



cambridge.org/enc

Research Paper

Cite this article: Liles MJ et al. (2021) Youth wildlife preferences and species-based conservation priorities in a low-income biodiversity hotspot region. *Environmental Conservation* 48: 110–117. doi: [10.1017/S0376892921000035](https://doi.org/10.1017/S0376892921000035)

Received: 22 June 2020

Revised: 18 December 2020

Accepted: 8 January 2021

First published online: 8 February 2021

Keywords:

ecological importance; environmental education; hawksbill sea turtle; human dimensions; Latin America; livelihoods; mangrove ecosystem; population decline; species attributes; values


Author for correspondence:

Dr Michael J Liles, Email: mliles@procosta.org

© The Author(s), 2021. Published by Cambridge University Press on behalf of Foundation for Environmental Conservation.

CAMBRIDGE
UNIVERSITY PRESS

Youth wildlife preferences and species-based conservation priorities in a low-income biodiversity hotspot region

Michael J Liles^{1,2} , M Nils Peterson³, Kathryn T Stevenson⁴ and Markus J Peterson⁵

¹Asociación ProCosta, Prados de San Luis, Polígono F #33, San Salvador, El Salvador; ²Eastern Pacific Hawksbill Initiative, 3193 B Street, San Diego, CA 92012, USA; ³Department of Forestry and Environmental Resources, North Carolina State University, 2800 Faucette Drive #3120, Raleigh, NC 27607, USA; ⁴Department of Parks, Recreation and Tourism Management, North Carolina State University, Box 8004, Biltmore 4008D, Raleigh, NC 27695, USA and ⁵Department of Biological Sciences, University of Texas at El Paso, 500 West University Avenue, El Paso, TX 79968, USA

Summary

Public preferences for wildlife protection can dictate the success or failure of conservation interventions. However, little research has focused on wildlife preferences among youth or how youth prioritize species-based conservation. We conducted a study of youth between 7 and 20 years old ($n = 128$) at five local schools situated near critical hawksbill turtle (*Eretmochelys imbricata*) nesting beaches in El Salvador to determine their wildlife preferences and how they prioritize species for conservation based on five attributes: endemism; use for hunting and fishing; rapid decline in population size; presence around their home; and ecological significance. These Salvadoran youth showed preferences for native over non-native species and tended to rank rapid population decline as the most important attribute for prioritizing wildlife for protection, followed by use for hunting and fishing. Participants in local environmental education activities placed greater importance on species in rapid decline than non-participants, who considered endemism as most important. Overall, these findings reveal how environmental education may successfully promote increased prioritization of imperilled species among youth. Economic payments for conserving hawksbill turtles may link the two top reasons that Salvadoran youth provided for protecting species by compensating for the reduced hunting required to facilitate population stabilization.

Introduction

One of the most profound conservation challenges facing humanity in the twenty-first century is deciding which species to protect (Wilson & Law 2016). Accelerated declines in global biodiversity coupled with insufficient conservation budgets incite an urgent need to prioritize species for protection (Bottrill et al. 2008, Collen 2015). Anthropogenic pressures, including overexploitation of species (Maxwell et al. 2016), habitat fragmentation (Tilman et al. 2017) and climate change (Poloczanska et al. 2013), continue to drive biodiversity loss worldwide. Current human-induced extinction rates are *c.* 1000 times higher than natural rates (Pimm et al. 2014) with 15–37% of Earth's species potentially 'committed to extinction' by 2050 (Thomas et al. 2004, p. 145). Although conservation-orientated institutions often prioritize threatened species (Drummond et al. 2010), some conservation scientists argue that characteristics other than extinction risk must be considered when setting conservation priorities (Marris 2007). Suggested ranking criteria include species attributes such as ecological importance (e.g., keystone species, such as sea turtles; Valls et al. 2015), evolutionary distinctiveness (e.g., species-poor clades, such as the Salvador worm salamander (*Oedipina salvadorensis*); Isaac et al. 2007), likelihood of persistence (e.g., social or legislative conditions exist to enable conservation action; Bottrill et al. 2008), economic value (e.g., species with high-value parts, such as sharks; McClenachan et al. 2016) and public appeal (e.g., species used as pets, such as parrots; Rodríguez et al. 2004).

Understanding how the general public prioritizes species is important because the fate of wildlife conservation interventions largely depends on public support (Czech et al. 1998, Martín-López et al. 2009, Teel & Manfredo 2010). Governments around the Earth claim authority over wildlife species under the public trust doctrine, where the trustee (e.g., the state) is responsible for managing the trust (e.g., wildlife) in the best interest of the trust beneficiary (i.e., the public) who holds title to the trust (Sax 1969, Horner 2000, Peterson et al. 2016). In nominally democratic countries, publicly elected government officials are tasked with formulating and implementing wildlife policies that best serve society's interests (Smith 2011). Often, however, conservation agendas are set from afar by international non-governmental organizations (NGOs) and distant scientists, which may not align with the priorities of on-the-ground

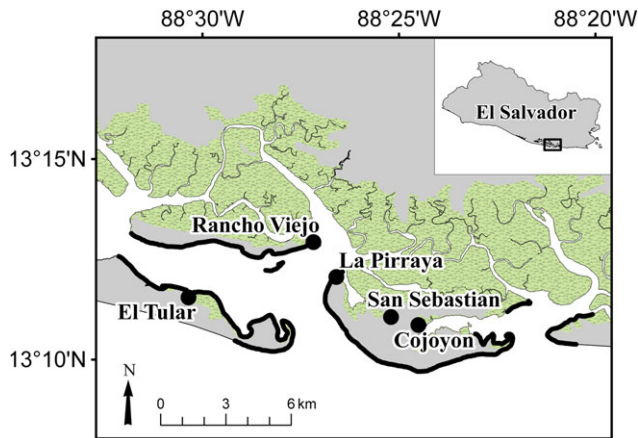


Fig. 1. Locations of hawksbill nesting beaches (black lines) and survey areas (black circles) at Bahía de Jiquilisco, El Salvador, 2016.

government agencies and other local groups (Smith et al. 2009). The disregard for local people’s perceptions of a species in conservation planning can result in ineffective conservation interventions due to a lack of public support or unanticipated public resistance (Kaltenborn et al. 2006).

