**Sea turtles support sustainable livelihoods at Ostional, Costa Rica**

Mallika Sardeshpande and Douglas Macmillan

### Supplementary Table 1 Selected literature on examples of legal sea turtle use, by location or topic.

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| --- | --- |
| Location | Reference |
| Cayman Islands | D’cruze, N., Balaskas, M., Morrison, T. & Alcock, R. (2015) Sea Turtle Farming. *SWOT report,* 10, 18–23. |
| Costa Rica (La Flor, Chacocente) | Hope, R.A. (2002) Wildlife harvesting, conservation and poverty: the economics of olive ridley egg exploitation. *Environmental Conservation,* 29, 375–384. |
| Colombia (Guajira) | Vliet, N.V., Gomez, J., Quiceno-Mesa, M.P., Escobar, J.F., Andrade, G, Vanegas, L.A. & Nasi, R. (2015) Sustainable wildlife management and legal commercial use of bushmeat in Colombia: the resource remains at the cross-road. *International Forestry Review,* 17, 438–447. |
| Cuba | Cardenas, E.A.C. (2000) Management Program and Traditional Catch Procedures in the Wild. In *Proceedings of the Eighteenth International Sea Turtle Symposium* (compilers F.A. Abreu-Grobois, R. Briseño-Dueñas, R. Márquez, & L. Sarti), p. 8. NOAA Technical Memorandum NMFS-SEFSC-436, Miami, USA. |
| El Salvador (Toluca, legal until 2009; now a performance payment programme) | Nuila, R.V. & Sanchez, J.C. (2000). Marine Turtle Project, Toluca Beach - CESTA. In *Proceedings of the Eighteenth International Sea Turtle Symposium* (compilers F.A. Abreu-Grobois, R. Briseño-Dueñas, R. Márquez, & L. Sarti), p. 148. NOAA Technical Memorandum NMFS-SEFSC-436, Miami, USA.  Liles, M.J., Peterson, M.J., Lincoln, Y.S., Seminoff, J.A., Gaos, A.R. & Peterson, T.R. (2015) Connecting international priorities with human wellbeing in low-income regions: lessons from hawksbill turtle conservation in El Salvador. *Local Environment,* 20, 1383–1404. |
| Guatemala (Aldea Hawaii) | Muccio, C. (2015) The Hawaii Integrated Coastal Zone Management Project, Guatemala. In *Conservation, crime and communities: case studies of efforts to engage local communities in tackling illegal wildlife trade* (ed. D. Roe), pp. 32–34. IIED, London, UK.  Handy, S., Lucas, S. & Muccio, C. (2010) The sea turtle egg donation system of Guatemala: Conservation on non-protected beaches. In *Proceedings of the Twenty-eighth Annual Symposium on Sea Turtle Biology and Conservation* (compilers K. Dean & M.C. López-Castro). (2010), p. 67. NOAA Technical Memorandum NMFS-SEFSC-602, Miami, USA.  Arana, L. (2006) Legislation that protects sea turtles in Guatemala. In *Book of Abstracts. Twenty-Sixth Annual Symposium on Sea Turtle Biology and Conservation* (compilers M. Frick, A. Panagopoulou, A.F. Rees & K. Williams), p. 113. International Sea Turtle Society, Athens, Greece. |
| Honduras (Punta Raton) | Dunbar, S., Salinas, L., & Castellanos, S. (2012) Community partnership in understanding population changes in “Tortuga Golfina” (*Lepidochelys olivacea*) on the south coast of Honduras. In *Proceedings of the Thirty-first Annual Symposium on Sea Turtle Biology and Conservation* (compilers T. Jones & P. Wallace), p. 88. NOAA Technical Memorandum NMFS-SEFSC-631, Miami, USA.  Dunbar, S., Salinas, L. & Berube, M. (2009) *Acivities of the Turtle Awareness and Protection Studies (TAPS) Progran Under the Protective Turtle Ecology Center for Training, Outreach, and Research (ProTECTOR) in Roatan, Honduras. 2007-2008 Annual Report*. Ministry of the Environment, Honduras.  Lagueux, C. (1989) Economic analysis of sea turtle eggs in a coastal communityon the Pacific coast of Honduras. In *Proceedings of the Ninth Annual Workshop on Sea Turtle Conservation Biology* (compilers S.A. Eckert, K.L. Eckert & T.H. Richardson), p. 91. NOAA Technical Memorandum NMFS-SEFC-232, Miami, USA. |
| India (Andaman & Nicobar Islands) | Shanker, K. (2015) *From Soup to Superstar: The Story of Sea Turtle Conservation along the Indian Coast*. Harper Collins, Noida, India. |
| Nicaragua (Pearl Cays) | Lagueux, C.J., Campbell, C.L. & Strindberg, S. (2014) Artisanal green turtle, *Chelonia mydas*, Fishery of Caribbean Nicaragua: I. catch rates and trends, 1991–2011. *PloS one*, 9(4), e94667.  Lagueux, C.J., Campbell, C.L. & Strindberg, S. (2017) Artisanal green turtle (*Chelonia mydas*) fishery of Caribbean Nicaragua: II. Characterization and trends in size, sex, and maturity status of turtles killed, 1994–2011. *Marine Biology,* 164, 60. |
| Australia (Torres Strait) | Watkin Lui, F., Stoeckl, N., Delisle, A., Kiatkoski Kim, M. & Marsh, H. (2016) Motivations for Sharing Bushmeat with an Urban Diaspora in Indigenous Australia. *Human Dimensions of Wildlife,* 21, 345–360. |
| Philippines (Turtle Islands) | Lejano, R.P., Ingram, H.M., Whiteley, J.M., Torres, D. & Agduma, S.J. (2007) The importance of context: integrating resource conservation with local institutions. *Society & Natural Resources*, 20, 177–185.  Poonian, C.N., Ramilo, R.V. & Lopez, D.D. (2016) Diversity, habitat distribution, and indigenous hunting of marine turtles in the Calamian Islands, Palawan, Republic of the Philippines. *Journal of Asia-Pacific Biodiversity,* 9, 69-73. |
| Global legalisation attempts (unsuccessful) | Donelly, M. (2011) Sea turtles and CITES. *SWOT report,* 6, 42–43. |
| Global review of legal sea turtle fisheries | Humber, F., Godley, B.J. & Broderick, A.C. (2014) So excellent a fishe: a global overview of legal marine turtle fisheries. *Diversity and Distributions,* 20, 579–590 |

