Earthwatch 2016 Annual Field Report

WHALES AND DOLPHINS IN GOLFO DULCE, COSTA RICA

Lenin Oviedo MSc.

REPORT COMPLETED BY: Lenin Oviedo MSc., Research Associate Centro de Investigacion de Cetaceos de Costa Rica CEIC

PERIOD COVERED BY THIS REPORT: January - December 2016
Dear Volunteers,

Field work in 2016 was intense and meaningful. The more we know about our whales and dolphins the more we discover new things and realized how important it is to keep their habitat healthy.

I need to start by saying thank you all for your kind support, for helping and being part of the big picture.

By the time I am writing this communication, we have translated our baseline data on humpback whales into a concrete mitigation policy to preserve calving habitat (in Golfo Dulce and Osa Peninsula) at international level with the Maritime International Organization (IMO), the UN specialized agency responsible for the safety and security of shipping and the prevention of marine pollution by ships.

Thanks to your participation our data collection has had an important progression. This year 2016 being an Earthwatch Project, we have been working closely with our partners at The Smithsonian Tropical Research Institute and The International Maritime University in Panama, seeking for more answers and better understanding of the dynamic between whales, dolphins and the habitat structure of Golfo Dulce and the wider region of the Eastern Tropical Pacific.

We do have conservation challenges still ahead in our paths, we have to do major efforts to convince authorities at political level, on how negative will be the effects of increased maritime traffic (due to a luxury Marina) on humpback whale’s calving critical habitat inside Golfo Dulce, on how devastating would be to disrupt dolphins critical foraging habitat, by building a luxury hotel in the middle of a mangrove lined wetland. I feel positive that step by step we might get closer to a much needed Marine Protected Area not only in Golfo Dulce but all around Osa Peninsula, Southern Costa Rica.

Once again many thanks.

Truly yours,

Leninviedo
MSc. PhDC
CEIC

CEIC-Earthwatch


CEIC | 300 m Sur Escuela de Rincón de Osa, El Chontal, Golfo Dulce, Península de Osa, Costa Rica, golfodulce cetaceans@gmail.com
Summary

Our knowledge in how our resident and migratory cetaceans in Golfo Dulce use this key marine habitat in the Pacific Coast of Costa Rica has increased tremendously. Data gathered on population dynamic of our resident population of bottlenose dolphins highlight a previously suspected connection to the inshore bottlenose dolphin’ community inhabiting Chiriquí Gulf in Panama. This imply that a portion of the dolphins we usually encountered are indeed year round residents in the Golfo Dulce, while some others usually go back and forth across Panamanian waters next to Golfo Dulce. Similarly the value of Golfo Dulce as a calving habitat for migratory southeast Pacific humpback whales is integrated to a greater wintering habitat which includes Osa Peninsula and territorial waters of Panama. All this important insights are being put forwards to the design of management and conservation tools.

Goals, Objectives, and Results

Report progress made towards your research goals and objectives as stated in your research proposal, and present your results thus far. Include all graphs, tables, figures, and in the body of the text, and please include citations. Clearly indicate confidential material that you do not want made public, or that might preclude future publication elsewhere.

Cetaceans research in 2016 has focalized in cetaceans records inside Golfo Dulce (GD), records of inshore bottlenose dolphins (n=44), spotted dolphins (28) and humpback whales (17) were gathered in 35 surveys along the inner basin and the sill area to account for 89 sightings throughout 2016.

Regarding objective 1 (To identify areas of critical importance to dolphins such as foraging areas, breeding and calving habitats in the inner basin, outer sill area and the transitional - oceanic habitat in Golfo Dulce) and objective 2 (To estimate population size and structure of spotted and bottlenose dolphins at the inner basin and outer sill area) of our research project, we summarize here the most important results in 2016:

**Inshore bottlenose dolphins:** we have refined the resolution of the information produced with this very important coastal population, we have identified the resident individuals (above 40% in recapture) as a very small local group (n≈23), mostly composed by females and calves plus a couple of male alliances, this implies that the major percentage of the GD population frequently move in and out of Golfo Dulce, during 2015 we have expended an important quantity of effort documenting cetacean populations outside Golfo Dulce (North to Nicoya Peninsula), where we documented the inshore population of Caldera Bay, with no recapture on any GD identified individual. This last rainy season we started a collaboration with Universidad Maritima Internacional de Panama (UMIP) to study the coastal dolphin population in Chiriquí Gulf, south of Golfo Dulce, we found recaptures of dolphins recorded in our photo ID surveys in Golfo Dulce (e.g. TtGD085). The insights on dispersal gained on a key inshore dolphin population, widens our understanding of population structure and dynamic, we recognized Golfo Dulce as the most important inshore population nuclei within Costa Rica’s territorial waters, but as part of a metapopulation of the Nicoya and Panama Bight Ecoregions. This knowledge consolidate baseline data on coastal top predators in the Eastern Tropical Pacific, which by inhabiting the coastal environment, they are a lot more exposed to human derived impacts.
Fig. 1 Recapture of inshore bottlenose dolphins between Golfo Dulce (Costa Rica) and Golfo de Chiriquí (Panama)

_Pantropical Spotted Dolphins_: Photo ID data gathering and processing continues for this species. We have also started the analysis of footage and pictures taken through UAVs, where foraging events involving spotted dolphins indicates the occurrence of fronts within the inner basin of GD. Those fronts are frequently explored by groups of spotted dolphins due to the key value in prey aggregation. Behavioral data collected both during boat surveys (35) and during exploratory UAV surveys (n=10) integrated with previous behavior records evidence the use of hydrographic features of the inner basin to favor prey capture, this information is currently being reviewed to understand the prey-predator dynamic within an inner sea such as Golfo Dulce, which is a guidance to policy related with one of the most important fishery resources in GD: the small pelagic, which are currently exploited without proper provisions regulating the resource.

Regarding the objective 3 (To identify key areas for calving and breeding humpback whales, as well as location of potential temporal and spatial overlap between the southern and northern stock) of this initiative, in particular our field data on southeast Pacific humpback whales encounters have been especially relevant, due to 1) the scientific cooperation scheme with Dr. Hector Guzman, from Smithsonian Tropical Research Institute to support the conservation and management of humpback whales in wintering areas of Central America by producing key baseline information on area use and movement between calving areas and summer foraging grounds by satellite telemetry, which is information that is being put forward to the creation of maritime traffic policy. 2) There is a cooperation agreement with cetaceans’ scientist from South-America to participate in a region wide assessment project “The population abundance estimation of humpback whales from stock G (southeast Pacific)”.

With addition of the data gathered during the humpback austral wintering season in 2016. We accounted 31 individuals photo-identified in Golfo Dulce (Flukes Pictures). The rather slow number and
the fact that the majority of flukes ID are obtained during competitive groups’ events, correspond with the occurrence of males visiting this important calving area in search of mating opportunities.

Fig. 2. New additions (2016) to the flukes identification catalogues for southeast Pacific humpback whales in Golfo Dulce. a) MnGD028, b) MnGD029, c) MnGD030 y d) MnGD031.

The distribution of southeast Pacific humpback whales sightings in Golfo Dulce (2007-2015: n=159), was assessed through the estimation of sightings per unit of effort (SPUE). Observation effort in Golfo Dulce has not been evenly distributed neither spatially nor seasonally, therefore, search effort on active visual survey were plotted as lines derived of each 30 min detectability station (Fig. 3). Each station is a vertex of a whole survey track, from which a raster layer of density of track lines was created. The track density was estimated by calculating the total length of track portions that fell within a radius of 1000 m in the neighborhood of each output raster cell from a grid of Golfo Dulce (approximately 2.22 x 2.22 Km), using the pixellate function from the spatstats package (see Baddeley & Turner 2005) in R.3.3.0 (R Core Team 2016). The value for density of effort of total distance covered in each cell (kilometers covered per unit area) is then allocated to each grid cell. The numbers of sightings within a cell was accounted and divided by the research effort to obtain the SPUE. The latter was estimated using all the sightings included in the analysis, and by group composition.
Fig. 3. Tracks summarizing detectability station (2011-2016) where presence absence of humpback whales have been recorded in Golfo Dulce.