Recent studies suggest that people have species-specific preferences, where they favour one species more than others (Schlegel & Rupf 2010, Ballouard et al. 2011, Frew et al. 2017). For example, the general public largely prefers mammals and birds to invertebrates and reptiles (Czech et al. 1998), but there can be considerable within-taxa variability (Crawford & Andrews 2016). Perceived charisma and attractiveness of a species are considered key characteristics that shape positive public perceptions (Lorimer 2007, Small 2011), whereas species that elicit fear or disgust tend to be viewed more negatively (Bjerke et al. 2001, Rakison 2009). People’s attitudes towards species are also influenced by context (e.g., culture and religion) and familiarity (e.g., interactions), so preferences often differ regionally and between people with different experiences of wildlife (Ressurreição et al. 2012, Macdonald et al. 2015). For example, rural residents who live in close proximity to wildlife and are more susceptible to wildlife-related impacts are more likely to have negative attitudes towards wildlife and are less likely to support their conservation than urban residents (Karlsson & Sjöström 2007, Liordos et al. 2017).

One of the fundamental tenets of conservation science is to protect biodiversity and the environment for future generations (Weiss 1990, Meine et al. 2006). Interestingly, however, studies on wildlife preferences of the public focus almost exclusively on adults, with little consideration given to the perspectives of youth and the species they would like to protect. Understanding youth priorities for species conservation is an ethical imperative because they will bear the burden of the future consequences of conservation actions taken today. Furthermore, youth perspectives towards species may also be important because they shape their parents’ environmental attitudes and behaviours (Damerell et al. 2013), including ideologically charged environmental issues (e.g., climate change; Lawson et al. 2019). This highlights the need to both better understand youth preferences for species-based conservation and evaluate how environmental education initiatives impact these preferences (Larson et al. 2010). These insights could shed light on ways to encourage public support for conservation among future generations as well as current ones, as children may shape adults’ perceptions. This need is particularly acute in low-income

biodiversity hotspots where conservation is critical (e.g., rare species are present) and can be contentious (e.g., increased poaching pressure; Harrison et al. 2016).

We conducted a survey of school youth to assess their wildlife preferences and prioritization of species attributes for conservation at Bahía de Jiquilisco in El Salvador. This area provides a useful case study in that most of the world’s threatened species are found in biodiversity hotspots in low-income regions, such as El Salvador, where the juxtaposition between high biological diversity and low economic wealth poses complex problems that intertwine the fates of biodiversity conservation and human well-being. We provide the first evaluation of youth wildlife preferences in a low-income region of Central America and of how they rank species attributes for conservation.

Background

El Salvador is situated entirely within the Mesoamerican biodiversity hotspot, which hosts *c.* 7% of global biodiversity and where >300 of the region’s endemic species are threatened, including at least 100 critically endangered species (Myers et al. 2000, Mittermeier et al. 2011). Concurrently, El Salvador is the smallest (21 041 km²) and most densely populated (316 people/km²) country in the mainland Americas, with 42% of its population living in poverty (ECLAC 2016).

Bahía de Jiquilisco is located in the Department of Usulután on the south-central coast of El Salvador and is a National Conservation Area, RAMSAR wetland and UNESCO Biosphere Reserve (Fig. 1). High poverty levels are common to Bahía de Jiquilisco, with most households lacking potable water and waste collection services, discontinuing education at middle school level and earning US\$164 per month (ICAPO 2012). The exploitation of wild natural resources, such as fishing, mollusc extraction and sea turtle egg collection, is an important source of income for impoverished residents. Nearly 100% of sea turtle eggs are collected by local residents at Bahía de Jiquilisco as a livelihood resource and are sold either legally to local NGOs for protection in hatcheries or illegally to local markets for consumption (Vásquez et al. 2008). Because Salvadoran law prohibits the sale of sea turtle products for purposes other than conservation (República de El Salvador 2009), direct payments for conservation (flat rate = \$2.50 per dozen eggs) provide an alternative economic incentive to sale for consumption that complies with statutory requirements and thus have gained acceptance among coastal communities over the last decade.

Bahía de Jiquilisco hosts the most important remaining rookery of critically endangered hawksbill turtles (*Eretmochelys imbricata*) in the eastern Pacific Ocean. Fewer than 700 adult female hawksbills nest along 15 000 km of Latin American coastline, with 40% of all nesting activity occurring at Bahía de Jiquilisco (Gaos et al. 2017). Prior to 2007, so few hawksbills were encountered in the eastern Pacific that they were considered virtually extirpated in the region (Cornelius 1982, Seminoff et al. 2003). During 2007–2008, researchers identified three remaining hawksbill nesting sites in El Salvador (Vásquez & Liles 2008), which served as a catalyst point for renewed hope of hawksbill recovery in the eastern Pacific and facilitated the formation of the Eastern Pacific Hawksbill Initiative in 2008 (ICAPO in Spanish; Gaos et al. 2010).

ICAPO is formally established in El Salvador by a group of 25 sea turtle specialists from 8 countries in the eastern Pacific to promote the recovery of hawksbills in the region through sharing information, raising awareness, forming alliances, conducting

research and initiating conservation (ICAPO 2008). Since 2008, ICAPO in El Salvador has spearheaded locally driven research and conservation of hawksbills and their habitat, as well as developing and carrying out educational activities for youth in partnership with local schools at Bahía de Jiquilisco. Educational activities and materials largely emphasize natural history, species interactions and the importance of protecting terrestrial and marine environments.

Materials and methods

We hypothesized that youth would prefer native species or taxa to non-native species. We based our hypothesis on previous studies demonstrating that children establish relationships with animals through interaction (Kellert 2002, Aguirre & Orihuela 2010); native species – including aquatic species such as fish and crabs – play a central role in the lives of people living in less developed, rural areas on the coast (Shapiro et al. 2017). Second, we hypothesized that participants in ICAPO's environmental education activities would rank declining species and ecologically important species as more important than those who have not participated in ICAPO's activities. This hypothesis was grounded in ICAPO's activities focusing primarily on sea turtles, which serve as examples of species with rapidly declining populations, species that fulfil important ecological roles and species that have significant economic impacts. ICAPO's activities include Hawksbill Festival and Turtle Day in local schools, short presentations, hands-on activities and interactive games. Third, we hypothesized that boys would rank use for hunting or fishing as a more important attribute for conservation than girls. This hypothesis emerged from previous studies suggesting a gender-based divergence in views towards nature in adults, where males tend to perceive nature through a more economic, utilitarian and dominionistic lens (Kellert & Westervelt 1984, Stern et al. 1993), whereas females are more aware of the relationships found in nature and concerned with the consequences of humans' actions on the environment (Stern et al. 1993, Zelezny et al. 2000).

