Human-otter interactions in the Peruvian Amazon: perceptions and potential for conservation

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Declaration

I declare that the work undertaken and reported within this thesis is my own and has not been submitted in consideration of any other degree or award.

Signed……Date…….

“Everything we hear is an opinion, not a fact.

Everything we see is a perspective, not the truth”

Marcus Aurelius

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Abstract

Human expansion is damaging pristine habitats and causing losses to biodiversity; meanwhile some wildlife species are perceived negatively when they cause damage or loss to humans. My main objective was to obtain a better understanding of the interactions between people and giant otters, a top aquatic predator in Amazonia and an international flagship species for tourism. In Chapter 2, I explore perceptions and attitudes towards wildlife using structured interviews and focus groups to find out how the perceptions of giant otters as damagers of fishing nets compared with that caused by other aquatic species. People from three Peruvian Amazon communities, Pacaya-Samiria National Reserve (PSNR), Pucacuro National Reserve (PNR) and Maijuna-Kichwa Regional Conservation Area (MKRCA) all had different perceptions of otters; in PSNR people were more tolerant to the presence of giant otters. In PNR and MKRCA interviewees had highly negative perceptions of giant otters, even though fishing registers demonstrated that giant otters have few interactions with fishermen during fishing and rarely damage nets in comparison to other aquatic predators. Moreover, fish such as piranha, suckermouth catfish, and wolf fish, among others, broke nets at the same frequency as did aquatic predators. Short and long-term outcomes of 'single-hit' conservation education was evaluated for schoolchildren in two communities in Chapter 3. There was no difference between the attitudes of schoolchildren who participated in single-hit session in 2009 and those who did not, however, overall, all participants had significantly more positive attitudes to giant otters after a single hit session in 2014.

In Chapter 4, I investigate the relative appeal of giant otters for tourists compared to other species, using questionnaires with tourists in the Peruvian Amazon, to determine their suitability as a flagship species for tourism - a role they are widely assumed to fulfil. While giant otters did not emerge in the top five as important flagship species during the interviews, they do fulfil all the criteria for making an excellent flagship species and remain an attractive candidate for conservation marketing. Building local awareness and a positive relationship between local people and aquatic predators is necessary to ensure their survival. Giant otters are now almost universally present in Amazonia and are potentially easy to focus tourism around – they represent the perfect flagship to promote conservation campaigns and to slow the destruction and degradation of waterways in the Amazon – currently a pressing issue in the region.

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Recharte, M. (2015) 'Coexistence with aquatic predators in the Peruvian Amazon'. Wildlife Symposium: V Anniversary of Pucacuro National Reserve], IIAP. 29-30th October, Iquitos, Peru.

Recharte, M. (2015) 'Coexistence with aquatic predators in the Peruvian Amazon'. Universidad Cientifica del Peru. SPU Auditorium. 23rd November, Iquitos, Peru.

Recharte, M. (2015) 'Coexistence with aquatic predators in the Peruvian Amazon'. In collaboration with SERNANP-RNP and Management Committee from RNP], Local community of Intuto, Rio Tigre. 6th December, Intuto, Peru.

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Poster presentations

Bowler, M. and Recharte, M. (2014) Marine otters (*Lontra Felina*): ecology, threats and tourism in Paracas National Reserve, Peru. *XII IUCN OSG International Otter Congress, An Action Plan for the Future*. Universidade Federal do Rio de Janeiro – Fórum de Ciência & Cultura. 11-15th August, Rio de Janeiro, Brazil.

Ruck, L., Perez, P., Escobedo, A. and Recharte, M. (2014) Monitoring giant otters in a protected area divided into petroleum concessions, the Pucacuro National Reserve, Peru. *XII IUCN OSG International Otter Congress, An Action Plan for the Future.* Universidade Federal do Rio de Janeiro – Fórum de Ciência & Cultura. 11-15th August, Rio de Janeiro, Brazil.

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Publications during research

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Chapter 1: Introduction

Plate 1. Family group of giant otters in the Lago Preto Conservation Concession, Yavari River - Peru.

1.1 Theory of wildlife coexistence

The constant growth of human populations and accompanying economic activities (Nyhus 2016, Waters et al. 2016), modification of habitats through deforestation, degradation, and conversion of landscapes for agriculture (Distefano 2005, Thirgood et al. 2005) are leading us to share ever-decreasing areas of natural habitats and to have more wildlife encounters in urban and rural areas (Nyhus 2016). Even when wildlife is protected inside reserves, animals do not identify boundaries and are not restricted by the limits of a reserve, often moving freely in and out between protected areas and human landscapes. The home-ranges of animals inevitably overlap with areas used by people living close to natural protected areas, leading to high frequencies of encounters (Woodroffe and Ginsberg 1998, Distefano 2005, Carter and Linnell 2016). 'Human-wildlife interactions' may be positive, such as when people enjoy seeing animals, or negative, for example when wildlife causes damage to property or resources used by humans, and can vary in intensity and frequency (Nyhus 2016).

Animals that are perceived as problematic or having negative interactions with people include many taxa, from common small animals; e.g. rodents, birds (Distefano 2005), frogs in Western Ghats (Kanagavel et al. 2017), to large vertebrates like elephants (*Loxodonta* and *Elaphus*) in Africa and Asia (Distefano 2005), anubis baboons (*Papio anubis*) in Uganda (Hill 2000), and jaguars (*Panthera onca*) in South America (Cavalcanti et al. 2010, Marchini and Macdonald 2012). Such negative interactions have historically been discussed under the term 'Human-wildlife conflict' (Hill et al. 2017), and identified as such due to a perception of danger to human life, livelihood activities, well-being, food or property caused by animals (Nyhus 2016) with evident economic costs (Pooley et al. 2017) or indirect costs that are difficult to quantify (Nyhus 2016). However, the term 'Human-wildlife conflict' has been criticised for implying conscious antagonism on the part of the animals (Hill et al. 2017), when in fact any real 'conflict' is better described as one between different human groups (Marshall, White and Anke 2007). These situations have been labelled as 'Conservation conflicts' by Redpath et al. (2013), when people come up against conservation aims for species or habitats but see their own interests as more important than those of the conservation group. This 'conflict of interest' can have a great influence over

the management of habitats or species (Redpath et al. 2015a), often producing long-term disagreement between individuals or groups of actors (Madden 2004, Peterson et al. 2010, Madden and McQuinn 2014, Redpath et al. 2015b). Affected people, with the help of government and/or NGOs, often instigate the management of direct impacts due to wildlife, such as the removal of "problem" animals, fencing, deterrence from travel or habitats, which then creates a conservation issue where wildlife populations may be negatively impacted (Kansky and Knight 2014).

The term 'human-wildlife coexistence' has also been used in describing the conservation of species that interact negatively with humans (Madden 2004), but this term does not explicitly describe negative interactions between people and animals, and could be interpreted simply as humans and wildlife sharing a landscape. In practice, human-wildlife coexistence' has been most commonly used to describe solutions to conservation issues, or a desired outcome where there is potential for negative human-wildlife interactions. For example, Carter and Linnell (2016) defined human-wildlife coexistence as a '*co-adaptation between humans and carnivores to share landscapes where human interactions with carnivores are governed by effective institutions that ensure long-term carnivore population persistence, social legitimacy and tolerable level of risk*'. But if the word 'conflict' ignores the origins of animal behaviours, then 'co-adaptation' also suggests an unrealistic expectation for wildlife to adapt in a way that benefits humans, or no longer allows the natural behaviour of predators. Clearly, humans must bear the responsibility of any adaptation to risk to their livelihoods, and society must recognise any benefits of doing so.

Although the term 'human-wildlife conflict' is widely used in related literature (Hill et al, 2017), I do not use it in this thesis, referring to 'conflict' only when between humans. I use the terms 'human-wildlife interactions' or 'human-otter interactions' to describe the behavioural patterns involving humans and wild animals, and only refer to 'human-wildlife coexistence' in the sense described by Madden (2004) and Carter and Linnell (2016).

Achieving sustainable coexistence with wildlife is important because many large (over 20kg) terrestrial, marine and freshwater mammals are in dramatic decline in their natural habitats, most of them due negative interactions with people (Macdonald et al. 2013, Dirzo et al. 2014, Nyhus 2016). Some are already categorized as 'Critically endangered' by

IUCN, for example: Sumatran tiger (*Panthera tigris sumatrae*), Asian lion (*Panthera leo persica*) (Distefano 2005), West African chimpanzee (*Pan troglodytes verus*), orangutans (*Pongo* spp.) (Hockings and Humle 2009), Vaquita (*Phocoena sinus*) or extinct such as Yangtze river dolphin (*Lipotes vexillifer*) (Turvey 2010, Iriarte and Marmontel 2013). Furthermore, each species has a role in the ecosystem and the decline of their populations and extinction will have as yet unknown effects on the habitats that they disappear from (Macdonald et al. 2013). Several examples already exist in which the extirpation of large mammals and has led to rapid changes in forest structure and loss of habitat diversity (Wright et al. 2000, Peres and Palacios 2007, Galletti et al. 2013, Kurten, 2013, Poulsen et al. 2017, Ripple et al. 2012).

1.2 Compensation as mitigation

Several methods can be used to mitigate negative impacts by wildlife on people and their livelihoods. Animals may be culled or killed, legally or illegally, or natural barriers, fences, traps, guarding, or dogs may be used as deterrence from crop foraging (Marchini 2014, Nyhus 2016). Other solutions have been based on economic models, in which NGOs and/or local governments implement compensation for crop or livestock loss, insurance schemes, conservation payments for coexistence and revenue-sharing (Dickman et al. 2011). Compensation is a direct payment to farmers for the loss of livestock, crops, property, human mortality or human injury (Dickman et al. 2011). There have been attempts to use compensatory methods to mitigate negative human-wildlife interactions. 'The Predator Compensation Fund' implemented in Kenya in 2006 aimed to increase the populations African lions (*Panthera leo*), and 'Defenders of wildlife' payment for wolves (*Canis lupus*) taking livestock in Yellowstone (Dickman et al. 2011). However, often compensation fails to improve tolerance to wildlife. For example, for wolves in Wisconsin (Naughton-Treves et al. 2003) and African wild dog (*Lycon pictus*) in Africa (Gusset et al. 2009). Compensation systems have been criticised for a lack of sustainability, creating a constant drain on resources, and because they may not increase in tolerance towards wildlife, or help species conservation or poverty alleviation. There are also the 'moral hazards' of driving farmers to over-report losses (Dickman et al. 2011, Chen et al. 2013), fraudulent declaration, disincentives farmers to prevent damage (Hussain, 2000), or creating bad relationships with conservation when programs finish or when payment is not forthcoming after proven attacks. In addition, corruption from payers is also possible (Dickman et al. 2011), and

compensation could be subsidising and therefore promoting agriculture or herding in wild areas (Bulte and Rondeau, 2005).

Insurance schemes are mechanisms by which compensation is managed by local people and private NGOs or corporations. This method may include an annual premium payment that could be higher or lower for different farmers according to a risk analysis estimate and valuation of the property at risk, and may be supported by multiple stakeholders including the community itself through tourism revenues (Chen et al. 2013). This method has been successful for snow leopard (*Uncia uncia*) in Pakistan since 1998 within the 'Project snow leopard' (Hussain 2000, Rosen et al. 2012). However, insurance schemes also frequently fail due to a dependence on financial viability and good accounting, that can be affected by the general political and economy stability of the country (Hussain 2000). Corruption may prevent schemes such as this from succeeding, and in poorer areas people may not have the money to pay the premium price (Nyhus 2016). Revenue sharing, in which people affected by negative interactions with wildlife are compensated by activities that receive benefits from wildlife, is often dependent on tourism revenues or trophy hunting (Dickman et al. 2011). In a follow-up to 'Project snow leopard', researchers implemented a compensation project while using external funding to develop governance to empower the community, improve access to education, and build predator-proof corrals (Rosen et al. 2012). Similar examples of success have been reported in Kenya by Hazzah et al. (2014) where compensation and community participation in conservation improved tolerance and decreased killing of the African lion. These mechanisms may fail if benefits are too sparse to share among all stakeholders, or when a lack of good infrastructure for tourism hampers the activity. Furthermore, to be able to receive a payment, local people may need to have land tenure or property rights (Dickman et al. 2011), excluding the poorest people without proof of land tenure. Such mechanisms are also open to corruption or perceived inequality in the sharing of benefits (e.g. Campfire in Zimbabwe – Newark and Hough 2000; meat quotas in Tanzania- Gillingham and Lee 1999).

1.3 The value of wildlife

The value of wildlife can be defined in economic terms, or in wider terms that include people's belief systems, cultural biases and aesthetic preferences (Fulton et al.

1996). Although, changing the way people value wildlife in this sense can lead to changes in behaviour in favour of conservation outcomes via policy (Hermann 2013), non-economic values for are difficult to quantify and applying them in conservation is problematic (Bright et al. 2000). Furthermore, 'value' in this sense can be discussed less ambiguously in terms of peoples' perceptions, and the psychology of conservation. Here, I discuss the economic value of problematic wildlife species and how that impacts the way people respond to negative human-wildlife interactions. Conserving species that are both problematic and exploited may require multiple approaches. The interactions between opinions formed when species cause damage, and those resulting from the consumptive use of an animal are complex. People may hold positive attitudes towards animals that are useful to them, mitigating negative interactions, but leading to overexploitation (Hazzah et al. 2017).

1.3.1 Wild meat and problematic wildlife

Demand for bushmeat encourages unsustainable hunting (Ripple et al. 2016), and larger-bodied animals tend to be most affected (Macdonald et al. 2013). Some animals that forage for crops are also hunted for bushmeat in some areas. Chimpanzees (*Pan troglodytes*) and other primates are widely hunted for bushmeat in Africa (e.g. Democratic Republic of Congo; Hicks et al. 2010), but may be spared in Muslim areas where they are often considered human-like and inedible, or in other areas where people hold cultural taboos against killing them (Matsuzawa et al. 2011). However, in these areas, chimpanzees and other primates may become crop foragers and face persecution (Garriga et al. 2017) and are more likely to end up in bushmeat markets (Humle and Konate 2015). Freshwater caimans (*Melanusuchus niger* and *Caiman crocodilus)* cause damage to fisherman's nets, and are also used as bushmeat in Amazonia (Parry et al. 2014, Beltrao et al. 2017, Plate 2), where there is an established demand for them as food. Both caimans and Amazon river dolphin (*Inia geoffrensis*) meat, which is not generally consumed, are increasingly used as a bait to catch catfish (Siluriformes). Commercialization of catfish is very profitable for fishermen in Brazil, Peru and Colombia (Loch et al. 2009, Beltrao et al. 2017). It is therefore possible that the bushmeat trade, and use for bait, might mitigate negative attitudes, but consumption in this context does not produce a positive conservation outcome.

Plate 2. Spectacled caiman poached for meat in Yanayacu river, PSNR.

1.3.2 Trophy hunting and problematic wildlife

Trophy hunting associated with the illegal trade of body parts is drastically endangering large mammals such as elephants and rhinos (Nijman et al. 2010). The income from trophy hunting events can appear to be large. For example, customers have paid as much as US$ 24,488/hunt for a package to hunt African elephant (*Loxodonta africana*) in Tanzania (Lindsay et al. 2012), although the number of licences for such hunts is supposed to be limited so overall returns may be lower than those for non-consumptive viewing (e.g. African elephant tusks remain very highly prized; consumers in China were paying US$2,100/kg in 2014, although this fell in early 2017 to US$730 (Vigne and Martin 2017; Do et al. 2018). Due to the unsustainable hunting of leopards (*Panthera pardus*) as trophies in South Africa, the government banned trophy hunting of this species in 2016 (Jacobson et al. 2016). Leopard skins, canine teeth, and body parts are also used for traditional rituals in Africa (Jacobson et al. 2016). Overall, the illegal wildlife trade is 'big business with revenues between US$5 billion to US$20 billion per year (Rosen and Smith 2010), and many of the species involved are large mammals that sometimes also forage on crops, kill livestock or represent a threat to people. Trophy hunting often occurs in areas where game is reserved for the purpose of hunting, while trophy species are more likely to be persecuted as 'problematic' in places where they are not valued in this way. As such, problematic trophy species are less likely to find areas of refuge. Consequently, it appears that

populations and quality of trophy-hunted species are declining due the pressure of other threats such as illegal hunting, habitat change, and droughts (Muposhi et al. 2017).

1.3.3 Indirect economic benefits of wildlife

The extirpation of large mammals can have wider impacts on habitats and wildlife populations on a large scale, in phenomena known as trophic cascades (Wright et al. 2000, Peres and Palacios 2007, Galletti et al. 2013, Kurten, 2013, Poulsen et al. 2017, Ripple et al. 2012). The benefits of a well-functioning wetland habitat may also be important in terms of the ecosystem services to human populations. Wetlands can ensure clean water for towns and cities, and a sustainable source of protein from fish (Gardner et al. 2015). The importance of aquatic predators in freshwater ecosystems in initiating trophic cascades is not well understood in Amazonia, although they certainly impact populations of fish that in turn may predate or disperse seeds (Galetti et al. 2008). In the case of the giant otter, however, most Amazonian wetlands have been without this aquatic predator for fifty years (Recharte and Bodmer 2010), and it may be difficult to convince people in rural areas of any beneficial role of this species to ecosystems and ecosystem services. In any case, research would be required to establish these benefits and deliver science-based conservation information to a target audience.

1.4 Tourism as a benefit for local people in Amazonia

In South America, wildlife watching is a prominent component of a lucrative tourist industry, but determining the value of wildlife tourism is difficult. Ecotourism is worth an estimated US$ 210 billion per year to the Peruvian economy (Kirkby et al. 2010). However, most tourists go to Machu Picchu and the surrounding parts of Cuzco (Schaaf 2017). Wildlife tourism in the country is largely split between the coastal areas, especially the marine protected areas such as Paracas National Reserve, and tropical rainforest areas west of the Amazon. While many visitors to rainforest areas may come specifically for wildlife watching, or to experience the River Amazon or Amazon Rainforest itself, there are other significant draws for tourism in the region. In the Iquitos region, for example, there is a large and lucrative tourist industry developed around the hallucinogenic drug ‘ayahuasca’ extracted from rainforest vines and administered by a shaman (Prayag et al. 2015).

Wildlife is probably the biggest draw for tourism in Amazonia, but little research has been done on which animals are the most important to the industry. In chapter 4, I investigate the importance of giant otters and other species in influencing tourists' decisions to come to the Amazon region. Valuing this tourism on a regional level is also problematic. Tourism to the Tambopata River, a premium wildlife viewing area in the South of Peru, was estimated to be worth US$ 1158 ha^{-1} in 2005 (Kirby et al. 2010), and giant otters are often considered a key draw for this kind of tourism (Groenendijk and Hajek 2006). Many major lodges in the lowland forests make giant otter boat tours on lakes where protected, habituated otters are regularly seen (Kirkby et al. 2011). In the Iquitos region of Peru, otters may be used to market tourism (Recharte et al. 2015, Chapter 4), but until recently, they were rarely seen, and their importance to local tourism is unknown.

Even where tourism benefits occur, it has proven very difficult to link the benefits of tourism to actual conservation (Recharte et al. 2015). Eshoo et al. (2018) tested a new model in the Nam Et-Phou Louey National Protected Area (NPA) in Lao PDR, in which they gave direct payments from tourism to villagers to increase wildlife populations. They found that the payments did reduce hunting. These kinds of arrangements could be used in the Amazon, and might benefit all parties if wildlife viewing could be improved. However, it may be a hard sell for tourism companies to start paying for wildlife protection that is already written into law.

1.5 Defining conservation psychology for wildlife conservation

To mitigate negative interactions with wildlife, researchers have often focused on the ecological impacts of damage produced by the animals, rather than the social dimension of the problem (Redpath et al. 2015a). Ecological research and the data it provides serve as a necessary background to support arguments otherwise based on suppositions and opinions (Redpath et al. 2015c). Using an ecological approach, different reasons have been cited for negative human-wildlife interactions between people and predators, for example: lack of non-domesticated prey availability, individuals being old or injured, females caring for cubs, males occupying bigger home-ranges, and environmental factors forcing contact such as restricted water supply, severe floods or dry seasons (Nyhus 2016). Putting negative

interactions into the context of animals' ecology and behaviour may be a first step towards mitigating issues with animals perceived as 'problematic' (Hill 2017), but this approach has limitations in that it does little to address the human dimension of such interactions. The conservation of wildlife biodiversity is not the aim of all people (Redpath et al. 2015a), and social and individual factors such as attitudes, perceptions, culture, religion, all influence human behaviours for or against conservation outcomes (Manfredo and Dyer 2004, Ferguson and Bargh 2004, Jhamvar-Shingote and Schuett. 2013, Costa et al. 2013, Kansky et al. 2014, Hazzah et al. 2017). The human dimensions of wildlife interactions have been highlighted as the most important component in managing instances of negative human-wildlife interactions (Decker and Chase 1997, Dickman 2010, Redpath et al. 2013, Bennett et al. 2017). Psychology addresses the fundamentals of human behaviour; cognition, attitudes, motives, beliefs and others, exploring why people behave in certain way (Saunders 2003, Clayton et al. 2013). Although, psychology is generally more focused on relationships among people, it includes sub-disciplines related to the conservation of the natural world: Conservation psychology and Environmental psychology (Bennet et al. 2016).

Conservation Psychology has been defined as '*reciprocal relationships between humans and the rest of nature, promoting conservation of the natural world…*' (Saunders 2003 pp. 138), and complements conservation biology (Saunders 2003, Clayton 2012). Conservation biology aims to preserve biodiversity based on scientific understanding, but can fall short where it fails to change people's behaviour in appropriate ways. Persuading an individual to care for a collective natural resource is the challenge addressed more directly by conservation psychology (Schultz 2011, Clayton 2012). Environmental conservation appeared in the 1960s as a sub-discipline of psychology, and has an emphasis on the relationships between human behaviour and their environment (Saunders 2003, Schultz 2011, Clayton 2012). Environmental psychology tends to focus on how the use of space is perceived and influences people (Clayton 2012) while conservation psychology is more tuned into changing people's behaviour.

1.6 Using conservation psychology to understand behaviour

There is no consensus on the best way to achieve coexistence with wildlife (Bennet et al. 2017) and cases in which mitigation has led to effectual elimination of negative

interactions are rare (Redpath et al. 2013; but see snow leopards Jackson and Wangchuk 2004; urban leopards in Mumbai Bhatia et al. 2013; great apes Hockings and Humle 2009). Achieving conservation behaviour has been difficult because behaviour predictors such as attitudes, cultures and beliefs are not static (Decker and Chase 1997, Clayton 2012, Pooley et al. 2017). People living around protected areas, while often dealing with poverty (Dickman et al. 2011), also face restrictions on the use of natural resources implemented by park managers. They may see few benefits from living surrounded with wildlife, while animals that cause negative impacts to their livelihoods are protected (Redpath et al. 2015a). Although economic loss caused by negative interactions with wild animals could be the main trigger for negative perceptions and attitudes (Sillero-Zubiri and Laurenson 2001, Redpath et al. 2015a), reducing attacks by wildlife, for example, may not always improve negative attitudes, which are often also driven by other people's views, (Dickman et al. 2014), by culture or religion (Kansky et al. 2014), or by privilege and gender (Costa et al. 2017). Local issues such as land tenure, land planning, transport, access to health care and schools can all drive perceptions of vulnerability to wildlife, poverty and disempowerment (Hill et al.2017).

Methods used to promote human-wildlife coexistence have been based in policy enforcement, governance, distribution of benefits and environmental education (Baruch-Mordo et al. 2009, Bruskotter and Wilson 2014, Nyhus 2016). Law enforcement does not promote pro-environmental behaviour or improve tolerance (Nyhus 2016), but good governance tends to promote more participation of local people in decision-making, and may have more success in this regard (Gillingham and Lee 1999, 2003). However, positive attitudes in rural communities are often heavily influenced by people with power or status in the community, and can be affected by corruption (Totikidis et al. 2005, Nyhus 2016). Burskotter and Wilson (2014) report that people tend to be more tolerant if they receive information about ecological benefits and direct benefits from wildlife. Part of this thesis focuses on perceptions about wildlife and the nature of interactions between people living alongside wildlife in Amazonia (Chapter 2).

Environmental education is currently used globally as an effective method to improve knowledge, but is not always effective as a conservation tool by itself because it does not necessarily change behaviour (McKenzie-Mohr et al. 2011, Schultz 2011). While

people that feel more connected to nature may be more inclined to change their behaviour towards a 'problem species', we have almost no evidence that one–off environmental education programmes result in long-term behaviour change as opportunities for longitudinal assessment have been limited. In Chapter 3, I examine the consequences for long-term attitudes and behaviour change of an education programme for schoolchildren in rural areas.

1.7 Background, ecology and overexploitation of giant otters

Most studies on human-wildlife coexistence have focused on terrestrial mammals or marine species. Damage to fisheries by marine species in South America are poorly documented, but species involved are American sea lions (*Otaria flavecens,* Machado et al. 2015), Southern right whale (*Eubalaena australis*, Zappes et al. 2013, Pont et al. 2016), common bottlenose dolphin (*Tursiops truncatus*, Zappes et al. 2011) and marine otters (*Lutra felina*) (Pizarro 2008). Reports about freshwater aquatic species that have negative interactions with humans are few, and most commonly feature Amazon pink river dolphins (Da Silva and Best 1996, Loch et al. 2009, Alves et al. 2012, Zappes et al. 2013, Iriarte and Marmmontel 2013, Mintzer et al. 2013, Mintzer et al. 2015), Neotropical otters (*Lontra longicaudis*, Moreno 2008, Barbieri et al. 2012, Quintela et al. 2012, Castro et al. 2014, Pinheiro 2016) and giant otters (*Pteronura brasiliensis,* Gomez and Jorgenson 1999, Roopsind 2002, Recharte et al. 2008, Fonseca and Marmontel 2011, Rosas-Ribeiro et al. 2012, Michalski et al. 2012, Lassmar et al. 2013, Lima et al. 2014). Other species like grey dolphin (*Sotalia fluviatilis*) and caimans have also been associated with negative impacts on fishing activities (Peres and Carkeek 1993, Loch et al. 2009, Alves et al. 2012).

My study focuses on giant otters, which after facing extinction due to overexploitation for their valuable fur (Ojasti 1996), have been slowly recovering for the last two decades in Brazil (Lima et al. 2014, Tomas 2015), Peru (Recharte and Bodmer 2010, Groenendijk et al. 2014) and Bolivia (Zambrana 2007), although populations have not returned to their original distributions (Groenendijk et al. 2015). The rise in numbers of giant otters in areas where the species was previously extirpated has brought otters into contact with people who have grown up without this species. Many such people feel scared of the otters when they encounter them up close, especially when the otters are in a big

group and perform territorial behaviour and vocalizations. One young fisherman that had never seen a giant otter before thought it was a 'jungle demon' (*Personal communication* R. Bodmer 2005, Plate 3). Over the past 10 years, people have gradually become more used to seeing these animals once again in the lakes, streams and rivers where they fish, and now think that giant otters are competitors for fish and blame them for damaging the fishing nets (Recharte et al. 2015).

Plate 3. Fishermen using gillnet in Dorado lake, PSNR.

Giant otters are the second largest otters in the world after the sea otter (*Enhydra lutris*) (Kruuk 2006). First recorded by Zimmerman in 1780, subspecies were described by Gmelin in 1788: *P. b. brasiliensis* for the Amazonian, Orinoco and Guianas rivers system and *P. b. paranensis* for southern Brazil, Uruguay, Paraguay and north of Argentina (Ojasti 1996). Subspecies classifications are not used currently, but tests on mitochondrial DNA and microsatellites collected from giant otter faeces revealed the existence of four evolutionary distinct population units which map onto Pantanal, Itenez, Madre de Dios and Amazon-Orinoco-Guiana regions (Pickles et al. 2012).

In Peru, giant otters are called 'river wolves' because of their large size and cooperative hunting (Duplaix 1980, Kruuk 2006). They are gregarious and diurnal, and use slow flowing creeks and oxbow lakes. They live in family groups, made-up by a monogamous reproductive alpha pair and their descendants, which can number two to sixteen individuals (Groenendijk et al. 2014). They build 'campsites' consisting of a den and latrine on the edge of the river or lake bank (Duplaix 1980, Plate 4). They are territorial,

and mark their territory with scent from anal glands mixed with faeces in communal latrines. The borderlines of their territory do not change during high-water season even when they start using the flooded forest for fishing (Leuchtenberger and Mourão 2008). All members help to defend the territory but this behaviour is led by the dominant adult male that will perform snorting and 'periscoping' behaviour when he feels threatened (Duplaix 1980). Other activities, such as group movements, foraging trips, visit to scent markings sites are led by dominant female (Staib 2002 cited by Kruuk 2006, Carter and Rosas 1997, Duplaix 1980). Sexual maturation has been recorded at two years of age, at which age both males and females tend to disperse to form new groups (Duplaix 1980).

Plate 4. Giant otter leaving the den in Yanayacu river, PSNR

They have one litter per year consisting of one to five cubs (Groenendijk et al. 2014). Cubs are born blind and open their eyes after four weeks (Kruuk 2006), all individuals have a white patch neck-mark that works as a digital print because is unique for each individual (Duplaix 1980). Cubs are born between May to September, coinciding with the low level of river water according with the hydrological system of Amazonian rivers. The cubs will start swimming and fishing around three months old (Groenendijk et al. 2014). Cubs will start to be weaned after six months and reach the full adult size at the age of 10 months old (Duplaix 1980). Giant otters are typical cooperatively breeding carnivores (Lukas and Clutton-Brock 2012) with alloparental behaviour, in which the older siblings help to raise the young and occasionally stay in the den to look after the cubs while the other group members go fishing (Rosas et al. 2009). Fish caught are not shared with other sub-adults or adults in the group, but cubs are feed with fish by all the members of the group (Kruuk 2006).

The pelt trade for giant otters' skins lasted approximately 40 years between 1942 and 1985 when nearly 90% of their total population disappeared (Utreras and Jorgenson 2003). Pelts were exported to Europe (Germany, United Kingdom, Swiss) and the USA (Pacheco 1983). Furs were smooth and thick like velvet, dark brown colour and waterproof; characteristics that made it appreciated for waterproof coats overseas. Skins costs US$90 dollars in South America in 1970 (Ojasti 1996) only surpassed by jaguar skin (US$ 130). By the time it reached foreign countries, otter skin could cost five times more (Smith 1976). After 1973, Venezuela, Brazil, Ecuador, Peru and Colombia adopted protectionist laws that stopped local markets for otter pelts, and in 1973 the Convention on Trade in Endangered Species (CITES) listed giant otter on Appendix I – no international trade was allowed between signatories - which helped to discontinue the international export of pelts (Ojasti 1996). In 1982, the giant otter was included in the IUCN red list of threatened species and categorized as Vulnerable, upgraded to Endangered in 2000 (Groenendijk et al. 2015).

Giant otters are predominately piscivorous (Carter and Rosas 1997) and can eat approximately three to four kilograms of fish per day, equivalent to 10% of their total weight (Duplaix 1980, Carter et al. 1999), so it is not unexpected that river-dwelling people would see them as competitors for fish. Furthermore, when giant otters feel threatened they produce long-range screams. The sound is made by all the members of the group or the alpha male (Mumm and Knörnschild 2017), and local people see these as confrontational and are frightened by this behaviour. Since the recovery of giant otters in certain areas of Amazonia, people see them with greater frequency giving rise to negative perceptions among local people; negative perceptions have been reported in Colombia (Gomez and Jorgenson 1999), Peru (Recharte et al. 2008), Guyana (Roopsind 2002), and Brazil (Fonseca and Marmontel 2011, Rosas-Ribeiro et al. 2012, Michalski et al. 2012, Lassmar et al. 2013, Lima et al. 2014). Conversely, in areas where tourist visits occur, people were more likely to have more positive perceptions due the direct benefits from tourism (Roopsind 2002, Recharte et al. 2015).

1.8 Methods: general overview

In this research, I used a combination of quantitative and qualitative methods and analyses, an approach often called 'mixed-methods research'. Since qualitative and quantitative methods have different strengthens and weaknesses (Table 1), they complement each other (Creswell and Clark 2007, Newing 2010) allowing for triangulation between ideas or concepts that emerge separately through the different approaches. Mixed methods combine social and natural sciences (Newing 2010), and help to answer questions that are difficult to tease apart using a single approach (Creswell and Clark 2007). The inductive and deductive rational approaches help to give a general impression of the research question. Despite all these characteristics, using mixed methods has disadvantages too; sampling is time-consuming, it can be expensive to train researchers to be efficient in both quantitative and qualitative methods, and it is more expensive to collect both types of data. It is time-consuming to analyse both methods, and it can be difficult to infer and generalize when conflicting results emerge (Driscoll et al. 2007, Lieber 2009).

Table 1. Advantages and disadvantages of qualitative and quantitative methods used in this research.

Type	Methods	Strengths	Weaknesses
Qualitative	• Face to face Semi-structure interviews • Focus groups	• More flexible • Exploratory • Helps to develop hypothesis • Respondents can have specialists' knowledge • Valuable information and ideas could arise and be collected • Offer clarification for the meaning of	• Small sample size, not suitable for statistical analyses • Need train the interviewer to don't have bias with personal views • Unstructured nature of the data need more time to be analysed, especially with 'words' data • Due the small sample is difficult to validate the data and generalized

		the questions with prompts.	
Quantitative	• Questionnaires	• Data is numerical and can be quantified • Objective and more structured • Has a hypothesis to be tested • Large sample size, suitable for statistical models. • Can uncover patterns • Is generalizable and reliable	• Not flexible • Contemplate little understanding of people actions and their problems

References: Msuha 2009, Newing 2010.

Qualitative methods used here included: semi-structured interviews and focus groups (Newing 2010). I used semi-structured interviews that consisted of a conversation led by the interviewer on a topic. The researcher needs to arrange a meeting with the respondent beforehand and these require an interview guide focused on the research question (Newing 2010).

When interviews are used to assess wildlife-related damage, respondents tend to overestimate losses (Bernard 1994, Niskanen 2005 cited by Msuha 2009, Prinston et al. 2012), or may give unreliable responses. For this reason, I asked the park manager to recommend reliable key informants for interviews. In each community, I first talked with the head of the community and explained what the research was about, clarifying that it was for academic purposes and that data would be confidential. I also organized focus group meetings, to discuss damage cause by aquatic wildlife, using an interview guide similar to that used in the semi-structured interviews. People were organised into smaller groups to

facilitate discussions between participants, following this, participants were able to share their answers with the other groups. This was useful to triangulate with the outcomes of previous semi-structured interviews.

My quantitative methods are based on questionnaires with closed-ended and ranking questions. They were fixed, short and administrated in the same way to all the respondents (Newing 2010). To assess the weaknesses of questionnaires, piloting was crucial; I made sure questions were clear to respondents and I chose to do face to face questionnaires to avoid misunderstandings about questions. Here, my language skills and local identity were important for creating trust and open communication with respondents since a researcher can appear as a powerful "other", evoking responses that may be what the respondent thinks the interviewer "wants to hear" (Drury et al. 2011).

Participatory fishing registers (Chapter 2), kept by key informants were also included during the research to assess which animals were damaging fishing nets with the highest frequency. Participatory methods often take in to account people's specialist knowledge. For the purposes of the research I selected six fishermen in each of two communities who were trained to fill out a data sheet every time they went fishing. The participants in semi-structured interviews (Chapter 2) were one male and one female per household (see Table 2 for all sample sizes). Only people that were willing to participate were interviewed. Interviews with the schoolchildren (Chapter 3) were done in the classroom during school hours with the previous permission of the teacher and the head master. These interviews were conducted in Spanish.

Questionnaires presented to tourists (Chapter 4) were online and designed in a software specific to questionnaire administration and analysis ['Qualtrics' https://www.qualtrics.com/uk/] and were delivered in the administrative office of tourist lodges and rescue centre (Table 2).

Table 2. Summary of the methods used and sample sizes.

N° Chapter	Methods	Sample size
2	Semi-structured interviews	N=172 local people
	Fishing registers	N=278 fishing events (12 fishermen)
	Focus groups (two groups)	N= (31 local people; 8 park guards)
3	Questionnaires	N=437 tourists
4	Interview-based questionnaire	N=38 schoolchildren

The chapters of this thesis were designed as papers for publication in scientific journals. Methods in detail are therefore given in each chapter, repetition was unavoidable in certain parts of the chapters. Each chapter consists of introduction, methods, results, and discussion. References and appendices for all chapters are located at the end of the thesis.

1.9 Aims and thesis structure

Research into perceptions and attitudes to wildlife aims to understand the nature of interactions between people and animals and is a useful tool for future management of animals and of human-animal interactions (Majić and Bath 2010). Understanding peoples' views is key for practitioners and researchers aiming to facilitate coexistence between people and wildlife (Msuha 2009). I identified a need for research into community attitudes in the Peruvian Amazon to explore the nature and degree of interactions between people and wildlife that can have negative impacts on people livelihoods. In this case, the focus was on the threatened giant otters that fishermen blame for fish disturbance, reduction of fish populations, and net damage. Therefore, it was important to have a better understanding of interactions between local people and giant otters and to provide information about perceptions and attitudes in an economic, social and conservation context. Furthermore, I assessed whether attitudes towards giant otters could be influenced by environmental education among schoolchildren coexisting with otters. Since the giant otter is considered an international flagship species (Kruuk 2006, Tomas et al. 2015), I aimed to find out which

wildlife tourists would like to see in the Amazonian forest and how much they were willing to pay and donate to conservation for this experience.

The main aim of this thesis was to seek a more comprehensive and in-depth understanding of conservation issues involving giant otters - an international flagship species for tourism and top fish predator in the Peruvian Amazon. The thesis has three main components: a) Identifying perceptions and attitudes in relation to how local people coexist or interact with giant otters [Chapter 2], b) to see if negative views about giant otters can be improved with environmental education [Chapter 3] and c) to see if giant otters are really a draw for the tourism industry [Chapter 4].

In **Chapter 2**, I a) Examined perceptions and interactions between people and top aquatic fish predators considered problematic to people and particularly fishermen and b) Put the damage cause by giant otters to fisheries into context by comparison with other aquatic predators. I assessed perceptions, attitudes and compared these with the reality of net damage caused by top aquatic fish predators in the Peruvian Amazon. In **Chapter 3**, I examined short and long-term changes in attitudes towards giant otters after 'single-hit' conservation education with children attending two schools within communities inside the Pacaya-Samiria National Reserve. Specifically, I evaluated an education session that focused on giant otters and their conservation, using short interviews before and after the session to identify any impact of the session on children's knowledge and/or attitudes. In **Chapter 4**, I explored the relative importance of different animals for the tourism experience in the Peruvian Amazon, and assessed the popularity of different species in relation to a potential role as a flagship species. Although I did not assess the actual economic value of the species, I included 'Willingness to pay' and 'Willingness to donate for species conservation' as an attractiveness (rather than an economic) indicator. Finally, in **Chapter 5**, I summarised the major findings, discussed the implications of the results and made recommendations for the effective management of negative otter-wildlife interactions in Amazonia.

Chapter 2: Perceptions, attitudes and reality towards damage cause by top aquatic fish predators in the Peruvian Amazon

Plate 4. Giant otter group eating fish in the Lago Preto Conservation Concession, Yavari River.

Abstract

Human-wildlife interactions can be problematic and vary in frequency, intensity and hostility as human populations expand. In Amazonian Peru, communities are principally riparian, and fish provide an important source of dietary protein. Interactions with aquatic predators are therefore likely to be of high salience, especially to fishermen. I a) examined the potential for coexistence between people and top aquatic fish predators, and b) determined the extent to which giant otters actually cause damage to fisheries in comparison to the other aquatic predators. I explored perceptions and attitudes towards wildlife using structured interviews and focus groups. I interviewed 302 people between September 2014 to May 2017, in three areas of the Peruvian Amazon: 80 in PSNR, 172 in PNR and 50 in MKRCA. I also trained 12 fishermen to complete fishing registers to compare the perception of damage with actual events of damage in relation to negative interactions between people and aquatic predators in PSNR and PNR. Perception and attitudes towards aquatic predators varied between communities. Despite the dominance of farming as a livelihood in PNR, and the lesser importance of fishing compared to people from the other protected areas, respondents from PNR listed aquatic predators among the top 10 most damaging animals, while arboreal and terrestrial animals ranked lower. People in PSNR expressed more tolerance to interactions with aquatic predators. People from PNR and MKRCA have highly negative perceptions to giant otters but fishing registers demonstrated that this species causes few interactions during fishing, only very rarely damaging nets during these occasional encounters. Pink dolphins and caimans damaged the nets more than the otters. Furthermore, fish such as piranha, suckermouth catfish, wolf fish among others, broke nets in the same frequency as did aquatic predators. Negative perceptions lead to retaliation against giant otters and other aquatic predators, especially when animals were perceived as responsible for breaking nets.

Key words: Human-wildlife coexistence, aquatic predators, perception, attitudes, protected areas.

2.1 Introduction

2.1.1 The economic impact caused by aquatic top predators

Interactions between aquatic wildlife and a growing human population can lead to economic losses, negative perceptions towards wildlife, and persecution towards aquatic predators. Negative interactions between fish predators with people engaged in artisanal fishing is not novel; for instance, Cetaceans (*T. truncates* and *Delphinus delphis*) damage nets in the Balearic Islands and on the coast of south Galicia in Spain, causing economic loss to fishermen (Brotons et al. 2008, Goetz et al. 2013). River dolphins, *I. geoffrensis* and *S. fluviatilis*, in Brazil are considered competitors for fish resources and cause damage through accidental entanglement in fishing gear (Da Silva and Best 1996, Alves et al. 2012). Other top aquatic predators, like crocodiles, are attracted by fishing nets and lines and end up destroying fishing gear in Namibia costing about 71 500 nets per year (Aust et al. 2009). On the Zambezi River, fishing from a canoe is considered one of the most dangerous activities because of potential attack by crocodiles (Aust et al. 2009, Wallace et al. 2012). In Brazil, three species of caimans (*M. niger*, *C. crocodilus* and *C. yacare*) break the gill-nets of commercial fishermen and leave them unusable and reportedly occasionally cause injuries or deaths to people (Peres and Carkeek 1993, Zucco and Tomas 2004, Haddad and Fonseca 2011, De Campos et al. 2013).