Qualitative validation of the spatial trend in SPUE was done through the overlap of tracks derived from satellite telemetry data. Humpbacks whales were tagged in Golfo Dulce in September 2015, specifically, two mother and calf pairs (tags numbered 459 and 462). Tagging procedure followed that of Guzman et al. (2013); Félix & Guzman, (2014) and Guzman & Felix (2017), using Wildlife Computers SPOT5 tags. The spatial trend in SPUE of the groups with calves and without calves equally favor the sill area, with a more important presence of the group with calves within the southern tip of the inner basin in between both coast, whereas the all adults groups showed a major occurrence closer to the entrance of the gulf. The SPUE of groups with calves (Fig 4) is contrasted with the tracks of two satellite tagged mother and calf pairs. The tracks overlapped with the area of higher SPUE showing a similar spatial trend favoring the western coast of the sill area.

Ecologically Golfo Dulce is a key wintering area for southeast Pacific humpback whales, they aggregate over the sill area primarily to give birth, nurse and reproduce, our results are supported by previous assessments and direct observations on calving in this key location (Herra Miranda et al. 2016, Oviedo et al. 2015) and by the high proportion of calves in the groups composition (54%), which is similar to the one reported in adjacent calving areas such as Chiriquí Gulf (52%, Rasmussen & Palacios 2013), off Drake Bay and Isla del Caño (58%, Vida Marina Foundation non published data, 2001-2006), comparable to other wintering grounds of *M. n. australis* off Brazil (Morete et al. 2007, 2003) and considerably higher than what have been documented in other wintering habitats such as Maui, Hawaii, USA (Mobley & Herman 1985; Smultea 1994), West Indies-Caribbean (Smith et al. 1999; Mattila et al.1994), the east coast of Africa (Ersts & Rosenbaum, 2003) and Ecuador (Scheidat et al. 2000). However, the important incidence of traveling behavior for both; calving and adults only groups; define the dynamic nature of the habitat use of Southeast Pacific humpback whales inside Golfo Dulce. The residency time within GD
of photo-identified individuals (1-3 days, CEIC non published Photo ID data) and that of satellite tagged mother and calf pairs (2 to 14 days) support this assertion, emphasizing the fluid movement pattern that would deemed this tropical fiord as a calving habitat, integrated to a major extended one comprising the whole Central America wintering habitat: Las Perlas Archipelago, Chiriquí Gulf (Panama) and Osa Peninsula, which would include Golfo Dulce (Costa Rica).

Fig. 4. Sighting per unit of efforts of humpback whales in Golfo Dulce, with details of satellite tracks of mothers and calves (tag No 459: blue; tag No 462: black). Maps below the SPUE estimation show behavior and group composition: MC (Mother-Calf pairs); MCE (Mother-Calf -Escort), MCP (Mother-Calf- > 1 additional Whale)
Implication for management and conservation: The found spatial distribution patterns and defined critical habitats should be used as baseline to establish guidelines for the management of this important coastal-marine habitat and the wintering grounds of a highly migratory species. The understanding of these patterns of spatial use, behavior and social structuring highlight the likelihood of human-animal conflicts and the locations where it may occur. The location of a port facility in Golfito and the construction plans for a luxury marina (Herra Miranda et al. 2016) make Golfo Dulce, the calving habitat in territorial waters of Costa Rica, likely to be disrupted by pervasive impacts, associated to coastal development and maritime traffic. Mitigation in the form of a Traffic Separation Scheme, as suggested by Guzman et al. (2012) and later implemented in the Gulf of Panama is being devised through the Maritime International Organization (IMO), however the closeness of the primary calving habitat to the major coastal urban settlement, which would harbor the marina, is still a major concern. Increased disturbance in the form of collision risk and noise pollution would have substantial implications on short-term residency patterns and individual and calf survivorship (Herra Miranda et al. 2016, Ersts & Rosenbaum 2003). Critical calving habitat would greatly benefit for the expansion of the Preciosa-Platanares National Wildlife Refuge to cover the marine environs evaluated in this study. It also suggests that using an ecosystem approach could be the right tool to meet the pressing need to create connections between already existing marine protected areas and this way to establish a comprehensive protection of species and resources.

REFERENCES


Project Impacts
Report contributions in the categories below for the past fielding year.