Sampling

In July 2016, we surveyed 128 youth between the ages of 7 and 20 years at the local schools (3rd–11th grade) of the five primary human settlements located within hawksbill nesting habitats (Fig. 1), which corresponds to c. 40% of all students aged 7–20 years who live in these areas: San Sebastián (n = 25; 28.4% of total), Cojoyón (n = 6; 20.0% of total), Rancho Viejo (n = 16; 41.0% of total), El Tular (n = 16; 37.2% of total) and La Pirraya (n = 65; 61.3% of total) (Fig. 1). The average distance between settlements was 5.4 km (SD = 2.89), with San Sebastián and Cojoyón nearest (0.6 km) and El Tular and Cojoyón farthest (9.9 km).

Prior to distributing the questionnaire, students were told the purpose of the study, that their participation was entirely voluntary, that they should not put their names on the questionnaire and that they could raise their hands with any questions. One questionnaire was given to each student, which they completed on an individual basis. All participating youth completed the questionnaire in under 30 minutes.

Within our dataset, the average age was 13 years (SD = 3.1; 7 years: n = 2; 8 years: n = 4; 9 years: n = 10; 10 years: n = 12; 11 years: n = 17; 12 years: n = 14; 13 years: n = 15; 14 years: n = 10; 15 years: n = 15; 16 years: n = 7; 17 years: n = 6; 18 years: n = 9; 19 years: n = 4; 20 years: n = 2), gender was balanced (55% female),

a third of students had captured wild animals to eat or sell (34%), nearly three-quarters of students had fishing experience (72%) and most students had participated in ICAPO's activities at least once (88%). This project was approved by the University of Texas at El Paso Institutional Review Board (IRB #1676085).

Questionnaire design

To measure youth wild animal preferences, we adapted and translated into Spanish questions from a survey by Shapiro et al. (2016) that asked students to rank species attributes based on their importance in prioritizing species conservation. Students were told that 'all animals that live in nature are wild animals' [underlining included in original], and were then asked, 'What are your five favourite kinds of wild animals in the world? Please put them in order with your most favourite first. If you don't know the name for five, then list as many as you can' [underlining included in original]. The second question asked, 'What are your five favourite kinds of wild animals that live in El Salvador? Remember to put your most favourite first. If you don't know the name for five then list as many as you can' [underlining included in original]. The third question asked, 'There are many things to think about when deciding which types of wild animals to protect and help first. Please place your ranking beside each kind of wild animal from 1 (should be protected first) to 5 (should be protected last)'. The five species attributes listed below this question were: wild animals that only occur in El Salvador; wild animals that people can hunt and fish for; wild animals whose numbers are going down fast; wild animals that I see around my home; and wild animals that are important in nature. The fourth question asked how many years the student had participated in ICAPO's activities including this year. We also asked each student four additional questions: (1) Have you ever captured wild animals to eat or sell? (2) Have you ever been fishing? (3) Are you a boy or a girl? (4) How old are you?

Analysis

For youth wildlife preferences, we assigned each species listed by students to 1 of 26 taxonomic categories. A single species received its own category if it occurred in at least 10% of surveys for favourite species overall and favourite species in El Salvador (Shapiro et al. 2017). For all other species, we used relevant taxonomic categories (e.g., amphibian). We assigned a score of '1' to each species listed by the child and '0' for all species not listed.

We formulated ordinal logistic regression models using five predictor variables (participation in ICAPO's activities, previous hunting experience, previous fishing experience, gender and age) to explain prioritization of the five species attributes (response variables: only occur in El Salvador, can hunt and fish for, numbers going down fast, see around the home and important in nature) by youth at Bahía de Jiquilisco. We evaluated the strength of association between each predictor variable and attribute prioritization by calculating the odds ratio. Odds ratios <1 and >1 indicate that a predictor is associated with lower and higher odds of an outcome, respectively. For odds ratios <1, we calculated their inverse proportion to facilitate interpretation. We used Nagelkerke R² values to assess the predictive capacity of the model to explain variation in the prioritization of species attributes.

Summary statistics are expressed as means ± 2 SE. We computed all analyses using *JMP Pro 12.0.0* (SAS Institute, Cary, NC, USA), with α levels of 0.10 and 0.05 where relevant.

Results

Youth preferences for species and taxonomic categories found in the world and in El Salvador were strongest for ‘other mammal’, lion and turtle, and for ‘other mammal’, bird and turtle, respectively (Fig. 2). Students showed little difference in preferences between overall favourite species and favourite Salvadoran species: wild aquatic species (20.3% vs 22.8%), wild terrestrial species (74.7% vs 69.6%) and domestic species (5.1% vs 7.6%), respectively. Greater differences emerged in preferences for mammals (61.7% world vs 40.9% El Salvador) and birds (13.3% world vs 22.7% El Salvador). For species and taxonomic groups found anywhere on Earth, youth listed species also native to El Salvador (64.2%) more than species from other places (35.8%), and turtle, parakeet and raccoon were the most commonly listed overall favourites from El Salvador, whereas lion, tiger and giraffe/elephant were the most common overall favourites not native to El Salvador (Fig. 2).

Rankings for prioritizing wildlife for conservation differed significantly among species attributes ($\chi^2 = 34.20$, $df = 4$, $p < 0.0001$), with students tending to rank rapid population decline as the most important attribute (mean rank = 2.47 ± 0.25 , where 1 was the most important and 5 was the least important), being able to hunt and fish for species as the second most important (2.73 ± 0.29) and other attributes as less important (Fig. 3). Ordinal logistic regression analyses demonstrated that participation in ICAPO’s environmental education activities and age were significant predictors of how youth prioritized endemism and rapid population decline (Table 1). Previous hunting experience, previous fishing experience and gender were not significant predictors of any attribute ranking. Youth who had not participated in ICAPO’s activities had 2.06 higher odds of prioritizing endemism than those that had participated, whereas youth who had participated in ICAPO’s activities had 1.76 higher odds of prioritizing rapid population decline than non-participants (Fig. 3). For each 1-year increase in age, youth had 1.11 lower odds of prioritizing endemism and had 1.18 higher odds of prioritizing population decline (Table 1).

Discussion

The tendency of youth in Bahía de Jiquilisco to list Salvadoran species most among favourite species matches our a priori hypothesis that they would prefer native species or taxa over non-native species, which was based on previous research that children establish relationships with animals through interaction and direct observation in daily life (Chawla 2007, Colléony et al. 2017). This can be particularly true in coastal areas with acute poverty, where employment opportunities are scarce and the livelihoods of impoverished residents invariably depend on natural resources from their local environment (Hutton & Leader-Williams 2003, UNEP 2014), including fish, birds, reptiles and mammals (González-Marín et al. 2017, Roldán-Clará et al. 2017, Vezina et al. 2020).