While a variety of wildlife species cause damage and losses to humans and their economic activities around the world, the extent or financial value of the damage is not always quantified. While financial losses can be either real or perceived, losses will influence peoples' attitudes and their degree of tolerance depending on the perceived value of the damage (Blair et al. 1979). In Namibia, Wickens (1996) recorded that fish lost to Cape fur seals (*Arctocephalus pusillus pusillus*) can cost fisheries US$ 246,184. Damage to Northwestern Hawaiian Island bottomfish fisheries by dolphins (*T. truncatus)* and monk seals (*Monachus schauinslandi*) in 1993 was estimated to be US$ 1587 and US$ 267 per trip respectively, including lost and damaged fish and equipment loses, totaling $185,414 per year (Kobayashi and Kawamoto 1995). Gray seals (*Halichoerus grypus*) in Sweden are thought to produce losses of up to 50% of the catch value in salmon fisheries (Westerberg et al. 2008). However, losses to freshwater fish stocks caused by aquatic wildlife have rarely been reported in terms of economic value.

Often there is a gap between the perception of economic loss from negative interactions with wildlife, and the reality. This has been best studies in primates, where wide gaps between perception and actual loss have been recorded (Lee and Priston 2005), for example, baboons (*Papio anubis*) were considered the most problematic species around farms in Uganda but measurements of loss showed that the perceived loss was disproportionately high compared to more damaging goats (*Capra hircus*) (Webber and Hill 2014). Conversely, in some areas perceptions are more positive than actual damage might suggest. For example, Sulawesi macaques (*Macaca* spp.) are highly tolerated despite causing considerable damage to crops around some communities (Riley and Priston 2010).

Economic losses can lead to persecution of wildlife by fishermen, and persecution of predators is resulting in significant species loss [e.g. Asian lions and Sumatran tiger (Distefano 2005)]. When aquatic predators come into contact with human fishing activities, intentional and accidental killing can occur, due to entanglement in gillnets during fishing (e.g. caimans in Amazonia, Peres and Carkeek 1993; porpoises worldwide, Jefferson and Curry 1994; cetaceans in Peru, Mangel et al. 2010; crocodiles in Africa, Wallace et al. 2012; pink dolphins in Amazonia, Mintzer et al. 2013, Plate 6).

Plate 5. Pink dolphin found dead in Samiria river, PSNR.

2.1.2 Coexistence between humans and otters around the world

Negative human-otter interactions are very well reported in central Europe. The first instances of otter damage to fisheries were reported in 1980 in carp (*Ciprinus carpio*) farms

in Austria, (Bodner 1995), and in Thailand, the sympatric Indian smooth-coated otter (*Lutrogale perspicillata*) and Eurasian otter (*Lutra lutra*) damage fishermen's nets (Kruuk 1995). In Cambodia, the Indian smooth-coated otter and Hairy-nosed otter (*Lutra sumatrana*) are perceived as competitors by some rural people that rely on fishing for almost 100% of their income (Nop 2007). The local people in Nepal used trained dogs to chase otters in an attempt to prevent damage to fish populations (Kafle 2009). Spotted-necked otters (*Lutra maculicollis*) interact with fishermen in Rwanda taking 15% of fish from their nets and are therefore considered to be "pests" (Lejeune 1989, Lavière 2002). In Alaska, sea otters (*Enydra lutris*) pose significant competition to shellfish fishermen, but the intensity and the importance of this competition varies by area (Johnson 1982). Competition has been reported between marine otters (*Lontra felina*) and local people in small-scale fisheries on the Peruvian coast, where fishermen chase them with their boats and otters have been found killed by fishing equipment (Pizarro 2008). Marine otters may also be killed intentionally by fishermen because of perceived competition for fish and prawns (Chehebar 1990, Pizarro 2008). *L. longicaudis* has also been reported damaging fishing nets from artisan fishermen (Barbieri et al. 2012) and fish traps in Brazil (Castro et al. 2014).

2.1.3 Negative interaction with giant otters in Amazonia

The giant otter is protected by the IUCN, who still report overall declining populations, largely through the destruction of their habitats (Groenendijk et al. 2015). However, in the last two decades, populations of giant river otters have been recovering slowly on a number of rivers in Brazil (Lima et al. 2014a) and Peru (Groenendijk and Hajek 2006, Recharte and Bodmer 2010, Groenendijk et al. 2014) and interactions with people have become inevitable (Gomez and Jorgenson 1999, Recharte et al. 2008, Rosas-Ribeiro et al. 2012, Lima et al. 2014b). Fishermen perceive competition with giant river otters' due to overlap in the fish species consumed by otters and those taken by fishermen (Carter and Rosas 1997, Gomez and Jorgenson 1999). In addition, fishermen also blame giant otters for reduced catches of fish, and for damaging fishing nets (Lima et al. 2014b, Recharte et al. 2015). In Peru, giant otters were blamed for a perceived drop in populations of 'Arowana' (*Osteoglossum bicirrhosum*), a large ornamental fish, catches of which generate a major source of income for many households in and around the Pacaya-Samiria National Reserve (Recharte et al. 2008). Peruvian otters are also blamed for damage to fishing nets, and are feared by some people (Recharte et al. 2015). Some residents indicated a desire to cull giant

otter populations (Recharte et al. 2008), so it is suspected that some fishermen may kill giant otters if they have the opportunity, despite their protected status.

2.1.4 Protected areas in the Peruvian Amazon

In the Peruvian Amazon, protected areas play an important role in reducing deforestation (Miranda et al. 2016a), but the main objective of the creation of protected areas is promoting the conservation of biological diversity (Solano 2010): 17.5% of the total area of Peru is designated as protected area by the Peruvian government (SPDA 2015). The Peruvian Amazon represents 59% of the Peruvian national territory and 12 million hectares of the Peruvian Amazon are under legal protection (Chávez et al. 2005). A key objective of Peruvian department of the environment's SERNANP who manage protected areas in Peru is conserving the key vulnerable species within the areas, including the giant otter (SERNANP 2018). Since the giant otter is highlighted by SERNANP as a priority for the management of many Amazonian reserves, managers of protected areas are inclined to collaborate on projects initiated by NGOs and researchers that aim to research and the protect species, even when financial recourses are limited for other activities, sometimes favouring species conservation over landscape management oriented towards the sustainability of natural resources (Chávez et al. 2005).

During this research, I visited communities in three protected areas: a) PNR, b) PSNR and c) MKRCA (Figure 1). Giant otters were first recorded in the PNR in 2002 (Ruck et al. 2014). In 2013, park guards recorded 12 sightings, and it is estimated that 64km (approximately 28% of river) was occupied by the species (Ruck et al. 2014). However, sightings were concentrated near the mouth of the Pucacuro, at the confluence of the Rio Tigre, where the park guards concentrated their activities. In PSNR, the first published record of giant otters was in 2000, where Isola (2000) counted 59 individuals in three main channels: Yanayacu River, Canal Puinahua and Samiria River. Recently surveys recorded giant otters' sightings at a rate of 1.12 ind/km^2 in the Samiria River, interpreted as a healthy recovery of a population for which sightings were extremely rare ten years previously (Bodmer et al. 2014). Similarly, in the main channels of the Yanayacu and Pacaya Rivers in the same reserve, there have been frequent sightings of the species but no surveys to determine abundance or population density. The MKRCA is a communal reserve and is

relatively new. Giant otters are present on the Algodon River, but not at communities on the Napo River where I conducted surveys (Bravo et al. 2010).

This chapter aims to a) examine interactions between people and top aquatic fish predators considered problematic by people and particularly fishermen, and b) determine whether giant otters cause damage to fisheries in comparison to the other aquatic predators. By designing interviews about all large predators and fish-eaters, I avoided biasing opinions for or against otters, and allowed for a comparison of the relative importance of problems perceived with otters against those for other species. This approach also resulted in the assessment of human-wildlife interactions for a range of species.

2.2 Methods

2.2.1 Study areas

This research was completed in three protected areas (Figure 1), the PNR where family groups of giant otters were confirmed during wildlife monitoring by park guards (Ruck et al. 2014); the PSNR, which has a healthy recovering population (Bodmer et al. 2014), and the MKRCA, which only has rare sightings of the species in the north of the reserve, and where the species is absent on the Rio Napo (Bravo et al. 2010); communities in the MKRCA on the Napo were selected as control communities. The areas are located in the north eastern of Peruvian Amazon, in the political district of Loreto.

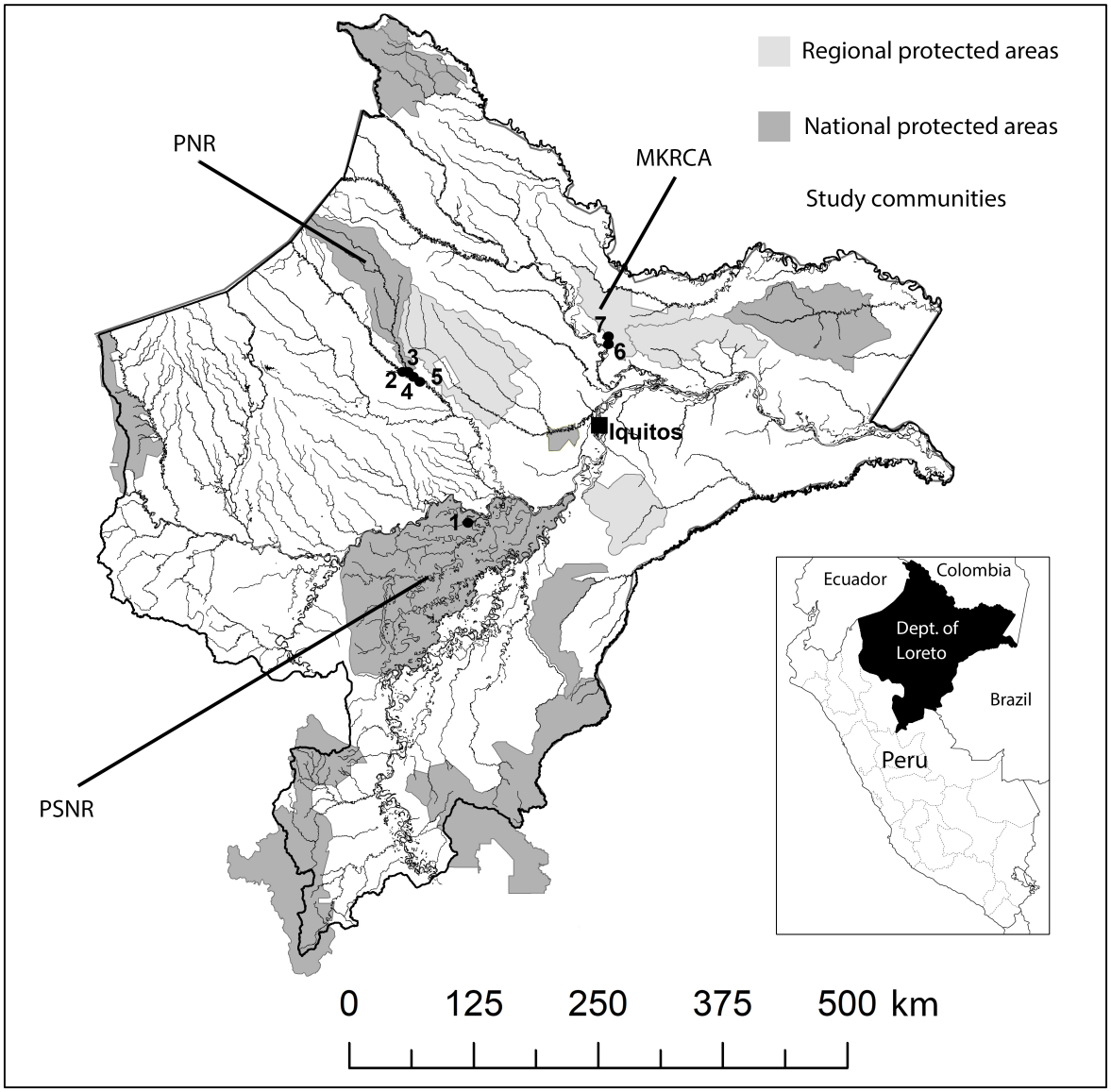


Figure 1. Location of communities visited in Pacaya-Samiria National Reserve (PSNR) [1. San Martin de Tipishca], Pucacuro National Reserve (PNR) [2. 28 de Julio, 3. Alfonso Ugarte, 4. Santa Elena, 5. Intuto], and the Maijuna Kichwa Regional Conservation Area (MKRCA) [6. Nueva Vida, 7. Puerto Huaman].

2.2.1.1 Pacaya-Samiria National Reserve

The PSNR is located between Marañon and Ucayali Rivers, two days in a commercial boat from Iquitos city, the main city in the Amazon region of Peru. This protected area was classified as a Reserved Zone in 1972 and upgraded to a National Reserve in 1982 (Plan Maestro PSNR 2009). It is one of the largest protected areas of the Peruvian Amazon and is a well-managed Freshwater Protected Area (Gomez-Salazar et al. 2012). It has an annual flood cycle that sees most of the reserve area underwater during peak of the high-water season (Takasaki et al. 2001). I visited the community of San Martin de

Tipishca (Plate 7) located on left side of Samiria River. Most of the residents are 'mestizo' mixed ethnic origin and belong to the linguistic family Kucama-Kucamilla (SERNANP 2009). People here have livelihoods based on agriculture, palm fruit extraction, managed hunting and fishing, and there are high levels of small-group tourism. The communities are highly involved in conservation activities following community-developed management plans assisted by NGOs dedicated to the conservation of biodiversity through sustainable development and SERNANP (government body that regulates protected areas in Peru).

Plate 6.View of San Martin de Tipishca community.

2.2.1.2 Pucacuro National Reserve

The PNR is located on the Tigre River, three days in a commercial boat from Iquitos. It was declared a Reserved Zone in 2005 and upgraded to a National Reserve in 2014. PNR was created to protect the Ecoregion Napo, one of the regions with the highest biodiversity in the world (Perez-Peña et al. 2014, Voss and Emmons 1996, Ridgely and Tudor 1989, SERNANP 2013). There are no communities inside the reserve, but eight communities are situated outside of the protected area, seven of which belong to the linguistic family Kichwa. Intuto (Plate 8) is the main harbour for the big boats from which most commercialized agricultural and forest products are taken to Iquitos. The main livelihood activities for the people here are farming and hunting, although fishing is a daily activity because fish one of the main sources of dietary protein. Several species of fish are commercially exploited including the ornamental fish, Arowana, several types of catfish

that sell locally for $1 USD per kilogram, and they also sell 'Pirarucu' (*Arapaima gigas*) fish for $3.25 USD per kilogram (Perez-Peña et al. 2014). The communities are relatively new to community-developed management and conservation initiated by SERNANP since the upgrade in status to National Reserve in 2014. The PNR has yet to develop tourism activities (Tanchiva 2014, *Personal comm.* SERNANP).

Plate 7. Intuto community road, PNR.

2.2.1.3 Maijuna-Kichwa Regional Conservation Area

The MKRCA is situated between the Napo River close to Iquitos, and the Algodon River close to the Colombian border on its northern side. It was proposed as a protected area in 2012 (Gilmore et al. 2013) and declared a Regional Conservation Area in 2015 (SPDA 2015). The area was created on part of the ancestral land of the indigenous Maijuna people and has an extensive area of primary forest (Gilmore et al. 2010, Horn et al. 2012). The area has upland and floodplain forest with important areas for palms (Aguaje: *Mauritia flexuosa* and Irapay: *Lepidocaryum tenue*) (Horn et al. 2012), with a diversity of mammals similar to other areas in the northern Peruvian Amazon (Bravo 2010). The main livelihood activities in the MKRCA are hunting, fishing, swidden-fallow agriculture and the collection of forest products like palm fruits (Gilmore et al. 2013). Three of four communities close to the

MKRCA are Maijuna native communities: San Pablo de Totoya (Algodon River), Nueva Vida and Puerto Huaman (Yanayacu River) and Sucusari (Sucusari River, Plate 9) (Gilmore et al. 2010, Horn et al. 2012). Each community holds the land title for the area surrounding their community (Gilmore et al. 2013). The community of Sucusari is located close to Explorama tourist lodge and receives occasional tourist visits, while Nueva Vida y Puerto Huaman does not have visits from tourists. Although the presence of giant otter has been recorded on the Algodon and Algodoncillo Rivers (Bravo et al. 2010), population densities are unknown in this area, and sightings are rare close to the communities, while giant otters have not been seen in recent years in communities on the lower Napo River (Gilmore 2017, *Personal communication*).

Plate 8. Sucusari community in Napo river, outside of MKRCA.

Table 3. Characteristics of the three study areas and methods used in each area.

Attributes	PSNR	PNR	MKRCA
Year of establishment as reserve zone	1972	2005	2015
Area (ha)	2 080 000	637 953	391 039

Presence of tourism	Yes	No	No
Main river	Marañon	Tigre	Napo
Ethnicity	Kucama-Kucamilla	Kichwa	Maijuna-Kichwa
Study villages for interviews	San Martin de Tipishca	28 de Julio, Alfonso Ugarte, Intuto, Santa Elena	Nueva Vida, Puerto Huaman
Presence of giant otters	Yes	Yes	No
Location of the communities	Inside	Outside	Outside
Interviews	Yes	Yes	Yes
Fishing registers	Yes	Yes	No
Focus groups	No	Yes	No

Source (SERNANP 2009, SERNANP 2013, Gilmore et al. 2010).

2.2.2 Data collection and analysis

I collected data from the three study areas during September 2014 to May 2017. I visited several communities outside PNR: 28 de Julio, Alfonso Ugarte, Santa Elena and Intuto. Outside of MKRCA, I visited two communities Nueva Vida and Puerto Huaman. In PSNR, I interviewed people from San Martin de Tipishca (Table 3). Interviewees in PNR were selected from a list of 'Hunting registers' comprising people that collaborate with the reserve by collecting data on the animals that they hunt inside the reserve. In PSNR and MKRCA, I asked the head of the community to identify key informants for the information required in the interviews. I had the help of park guards to meet representatives of each community to ask for permission to carry out research in the communities. When I approached a potential interviewee, before fixing a date according to their availability, I explained about the research, who I was and the objective of the interview. Prior the interview, I asked their consent to collaborate with the study and I got a signed consent form when possible. In each community, I interviewed two representative adults per household

(over 18 years old) who were willing to participate. One male and one female were selected to compare gender variation in perception and attitudes. In addition to the list of 'hunting registers' and key informants I also used a 'snowball' method (Bernard 2006) to find additional interviewees. I tried to ensure that all interviewees were isolated from other members of the house during the interview to avoid interference, but on some occasions, people stayed around to listen the interview but did not interfere in the answers or participate in further interviews. Ethical permission for questionnaires and interviews was given by the University of Stirling Psychology Ethics Committee.

Information about main livelihood or economic activities for respondents was coded and classified into five categories (Figure 2): responses related to the collection of palm fruits or other parts of palms, farming, production of fariña (yucca flour) were included in 'Farming', 'Paid job' included answers such as teacher, working for the municipality, nurse, park guard, while 'Others' included keeping a shop, selling food, carpentry, mechanic, employment on boat transport and painting. The main categories of economic activity were then ranked according to their frequency of occurrence in each site. I used the mean rank of the Weighted Rank Index (WRI) to standardized these responses; the index was calculated separately for open-ended questions and closed questions (Nepal and Weber 1993, Gillingham and Lee 2003), where:

WRI=$\sum_{i}^{n}(\frac{1}{R_i})/N$ correspond to:

n= number of respondents ranking species

R_i= rank of the *ith* order

N= total number of respondents in the sample

2.2.2.1 Perception and attitudes

I used a face-to-face survey and a semi-structured interview (Plate 10) with close-ended and open-ended answers. I asked respondents about 1) their socio-demographic background; 2) their perception of common large wildlife species including terrestrial and aquatic species, where I included 22 pictures of animals; 3) their perception (liked or disliked) of aquatic predators; 4) I asked about attitudes towards the aquatic predators.

Perception was defined as '*the way an individual observes, understands, interprets, and evaluates a referent object, action, experience, individual, policy, or outcome'* (Bennet 2016: page 585). Attitude was defined as '*disposition, tendency or respond with some degree of favour or not to a psychological object'* (Kansky et al. 2014: page 925). The full questionnaire is shown in Appendix B. Interviews were conducted in Spanish, without translation until coding for analysis.

To compare perceptions of the most disliked animals in the three study areas, participants ranked animals from 22 photos: terrestrial (n=8), arboreal (n=7) and aquatic (n=7) to determine the relative importance of aquatic mammals to other species. Afterwards, I asked them to rank the species that "*steals most fish*" and "*damages nets most*" from six aquatic predators and a control species; the vegetarian capybara (*H. hydrochaeris*). I calculated WRI as the mean score of responses of species rankings so as to compare answers across animals in each community. I also asked about the perception of the relative cost of repairing broken fishing nets attributed to each animal species; all the answers were converted to American dollars ($) (Appendix B).

Plate 9. Interview to parkguard from the community of 28 of Julio, PNR.

Perception, attitudes and tolerance towards giant otters were compared in the three areas using the percentage of answers of the interviewees in the three areas (Table 4).

Descriptive statistics were calculated using Statistical Package for Social Science (SPSS IBM corp.) version 21.0 for Windows. To compare attitudes, I asked the questions: a) Should all animals that break nets be killed? b) Did you ever kill or try to hunt giant otter? And c) Is it legal to kill/hunt giant otter? Answers were coded as Negative =0, Positive=1, people that did not answer or said, 'I don't know' were coded as 'Negative' because a lack of a clear response can imply negative attitudes that the respondents are unwilling to articulate (Newmark et al. 1993). Since the interpretation of neutral responses as negative is not validated in this research environment, responses categorisation used here can be considered 'positive' and 'non-positive'. However, I retain the language used by Newmark et al. (1993) for clarity. I report the sample size of people who abstained or answered neutrally in Appendix C.

Table 4. Perception and attitude questions.

Variables	**Questions**
Perceptions	I like to have giant otters living close to my community
	I am scared of giant otters
	The only way to have more fish is if all the giant otters disappear from the area
	There are more giant otters now than ten years ago
	There are a lot of fish in the river for the giant otter and for us
Attitudes	All the animals that break the nets should be killed
	Did you kill or try to hunt giant otter?
	Is it legal to kill/hunt giant otter?

To determine if socio-demographic factors were associated with attitudes, I used 1) gender, 2) location and 3) educational level as explanatory variables and I used a Generalized Linear Model [GLZM(b)] with logit link function (Binomial logistic

regression) to assess which factors were associated with overall attitude scores. From the three attitudes answers the modal score was used in the GLZM(b) model. I use Pearson χ^2 to look for over-dispersion. Wald χ^2 was used to estimate the significance of each factor. Values $p \leq 0.05$ were considered as significant. Because the data were categorical, the assumptions of multicollinearity are violated. I did not test for interactions between the variables because the sample was small and the model was not robust enough for valid assessment of interactions (Table 5).

Table 5. Explanatory variables for Binomial regression using GLZM(b).

Question	**Variables**	**Score**	**Response**	**Reference**
All interviewees, Attitudes		1=Positive, 0=Negative	Negative attitude	Highest value
	Gender	0=Male 1=Female		Highest value
	Location	1=PSNR 2=PNR 3=MKRCA		Highest value
	Education	0=No attendance 1=Primary 2=Upper primary		Highest value

2.2.2.2 Focus groups and coding

After the interviews, to gain detailed contextual information about perception and attitudes to aquatic predators, two focus group meetings were conducted outside PNR. First, with the help of two research assistants I elaborated a discussion plan of the themes related to the interviews; in this thesis I focus on three attitudinal questions: 1) From the seven animal pictures, choose which animal breaks the net with the highest frequency, and what you will do if you encounter this animal damaging nets or taking fish; 2) Your friends told you that there is a group of giant otters in a lake, would you go fishing in that lake, Why?; 3) You go fishing on a lake and there are no fish, when you start picking up your net, you see a group of otters, What you will do and why? (Appendix D).

I held one meeting in the community of Santa Elena (N=54 households) (Plate 11). An invitation letter was sent to each house in the community, and 31 people participated, 11 women and 20 men. Participants, all of whom had basic literacy skills, were divided in six groups, two groups of women and four groups of men. The second meeting was with the park guards of PNR in SERNANP office located in Intuto community, park guards belong to the communities around Pucacuro reserve and only two park guards were from Iquitos. Eight participants were divided in two groups, all men. The meetings lasted about three hours, in two parts. Before the break, all the groups chose a coordinator, and everyone was given markers and pieces of cardboard to write the answers, after the break the coordinator of each group presented the responses of each participant in their group, a picture of all participants was taken and a copy of the picture sent to each of them one month later.

The information captured during the meetings was manually coded into themes to look for patterns and relationships between answers and respondents. I used Nvivo 11 Pro-edition to visualize patterns in the responses, links between codes, and the main points that respondents were making (Joffe 2012). First, I coded each response into the following categories: a) Perception of the most disliked animal, b) Perception of aquatic animals that causes damage, c) Perception of the animal that breaks the nets with highest frequency, and d) Perception and attitudes towards giant otters. Nvivo was used to separate ‘units of observation’ on this occasion ‘individuals’. The coding was grouped by themes that emerge in the answers also defined as nodes [e.g. animals, type of damage]. I used Mind map to visualize the distribution of the nodes. When the nodes were created from the interviews, answers were coded and located in the ‘nodes’ related to the theme mentioned by the respondent, I used a Project Map to create graphics to visualize the results from the thematic analysis, and perceptions and attitudes were classified as positive (to be treated as mitigation compatible with conservation objectives) or negative (potential actions that are not compatible with conservation objectives).

Plate 10. Focus group meeting delivered in Santa Elena, PNR.

2.2.2.3 Fishing registers

To explore the actual net damage caused by aquatic predators, I used participatory fishing registers to measure negative interactions between aquatic fish predators and fishermen. I made a datasheet 'Interaction with wildlife during fishing activities' (Appendix E). I recruited six fishermen in Santa Elena (PNR) and six fishermen in San Martin de Tipishca (PSNR). Fishermen were trained to fill-in the datasheet and record the number of times actual damage was caused by aquatic predators and fish (Plate 12). They also recorded dates, number of fishing hours, an estimate of the amount of fish caught, size of the net used, and the size of every instance of damage. I used descriptive statistics and a non-parametric Kruskal-Wallis test to compare the amount of net damage due to each species. To determine if the total hours of fishing and total fish capture predicted occurrence (yes/no) of damage, I used binomial logistic regression.

Plate 11. Training fishermen to fill fishing registers in San Martin de Tipishca, PSNR.

2.3 Results

2.3.1 Demographic background

I interviewed 302 people in total, 172 (57%) from PNR, 80 (26.5%) from PSNR and 50 (16.6%) from MKRCA. Around half of the people were men (N=155, 51.3%). The average age of the interviewees was 41 years (mean=40.68, SD 13.49), and the average family size was five (mean=5.2, SD 2.4). Most of the interviewees were literate (85.5%), but 14.6% had not attended school, 48.7% attended only primary school and 36.8% went to high school or further. The main livelihood activity listed was farming (91.7%, N=277); PNR (WRI=0.75), PSNR (WRI=0.75) and MKRCA (WRI=0.74) (Figure 2). Although 162 (53.6%) of respondents mentioned fishing as one of the most important activities for earning money, only 37 (12.3%) interviewees mentioned it as the main activity. There were 53 (17.5%) people that didn't fish, most of whom were women (N=49, 16.2%).

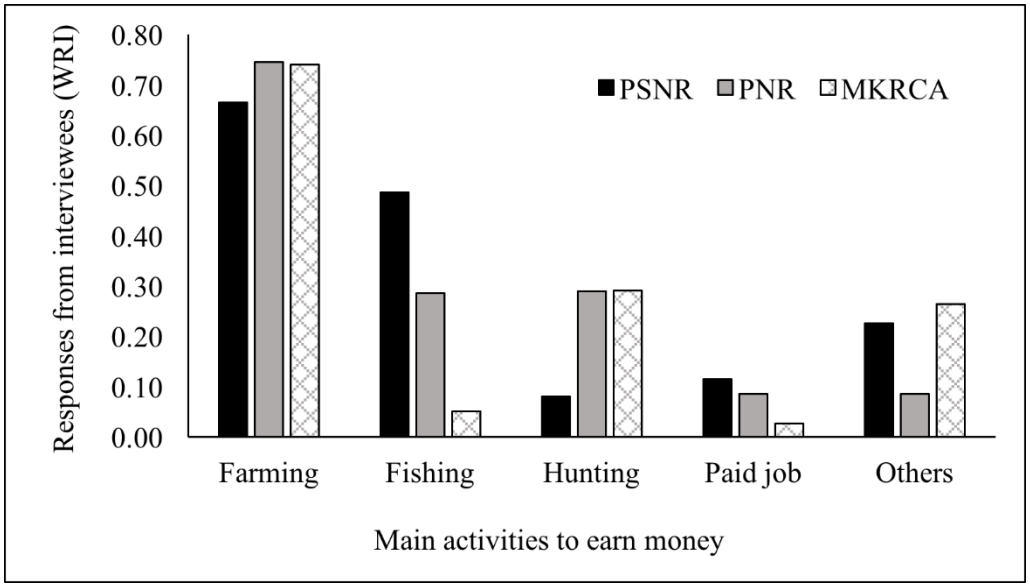


Figure 2. Frequency of main economic activities of interviewees from the communities of PSNR (N=75), PNR (N=157) and MKRCA (N=45), Loreto, Peru. 'Other' economic activities included keeping a shop, selling food, carpentry, mechanic, employment on boat transport and painting.

2.3.2 Opinions towards protected areas

When I asked respondents their opinions about the protected area, all (100%) interviewees from San Martin de Tipishca said that they liked the protected area, 83.72% (N=144) of respondents from PNR agreed that they liked the reserve and 96% (N=48) in MKRCA also felt that they liked the reserve. I also asked whether in some way they benefitted from the protected areas; 82.5% (N=66) people said they benefit from PSNR, 72% (n=36) said they benefit from MKRCA, but fewer than half of respondents (48.84%, n=84) said that they felt that they benefitted from PNR.

2.3.3 Perception of aquatic predators' relative to terrestrial and arboreal wildlife

Despite the dominance of farming and hunting activities, aquatic animals ranked highly when people were asked to rank their most disliked species from 22 photos of terrestrial (n=8), arboreal (n=7) and aquatic (n=7) animals. In PSNR the highest ranked for "disliked" were; jaguar (WRI=0.56), black caiman (WRI=0.43), and puma (WRI=0.27) (Figure 3a). In the communities' close to the PNR, the list of most disliked animals was

dominated by aquatic predators; pink dolphins (WRI=0.29), giant otters (WRI=0.23), neotropical otters (WRI=0.17) and caimans (spectacled caiman WRI=0.10 and black caiman WRI=0.10), while ocelot, in fifth position (WRI=0.11), was the only terrestrial species ranked among aquatic predators (Figure 3b). In the MKRCA, terrestrial wildlife species were the least liked, with the Neotropical otter (WRI=0.25) the only aquatic animal making it into the top five (Figure 3c, Appendix F).

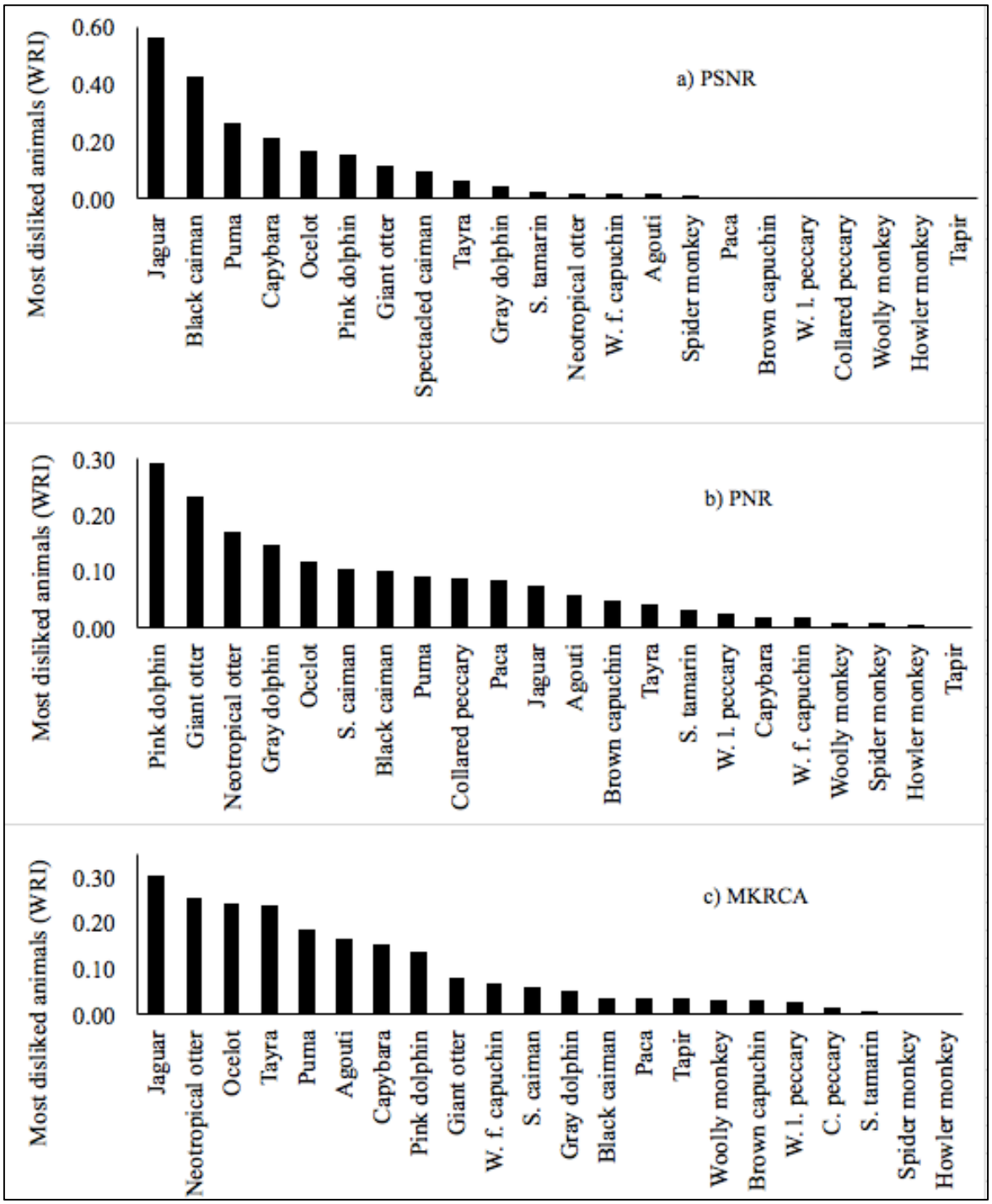


Figure 3. Animals reported as the 'most disliked' by interviewees of the communities: a) PSNR (N=80), b) PNR (N=172), and c) MKRCA (N=50), ranked using the Weighted Rank Index (WRI).

2.3.4 Perception of damage caused by aquatic predators

Net damage was reported by 100% of respondents, but when I asked which animals they thought stole most fish from nets, and caused most damage to fishing nets, the animals identified varied among the communities. While pink dolphin and giant otter were consistently considered among the most harmful in all three communities, caiman were considerably more harmful in PSNR than in the other two areas, and in MKRCA the neotropical otter was perceived as taking most fish from nets (Figure 4, Appendix G, H).

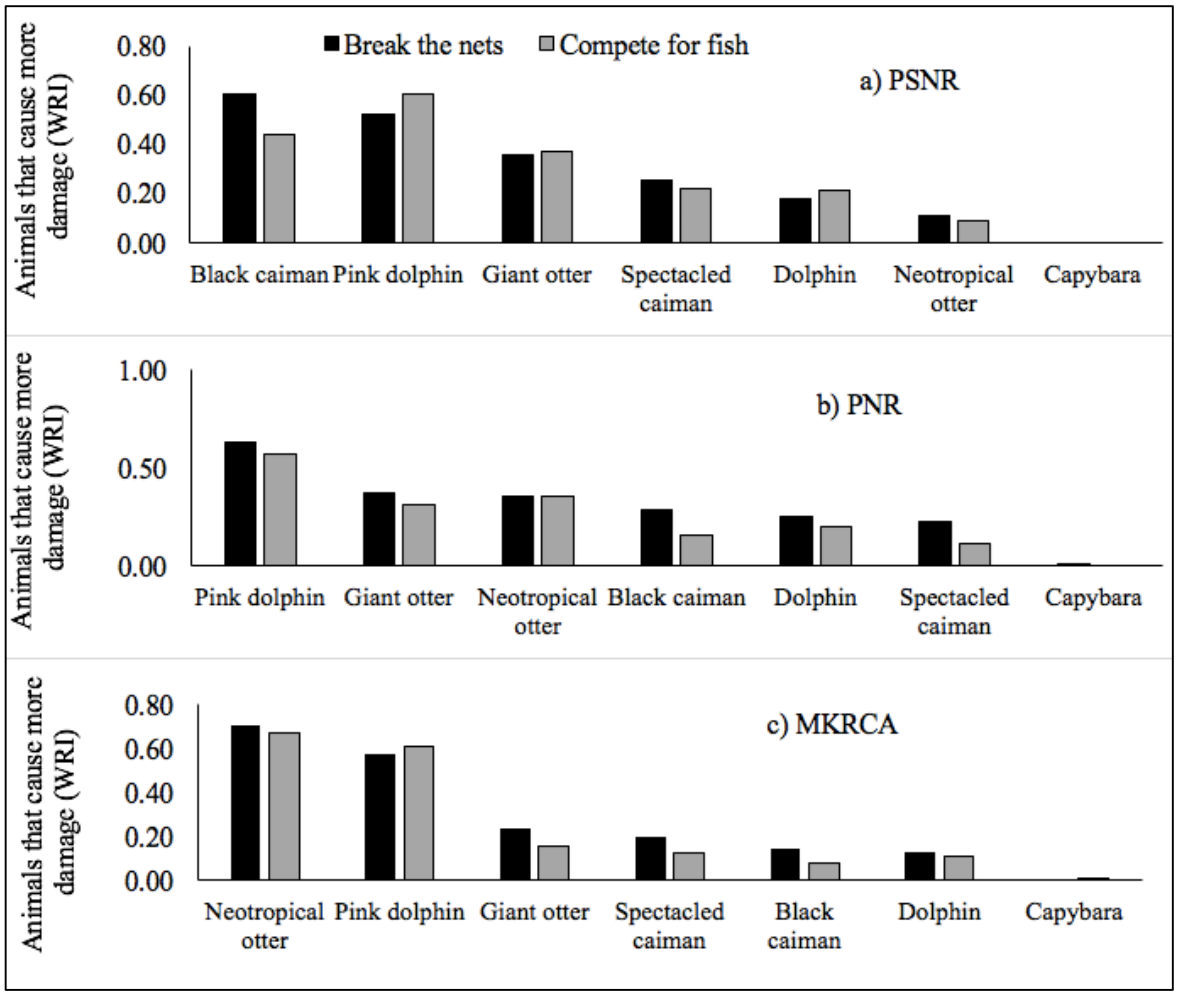


Figure 4. Perceptions of loss of fish and damage to nets by aquatic predators by interviewees of the communities: a) Pacaya-Samiria National Reserve (PSNR, N=80), b) Pucacuro National Reserve (PNR, N=172), and c) Maijuna-Kichwa Regional Conservation Area (MKRCA, N=50), scored using the Weighted Rank Index (WRI) for each species. Capybara was included as a control.

2.3.5 Costs of net damage in rural communities

Damage to nets is associated with a number of costs. As well as the monetary value of the net and the reduction in the efficacy of the net, time and resources are used in repairing nets. Respondents (n=278) mentioned several different activities used to fund materials to repair the nets, from 318 answers respondents mentioned selling farm products (46%), fish (25%), bushmeat (8%) or handy crafts (3%). 13% (N=42) said they organised a communal 'minga' for repairing nets, a Quechua word for a get-together for communal work, usually including food and typically 'masato' a type of alcoholic drink made from yucca (Peliks, 2012). Interviewees were asked to estimate the cost of repairing the net from a single 'damage event' caused by each species that broke it. The perceived cost of events was greatest for black caiman and lowest for gray dolphin, but the range of $8-12 was not highly variable between species (Figure 5).

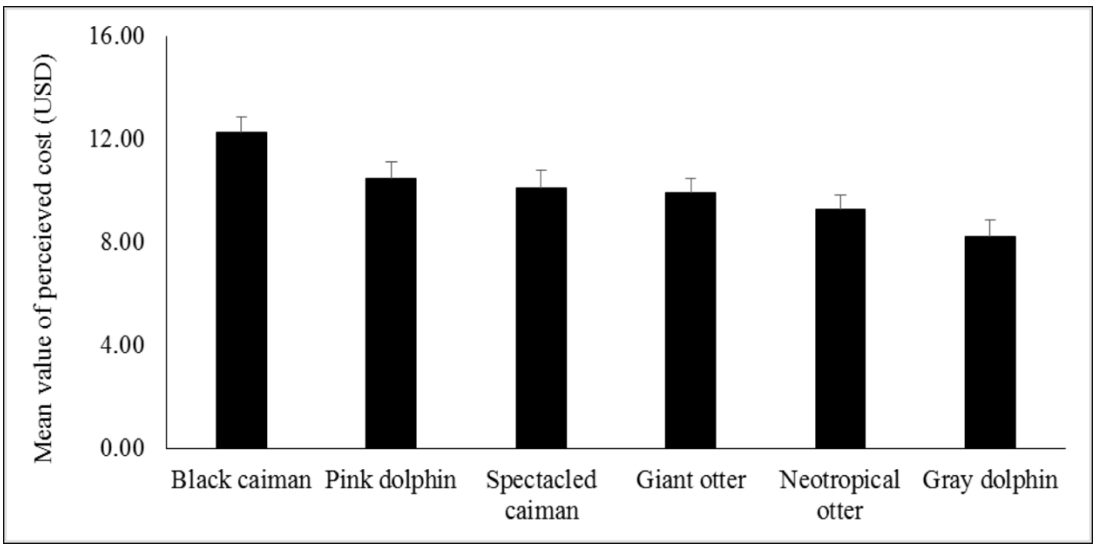


Figure 5. Perceived cost of repairing fishing nets per damaging events by different species (mean values and SE, N=299 respondents).