### Supplementary Material 2 Questionnaire

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0.1 | | What is your age? | | | | | |  |
|  | | | | | | | |  |
| 0.2 | | What is your gender? | | | | | |  |
|  | | | | | | | |  |
| 0.3 | | What was your last educational qualification? | | | | | |  |
|  | | None | School | | High school | | Diploma |  |
|  | | Graduate degree | Postgraduate  degree | | Doctorate  or higher | | Prefer not  to say |  |
| 0.4 | | Have you participated in a survey before? | | | | | |  |
|  | | No | Yes, less than 5  years ago | | Yes, less than 10 years ago | | Yes, more than  10 years ago |  |
| 1. | | How long have you lived in Ostional? | | | | | |  |
|  | | | | | | | |  |
| 2. | How many members does your household comprise of? | | | | | | | |
|  | Under 15 | | | 16-25 | | 26-45 | | |
|  | 46-65 | | | Over 66 | | Total | | |
| 3. | How many members contribute to the household income? | | | | | | | |
|  | | | | | | | | |
| 4. | What is your average household income? | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 5. | Which of these activities contribute to the household income? | | Y/N | How much does this activity contribute to the household income? (percentage/fraction/amount/rank) | | | At what time of the year is this activity practiced? | Can you name some good things about this activity? | | Can you name some bad things about this activity? | |
|  | A | Agriculture or cultivation | |  |  | | |  |  | |  | |
|  | B | Animal husbandry | |  |  | | |  |  | |  | |
|  | C | Production (crafts, factory work) | |  |  | | |  |  | |  | |
|  | D | Services (practice, office work) | |  |  | | |  |  | |  | |
|  | E | Tourism | |  |  | | |  |  | |  | |
|  | F | Wildlife conservation | |  |  | | |  |  | |  | |
|  | G | Other (please specify) | |  |  | | |  |  | |  | |
| 6. | | | Are you aware of the ADIO? | | | | | | | | |  |
|  | | | Yes | | | | No (If no, please proceed to question 12) | | | | |  |
| 7. | | | What in your knowledge does the ADIO do? | | | | | | | | |  |
|  | | | Sea turtle conservation | | | Wildlife  conservation | Development  projects | | | Community  projects | |  |
|  | | | Tourism  projects | | | Literacy and education | Administration  and governance | | | Other  (please specify) | |  |
| 8. | | | Is anyone in your household associated with ADIO? If yes, in what capacity? | | | | | | | | |  |
|  | | | Not associated | | | Egg harvesting | Beach monitoring | | | Tourist guide | |  |
|  | | | Sea turtle monitoring | | | Administration | Other  (please specify) | | | Total | |  |
| 9. | | | Are you aware of the egg harvesting project? | | | | | | | | |  |
|  | | | Yes | | | | No (If no, please proceed to question 12) | | | | |  |
| 10. | | | Could you list 3 good things about the egg harvesting project? | | | | | | | | |  |
| 1 | | |  | | | | | | | | |  |
| 2 | | |  | | | | | | | | |  |
| 3 | | |  | | | | | | | | |  |
| 11. | | | Could you list 3 bad things about the egg harvesting project? | | | | | | | | |  |
| 1 | | |  | | | | | | | | |  |
| 2 | | |  | | | | | | | | |  |
| 3 | | |  | | | | | | | | |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 12. | To what extent do you agree with the following statements? | Agree | Neutral | Disagree | Don’t know | Comments (if any) |
| A | Sea turtles at Ostional are in danger |  |  |  |  |  |
| B | Sea turtles are important for the environment |  |  |  |  |  |
| C | Sea turtle eggs are an important source of food |  |  |  |  |  |
| D | Sea turtles are an important source of income |  |  |  |  |  |