In many coastal communities in El Salvador, local residents consider sea turtle eggs to be an important economic resource, but their connection to turtles transcends a simple transactional relationship, which also is rooted in respect, appreciation and tradition (Liles et al. 2016). The fact that the youth in Bahía de Jiquilisco listed turtles among their favourite species may be indicative of this deeper connection. This is also consistent with other studies that demonstrate that people tend to show greater

Table 1. Ordinal logistic regression models for the ranking of five species attributes by youth in Bahía de Jiquilisco, El Salvador.

Variable	Only in El Salvador			Can hunt and fish for			Species attribute			See around the home			Important in nature		
	β	Wald (p-value)	OR (1/OR)	β	Wald (p-value)	OR (1/OR)	β	Wald (p-value)	OR (1/OR)	β	Wald (p-value)	OR (1/OR)	β	Wald (p-value)	OR (1/OR)
ICAPO (no)	0.72	5.46 (0.0195**)	2.06	-0.19	0.41 (0.5210)	0.83 (1.21)	-0.56	3.73 (0.0533*)	0.57 (1.76)	-0.03	0.01 (0.9232)	0.97 (1.03)	0.07	0.06 (0.8129)	1.07
Hunt (no)	0.19	0.93 (0.3338)	1.21	-0.20	0.97 (0.3239)	0.82 (1.22)	-0.09	0.21 (0.6497)	0.91 (1.10)	0.21	1.08 (0.2994)	1.24	-0.25	1.65 (0.1996)	0.78 (1.30)
Fish (no)	0.32	2.17 (0.1409)	1.38	-0.35	2.59 (0.1073)	0.70 (1.42)	0.08	0.14 (0.7052)	1.09	0.06	0.07 (0.7934)	1.06	0.14	0.46 (0.4979)	1.15
Gender (male)	0.03	0.02 (0.8837)	1.03	-0.23	1.32 (0.2505)	0.79 (1.26)	0.00	0.00 (0.9978)	1.00	0.31	2.29 (0.1303)	1.37	-0.02	0.01 (0.9233)	0.98 (1.02)
Age	-0.10	2.99 (0.0838*)	0.90 (1.11)	0.06	1.10 (0.2934)	1.07	0.16	6.58 (0.0103**)	1.18	-0.10	2.37 (0.1238)	0.91 (1.10)	0.03	0.24 (0.6277)	1.03
Full model															
n		102			103			102			103			103	
Wald		11.94			6.19			11.42			6.10			2.02	
P-value		0.0356**			0.2879			0.0437**			0.2969			0.8459	
R ²		0.1153			0.0614			0.1111			0.0607			0.0203	

* $p < 0.1$, ** $p < 0.05$. β = logistic regression coefficient; Wald = Wald statistic; OR = odds ratio; 1/OR = inverse of odds ratio <1; ICAPO = Eastern Pacific Hawksbill Initiative; R² = Nagelkerke R².

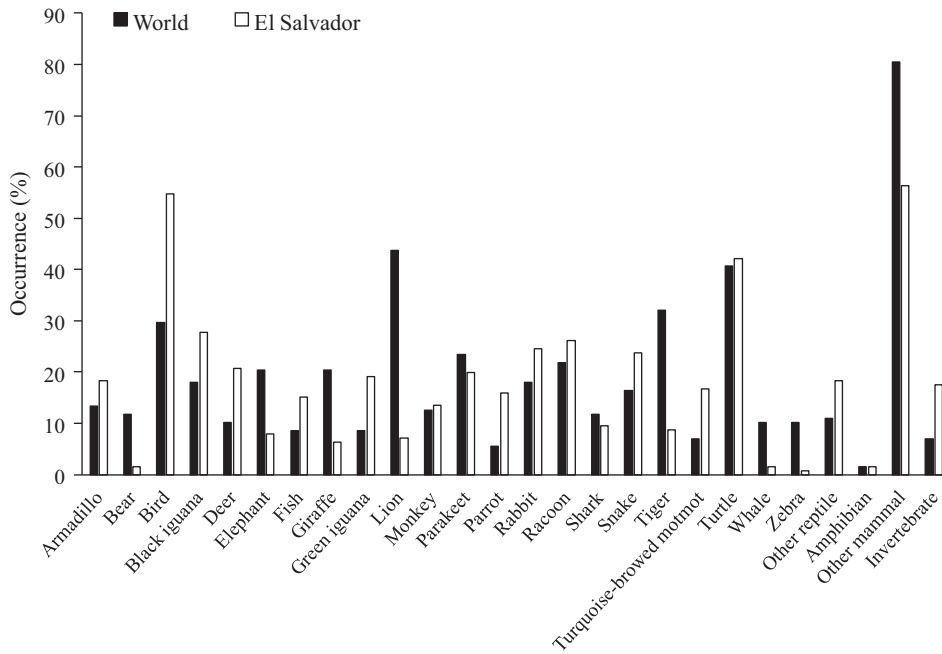


Fig. 2. Percentage occurrence of youth wildlife preferences for 26 taxonomic categories found in the world (black bars) and in El Salvador (white bars) at Bahía de Jiquilisco, El Salvador, 2016.

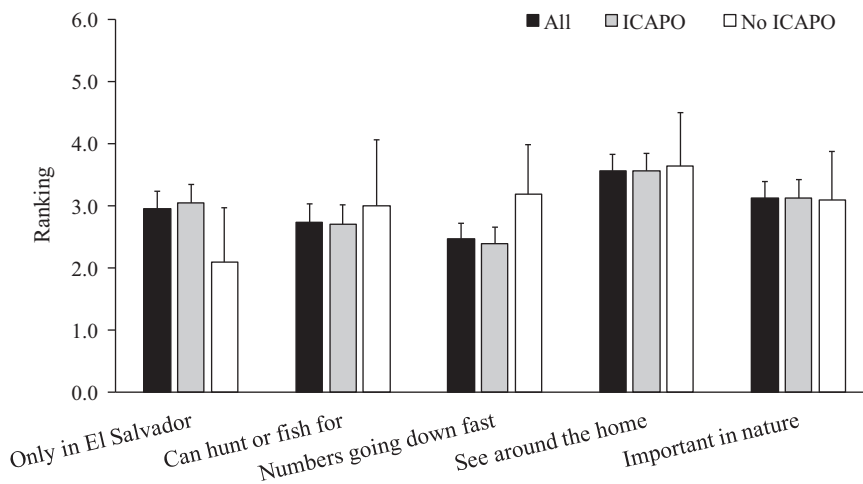


Fig. 3. Ranking of species attributes across all youth (black bars), youth that participated in the Eastern Pacific Hawksbill Initiative’s (ICAPO) environmental education activities (grey bars) and youth that never participated in ICAPO’s activities (white bars) at Bahía de Jiquilisco, El Salvador, 2016. Means \pm 2 SEs depicted. Ranking ranged from 1 = most important to 5 = least important.