2.3.6 Opinions and perceptions towards giant otters

When asked if there were more giant otters than 10 years ago, from 302 respondents, most people said 'Yes' (70%, N=211). The majority of the respondents in PSNR and PNR (81.2% and 72.1% respectively) but fewer than half respondents from MKRCA (44%) believed that giant otters population were increasing. 70% of respondents from PSNR and 25.6% from PNR said they liked living close to the giant otters, compared to 50% of the respondents from the MKRCA, where giant otters are rare (Gilmore et al., 2010). When asked about the impact of giant otters on fish populations, there was a difference between

the communities; 61% of respondents in PNR, and 40% in MKRCA thought that removing giant otters from the area would lead to increased fish populations. In PSNR, this was much lower, with only 25% of people agreeing with that statement. Most people in all areas thought that there were plenty of fish for both their communities and the giant otters. Less than 52% of interviewees agreed with the statement 'I feel scared of giant otters' (Figure 6).

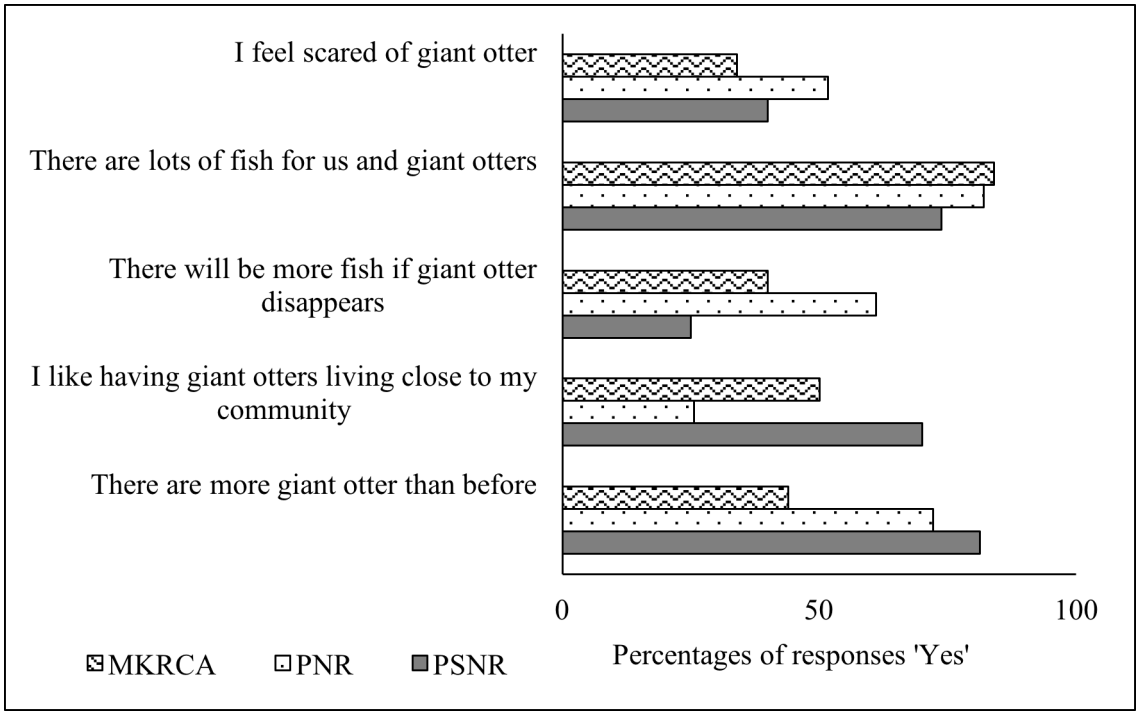


Figure 6. Opinions and perception towards giant otters in the three study areas: a) PSNR (N=80), b) PNR (N=172), and c) MKRCA (N=50).

2.3.7 Attitudes towards giant otters – Tolerance

Less than a third of respondents (28.8%) from PSNR agreed with the statement that animals that broke the nets should be killed, in contrast with the other communities, in which more than half of respondents (57.6%) in PNR and (66%) in MKRCA agreed that animals that break the nets should be killed; there was significant difference in the proportion of the answers by community (χ^2 (2, N=302) =23.31, P<0.001) (Figure 7).

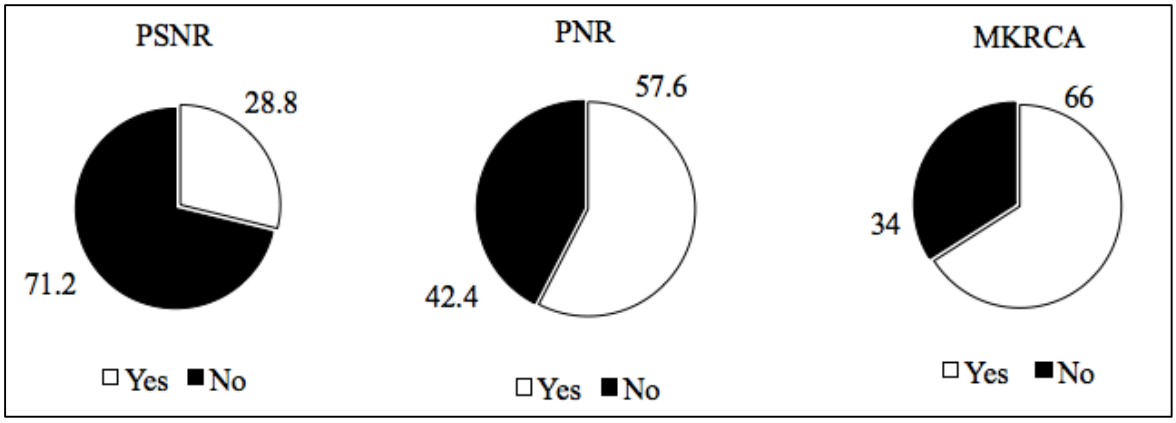


Figure 7. Opinions towards aquatic predators that cause damage 'All animals that breaks the nets should be killed?': a) PSNR (N=80), b) PNR (N=172), and c) MKRCA (N=50).

The minority of the respondents (1.2%) from PSNR and less than half (23.3%) in PNR and (32%) MKRCA were willing to state that they had tried to kill a giant otter; there was a significant difference in the proportion of people self-reporting that they had killed or tried to kill giant otters in PNR and MKRCA (χ^2 (2, N=302) =24.01, P<0.001). Not all respondents knew about protected species legislation. Fewer than half of the respondents (6.2 %) in PSNR and (34.9%) in PNR said that killing giant otters was permitted, while more than half of people (60%) in MKRCA thought that killing giant otter was permitted; there was significant difference in the proportion of responses by community (χ^2 (2, N=302) =43.40, P<0.001) (Figure 8).

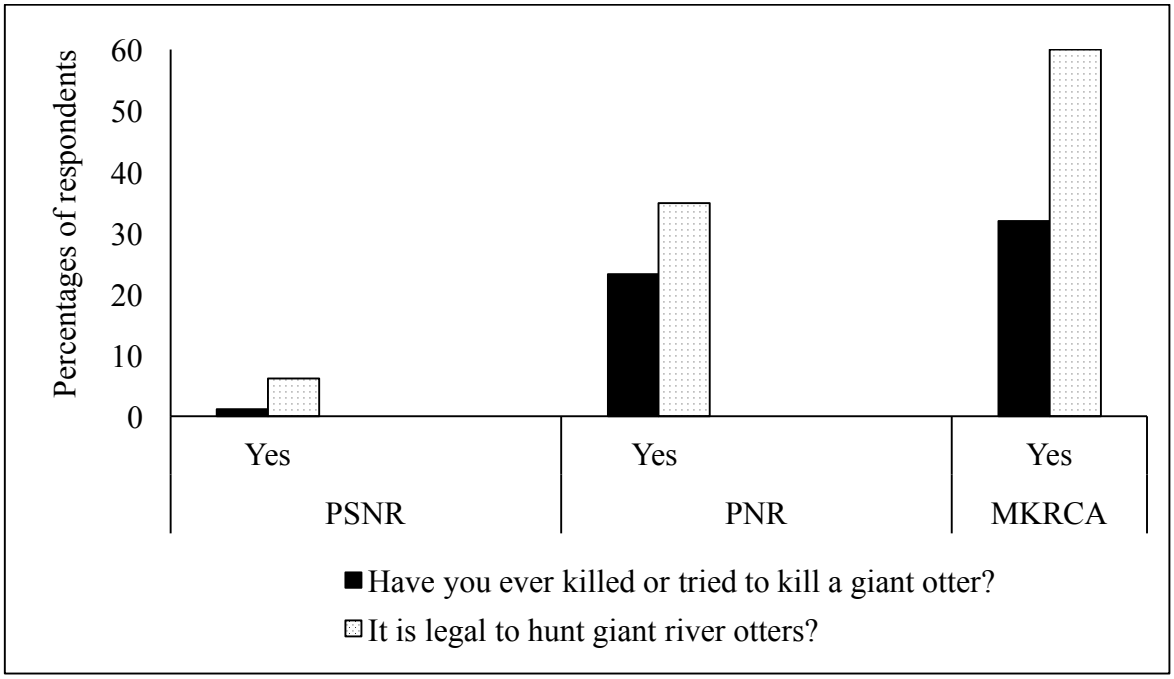


Figure 8. Self-reported retaliation towards giant otters and lethal control in the three study areas: a) PSNR (N=80), b) PNR (N=172), and c) MKRCA (N=50).

To understand the reasons why people would kill giant otters, I asked interviewees if they knew somebody that had killed or tried to kill a giant otter, and if so why they had done so. Of 302 respondents 34% (N=103) said they knew someone that had previously hunted giant otter. Of these, 50 people said it was because of damage to nets, 26 respondents said they wanted to sell the skin, 16 respondents in PSNR and PNR said it was to have the young as a pet, while 10 gave other reasons (Figure 9).

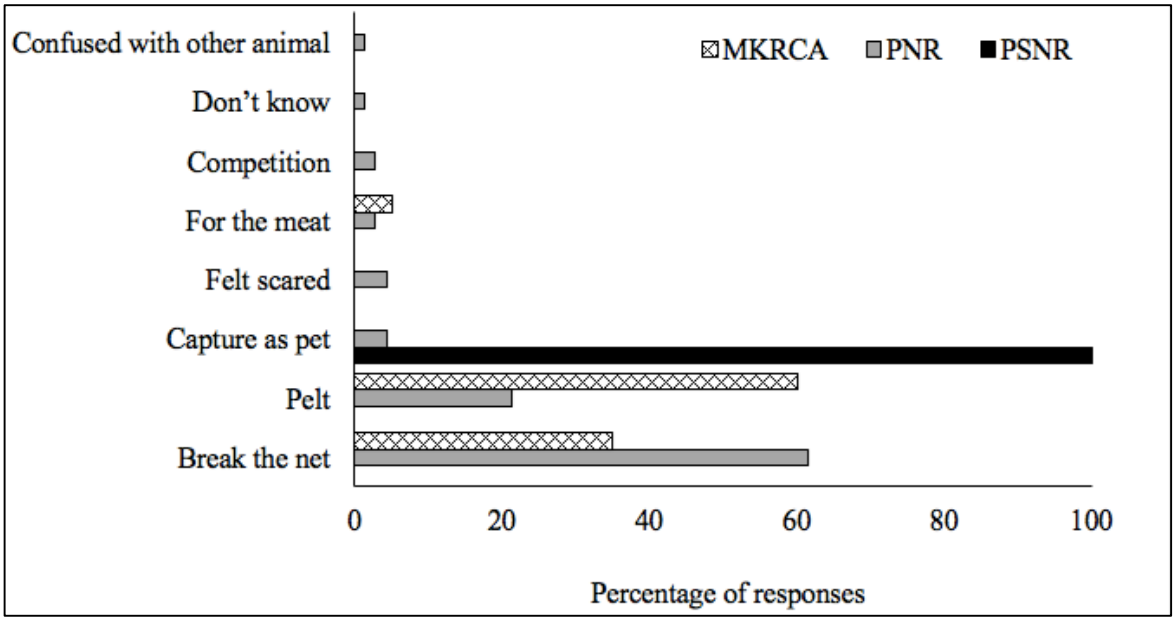


Figure 9. Percentages of answers mentioned by the interviewees on why somebody would try to kill or had killed giant otters.

2.3.8 Influence of demographic factors on attitudes

A generalized linear model using a binary logistic regression was developed to see if positive or negative attitudes scored for each respondent (N=302, all responses were included in the model) were associated with a) gender, b) education or the c) location which they belong. Overall model fitted the data very well, Pearson χ^2 was close to one, indicating that the data were not over-dispersed (Pearson χ^2=1.6, df=12) and the Akaike information criteria was low (AICc=72.06). The model explains a significant amount of the variation in whether background of the respondents was associated to attitudes according to Likelihood Ratio χ^2 (GLZM(b): Likelihood $\chi^2_{2=}$ 55.64, N=302, p≤0.001). Wald χ^2 suggested that there was a significant difference between genders in the probability of the respondent having negative attitude (GLZM(b): W^2_1=5.14, p=0.023), with women having more negative attitudes than men. There was an association between location and negative attitude (W^2_2=24.66, p=0.0001), with PNR and MKRCA having more negative attitudes than PSNR. Overall, the influence of level of education on negative attitude was not significant (W^2_2=5.67, p=0.059), but respondents that did not attend school or only studied at primary level had more negative attitudes than people that had completed more school years (Table 6).

Table 6. Attitudes of the respondents with their associated variable using Binary Logistic Regression [GLZM(b)].

Response variables		**B**	**SE**	**Wald χ^2**	**df**	**P**	**Exp(B)**
Location	ACR MK	2.74	0.55	24.65	1	≤0.001	15.51
	PNR	1.98	0.49	15.98	1	≤0.001	7.22
	PSNR	Reference					1
Gender	Female	0.65	0.29	5.14	1	0.023	1.91
	Male	Reference					1
Level of education	No attend	0.91	0.44	4.34	1	0.037	2.49
	Primary	0.67	0.33	4.28	1	0.038	1.97
	Upper primary	Reference					1
Overall model	LR χ^2	55.64					
	df	5					
	P	≤0.001					
Explanatory variables significance	Location			24.65	2	≤0.001	
	Gender			5.14	1	0.023	
	Level of education			5.67	2	0.059	

2.3.9 Mitigation and retaliation from focus groups meetings

From 52 houses in the community of Santa Elena, 31 people participated in the first focus-groups meeting and 8 park guards participated in the second focus group. The discussion meetings largely confirmed the questionnaire respondents' perceptions of the species (see Figure 4b) from the 22 pictures displayed. The focus groups also helped to understand *why* the respondents felt negative perceptions to these animals (Table 7).

Table 7. Perceptions about the animals that cause more damage, and the reasons for negative perceptions (including aquatic, arboreal and terrestrial animals). Two groups combined.

Animal	**N**	**%**	**Reason why they are 'bad'**
Pink dolphin	8	21	Break the net, competition for fish
Neotropical otter	6	15	Break the net, competition for fish
Jaguar	5	13	Attack animals, feel scare of being attack or die cause attack
Agouti	4	10	Affect the farm
Giant otter	4	10	Break the net, competition for fish
Spectacled caiman	2	5	Break the net
Black caiman	1	3	Break the net, fear of attack
Dolphin	1	3	Break the net
White-lipped peccary	1	3	Affect the farm
Spider monkey	1	3	Is mischievous
White-fronted capuchin	1	3	Affect the farm
Puma	1	3	Fear of being attack
Capybara	1	3	Affect the farm
Tapir	1	3	Affect the farm
Collared peccary	1	3	Affect the farm
Ocelot	1	3	Affect farm animals

Nvivo software was used to help to understand connections between respondents and perceptions of damage from two questions in the focus groups meetings: 1) Animals that cause more damage (including aquatic, arboreal and terrestrial animals), and 2) Aquatic animals that cause more damage including only six aquatic predators and an aquatic control species. Pink dolphin was mentioned by 21 respondents in total but only three people mentioned this species in response to both questions (D009, D023, D030) (Figure 10). Neotropical otter was mentioned by 10 respondents in total in both questions (Figure 11). Black caiman was mentioned by six respondents in total, only one respondent mentioned it in both questions (D033) (Figure 12). Giant otter was mentioned by eight respondents in total and only one respondent mentioned it in both questions (Figure 13).

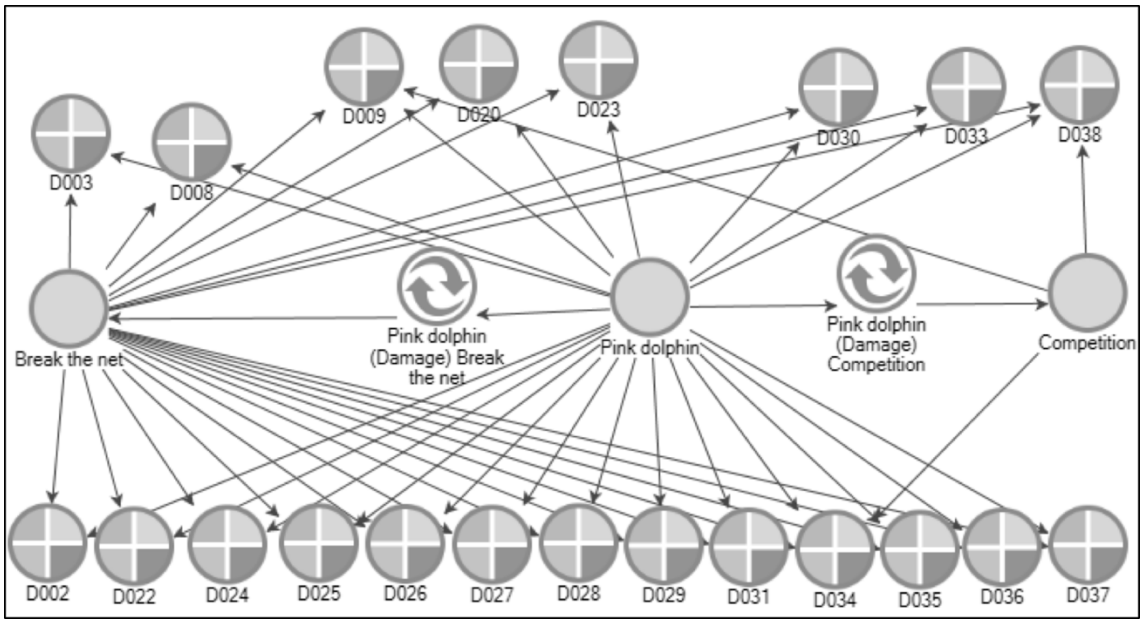


Figure 10. Links of respondents that mentioned 'pink dolphin' as a damaging animal and the type of damage that it causes. Each cross-hatched circle represents a single respondent, while the arrows show the links between respondents and responses. The plain circles represent the causes mentioned by respondents. When more than one problem was associated with the species, these are shown with the double arrow symbol.

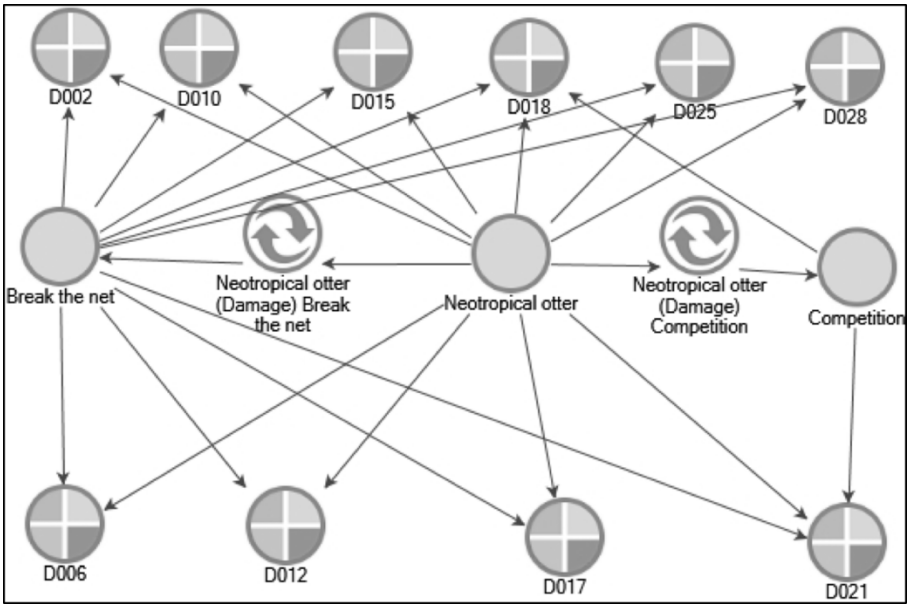


Figure 11. Links of respondents that mentioned 'neotropical otter' as a damaging animal and the type of damage that it causes. Key as Fig. 10.

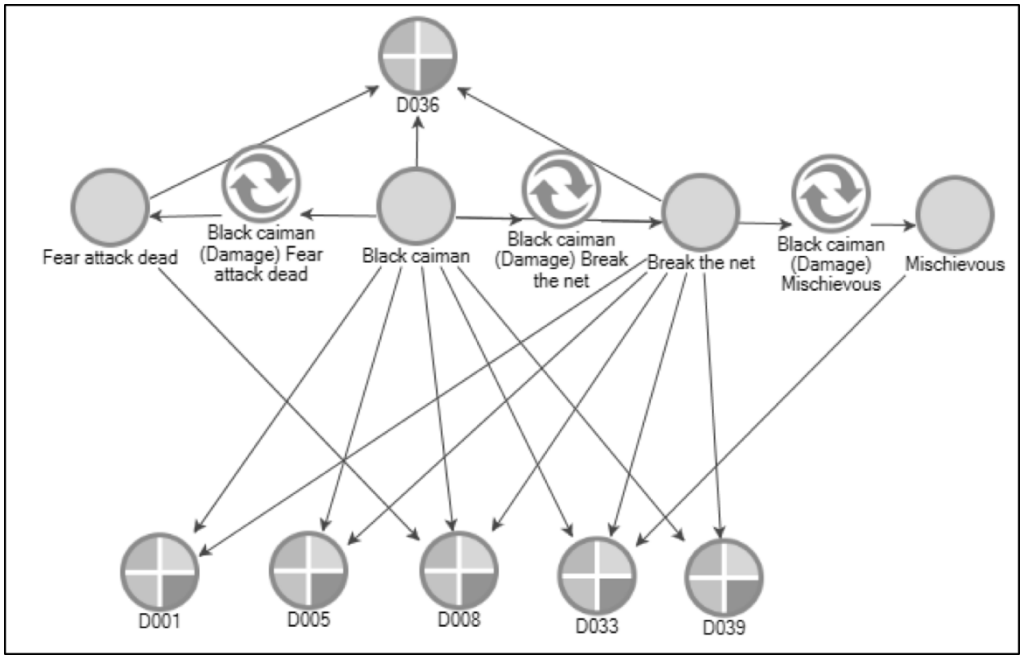


Figure 12. Links of respondents that mentioned 'black caiman' as a damaging animal and the type of damage that it causes. Key as Fig. 10.

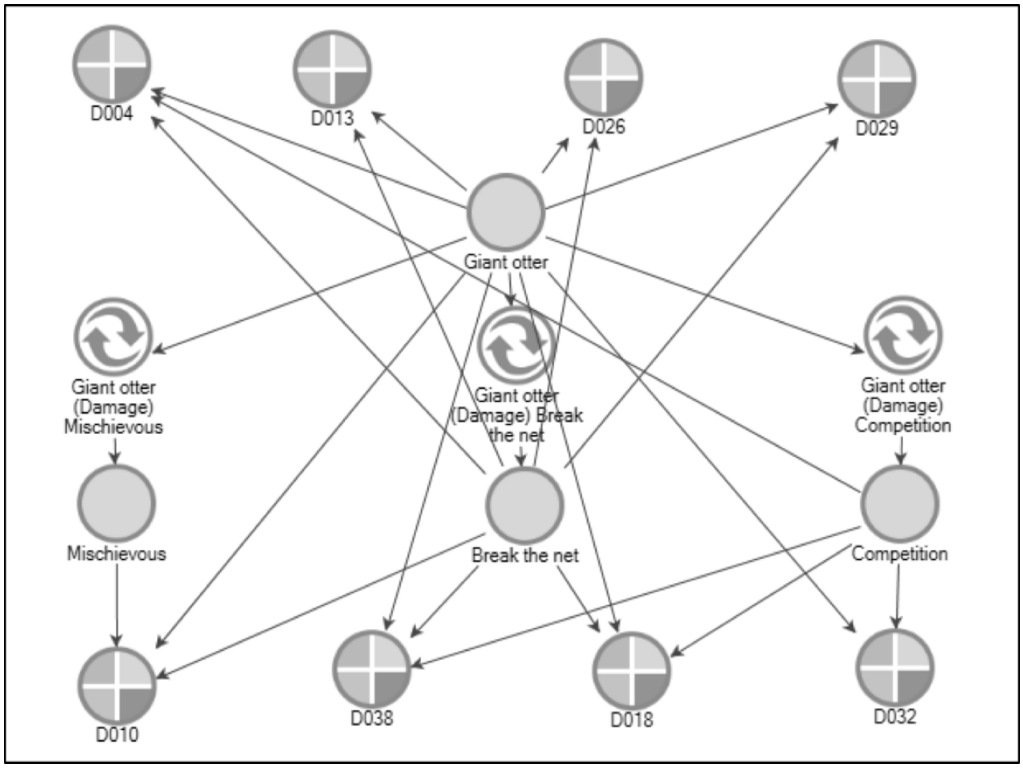


Figure 13. Links of respondents that mentioned 'giant otter' as a damaging animal and the type of damage that it causes. Key as Fig. 10.

When I asked focus group respondents to choose the animals that caused the most damage from the seven pictures of aquatic predators, pink dolphin (n=16) was mentioned most commonly and most of the people agreed that they broke nets (n=16) more often while just two respondents mentioned competition for fish. Black caiman (n=7) was in the second place; respondents mentioned that they broke nets (n=5), were 'naughty' (n=2) and that they were scared of them (n=1). Naughty in this context was similar to the term 'mischievous' as applied to monkey, suggesting that people attributed intentional mischief-making or 'bad behaviour' to some species. Giant otter (n=5) was third most mentioned, in contrast with the interviews where the giant otter was in second place and black caiman in fourth place (Figure 4b). Respondents mentioned that giant otters break the nets (n=2), compete for fish (n=2) and were naughty (n=1) (Figure 14).

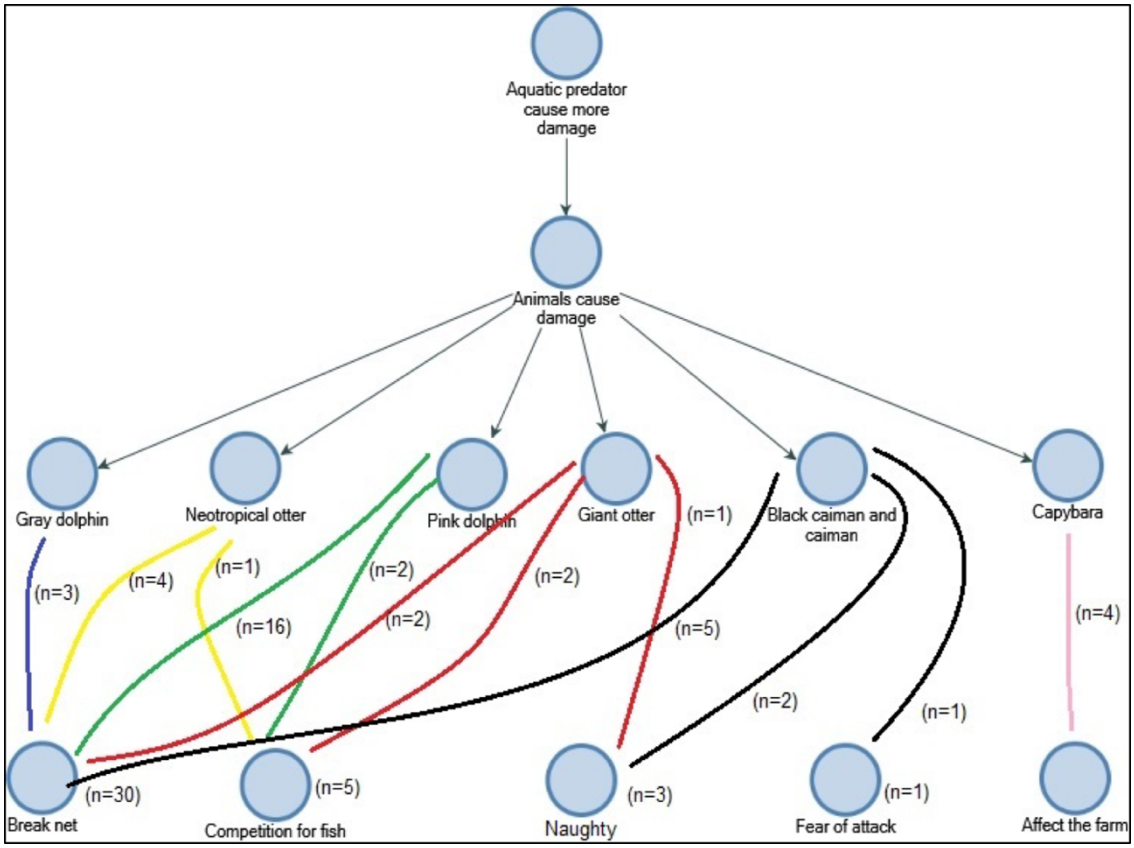


Figure 14. Aquatic predators and control species, and the perceptions of the damage they cause. Key: Blue circles represent the animals that cause damage and type of damage. Coloured lines symbolise link between animal and type of damage, (n=number of comments).

When I asked focus group participants to choose which animal breaks the net with greatest frequency, they mentioned only four species: pink dolphin, neotropical otter, dolphin and black caiman. Most of the respondents (n=27) said that they would be willing to kill the animal, and some respondents (n=8) mentioned that they would protect the nets and scare the animals (n=7) (Figure 15, Table 8). Surprisingly, giant otter was not included in the list of most problematic species. Although, park guards mentioned that they will kill species that break nets, they also said that they will scare the animal and go somewhere else to fish.

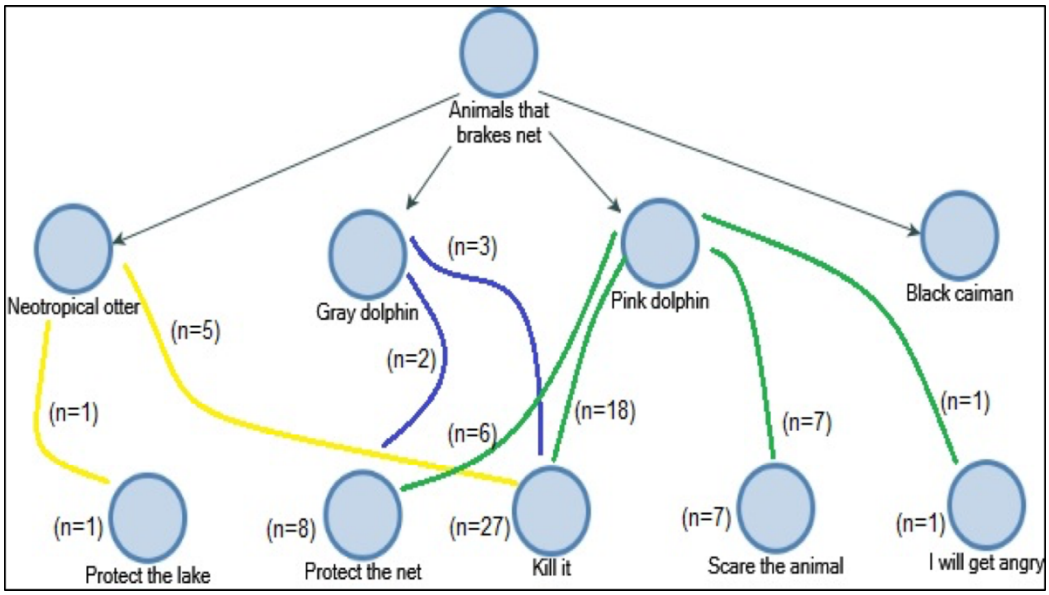


Figure 15. Perception of the aquatic predators that breaks fishing nets with the greatest frequency and the actions that respondents will use towards these animals (n=number of comments).

Table 8. Responses about animals that damage nets by community members and park guards.

(n)	Positive answers	Negative answers
Pink dolphin (28)	• I will take the net out of the water (3) • I look after my net (2) • I will scare the animal so it doesn't break the net (3) • I will put chilli in the net (1)	• I will spear it with a fishing spear (3) • I will kill it with a shotgun (1) • If I find it in the net I will kill/hurt it (6) • I will kill it (7) • I will scare or kill it (1) • People get angry with animals that break the nets (1)
Neotropical otter (6)	• I will protect my fishing area more from this animal (1)	• If it goes to eat the fish, or breaks the net I will kill it (1) • I will kill it (4)
Dolphin (4)	• I will immediately take out my net (1)	• I will scare it or killed it (1) • I will kill it (2)
Black caiman (1)	•	• When the animal is fishing, it sometimes breaks the nets (1)

For the hypothetical statement 'If there are giant otters in a lake. Would you go fishing in that lake?' Most of the participants (n=26) said they would not fish in a lake that has giant otters, and three participants mentioned that they would go to the lake, but would kill the animals (Table 9). Nonetheless, if they go to a lake without knowing or expecting to see a giant otter, most of the participants (n=31) mentioned that they would let the animal go because it did not cause any damage to the net (Table 10).

Table 9. Hypothetical responses to presence of giant otters in a fishing lake by community members and park guards; positive (mitigation) and negative (retaliation). Based on two focus groups.

	Positive answers (n)	**Negative answers (n)**
Yes, I will go	• I will protect my net from the giant otters (2) • That lake will have more fish (5) • The giant otters migrate (1) • I will go to check that there are more fish (1)	• I will go to fish and I will kill the giant otter with my shotgun (1) • I will go to kill it, because is dangerous (1) • I will go to kill it because breaks nets (1)
No, I will not go	• I don't have time (1)	• I will not go because they are dangerous and can bite us (1) • I will not go because the giant otters eat all the fish (2) • I will not put my net there because the giant otter will break it (21) • This animal will break the net and it costs money (1)

Table 10. Hypothetical responses to: If there are giant otter in a lake. Would you go fishing in that lake? What would you do if you see giant otter in the lake?

Positive answers (n)	Negative answers (n)
• I go to another lake to avoid giant otters breaking the nets (6) • I will scare them (1) • I will not do anything, just scare them (1) • I will not do anything, just watch them (1) • If does not break the net, I will not do anything (1) • I will let them go, because it is not doing any harm (10) • I will do not do anything because they are not bad (1) • I will let them go (6) • I will let them pass, because they are passing too (3) • I will let them go, so they can increase the population (1)	• I will take out my net because the giant otter ate all the fish (2) • I will kill it for security (4) • I will take out my net because I will not be able to fish anything (1) • I will take out my net because the giant otter will break the net (1)

Generally, people had negative perceptions (n=14) about giant otters, held largely because they break nets (n=6), compete for fish (n=7) or are naughty (n=1). The minority of the respondents thought that if there was a giant otter in the lake, it would have more fish (Figure 16).

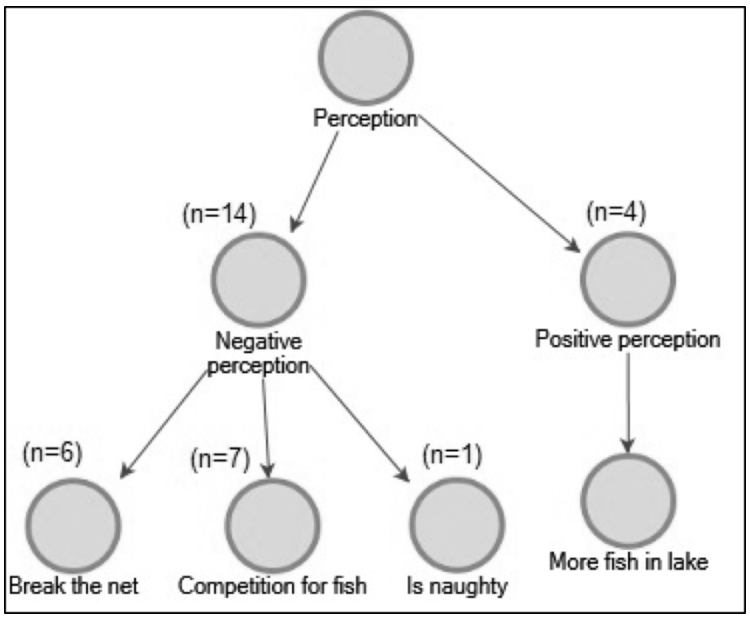


Figure 16. Perceptions about giant otters and their linkages mentioned during the focus group meetings in the community of Santa Elena, outside PNR, (n=number of comments)

People from focus groups mentioned some mitigation actions to avoid net damage (positive attitude, n=94). They would evade the giant otters by going to fish in another area (n=28); when they see a giant otter in the fishing area, the fishermen will not put out their net or if is already in the water, they will take the net out. Only 12 people exhibited negative attitudes towards otters and said that they will kill it (n=10) or would feel threatened because they are dangerous (n=2) (Figure 17).

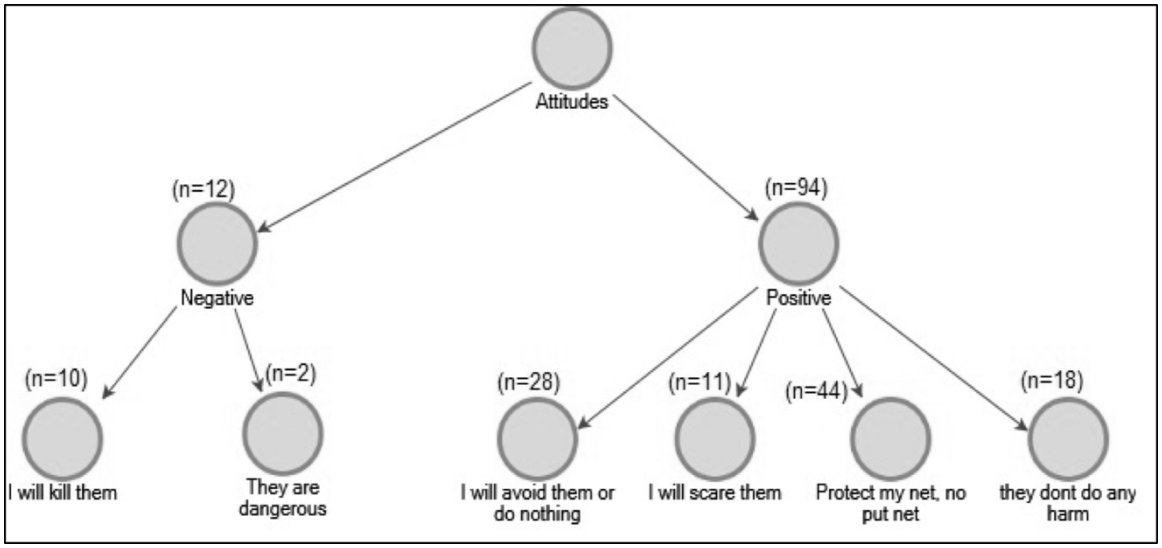


Figure 17. Attitudes about giant otters mentioned during the focus groups meetings in the community of Santa Elena, outside PNR (n = number of comments).

2.3.10 Interactions with aquatic predators – Reality

In 278 fishing sessions, damage was common, occurring on 61% of the fishing sessions. Of all 172 damage events, 31% (n=86) were caused by fish, 30% (n=83) were caused by aquatic predators and 1% (n=3) events in which the fishermen could not identify which animal broke the net. Of the 86 events caused by fish, 64% (n=55) were made by piranhas, which bite holes when they attack other fish in the nets, 21% (n=18) by suckermouth catfish that hold hard fin spines out at right-angles when they are caught, and fishermen usually have to break the net to get them out, and 15% (n=13) by other types of fish (Figure 18). There were 83 events caused by aquatic predators, including; dolphins (n=51), caiman (n=23), giant otter (n=7) and gray dolphin (n=2). (Figure 19).

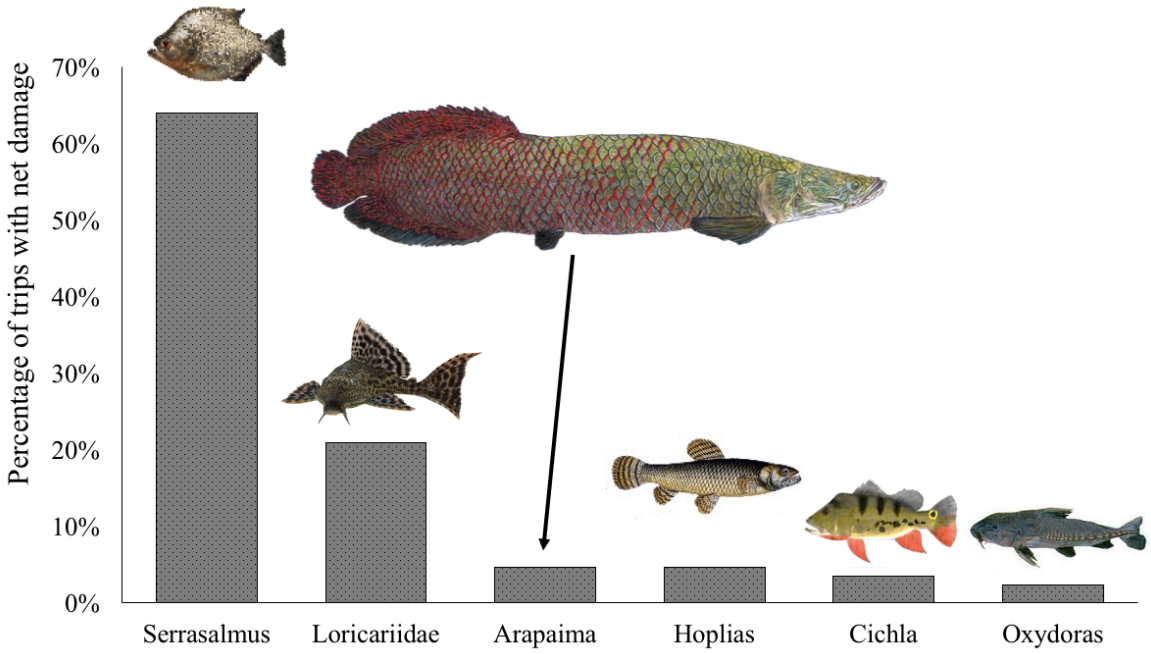


Figure 18. Proportions of fish damage events caused by each fish species in the PSNR.

