6	107	1.8	3.0	6.5	73.9	70.0	Corcovado Foundation

Figure 3. Comparison of the number, proportion and density of Olive Ridley nests registered on the five major nesting beaches in the Osa Peninsula, from 01 August through 31 December 2015, showing poaching and reproduction rates.

Data from Carate beach, and from Pejeperro and Piro beaches, used with kind permission from COTORCO (Barquero-Edge PS) and Osa Conservation (Sánchez M), respectively.

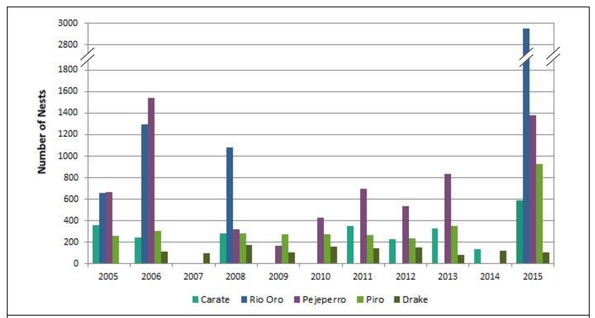

Figure 4. Comparison of number of Olive Ridley nests registered on the five major nesting beaches in the Osa Peninsula each season, from 2005 to 2015. Río Oro beach was not routinely monitored from 2009 through 2014. All other gaps correspond to data that are currently irretrievable.

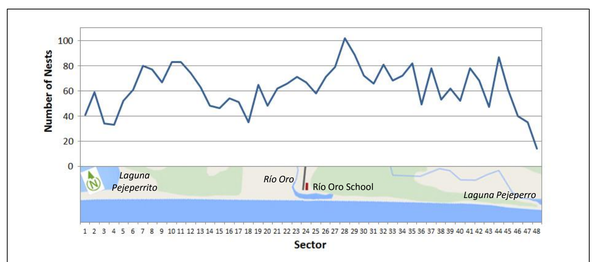

Figure 5. Spatial distribution showing number of Olive Ridley nests registered on Río Oro beach from 01 August through 31 December 2015, showing locations of the Río Oro river, Laguna Pejeperrito and Laguna Pejeperro, all of which remained isolated from the sea during this period.

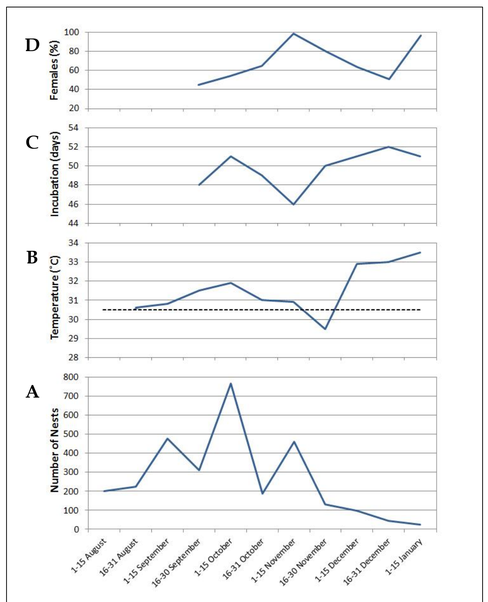

Figure 6. Temporal distributions showing **A**. number of Olive Ridley nests registered on Río Oro beach, and **B**. mean CTEs (°C) showing pivotal temperature (dotted)[10], and **C**. mean incubation period (days) and **D**. mean estimated sex ratio (% ♀) for a sample of 144 nests (plotted according to hatch date), during 15/16-day periods from 01 August 2015 through 15 January 2016.