| E | Ostional beach needs better protection |  |  |  |  |  |
| F | There are too many tourists in Ostional |  |  |  |  |  |
| G | The government needs to do more for Ostional |  |  |  |  |  |
| H | The egg harvesting project has helped the community |  |  |  |  |  |
| I | The egg harvesting project has helped the sea turtles |  |  |  |  |  |
| J | The egg harvesting project will continue for the next 10 years |  |  |  |  |  |

|  |  |
| --- | --- |
| 13. | Could you list 3 things you like about living in Ostional? |
| 1 |  |
| 2 |  |
| 3 |  |
| 14. | Could you list 3 things you dislike about living in Ostional? |
| 1 |  |
| 2 |  |
| 3 |  |

15. Could you describe how Ostional has changed over the last 10 years?

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 16. | Do you think the numbers of sea turtles at Ostional beach have: | | | | | | |
|  | Increased | | Decreased | | Not changed | | Don’t know |
| 17. | Can you tell why sea turtles are protected? | | | | | | |
|  | | | | | | | |
| 18. | Can you describe how sea turtles are protected? | | | | | | |
|  | | | | | | | |
| 19. | | Do you know about the use of sea turtle eggs? | | | | | |
|  | | I don’t know about the  use of sea turtle eggs;  I don’t use them  (Please proceed to question 21) | | I know about the use  of sea turtle eggs;  I don’t use them | | I know about the use  of sea turtle eggs;  I use them | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 20. | What are sea turtle eggs used for? | Not used | Used by others, not me | Used by others and me | Used by me, not others | Don’t know |
| A | In and as food |  |  |  |  |  |
| B | In and as medicine |  |  |  |  |  |
| C | In and as livestock feed |  |  |  |  |  |
| D | In and as cultural practice |  |  |  |  |  |
| E | In hatcheries for conservation |  |  |  |  |  |
| F | Sold in the market |  |  |  |  |  |
| G | Other (please specify) |  |  |  |  |  |
|  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 21. | Do you know about the trade of sea turtle eggs? | | | | | | |
|  | I don’t know about the  trade of sea turtle eggs;  I don’t trade them  (Please proceed to question 27) | | I know about the trade  of sea turtle eggs;  I don’t trade them  (Please proceed to question 23) | | | I know about the trade  of sea turtle eggs;  I trade them | |
| 22. | Do you trade sea turtle eggs? | | | | | | |
|  | No, I don’t use  or trade them  (Please proceed to question 27) | No, I use them  but don’t trade  them | | Yes, I use them  and trade them | | | Yes, I don’t use  them but trade  them |
| 23. | At what price are sea turtle eggs bought and sold? | | | | | | |
|  | Don’t know | Buying price: | | | Selling price: | | |
| 24. | Who trades sea turtle eggs? | | | | | | |
|  | Community at Ostional | ADIO | | Other places in Nicoya Peninsula | | | Other places in  Costa Rica  (please name) |
|  | Other places in Central America (please name) | Other countries  in the world  (please name) | | Other  (please specify) | | | Don’t know |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 25. | Which turtles’ eggs are used in Ostional/Costa Rica? | Not used, not traded | Use, not traded | Used and traded | Don’t know |
| A | Olive ridley |  |  |  |  |
| B | Leatherback |  |  |  |  |
| C | Hawksbill |  |  |  |  |
| D | Loggerhead |  |  |  |  |
| E | Green |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 26. | Is there a way to identify eggs legally harvested in Ostional? | | | |
|  | No, they cannot  be identified | I cannot identify them, but others  can | Yes, I can identify them, and can  show you how to | Don’t know |