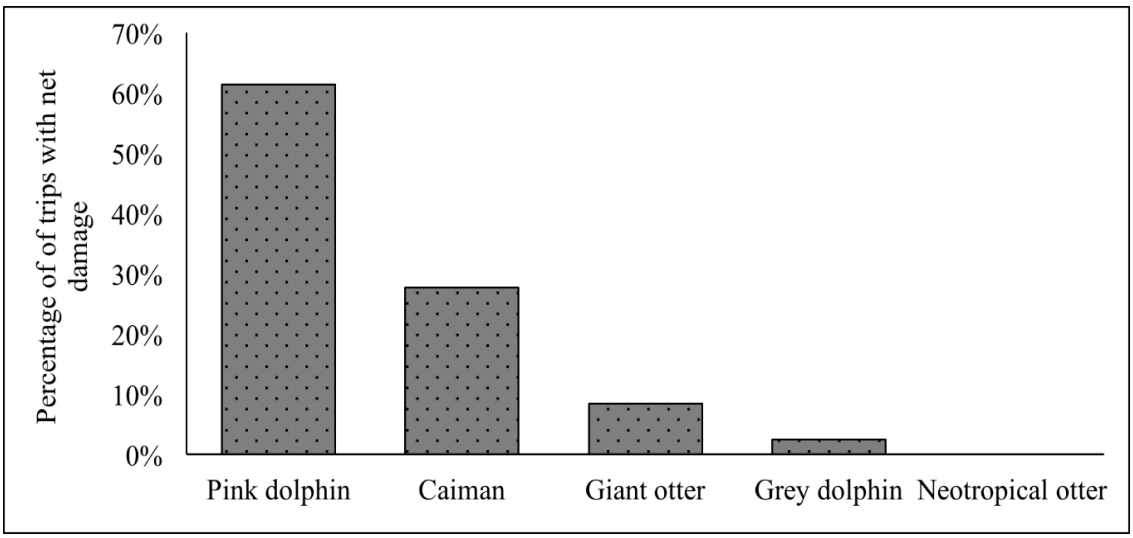


Figure 19. Percentage of damage by aquatic predator species during fishing trips (N=83).

Calculating the amount of damage caused per hour during each fishing event, caiman caused the most damage, with the pink dolphin second (Figure 20). The caiman species were recorded together, because the fishermen did not usually see enough of the animal to identify it to species level. Relative to caiman and dolphins, giant otters cause little damage. Damage size (per 100m of net) was significantly different between species (Kruskal-Wallis, N=169, χ^2=45.72, P<0.01).

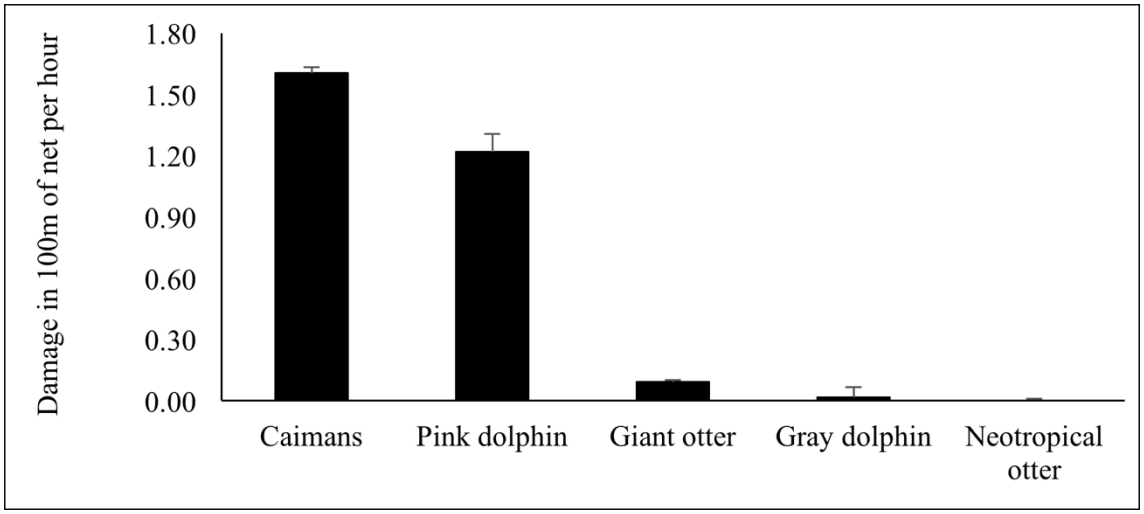


Figure 20. Comparison of damage to fishing nets by aquatic predators during fishing trips.

More damage occurred during the day. Dolphins and caiman damaged the nets both during the day and at night. Caimans attacked the nets mostly in the day despite being a nocturnal species (Figure 21).

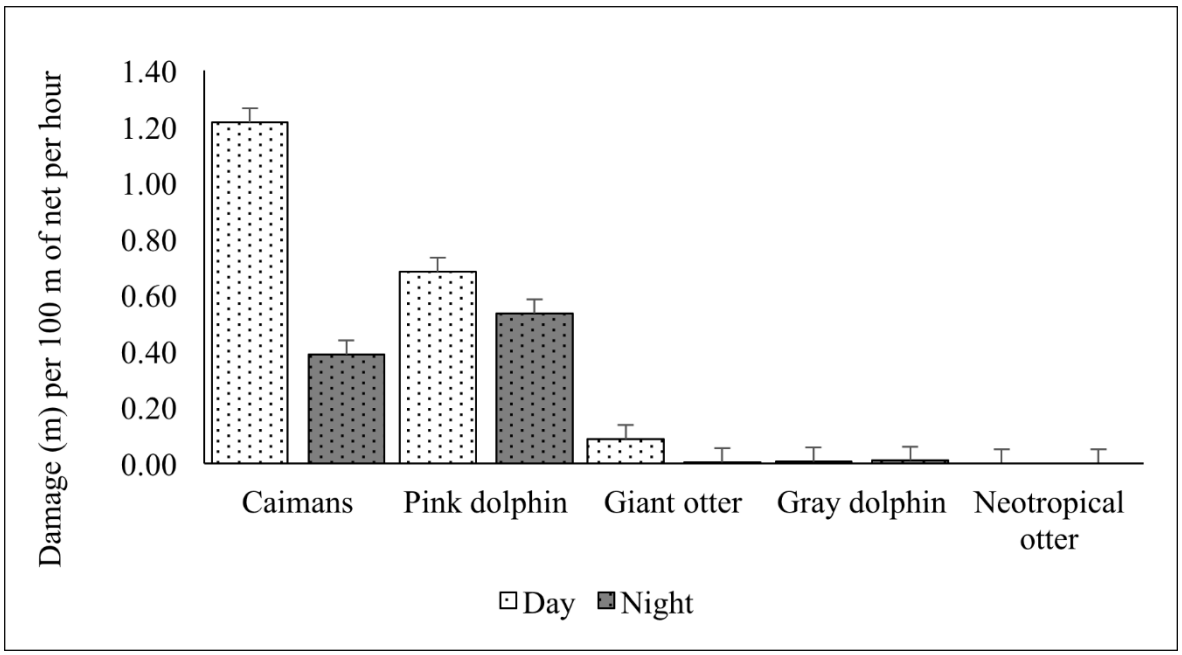


Figure 21. Comparison of net damage by aquatic predator's attacks in day and night time.

2.3.11 The effects of fishing time and rates of fish capture on net damage

Total hours fishing and total fish capture were entered into a binomial logistic regression to predict damage (yes/no) to nets. The overall model was statistically significant (χ^2=11.14, df=2, p<0.05). The model explained 11% (Nagelkerke R^2=0.11) of the variance of net damage and correctly classified 60% of the fishing trips in relation to net damage. Increasing total fish capture in the nets increased the likelihood of having net damage (Odds ratio=1.04; 95% CI=1.02 - 1.06; p≤0.001), but the length of a fishing session had no effect on net damage (Odds ratio=0.96, 95% CI=0.89 - 1.63; p=0.24).

2.4 Discussion

2.4.1 People's perceptions of aquatic predators

Despite being more involved in agriculture and hunting than fishing, people living close to or inside the protected reserves (PNR, MKRCA and PSNR) have different perceptions about which animals are the most disliked. In PNR, respondents considered aquatic predators more damaging than terrestrial and arboreal animals, while in PSNR and MKRCA the most disliked predator was the jaguar (Plate 13). Jaguar interactions with people have been widely studied in South America due the loss of livestock (Hoogesteijn et al. 1993, Zimmermann et al. 2005) and fears for human safety (Marchini and McDonald 2012). Other felids such as puma and ocelot were also in the top 5 for PSNR and MKRCA. The puma, due to its wide geographic distribution, is often reported as a danger for livestock (Palmeira et al. 2008) and they are sometimes considered more dangerous than jaguars (Campbell and Torres 2011). Agouti, capybara, collared peccary and paca also made the 'most disliked' list, due to crop-foraging, but they were also considered as 'good' animals for their meat.

Plate 12. Jaguar killed close to the community of Parinari, outside PSNR.

During the interviews and focus groups, pink dolphins were ranked in first or second place as the animals that caused most damage, broke nets with the highest frequency and took the most fish from nets. Pink and gray dolphins are considered competitors for fish resources in Amazonia, and people report accidental killing of dolphins during artisanal fishing. In the Brazilian Amazon 238 freshwater dolphins (208 pink dolphins and 30 gray dolphins) die accidentally per year in fishing nets, (Brum 2011). In Peru, Brazil and Colombia, people use this species as a bait to catch commercially valuable catfish (Siluriformes) (Da Silva and Best 1996, Loch et al. 2009, Alves et al. 2012, Mintzer et al. 2015). In Brazil, 600 individuals are killed annually for bait (Loch et al. 2009). In the northern Peruvian Amazon, unintentional captures were more common in Loreto than Ucayali (Vélez 2017). There is also an added value to body parts of pink dolphins used as lucky charms (Vélez 2017), but there is no research on the demand for dolphin body parts, for which commercialization has been illegal since 1996 (D.S. N° 002-96-PE). Gomez-Salazar et al. (2012) reported high populations of river dolphins in the Samiria River, and the PSNR has been suggested to be a hotspot for river dolphin conservation in South

America. Nonetheless, outside protected areas, the dolphins are effectively unprotected from retaliation by fishermen, since laws are rarely enforced.

Caiman also ranked highly during interviews and focus groups, especially the very large *M. niger*, which apart from damaging the nets, are considered dangerous animals by fishermen (Peres and Carkeek 1993). A single encounter with either caiman species can often render a net unusable (Peres and Carkeek 1993). Caimans are important for locals because the meat can be consumed locally and there is strong demand in the market of Iquitos, where they can also be sold as 'Pirarucu' or catfish meat (Mendonça et al. 2016). In the north of the Brazilian Amazon, caimans are more frequently used as a bait for catfish than dolphins because they are more abundant (Beltrao et al., 2017). As mitigation against threats to these species, different meat such as bovine viscera and remains of fish (Beltrao et al., 2017) has been recommended to stop fishermen using caimans and dolphins as bait in Brazil.

The Neotropical otter was associated with damage to nets and competition for fish, but there was no record of interaction with fishermen during my fishing registers. These results suggest that while locals have negative perceptions, the reality is that damage is infrequent, at least in PNR and PSNR. Negative interactions such as entanglement and drowning in fishing nets has been documented in northeast of Brazil (Quintela et al. 2012; Pinheiro 2016), and people also report that they occasionally eat their meat (Pinheiro 2016). In southeast of Brazil neotropical otters are considered pests because of damage to artisanal fishermen's nets (Barbieri et al. 2012), "attacks" on artisanal fixed fence traps (Castro et al. 2014) and their effect on aquaculture (Moreno 2008). It is suggested that the damage to fisheries could reach 25% of the production of fish and prawns which are predated and partially eaten by otters (Pinheiro 2016). On the other hand, a study in the south of Brazil also reported that only commercial fishermen have negative perceptions towards neotropical otters while local people that only fish for personal consumption did not exhibit negative perceptions (Dias 2016). Similarly, in Uruguay (Lacombe et al. 2001) fishermen have more positive attitudes towards otters, and even feed them when possible. The use of stronger 'otter-proof' nets for reducing damage caused by neotropical otters have been suggested in Brazil, but have not been implemented (Pinheiro 2016).

2.4.2 Peoples' perception of giant otters

Recorded perceptions in focus groups were more positive than those recorded in interviews, possibly because interviews were confidential and focus groups were not. Overall, respondents from PNR show more negative perceptions and attitudes towards giant otters than did those in the PSNR, even though fewer people in PNR specialise in commercial fishing. This could be because non-fishermen have poorer knowledge about giant otters. This may be exacerbated by the giant otter's more recent recovery in PNR, which may have lagged 10 to 15 years behind that in PSNR (Recharte and Bowler 2018). In MKRCA, respondents' perceptions were less negative, probably because giant otters are found far away from the communities and their fishing areas, while the neotropical otter was ranked in first place as net damager and competitor for fish. People that fish mainly for subsistence and say that fishing is not their main economic activity remained concerned about losing their catches. Commercial fishermen that are actively protecting fishing lakes in PSNR as part of a management plan in agreement with SERNANP invest the most time and money towards conserving fishing stocks, and have more at stake from giant otter population increase (SERNANP 2013). Any threat to fish stocks by wildlife or illegal fishermen elicits a strong emotional response in this group (*personal observation*). In other areas where fishing is the most important livelihood for local people, the pressure on aquatic predators is likely to be even greater. The growing market for ornamental fishing, especially the large ornamental 'arowana', is also likely to further increase negative perceptions and the persecution of giant otters (Recharte et al. 2008, SERNANP 2013). Negative interactions could increase in areas across the entire Amazon region, since virtually all communities in Amazonia use nets to fish. Hostility to growing populations of otters is a widespread problem that is likely to be worst in the most remote areas where people do not have easy access to markets, with increased costs for fishing gear, and reduced incomes due to the distance to markets. PNR is more remote than PSNR and these factors may well be important for fishermen living there. However, PNR is by no means the one of the most remote protected areas in Loreto. For example, Gueppi National Park is accessible only by plane for Peru, or several days travel by boat from Colombia, and Sierra del Divisor National Park is similarly remote. Furthermore, otters are recovering in all remote lowland forested non-protected areas that have been surveyed in Loreto (Recharte and Bowler 2018) and are surely coming into contact with isolated fishermen.

2.4.3 The reality of interactions with giant otters

People from the communities had negative views towards giant otters, but in reality, this species had minor interactions with fishermen and very rarely damaged nets. Other species like pink dolphins can cause damage with more frequency, and caimans cause major holes in the nets compared to the other aquatic species and consequently the cost of repair is higher. People also said they fear being attacked by both caimans and giant otters. People do not express negative perceptions towards fish that break the nets, even though they damage nets at the same frequency as aquatic predators. Managing local peoples' negative feelings about wildlife is essential (Distefano 2005) because perceptions influence human behaviour towards wildlife, including possible persecution (Madden 2004).

There was a gap between the perception of net damage by giant otters in relation to other species and the reality of how much damage they actually cause. Similar patterns have been found in terrestrial mammals in Uganda, where perceptions of damage were seen to reflect the extent of damaging events rather than their frequency or the average damage caused by each species (Naughton-Treves 1997). I propose two reasons for the gap in perceptions and reality of damage caused by otters. Firstly, the giant otter is more conspicuous than the other species, swimming at the surface more often, feeding out of the water, moving in large groups and vocalising loudly and frequently. Secondly, perceptions are based on fishermen's experiences, and otters have only recently recovered in Loreto. In the most remote parts of PSNR, experiencing the fastest recovery of giant otters, fishermen started to come into contact with the otters within a decade of the interviews (Recharte et al. 2008). Fishermen in PNR rarely reported sightings until 2012 (Ruck et al. 2014) and few people in MKRCA had ever seen the species at the time of interview.

2.4.4 Persecution of giant otters

It is not always clear how attitudes correlate with the actual behaviour of people towards predators (Dickman et al. 2014). Negative perceptions could lead to retaliation against giant otters and other aquatic predators, especially pink dolphins and neotropical otters, although from our records, neotropical otters did not cause damage to nets during fishing. In Peru, indigenous communities living near to the Güeppi Reserved Zone have

indicated a desire to organize a systematic cull of giant otters (J. Lopez 2013, *Personal communication*) due to perceived competition for fish. In Pucacuro, negative attitudes to aquatic predators exist, due to concerns over damage to nets. This may be causing hostility and retaliation towards giant otters in particular, despite legal protection. In our study, several interview respondents openly admitted to persecuting otters despite their known protected status, especially in the most remote PNR. However, within this sensitive line of questioning, we did not ask when the events occurred. Many of these events could be historical events relating to the sale of skins when markets did exist or had only recently been restricted. In another line of questioning, four fishermen said they *would* kill giant otters if they found them in a lake, but due to fear for their safety, suggesting that skins are not currently important, but that otters may still be persecuted. Additionally, as a new National Reserve, PNR is still developing agreements with local people to protect lakes inside the reserve for fishing. Without care, this process could lead to the persecution of giant otters as people develop increased economic stakes and presence in the area.

The 16 interviewees who said that they had killed or knew people that had killed giant otters to take the young as pets may reflect a low volume of activity that is still occurring. Zoos and rescue centres in Iquitos and Lima, Peru occasionally take in young giant otters that are abandoned or given anonymously (Daniel Montes, Parque de las Leyendas, Lima, *Personal communication,* October 2017). No international trade in giant otters occurs, but the extent of local trade and collection for pets merits further investigation.

2.4.5 How can perceived negative interactions be mitigated or reduced?

Economic compensation mechanisms have been implemented to reduce negative actions by farmers due to loss of livestock to large carnivores in Europe (Fritts 1982, Fischer 1989, Fritts et al. 2007). Kucerova (1999) suggested that in areas where Eurasian otters raid fish farms, the owner should be compensated, and similar compensation schemes have been applied in Austria (Kranz 1994, Mysiak et al. 2004), Germany (Schwerdtner and Gruber 2007) and the Czech Republic (Mysiak et al. 2004). In South America, no schemes yet exist to compensate fishermen for damage to fishing equipment or for perceived reductions in fish stocks caused by otters or other species.

Residents of PSNR have more positive perceptions and attitudes towards giant otters; this could be because many residents are involved in conservation management programs with different NGOs and tourists regularly visit the community of San Martin the Tipishca. Tourism has been introduced in many regions as a form of mitigation for negative experiences with large predators and other problematic wildlife (Kiss 2004). However, although, tourism has the potential to reduce negative perceptions of otters and increase tolerance to their presence in the area, this activity has not been easy to implement in some areas (Recharte et al. 2015). In the extreme north of Peru close to the Ecuadorian border, the remote nature of the site and poor transport logistics means that people are not able to develop tourism (Alverson et al. 2008). Similarly, tourism is very limited in MKRCA and PNR. Developing tourism in PNR will probably not be practical due to the distance from Iquitos, the costs of transport and rudimentary hospitality infrastructure. Tourism as a form of compensation for perceived losses from damage caused by otters is therefore not currently viable. This economic benefit may not reach everyone in a community and returns can often be lower than expected (Goodwin and Roe 2001).

Where tourism cannot reach, changing fishermen's methods may be an effective option in mitigating negative interactions with aquatic predators. One possible action would be to guard the fishing nets during fishing and scare the animals when they are close to the nets. However, fishermen are typically used to leaving fishing nets for two or three hours or longer before returning to collect the fish. A second possibility would be to check the nets more frequently for fish. Increasing total fish capture in the nets increased the likelihood of having net damage, while the length of a fishing session had no effect on net damage. This suggests that net damage would be reduced if fewer fish are in the nets at any moment in time. More frequent checking of nets would mean fewer fish in the nets on average, and have the added benefit of reducing loss of fish to piranha or other predators and may be acceptable to fishermen. Further research is required to test the efficacy of this strategy while controlling for spatial correlations in otter and fish abundance.

Changing perceptions may be one of the few widely applicable methods for mitigating damage by giant otters. It is important to empower local people in the context of coexistence with wildlife. For instance, a positive experience has been documented via 'Lion guardians' in Kenya (Amboseli-Tsavo), where they changed the rate of lion killing by 99%, employing traditional mitigation techniques and empowering people through

employed participation in conservation and monitoring lion populations (Hazzah et al. 2017). Giant otter conservation may require some creative solutions to change opinions and encourage peaceful coexistence between people and otters in the face of perceived losses. Although actual losses appear to be much lower than they are perceived, few routes of mitigation exist in that will apply in all regions. The most promising are changes in fishing methods, which requires further experimentation, and environmental education and promotion of the species to improve positive opinions and perceptions.

Chapter 3: Single-hit conservation education with schoolchildren in the Peruvian Amazon: Evaluating short and long-term attitudes towards giant otters

Plate 13. Conservation education delivered in San Martin de Tipishca, PSNR.

Abstract

Positive changes in conservation attitudes follow short-term education sessions, but long-term evaluations of their impact are rare. I examined both short and long-term outcomes of 'single-hit' conservation education for schoolchildren in two Peruvian Amazon communities. Twenty participants from 2009 were re-contacted while 38 participants engaged only in 2015. All participants completed brief interviews before and after attitude questionnaires. Attitudes did not differ between participants and non-participants in the 2009 session, but overall attitudes were significantly more positive following activities. Although 'single-hit' conservation education classes lead to short-term changes in self-reported attitudes, longer-term changes were not detected. While it could be that no long-term change occurred, groups had universally very positive attitude scores that could not be improved for many individuals within the study design, so changes could not be detected using the tests used.

Key words: Conservation, education, opinions, schoolchildren, behaviour change, Peru.

3.1 Introduction

3.1.1 Conservation education in the tropics

The terms 'conservation education' (CE) and 'environmental education' (EE) are used to describe overlapping activities related to the promotion of 'the smart use of natural environment through maintenance and regeneration of natural resources for aesthetic and cultural needs to benefit present and future generations' (ERIC 1970: pp 3). While EE typically encompasses a wide range of environmental topics, and aims to instil a perception of value for the environment in primarily urban schools all around the world, CE has been developed for children and adults as a tool to protect habitats and wildlife, and aims to teach these themes in a way that will promote behaviour that achieves this goal (Pooley and O'Connor 2000). Ultimately, the aims for both forms of education are that more environmental understanding will lead to pro-environmentalist or ecocentric behaviour (Hungerford and Volk 1990). CE, the focus of this chapter and the term used hereon in, is often integrated into conservation programs and delivered to diverse groups in society, from very young children to adults (Feinsinger et al. 1997). Despite its labour-intensive nature, CE is considered cost-effective because of its supposed positive effects on behavioural change, although evidence to that effect is rare (Dietz and Nagata 1995, Jacobson 1987, Engels and Jacobson 2007).

CE programmes can be developed as a mechanism for improving attitudes towards wildlife conservation (White and Jacobson 1994), especially for endangered species (Fernandez-Juricic 2000). As such as it often aims to change the behaviour of people living alongside wildlife or habitats. Often CE aims to solve specific problems due to a hostile human-animal interface. For example, in Kenya people were persuaded to stop killing wild dog (*Lycaon pictus*) cubs in their dens, and Canadian farmers were convinced to start working towards the conservation of persecuted swift foxes (*Vulpes velox*), as a result of engagement with CE programmes (Sillero and Laurenson 2001).

General and targeted education campaigns, aiming for attitudinal and behavioural changes, have been effectively used in Central and South American contexts for decades (Mulder et al. 2009). Of the sixty-two non-governmental organizations (NGOs) created to

work in education in South America, 53% work only on EE (Bermudez and Lombada 2009). The northeast of Peru is an area of high biodiversity, with many endangered and endemic species. Here, there are approximately five NGOs working principally on CE, but many more that include CE in their activities, and CE with local people is an important tool to preserve wildlife (NCI 2015). Additionally, in rural areas, the Peruvian Government are involved in providing CE to park guards, local managers, hunters, fishermen and local people, training them on how to preserve and manage their resources for sustainable use and ecotourism (C. N. Tanchiva 2015 *personal communication.* December 2015).

Conservation projects often focused on ecology and also have a CE element to meet the remit of funders. For example, one international funding organisation for nature conservation has awarded small grants to 3511 projects in 155 countries (The Rufford Foundation 2016). Of 91 funded projects in Peru, while only 16 were explicitly conservation education projects, the majority included an element of conservation education in the project description in the webpage or in their final reports. However, due to the short-term nature of such conservation grants, many of these conservation education activities are necessarily short-term (The Rufford Foundation 2015).

CE activities can be categorised by their longevity: a) *Long-term programs* with regular activities, lasting several years; b) *Short-term programs* with comprehensive activities involving several sessions with the same participants, but within a limited period, c) '*single-hit' (one-off) sessions* lasting for an extended school class for each set of participants. In Peru, short-term programs and single-hit sessions are common, most likely due to budgetary constraints, so their effectiveness is important, or money would be better spent on fewer more extended programmes. While there are many examples of the use of CE in habitat countries, published evaluations of outcomes are less common, and I am aware of few long-term evaluation of education programs that have been implemented in rural areas of South America. Mulder et al. (2009), assessed children's' knowledge and attitudes in Guyana, finding minor impacts of CE on children's' knowledge and no change in attitudes to exploitation and utilization. The authors did not specify if the CE was single-hit or long-term visit from conservation organization to the assessed schools. Following this assessment, they recommended more frequent visits to improve knowledge. Norris and

Jacobson (1998), found that the longevity of CE programs and follow-up sessions affects the outcomes of CE because this allow further assessment of long-term effects of education program strategies. CE assessments are more common in urban schools, where conservation researchers evaluate increases in knowledge, and attitude change, but fewer studies consider whether these also underpin changes in behaviour (Burnett et al. 2016).

3.1.2 Conservation education used to mitigate hostile wildlife-interaction

In recent years, growing human populations have resulted in an increased interface between wildlife and people, leading to problems with top carnivores that take livestock from farmers (e. g. various carnivores in Europe, Johansson et al. 2016; bears in USA and South America, Dunn et al. 2008, Slagle et al. 2013, Espinosa and Jacobson 2012; wolves in USA, Johansson et al. 2012; felids in Chile, Silva-Rodriguez et al. 2007, lions and other carnivores in Africa, Dickman et al. 2014). Likewise, people have reported issues with aquatic predators: bottelnosed dolphins (*T. truncatus*) damage nets while stealing fish in the Balearic Islands, causing economic loss to fishermen (Brotons et al. 2008), and river dolphins in Brazil are considered competitors for the fish resources and cause damage though accidental entanglement in the fishing gear (Da Silva and Best 1996, Alves et al. 2012). Other top aquatic predators, like crocodiles, are attracted by fishing nets and lines and end up destroying fishing gear (Aust et al. 2009). On the Zambezi River, fishing from a canoe is considered one of the most dangerous livelihoods because of potential attack by crocodiles (Aust et al. 2009, Wallace et al. 2012). In Brazil, caimans interfere with the gill-nets of commercial fishermen and leave them unusable (Peres and Carkeek 1993). As a result of such as interactions between predators and livelihoods, CE has been targeted towards helping specific species such as: bears in USA (Dunn et al. 2008) and South America (Espinosa and Jacobson 2012), alligators in Georgia USA (Skupien et al. 2016) and bottle-nosed dolphins in Peru (Van Bressem et al. 2006). Conservation Education is also used in a long-term program to mitigate perceptions of net damage and fish loss caused by Amazon River Dolphins in Peru (Gilleman 2015).

3.1.3 Giant otter – a negative perceived flagship species

Historically, the giant otter was heavily hunted for the pelt trade, and after nearly disappearing from natural habitats, it was included in 1973 in the Appendix I of CITES which eliminated the trade. The species was classified on the IUCN Red List as Vulnerable in 1982 and upgraded in 2000 to Endangered. Populations are still thought to be declining, largely as a result of the destruction of their habitats (Groenendijk 2015), but in the last few years populations of giant river otters have been recovering on a number of rivers in Brazil (Lima et al. 2014a) and Peru (Groenendijk and Hajek 2006, Recharte and Bodmer 2010, Groenendijk et al. 2014). Consequently, interactions with people have become more frequent (Gomez and Jorgenson 1999, Recharte et al. 2008, Rosas-Ribeiro et al. 2012, Lima et al. 2014b).

Internationally, the image of giant otters is used to encourage public support for conservation and generate funds (Norris and Michalski 2009), and the popularity of the species has resulted in a successful tourism industry in the Brazilian Amazon and Southern Peruvian Amazon (Groenendijk and Hajek 2006, Kruuk, 2006). However, not all local communities consider this recovery to be beneficial because giant otters are feared by some people (Recharte et al. 2014, Chapter 2) and are also blamed for a perceived drop in populations of fish (Recharte et al. 2008, Rosas-Ribeiro et al. 2012, Michalski et al. 2012, Lima et al. 2014b, Lassmar et al. 2015) and damage to fishing nets (Recharte et al. 2015, Chapter 2).

Giant river otters are considered a flagship species because they can raise financial support for habitat conservation (Stevens et al. 2011), furthermore otters are also touted as flagships on several other levels. For example, as ‘indicators’ of healthy habitats (Groenendijk et al. 2000, Ayala et al. 2015), or ‘Umbrella’ species (Groenendijk et al. 2000, Norris and Michalski 2009), meaning that protecting them can protect other species and habitats. They are ‘Charismatic’ influencing peoples’ support for nature conservation more generally (Home et al. 2009). In Madre de Dios, in the south of Peru, the giant otter is used as a local flagship, taking a central role in environmental education campaigns in schools and villages in the region where the charismatic species is used to engage school children with a wider ranging conservation message (Groenendijk and Hajek 2006).

In contrast, in the Northern Peruvian Amazon, any benefits from the presence of giant otters for tourism have had a limited impact on local community conservation (Recharte et al. 2015), perhaps because the population recovery is more recent in this region (Recharte and Bodmer 2010), but also due to the lower volumes of tourism in the region. In the northeast of Peru, there are several protected areas were rural people and fishermen report the recent recovery of giant otters: Gueppi National Park, Pucacuro National Reserve, Matses National Reserve, Communal Reserve Tamshiyacu Tahuayo (*Personal observations*). At the turn of the century, in the Pacaya-Samiria National Reserve (PSNR), giant otters had not been recorded as present for many years (Isola 2000). PSNR is one of the largest protected habitats in Peru, 96% of the area is flooded forest, and one of the objectives of the creation of the reserve was to protect flagship species like giant otters. Populations of otters are now growing in this area and there are regular recorded sightings, both inside and outside the boundaries of the protected area (Recharte et al. 2015).

I examined 'single-hit' conservation education with children attending two schools within communities inside the PSNR. Specifically, I evaluated an education session that focused on giant otters and their conservation, using short interviews before and after the session to identify any impact of the session on children's knowledge and/or attitudes. Previous studies identified positive changes in conservation attitudes following short-term sessions, but there has been limited evaluation of either 'single-hit' or 'long-term' activities and therefore limited assessment of longer-term learning outcomes in either modes of delivery for CE (e.g. Kuhar et al. 2007, Dolins et al. 2010, Burnet et al. 2016). My evaluations were conducted in 2015 but a similar CE activity session was delivered in the same schools several years earlier in 2009 allowing for a long term follow up in 2015, shortly before the delivery of CE, for those children who attended the session at both time points.

3.2 Methods

3.2.1 Study area

This study was carried out in San Martin de Tipishca, a community on the Samiria River, in the Pacaya-Samiria National Reserve in the northeast Peruvian Amazon (73°W, 04°S) (Figure 22). The community is located on the river, community members practice agriculture, palm fruit extraction, managed hunting and fishing, and low levels of small-group tourism. The communities are highly involved in conservation activities following community developed management plans assisted by the NGO 'ProNaturaleza', Wildlife Conservation Society, and other NGOs that are dedicated to the conservation of biodiversity through sustainable development and SERNANP (government body that regulates protected areas in Peru).

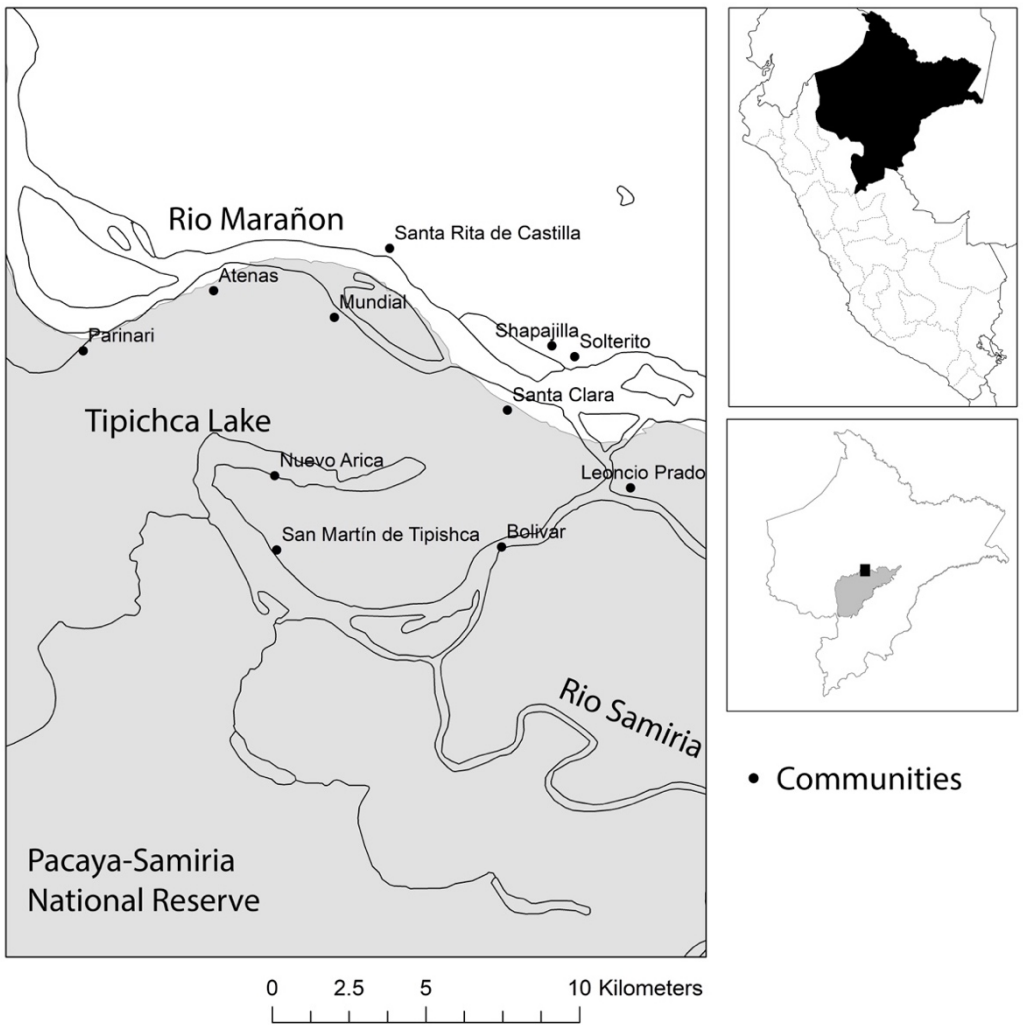


Figure 22. Community of San Martin de Tipsihca, Pacaya-Samiria National Reserve

3.2.2 Study design and participants details

A within-participant design, using interview-based questionnaires, assessed the knowledge and attitudes of 38 school children (aged from 5 to 15) towards giant otters before and after a single-hit conservation session in 2015. In addition, interviews with a group of 20 participants who had also previously engaged in a similar session in 2009 were used to identify any longer term or cumulative impact of such sessions on the children's attitudes.

3.2.2.1 Longitudinal group

In 2009, a single-hit conservation session was delivered to children in a school setting in both communities. Children engaged in a 3-hour educational session that focused on the ecological importance and conservation issues for giant otters, including one video of 45mins about the research and conservation of giant otters, and a drawing activity based around giant otters. Attendance records were taken but no formal evaluation of these session was undertaken (Plate 15).

Plate 14. Conservation education in 'San Martin de Tipishca', PSNR, 2009.

3.2.2.2 Single session group

In 2015, the same communities and schools were revisited. Prior to any announcement of the focus of the session (i.e. giant otter conservation), three researchers interviewed all the schoolchildren attending school on the day of the session (n=58). Of these, 20 students were identified from the list of participants in 2009, according to the schoolteachers and community leaders, the remaining 38 schoolchildren had not experienced any CE about giant otters. Due to the time constraints of the students' school curricula, all activities including interviews were completed across two days, so interviews had to be kept short, pre-activity interviews and educational activities were done in day-one, and drawings were collected and post-activity interviews done on day-two (Table 11). Prior to the session, participants were asked the following questions (see Appendix I for interview schedule and materials):

1. Participants were asked to identify giant river otters in a set of photos of giant otter and related or superficially similar animals from the region: Neotropical otter (*Lontra longicaudis*), tayra (*Eira barbara*) and capybara (*Hydrochoerus hydrochaeris*), pink river dolphin (*Inia geoffrensis*), gray dolphin (*Sotalia*

fluviatilis), black caimans (*Melanosuchus niger*) and common caiman (*Caiman crocodilus*).

2. Those individuals identified as previously participating in 2009, were asked; Do you remember the activity in 2000?

3. Do you like giant otters?

4. Why?

5. What do you know about giant otters?

Both CE sessions were delivered by myself. The CE delivered in 2015 was a 'single-hit school' classroom session, the session was very similar to that in 2009 but some sections had been updated with recent research on the range and diet of giant otters. The session included an oral presentation with colour slides explaining the ecology and main characteristics of giant otter: ecology, distribution, diet, importance of the species, as well as their conservation and threats. After the presentation, the children were asked to draw any animal that they like, with prizes available for the best drawings. Participants were interviewed the following day, by myself and two research assistants, using the same questions above, with the exception of question 2, which was not re-used. We interviewed a total of 69 schoolchildren in the pre-interview, and 58 returned for the post-interview.

Table 11. Description of the schoolchildren interviewed in PSNR.

Groups	**Longitudinal 2009**		**Single session 2015**	
Age range	5-15		10-15	
Gender	N	%	N	%
Female	9	45.0	23	60.5
Male	11	55.0	15	39.5
Total	20		38	

3.2.2.3 Ethical permissions

Ethical approval for this study was granted by the University of Stirling Psychology Ethics Committee. In addition, all parents were informed of the planned activity and given opportunities to withdraw their children. The Principal and teachers at the schools generously allowed us to run these activities. Activities were in line with the guidelines of the British Psychological Society, and children's participation in evaluation interviews was optional and anonymous.

3.2.3 Data analysis

For question one, two and three I used binomial (Yes/No) coding. The responses for question four about why they like or do not like otters were coded into categories (positive/negative) and sub-categories as illustrated in Table 12 (Dey 1999); if the children made different statements related to behaviour, or the appearance of the animal, ecology and its presence related to the habitat and nature, these answers were coded as positive attitudes while answers related to fear, not knowing the animal and uses of part of the animal were coded as negative attitudes. The short answers were further classified according to a framework for attitudes (Kellert and Berry 1987, Eagles and Muffit 1990); positive for Scientific, Naturalistic, Ecological, Moralistic, Aesthetic, Humanistic, and negative for Utilitarian and Negativistic (Table 12). Children who preferred not to answer this question, or were neutral, were coded as negative since neutral attitudes can potentially indicate negative attitudes (Newmark et al. 1993). Since the interpretation of neutral responses as negative is not validated in this research environment, responses categorisation used here can be considered 'positive' and 'non-positive'. However, I retain the language used by Newmark et al. (1993) for clarity, and because neutral responses did not occur, and abstentions were relatively rare (Pre CE test: n=2 in question three and n=7 in Question five; Post CE test: n=5 in question five only). Each response was given an overall binomial value (Positive =1, Negative = 0) for statistical analysis (Table 12).

Table 12. Categorization of attitudes towards wildlife.

Category	**Definition**	**Traits mentioned**	**Positive(P) /Negative (N)**
Scientistic	Interest on biological function and physical attributes of the animals	Increase knowledge	P
Naturalistic	Affection for wildlife and outdoors	Important for nature	P
Ecologistic	Concern for the environment, integrative relationship between wildlife and natural habitat	Important for nature	P
Aesthetic	Interest on the symbolic characteristics of animal, appearance.	Pretty	P
Humanistic	Strong affection for individual animals, pets	Similar to humans	P
Negativistic	Orientation on active avoidance to animals' due indifference, dislike or fear.	Fear, no answer	N
Utilitarian	Interest of the value of the animal	Edible, sellable	N
Moralistic	Care for the right and wrong treatment of animals, with strong opposition to cruelty towards animals	No responses	

Dominionistic	Interest on control over animals, typically in sporting situation	No responses

Source: Eagels and Muffitt 1990.

Analyses were conducted in SPSS PASW 17. I analysed two variables, 1) if children recognize otters from pictures and 2) if they like otters. I compared groups from pre-test and post-test using McNemar's Test to determine difference on scores. I use a test of association (Fisher's exact test) to analyse the difference between Longitudinal and Single session group responses for the first interview.

3.3 Results

3.3.1 Recognition of giant otters in pictures

I interviewed 58 schoolchildren in total. During the pre-test, most of the respondents (N=51, 88%) from single session group distinguished giant otter in the pictures from other animal pictures, and 98% (N=57) children recognized the otter in the post-test the following day. There was a statistically significant difference in the proportion of schoolchildren that recognize giant otter after the environmental session (McNemar's exact p=0.03), providing evidence that short-term change in knowledge results from environmental education.