affinity and affection for turtles and tortoises – contrary to negative attitudes towards reptiles generally, including crocodilians (Czech et al. 1998, Kaltenborn et al. 2006, Schlegel & Rupf 2010) – likely because they are common pets, not venomous and positively depicted in media (Woods 2000, Prokop & Tunnicliffe 2010). Similarly to turtles, youth preference for ‘other mammal’ and birds may also be influenced by experiences with common pets, such as dogs, cats and parrots, and how these animals are portrayed in the media (Dydzynski & Mäekivi 2018). Interestingly, however, fish ranked low on the list of youth preferences, despite their ubiquity and importance in daily activities at Bahía de Jiquilisco. We suspect that this may reflect, at least in part, a greater preference for affect-related characteristics, such as the charisma of an animal (Colléony et al. 2017).

The youth in Bahía de Jiquilisco listed turtles among their favourite species far more often than children and youth in areas with relatively large sea turtle populations, such as the Bahamas (Shapiro et al. 2017). This finding may be explained by the high percentage of our sample that participated in ICAPO’s activities,

whose programming focused on hawksbill turtle conservation, and supports other research that demonstrates pedagogical hands-on activities improve students’ knowledge and attitudes towards biodiversity, especially reptiles and amphibians (Ballouard et al. 2012, Sousa et al. 2016). As a charismatic, local species, turtles in this context likely fill two roles that have been linked to conservation support. Previous studies demonstrate that the use of charismatic species as flagships can effectively engender public support for wildlife conservation and that learning about locally relevant species can improve people’s knowledge, attitudes and behaviours towards wildlife (Veríssimo et al. 2014, Macdonald et al. 2015, Liordos et al. 2017).

The tendency for Bahía de Jiquilisco youth to prioritize species with declining populations and value for hunting and fishing highlights the potential value of direct payments for conservation. Specifically, hawksbill turtles are a critically endangered species that, at the same time, are highly coveted by impoverished local residents for the economic value of their eggs (Liles et al. 2015). The purchase of hawksbill eggs from local residents by

conservation programmes for protection simultaneously addresses Salvadoran youth's top-ranked attributes for protection: species in rapid decline and species used in hunting and fishing. This process benefits both humans and hawksbills, where local residents with few employment opportunities receive economic relief from the sale of hawkbill eggs for conservation, and the hatchlings produced from the eggs that are protected in hatcheries contribute to hawkbill population recovery. Undoubtedly, market-based approaches in conservation can be polarizing (e.g., Sandbrook et al. 2019). However, under certain circumstances, direct payments for conservation can be a socially just strategy that recognizes human need and can alter historically marginalized people's position in the conservation milieu. By selling turtle eggs for protection, these local residents become part of the conservation effort, which opens up possibilities that can transcend neoliberal economics and facilitate meaningful participation in conservation decision-making (Liles et al. 2015).

Youth who participated in ICAPO's educational activities ranked declining species as a more important species attribute compared to non-participants, which partly supported our hypothesis that participants would rank declining species and ecologically important species as more important than those who had not participated. Prioritization of population decline by youth is likely indicative of the programme's focus on the critically endangered hawkbill turtle. Experiential learning with wildlife has been shown to enhance environmental awareness among participants, which can subsequently carry over into their attitudes and actions (Reynolds et al. 2018).

Contrary to our expectation, however, the odds of youth prioritizing ecologically important species were not significantly higher for youth that had participated in ICAPO's activities than those that had not participated (Table 1). This finding could be attributed to the frequency with which youth participated in environmental education activities. For example, Sharp (2010) found significant differences between first-time and repeat visitors to a US National Park in their attitudes towards invasive species, where repeat visitors who were exposed to multiple interpretive programmes and several interactions with park rangers showed greater support than first-time visitors for the need to control some wildlife in order to help conserve the natural ecosystem. Because repeated exposure to unfamiliar or complex environmental concepts can foster improved understanding in children (White et al. 2018) and adults (Cox & Gaston 2015), increasing the frequency and length of ICAPO's environmental education activities could enhance youth understanding of, and attitudes towards, species that are ecologically important (Chawla & Cushing 2007).

Regional gender-based family roles may explain why we did not detect relationships between gender and conservation importance attributed to hunted and fished species. This was not consistent with our hypothesis that boys would rank use for hunting or fishing as a more important attribute for conservation than girls, nor with previous findings in other regions where adult males exhibited more dominionistic and utilitarian views towards wildlife than females (Kellert & Berry 1987, Vaske et al. 2011). Because women and girls are socialized from an early age to be caretakers of the family in areas where hunting and fishing is a utilitarian livelihood strategy, such as in Bahía de Jiquilisco, it is possible that gender-based roles in the family contributed to girls in this study ascribing greater conservation importance to hunted and fished species than was the case in other studies where boys valued those species more than girls (Shapiro et al. 2016, 2017). This may be particularly true because collecting sea turtle eggs, trapping crabs and extracting

molluscs may relate more to familial food provisioning than other forms of paid labour (Magalhães et al. 2007, Carney 2017, Aye et al. 2019). Additional research into the factors that influence gender-based differences in youth wildlife value orientations could address related hypotheses. For instance, in high-income regions, where most similar research occurs, gender socialization related to wildlife may be driven more by electronic media and books emphasizing aesthetic and humanistic orientations towards wildlife, whereas in regions with subsistence livelihoods, the exigencies of surviving may emphasize a utilitarian valuation of wildlife, even among children.