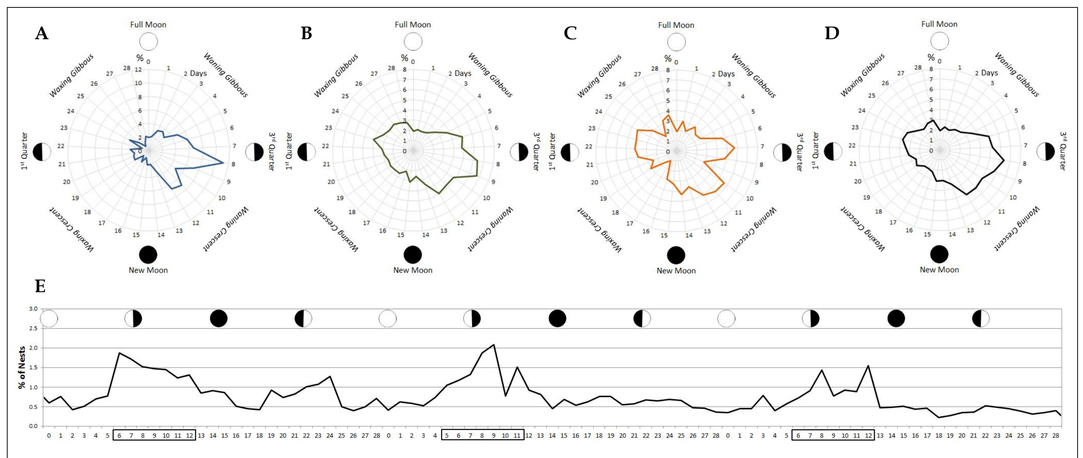

Figure 7. Percentage of *solitary* Olive Ridley nests laid on each day of the lunar cycle on three beaches: **A**. Río Oro (2015, n=2,591), **B**. Corozalito, Nicoya Peninsula (mean: 2009-2015, n=10,223), **C**. San Miguel, Nicoya Peninsula (mean: 2010-2012, n=1,004), and **D**. mean of all datasets. **E**. Mean dataset plotted linearly over three lunar cycles (3rd, 4th and 5th of nesting season) showing three conserved peaks. Data from Corozalito and San Miguel beaches used with kind permission from PRETOMA (Arauz Vargas R).

Discussion

From 01 August through 31 December 2015, a total of 4,187 crawls by Olive Ridley sea turtles were registered on Río Oro beach, of which 2,951 were nesting events and 1,236 were false crawls (**Figure 2**). A comparison of data from the five major nesting beaches in the Osa Peninsula (**Figure 3**) shows that 49.5% of the total nests registered during this period were laid on Río Oro beach, giving rise to a nesting density (61.5/100m) several times higher than on any other beach. Historical data suggest that Río Oro beach has always been a site of major Olive Ridley nesting in the region[1], but analysis of more recent data suggest that its relative superiority may have increased dramatically since 2006 (**Figure 4**).

The mean hatching (81.0%) and emergence (76.1%) rates reported here for Río Oro beach are typical for this species and comparable to that of neighboring beaches (**Figure 3**). The poaching (1.5%) and predation (0.1%) rates appear to be exceptionally low; however, assuming that the 144 marked nests that were not recovered were also poached, the former rate may be closer to 6.4%. The poaching rate prior to 2015 is not known; however, data from neighboring beaches (**Figure 3**) and personal communications from local residents would suggest that it may have been over 30.0% of nests.

The spatial distribution of nests on Río Oro beach during this period (**Figure 5**) reveals more or less uniform density across the 48 sectors, although nesting was slightly more intense in the southern half (sectors 25-48, density = 64.5/100m) compared to the northern (sectors 1-24, density = 58.5/100m). The highest nesting density was registered in sectors 28 and 29, immediately to the South of the zone where the Río Oro river typically forms a mouth.

The temporal distribution of nests (**Figure 6A**) reveals that nesting peaked during the period 1-15 October 2015 on Río Oro beach**,** with 276 nests registered between 5-6 October alone. The mean CTE for each 15/16-day period (**Figure 6B**) remained above the published pivotal temperature (30.5°C) for this species[10], except during the period 16-30 November which experienced the greatest rainfall of the season. These high temperatures gave rise to relatively short nest incubation periods (**Figure 6C**) and a putative female bias in the majority (77.8%) of the 144 nests profiled (**Figure 6D**). An estimated 72.5% of the hatchlings liberated from this sample of nests were likely to have been female (**Figure 2**). The strong El Niño effect during 2015 resulted in an extraordinarily hot and dry rainy season on the Pacific coast, and previous reports suggest that this female bias is probably season-specific[4].

The temporal distribution of nests on Río Oro beach (**Figure 6A**) is characterized by three notable peaks in nesting frequency, which were found to clearly coincide with the 3rd quarter lunar phase. Increased nesting frequency during this phase was reported previously on Drake beach[12], however, the sample size was small (n=958). The data presented here (**Figure 7**) correspond to a larger sample of nests (n=13,818) and suggest that this trend is not only conserved in the Osa Peninsula (**Figure 7A**. Río Oro), but also on beaches in the Nicoya Peninsula (**Figure 7B**. Corozalito, and **Figure 7C**. San Miguel) located over 250km to the North.