3.3.2 Short-term change in attitudes in schoolchildren

Although most children from the single group session already stated that they liked otters (N=51, 88%), the negative responses reported by seven children all changed to positive responses following the session. Again, the proportion of schoolchildren that like giant otters after environmental education session increased significantly (McNemar's exact p=0.02), demonstrating a change in attitudes after environmental education.

3.3.3 Long-term change in attitudes in schoolchildren

In the pre-test in 2015, 40% (n=8) of the children remember the session completed in 2009. However, 21% (n=8) of children that did not participate in the activity in 2009, also said that they remembered the environmental education session in 2009. We use Fisher's exact test and could not find any significant difference in knowledge or attitudes between the group that remember the CE in 2009 and the children that not remember (recognizing giant otters in pictures p=0.17, liking giant otters p=0.66, or given positive opinions p=0.08), although the result is close to significant and sample size is small. One reason the sample size is so small is that the long-term change was measured after six years, when many of the original participants had left school and where unavailable for interview. This period is longer than ideal and better results might be obtained using a shorter period of one to three years and a more sensitive measure than a binary response, such as a Likert scale, although these can be difficult to administer with the younger participants.

Most children in both the 'Single session' (N=32, 84%) and 'Longitudinal' groups (N=19, 95%) were able to identify a photograph of a giant otter and there was no significant difference between group in recognition rates (Fisher's exact, p = 0.4). Failure to identify giant otter was rare (3% of children), and all those that failed to identify giant otters confused them with the similar Neotropical otter. The lack of difference in knowledge suggest that there was no long-term change after environmental education. Ninety percent (N=18) of participants from the longitudinal group said that they like otters, compared to 87% of single session group, which was not a significant difference between the groups in attitudes (Fisher's exact, p=1).

3.3.4 General opinions about giant otter

When I asked a further question about why they liked otters before the session, statements included behaviour, appearance, and ecology of the animal, with 44 children (75%) reporting positive attitudes towards otters. In the post-activity session, significantly more children (N=52, 89%) made positive statements (McNemar's exact p=0.04). Fifteen (75%) of the children from the longitudinal group included positive reasons for liking otters,

compared to 29 (76%) of the children from the single session, suggesting no long difference between the groups in attitudes (Fisher's exact, p=1) (Table 13).

Table 13. Comparison of positive responses about giant otters in Pacaya-Samiria National Reserve for all (N=58), longitudinal (n=20) and single session (n=38) children.

Short-term changes			
Question	Pre-test	Post-test	McNemar's
	Yes/Positive	Yes/Positive	P value
Can you recognize a giant otter?	88%	98%	0.03
Do you like giant otters?	88%	100%	0.02
Why do you like giant otters?	76%	90%	0.04
Long-term changes			
Question	Longitudinal session	Single session	Fisher's exact
	Yes/Positive	Yes/Positive	P value
Can you recognize of giant otter?	95%	84%	0.4
Do you like giant otters?	90%	87%	1
Why you like giant otters?	75%	76%	1

Opinions about giant otters among school children in PSNR are generally positive. Most children in the pre-test (90%) mentioned the appearance of the otters in a positive way: e.g. *'they look beautiful when they swim, and they are not bad when they get closer'* (Female, 14), '*I like their color and the way that they call'* (Female, 10), while the remainder (10%)

identified their place in nature as an explanation for liking this species, *'they are animals from Amazonia'* (Male, 13). In the post-test, physical appearance remained the most popular reason for liking otters for 90% (n=46), but some more knowledge-based ecological answers were given *'they make a hole to sleep'* (Female, 14), *they are cute, eat fish and they can live 19 years'* (Male, 10).

In the pre-test, some negative answers were provided (N=14, 24.13%). The schoolchildren reported that they have never seen the giant otter or did not answer, and the others (N=5, 31%) stated that they feel scared of them, or that giant otters were good as a food source. In the post-test, seven (12%) of the 58 children gave negative or neutral opinions, five citing fear, while two children said that they do not know the giant otter. Some specific statements were: *'I do not know this animal'* (Male, 15), *'they are good animals, they don't harm, just scare you'* (Male, 13), '*they are very tasty'* (Female, 10).

3.3.5 Gender influence

I interviewed 32 girls and 26 boys, and there was no influence of gender on the predisposition to like otters in the pre-test (Fisher's exact, p=0.44) or post-test (Female, McNemar's exact p=0.06; Male, McNemar's exact p=0.5). When I compared the frequency of positive opinions given to the follow-up question 'why do you like/dislike giant otters' between genders, there was no significant difference in positive responses among females (pre-test: N=21, post-test: N=27) (McNemar's exact p=0.07) or males (pre-test: N=23, post-test: N=25) (McNemar's, exact p=0.63).

3.3.6 Schoolchildren drawings

When children were asked to draw 'the animal that they most like': 41% of the schoolchildren drew just one animal in the picture, while others included two or more animals. From all the drawings, 41% included a giant otter in the picture, 29% jaguar, and 17% caiman (Table 14).

Table 14. Percentage of animals drew by schoolchildren in Pacaya-Samiria National Reserve.

Category	**Animal**	**N**	**%**
Mammals	Giant otter	24	41.38
	Jaguar	17	29.31
	Howler monkey	8	13.79
	Pink dolphin	4	6.90
	Tapir	4	6.90
	Saddleback tamarin monkey	2	3.45
	Squirrel monkey	2	3.45
	Gray dolphin	1	1.72
Reptiles	Caiman	10	17.24
	Turtles	2	3.45
	Boa	1	1.72
	Anaconda	1	1.72
Birds	Heron	7	12.07
	Parrots	4	6.90
	Toucan	3	5.17
	Hummingbird	2	3.45
	Hoatzin	2	3.45
	Woodpecker	1	1.72
	Red Macaw	1	1.72
	Kingfisher	1	1.72
Fish	Fish	3	5.17
	Arapaima	2	3.45
Insects	Butterflies	2	3.45

3.4 Discussion

3.4.1 General attitudes about giant otters among schoolchildren

Children's attitudes were generally very positive towards giant otters. During the pre-interview test, most of the children had positive perceptions towards giant otters, regardless of whether they had participated in our 'one-hit' conservation education in 2009, or only the single session. Almost all children recognized the species and gave aesthetic or scientific/humanistic reason for why they liked giant otters. Opinions of children in the PSNR contrast with those of adults at the same study site, as determined by interviews in 2009 (Recharte et al. 2015). Whilst two thirds of adults there had overall positive opinions towards otters, the majority also mentioned some negative opinions, and about a third had mainly negative opinion (see also Chapter 2). Most adults' opinions related to resource competition for fish or net damage during fishing (Recharte et al. 2015). The most common positive opinion expressed by adults was that giant otters were important 'for future generations' (Recharte et al. 2015).

The low number of negative attitudes expressed by children compared to adults (Chapter 2) probably reflects the fact that they tend not to go on fishing expeditions far from the communities and experience limited contact with giant otters. Children in fishing families may become more sensitive to their parents mentioning 'competition for fish' and 'net damage', as they grow older and start taking an interest in family livelihoods, and to start to experience negative interactions with otters. I was unable to separate children of different ages due to small sample sizes. There are several accounts of children influencing parents' attitudes and knowledge (Eagles and Demare 1999, Damerrell et al. 2013), but there has been limited study of how parents influence children's' attitudes towards nature (Cheng and Monroe 2012) or science more broadly (Archer et al. 2012), and usually these studies take place in urban schools. However, there is evidence that verbal information can shape fear of animals in children (Muris et al. 1996, Field and Lawson 2008, Muris et al. 2010). Similarly, a study in Finland reported that adolescent girls' attitudes towards the environment and nature tend to be more similar to their parents' than were those of boys, mothers and daughters have more positive environmental attitudes and this could be related to gender roles (Leppänen et al. 2012). Some studies have shown that males have more knowledge on about wildlife, appear to enjoy direct contact with animals and are more

concerned about animals and their natural environment (Kellert and Berry 1987), but others have found that women tend to be more pro-environmentalist (Uysal et al. 1994) and have negative attitude against cruelty to animals (Kellert and Berry 1987). Culture surely influences these findings and different patterns are likely to be found in different places. While gender effects are likely to be important in conservation education and research, these are likely to be highly dependent on the context of the program,

3.4.2 Conservation education: the long-term and short-term effect

This study did not detect long-term effects of using conservation education to change knowledge or perceptions in schoolchildren after a 'single-hit' classroom presentation about a single flagship species. Although our interval of five years is particularly long, and means some children were very young when we first engaged with them, few other studies can look at such long-term effects. In Uganda, a single hit education program for school children aged around 10 to 11 years old in Kalinzu Forest Reserve was evaluated after one month, one year and two years. There was a positive effect on knowledge at each interval (Kuhar et al. 2010). In Cote d'Ivoire, the long-term (two years) evaluation of an education program found increased knowledge and positive attitudes towards nature (Brochers et al. 2014). Most studies, as was shown here, find short-term positive effects after doing environmental education with children (Kuhar et al. 2007, Dolins et al. 2010, Burnet et al. 2016), and demonstrate that short-term 'single session' conservation education can have positive effect on opinions and attitudes towards a promoted species. Studies in schools in urban areas have found positive effects of environmental programs and demonstrate that children with very high knowledge about nature already have pro-environmental thinking even before the CE activities (Burnett et al. 2016). Demonstrating that an increase in knowledge or changes in attitudes are a result of a specific activity is challenging due to the range and variety of other experiences and teaching to which participants are typically exposed (Burnett et al. 2016). In our study, the high levels of species recognition and positive attitudes expressed before the session indicated that children in rural areas already have a good knowledge of nature and have predominantly positive attitudes, at least in areas like our study area, where conservation is practiced in the community. Indeed, in my questionnaire, most of the children registered the highest possible scores for a positive attitude towards wildlife. When this is the case, Bettinger et al. (2010) suggests focusing the

education program on something other than changing attitudes, such as measuring the actions of participants, so that positive changes in behaviour can be measured.

3.4.3 Targeting single-hit conservation education – assessing need

That schoolchildren in this area of Peru have largely positive opinions about giant otters, especially when compared to those of fishermen (Recharte et al. 2015, Chapter 2), highlights the advantages of assessing existing opinions, and the need for CE, before delivering conservation education packages. One of the main activities for local people in the PSNR is fishing, both for subsistence and for economic benefit. While a proportion of the recipients of our school-based conservation education in the PSNR may eventually become fishermen, the implications of coexistence with piscivorous species may only become evident in adulthood, and only for a proportion of the participants. Where resources dictate that only single-hit or short-term conservation education are possible, and rapid changes in human behaviour are the desired outcomes, targeting efforts to where it is most needed would be the most efficient strategy. In our case, focusing on adult male fishermen might be a more effective strategy. Alternatively, designing activities that intentionally involve school children's' families might also be effective. Thus, assessing needs for conservation education and determining the most important groups to target before programs are designed, may be more important than assessing its effectiveness.

3.4.4 Single-hit conservation presentations for rural children

Currently in the PSNR, environmental education is included in the school curriculum; teachers take the children to participate in activities like farming and gardening, and there are activities lead by conservation NGOs and park managers. All this extracurricular activity surely helps build positive attitudes. When effective single-hit lessons on giant otters are supplemented by other conservation teaching, both contribute to an overall education and promote conservation of wildlife, in a similar way to umbrella programs that use large charismatic animals to protect other species and biodiversity generally (bears, Dunn et al. 2008, Espinosa and Jacobson 2012; alligators, Skupien et al. 2016, bottle-nosed dolphins, Van Bressem et al. 2006; Amazon River Dolphins, Gilleman 2015). While the long-term benefits of a single-hit session might be difficult to detect, the

cumulative effects of positive classes on conservation and the environment are likely to promote awareness of the species of conservation concern, change negative or neutral attitudes to positive attitudes, and ultimately lead to changes in the behaviour of the next generation of inhabitants of the targeted areas (Bettinger et al. 2010), but there remains a paucity of evidence to support these commonly-help assumptions.

Chapter 4: Giant otters and the 'Big five' for Amazonian wildlife tourism: flagship species and marketing for conservation

Plate 15. Pair of giant otters sighted in Yanayacu river, PSNR.

Abstract

Flagship species are defined as species that promote conservation awareness and generate funds through wildlife tourism. The beneficiaries may be private companies and individuals, as well as conservation NGOs and government bodies. The Amazon rainforest is diverse and there are many flagship candidates that could attract tourists. I used questionnaires to explore and identify the most suitable flagship species for tourism in the Amazon region. When I asked open-ended questions about which animals tourists would like to see, 'Monkeys' were the most salient and desirable group to see in the Amazon, followed by jaguar, pink dolphin, sloth, birds and caiman. Tourists also ranked species from a fixed list of 21 species; jaguar, pink dolphin, sloth, red and green macaw and anaconda were in the top five, with giant anteater replacing anaconda for more experienced travellers. Tourists were overwhelmingly more willing to pay to see jaguars, or donate for their conservation. Pink dolphins were also attractive as assessed by potential donations, and the harpy eagle emerged as potentially lucrative species for tourism and conservation. Red howler monkey was the most attractive primate species, and the best candidate for a representative flagship for this group. Jaguar, sloth, pink dolphin and black caiman were the top candidates for the rest of the Big five, but dolphins are not present at some top tourist sites. Since anacondas may polarise public opinion, and giant anteaters are extremely hard to see, the harpy eagle may be the next more practical option. While giant otters did not emerge as important in questionnaires, they are still relatively unknown to the general public and fulfil all the criteria for an excellent flagship and remain an excellent candidate for conservation marketing. If flagship species are required to help to promote Peru's most-visited Amazonian areas, the absence of the pink dolphin in the south of Peru and the facility of viewing of giant otters means that they could be considered for inclusion in the *Big five.* However, the appeal of 'diversity' to tourism may be more important in Amazonia than in other areas, and the *Big five* concept may not suit the community of species present. Consequently, I propose that the Amazonian *Big five* should be more flexible, including any of; jaguar, red howler monkey, sloth, red and green macaw, black caiman, pink dolphin and other species to be used where appropriate, depending on the context of the campaigns they are used in.

Keywords: tourist perceptions, giant otters, ecotourism, Amazonia, economic decisions, flagship species.

4.1 Introduction

4.1.1 Defining 'Flagship species'

Flagship species are typically large charismatic vertebrates thought to raise conservation awareness, public support, promote fundraising (Clucas et al. 2008, Caro 2010) and *'rally support for the protection of that species' habitat*' (Caro et al. 2010; pp. 245). A flagship species can serve several different functions, depending on the specific conservation objectives of the organization. Caro et al. (2010) identified four objectives for the use of flagship species: 1) to promote conservation awareness, 2) to promote an organisation, 3) to raise funds, and 4) to set up nature reserves. For instance, the Bengal tiger (*Panthera tigris*) was selected as the national animal of India in 1972 to help people understand concept of conservation (Jepson and Barua 2015), and the orangutan (*Pongo spp.*) supports worldwide campaigns to stop unsustainable palm oil production (Jepson and Barua 2015). The giant panda (*Ailuropoda melanoleuca*) has become a national symbol for China, driving new policies, marketing and conservation strategies for in-situ habitat conservation, not to mention gate receipts (and therefore potentially conservation funding) for zoos across the globe (Jepson and Barua 2015). Flagship species are also often promoted as having a key environmental role, which can take a number of forms. There are other similar concepts like: 'Umbrella species', those '*whose conservation confers protection to a large number of naturally co-occurring species'* Bifolchi and Lodé (2005), while 'keystone species' are those '*whose presence or absence influence distribution and abundance of many others'* (Soule et al. 2005 cited by Caro et al. 2010: pp 127) and the presence of 'indicator species' *'indicates ecosystem health'* (Caro et al. 2010: pp 161). This confusing set of variations led Caro et al. (2010) to use the term *flagship umbrella species* because of the overlap in roles of certain species as used by NGOs, government and local groups. However, the ecological role of species used in this way is not always supported by evidence, for instance: Bifolchi and Lodé (2005) suggested that European otter (*L. lutra*) was not a good umbrella species to confirm biodiversity in the Pays de Loire region, France, and Berger (1997) found that black rhinoceros (*Diceros bicornis*) was not an umbrella species in the Namib Desert and was unlikely to guarantee the presence of other species.

An economically-based "marketing" approach was adopted by Verissimo et al. (2011), describing flagship species as '*species used as the focus of a broader conservation marketing campaign, based on its possession of one or more traits that appeal target audience'*. This is clearly not a novel approach for businesses, which have been making successful brand symbols using charismatic wildlife for many years (e.g. Lynx aftershave, Puma sports clothing, Jaguar cars, etc.) (Macdonald et al. 2015, Wright et al. 2015), and indeed big NGOs and zoos have always used charismatic megafauna in this way. However, many organizations are now identifying new species to use in marketing strategies to promote local endemic species (e.g. the 'Rare' campaigns Jenks et al. 2010, Wright et al. 2015).

Flagship species can also be used to generate funds through wildlife tourism. The beneficiaries may be private companies and individuals, as well as conservation NGOs and government bodies. Regardless of where proceeds are directed, wildlife tourism can give wildlife and environments some form of economic value, which is perceived to provide motivation to conserve these resources in as sustainable way as possible for local stakeholders and policy makers (Di Minin et al. 2013a, Pegas et al. 2013). Whatever the critiques of 'valuing species' (e.g. Corbera et al. 2007), and there have been many, attaching economic values to wildlife allows us to gain some insights into a component of attitudes or reasoned actions in relation to biodiversity conservation (e.g. Richardson and Loomis 2009).

4.1.2 The impact of having a 'Big five'

Flagships in wildlife tourism may be those animals that tourists are frequently able to watch, or they may be those most popular in promotional materials. One of the classic examples of marketing wildlife with a flagship strategy is the use of the '*Big five*' of Southern and Eastern Africa, around which perhaps the largest wildlife tourism industry is built (Walpole and Leader-Williams 2002, Caro and Riggio 2013, Di Minin et al. 2013a). Consisting of the lion, leopard *(Panthera pardus*), buffalo (*Syncerus caffer*), elephant and rhinoceros (*D. bicornis* and *Ceratotherium simum*) (Caro and Riggio 2013), the formal taxonomy is not strictly applied; the two-rhinoceros species are grouped together, although they come from different genera in the family Rhinocerotidae, while lion and leopard, in the same genus, are treated separately. The *Big five* were originally selected by big game hunters

but now have an important socio-economic value to wildlife tourism (Williams et al. 2000) bringing an enormous number of tourists to Africa (Caro and Riggio, 2013). Because of the demand generated by the *Big five,* driven largely by the runaway marketing of these six species, some private game reserves in South Africa even re-introduce these species to fulfil tourist expectations, the cost of which is estimated at between $97,500 – 1.8 million per private protected area (Sims-Castley et al. 2005, Maciejewski and Kerley 2014). However, recent studies show that wildlife preferences vary between tourists, with more knowledgeable visitors often preferring to see wildlife with other attributes, such as small population size or endemism, rather than exclusively charismatic megafauna (Lindsey et al. 2007, Okello and Yerian 2009, Di Minin et al. 2013a, Maciejewski and Kerley 2014, Macdonald et al. 2015).

Such is the success and draw of the *Big five* concept in Africa, and perhaps to highlight some diversity rather than opting for a single flagship strategy (Di Minin et al. 2013b), various organisations have attempted to market Big fives for other countries, continents or ecosystems. The IUCN identify a Big five for Europe: lynx (*Lynx lynx* and *Lynx pardinus*), Wolf (*Canis lupus*), brown bear (*Ursus arctos*), wolverine (*Gulo gulo*) and European bison (*Bison bonasus*) (Linnell 2014). Denali National Park, USA proposed brown bear, wolf, caribou (*Rangifer tarandus*), dall sheep (*Ovis dalli dalli*) and moose (*Alces alces gigas*) as their *Big five*, based on tourist satisfaction of sightings (Skibins et al. 2012). In Scotland, the Scottish Natural Heritage led a voting campaign to select the *Big five* for Scotland to drive more tourism to Scotland, eventually selecting the golden eagle (*Aquila chrysaetos*), harbour seal (*Phoca vitulina*), European otter (*Lutra lutra*), red deer (*Cervus elaphus*), and red squirrel (*Sciurus vulgaris*) (SNH 2013). In South America, WWF (Wildlife World Fund) selected a Big five for the Cerrado savannah and Pantanal wetland; jaguar (*Panthera onca*), giant armadillo (*Priodontes maximus*), tapir (*Tapirus terrestris*), giant anteater (*Myrmecophaga tridactyla*) and maned wolf (*Chrysocyon brachyurus*) (WWF 2015), while the tourist board for Madre de Dios, Peru promoted an Amazonian Big five: jaguar, giant otter (*Pteronura brasiliensis*), black caiman (*Melanosuchus niger*), Andean cock-of-the-rock (*Rupicola peruvianus*) and the red and green macaw (*Ara chloropterus*) (Gobierno regional - Madre de Dios 2016).

Regardless of what the *Big five* might look like for any one region, the identification of suitable species as the focus of marketing campaigns is clearly of considerable worth for the marketing of conservation and wildlife tourism (Verissimo et al. 2011). The Amazon rainforest is diverse and there are many flagship candidates that may attract tourists for different reasons. As noted above, the giant otter is often lauded as a flagship for tourism to the Amazon Region, suggesting that otter tourism could provide and income for an area, leading to the protection of the species and habitat (Groom et al. 1991, Groenendijk and Hajek 2006). The assumption that giant otters are a good flagship for tourism is logical, since people are willing to support conservation of other otter species globally, especially in Europe and North America (Kruuk 2006). Furthermore, giant otters and Neotropical otters are important attractions for tourists in the Pantanal wetland of Brazil, (Kruuk 2006). Nonetheless, with so many charismatic species in the Amazon rainforest, it remains unclear which species are the most important for tourists and have the most potential to generate funds for conservation.

In terms of assessing economic impact, one commonly used measure is 'willingness to pay' (WTP), which represents the amount of money that a tourist is 'willing to pay' or intends to pay for non-market goods (Chung et al. 2011, Abdullahi et al. 2015). A few studies have examined WTP in relation to wildlife tourism for safaris (Sekar et al. 2014), conservation of a game reserve (Abdullahi et al. 2015), endangered species conservation (Lindsey et al. 2007, Richardson and Loomis 2009), and local species and flagships (White et al. 1997, Di Minin et al. 2013a). Willingness to donate 'WTD' is a similar concept but measures the willingness of people to contribute to wildlife conservation without receiving anything in return.

In this chapter, I use interviews with tourists to investigate the relative importance of different animals for the tourism experience in the Peruvian Amazon and identify those that might be most suitable as flagship species for the region. I ask about WTP and WTD as a measure to assess appeal for different species as flagships (Meer et al. 2016), but not to assess the actual economic value of these species.

4.2 Methods

4.2.1 Study areas

Data were collected from May 2015 to April 2016. Myself and two research assistants approached tourists in two regions of the Peruvian Amazon. In north-eastern Peru, there were three locations around Iquitos city: 1) Pilpintuwasi Amazon Animal Orphanage, (N=123 tourists, 28.1%), 2), Centro de Rescate Amazonico – CREA (N=113 tourists, 25.9%), and 3) Museo de Culturas Indigenas Amazonicas (Museum of Indigenous Amazonian Cultures) (N=106 tourists, 24.3%). In south-eastern Peru, in the city of Puerto Maldonado I approached tourists who were on their way to lodges, in the offices of a tour company; 'Rainforest Expeditions' (N=74 tourists, 16.9%). Respondents were 55% female and 45% male. (Figure 23).

Figure 23. Interviews were conducted in the cities of Puerto Maldonado and Iquitos in the South and North of Peru, respectively.

4.2.1.1 Pilpintuwasi Amazon Animal Orphanage

Initially created to breed butterflies, Pilpintuwasi is a recognised rescue centre housing, at the time of the interviews, 12 species of primates, turtles, macaws, a jaguar, an ocelot, a manatee and a tapir. Of note are the nine red uakari monkeys (*Cacajao calvus*

ucayalii), which are free ranging, with tourists protected from direct contact by observing from inside a mesh tunnel. Pilpintuwasi is in the village of Padre Cocha, 20 minutes by boat from Iquitos city. Many tourists visit independently but it is also included as destination by tourism companies as a part of their city tours.

Plate 16. Pilpintuwasi Amazon Animal Orphanage.

4.2.1.2 CREA (Centro de Rescate Amazonico)

This wildlife rescue centre has a special focus on rescuing and rehabilitating manatees, but also has other species, including Neotropical otters, red uakari, woolly monkeys and capuchins. The centre is located 8 km. from the city centre of Iquitos and several ecotourism companies bring tourists to visit CREA to see manatees.

Plate 17. Centro de Rescate Amazonico (CREA).

4.2.1.3 Museum of Indigenous Amazonian Cultures (MIAC)

The museum displays objects from about 40 different indigenous groups from the Peruvian and Brazilian Amazon, including traditional clothes, musical instruments, objects from ceremonial meetings and several tools used for fishing and hunting. MIAC is located in Iquitos city, and is included in the city tour by tour companies.

Plate 18. Museum of Indigenous Amazonian Cultures (MIAC).

4.2.1.4 Rainforest expeditions

A well-established ecotourism company well known for their 'Macaw clay lick' visits and research centre focused on studying macaws. Currently the company runs three tourist lodges along the Tambopata River and promotes various activities in the tropical forest depending on tourists' preferences. The company also collaborates extensively with research biologists. The main office of the lodges is in Puerto Maldonado where tourists gather before and after their journey to the lodges.

Plate 19. Rainforest expeditions office in Puerto Maldonado.

4.2.2 Questionnaire

First, I asked about 'motives for visiting Amazonia' to explore the reasons why tourists visit Peruvian Amazon; this question was classified into seven main categories; 1) biodiversity, 2) mammals, 3) flora, 4) birds, 5) indigenous or Latin culture, 6) physical geography (landscapes: rivers, mountains) and 7) exploration or adventure.

To explore the importance of various species for tourism, and their suitability as flagship species for tourists, I designed a questionnaire including fixed-response and open-ended questions. These were implemented using an electronic survey platform; 'Qualtrics'

(www.qualtrics.com). The questionnaire first divided respondents into two groups; 1) people that had already visited the forest in Amazonia either on their current trip or on a previous visit, identified as *'Tourists with experience'* and 2) people that had not yet visited Amazonian forests *'Tourists with no experience'*. I asked respondents for their age, gender and home country. The questionnaire was piloted with 30 participants from outside of Peru to ensure that all the questions were clearly understood; after these pilot interviews, some minor changes in wording were made. I recruited participants by contacting organizations involved with tourism to get their approval to work at their sites. Tourists were approached with the same electronic interface at Pilpintuwasi, CREA, Rainforest Expeditions and MIAC. Only adults over 18 years old were interviewed. A total of 502 people was interviewed but 65 interviews were not completed, so I consider 437 completed interviews for analysis. All questions were written in English and administered in either English or Spanish, translated by the assistant administering the survey where necessary. Participation was voluntary, and participants were informed that their responses would be anonymised and that they could withdraw their consent at any time.

4.2.2.1 Wildlife species preference

'Tourists with no experience' were asked one open-ended question A.1. 'what species would you most like to see on a trip to the Amazon Rainforest? *Tourists with experience'* were first asked two open-ended questions; A.2 what animals they had most liked seeing on their trip to the Amazon rainforest, and A.3 what animals *that they did not see* would they most liked to have seen. Then, respondents were presented with images and common names of 21 wildlife species (Table 15) and asked to rank the top five animals they would like to see on a trip to the Amazon rainforest, using a five-point scale from 'most desirable (1)' to 'fifth most desirable (5)'. Wildlife species were selected for inclusion in the questionnaire based on interviews made in the Pacaya-Samiria National Reserve (PSNR) (Recharte et al. 2015) in which I asked local people which animals they thought tourists would like to see in the rainforest. To ensure I did not leave out key species from the south of Peru, I also reviewed the Peru Tourist Board marketing for key species mentioned. This lead to the inclusion of one additional species; the Andean cock-of-the-rock (Table 15).

Table 15. Species that interviewees were asked to rank as most desirable to see on a trip to the Amazon Rainforest.

Group	Species	Scientific name
Birds	*Harpy eagle	*Harpia harpyja*
	*Red and green macaw	*Ara chloropterus*
	Cock of the rock	*Rupicola peruvianus*
Carnivores	*Giant otter	*Pteronura brasiliensis*
	*Jaguar	*Panthera onca*
	*Neotropical otter	*Lontra longicaudis*
Cetaceans	*Pink dolphin	*Inia geoffrensis*
	Gray dolphin	*Sotalia fluviatilis*
Primates	*Spider monkey	*Ateles chamek*
	*Red uakari	*Cacajao calvus*
	Squirrel monkey	*Saimiri boliviensis*
	Brown capuchin	*Sapajus macrocephalus*
	Red howler monkey	*Alouatta seniculus*
Reptiles	*Black caiman	*Melanusuchus niger*
	Spectacled caiman	*Caiman crocodilus*
	Anaconda	*Eunectes murinus*
Pilosa	Giant anteater	*Myrmecophaga tridactyla*
	Sloth	*Bradypus variegatus*
Artiodactyla	*White-lipped peccary	*Tayassu pecari*
Perissodactyla	*Tapir	*Tapirus terretris*
Rodentia	Capybara	*Hydrochoerus hydrochaeris*

Note 1: * species also used to explore Willingness to Pay (WTP) for tourism and Willingness to Donate (WTD) to conservation.

Participants were also asked about WTP and WTD for a subset of 11 of these species, selected using the same criteria, but narrowing the list to keep the questionnaire managable (Table 15). These measures were used to determine the relative popularity and potential of species as a flagship for the tourist industry and to conservation rather than as a

means of estimating the economic value of the species (Meer et al. 2016). First, to explore the popularity of a species using WTP, I allowed respondents to use a sliding bar to decide the amount of money they would be willing to spend on a single day trip to see this animal. Second, I asked about WTD for the conservation of specific animal; again, a sliding bar was used to explore their preference for species and donation amount. Finally, socio-demographic data such as gender, occupation and age, was requested (Table 16; complete interview in Appendix J). Surveys took usually between 15 min and 20 mins.

Table 16. Main questions analysed from the questionnaire presented to tourists.

Aim	**Type of question**	**Question**
A. Preference for species (Dichotomous question)	Open-ended	A.1. What animals would you *most like to see* on a trip to the Amazon Rainforest? List up to 5, with the most desirable first[1].
	Open-ended	A.2. What animals did you *most like seeing* on your trip(s)? List up to 5 with the most desirable first[2].
	Open-ended	A.3. What animals, that you *did not see*, would you have most liked to see on your trip(s)? List up to 5 with the most desirable first[2].
B. Rank animal to see preference for species	Fixed-response	From the photos below, please rank (from 1 -5, 1 = most desirable) the five animals that you would most like to see on a trip to the Amazon Rainforest
C. Explore the popularity of the species	Fixed-response	C.1. WTP: 'If you were already in the Amazon Rainforest, how much would you be prepared to spend on a single day excursion to see the following animals? (For a separate trip to see only the animal mentioned, indicate within the range of $1-$1000 American dollars.

	Fixed-response	C.2 WTD 'If you were taking such a single day excursion to see one of the following animals, would you be prepared to also give a donation towards their conservation? For each species, if prepared to donate, indicate within the range of $1 - $100 American dollars.)

4.2.3 Data analysis

Descriptive statistics were calculated using Statistical Package for Social Science (SPSS IBMcorp.) version 21.0 for Windows. Responses about WTP and WTD were converted into binomial categories for analysis with binomial regression (Response variable). Since respondents could give different numbers of responses in open ended questions, I calculated the mean rank of the answers for animal preferences using a Weighted Rank Index (WRI) to standardize the answers with a mean value, the index was calculated separately for open-ended questions (A.1, A.2, A.3) and closed questions (B) (Nepal and Weber 1993, Gillingham and Lee 2003), where:

WRI=$\sum_{i}^{n}(\frac{1}{R_i})/N$ correspond to:

n= number of respondents ranking species

R_i= rank of the *ith* order

N= total number of respondents in the sample

To analyse WTP and WTD, a subset of eleven species were selected; five species that could potentially be 'flagships' and six species that were less attractive, as identified in an earlier survey (Recharte et al., 2015); each species was given a score of '1' (Yes) if the respondent indicated WTP or WTD at any value, and '0' (No) if respondents were not willing to pay or donate. The total amount of money was also calculated in US American dollars (Table 17).

Table 17. Summary of variables analyses and their coding use in Binomial logistic test [GLZM(b)].

Question	Variables	Score	Response	GLZM(b) Model reference
a) All tourists WTP for 11 animal pictures	Pay	1=Yes, 0=No	Yes, I would pay to see the animal	Lowest value
b) All tourists, WTD for 11 animal pictures	Donate	1=Yes, 0=No	Yes, I would donate for this animal	Lowest value
Predictor 1	Gender	0=Male 1=Female		Lowest value
Predictor 2	Age	1=18-24 2=25-44 3=45+		Lowest value
Predictor 3	Home-continent	1=S. America 2=N. America 3=Europa 4=Other		Lowest value

Preferences to pay or donate ($) were skewed because of the high number of zeros and species that were not selected in the results. I used a generalized linear model [GLZM(b)] to assess species preferences by tourists, and a logit link function (Binomial logistic regression) to determine whether the predictors: 1) Gender, 2) Age and c) Home-continent could influence the WTP and WTD for 11 photographs of animals). For home-continent I grouped Asia, Africa and Oceania together as 'other' because the sample for each continent was small. Pearson Chi-square statistic and the Likelihood Ratio χ^2 were estimated to validate the model, Pearson χ^2 was used to look for over-dispersion. Wald χ^2 was used to estimate the significance of each factor. Values $P<0.05$ were Significant and values $P<0.001$ were Highly significant. Because the data were categorical, the assumptions of multicollinearity are violated. I did not test for interactions between the variables because the sample was small and the model was not robust enough for valid assessment of interactions (Table 18).

Table 18. Description of the main variables used for WRI and General Linear Model (Binomial logistic regression) GLMZ(b).

Variable	**Characteristic of variables**	**N**	**%**
Visit	Tourist with no experience	329	75.3
	Tourist with experience	108	24.7
	Total	437	100.0
Gender	Female	238	55.0
	Male	195	45.0
	Total	433	100
Continent	Europe	105	25.3
	North America	111	26.7
	South America	164	39.5
	Others	35	8.4
	Total	415	100.0
Age	18-24	100	23.4
	25-44	233	54.4
	45+	95	22.2
	Total	428	100.0

4.3 Results

A total of 437 tourists completed the survey, 329 were '*Tourists with no experience'* and 108 were '*Tourists with experience*' in Amazonian rainforests with one or more visits to the Amazon forest in any country. Generally, tourists ranked Biodiversity (16%) as the top reason to visit Amazonia, followed very closely by the other categories (Figure 24).

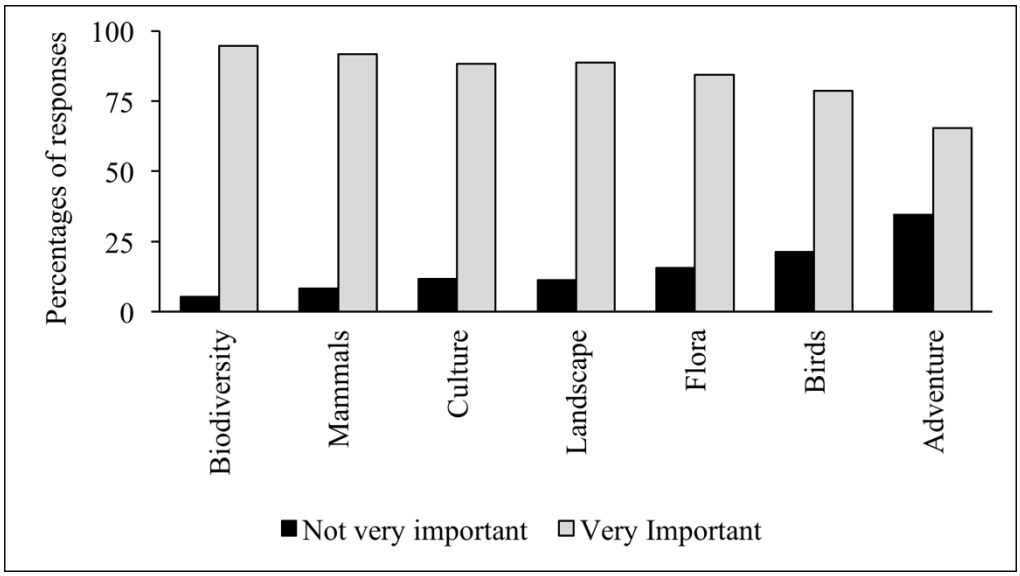


Figure 24. Tourists' motives to visit Amazonia.

4.3.1 Open-ended questions – Preferences for taxonomic Orders

4.3.1.1 'What animals would you most like to see on a trip to the Amazon?

In the subgroup '*Tourists with no experience'* (n=329), 299 people answered the open-question 'What animals would you *most like to see* on a trip to the Amazon Rainforest? Responses were free-listed, and I took the first response to determine the most salient (Quinlan, 2005). Since some respondents only listed one species, I used the first choice to determine the most preferred animals. Responses did not consistently refer to species, genera or other taxonomic levels. For example, different respondents may have responded 'scarlet macaw', 'macaws', 'parrots' or 'birds'. All the answers were grouped by Order to include both specific and non-specific responses given. There was a strong preference for carnivores (27%, N=81), followed by Primates (22%, N=66) and Cetaceans (12%, N=36). A minority of tourists identified fish (Characiformes and Osteoglossiformes), Anura, Testunides, Rodentia, Cingulata and Passeciformes, each listed in first place by one respondent (0.33%) (Figure 25).

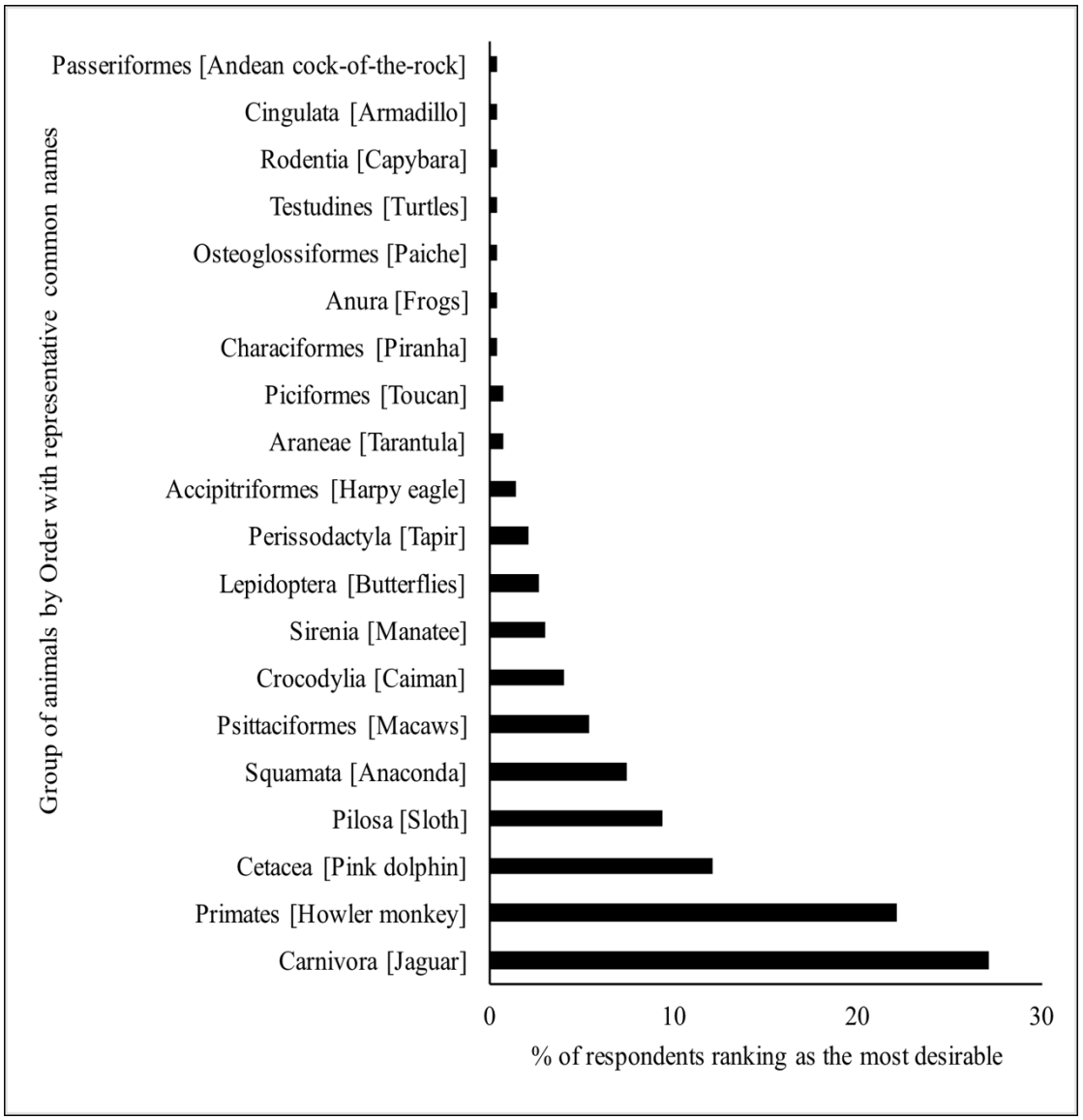


Figure 25. Responses of '*tourists with no experience*' to the open-ended question 'What animals would you most like to see in the Amazon Rainforest?' Answers grouped by taxonomic Order with representative species.

4.3.1.2 'What animals did you most like seeing?

From the subgroup *tourists with experience* (n=108), only 90 answered the open-question 'What animals did you *most like seeing* on your trip(s)? Again, I took the first response to determine the most salient, and answers were grouped by Order. Primates (37%) were the most popular, followed by Carnivores (11%) and Cetaceans (11%) together. Sirenia, an order with only one species in the region, the Amazonian manatee, was in the third place. However, Amazonian manatees are extremely hard to observe in the wild, and

these 'sightings' were probably referring to captive animals at the manatee rescue centre (CREA) (Figure 26).