The tendency for younger individuals to prioritize endemism could be attributed to a place-based connection to the world, cultivated by daily interactions with their surroundings and the endemic species that inhabit them (Shapiro et al. 2016). Older youth giving higher priority to the protection of species in rapid decline is consistent with previous studies that suggest age is positively correlated with environmental knowledge and pro-environmental attitudes among youth (Kellert & Westervelt 1984, Kahn 1999, Casaló & Escario 2018). Because the over-utilization of wildlife species for subsistence has contributed to the decline of some populations in Bahía de Jiquilisco, including fish, iguanas and sea turtles, children may increasingly prioritize declining species as they get older and will be increasingly able to link declining species abundance to declining yields and utilization. Indeed, in 2012, ICAPO initiated a conservation tourism programme focused on increasing the non-extractive value of wildlife by training and employing local youth as tour guides and population monitoring assistants. For these reasons, environmental education may be a critical tool to help current and future generations of coastal communities understand that species conservation is directly tied to their livelihoods.

Because people's attitudes towards species often differ regionally and based on personal experience (Macdonald et al. 2015), additional research would benefit from sampling youth from different age groups and across gradients of urbanization and socio-economic status in multiple countries. Understanding youth preferences may facilitate more effective harmonization of priorities for wildlife conservation and improved human well-being, which can be essential to protecting species in biodiversity hotspots of low-income regions (Hutton & Leader-Williams 2003, Sodhi et al. 2006, Green et al. 2018). Whereas ideological biases among adults can hinder the effectiveness of education efforts (Stevenson et al. 2014), environmental education may successfully promote the increased prioritization of imperilled species among youth.

Acknowledgements. We thank the directors, teachers and students from local schools who participated in the study. We are grateful to Sofia Chavarría, Melissa Valle, Ani Henríquez, Neftaly Sánchez, Iris Chavarría, Mauricio Bolaños, Cesar Linares, Mauricio Melara and Carlos Vallecamos for assistance with facilitating and conducting the surveys.

Financial support. None.

Conflict of interest. None.

Ethical standards. None.

References

- Aguirre V, Orihuela A (2010) Assessment of the impact of an animal welfare educational course with first grade children in rural schools in the state of Morelos, Mexico. *Early Childhood Education Journal* 38: 27–31.