Imagine that access to the beach at Ostional is banned to protect the turtles. No visitors are allowed to see the sea turtles, and their eggs cannot be used in any way by anyone. Very limited research and monitoring is done only by personnel with special permission from the government. Please consider the following 2 questions:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 27. | What impact do you think this ban will have on the following: | Positive | Negative | No effect | Don’t know |
| A | Tourism |  |  |  |  |
| B | ADIO |  |  |  |  |
| C | Jobs for the people of Ostional |  |  |  |  |
| D | Food supply for people and livestock |  |  |  |  |
| E | Places for relaxation and recreation in Ostional |  |  |  |  |
| F | Playa Ostional (the beach) |  |  |  |  |
| G | Sea turtles |  |  |  |  |
|  | Other (please specify) |  |  |  |  |
|  |  |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 28. | Please respond to only those selected as negative in the previous question | 1. Would your household suffer any of the negative impacts? | 2. Would your household accept payments as compensation? | 3. How much money would your household require as compensation? |
| A | Tourism |  |  |  |
| B | ADIO |  |  |  |
| C | Jobs for the people of Ostional |  |  |  |
| D | Food supply for people and livestock |  |  |  |
| E | Places for relaxation and recreation in Ostional |  |  |  |
|  | Other (please specify) |  |  |  |

**Thank you for your time and contribution!**

### Supplementary Material 2 Interview question guide.

1. How did you start working with the ADIO and the egg harvesting project?
2. Could you please describe your work/role briefly?
3. Do you face any obstacles/challenges in your work?
4. What do you like/enjoy about your work?
5. What do you think are the weak points of the egg harvesting project?
6. What do you think are the strong points of the egg harvesting project?
7. What do you think about the future of the egg harvesting project?
8. How do you think the project has affected the turtles?
9. How do you think the project has affected the beach?
10. How do you think the project has affected the community?
11. How much do you think the project contributes to Ostional’s economy?
12. How much do you think tourism contributes to Ostional’s economy?

Additional questions:

**ADIO officials**

1. How does the distribution and trade work? Who buys and sells the eggs? What are the prices?
2. How does the membership work? Who can become a member? How can one become a member? How many members do you have?
3. How are the eggs and earnings distributed?
4. Do you get volunteers for the egg harvesting? Do you know who they are?
5. Has the egg harvesting project changed over the years? How?

**Researchers**

1. What do you think of the EHP?
2. Who works at Ostional? Are there collaborations with other institutions/NGOs?
3. What research is done at Ostional? How are you involved with it?
4. Have you noticed any significant population/ecosystem changes over time?

**Patrollers**

1. How does the distribution and trade work? Who buys and sells the eggs? What are the prices?
2. Are you aware of eggs traded elsewhere legally or illegally?
3. Does the beach need better protection? In what ways?
4. Can the government do more for the beach or the community of Ostional? In what ways?
5. Have you noticed any significant changes in the turtles or the beach over time?

**Tourist Guides**

1. What do you do on your tours? How long does a tour last?
2. What are tourists’ views on the EHP?
3. How long have you been working as a guide? Do you get trained to do tours?
4. Is there a particular time of the year when you get many tourists? Do you have to remind people of the rules? Are there problems with compliance?
5. Could I ask how much you charge people? How do tourists contact you?