1. Increasing Scientific Knowledge
   a. Total citizen science research hours - provide an estimate for the number of hours per day that
      volunteers spent collecting data, being trained to collect data in the field, and performing data entry.
      During 2016 we have had the total amount of citizen science research hours spent in 2015 were 478 hours, distributed as follow:
      - Boat surveys: searching for whales and dolphins in Golfo Dulce (most of this was spent in the inner basin and sill areas of Golfo Dulce) 220 hours
      - Data processing of Photo ID pictures= 162 hours
      - Volunteer Training on Task= 98 hours
   b. Peer-reviewed publications
      We have produced the following publications, where the support of Earthwatch has been crucial and properly acknowledged:

In preparation / in review

- Pacheco-Polanco, D., Oviedo, L. Herra-Miranda, D. and M. Fernandez. Spatial Analysis on The Occurrence of Inshore and Offshore Bottlenose Dolphins (Tursiops truncatus) in Osa Peninsula Waters and Golfo Dulce, Costa Rica. This manuscript has been sent to the “Journal of Cetacean Research and Management” of the International Whaling Commission on the 29 June 2016.
- Oviedo, L., Fernandez, M., Herra-Miranda, D., Pacheco-Polanco, D., Hernández-Camacho, C. and D. Aurioles. Habitat partitioning mediates the coexistence of sympatric dolphins in a tropical fjord. This manuscript has been sent to the Journal “Estuarine, Coastal and Shelf Science” on the 28 September 2016.
• Oviedo, L., Herra-Miranda, D., Goodman, S., Pacheco-Polanco, D. and M. Fernandez. The distribution of oceanic odontocetes (Delphinidae, Kogiidae, Ziphiidae) in transitional oceanic waters off Osa Peninsula, Costa Rica. This manuscript has been sent to the journal “Marine Biodiversity Records” on the 18 May 2017.

c. Non-peer reviewed publications: Technical reports, white papers, articles, sponsored or personal blogs

d. Presentations : indicate if this was an invited paper, panel presentation, keynote speech, plenary address, or other.
3.- Las ventajas de ser residente: perspectivas del estudio de delfines simpáticos en Golfo Dulce Costa Rica (The advantages of being resident: perspectives on the study of sympatric dolphins in


e. Mentoring

a. Graduate students - list graduate students doing thesis work on the project and include student CVs and their research proposal on file with the university as an attachment when you submit your annual report

<table>
<thead>
<tr>
<th>Student Name</th>
<th>Graduate Degree</th>
<th>Project Title</th>
<th>Anticipated Year of Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veronica Cereceres</td>
<td>BSc.</td>
<td>Behavioral ecology of inshore bottlenose dolphins</td>
<td>2018</td>
</tr>
<tr>
<td>Erika Sanchez Robledo</td>
<td>BSc.</td>
<td>Habitat use of <em>Pseudorca crassidens</em> in Golfo Dulce and Osa Peninsula, Costa Rica</td>
<td>2016</td>
</tr>
</tbody>
</table>

b. Community outreach - provide details on how you have supported the development of environmental leaders in the community in which you work.

<table>
<thead>
<tr>
<th>Name of school, organization, or group</th>
<th>Education level</th>
<th>Participants local or non-local</th>
<th>Details on contributions/activities</th>
</tr>
</thead>
</table>

f. Partnerships - list your current active professional partnerships that contribute to your project and indicate the type of support these partners provide

<table>
<thead>
<tr>
<th>Partner</th>
<th>Support Type(s)¹</th>
<th>Years of Association (e.g. 2006-present)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACOSA-MINAET</td>
<td>The local Delegation of the Ministry of Environment for Osa Peninsula Conservation Area: Permits</td>
<td>2005- Present</td>
</tr>
<tr>
<td>OSA CONSERVATION</td>
<td>A leading NGO supporting the</td>
<td>2013-Present</td>
</tr>
<tr>
<td>Plan/Policy Name</td>
<td>Type</td>
<td>Level of Impact</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>------</td>
<td>----------------</td>
</tr>
<tr>
<td>Ship Trafic Separation Scheme</td>
<td>Policy</td>
<td>Local-Regional</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Description of Contribution:** This environmental policy will be adopted primarily for preservation of the critical calving habitat of humpback whales, to mitigate potential collision due to maritime traffic associated with the advent of the Nicaragua Canal and the new widening of the existing Panama Canal in addition to local maritime traffic in CR waters. The proposal was supported by the satellite and field data on humpback whales produced by the partnership between CEIC and Dr. Hector Guzman (STRI)