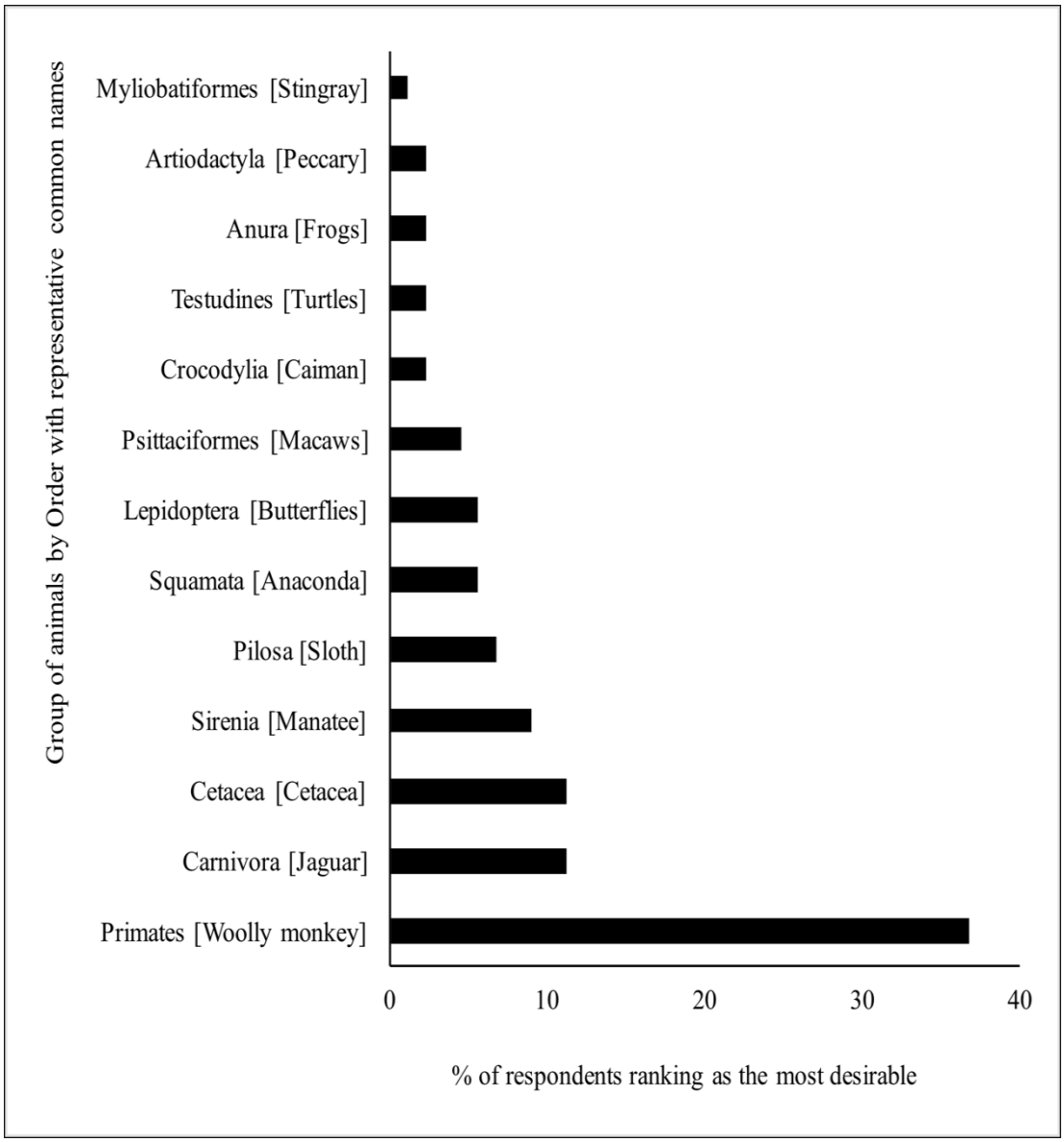


Figure 26. Responses of '*tourists with experience*' to the open-ended question 'What animals did you most like seeing in the Amazon Rainforest?' Answers grouped by taxonomic Order with representative species.

4.3.1.3 'What animals, that you did not see, would you have most liked to see?

From the subgroup '*Tourists with experience*' (n=108), 94 responded to the open question 'What animals, that you <u>*did not see*</u>, would you have most liked to see on your trip? Most of the tourists in this subgroup mentioned Carnivores (32%), Cetaceans (18%)

and Primates (13%). Fourth place was occupied by Crocodylia (9%) with the snakes, Squamata in the fifth place (7%) (Figure 27).

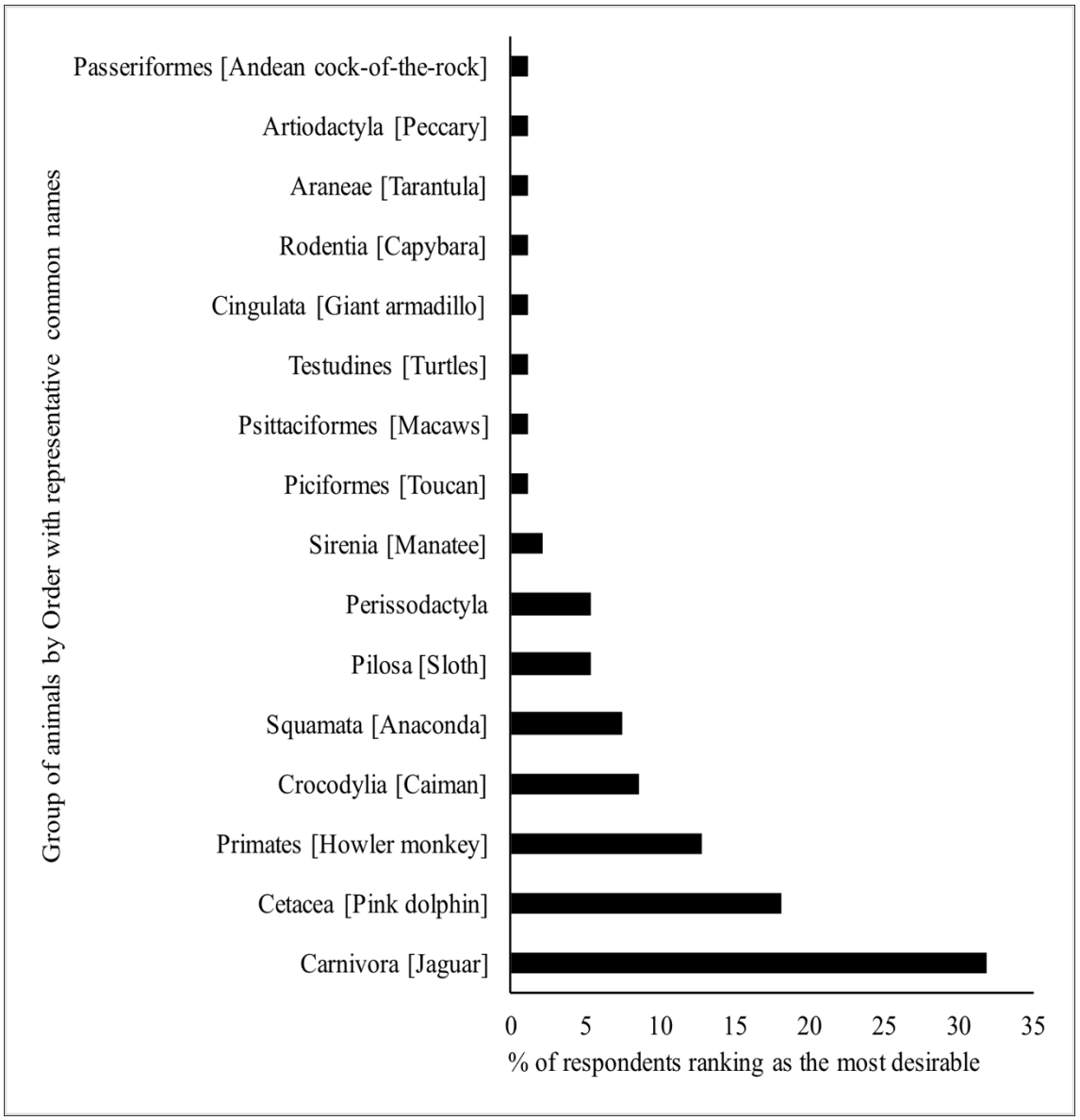


Figure 27. Responses of '*tourists with experience*' to the open-ended question 'What animals *that you did not see,* would you most liked to have seen in the Amazon Rainforest?' Answers grouped by taxonomic order with representative species.

4.3.2 Open-ended questions – salient taxonomic units

Interviewees responding to open ended questions categorized their preferences at varying taxonomic levels. For example, 'monkey' 'and 'howler monkey' both appear as responses to the open-ended questions. I calculated the WRI for 'responses' which can

include species, genera, families or orders, or paraphyletic groups of animals, such as 'birds-of-prey'. Thus, the results are for preferences for 'salient taxonomic units'.

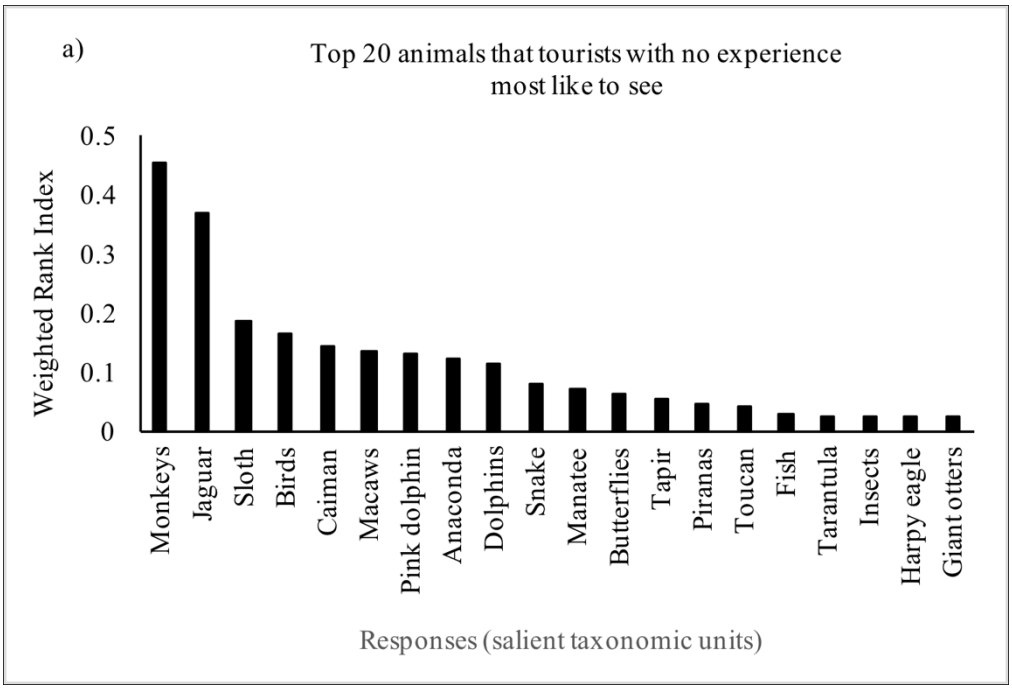
4.3.2.1 WRI - Tourist with no experience

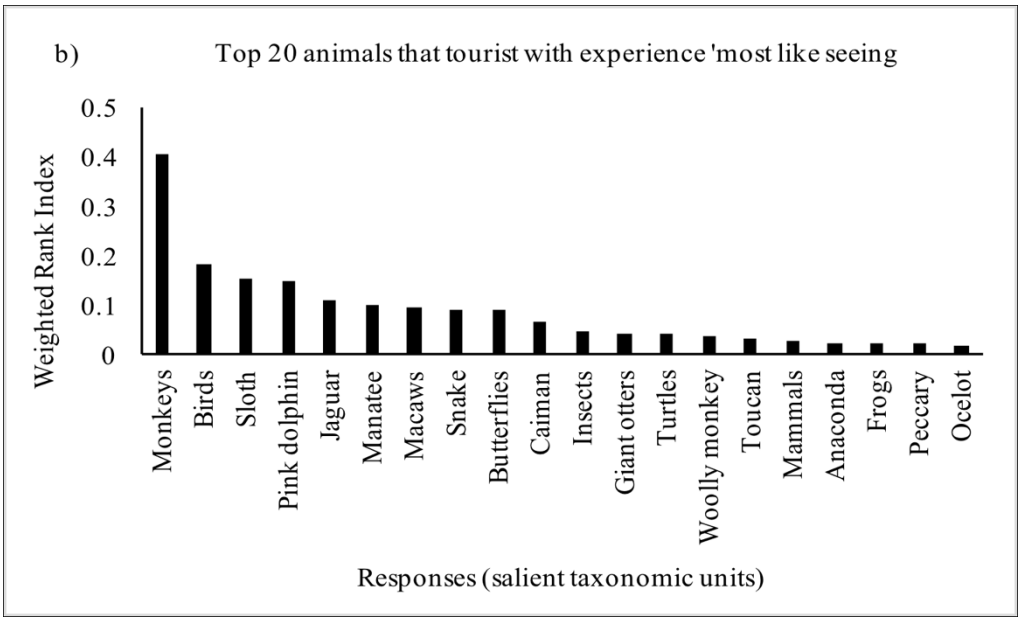
There were 57 different responses to the question; 'What animals would you most like to see on a trip to the Amazon Rainforest?' The response 'monkey' (WRI=0.45) was ranked highest, followed by 'jaguar' (WRI=0.37), 'sloth' (WRI=0.19), 'birds' (WRI=0.17) and 'caiman' (WRI=0.14) (Figure 28a.). Specified monkey species or genera did not make the top 20, and giant otters were ranked 20th (WRI=0.02).

4.3.2.2 WRI – Tourist with experience

There were 68 different responses to the question; 'What animals did you most like seeing on your trip to the Amazon Rainforest?' The response 'monkey' (WRI=0.41) was ranked highest, followed by 'birds' (WRI=0.18), 'sloth' (WRI=0.16), 'pink dolphin' (WRI=0.15) and 'jaguar' (WRI=0.11) (Figure 28b.). One specific monkey species 'woolly monkey' (WRI=0.04) was ranked in the top 20 and giant otters were ranked 12th (WRI=0.04).

There were 56 different responses to the question; 'What animals *that you did not see,* would you have most liked to have seen on your trip to the Amazon Rainforest?' The response 'jaguar' (WRI=0.27) was ranked highest, followed by 'monkeys' (WRI=0.14), 'caiman' (WRI=0.11), 'pink dolphin' (WRI=0.01) and 'dolphins' (WRI=0.01), while giant otters were ranked 11th (WRI=0.04) (Figure 28c).


a)
Top 20 animals that tourists with no experience most like to see
Weighted Rank Index
0.5
0.4
0.3
0.2
0.1
0
Monkeys
Jaguar
Sloth
Birds
Caiman
Macaws
Pink dolphin
Anaconda
Dolphins
Snake
Manatee
Butterflies
Tapir
Piranas
Toucan
Fish
Tarantula
Insects
Harpy eagle
Giant otters
Responses (salient taxonomic units)


b)
Top 20 animals that tourist with experience 'most like seeing
Weighted Rank Index
0.5
0.4
0.3
0.2
0.1
0
Monkeys
Birds
Sloth
Pink dolphin
Jaguar
Manatee
Macaws
Snake
Butterflies
Caiman
Insects
Giant otters
Turtles
Woolly monkey
Toucan
Mammals
Anaconda
Frogs
Peccary
Ocelot
Responses (salient taxonomic units)

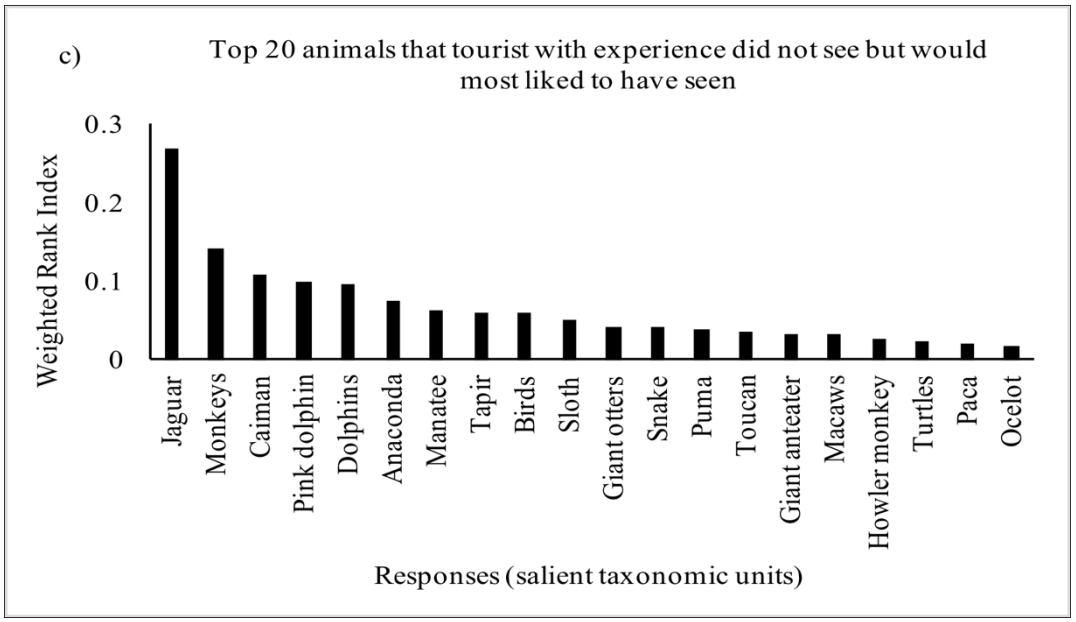


Figure 28. Top 20 responses to open-ended questions, grouped in 'salient taxonomic units'. a) 'What animals would you most like to see on a trip to the Amazon Rainforest? (Tourists with no experience), b) 'What animals would you most like to see on a trip to the Amazon Rainforest? (Tourists with no experience), c) 'What animals, *that you did not see*, would you most liked to have seen on your trip to the Amazon Rainforest? (Tourists with experience).

4.3.3 Wildlife species preferences – ranking wildlife images

After open ended questioning, both groups, *tourists with no experience* (TNE) and *tourists with experience* (TWE), were asked which animal they would most like to see on a trip to the Amazon rainforest, from a selection of 21 animal pictures. This question avoids the issue of mixed taxonomic levels and is designed to minimize bias from previous sightings or missed opportunities. Using WRI, the top-rated animals for *tourists with no experience* were jaguar (WRI=0.36), pink dolphin (WRI=0.22), sloth (WRI=0.19), red and green macaw (WRI=0.18), and anaconda (WRI=0.16). For *tourists with experience* jaguar (WRI=0.33) and pink dolphin (WRI=0.21) were also the highest ranked, but giant anteater (WRI=0.16) came in at number three, followed by red and green macaw (WRI=0.15) and sloth (WRI=0.14). In general, species preferences for wildlife viewing were similar regardless of whether participants had visited the Amazon or not, with the following exceptions: The giant anteater (TNE, WRI=0.13; TWE, WRI=0.16), spider monkey (TNE, WRI=0.19; TWE, WRI=0.16), harpy eagle (TNE, WRI=0.09; TWE, WRI=0.12) and

Andean cock-of-the-rock (TNE, WRI=0.04; TWE, WRI=0.10) which were all ranked higher by people who had visited Amazonian rainforest before (Figure 29).

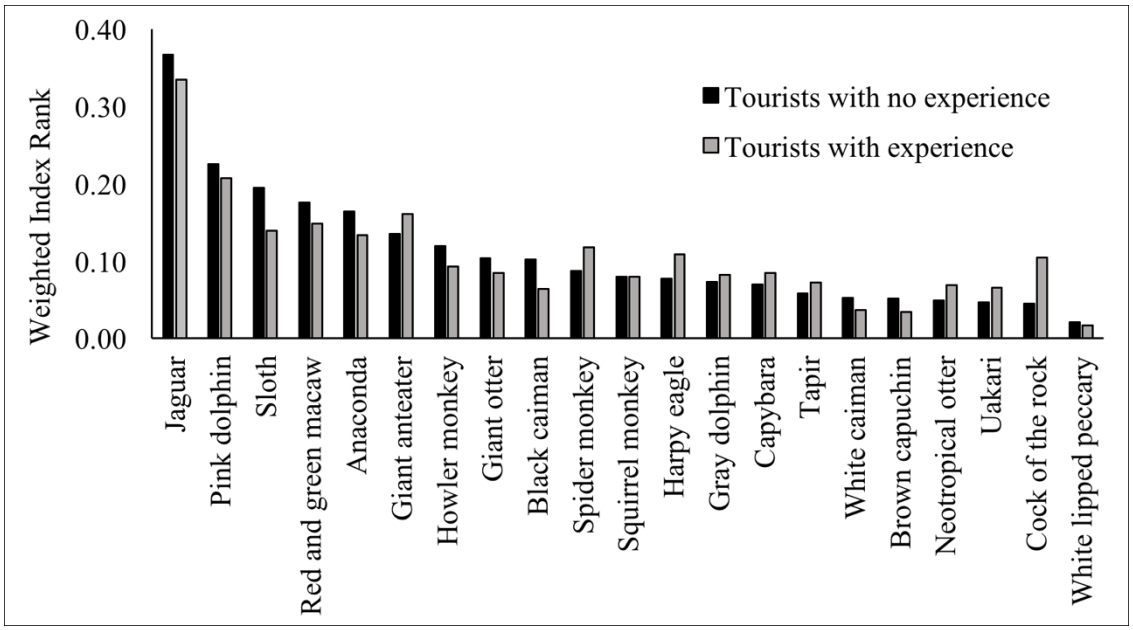


Figure 29. The 'most desirable' animals to see in Amazonia using the WRI score from a selection of twenty-one pictures. From two groups of tourists; a) Tourists with no previous experience in Amazonian rainforest and b) Tourists with experience in Amazonian rainforest.

4.3.4 Willingness to pay for potential flagship species

4.3.4.1 Willingness to pay for excursions guaranteeing sightings of selected species

Of 437 tourists, 363 (84%) were willing to pay to see one or more of the animals listed. Most tourists (68%) were willing to pay to see jaguar, some indicating that they would pay a maximum price of $1000 US dollars (the upper limit of the sliding scale) to guarantee sightings of one, with $159 dollars as a mean value for all the tourist that selected non-zero values for this animal. A majority of tourists also indicated they would pay extra to see pink dolphins (64%, mean $102.86), spider monkey (54%, mean $93.85), black caiman (54%, mean $92.15), red and green macaw (54%, mean $83.05), harpy eagle (51%, mean $97.11), uakari monkey (51%, mean $91.54) and giant otter (51%, mean=$88.83) (Table 19).

Table 19. Comparison of the amount of money that tourists were willing to pay to see specific animal on an extra day trip; mean $USD, excludes tourists that indicated that they would not be prepared to pay extra to guarantee sightings (n = 437).

Species	**Mean $USD**	**%**	**N**	**Range $USD**	
				Min	**Max**
Jaguar	159.54	68	299	4.0	1000
Pink dolphin	102.86	64	281	4.0	1000
Harpy eagle	97.11	51	223	2	1000
Spider monkey	93.85	54	238	5.0	670
Black caiman	92.15	54	236	3.0	513
Uakari monkey	91.54	51	222	3.0	704
Giant Otter	88.83	51	223	3.0	583
Tapir	85.24	50	219	2.0	657
Red and green macaw	83.05	54	234	4.0	580
Neotropical otter	80.71	46	202	3.0	483
White-lipped peccary	74.69	41	178	4.0	469

4.3.4.2 Willingness to donate for the conservation of selected species

Of all the interviewees, 338 (78%) were willing to donate for the conservation of one or more animal from the list. More than 50% of tourists were WTD for the conservation of three specific animals in Amazonia; the jaguar (64%), pink dolphin (62%) and giant otter (51%). However, differences were not pronounced, with around half of people indicating they would be prepared to donate for the conservation of any species (Table 20).

Table 20. Comparison of the amount of money that tourists were willing to donate for conservation of the species. Mean $USD does not include tourists that would not donate.

Species	**Mean $USD**	**%**	**N**	**Median $USD**	**Min. $USD**
Jaguar	35.79	64	279	29	2
Pink dolphin	32.04	62	269	20	2
Harpy eagle	28.83	46	200	20	2
Black caiman	27.86	47	205	20	2
R. and g. macaw	27.38	49	216	20	1
Uakari monkey	27.22	47	205	20	1
Giant Otter	26.84	51	221	20	1
Neotropical otter	26.84	46	202	20	2
Spider monkey	26.4	48	208	20	2
Tapir	26.3	45	197	20	2
W. l. peccary	23.95	41	180	17.5	1

4.3.5 The relationship between preferred wildlife viewing, WTP and WTD

I plotted WRI of the ranked images against the mean value of WTP in American dollars ($USD) for tourists (n=311) that were willing to pay for a day trip to see a specific animal (Figure 7) and the WTD for the conservation of species (Figure 30). For WTP, jaguar is a strong outlier with by far the highest WRI for viewing preference, and people prepared to pay considerably more money to see one. The jaguar was also the 'highest potential earner' for WTD, and people were more willing to donate for the conservation of species they would also most like to see (Figure 31).

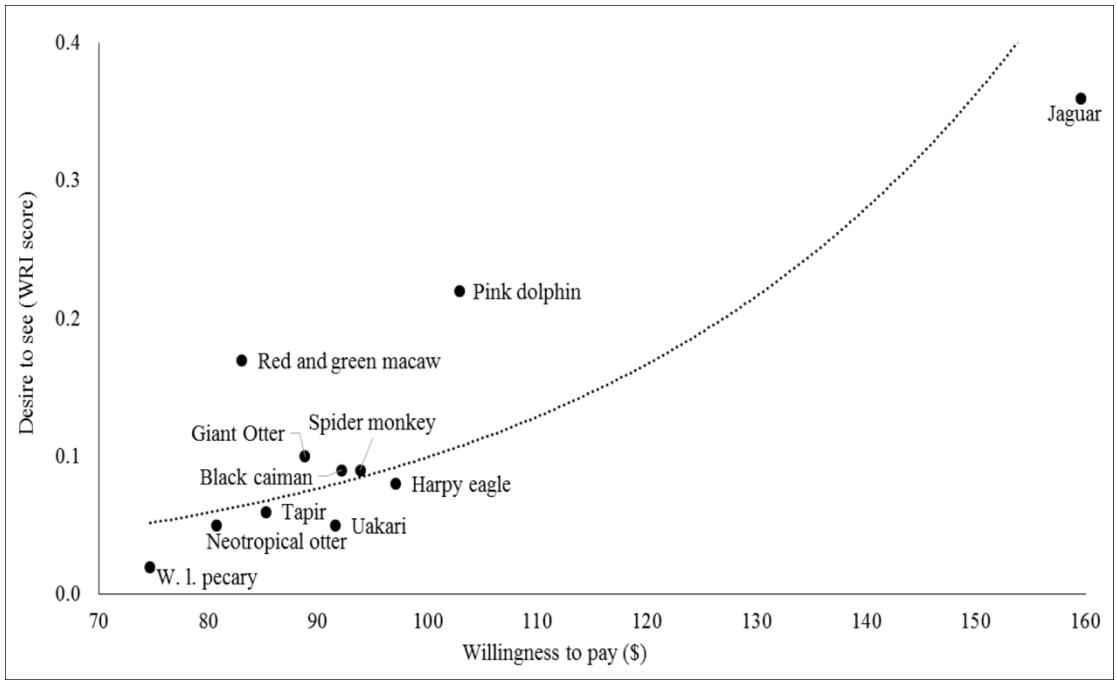


Figure 30. Relation between animals that tourists would most like to see (WRI score) in the Amazon rainforest and their WTP ($ USD) to see them. Note that several species that scored highly for 'desire to see' were not included in the 'WTP' questions.

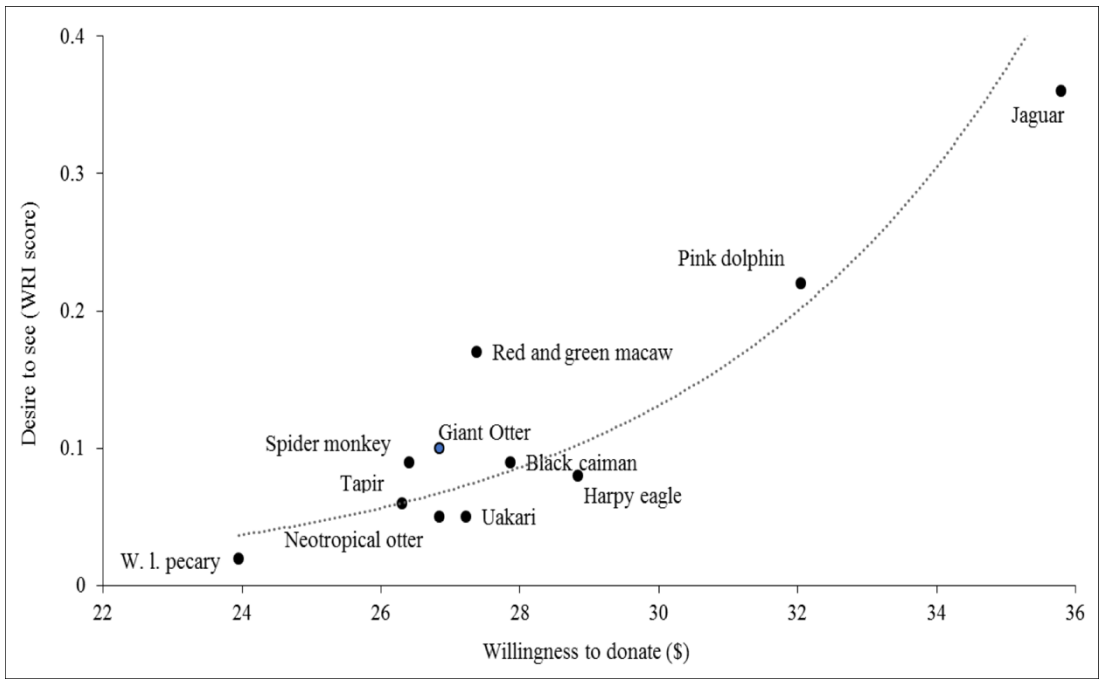


Figure 31. Relation between animals that tourist l would most like to see (WRI score) in the Amazon rainforest and their WTD ($ USD) for their conservation. Note that serveral species that scored highly for 'desire to see' were not included in the 'WTD' questions.

4.3.6 The relationship between species characteristic and WRI, WTP and WTD

There was no association between the WRI of tourist preferences to see an animal and the body weight (Spearman rank, $r_s = 0.164$, P (two-tailed) = 0.478) (Figure 32). Neither does the conservation status of the selected species appear to have any relationship with the WRI for 'desire to see' a species (Table 21).

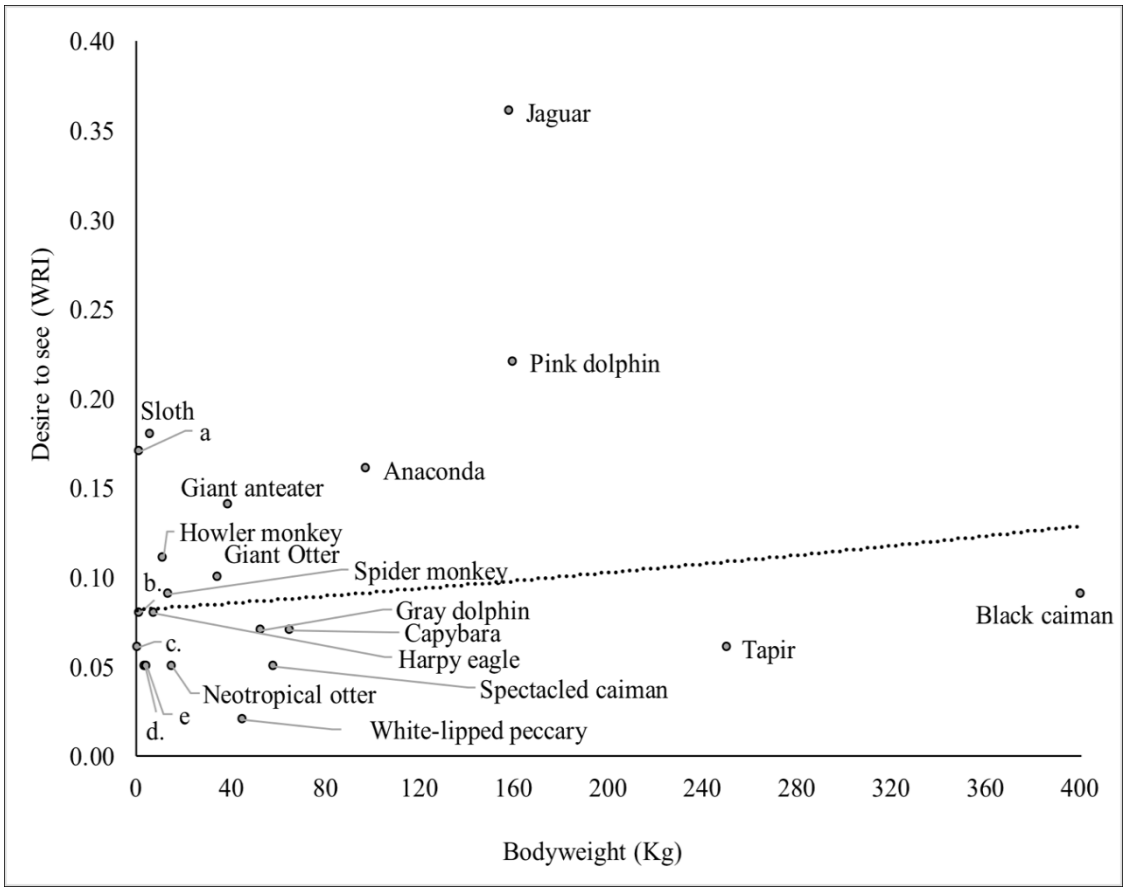


Figure 32. Preference for animals to see in Amazonia, ranked from the 21 pictures, and the WRI score for desire to see. References for Bodyweights: Mammals (Emmons and Feer, 1997), *H. harpyja* (Miranda 2015), *A. chloropterus* (Haugaasen and Peres 2008), *R. peruvianus* (Boyle 2006), *M. niger* (Thorbjarnarson 2010), *C. crocodilus* (Ojasti 1996), *E. murinus* (Miranda et al., 2016b).

Note 1. a. Red and green macaw, b. Squirrel monkey, c. Cock-of-the-rock, d. Red uakari monkey, e. Brown capuchin.

Table 21. Preference for animals to see in Amazonia, ranked from the 21 pictures, IUCN red list categorization.

Species	Desire to see (WRI)	Body weight (kg.)	Median WTP $	Median WTD $	Conservation status	Population trend
*Jaguar	0.36	158	100	29	NT	Decreasing
*Pink dolphin	0.22	160	70	20	DD	Unknown
Sloth	0.18	5.5		20	LC	Unknown
*Red and green macaw	0.17	1.25	55	20	LC	Decreasing
Anaconda	0.16	97.5		20	ND	Not evaluated
Giant anteater	0.14	39		20	V	Decreasing
Red howler monkey	0.11	11.1		20	LC	Decreasing
*Giant otter	0.1	34	65	20	E	Decreasing
*Spider monkey	0.09	13.5	58	20	E	Decreasing
*Black caiman	0.09	400	70	20	LC	Stable
*Harpy eagle	0.08	7.6	74	20	NT	Decreasing
Squirrel monkey	0.08	1.4		20	LC	Decreasing
Gray dolphin	0.07	53		20	DD	Unknown
Capybara	0.07	65		20	LC	Stable
Cock of the rock	0.06	0.25		20	LC	Stable
*Tapir	0.06	250	53	20	V	Decreasing
*Neotropical otter	0.05	14.75	54	20	NT	Decreasing
*Red uakari	0.05	3.5	55	20	V	Decreasing
Brown capuchin	0.05	4.5		20	LC	Decreasing
Spectacled caiman	0.05	58		20	LC	Stable
*White-lipped peccary	0.02	45	51	17.5	V	Decreasing

Note 1: (NT = near threatened, DD = Data deficient, LC = Least concern, V = Vulnerable, E = Endangered) and WRI score.

Note 2: *Species used in this research to explore WTD. References for Body weights: *H. harpyja* (Miranda 2015), *A. chloropterus* (Haugaasen and Peres 2008), *R. peruvianus* (Boyle 2006), Mammals (Emmons and Feer 1997), *M. niger* (Thorbjarnarson 2010), *C. crocodilus* (Ojasti 1996), *E. murinus* (Miranda et al. 2016b).

There was no relationship between WTP (Figure 33) or WTD (Figure 34) with body size (WTP Spearman rank, $r_s = 0.183$, P (two-tailed) = 0.591; WTD Spearman Rank, $r_s = 0.067$, P (two-tailed) = 0.844). However, the analysis includes both mammals and birds.

The harpy eagle is one of the lightest species in the analysis, but is very large for a bird, and is in fact the biggest eagle in the world (Miranda, 2015). The conservation status of the selected species does not appear to have any relationship with the WTP or WTD for the selected species (Table 21).

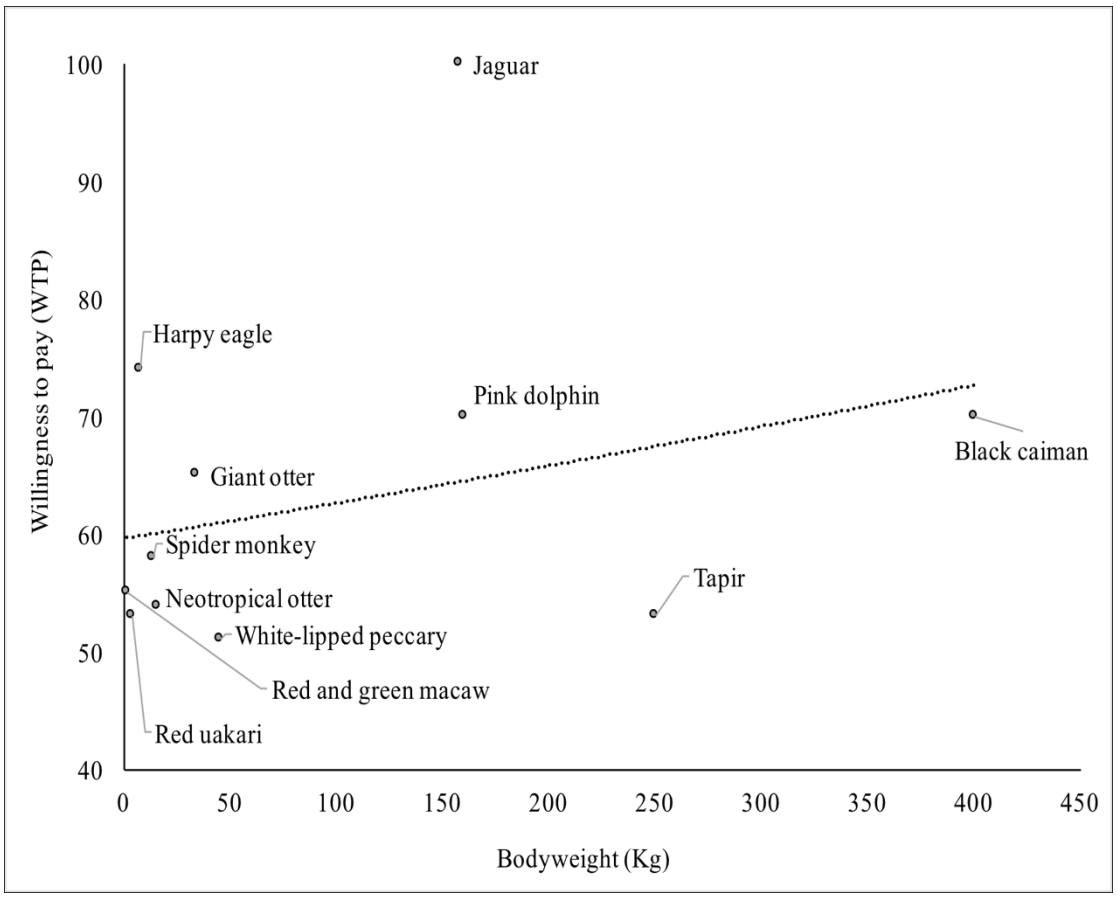


Figure 33. Willingness to pay (WTP in $USD) versus Bodyweight of selected species. References for Body weights: *H. harpyja* (Miranda 2015), *A. chloropterus* (Haugaasen and Peres 2008), *R. peruvianus* (Boyle 2006), Mammals (Emmons and Feer 1997), *M. niger* (Thorbjarnarson 2010), *C. crocodilus* (Ojasti 1996), *E. murinus* (Miranda et al. 2016b).