Conclusions

The data presented here demonstrate that the RONWR is the most important site for Olive Ridley nesting in the South Pacific of Costa Rica, and represents a high-priority site for the conservation of this species. The high reproduction rates reported here, compared to those reported for arribada beaches[7][8], highlight the importance of the contribution of high-intensity *solitary* nesting beaches, such as Río Oro, to the overall Olive Ridley sea turtle stock. The marked reduction in poaching activity at Río Oro beach during 2015 is a major achievement for the program and indicates that the conservation methodology used was effective.

The Olive and Kemp's Ridley – uniquely among sea turtle species – are apparently able to delay nesting until conditions are favorable, and their predisposition toward synchronized nesting behavior is dramatically demonstrated during Olive Ridley arribada events. Arribadas in the eastern Pacific generally coincide with the 3rd quarter lunar phase, and there is substantial evidence to suggest that environmental – rather than social – cues may be responsible for inducing these simultaneous nesting events[11]. Evidence for reproductive synchrony in *solitary* Olive Ridley populations, however, is largely absent from the literature. The data presented here support the hypothesis that the same environmental cues are responsible for inducing synchronized nesting behavior in both *arribada* and *solitary* Olive Ridley populations, and that this periodicity is robustly coupled to the lunar cycle. The precise nature of these cues, the selective pressures at work and the evolutionary advantage of such synchrony remain elusive.

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RED DE CONSERVACIÓN DE TORTUGAS MARINAS PACÍFICO SUR

DOCUMENTO BASE

Versión 1.
Fecha: 20 de mayo 2015
Participantes: Geovanny Agüero, Alonso Badilla, Geinor Barquero, Miguel Brais, Oscar Brenes, Marvin Cubero, Phoebe Edge, Luis Fonseca, Víctor Gamboa, Robert James, Nicole Jirón, Víctor Mena, Damián Martínez, Francisco Mendoza, Pedro Porras, Guido Saborío, Juan Salazar, Cira Sánchez, Manuel Sánchez, Reinaldo Van Vee, Wilberth Vargas, Johnson Villalobos, Ronald Villalobos.
Editores: Nicole Jirón, Damián Martínez y Guido Saborío.

I. Introducción

El presente constituye el documento base de la **Red de Conservación de Tortugas Marinas Pacífico Sur**. Esta Red surge como producto del taller *Conservación de Playas de Anidación y Tortugas Marinas: Estrategia conjunta de monitoreo*, realizado el 22 y 23 de mayo de 2015 en las instalaciones de Reserva Playa Tortuga.

Este taller fue convocado por el Programa de Investigación del Área de Conservación Osa (ACOSA) y financiado por el programa Consolidación de las Áreas Marinas Protegidas del PNUD - SINAC – GEF. En este taller participaron organizaciones del área Pacífico sur, como se detallan en la lista del Anexo 1.

A continuación se describe los términos y condiciones con las que fue diseñada la **Red**.

II. Antecedentes

Se pueden identificar dos antecedentes para la constitución de esta **Red,** uno de iniciativa local y otro de interés institucional.

- Iniciativa Local: el Centro de Investigación Reserva Playa Tortuga, el Comité para la Conservación de las Tortugas Marinas de Corcovado (COTORCO) y el Programa de Investigación de ACOSA convergieron en la necesidad de sumar esfuerzos en la zona del Pacífico Sur acerca de la importancia del monitoreo de tortugas marinas. Este interés se materializó en la redacción de un documento titulado RED DE CONSERVACIÓN DE TORTUGAS MARINAS DE ACOSA. Este documento fue presentado a los participantes del taller y sirvió como insumo para la presente **Red**.

- Interés Institucional: El SINAC ha desarrollado en los últimos años esfuerzos hacia la consolidación del Programa de Monitoreo Ecológico (PROMEC) en su escala nacional, local y para los ambientes terrestres, marinos y dulceacuícolas. A través del proyecto

Consolidación de las Áreas Marinas Protegidas el SINAC ha invertido en el desarrollo de propuestas de protocolos para los principales objetos de conservación marinos de interés para el sistema de áreas de conservación. Paralelamente a estos esfuerzos el Programa de Investigación de ACOSA propone invertir esfuerzos en la consolidación de monitoreo para playas de anidación de tortugas marinas.

III. Justificación

Además de los antecedentes anteriormente expuestos, el trabajo conjunto realizado durante el taller del 22 y 23 de mayo evidenció 5 razones que justificaron la necesidad de conformar una Red para el monitoreo conjunto.