- Aye WN, Wen Y, Marin K, Thapa S, Tun AW (2019) Contribution of mangrove forest to the livelihood of local communities in Ayeyarwaddy Region, Myanmar. *Forests* 10: 414.
- Ballouard J, Brischox F, Bonnet X (2011) Children prioritize virtual exotic biodiversity over local biodiversity. *PLoS ONE* 6: e23152.
- Ballouard J, Provost G, Barré D, Bonnet X (2012) Influence of a field trip on the attitude of schoolchildren toward unpopular organisms: an experience with snakes. *Journal of Herpetology* 46: 423–429.
- Bjerke T, Kaltenborn BP, Thrane C (2001) Sociodemographic correlates of fear-related attitudes toward the wolf (*Canis lupus lupus*). A survey in southeastern Norway. *Fauna Norvegica* 21: 25–33.
- Bottrill MC, Joseph LN, Carwardine J, Bode M, Cook C, Game ET, Grantham H et al. (2008) Is conservation triage just smart decision making? *Trends in Ecology & Evolution* 23: 649–654.
- Carney JA (2017) Shellfish collection in Senegambian mangroves: a female knowledge system in a priority conservation region. *Journal of Ethnobiology* 37: 440–457.
- Casaló LV, Escario J (2018) Heterogeneity in the association between environmental attitudes and pro-environmental behavior: a multilevel regression approach. *Journal of Cleaner Production* 175: 155–163.
- Chawla L (2007) Childhood experiences associated with care for the natural world. *Children, Youth and Environments* 17: 144–170.
- Chawla L, Cushing DF (2007) Education for strategic environmental behavior. *Environmental Education Research* 13: 437–452.
- Collen B (2015) Conservation prioritization in the context of uncertainty. *Animal Conservation* 18: 315–317.
- Colléony A, Clayton S, Couvet D, Saint Jalme M, Prévot A (2017) Human preferences for species conservation: animal charisma trumps endangered status. *Biological Conservation* 206: 263–269.
- Cornelius SE (1982) Status of sea turtles along the Pacific coast of Middle America. In: KA Bjørndal (ed.), *Biology and Conservation of Sea Turtles* (pp. 211–219). Washington, DC, USA: Smithsonian Institution Press.
- Cox DT, Gaston KJ (2015) Likeability of garden birds: importance of species knowledge and richness in connecting people to nature. *PLoS ONE* 10: e0141505.
- Crawford BA, Andrews KM (2016) Drivers' attitudes toward wildlife–vehicle collisions with reptiles and other taxa. *Animal Conservation* 19: 444–450.
- Czech B, Krausman PR, Borkhataria R (1998) Social construction, political power, and the allocation of benefits to endangered species. *Conservation Biology* 12: 1103–1112.
- Damerell P, Howe C, Milner-Gulland EJ (2013) Child-orientated environmental education influences adult knowledge and household behaviour. *Environmental Resource Letters* 8: 1–7.
- Drummond SP, Wilson KA, Meijaard E, Watts M, Dennis R, Christy L, Possingham HP (2010) Influence of a threatened-species focus on conservation planning. *Conservation Biology* 24: 441–449.
- Dydynski J, Mäekivi N (2018) Multisensory perception of cuteness in mascots and zoo animals. *International Journal of Marketing Semiotics* 6: 2–25.
- ECLAC (2016) *Statistical Yearbook for Latin America and the Caribbean, 2016*. Santiago, Chile: United Nations.
- Frew K, Peterson MN, Stevenson K (2017) Are we working to save the species our children want to protect? Evaluating species attribute preferences among children. *Oryx* 51: 455–463.
- Gaos AR, Abreu-Grobois FA, Alfaro-Shigueto J, Amorocho D, Arauz R, Baquero A et al. (2010) Signs of hope in the eastern Pacific: international collaboration reveals encouraging status for a severely depleted population of hawksbill turtles *Eretmochelys imbricata*. *Oryx* 44: 595–601.
- Gaos AR, Liles MJ, Gadea V, Peña de Niz A, Vallejo F, Darquea JJ et al. (2017) Living on the edge: hawksbill turtle nesting and conservation along the eastern Pacific Rim. *Latin American Journal of Aquatic Research* 45: 572–584.
- González-Marín RM, Moreno-Casasola P, Castro-Luna AA, Castillo A (2017) Regaining the traditional use of wildlife in wetlands on the coastal plain of Veracruz, Mexico: ensuring food security in the face of global climate change. *Regional Environmental Change* 17: 1343–1354.
- Green JMH, Fisher B, Green RE, Makero J, Platts PJ, Robert N et al. (2018) Local costs of conservation exceed those borne by the global majority. *Global Ecology Conservation* 14: e00385.
- Harrison RD, Sreekar R, Brodie JF, Brook S, Luskin M, O'Kelly H et al. (2016) Impacts of hunting on tropical forests in Southeast Asia. *Conservation Biology* 30: 972–981.
- Horner SM (2000) Embryo, not fossil: breathing life into public trust in wildlife. *Land and Water Law Review* 35: 23–75.
- Hutton JM, Leader-Williams N (2003) Sustainable use and incentive-driven conservation: realigning human and conservation interests. *Oryx* 37: 215–226.
- ICAPO (2008) *Proceedings from the First Workshop of the Hawksbill Turtle in the Eastern Pacific*. Los Cóbano, El Salvador: ICAPO.
- ICAPO (2012) *Socio-Economic Baseline of Hawksbill Egg Collectors in Bahía de Jiquilisco, El Salvador and Estero Padre Ramos, Nicaragua*. San Salvador, El Salvador: USAID.
- Isaac NJB, Turvey ST, Collen B, Waterman C, Baillie JEM (2007) Mammals on the EDGE: conservation priorities based on threat and phylogeny. *PLoS ONE* 2: e296.
- Kahn PH (1999) *The Human Relationship with Nature: Development and Culture*. Cambridge, MA, USA: MIT Press.
- Kaltenborn BP, Bjerke T, Nyahongo JW, Williams DR (2006) Animal preferences and acceptability of wildlife management actions around Serengeti National Park, Tanzania. *Biodiversity & Conservation* 15: 4633–4649.
- Karlsson J, Sjöström M (2007) Human attitudes towards wolves, a matter of distance. *Biological Conservation* 137: 610–616.
- Kellert SR (2002) Experiencing nature: affective, cognitive, and evaluative development in children. In: PH Kahn, SR Kellert (eds), *Children and Nature: Psychological, Socio-cultural and Evolutionary Investigations* (pp. 117–151). Cambridge, MA, USA: MIT Press.
- Kellert SR, Berry JK (1987) Attitudes, knowledge, and behaviors toward wildlife as affected by gender. *Wildlife Society Bulletin* 15: 363–371.
- Kellert SR, Westervelt MO (1984) Children's attitudes, knowledge and behaviors towards animals. *Children's Environments Quarterly* 1: 8–11.
- Larson LR, Castleberry SB, Green GT (2010) Effects of an environmental education program on the environmental orientations of children from different gender, age, and ethnic groups. *Journal of Park & Recreation Administration* 28: 95–113.
- Lawson DF, Stevenson KT, Peterson MN, Carrier SJ, Strnad RL, Seekamp E (2019) Children can foster climate change concern among their parents. *Nature Climate Change* 9: 458–462.
- Liles MJ, Chavarria S, Altamirano E, Yañez I, Urteaga J, Gaos AR (2016) Community construction through culturally rooted celebration: turtles all the way down. In: AM Feldpausch-Parker, H Bergea, TR Peterson, K Raitio (eds), *Environmental Communication and Community: Constructive and Deconstructive Dynamics of Social Transformation* (pp. 204–226). London, UK: Routledge.
- Liles MJ, Peterson MJ, Lincoln YS, Seminoff JA, Gaos AR, Peterson TR (2015) Connecting international conservation priorities with human wellbeing in low-income nations: lessons from hawksbill turtle conservation in El Salvador. *Local Environment* 20: 1383–1404.
- Liordos V, Kontsiotis VJ, Anastasiadou M, Karavasias E (2017) Effects of attitudes and demography on public support for endangered species conservation. *Science of the Total Environment* 595: 25–34.
- Lorimer J (2007) Nonhuman charisma. *Environment and Planning D* 25: 911–932.
- Macdonald EA, Burnham D, Hinks AE, Dickman AJ, Malhi Y, Macdonald DW (2015) Conservation inequality and the charismatic cat: *Felis felix*. *Global Ecology Conservation* 3: 851–866.
- Magalhães A, Marinho da Costa R, da Silva R, Carneiro Pereira LC (2007) The role of women in the mangrove crab (*Ucides cordatus*, Ocypodidae) production process in North Brazil (Amazon region, Pará). *Ecological Economics* 61: 559–565.
- Marris E (2007) Conservation priorities: what to let go. *Nature* 450: 152–155.
- Martín-López B, Montes C, Ramírez L, Benayas J (2009) What drives policy decision-making related to species conservation? *Biological Conservation* 142: 1370–1380.
- Maxwell SL, Fuller RA, Brooks TM, Watson JEM (2016) Biodiversity: the ravages of guns, nets and bulldozers. *Nature* 536: 143–145.
- McClenachan L, Cooper AB, Dulvy NK (2016) Rethinking trade-driven extinction risk in marine and terrestrial megafauna. *Current Biology* 26: 1640–1646.
- Meine C, Soulé M, Noss RF (2006) 'A mission-driven discipline': the growth of conservation biology. *Conservation Biology* 20: 631–651.