h. **Conserving natural and sociocultural capital**

   a. **Conservation of taxa**

   i. List any focal species that you did not list in your most recent proposal

<table>
<thead>
<tr>
<th>Species</th>
<th>IUCN Red List category</th>
<th>Local/regional conservation status</th>
<th>Local/regional conservation status source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>IUCN Red List category</td>
<td>Local/regional conservation status</td>
<td>Local/regional conservation status source</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------------------------</td>
<td>------------------------------------</td>
<td>-------------------------------------------</td>
</tr>
<tr>
<td><strong>Humpback Whale</strong></td>
<td>Least Concern</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td><strong>Bottlenose Dolphin</strong></td>
<td>Least Concern</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td><strong>Pantropical Spotted Dolphin</strong></td>
<td>Least Concern</td>
<td>Migratory Species requiring international cooperation</td>
<td>CMS: Convention Migratory Species</td>
</tr>
<tr>
<td><strong>Pantropical spotted dolphin</strong> (Stenella attenuata), this species was targeted by the tuna fishery and suffered population decline due to purse seine fishery. Populations are yet to recover in the ETP. Our population of spotted dolphins could be a very local ecotype.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ii. In the past year, has your project helped conserve or restore populations of species of conservation significance? If so, please describe below.**

<table>
<thead>
<tr>
<th>Species</th>
<th>IUCN Red List category</th>
<th>Local/regional conservation status</th>
<th>Local/regional conservation status source</th>
<th>Description of contribution</th>
<th>Resulting effect</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rhynoptera steindachneri</strong></td>
<td>Near Threaten</td>
<td><code>-.-</code></td>
<td><code>-.-</code></td>
<td><strong>Description of contribution</strong> Sympatric on critical habitats of inshore bottlenose dolphins</td>
<td><strong>Resulting effect</strong> A new focus of assessment to support protection of habitat</td>
</tr>
</tbody>
</table>
Aetobatus narinari Near Threaten Sympatric on critical habitats of inshore bottlenose dolphins A new focus of assessment to support protection of habitat

b. **Conservation of ecosystems** - in the past year, has your project helped conserve or restore habitats? If so, please describe below.

<table>
<thead>
<tr>
<th>Habitat type</th>
<th>Habitat significance</th>
<th>Description of contribution</th>
<th>Resulting effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mangrove</td>
<td>nursery, breeding ground, feeding site</td>
<td>We have identified all major mangrove associated estuaries as the critical habitat of the inshore bottlenose dolphins. Showing the relevance of this habitats in all the trophic levels in the marine ecosystem.</td>
<td>extent maintained</td>
</tr>
<tr>
<td>Coast</td>
<td>nursery, breeding ground, refuge, feeding site</td>
<td>We identified the relevance of the coastal habitats for humpback whales calving and reproduction, as well as a foraging ground for bottlenose dolphins.</td>
<td>extent maintained</td>
</tr>
<tr>
<td>Pelagic</td>
<td>feeding site</td>
<td>We have identified the inner basin of GD, as the critical habitat of pantropical spotted dolphins. Showing the relevance of this habitats in all the trophic levels in the marine ecosystem.</td>
<td>extent maintained</td>
</tr>
</tbody>
</table>

c. **Ecosystem services** - Indicate which ecosystem service categories you are directly studying in your Earthwatch research and provide further details in the box below.

- [ ] Food and water
- [ ] Flood and disease control
- [ ] Spiritual, recreational, and cultural benefits
- [x] Nutrient cycling

Details:

There are two main ecosystem services we focus in particular; Carbon Off-setting and Biodiversity Preservation: The critical habitats of our target species are key areas for carbon retention, such as mangrove forest along river mouths and the anoxic basin of Golfo Dulce. Those areas are along with the transitional oceanic area of Golfo Dulce, crucial in the preservation of the eco-dynamic processes, sustaining the whole marine
biodiversity, not only in Golfo Dulce, but in the whole Osa Peninsula.

We also support by our actions the aesthetic value of Golfo Dulce and promote the adoption of sustainable practices to enhance eco-tourism as an alternative for local communities.

Acknowledgements

The staff of Safeguarding Whales and Dolphins Costa Rica deeply appreciate the support of all the staff at the Earthwatch Office, especially from our (very awesome) Project Manager Caroline Dunn.