1. Se evidenció que las organizaciones del área del Pacífico Sur cuentan con experiencia y capacidad instalada en el tema de conservación y monitoreo de playas de anidación de tortugas marinas.
2. Se evidenció la disposición de compartir conocimiento de parte de las organizaciones de mayor experiencia y se identificó el interés por aprender de parte de las organizaciones más incipientes.
3. Se subrayó la importancia de trabajar en una visión Pacífico Sur ya que el trabajo de conservación de tortugas marinas supera el trabajo individual o por playa.
4. Como parte del trabajo conjunto realizado por los participantes durante el taller del 22 y 23 de mayo se elaboró un estado de situación de las tortugas marinas en el Pacífico sur; entre sus resultados se señaló la "*Falta de línea base estandarizada para caracterizar los cambios, comparar y poder tomar decisiones*". Lo que introdujo la necesidad de trabajar de manera conjunta el tema del monitoreo de playas de anidación de tortugas marinas.
5. Se cuenta con la motivación de las organizaciones del área en ser pioneros a escala nacional en el monitoreo conjunto de tortugas marinas.

IV. ¿Para qué una Red?

Con base en el trabajo de la pregunta "¿Para qué queremos una Red?", los participantes acordaron 5 orientaciones básicas:

1. Acordar un protocolo de monitoreo conjunto de playas de anidación de tortugas marinas, mediante la *estandarización de los indicadores.*

2. Colaborar en la *legalización y formalización de los proyectos* participantes.

3. *Compartir información y experiencias* acerca del monitoreo de tortugas marinas en playa y agua.

4. *Realizar documentos técnicos* para divulgar la información.

5. Fomentar la *vinculación entre proyectos e instituciones* (SINAC-Guardacostas- Policía Turística- Fuerza Pública, etc.

V. Agenda de trabajo

Primeras Acciones

¿Para Qué?	¿Cómo?	Responsable/ Fecha
Acordar un protocolo de monitoreo conjunto , mediante la estandarización de los indicadores: 1. # de hembras anidadoras 2. # de nidos por temporada por especie	Luis Fonseca presentó el protocolo elaborado para el PROMEC-, el cual ha sido experimentado en Santa Rosa y Cahuita. El grupo eligió 2 indicadores. Luis Fonseca enviará protocolo para los 2 indicadores elegidos. Entre junio y julio Luis Fonseca y Guido Saborío visitarán los proyectos para estandarizar el monitoreo de los 2 indicadores elegidos. Cada final de temporada se considerará incluir nuevos indicadores.	Luis Fonseca- junio. Luis Fonseca y Guido Saborío- junio- julio.
Colaborar en la *legalización y formalización de los proyectos* participantes.	Requisitos para obtener los permisos de investigación. Requisitos para obtener los permisos de vivero. Estos trámites tardan al menos 1 mes Es responsabilidad de cada proyecto sacarlo adelante. Necesidad de Regente - $165 día de visita + viáticos/ 1 mes- para 3 proyectos.	Guido Saborío enviará los requisitos para obtener el permiso de investigación. Óscar Brenes enviará los requisitos para obtener los permisos para dirigir un vivero. Guido Saborío consultará opciones para contratar un regente para los 3 proyectos que no cuentan con ese servicio.

Compartir información y experiencias acerca del monitoreo de tortugas marinas en playa y agua.	Lista de correos para información formal y científica. Facebook cerrado para divulgar eventos. 2 reuniones presenciales: finales octubre 2015/ enero-febrero 2016. Fichas de trabajo por tema: - Búsqueda de fondos: - Voluntariado: Visita a proyectos a cargo de Guido y Luis. (junio- julio 2015) Programa de Intercambio Interno	Guido Saborío enviará la lista de participantes y sus correos electrónicos. Luis Fonseca abrirá una cuenta privada en Facebook. Guido Saborío le comentará a Damián Martínez la importancia de estos encuentros. Robert James diseñará y circulará una breve encuesta para sistematizar las experiencias en Búsqueda de Fondos. Óscar Brenes y Ronald Villalobos, individualmente, elaborarán una ficha acerca de sus experiencias en la consecución de voluntariado para fortalecer los diferentes proyectos. Entre junio y julio Luis Fonseca y Guido Saborío visitarán los proyectos. Geinor Barquero y Alonso Badilla diseñarán un Programa de Intercambio Interno entre los proyectos participantes de la Red.
Realizar documentos técnicos para divulgar la información.	Enviar información (abril 2016) acerca de los 2 indicadores acordados al final de la temporada.	Guido Saborío enviará el formato para informe final de temporada.
Fomentar la vinculación entre proyectos e instituciones (SINAC-Guardacostas- Policía Turística-Fuerza Pública, etc.)	Coordinaciones para patrullaje Cada proyecto deberá establecer las fechas en las que requieren ayuda. Los Guardacostas requieren hospedaje.	Cada proyecto/institución deberá enviar solicitudes de apoyo antes del 16 de junio- Geinor Barquero y Alonso Badilla.