- Mittermeier RA, Turner WR, Larsen FW, Brooks TM, Gascon C (2011) Global biodiversity conservation: the critical role of hotspots. In: FE Zachos, JC Habel (eds), *Biodiversity Hotspots* (pp. 3–22). Berlin, Germany: Springer.
- Myers N, Mittermeier RA, Mittermeier CG, da Fonseca GAB, Kent J (2000) Biodiversity hotspots for conservation priorities. *Nature* 403: 853–858.
- Peterson MJ, Peterson MN, Peterson TR (2016) What makes wildlife wild? How identity may shape the public trust versus wildlife privatization debate. *Wildlife Society Bulletin* 40: 428–435.
- Pimm SL, Jenkins CN, Abell R, Brooks TM, Gittleman JL, Joppa LN et al. (2014) The biodiversity of species and their rates of extinction, distribution, and protection. *Science* 344: 1246752.
- Poloczanska ES, Brown CJ, Sydeman WJ, Kiessling W, Schoeman DS, Moore PJ et al. (2013) Global imprint of climate change on marine life. *Nature Climate Change* 3: 919–925.
- Prokop P, Tunnicliffe SD (2010) Effects of having pets at home on children's attitudes toward popular and unpopular animals. *Anthrozoös* 23: 21–35.
- Rakison DH (2009) Does women's greater fear of snakes and spiders originate in infancy? *Evolution and Human Behavior* 30: 438–444.
- República de El Salvador (2009) Veda total y permanente al aprovechamiento de huevos, carne, grasa, aceite, sangre, huesos, especímenes disecados, caparzones, fragmentos y productos elaborados de caparzones de todas las especies de tortugas marinas. In: *Diario Oficial No. 23. Tomo No. 382* [www document]. URL <https://www.diariooficial.gob.sv/diarios/do-2009/02-febrero/04-02-2009.pdf>
- Ressurreição A, Gibbons J, Kaiser M, Dentinho TP, Zarzycki T, Bentley C et al. (2012) Different cultures, different values: the role of cultural variation in public's WTP for marine species conservation. *Biological Conservation* 145: 148–159.
- Reynolds BR, Salamander T, Wilson TP (2018) A walk in the woods: changing student attitudes toward amphibians and reptiles. *Creative Education* 9: 182–191.
- Rodríguez JP, Rojas-Suárez F, Sharpe CJ (2004) Setting priorities for the conservation of Venezuela's threatened birds. *Oryx* 38: 373–382.
- Roldán-Clará B, López-Medellín X, Leyva C, Calderón de la Barca N, Espejel I (2017) Mexican birds use according to environmental officers. *Ethnobiology and Conservation* 6: 13.
- Sandbrook C, Fisher JA, Holmes G, Luque-Lora R, Keane A (2019) The global conservation movement is diverse but not divided. *Nature Sustainability* 2: 316–323.
- Sax JL (1969) The public trust doctrine in natural resource law: effective judicial intervention. *Michigan Law Review* 68: 471–566.
- Schlegel J, Rupf R (2010) Attitudes towards potential animal flagship species in nature conservation: a survey among students of different educational institutions. *Journal for Nature Conservation* 18: 278–290.
- Seminoff JA, Nichols WJ, Resendiz A, Brooks LB (2003) Occurrence of hawksbill turtles, *Eretmochelys imbricata* (Reptilia: Cheloniidae), near the Baja California peninsula, Mexico. *Pacific Science* 57: 9–16.
- Shapiro HG, Erickson KA, Peterson MN, Frew KN, Stevenson KT, Langerhans RB (2016) Which species to conserve: evaluating children's species-based conservation priorities. *Biodiversity & Conservation* 25: 539–553.
- Shapiro HG, Peterson MN, Stevenson KT, Frew KN, Langerhans RB (2017) Wildlife species preferences differ among children in continental and island locations. *Environmental Conservation* 44: 389–396.
- Sharp RL (2010) *The Effects of Two Educational Programs on Visitors' Knowledge of and Attitudes towards, and Support for Control of, Invasive Species on Cumberland Island National Seashore*. Doctoral dissertation, University of Georgia.
- Small E (2011) The new Noah's Ark: beautiful and useful species only. Part I. Biodiversity conservation issues and priorities. *Biodiversity* 12: 232–247.
- Smith CA (2011) The role of state wildlife professionals under the public trust doctrine. *Journal of Wildlife Management* 75: 1539–1543.
- Smith RJ, Veríssimo D, Leader-Williams N, Cowling RM, Knight AT (2009) Let the locals lead. *Nature* 462: 280–281.
- Sodhi NS, Brooks TM, Pin Koh L, Acciaioli G, Erb M, Khee-Jin Tan A et al. (2006) Biodiversity and human livelihood crises in the Malay Archipelago. *Conservation Biology* 20: 1811–1813.
- Sousa E, Quintino V, Palhas J, Rodrigues AM, Teixeira J (2016) Can environmental education actions change public attitudes? An example using the pond habitat and associated biodiversity. *PLoS ONE* 11: e0154440.
- Stern PC, Dietz T, Kalof L (1993) Value orientations, gender, and environmental concern. *Environment and Behavior* 25: 322–348.
- Stevenson KT, Peterson MN, Bondell HD, Moore SE, Carrier SJ (2014) Overcoming skepticism with education: interacting influences of worldview and climate change knowledge on perceived climate change risk among adolescents. *Climatic Change* 126: 293–304.
- Teel TL, Manfredo MJ (2010) Understanding the diversity of public interests in wildlife conservation. *Conservation Biology* 24: 128–139.
- Thomas CD, Cameron A, Green RE, Bakkenes M, Beaumont LJ, Collingham YC et al. (2004) Extinction risk from climate change. *Nature* 427: 145–148.
- Tilman D, Clark M, Williams DR, Kimmel K, Polasky S, Packer C (2017) Future threats to biodiversity and pathways to their prevention. *Nature* 546: 73–81.
- UNEP (2014) *The Importance of Mangroves to People: A Call to Action*. Nairobi, Kenya: United Nations Environment Programme.
- Valls A, Coll M, Christensen V (2015) Keystone species: toward an operational concept for marine biodiversity conservation. *Ecological Monographs* 85: 29–47.
- Vaske JJ, Jacobs MH, Sijtsma MTJ (2011) Wildlife value orientations and demographics in the Netherlands. *European Journal of Wildlife Research* 57: 1179–1187.
- Vásquez M, Liles MJ (2008) Estado actual de las tortugas marinas en El Salvador. *Mesoamericana* 12: 53–53.
- Vásquez M, Liles MJ, Lopez W, Mariona G, Segovia J (2008) *Sea Turtle Research and Conservation in El Salvador*. San Salvador, El Salvador: FUNZEL-ICMARES/UES.
- Veríssimo D, Fraser I, Girão W, Campos AA, Smith RJ, MacMillan DC (2014) Evaluating conservation flagships and flagship fleets. *Conservation Letters* 7: 263–270.
- Vezina BJ, Ranaivoson A, Razafimanahaka JH, Andriafidison D, Andrianirina H, Ahamady K et al. (2020) Understanding livelihoods for protected area management: insights from northern Madagascar. *Conservation and Society* 18: 327–339.
- Weiss EB (1990) Our rights and obligations to future generations for the environment. *American Journal of International Law* 84: 198–207.
- White RL, Eberstein K, Scott DM (2018) Birds in the playground: evaluating the effectiveness of an urban environmental education project in enhancing school children's awareness, knowledge and attitudes towards local wildlife. *PLoS ONE* 13: e0193993.
- Wilson KA, Law EA (2016) Ethics of conservation triage. *Frontiers in Ecology and Evolution* 4: 112.
- Woods B (2000) Beauty and the beast: preferences for animals in Australia. *Journal of Tourism Studies* 11: 25–35.
- Zelezny LC, Chua PP, Aldrich C (2000) New ways of thinking about environmentalism: elaborating on gender differences in environmentalism. *Journal of Social Issues* 56: 443–457.