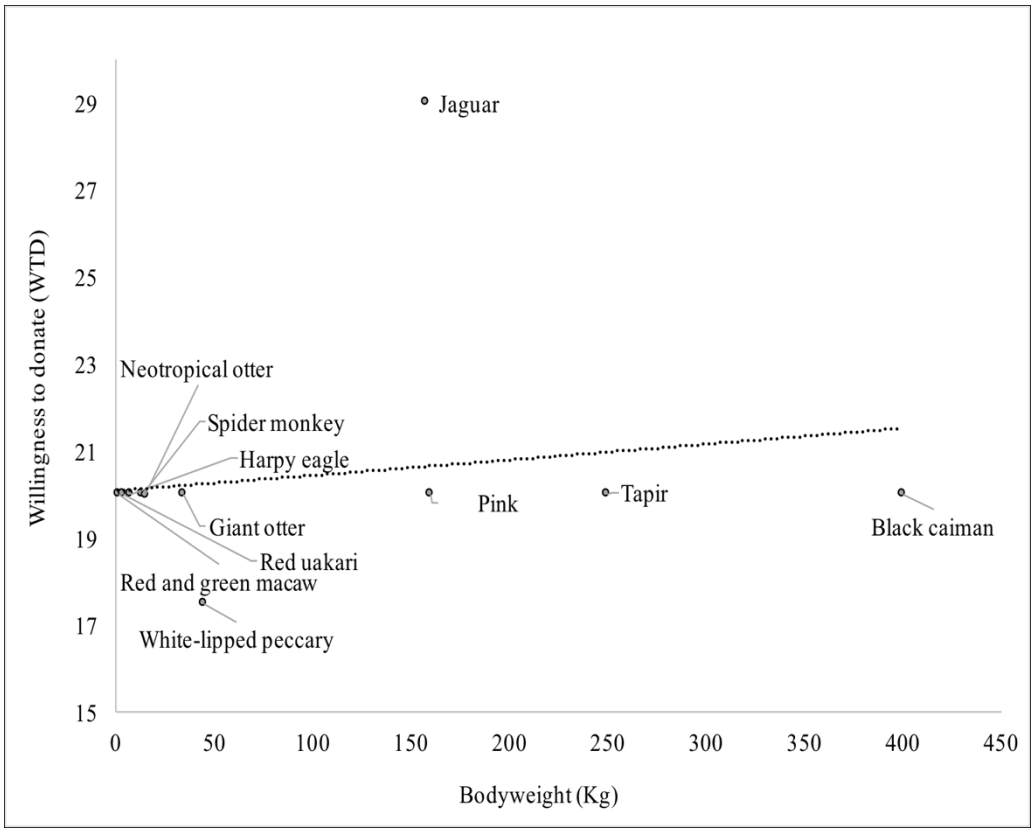


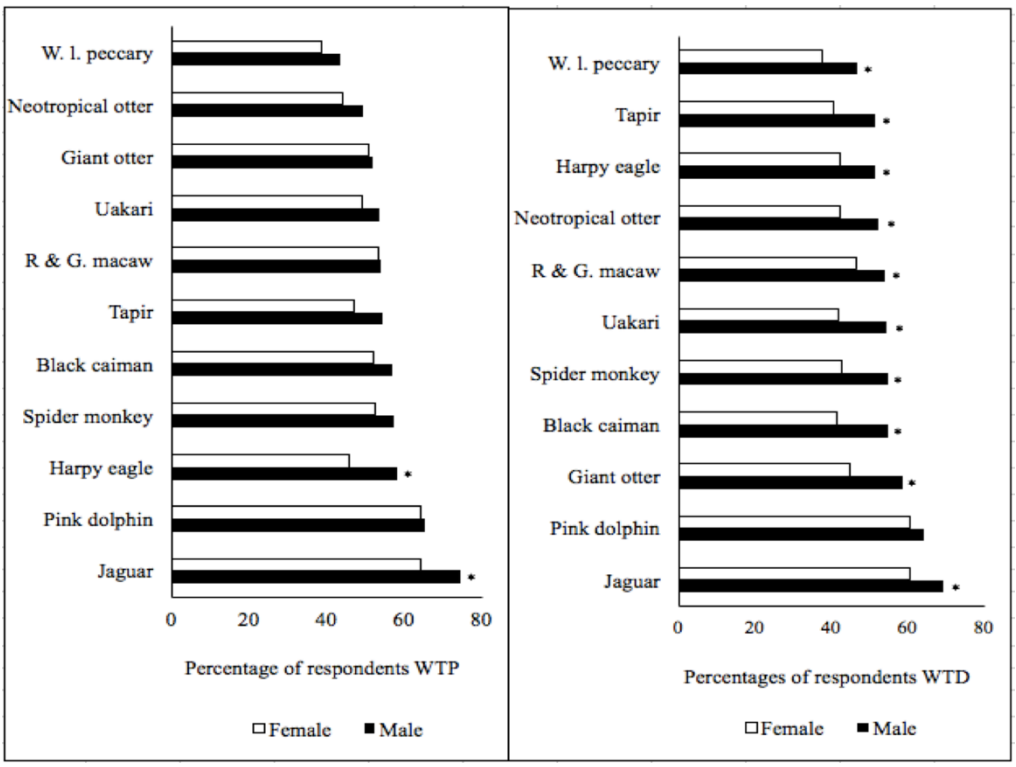
Figure 34. Willingness to donate (WTD in $USD) versus Bodyweight of selected species. References for Body weight: *H. harpyja* (Miranda 2015), *A. chloropterus* (Haugaasen and Peres 2008), *R. peruvianus* (Boyle 2006), Mammals (Emmons and Feer 1997), *M. niger* (Thorbjarnarson 2010), *C. crocodilus* (Ojasti 1996), *E. murinus* (Miranda et al. 2016b).

4.3.7 Socio-demographic factors influencing species WTP and WTD

A binomial logistic regression model using the predictors: 1) Gender, 2) Age and 3) Home-continent', explained a significant amount of the variation in preferences for some flagship species, only 410 (N) contribute with the GLZM(b) analysis from the totals sample of 437. According to Hawkins (2014) over-dispersion value should be close to 1, Pearson χ^2 for spider monkey and uakari monkey were over 2 in WTP, suggesting over-dispersion and the probability of poor model fit and also presented the highest AICc (Table 22). For Tapir in WTP the validity of the model was uncertain. In the other hand, model fitting for the other species were good according to Pearson χ^2 in WTP and WTD. I concluded that the model explains significant amount of the variation in whether the respondents tend to pay or donate for the species presented in the pictures according to P values from Likelihood Ratio χ^2. Type of socio-demographic background could have a significant contribution to

the respondents WTP and WTD for different species (Table 22 and 23, complete GLZM(b) results for each animal in Appendix K, L).

Wald χ^2 helped to conclude that: Men were more inclined to pay for an extra day to see a specific animal, preferring jaguars and harpy eagles. Men were more likely to donate for the conservation of most of the animals listed (jaguar, harpy eagle, spider monkey, uakari monkey, neotropical otter, red and green macaw, giant otter, white lipped peccary, tapir, black caiman) but not pink dolphin (Figure 35).

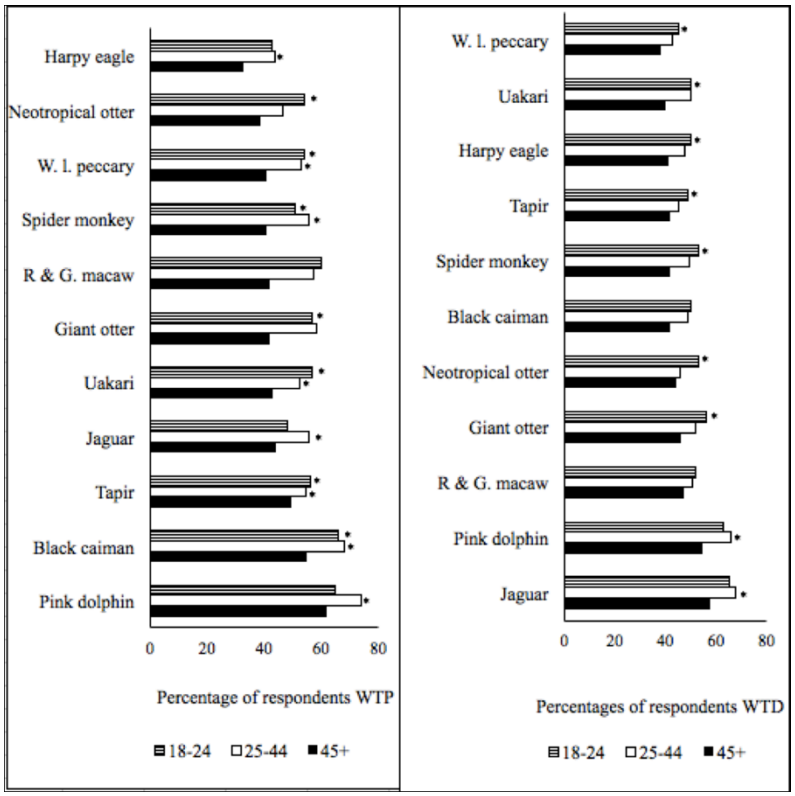


Note 1: *p<0.05, ** p <0.001 [GLZM(b)].

Figure 35. Percentage of tourists that were WTP and WTD by gender (men n = 238, women n = 195).

The youngest age group [18-24] was more willing to pay for an extra day to see neotropical otter, giant otter, spider monkey, uakari monkey, black caiman, white lipped peccary and tapir. The middle age group would pay to see spider monkey, uakari monkey, black caiman, white lipped peccary, tapir, jaguar, harpy eagle and pink dolphin. No groups were interested to pay an extra day to see red and green macaw (Figure 13).

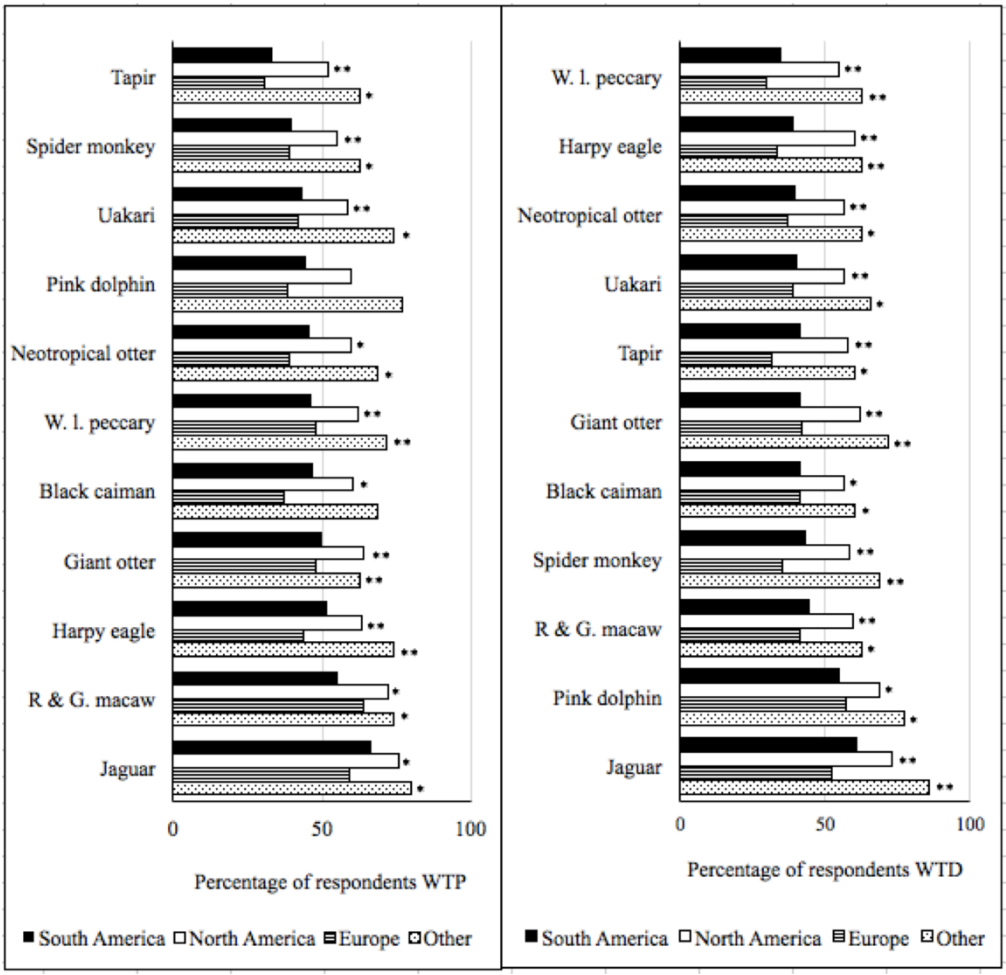
The youngest age group was more likely to donate for the conservation of neotropical otter, giant otter, spider monkey, uakari monkey, white-lipped peccary, tapir and harpy eagle but not black caiman and red and green macaw. Middle age group was more likely to donate for the conservation of jaguars and pink dolphins (Figure 36).



Note 1: *p<0.05, ** p <0.001 [GLZM(b)].

Figure 36. Percentage of tourists that WTP and WTD by age group (young n = 100, mid n = 233, old n = 95).

People from North America were more likely to prefer harpy eagle, spider monkey, uakari monkey, wild lipped peccary, jaguar, black caiman, neotropical otter, giant otter and red and green macaw. People from the 'Other' group were more willing to pay to see harpy eagle, giant otter, white lipped peccary, jaguar, spider monkey, uakari monkey, neotropical otter, red and green macaw and tapir. Finally, respondents from North America and Other were willing to donate for the conservation of all the animals (Figure 37).



Note 1: *p<0.05, ** p <0.001 [GLZM(b)].

Figure 37. Percentage of tourists that were WTP and WTD by home-continent (South America n = 164, North America n= 111, Europe n = 105, Other n = 35).

Table 22. Summary of the results of the Binary logistic regression using Generalized Linear Model and the significant variables that contribute favourable on the 'Willingness to pay' to see this animals in Amazonia, *p<0.05, ** p <0.001 [GLZM(b)]. Cont. = home continent of interviewee.

Species	AICc	P. x^2	LR x^2	df	p<	Sig. var.	Wald x^2	df	p<	Category	B	SE	Wald x^2	Exp B	p<	95% CI ExpB	
																Lower	Upper
Jaguar	96.85	1.15	24.86	6	*	Gender	7.57	1	*	Female	-0.6	0.23	7.57	0.54	*	0.35	0.84
						Cont.	11.53	3	*	Other	1.02	0.48	4.53	2.77	*	1.08	7.05
										NA	1	0.33	9.46	2.72	*	1.44	5.14
						Age	7.04	2	*	25-44	0.73	0.28	6.91	2.07	*	1.2	3.56
Hapy eagle	99.42	1.11	35.1	6	*	Gender	7.35	1	*	Female	-0.57	0.21	7.35	0.57	*	0.38	0.86
						Cont.	22.11	3	**	NA	1.02	0.29	11.6	2.76	**	1.54	4.96
										Other	1.72	0.46	14.1	5.61	**	2.28	13.77
						Age	4.77	2	0.1	25-44	0.57	0.27	4.68	1.77	*	1.06	2.99
Pink dolphin	104	1.35	17.76	6	*	Cont.	11.72	3	*	No significant value							
						Age	7.34	2	*	25-44	0.71	0.27	7.22	2.04	*	1.21	3.43
Black caiman	99.59	1.03	21.19	6	*	Cont.	12.19	3	*	NA	0.93	0.3	9.62	2.54	*	1.41	4.58
						Age	10.19	2	*	25-44	0.82	0.26	9.67	2.27	*	1.35	3.8
										18-24	0.80	0.32	6.34	2.23	*	1.19	4.16
Spider monkey	115	2.11	25.28	6	*	Cont.	17.28	3	**	Other	1.40	0.44	9.97	4.05	**	1.7	9.65
										NA	1.03	0.3	11.9	2.81	*	1.56	5.05
						Age	9.26	2	*	25-44	0.69	0.26	6.18	1.98	*	1.18	3.32
										18-24	0.91	0.32	8.11	2.49	*	1.33	4.67
Uakari	114.2	2	28.96	6	*	Cont.	20.88	3	**	Other	1.33	0.43	9.84	3.79	**	1.65	8.72
										NA	1.22	0.3	16.2	3.38	*	1.87	6.1
						Age	8.27	2	*	25-44	0.75	0.27	7.98	2.12	*	1.26	3.58
										18-24	0.71	0.32	4.82	2.03	*	1.08	3.8

Table 22. Summary of the results of the Binary logistic regression using Generalized Linear Model and the significant variables that contribute favourable on the 'Willingness to pay' to see this animals in Amazonia. (Continuation from page 120).

Species	AICc	P. x^2	LR x^2	df	p<	Sig. var.	Wald x^2	df	p<	Category	B	SE	Wald x^2	Exp B	p<	95% CI ExpB	
																Lower	Upper
N. otter	97.93	0.92	19.94	6	*	Cont.	15.45	3	**	Other	1.08	0.41	6.85	2.93	*	1.31	6.56
										NA	0.87	0.3	8.65	2.38	*	1.34	4.25
						Age	5.54	2	0.1	18-24	0.75	0.32	5.54	2.12	*	1.13	3.96
R. and g. macaw	106.5	1.43	15.85	6	*	Cont.	13.97	3	*	Other	1.03	0.43	5.86	2.81	*	1.22	6.49
										NA	0.73	0.29	6.2	2.07	*	0.17	3.67
Giant otter	95.25	0.77	24.96	6	*	Cont.	19.91	3	**	Other	1.48	0.44	11.2	4.37	*	1.84	10.39
										NA	0.91	0.3	9.51	2.49	**	1.39	4.43
						Age	6.39	2	*	18-24	0.79	0.32	6.19	2.21	*	1.18	4.14
W. l. peccary	101.1	1.24	30.36	6	*	Cont.	25.09	3	**	Other	1.4	0.42	11.2	4.04	**	1.78	9.15
										NA	1.15	0.3	14.4	3.17	**	1.75	5.75
						Age	5.77	2	0.1	25-44	0.62	0.28	5.07	1.86	*	1.08	3.2
										18-24	0.69	0.33	4.34	2	*	1.04	3.84
Tapir	102.8	1.29	25.27	6	*	Cont.	18.05	3	**	NA	1.06	0.29	13	2.88	**	1.6	5.17
										Other	1.29	0.42	9.26	3.64	*	1.58	8.35
						Age	6.21	2	*	25-44	0.6	0.26	5.19	1.82	*	1.08	3.05
										18-24	0.71	0.32	4.98	2.04	*	1.09	3.82
						Gender	3.7	1	*	No significant value							

Table 23. Summary of the results of the Binary logistic regression using Generalized Linear Model and the significant variables that contribute favourable on the 'Willingness to donate' to see this animals in Amazonia, *p<0.05, ** p <0.001 [GLZM(b)]. Cont. = home continent of interviewee.

Species	AICc	P. x^2	LR x^2	df	p<	Sig. var.	Wald x^2	df	p<	Category	B	SE	Wald x^2	Exp B	p<	95% CI ExpB	
																Lower	Upper
Jaguar	89.22	0.68	32.46	6	*	Gender	6.63	1	*	Female	-0.6	0.22	6.63	0.57	*	0.37	0.87
						Cont.	21.51	3	*	NA	1.22	0.32	14.7	3.39	**	1.82	6.31
										Other	1.77	0.53	11.2	5.87	**	2.08	16.58
						Age	5.36	2	0.1	25-44	0.6	0.27	4.76	1.81	*	1.06	3.09
Harpy eagle	92.38	0.61	39.58	6	*	Gender	6.76	1	*	Female	-0.6	0.21	6.77	0.58	*	0.38	0.87
						Cont.	30.35	3	*	NA	1.48	0.31	22.9	4.41	**	2.40	8.09
										Other	1.35	0.42	10.4	3.86	**	1.70	8.75
						Age	6.59	2	*	18-24	0.84	0.33	6.48	2.32	*	1.21	4.42
Uakari	104.3	1.3	31.55	6	*	Gender	9.58	1	*	Female	-0.6	0.21	9.57	0.53	*	0.35	0.79
						Cont.	19.91	3	*	NA	1.03	0.30	11.8	2.81	**	1.56	5.05
										Other	1.19	0.42	8.09	3.30	*	1.45	7.52
						Age	5.41	2	0.1	18-24	0.71	0.32	6.34	2.03	*	1.07	3.82
Pink dolphin	97.89	1.05	19.58	6	*	Cont.	12.95	3	*	NA	0.76	0.31	6.14	2.14	*	1.17	3.40
										Other	0.95	0.46	4.36	2.59	*	1.06	6.32
						Age	6.35	2	*	25-44	0.65	0.26	6.02	1.91	*	1.14	3.21
Black caiman	93.29	0.61	24.18	6	*	Gender	9.83	1	*	Female	-0.7	0.21	9.82	0.52	*	0.35	0.79
						Cont.	13.59	3	*	NA	0.87	0.29	8.61	2.39	*	1.34	4.27
										Other	0.85	0.41	4.35	2.35	*	1.05	5.22
Spider monkey	94.64	0.75	36.58	6	*	Gender	8.91	1	*	Female	-0.6	0.21	8.91	0.54	*	0.36	0.81
						Cont.	25.56	3	*	NA	1.32	0.31	18.4	3.73	**	2.04	6.79
										Other	1.54	0.43	12.9	4.68	**	2.02	10.87
						Age	6.3	2	*	18-24	0.82	0.33	6.34	2.27	*	1.19	4.29

Table 23. Summary of the results of the Binary logistic regression using Generalized Linear Model and the significant variables that contribute favourable on the 'Willingness to donate' to see this animals in Amazonia. (Continuation from page 122).

Species	AICc	P. x^2	LR x^2	df	p<	Sig. var.	Wald x^2	df	p<	Category	B	SE	Wald x^2	Exp B	p<	95% CI ExpB	
																Lower	Upper
N. otter	98.15	0.94	31.24	6	*	Gender	8.11	1	*	Female	-0.6	0.21	8.11	0.55	*	0.36	0.83
						Cont.	21.38	3	*	NA	1.14	0.30	14.2	3.12	**	1.73	5.63
										Other	1.22	0.42	8.56	3.38	*	1.49	7.63
						Age	6	2	*	18-24	0.77	0.32	5.68	2.16	*	1.15	4.07
R. and g. macaw	95.23	0.7	20.03	6	*	Gender	4.53	1	*	Female	-0.4	0.21	4.53	0.65	*	0.43	0.97
						Cont.	14.93	3	*	NA	0.97	0.30	10.7	2.67	**	1.47	4.70
										Other	0.96	0.41	5.51	2.62	*	1.17	5.84
Giant otter	89.1	0.41	40.74	6	*	Gender	11.29	1	*	Female	-0.7	0.21	11.3	0.49	**	0.33	0.74
						Cont.	27.13	3	*	NA	1.19	0.31	15.4	3.31	**	1.82	6.03
										Other	1.39	0.44	10.2	4.04	**	1.72	9.49
						Age	6.26	2	*	18-24	0.81	0.33	6.22	2.26	*	1.19	4.29
W. l. peccary	92.48	0.6	36.95	6	*	Gender	6.28	1	*	Female	-0.5	0.21	6.28	0.59	*	0.39	0.89
						Cont.	29.36	3	*	NA	1.37	0.31	19.7	3.93	**	2.14	7.21
										Other	1.51	0.42	12.9	4.54	**	1.99	10.36
						Age	4.09	2	0.1	18-24	0.67	0.33	4.07	1.95	*	1.02	3.71
Tapir	92.63	0.6	32.87	6	*	Gender	8.026	1	*	Female	-0.6	0.21	8.03	0.55	*	0.37	0.83
						Cont.	23.83	3	*	NA	1.37	0.31	19.8	3.94	**	2.15	7.19
										Other	1.31	0.42	10	3.72	*	1.65	8.4
						Age	4.49	2	0.1	18-24	0.69	0.33	4.49	1.99	*	1.05	3.76

4.4 Discussion

4.4.1 The 'Big five' for Amazonia

Overall, from the 21 pictures displayed to the tourists, jaguar, pink dolphin, sloth, red and green macaw and anaconda were rated as the most desirable animals to see in Amazonia. However, choosing the Amazonian Big five from this list would be restrictive. Free-listing in the open-ended questions revealed that monkeys altogether may be the most salient and desirable species to see on a trip to the Amazon, so any *Big five* for marketing in the region should include a representative monkey species, with the woolly monkey and howler monkey emerging as prime candidates. It was also apparent that many tourists were unaware of many of the species presented in the 21 pictures, or able to name many species during free listing. Other considerations are the importance of diversity in the Big five – filling the Big five with charismatic but difficult to see cats, may not be as effective as including a range of distinct, but appealing and readily seen taxa.

We considered the size of animals as a factor that influences their appeal, a relationship that does seem to hold in our study as well as others (MacDonald et al. 2015, Verissimo et al. 2014). MacDonald et al. (2015) also isolated forward-facing eyes as an important feature of animals selected as flagship species. The problem with such an analysis is that it does not very well account for phylogeny. This group would include all monkeys and cats, which are popular, but it is difficult to isolate forward facing eyes as the important feature for both of these two taxonomic groups. There is nothing to suggest that the same features are necessarily the important ones for each taxa. Other groups with forward facing eyes include the harpy eagle and other raptors and the otters along with the other mustelids, none of which were popular in my questionnaire. Conversely, the highly popular dolphins, macaws and caiman, do not have forward facing eyes.

The issue of familiarity is central to the results of this questionnaire. Species that are well known did well. There are lesser-known species that might be great flagships. The Amazon's rare dog species are not well known to public, but according to the criteria suggested for flagship species (MacDonald et al. 2015) are well suited as flagship species. This leaves room for species to become better known through marketing or featuring by

chance in high profile television or internet publications, as has happened with the sloth [e.g. Meet the Sloths (Cooke 2010)].

4.4.1.1 Monkeys

Primates were an important group for tourists, and particularly so given that they are easily seen and were ranked highly as animals that *tourists with experience* most enjoyed seeing. However, tourists did not usually specify which species of monkey they would like to see. MacDonald et al. (2015) found that primates were the second most charismatic group just behind felids, because they have some traits that are important for human preferences, but in my study for the Amazon, these positions were reversed. From the selection of monkeys shown to participants, the howler monkey scored highly for *'Tourists with no experience'* and spider monkey was important for the *'Tourists with experience'*. Uakaris were low rated by tourists, despite appearing frequently in tourist promotional material in Iquitos (*personal observation*), meeting the criteria of a charismatic species, and being used as the flagship species of Tamshiyacu-Tahuayo Communal Reserve (Bowler et al. 2009). This may be due to a lack of knowledge about this species in the general public. Since howler monkeys have a large body size, produce one of the evocative sounds of the Amazon rainforest in their distinctive calls, and appear to be more salient to less experienced travellers, this is perhaps the obvious primate candidate for the Amazonian '*Big five'*.

4.4.1.2 Jaguar

In Africa, tourists have marked preferences for large carnivores; leopards, lions and cheetahs, and the willingness to pay to see these is higher than for other species (Lindsey et al. 2007, Di Minin et al. 2013a, Meer et al. 2016). Cats are charismatic for different reasons. They are large, are predators embodying a genuine potential threat to humans, are included in the Threatened Species Red List of IUCN, have forward-facing eyes, have facial markings and some have bright colouration (MacDonald et al. 2015). In this study, one felid – the jaguar – clearly emerged as the most preferred species. Jaguar tourism has been implemented in Brazil and there are areas in Pantanal where cattle ranchers have a partnership with hotels and benefit directly from jaguar tourism (Tortato and Izzo 2017). Jaguars are also often seen by tourists when travelling on the river Tambopata, Peru (Cart

2015). There are other felids in Amazonia: puma, ocelot, margay, jaguarundi (Emmons and Feer 1997), but none compete with the jaguar for salience and tourist preference.

4.4.1.3 Pink dolphin

The pink dolphin emerged as the second most popular single species for tourists. The popularity of watching dolphins in the wild is well known around the world (Peters et al. 2013), and specific pink dolphin tourism started 15 years ago in Amazonas state of Brazil (Frias 2014) where tourists interact directly (and controversially) with pink dolphins. Interactions include feeding, touching and swimming (Alves et al. 2012). Tourist satisfaction was higher when they felt they had experienced a close encounter with pink dolphins (Mattos 2012), and 'Dolphin feeding tourism' provides high revenues to tour managers in Brazil (Alves et al. 2012). Pink dolphins are absent from Madre de Dios, in the south of Peru, but in the north, tour companies do boat-based excursions for general wildlife, and tourists are able to spot them during most boat rides.

4.4.1.4 Sloths

Sloths, consisting of two distantly related genera, are a clear contender for the Amazonian *Big five*. Although this animal does not meet MacDonald et al.'s (2015) criteria for charismatic species, apart from having almost forward-facing eyes and prominent facial markings in the three-toed species (*Bradypus* spp.), there have been a number of highly popular viral internet videos, followed by network television series that have recently propelled sloths to cult status as wildlife flagships. They have the characteristics of being docile and charming, especially when they are infants, which also puts them in danger from wildlife trafficking (Moreno and Plese 2006). My results demonstrate that they are important for tourism, but unfortunately, this species' recent surge in popularity was not in time to be included in the WTP and WTD measures to see if tourists will support this species financially.

4.4.1.5 Macaws and other birds

Birds as a group were very highly ranked by respondents; Colombia, Peru and Brazil are consistently ranked as the top countries for bird biodiversity in the world (Buttler 2016)

making Peru a Mecca for birdwatchers, and supporting a thriving sub-industry of Birdwatching. Within the birds, 'macaws' were also clear candidates for the *Big five* and parrots meet the criteria for charismatic species (Frynta et al. 2010). In the open-questions tourists did not identify which species of macaw they would like to see. Coloration has been reported to be important for humans' preferences for birds (Lišková et al. 2015), Colour is an important trait for attraction, and overall attractiveness is an important aspect for birds as flagship species (Veríssimo et al. 2014). Appropriately, by these criteria, the red and green macaw is used by the Madre de Dios Tourist board (Gobierno regional – Madre de Dios 2016) as a flagship for tourism.

4.4.1.6 Anaconda

Anaconda were important for tourists too. They are large and have a dubious reputation for being life-threatening snakes – their size is often exaggerated in Hollywood films, which have also promoted the popularity of the species (Anaconda 1997). Furthermore, some anacondas are a striking bright yellow. However, they are not usually considered charismatic, and may polarize the public in terms of desirability. Regardless, tour operators have seen the importance of this species for tourism and they can be found in captivity in some lower-budget lodges (*personal observation*), as well as private zoos and rescue centres in Amazonia. While perhaps not universally ideal as a *Big five* candidates, they clearly have considerable potential as an unusual tourism flagship species (Miranda et al. 2016b).

4.4.1.7 Caiman

Black Caiman are potentially very large animals, but there are few areas where very large caiman still occurs and genuinely represents a threat to humans. Spectacled caimans are never large enough to pose a realistic threat to humans but may still inspire awe in tourists. Caiman are consistently highly ranked by both *tourists with experience* and *tourists with no experience.* They are easy to find in pristine areas, but not those impacted by humans (Thorbjarnarson 2010), and are taxonomically distinct from the other potential flagships. Willingness to pay placed these animals in the top five, but desire to see ranked them lower.

4.4.1.8 Other species

When we try to put together a general *Big five* for Amazonia, it becomes apparent that there are always several animals that are excluded despite being attractive to or desired by tourists. While this is the case also in Africa and other regions, perhaps there is no '*Big five*' for Amazonia, but rather a 'Big Diversity' of charismatic animals that are appropriate for marketing tourism and conservation throughout the area. The jaguar was clearly the most desirable animal species to see for tourists, they would pay a premium price for an extra day to guarantee a sighting of this animal in the wild, and were likely to donate more money for their conservation. However, as shown in other studies in Africa, tourists' visits are not limited to just viewing wildlife and the other things that they would like to see in Amazonia: culture and landscape (Lindsey et al. 2007, Kambogo and Bizimana 2016). In a study in Amboseli National Park in Africa, Okello et al. (2008) demonstrated that other species not included in the '*Big five*' were also important for tourists; common waterbuck *Kobus ellipsiprymnus*, were abundant and easy to see, as were spotted hyena *Crocuta crocuta*. Other species form part of an impressive natural spectacle, such as the migration of common wildebeest (*Connochaetes taurinus*). This attraction to a diversity of species appears to be true of Amazonia as well - several smaller and less "charismatic" species have a high potential for marketing by tour companies. In Amazonia, there was no consensus on which animals were the best to promote visits to the region. If flagship species are required that help promote Peru's most-visited Amazonian areas in the south of Peru, then the absence of the pink dolphin and the ease of viewing of giant otters in southern departments means that they could be continued to be included in the *Big five,* as they are used by the local tourist board and several tour companies. Otters are also easy to build tourism around, and represent an ideal flagship to promote conservation campaigns to slow the destruction and degradation of waterways in the Amazon – currently a pressing issue in the region.

Veríssimo et al. (2017) state that well-marketed species including less appealing species like bats, rodents and insectivores, can influence donors even if the species is not actually likeable for the majority of people. Moreover (Wright et al. 2015) argue that 'conservation marketing' is effective in changing human behaviour for conservation purposes. If this holds true, then there is a multitude of Amazonian species that could be harnessed as flagships. I propose that the Amazonian *Big five* should be a more flexible '*Big six'* or *'Big seven'*, including jaguar, red howler monkey, sloth, red and green macaw, and

black caiman, with the pink dolphin and other species to be used where appropriate, depending on the context of the campaigns they are used in.

4.4.2 Willingness to pay and donate and the selection of the 'Big five'

I used the willingness to pay and donate to examine the relative appeal of different species as flagship species for Amazonia. Several studies examined the valuation of wildlife and their importance as a tool for local income and policy-making to protect biodiversity (Christie et al. 2006, Martín-López et al. 2007). In my study, the jaguar was very clearly the top species for both WTP and WTD in Amazonia, confirming previous suggestions that it functions as both a tourism flagship and a fundraiser. While WTP and WTD are conceptually different, in the context of the questionnaires, they perhaps measure more general underlying attitudes towards species. Furthermore, WTP for a tour may also lead to conservation. Tortato et al. (2017), determined that the total revenue for Brazilian tourist lodges, where visitors go to see jaguars was US$6,827,625 per year - reason enough to support conservation programmes on this species. Tourists will also contribute for the conservation of pink dolphins. This is an encouraging result, because while this species is currently widespread in the Amazon Basin, it is increasingly targeted due to negative interactions with local fishermen (Chapter 2). The willingness to pay for dolphin tourism and conservation suggests that some mechanism for using funds generated by tourism, or donations from tourists could be used to mitigate these negative interactions.

The harpy eagle was moderately ranked for desirability to see, but tourists were still willing to pay and donate for their conservation. Currently, tourism focused on harpy eagles is not widespread, but there are tour companies that market a chance to see this species in the wild where nest sites are known (e.g. Panama, Tambopata-Peru). The Peregrine fund has used this species as a local flagship species (Curti and Valdez 2009). While macaws did not score particularly highly for WTP or WTD, in the south of Peru, tourism centred around clay licks visited by flocks of macaws and other parrots has been highly lucrative for high volumes of tourists for many years (Munn 1992, Torres-Sovero et al. 2012), and their value to local economies should not be underestimated.

4.4.3 Which demographic factors are affecting willingness to pay?

Socio-demographic factors influence WTP for conservation (Bhandari and Heshmati 2010). In this study, male tourists were more likely to pay to see jaguar and harpy eagle, in agreement with Meer et al. (2016) who found that women were less likely to pay to see specific carnivores than were men. The pink dolphin was not ranked highly for WTD, despite being classified as an appealing animal (Driscoll 1995).

Older tourists were less likely to pay to see wildlife or donate for their conservation. Similar outcomes were found in study in Africa by Meer et al. (2016), but Rathnayake (2016) found that older people were willing to pay *more* for park fees, bird watching, crocodile watching and other facilities included with higher entrance fees in Kawdulla National Park in Sri Lanka. Bhandari and Heshmati (2010) suggest that older people (between 40-49) have more knowledge about wildlife and tend to pay more for better conservation practices, but WTP declines again in people over fifty. Odunga and Folmer (2004) said that older tourists will spend more time and money to increase their knowledge rather than having an adventurous excursion. Only young tourists demonstrated a stronger preference to pay to see otters (giant otter and neotropical otter), while only middle age people were interested in paying to see harpy eagle, jaguar and pink dolphin. However, both groups, young and middle-aged tourists, tend to pay to see less charismatic species like: peccary, spider monkey, uakari, tapir and black caiman. These results contradict Lindsay et al.'s (2007) findings in Africa, where younger tourists (less than 50) have preferences for birds and plants. Younger tourists in this study were also interested in seeing uakari monkeys, which may have been influenced by their presence in sanctuaries in Iquitos, but they are absent in the south of Peru, where older travellers (who may have more disposable income) may choose to travel due the presence of 'higher end' lodges and convenient logistics. Older people did not show strong tendencies to donate for wildlife conservation, a finding also consistent with Meer et al. (2016).

Tourists from North America and 'Others' had higher WTD for the conservation of Amazonian wildlife and were willing to pay more to see them. Tourists from Europe perhaps have other motivations to visit Amazonia like adventure, experience with nature and relaxation (vdM Ruschmann 1992, Torres-Sovero et al. 2011), and this might have reduced

their WTP and WTD for Amazonian species. Di Minin et al. (2013a) suggested that being a tourist with 'experience' was more important to WTP than being 'international' or 'national', and tourists with experience will have more WTP to see animals that are more difficult to observe in the wild (e.g. leopard with cub) and less charismatic but endangered wildlife (e.g. African wild dog) rather than just the Big five, and will probably visit more parks to try to see these animals.

Chapter 5: General discussion and recommendations

Plate 20. View of San Martin de Tispishca.

5.1 Summary of major findings

The main objective of this research was to achieve a better understanding of interactions between local people, conservation organisations and giant otters in the Peruvian Amazon. In Chapter 2 the research revealed that people living in different areas in the Peruvian Amazon: PSNR, PNR and MKRCA, exhibit different perceptions of and attitudes towards giant otters. People that live where there is tourism were more positive about the otters than were those that live where there is no tourism. Giant otters were rarely responsible for net damage where registers were kept, but local people still hold negative perceptions about them, especially in relation to competition for fish. In Chapter 3, we determined that knowledge and attitudes in schoolchildren can improve after a single environmental education session, but I could not identify long-term changes after experiencing environmental education. Finally, in Chapter 4, tourists' responses during interviews helped me to suggest which species would be suitable to represent the '*Big five'* (actually six) for marketing to tourists visiting Amazonia: Jaguar, red howler monkey, sloth, red and green macaw, black caiman and giant otters. Although the giant otter was not highly rated by tourists, it has high potential for marketing.

5.1.1 Impacts of negative perceptions on giant otter recovery and resilience

It is not always clear how attitudes and perceptions connect with the actual behaviour of people living in coexistence with predators (Dickman et al. 2014). People's actions are heavily influenced by social factors (Dickman et al. 2014, Kansky et al. 2014, Costa et al. 2017, Bruskotter and Wilson 2014), and there may not be a direct connection between attitudes and behaviour (Heberlein 2012). However, in places where researchers empowered local participation in wildlife conservation, negative attitudes became more positive (Hazzah et al. 2017). This phenomenon has not often been recorded in the Peruvian Amazon, where attitudes towards wildlife are rarely researched (Recharte et al. 2015), but the differences between attitudes in the more established PSNR over those in the much newer PNR (Chapter 2) might reflect attitudinal changes associated with many years of local participation in conservation. On a more local scale, and regarding specific cases of human-wildlife interactions, I found that local people tend to have negative perception towards otters' even if negative interactions were minimal or non-existent. Fishermen did appear to

perceive a shortage of fish at the study sites, perhaps because they are involved in fisheries management to ensure sustainable stocks. However, they frequently lamented damage to nets, but aquatic predators, and otters were one of the most cited as net damagers. In reality, otters damaged nets less frequently than other species. In 278 fishing events registered by fishermen (Chapter 2), giant otters damaged nets just seven times, far less than caiman, dolphins and especially, the fish themselves. This finding was important because if people rarely have direct negative interactions with otters, they will be less predisposed to harm them. However, we still need to deal with negative perceptions, and look at why they come about.

Bruskotter and Wilson (2014) suggested three important points that could increase tolerance to wildlife: 1) perception of risk, 2) benefits associated with the species, and 3) perceived control over a hazard. My findings demonstrate that while the 'perception of risk' from giant otters was high (they were in the top ten 'animals that cause most damage' in my interviews, Chapter 2), there is a potential to improve the 'perception of control over the hazard'. If people were aware of the actual rates of damage caused by otters and have means to reduce this, as suggested in the focus groups (Chapter 2), this could enhance tolerance. However, dealing with negative perceptions is more difficult when there are no benefits forthcoming from the species that causes damage – often the case in places that tourism does not reach.

We do not suspect that trade in giant otter skins is occurring in Peru, however, an unexpected finding in this research was that some people belonging to PSNR indicated that they wanted to have giant otter cubs as pets. There was no question in this research asking if they received any revenue for having them (e.g. to sell to lodges, or for tourists to pay to see them) or whether they were kept for other reasons. CREA recently rescued a three-month-old giant otter cub in Requena port, on the Tapiche River, Loreto, and the manager of the zoo 'Parque de las leyendas' located in Lima (capital city of Peru) also mentioned that in 2017 they rescued a juvenile otter abandoned in a park (D. Montes, *Personal communication*, October 2017). Although unlikely to occur on a large scale, capture for the local illegal pet trade is a potential threat for giant otter cubs. The capture of cubs could be related to local people being unaware of restrictions on capture and laws that protect the giant otter, or could be linked to the 'perception of benefit'. Certainly, many local people

are unaware of the worldwide classification of threatened species and the status of aquatic predators living inside PSNR. Furthermore, these rules appear illogical and counterproductive to local people because these species appear abundant in their local area.

5.1.2 Will conservation education with local children help reduce negative perceptions and change fisherman's behaviour towards giant otters?

This study found that conservation education has a short-term positive effect on the knowledge and attitudes of schoolchildren, but this may not persist over the long-term. In situ education programs are very significant for local people and communities (Hughes and Woollard 2002), although conservation education is not a panacea by itself, because it requires considerable effort and persistence. The most effective conservation education often includes practical experience such as physical contact with animals (Ballouard et al. 2013, Rakotomamonjy et al. 2015) and constant outdoor experiences in contact with nature to keep nurturing positive perceptions, positive attitudes and knowledge of wildlife (D'amato and Krasny 2011). Environmental and conservation education in children can promote pro-environmental attitudes (Asunta 2003 cited by Rakotomamonjy et al. 2015) and it is recommended to expose children to the environment before they reach adolescence, when their identity is forming and their experiences can most influence their values and behaviour in their future life (Smith 1999, Alvin and McCammon 2003, Wray-Lake et al. 2010). It is also more effective than working with adults because children's cognition is less compartmentalized that adults (Eilam and Trop 2012).

Environmental education is embedded in the curriculum of Peruvian rural schools, but teachers are understandably focused on teaching reading, writing and mathematics, leaving aside the environmental education that is key to a population that will live alongside and be dependent on a National Reserve. It is important to note that teachers' training and experience varies greatly. In rural areas of Peru, teachers tend to be from the same community, but some teachers come from Iquitos city. If a teacher is from an urban area, they may feel insecure teaching subjects that they do not know first-hand (Rakotomamonjy et al. 2015). On the other hand, many children in the area do not go to school for the full academic year because they are helping with fishing and farming, or travelling with parents to trade goods, and therefore they are gaining direct 'environmental experiences'.