Otros temas de Agenda

Tarea	Responsable
Los proyectos/ instituciones asistentes al taller del 22 y 23 de mayo en Reserva Playa Tortuga, deberán obtener su respectiva carta de aceptación y designación como representantes en la Red.	Cada proyecto/ institución deberá enviar su carta máximo el 29 de mayo- enviársela a Luis Fonseca.
Cada proyecto deberá enviar su lista de necesidades de equipo.	Deberán enviársela a Luis Fonseca (máximo 15 de junio)

VI. Acerca del manejo de datos

Con respecto al manejo de los datos los participantes acordaron lo siguiente:

1. La base de datos es propiedad de cada proyecto.
2. La interpretación de los datos /los resultados se comparten con la red, citando la fuente.

VII. Acerca de los participantes de la red y nuevos miembros

Con respecto a los actores legítimos para participar y la incorporación de nuevos miembros, los participantes acordaron lo siguiente:

1. La Red está constituida originalmente por los proyectos/ instituciones asistentes al taller del 22 y 23 de mayo en Reserva Playa Tortuga, con su respectiva carta de aceptación y designación como representantes.
2. Podrá participar cualquier proyecto/institución que realice actividades de monitoreo de tortugas marinas en la zona.
3. El proyecto/ institución debe contar con permisos de investigación y funcionamiento del vivero de tortugas marinas por parte del SINAC (otorgados o en trámite de consecución).
4. El proyecto/ institución deberá aceptar lo acordado por la Red en el Documento Base.
5. Cada proyecto/institución participante deberá realizar una nota en la cual acepta participar de la red y deberá designar un representante y un suplente.

6. Las instituciones representadas podrán contar con más de 1 representante, en vista de que participan diferentes programas o unidades.

7. Los nuevos miembros, después del taller del 22 y 23 de mayo, deberán cumplir con todos los requisitos anteriores y se deberá postular su ingreso. Ingresará por mayoría simple.

VIII. Acerca de la Logística de la Red

Acerca de la metodología de trabajo de la Red los participantes acordaron lo siguiente:

1. Habrá 1 participante por proyecto/institución.
2. 1 proyecto/institución 1 voto.
3. Luis Fonseca de LAST será el secretario de la Red.
4. La convocatoria de la Red la deberá hacer la secretaría.
5. La estrategia de comunicación será la siguiente:
    a. La Red contará con una Secretaría
    b. Se compartirá información formal y científico vía el Correo Electrónico
    c. Se abrirá una cuenta en Facebook (privada) para el intercambio de información acerca de eventos.

IX. Acerca de la búsqueda de fondos

Acerca de la búsqueda de fondos los participantes acordaron lo siguiente:

1. Es necesario crear experiencia reconocida como requisito para solicitar fondos.
2. Se esperará hasta final de la primera temporada (abril 2016) para considerar la búsqueda de fondos según determinadas necesidades y/o oportunidades surgidas de la primera experiencia.
3. Durante la temporada 2015, la búsqueda de fondos estarán enfocadas en:
    a. Regente para los proyectos que aún no lo tienen
    b. Encuentros presenciales
    c. Programa de intercambio interno
4. En caso de que surjan donaciones de equipo, los proyectos/ instituciones informará a la Red y la red votará para definir su repartición y uso.

5. Cada proyecto deberá enviar a Luis Fonseca su lista de necesidades de equipo.

TALLER DE CONSERVACION DE TORTUGAS MARINAS
ÁREA DE CONSERVACIÓN OSA
PLAYA TORTUGA, 22 - 24 DE MAYO 2015

#	Institución	Participantes	Teléfono	Correo
1	Punta Banco	Reinaldo Van Vee	8327-6700	losvanvee@gmail.com
2		Wilberth Vargas	27762059	wilber_vargas@costarricense.cr
3	Comunidad de Drake, www.drakebayturtles.org	Fransisco Mendoza Hernandez	83025972	franciscomendoza19@gmail.com, tortugasmarinaselprogreso@gmail.com
4		Johnson Villalobos Chavarría	88190838	madreselvaosa70@gmail.com
5	Fundación Corcovado	Robert James	2297-3013 / 8499-0019	robert@fundacioncorcovado.org
6	Conservación Osa	Manuel Sánchez	2735-5756	manuel@osaconservation.org
7	COTORCO, ADICOR	Phoebe Edge	84095875	fifipibi85@gmail.com
8		Cira Sánchez	83825423	haciendariooro@gmail.com
9	Reserva Playa Tortuga	Oscar Brenes	2786-5200	oscarbreari@gmail.com
10		Juan Salazar	2786-5200	rptojochal@gmail.com
11	ACOSA-Parque Nacional Marino Ballena	Víctor Mena	2786-5392	victor.mena@sinac.go.cr
12	ACOSA-Parque Nacional Marino Ballena	Pedro Porras	2786-5392	pedro.porras@sinac.go.cr
13	ACOSA-Programa de Prevención, Control y Protección	Geinor Barquero	88402574	pipipipi84@gmail.com
14	ACOSA-Programa de Prevención, Control y Protección	Alonso Badilla	87825546	alonso.badilla@sinac.go.cr
15	ACOSA-Programa de Investigación y Monitoreo	Guido Saborio	88407041	guido.saborio@sinac.go.cr
16	LAST	Luis Fonseca Lopez	8735-2419	luisfonsecalopez@gmail.com
17	Refugio de Vida Silvestre Baru	Ronald Villalobos	2787-0007	rvillaloboshoffmann@gmail.com
18	Guardacostas Quepos	Miguel Brais	27771386	braismedina@gmail.com
19		Geovanny Agüero	27771386	queposol@hotmail.com
20		Víctor Gamboa	27771386	vgamboa2011@hotmail.com
21	Camping Chaman	Marvin Cubero Ramírez	27438160, 27438161, 87018527	chamanran4@hotmail.com, campaingelchaman@gmail.com
22	Facilitadora	Nicole Jirón Beirute	8838-1208	njironbeirute@gmail.com
23	Proyecto Consolidación de las Áreas Marinas	Damián Martínez	8817-7271	damian.martinez@sinac.go.cr

ANEXO 1

ANEXO 2

ALGUNAS FOTOGRAFÍAS


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RED DE CONSERVACIÓN DE TORTUGAS MARINAS PACÍFICO SUR

DOCUMENTO BASE

Versión 1.
Fecha: 20 de mayo 2015
Participantes: Geovanny Agüero, Alonso Badilla, Geinor Barquero, Miguel Brais, Oscar Brenes, Marvin Cubero, Phoebe Edge, Luis Fonseca, Víctor Gamboa, Robert James, Nicole Jirón, Víctor Mena, Damián Martínez, Francisco Mendoza, Pedro Porras, Guido Saborío, Juan Salazar, Cira Sánchez, Manuel Sánchez, Reinaldo Van Vee, Wilberth Vargas, Johnson Villalobos, Ronald Villalobos.
Editores: Nicole Jirón, Damián Martínez y Guido Saborío.

I. Introducción

El presente constituye el documento base de la **Red de Conservación de Tortugas Marinas Pacífico Sur**. Esta Red surge como producto del taller *Conservación de Playas de Anidación y Tortugas Marinas: Estrategia conjunta de monitoreo*, realizado el 22 y 23 de mayo de 2015 en las instalaciones de Reserva Playa Tortuga.

Este taller fue convocado por el Programa de Investigación del Área de Conservación Osa (ACOSA) y financiado por el programa Consolidación de las Áreas Marinas Protegidas del PNUD - SINAC – GEF. En este taller participaron organizaciones del área Pacífico sur, como se detallan en la lista del Anexo 1.

A continuación se describe los términos y condiciones con las que fue diseñada la **Red**.

II. Antecedentes

Se pueden identificar dos antecedentes para la constitución de esta **Red,** uno de iniciativa local y otro de interés institucional.

- Iniciativa Local: el Centro de Investigación Reserva Playa Tortuga, el Comité para la Conservación de las Tortugas Marinas de Corcovado (COTORCO) y el Programa de Investigación de ACOSA convergieron en la necesidad de sumar esfuerzos en la zona del Pacífico Sur acerca de la importancia del monitoreo de tortugas marinas. Este interés se materializó en la redacción de un documento titulado RED DE CONSERVACIÓN DE TORTUGAS MARINAS DE ACOSA. Este documento fue presentado a los participantes del taller y sirvió como insumo para la presente **Red**.

- Interés Institucional: El SINAC ha desarrollado en los últimos años esfuerzos hacia la consolidación del Programa de Monitoreo Ecológico (PROMEC) en su escala nacional, local y para los ambientes terrestres, marinos y dulceacuícolas. A través del proyecto

Consolidación de las Áreas Marinas Protegidas el SINAC ha invertido en el desarrollo de propuestas de protocolos para los principales objetos de conservación marinos de interés para el sistema de áreas de conservación. Paralelamente a estos esfuerzos el Programa de Investigación de ACOSA propone invertir esfuerzos en la consolidación de monitoreo para playas de anidación de tortugas marinas.

III. Justificación

Además de los antecedentes anteriormente expuestos, el trabajo conjunto realizado durante el taller del 22 y 23 de mayo evidenció 5 razones que justificaron la necesidad de conformar una Red para el monitoreo conjunto.

1. Se evidenció que las organizaciones del área del Pacífico Sur cuentan con experiencia y capacidad instalada en el tema de conservación y monitoreo de playas de anidación de tortugas marinas.
2. Se evidenció la disposición de compartir conocimiento de parte de las organizaciones de mayor experiencia y se identificó el interés por aprender de parte de las organizaciones más incipientes.
3. Se subrayó la importancia de trabajar en una visión Pacífico Sur ya que el trabajo de conservación de tortugas marinas supera el trabajo individual o por playa.
4. Como parte del trabajo conjunto realizado por los participantes durante el taller del 22 y 23 de mayo se elaboró un estado de situación de las tortugas marinas en el Pacífico sur; entre sus resultados se señaló la "*Falta de línea base estandarizada para caracterizar los cambios, comparar y poder tomar decisiones*". Lo que introdujo la necesidad de trabajar de manera conjunta el tema del monitoreo de playas de anidación de tortugas marinas.
5. Se cuenta con la motivación de las organizaciones del área en ser pioneros a escala nacional en el monitoreo conjunto de tortugas marinas.

IV. ¿Para qué una Red?

Con base en el trabajo de la pregunta "¿Para qué queremos una Red?", los participantes acordaron 5 orientaciones básicas:

1. Acordar un protocolo de monitoreo conjunto de playas de anidación de tortugas marinas, mediante la *estandarización de los indicadores.*

2. Colaborar en la *legalización y formalización de los proyectos* participantes.

3. *Compartir información y experiencias* acerca del monitoreo de tortugas marinas en playa y agua.

4. *Realizar documentos técnicos* para divulgar la información.

5. Fomentar la *vinculación entre proyectos e instituciones* (SINAC-Guardacostas- Policía Turística- Fuerza Pública, etc.

V. Agenda de trabajo

Primeras Acciones

¿Para Qué?	¿Cómo?	Responsable/ Fecha
Acordar un protocolo de monitoreo conjunto , mediante la estandarización de los indicadores: 1. # de hembras anidadoras 2. # de nidos por temporada por especie	Luis Fonseca presentó el protocolo elaborado para el PROMEC-, el cual ha sido experimentado en Santa Rosa y Cahuita. El grupo eligió 2 indicadores. Luis Fonseca enviará protocolo para los 2 indicadores elegidos. Entre junio y julio Luis Fonseca y Guido Saborío visitarán los proyectos para estandarizar el monitoreo de los 2 indicadores elegidos. Cada final de temporada se considerará incluir nuevos indicadores.	Luis Fonseca- junio. Luis Fonseca y Guido Saborío- junio- julio.
Colaborar en la *legalización y formalización de los proyectos* participantes.	Requisitos para obtener los permisos de investigación. Requisitos para obtener los permisos de vivero. Estos trámites tardan al menos 1 mes Es responsabilidad de cada proyecto sacarlo adelante. Necesidad de Regente - $165 día de visita + viáticos/ 1 mes- para 3 proyectos.	Guido Saborío enviará los requisitos para obtener el permiso de investigación. Óscar Brenes enviará los requisitos para obtener los permisos para dirigir un vivero. Guido Saborío consultará opciones para contratar un regente para los 3 proyectos que no cuentan con ese servicio.

Compartir información y experiencias acerca del monitoreo de tortugas marinas en playa y agua.	Lista de correos para información formal y científica. Facebook cerrado para divulgar eventos. 2 reuniones presenciales: finales octubre 2015/ enero-febrero 2016. Fichas de trabajo por tema: - Búsqueda de fondos: - Voluntariado: Visita a proyectos a cargo de Guido y Luis. (junio- julio 2015) Programa de Intercambio Interno	Guido Saborío enviará la lista de participantes y sus correos electrónicos. Luis Fonseca abrirá una cuenta privada en Facebook. Guido Saborío le comentará a Damián Martínez la importancia de estos encuentros. Robert James diseñará y circulará una breve encuesta para sistematizar las experiencias en Búsqueda de Fondos. Óscar Brenes y Ronald Villalobos, individualmente, elaborarán una ficha acerca de sus experiencias en la consecución de voluntariado para fortalecer los diferentes proyectos. Entre junio y julio Luis Fonseca y Guido Saborío visitarán los proyectos. Geinor Barquero y Alonso Badilla diseñarán un Programa de Intercambio Interno entre los proyectos participantes de la Red.
Realizar documentos técnicos para divulgar la información.	Enviar información (abril 2016) acerca de los 2 indicadores acordados al final de la temporada.	Guido Saborío enviará el formato para informe final de temporada.
Fomentar la vinculación entre proyectos e instituciones (SINAC-Guardacostas- Policía Turística-Fuerza Pública, etc.)	Coordinaciones para patrullaje Cada proyecto deberá establecer las fechas en las que requieren ayuda. Los Guardacostas requieren hospedaje.	Cada proyecto/institución deberá enviar solicitudes de apoyo antes del 16 de junio- Geinor Barquero y Alonso Badilla.

Otros temas de Agenda

Tarea	Responsable
Los proyectos/ instituciones asistentes al taller del 22 y 23 de mayo en Reserva Playa Tortuga, deberán obtener su respectiva carta de aceptación y designación como representantes en la Red.	Cada proyecto/ institución deberá enviar su carta máximo el 29 de mayo- enviársela a Luis Fonseca.
Cada proyecto deberá enviar su lista de necesidades de equipo.	Deberán enviársela a Luis Fonseca (máximo 15 de junio)

VI. Acerca del manejo de datos

Con respecto al manejo de los datos los participantes acordaron lo siguiente:

1. La base de datos es propiedad de cada proyecto.
2. La interpretación de los datos /los resultados se comparten con la red, citando la fuente.

VII. Acerca de los participantes de la red y nuevos miembros

Con respecto a los actores legítimos para participar y la incorporación de nuevos miembros, los participantes acordaron lo siguiente:

1. La Red está constituida originalmente por los proyectos/ instituciones asistentes al taller del 22 y 23 de mayo en Reserva Playa Tortuga, con su respectiva carta de aceptación y designación como representantes.
2. Podrá participar cualquier proyecto/institución que realice actividades de monitoreo de tortugas marinas en la zona.
3. El proyecto/ institución debe contar con permisos de investigación y funcionamiento del vivero de tortugas marinas por parte del SINAC (otorgados o en trámite de consecución).
4. El proyecto/ institución deberá aceptar lo acordado por la Red en el Documento Base.
5. Cada proyecto/institución participante deberá realizar una nota en la cual acepta participar de la red y deberá designar un representante y un suplente.

6. Las instituciones representadas podrán contar con más de 1 representante, en vista de que participan diferentes programas o unidades.

7. Los nuevos miembros, después del taller del 22 y 23 de mayo, deberán cumplir con todos los requisitos anteriores y se deberá postular su ingreso. Ingresará por mayoría simple.

VIII. Acerca de la Logística de la Red

Acerca de la metodología de trabajo de la Red los participantes acordaron lo siguiente:

1. Habrá 1 participante por proyecto/institución.
2. 1 proyecto/institución 1 voto.
3. Luis Fonseca de LAST será el secretario de la Red.
4. La convocatoria de la Red la deberá hacer la secretaría.
5. La estrategia de comunicación será la siguiente:
    a. La Red contará con una Secretaría
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IX. Acerca de la búsqueda de fondos

Acerca de la búsqueda de fondos los participantes acordaron lo siguiente:

1. Es necesario crear experiencia reconocida como requisito para solicitar fondos.
2. Se esperará hasta final de la primera temporada (abril 2016) para considerar la búsqueda de fondos según determinadas necesidades y/o oportunidades surgidas de la primera experiencia.
3. Durante la temporada 2015, la búsqueda de fondos estarán enfocadas en:
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TALLER DE CONSERVACION DE TORTUGAS MARINAS
ÁREA DE CONSERVACIÓN OSA
PLAYA TORTUGA, 22 - 24 DE MAYO 2015

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ANEXO 2

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