Furthermore, attendance by teachers originating from the city may be poor in some communities. Lack of environmental education has been identified as a weakness in Peru, and managers of natural reserves have been given the task of providing environmental education to fishermen and hunters (SERNANP 2013). Currently, SERNANP, with the help of UGEL (government institution in charge of school education), has a plan to implement school teacher training in environmental education with the production of booklets to disseminate information about Natural Protected Areas to rural schools. However, there is still a knowledge gap to be filled when schoolchildren grow up as teenagers and need to contribute to the economics of their household. That I found that schoolchildren generally pro-environmental attitudes, despite being unable to demonstrate that environmental education has a long-term influence, these results suggests that many experiences with positive information will produce more positive attitudes, and hopefully actions. NGOs and governmental programs should continue to provide, and expand, environmental education in rural areas, making sure the messages are appropriate and targeted to the right group.

5.1.3 The potential of giant otters as flagship species for tourism

Giant otters were not especially highly ranked for 'desire to see' (Chapter 4). This may be surprising given the high profile and flagship status given to otters around the globe, but could also be a result of them not seeming so exotic to people that can see similar species closer to home. People from Europe and North America consider otters as flagships, giving significant donations for their protection (Kruuk 2006); Giant otters meet all the requirements of a good flagship according to MacDonald et al. (2015); they are diurnal and have fixed territories (Leuchtenberger et al. 2013, Leuchtenberger et al. 2015), habituate easily to boats in places where they are not persecuted, such as Madre de Dios in Peru (Groenendijk and Hajek 2006) and the Pantanal in Brazil (Munn 2005), they are easy to spot because they are gregarious, display interesting and easily observable behaviour, and are highly vocal. All these traits can boost tourist satisfaction during otter-watching. In fact, they are already very important for tourism in the Pantanal (Kruuk 2006, Tomas et al. 2015). Otters in Peru fared better, ranked 12th in my interviews, for the animals' people *most liked seeing*, probably because they are frequently seen at Rainforest Expedition's lodges. However, in the north of Peru giant otters were previously very rare and have only recently recovered in numbers (Recharte and Bodmer 2010). No groups have yet been habituated for long-term interactions, and the species is under-utilized by tourism companies. Thus,

marketing for the giant otters in Iquitos is probably lagging behind other species. New marketing approaches for this species may be the way to boost their importance for tourism.

Also important is that giant otters' reliance on aquatic habitats, and its wide geographic range, make it an easy focal point for tours, and also make it an appropriate umbrella species for protecting aquatic environments. Giant otters have also been lauded as 'indicators' of healthy habitats (Ayala et al. 2015). However, other otter species have been shown to be quite poor indicators of species richness (Bifolchi and Lodé 2005), and since the giant otter was previously hunted to near extinction in Peru (Recharte and Bodmer 2010), its absence in Amazonia certainly does not indicate poor habitat quality for other species. However, the potential for giant otters to act as an 'umbrella' species is considerable; protecting them can simultaneously protect other species and their habitats (Groenendijk et al. 2000, Norris and Michalski 2009). Threats to aquatic habitats in Amazonia are decidedly large-scale. For instance, gold mining is affecting many different parts of South America. The method used to extract gold is dredging rivers, changing the transparency of the water, causing fish asphyxiation and the by-product 'methylmercury' produced during the gold extraction process is introduced to the food chain, affecting predatory fish because they accumulate more mercury, and subsequently affecting fish predators (including otters and humans) that eat contaminated fish (Carter and Rosas 1997, Roach et al. 2013). Hair, liver, muscle and brain tissues accumulate mercury and cause death to animals in laboratory studies, but even in lower concentrations affect reproduction, growth and behaviour (Carter and Rosas 1997). Fish are the main prey for otters and otters are threatened by mercury poisoning (Gutleb et al. 1997, Uryu et al. 2001, Roach et al. 2013). This problem, which may cause the patchy giant otter populations in the south of Peru, is also raising public awareness about human health and the need for protection of rivers. Gold mining also causes deforestation, air and water pollution, acid mine drainage, cyanide contamination (Swenson et al. 2011) and was estimated to destroy 32,371 ha of pristine tropical forest in Madre de Dios between 1999-2012 (Asner et al. 2013). Given the natural absence of river dolphins in the south of Peru, the charismatic giant otter may represent the perfect flagship to promote conservation campaigns that aim to slow the destruction and degradation of waterways in the Amazonian Rainforest.

5.1.4 Is tourism the only tangible benefit from giant otter conservation?

Protected areas such as PNR and PSNR consider the giant otter a priority species for conservation and as an 'indicator' for healthy aquatic habitats (SERNANP 2013, Groenendijk et al. 2000), a role in which the otter currently fails to accomplish, because it is still absent from many intact habitats due to the historical hunting for its pelts (Chapter 4). Furthermore, the global popularity of otters in Europe and North America has led some people to assume the giant otter has potential as a 'local flagship' (Groenendijk and Hajek 2006, Kruuk 2006). However, I found that tourists are not necessarily interested in giant otter watching. Possibly, tourists confuse the giant otter with other local otters in their home-country, rather than something uniquely Amazonian (Tour guide, *Personal communication*, 10 March 2017), preferring instead to select characteristically tropical species like monkeys as their 'most like to see' animals for visits to the Amazonian forest (Chapter 4).

Although the current importance of otters to tourism in Loreto is probably overestimated, communities with a high level of tourism such as PSNR tend to be more tolerant to negative interactions with aquatic predators. Tourism is unlikely to generate significant income for most people in the short term, but it may have some value in encouraging local people to protect wildlife and see the broader economic value of animals, including the giant otter. Though the potential for tourism is limited, we currently have no clear, viable alternatives for mitigating negative perceptions of otters. The key to otter conservation may therefore lie in constructing positive relationships between animals and people (Kellert and Wilson 1993).

While the only tangible and profitable economic 'service' generated by giant otters is tourism, and habitat protection as an ecosystem service may not appear profitable to many, it will assure the well-being of people, and may ultimately lead to better fisheries and sustained income generation. The value of ecosystem services for biodiversity conservation is still being researched, and there is no evidence to suggest the presence of giant otters will have either a positive or a negative effect on fisheries or ecosystem services provided by aquatic habitats. However, the development of the concept of ecosystem services as a mechanism to protect nature is widely seen as important, and some assert that researchers

should have more input into convincing stakeholders and the public that revenues generated from these services are best used for the conservation of biodiversity and should not be considered as profit, turning this concept into one that is more moralistic than utilitarian (McCauley, 2006). This viewpoint may be hard to apply in rural areas of Peru, where incomes are extremely low and a moralistic view of conservation may be seen as a luxury by many. However, I have found that moralistic and aesthetic opinions *are* common in rural areas (Chapter 3). People living in wild areas often have an understanding and attachment to natural areas and wildlife, and will lament their loss. Conservation action could harness these existing opinions.

5.1.5 Giant otters and the bigger picture of conservation in Loreto

Although this study is focused on giant otters' interactions with humans, like many charismatic wildlife populations around the world, the species is under pressure from several direct threats within its wider geographical distribution, including habitat loss, degradation and fragmentation (Courchamp et. al. 2018), often caused by mining, fossil fuel exploration, the use of pesticides and fertilizers for monocultures, new hydroelectric dams' and highways, and the expansion of fish farming (Groenendijk et al. 2015). In Loreto, several development projects threaten to drastically change the playing field for giant otter conservation in Peru. The Ministry of Transport and Communication signed a concession contract to build an Amazonian '*hydrovia'*, to improve the navigability of the Amazon river and effluents. This will dredge large sections of river about 56m wide and 12m deep along 2600km of river. Although the ecological effect of this project is unknown, changing flood dynamics may be drastic and fish populations may change considerably. Many predict a negative impact in the aquatic wildlife specially fish, the main source of food of giant otters (R. Bodmer *Personal communication* – 2 April 2018). Loreto has many good recovering populations of giant otters, but projects such as this, along with several major road infrastructure projects are going to drastically change access to the forest and river areas and threaten to impact wild populations of giant otters. This will isolate populations and reduce gene flow between populations that may already have been through population bottlenecks in some areas. Environmental concerns often seem to have little influence on decisions made by the Peruvian government. I perceive a need to develop more 'conservation marketing' throughout Peru to bring ecological issues into the political

landscape. This may be necessary before significant progress can be made in using giant otters as a tool to influence such large political and development decisions in Peru.

5.2 Implications of the results and recommendations

There is no single solution to eliminate negative interactions with wildlife (Redpath et al. 2015a), and positive results do not always mean positive conservation outcomes. This study found that people in PSNR support the presence of giant otters more than other areas, but it is unclear if this is due to increased contact with the species, longer periods of time engaged in community conservation, or because of perceived direct or indirect benefits received through tourism or other means. There is a need to create and disseminate guidance on the various threats to giant otters that stem from differing attitudes and opinions on wildlife, so that managers are aware of the range of threats and will be able to include better mechanisms of management to decrease threats to giant otters inside the reserve.

Tangible costs from living close to giant otters can be estimated from the cost of the net damage, but not impact to fisheries through consumption of fish. In Peru, a new fishing net could cost around US$30 dollars, but there is no way to measure the costs of competition for fish or the impact of peoples' fear of confrontation with giant otters. Since, most people in Amazonian communities' use fish for subsistence, most have nets at risk of damage by otters or other aquatic wildlife including fish. In Chapter 2 I recommend that fishers try to avoid confrontation and negative encounters with giant otters by looking after the fishing nets more closely. It will be helpful too, to make a 'Risk map' of presence of otters in lakes that could help to avoid otters, utilising existing and developing monitoring programs for aquatic predators, fish and fishing activity to highlight high risky areas. This would need to be updated regularly, since protecting otters could quickly expand those risks to new lakes. The recent rapid expansion of otters has seen them quickly fill habitats in many areas in the last decade. Further risks to net damage could be included in the 'Risk map' such as high presence of piranha, previous report from damage from dolphins, so local people could be more aware of 'perception of risks'. Additionally, in more sensitive areas, I would recommend a change from the use of gillnet to other traditional fishing methods such as homemade fishing pole, hooks and lines and harpoons that are more selective, and can target bigger, more valuable fish. This may have the added advantage of increasing the

sustainability of fisheries, but could be a hard sell, given the high efficiency of gillnets (Mesquita and Isaac-Nahum 2015), and would require a cost-benefit and feasibility analyses. However, it would favour skilled local fishermen with traditional knowledge, who may be the most experienced and influential in fisheries groups, and could be successfully applied to the zoning system already used in the management of PSNR and PNR (SERNANP 2009).

Chapter 3 highlighted a need to reinforce teacher training in environmental education. Such grass roots approaches may be the key to changing attitudes in the region, but the scale of the job is immense. It will be necessary to engage schools on a wide level and include NGOs in partnerships to train teachers or invite them to present themes related to wildlife and conservation in rural schools to reach the target of improving knowledge, biophilia and positive attitudes to wildlife conservation. Ultimately, the only way to achieve this in a sustainable and scalable way outside specific protected areas may be to lobby for curriculum change in schools across regions.

5.3 Limitations of the research and directions for future investigation

My research was based almost entirely on interviews with a wide variety of people from very different demographics, ranging from English-speaking tourists to children in remote Peruvian schools. While the questionnaires were carefully designed to be used with each target population, there were a number of practical issues and limitations to contend with.

During semi-structured interviews (Chapter 2), I had some problems in the Kichwa communities outside PNR. Men tended to start drinking early morning and were drunk by the afternoon. This was time-consuming, since I needed to wait for a for potential respondents until they were able to answer questions, and probably lead to reduced sample sizes in Chapter 2. Also, in these communities, some interviewees had limited Spanish, and were more fluent in Kichwa, requiring longer sessions to make the questions clear.

In Chapter 3, some questions were designed with a binary response, since experience had shown that other designs, such as Likert scales were difficult for many children to understand in rural schools and had a very low response rate, or lead to illogical answers. I

attempted to implement a design that analysed drawings made by school children, but in the time allocated by the schools I was unable to collect before and after drawings from the children either side of the CE. This approach has considerable potential for future work.

In Chapter 4, the on-line based questionnaire for tourists was designed in English. Initially it was supposed to be self-administrated online, but it had and extemely low rate of responses and completion, so these were considered only as a pilot study, and I used face to face interviews, which had its own difficulties when it came to recruiting participants. Furthermore, the locations at which I was able to work introduced their own biases because of the wildlife present at the sites, or even held in enclosures in the case of the two wildlife rescue centres. Initially I was hoping that I would be able to analyse the effects of wildlife sightings and the display of rescued animals on peoples' preferences for wild viewing and donations, but unfortunately the sample size achieved did not allow this. However, the most extreme example of a bias in the responses does hint of an effect. The Amazonian manatee is so poorly known to visitors to the Amazon, that it was not included after the pilot study. However, it was popular with people that were interviewed at CREA, where rescued manatees are rehabilitated. This remains an area for future investigation.

There was a gap between the perception of net damage by giant otters in relation to other species and the reality of how much damage they actually cause. Whilst I speculate on the possible reasons for this, more in depth analyses could be done, similar to those done on terrestrial mammals in Uganda (Naughton-Treves 1997). If the reason for the difference between perceptions and reality is because of differing fishermen's experiences, I should be able to detect this by quantifying the time fishermen spent fishing and by estimating the number of encounters with otters that they have had.

In this research, I was able to gain a good understanding of the interactions between humans and giant otters in several spatially separated sites in Loreto. However, it is not a complete picture of the situation and further studies are needed. Currently, there are areas of Amazonia where giant otters are still absent, such as the control area in this study, but unless the range is restricted by persecution or habitat degradation and fragmentation, every indication is that the otters will return here too. People still have some knowledge of the

species because fishermen travel to areas where they can find more fish, or move around between communities. It would be interesting to find out if there are factors other than persecution stopping the expansion of otters? Are greatly reduced fish populations stopping them from recolonized areas which are apparently habitable by otters? Studies on human dimensions should include teenagers, a generation often missed when conservation actions target schools or key professions like fishermen, this demographic will be highly influential in the near future, and already have opinions and biases that will affect their care for wildlife, perceptions of wildlife, and their future careers and activities. More research is need on the 'perception of benefit' and 'conservation marketing' in local areas where people share habitats with otters. We need a deeper understanding of tangible and intangible costs of damage and be able to elaborate and apply mitigation methods and reduction of damage for each type of cost. Also, in the absence of a financial return from the presence of giant otters, there is still a need to look for methods to increase tolerance to wildlife, promoting the viewpoint that it is possible to coexist with giant otters and other aquatic predators.

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Appendix A. Abstract of published paper in 2015

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A recovering flagship: giant otters, communities and tourism in northern Peru

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Abstract

Context. Ecotourism, driven by viewing large charismatic fauna, is often assumed to contribute to the conservation of animals and their habitats. Giant otter populations continue to increase and repopulate areas near communities, leading to problems with fishermen because of perceived competition and damage to nets.

Aims. We investigate attitudes towards giant otters in rural northern Peru, to see whether negative perceptions towards the species are mitigated by involvement in tourism.

Methods. We interviewed 103 people from communities on the following three Amazonian rivers where giant otter populations have recovered: one where logging and hunting are main activities, and where there is no tourism and only a low level of fishing; one with a medium level of tourism and a high level of fishing; and, one with a higher level of both tourism and fishing. We asked interviewees about their main commercial activities and experiences and opinions of giant otters.

Key results. Whereas two-thirds of interviewees declared predominantly positive opinions about giant otters, just under half mentioned competition with giant otters for fish, and a fifth reported giant otters damaging fishing equipment. However, there was no difference between opinions about otters of people who identified fishing as their main source of income and those who did not. Although people working directly for tourism companies were no more likely to say that they received benefits from giant otters than were other people, and there was no significant difference in their opinions about otters when people receiving indirect benefits from tourism were also included in the sample, this group was significantly more likely to have positive opinions about otters.

Conclusions. Both positive and negative opinions occurred in our study areas, and we detected only limited changes in the perceptions of people living with giant otters with respect to their involvement with tourism.

Implications. To mitigate negative perceptions of giant otters and the threat of persecution, benefits from tourism must reach those who are likely to perceive or experience costs from coexistence. We highlight the need for research into the value of otters to tourism, and to disseminate the results in rural areas where otter tourism may benefit local people.

Appendix B. Structure interview: Interactions with aquatic wildlife (translation)

Survey number: Community: Date:

A. Socio-economic information

1. Which jobs/activities generate money to your family. Mark with a X

	Activity	Cross		Activity	Cross
1	Palm fruits		9	Manoic production	
2	Other palm products		10	Timber	
3	Fishing		11	Artisans	
4	Hunting		12	Paddles/canoes	
5	Farming		13	Building	
6	Paid job (teacher, nurse, etc)		14	Farming animals	
7	Tourism		15	Other: especify	
8	Handy crafts				

Mention the three mains activities for order of importance:

Order: 1˚_____2˚_____3˚_____

2. In a week. How many days per week do you eat fish? _____

3. Do you fish more at?

1. DAY 2. NIGHT 3. DAY and NIGHT 4. No fishing

3.1 Why? _____

4. Do you belong to a management group? (ORMARENA, Association, Family that protects a lake in a formal or informal way) Mark with a X.

1. Yes ___ 2. No ____

4.1 What resources are you protecting?

1. Arowana
2. Paiche
3. Turtles
4. Aguaje
5. Huasai
6. Yarina
7. Other ____ Specify_____

5. Do you like to live close to the Pucacuro National Reserve?

1. Yes ___ 2. No ____ 3. I do not know

6. Do you benefit from the protected area? (Prompt: use resources from the reserve?).

1. Yes ___ 2. No ____ 3. I do not know

6.1 Why? _____

7. Do you own?

1. Wooden boat	Yes ___ No___
2. Wooden canoe	Yes____ No___
3. Speedboat	Yes____ No___
4. Small engine	Yes____ No___
5. Outboard moto	Yes____ No___
6. Generator	Yes____ No___
7. Mobile phone	Yes____ No___
8. TV	Yes____ No___
9. Shotgun	Yes____ No___

8. Do you have a Farm? 1. Yes 2. No

8.1. Which plants do you have?

_____

B. Interaction between people and wildlife

9. When you go hunting, how many days do you stay in the field? _____

10. How many times in a year do you go hunting? _____

11. Show pictures. Can you tell me which animals do you see more, starting for the most frequent? (discard the first selected, ask the same question until they have selected five animals).

1˚ _____
2˚_____
3˚_____
4˚_____
5˚_____

12. Show pictures. Can you tell me which animals do you see less, starting for the less frequent? (discard the first selected, ask the same question until they have selected five animals).

1˚ _____
2˚_____
3˚_____
4˚_____
5˚_____

13. Show all the pictures and select the animals: good and/or beneficial. Mark with an X.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V

13.1 Order the animals starting for the best.

1˚_____ why? _____

2˚_____ why? _____

3˚_____ why? _____

4˚_____ why? _____

5˚_____ why? _____

14. Show all the pictures and select the animals: bad and/or harmful. Mark with a X.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V

15.1 Order the animals starting for the most bad/harmful

1˚_____ why? _____

2˚_____ why? _____

3˚_____ why? _____

4˚_____ why? _____

5˚_____ why? _____

C. Aquatic wildlife

15. Show only pictures of aquatic mammals.

Which animals eat fish in the river and/or lake?

D	E	F	G	H	R	S

15.1 Order starting from the one that eats most fish.

1˚ _____

2˚_____

3˚_____

4˚_____

5˚_____

16. If talk about damage of loss of fishing material.

Which animals damage your fishing nets? Mark with an X.

D	E	F	G	H	R	S

17. From the list of aquatic animals, tell me:

Order	Which animal damages fishing nets most?	In a MONTH. How many times does it damage your fishing net?	The last time that it damaged your net. How much money/time did it cost to repair your net?
1˚			
2˚			
3˚			
4˚			
5˚			

18. In case you need to repair your fishing net (or buy a new net) Which activity do you do to get money to repair or buy your fishing net?

_____

19. Show only aquatic animals.

If we talk about loss of fish from the fishing nets, choose: Which animals eat/steal more fish from the fishing net?

Order	Which animal from the pictures eat/steal more fish from the net?	From all the fish that are caught in the net. Can you tell me how much of the fish are lost by the animal? Refer list below.
1°		
2°		
3°		
4°		
5°		

1	Most of the catch	5	Less than 1/8 of the catch
2	Half of the catch (or more)	6	Very few
3	A quarter of the catch (or more)	7	I do not lose any
4	1/8 of the catch (or more)		

20. Which time of the year do the animals damage more your fishing net most?

1. Low water 2. High water

20.1 Which months of the year?

_____

21. There are lakes where these animals always damage the fishing nets?

_____

D. Tolerance to aquatic wildlife

22. Please answer with Yes, No or I don't know.

Statement /question	1.Yes	2.No	3. I don't know
1.I like having giant otters living close to my community			
2. The giant otters scare me			
3.The only way of having more fish is if all the giant otters disappear from the area			
4.Now there are more giant otters that 10 years			
5.Did kill or try to hunt a giant otter?			
6.All the animals that damage the fishing nets should be killed			
7.There are a lot of fish in the river for the Giant otters and us			
8.Is legal to kill/hunt giant otter			

23. Have you hunted or killed giant otter?

1. Yes 2. No

23.1 Why did you do it?

E. Biology and ecology

24. Do you think that there are more or less giant otters that before?

1. MORE 2. LESS 3. Same as before 4. I don't know

24.1 Why do you think there are more giant otters now?

25. How many giant otters can live together in a group?

26. How many cubs does a giant otter have?

27. How many times in a year a giant otter have cubs?

28. Do you know what a giant otter eats?

29. Do you know where the giant otters sleep?

30. Do you know how many years a giant otter lives?

F. Personal data

31. Name: Male/Women

32. Age:

33. Place of birth:

34. How many people live with you?

35. How many people depend economically on you?

36. Study: Primary, Secondary, Tertiary

37. Can you tell me who else I can interview on this subject?

A. White-lipped peccary (*Tayassu peccari*): Terrestrial

B. Poepiig's woolly monkey (*Lagothrix poepiggi*): Arboreal

C. Red howler monkey (Alouatta seniculus): Arboreal

D. Giant otter (*Pteronura brasiliensis*): Aquatic

E. Pink dolphin (*Inia geoffrensis*): Aquatic

F. White caiman (*Caiman crocodilus*): Aquatic

G. Black caiman (*Melanushus niger*): Aquatic

H. Neotropical otter (*Lutra longicaudis*): Aquatic

I. Tapir (*Tapirus terrestris*): Terrestrial

J. Ocelot (*Leopardus tigrinus*): Arboreal

K. Brown capuchin monkey (*Sapajus macrocephalus*): Arboreal

L. Paca (*Cuniculus paca*): Terrestrial

M. Tamarin monkey (*Saguinus fuscicollis*): Arboreal

N. White-bellied Spider Monkey (*Ateles belzebuth*): Arboreal

O. Collared peccary (*Tayassu tajacu*): Terrestrial

P. Puma (*Puma concolor*): Terrestrial

Q. White-fronted capuchin (*Cebus albifrons*): Arboreal

R. Grey dolphin (*Inia geoffrensis*): Aquatic

S. Capybara (*Hidrochoerus hidrochaeris*): Aquatic

T. Tayra (*Eira barbara*): Terrestrial

U. Agouti (*Dasyprocta fuliginosa*): Terrestrial

V. Jaguar (*Panthera onca*): Terrestrial

Appendix C. Responses by interviewees to tolerance questions (n values, N=302)

Variables	Questions	Yes	No	I don't know
Perceptions	I like to have giant otters living close to my community	125	153	24
	I am scared of giant otters	138	141	23
	The only way to have more fish is if all the giant otters disappear from the area	145	108	49
	There are more giant otters now than ten years ago	211	44	47
	There are a lot of fish in the river for the giant otter and for us	242	38	22
Attitudes	All the animals that break the nets should be killed	121	147	34
	Did you kill or try to hunt giant otter?	37	245	20
	Is it legal to kill/hunt giant otter?	17	207	78

Appendix D. Focus groups activities

Activities	Questions formulated during meeting
Activity 1	**1.** Show 22 pictures, select animals that the most harmful? (discuss and down the most harmful animals and why they you chose them.
	2. Show 7 pictures from aquatic animals, select animals that the most harmful? (discuss and down the most harmful animals and why they you chose them.
Activity 2	**3.** From the 7 animals chose which animals should be protected (discuss and write down why it should be protected).
	4. From the 7 animals chose which animals break the nets with more frequency. What will theydo if this animal is in the same fishing area when they are fishing and eat some fish (discuss and write in a paper).
	5. If your friends told you that they saw and giant otter in a fishing lake, would you go to fish in that lake? Why? (discuss and write in a paper).
	6. If you are finishing your fishing and see a group of giant otters. What you will do? Why? (discuss and write in a paper).
	7. Identify solutions to avoid net damage by giant otters.
Activity 3	Elaborate a participative map. Identify in which lakes people experienced negative interaction with aquatic wildlife.
Activity 4	**8.** In general, what are the negative things about otters that worrythem.

Appendix E. Fishing registers: Interaction with aquatic wildlife during a fishing event

Name of the register:

Community:

Date:

Fishing area:

Time start fishing:

Time finish fishing:

Number of total hours fishing:

Estimate of total of fish collected in Kgs:

Number of nets used during the fishing event:

Size of net in meters:

Size of net damage in meters:

Identification of animal that brake the net:

Other observations:

Appendix F. Perception of the most disliked animals (WRI values) by respondents.

Animals	PSNR	PNR	MKRCA
Jaguar	0.5602	0.0739	0.3043
Black caiman	0.4269	0.1013	0.0373
Puma	0.2652	0.0911	0.1837
Capybara	0.2119	0.0193	0.1547
Ocelot	0.1671	0.1177	0.2403
Pink dolphin	0.1542	0.2925	0.1367
Giant otter	0.1123	0.2342	0.0797
Spectacled caiman	0.0946	0.1039	0.0597
Tayra	0.0602	0.0427	0.2397
Gray dolphin	0.0431	0.1472	0.0510
S. tamarin	0.0213	0.0310	0.0090
Neotropical otter	0.0192	0.1702	0.2527
W. f. capuchin	0.0192	0.0185	0.0667
Agouti	0.0177	0.0588	0.1667
Spider monkey	0.0125	0.0078	0.0000
Paca	0.0063	0.0859	0.0350
Brown capuchin	0.0063	0.0484	0.0333
W. lipped peccary	0.0025	0.0270	0.0290
Collared peccary	0.0000	0.0882	0.0150
Woolly monkey	0.0000	0.0107	0.0340
Howler monkey	0.0000	0.0058	0.0000
Tapir	0.0000	0.0000	0.0350

Appendix G. WRI values about perceptions of the aquatic predators that breaks nets

Aquatic animals	PSNR	PNR	MKRCA
Black caiman	0.6060	0.2828	0.1487
Pink dolphin	0.5235	0.6305	0.5757
Giant otter	0.3583	0.3753	0.2370
Spectacled caiman	0.2527	0.2284	0.1960
Gray dolphin	0.1773	0.2512	0.1327
Neotropical otter	0.1100	0.3585	0.7050
Capybara	0.0000	0.0049	0.0067

Appendix H. WRI values about perceptions of the aquatic predators that steal more fish

Aquatic animals	PSNR	PNR	MKRCA
Pink dolphin	0.6083	0.5746	0.6067
Black caiman	0.4427	0.1579	0.1133
Giant otter	0.3746	0.3091	0.1600
Spectacled caiman	0.2179	0.1143	0.0800
Gray dolphin	0.2165	0.1986	0.1233
Neotropical otter	0.0925	0.3576	0.6733
Capybara	0.0000	0.0000	0.0100

Appendix I. Interview guide for Schoolchildren in PSNR

1. Show just aquatic animal pictures. Do you know which one is the giant river otter?

1. Yes ____ 2. No____ 3. I don't know_____

2. Do you remember the video presentation on giant otters and the drawing activity afterwards?

1. Yes ____ 2. No____

3. Do you like giant river otter?

1. Yes ____ 2. No____

Why? _____

4. What else do you know about giant otters? (Prompts: what they eat? where do they live? What colour they are?).

5. Name:

6. Gender:

7. Age:

8. Community:

9. Date:

Giant otter (*Pteronura brasiliensis*)

Neotropical otter (*Lutra longicaudis*)

Pink dolphin (*Inia geoffrensis*)

Grey dolphin (*Sotalia fluviatilis*)

Spectacled caiman (*Caiman crocodilus*)

Capybara (*Hidrochoerus hidrochaeris*)

Black caiman (*Melanushus niger*)

Tayra (*Eira barbara*)

Appendix J. Online interview to tourists on Qualtrics

Interview about Amazon Wildlife:

Thank you for agreeing to take part in this short survey on wildlife and tourism in the Amazon Rainforest region. Results may be used in my PhD and related publications, but all personal details will remain confidential and anonymous.

Maribel Recharte
PhD student
School of Natural Sciences
University of Stirling, Scotland, UK.

Interview A.

Q1. How many times have you visited the Amazon Rainforest?

- o 0 [Go to Interview A]
- o 1 [Go to Interview B]
- o 2 [Go to Interview B]
- o 3 or more [Go to Interview B]

Q2. How important are the following attractions to you in deciding whether or not to visit the Amazon Rainforest?

	Not very important	Very important
Mammals		
Birds		
Biodiversity		
Flora		
Culture		
Adventure		
Landscape		

Q3. How likely do you think it is that you will visit the Amazon Rainforest in the next 10 years?

- o Very Unlikely
- o Unlikely

- Moderate
- Likely
- Very Likely

Q4. What animals would you *most like to see* on a trip to the Amazon Rainforest? (List up to 5, with the most desirable first).

1_____

2_____

3_____

4_____

5_____

Q5. Now from the photos, please rank (from 1 -5) the five animals on the list below that you would most like to see on a trip to the Amazon Rainforest (enter 1 for the most desirable, 2 for second most, etc.)

Q6. If you were already in the Amazon Rainforest, how much would you be prepared to spend on a single day excursion to see the following animals? (Treat each slider as a separate trip to see only the animal mentioned) Range of $1-$1000 American dollars.

____Jaguar

____Giant Otter

____Red and Green Macaw

____Uakari Monkey

____Pink River Dolphin

____Spider Monkey

____Lowland Tapir

____Neotropical Otter

____White-lipped Peccary

____Black Caiman

____Sloth

Q7. If you were taking such a single day excursion to see one of the following animals, would you be prepared to also give a donation towards the conservation of that animal? If so, move the slider to the value you would be prepared to donate. From a range of $1 - $100 American dollars.

____Jaguar

____Giant Otter

____Red and Green Macaw

____Pink River Dolphin

____Bald Uakari Monkey

____Spider Monkey

____Black caiman

____Neotropical Otter

____White-lipped Peccary

____Lowland Tapir

____Sloth

Q8. Gender

- o Male
- o Female

Q9. Nationality

Q10. Age

Q10. Occupation

Q11. Location Interview taken

- o Pilpintuwasi
- o CREA Manatee Sanctuary, Iquitos
- o Madre de Dios
- o Other

Interview B.

Q2. What parts of the Amazon Rainforest have you visited? (Please list up to three of the most recent). If you stayed in lodges, please list them too. Visit 1 – Country_

Region(s) Lodge(s) Visit 1 – Country_

Region(s) Lodge(s) Visit 2 – Country_

Region(s) Lodge(s) Visit 3 – Country_

Q3. What animals did you *most like seeing* on your trip(s)? List up to 5 with the most desirable first.

1_____

2_____

3_____

4_____

5_____

Q4. What animals, that you *did not see*, would you have most liked to see on your trip(s)? List up to 5.

1_____

2_____

3_____

4_____

5_____

Q5. Now from the photos, please rank (from 1 -5) the five animals on the list below that you would most like to see on a trip to the Amazon Rainforest (enter 1 for the most desirable, 2 for second most, etc.) [Same pictures as in Q5 Interview A].

Q6. If you were already in the Amazon Rainforest, how much would you be prepared to spend on a single day excursion to see the following animals? (Treat each slider as a separate trip to see only the animal mentioned) Range of $1-$1000 American dollars.

____Jaguar
____Giant Otter
____Red and Green Macaw
____Bald Uakari Monkey
____Pink River Dolphin
____Spider Monkey
____Lowland Tapir
____Neotropical Otter
____White-lipped Peccary
____Black Caiman

Q7. If you were taking such a single day excursion to see one of the following animals, would you be prepared to also give a donation towards the conservation of that animal? If so, move the slider to the value you would be prepared to donate. From a range of $1 - $100 American dollars.

____Jaguar
____Giant Otter
____Red and Green Macaw
____Pink River Dolphin
____Bald Uakari Monkey
____Spider Monkey
____Black caiman
____Neotropical Otter
____White-lipped Peccary
____Lowland Tapir

Q8. Gender

- o Male
- o Female

Q9. Nationality

Q10. Age

Q10. Occupation

Q11. Location Interview taken

- Pilpintuwasi
- CREA Manatee Sanctuary, Iquitos
- Madre de Dios
- Other

Appendix K. Socio-demographics factors influencing WTP-GML

1) Jaguar

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	0.34	0.27	1.71	0.19	1.42
	North America	1.00	0.33	9.46	*	2.72
	Others	1.08	0.48	4.53	*	2.77
	South America	Reference				
Age	18-24	0.43	0.33	1.69	0.19	1.53
	25-44	0.73	0.28	6.91	*	2.07
	45+	Reference				
Gender	Female	-0.62	0.23	7.57	*	0.54
	Male	Reference				
LR χ^2	24.86					
df	6					
P	**					

2) Harpy eagle

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	0.29	0.26	1.22	0.27	1.33
	North America	1.02	0.30	11.58	**	2.76
	Others	1.72	0.50	14.09	**	5.60
	South America	Reference				
Age	18-24	0.35	0.32	1.22	0.27	1.42
	25-44	0.57	0.27	4.68	0.30	1.78
	45+	Reference				
Gender	Female	-0.57	0.21	7.35	*	0.57
	Male	Reference				
LR χ^2	35.1					
df	6					
P	*					

3) Pink dolphin

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	-0.33	0.26	1.55	0.21	0.72
	North America	0.56	0.31	3.24	0.07	1.76
	Others	0.48	0.44	1.18	0.27	1.62
	South America	Reference				
Age	18-24	0.61	0.32	3.59	0.59	1.83
	25-44	0.71	0.27	7.22	*	2.04
	45+	Reference				
Gender	Female	-0.12	0.21	0.29	0.59	0.89
	Male	Reference				
LR χ^2	17.76					
df	6					
P	*					

4) Black caiman

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	0.15	0.26	0.32	0.57	1.16
	North America	0.93	0.30	9.62	*	2.54
	Others	0.64	0.41	2.47	0.12	1.90
	South America	Reference				
Age	18-24	0.80	0.32	6.35	*	2.23
	25-44	0.82	0.26	9.65	*	2.27
	45+	Reference				
Gender	Female	-0.29	0.21	2.02	0.16	0.75
	Male	Reference				
LR χ^2	21.19					
df	6					
P	*					

5) Spider monkey

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	0.40	0.26	2.46	0.12	1.50
	North America	1.03	0.30	11.86	**	2.81
	Others	1.40	0.44	9.97	*	4.05
	South America	Reference				
Age	18-24	0.91	0.32	8.11	*	2.49
	25-44	0.69	0.26	6.78	*	1.98
	45+	Reference				
Gender	Female	-0.29	0.21	1.91	0.17	0.75
	Male	Reference				
LR χ^2	25.28					
df	6					
P	*					

6) Uakari monkey

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	0.45	0.26	3.00	0.08	1.57
	North America	1.22	0.30	16.22	**	3.38
	Others	1.33	0.42	9.84	*	3.79
	South America	Reference				
Age	18-24	0.71	0.32	4.82	*	2.06
	25-44	0.75	0.27	7.98	*	2.12
	45+	Reference				
Gender	Female	-0.28	0.21	1.87	0.17	0.75
	Male	Reference				
LR χ^2	28.96					
df	6					
P	*					

7) Neotropical otter

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	0.10	0.26	0.15	0.70	1.11
	North America	0.87	0.30	8.65	*	2.38
	Others	1.08	0.41	6.85	*	2.93
	South America	Reference				
Age	18-24	0.75	0.32	5.54	*	2.12
	25-44	0.39	0.26	2.21	0.14	1.48
	45+	Reference				
Gender	Female	-0.29	0.20	1.97	0.16	0.75
	Male	Reference				
LR χ^2	19.94					
df	6					
P	*					

8) Red and green macaw

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	-0.02	0.25	0.01	0.93	0.98
	North America	0.73	0.29	6.20	*	2.07
	Others	1.03	0.43	5.86	*	2.81
	South America	Reference				
Age	18-24	0.37	0.31	1.41	0.24	1.45
	25-44	0.31	0.26	1.52	0.22	1.38
	45+	Reference				
Gender	Female	-1.15	0.20	0.56	0.46	0.86
	Male	Reference				
LR χ^2	15.85					
df	6					
P	*					

9) Giant otter

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	0.13	0.26	0.24	0.63	1.13
	North America	0.91	0.30	9.51	*	2.49
	Others	1.48	0.44	11.16	**	4.37
	South America	Reference				
Age	18-24	0.79	0.32	6.19	*	2.21
	25-44	0.50	0.26	3.62	0.06	1.65
	45+	Reference				
Gender	Female	-0.14	0.21	0.49	0.48	0.87
	Male	Reference				
LR χ^2	24.96					
df	6					
P	*					

10) White lipped peccary

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	0.16	0.27	0.35	0.56	1.18
	North America	1.15	0.30	14.38	**	3.17
	Others	1.40	0.42	11.20	**	4.04
	South America	Reference				
Age	18-24	0.69	0.33	4.34	*	2.00
	25-44	0.62	0.28	5.07	*	1.86
	45+	Reference				
Gender	Female	-0.26	0.21	1.48	0.22	0.77
	Male	Reference				
LR χ^2	30.36					
df	6					
P	*					

11) Tapir

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	0.34	0.26	1.68	0.20	1.40
	North America	1.06	0.30	12.55	**	2.88
	Others	1.29	0.42	9.26	*	3.64
	South America	Reference				
Age	18-24	0.71	0.32	4.98	*	2.04
	25-44	0.60	0.26	5.10	*	1.82
	45+	Reference				
Gender	Female	-0.40	0.21	3.70	0.05	0.67
	Male	Reference				
LR χ^2	25.27					
df	6					
P	*					

Female results for P=0.054

Appendix L. Socio-demographics factors influencing WTD-GML

1) Jaguar

Response variables		**B**	**SE**	**Wald χ^2**	**P**	**Exp(B)**
Home-continent	Europe	0.41	0.26	2.55	0.11	1.51
	North America	1.22	0.32	14.73	**	3.39
	Others	1.77	0.53	11.16	**	5.87
	South America	Reference				
Age	18-24	0.64	0.33	3.75	0.05	1.89
	25-44	0.60	0.28	4.77	*	1.81
	45+	Reference				
Gender	Female	-0.57	0.22	6.63	*	0.57
	Male	Reference				
LR χ^2	32.46					
df	6					
P	*					

Age 18-24 results for P=0.053

2) Harpy eagle

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	0.34	0.27	1.60	0.21	1.40
	North America	1.48	0.31	22.90	**	4.41
	Others	1.35	0.42	10.41	**	3.86
	South America	Reference				
Age	18-24	0.84	0.33	6.48	*	2.32
	25-44	0.50	0.27	3.44	0.06	1.66
	45+	Reference				
Gender	Female	-0.55	0.21	6.77	*	0.58
	Male	Reference				
LR χ^2	39.58					
df	6					
P	*					

3) Uakari monkey

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	0.12	0.26	0.21	0.65	1.13
	North America	1.03	0.30	11.80	**	2.81
	Others	1.19	0.42	8.09	*	3.30
	South America	Reference				
Age	18-24	0.71	0.32	4.76	*	2.03
	25-44	0.53	0.27	3.98	*	1.71
	45+	Reference				
Gender	Female	-0.64	0.21	9.57	*	0.53
	Male	Reference				
LR χ^2	31.55					
df	6					
P	*					

4) Pink dolphin

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	-0.05	0.26	0.05	0.83	0.94
	North America	0.76	0.31	6.14	*	2.14
	Others	0.95	0.46	4.36	*	2.59
	South America	Reference				
Age	18-24	0.62	0.32	3.79	0.05	1.86
	25-44	0.65	0.26	6.02	*	1.91
	45+	Reference				
Gender	Female	-0.30	0.21	1.97	0.16	0.74
	Male	Reference				
LR χ^2	19.58					
df	6					
P	*					

Age 18-24 results for P=0.051

5) Black caiman

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	0.08	0.26	0.10	0.76	1.08
	North America	0.87	0.30	8.61	*	2.39
	Others	0.85	0.41	4.35	*	2.35
	South America	Reference				
Age	18-24	0.56	0.32	3.04	0.08	1.74
	25-44	0.40	0.26	2.35	0.13	1.50
	45+	Reference				
Gender	Female	-0.65	0.21	9.83	*	0.52
	Male	Reference				
LR χ^2	24.18					
df	6					
P	*					

6) Spider monkey

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	0.44	0.27	2.76	0.10	1.56
	North America	1.32	0.31	18.44	**	3.73
	Others	1.54	0.43	12.88	**	4.68
	South America	Reference				
Age	18-24	0.82	0.33	6.34	*	2.27
	25-44	0.43	0.27	2.62	0.11	1.54
	45+	Reference				
Gender	Female	-0.63	0.21	8.91	*	0.54
	Male	Reference				
LR χ^2	36.58					
df	6					
P	*					

7) Neotropical otter

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	0.21	0.26	0.61	0.44	1.23
	North America	1.14	0.30	14.15	**	3.12
	Others	1.22	0.42	8.56	*	3.38
	South America	Reference				
Age	18-24	0.77	0.32	5.68	*	2.16
	25-44	0.27	0.27	1.06	0.30	1.31
	45+	Reference				
Gender	Female	-0.59	0.21	8.11	*	0.55
	Male	Reference				
LR χ^2	31.24					
df	6					
P	*					

8) Red and green macaw

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	0.20	0.26	0.61	*	1.22
	North America	0.97	0.30	10.67	0.44	2.63
	Others	0.96	0.41	5.51	**	2.62
	South America	Reference				
Age	18-24	0.51	0.32	2.58	*	1.66
	25-44	0.33	0.26	1.56	0.11	1.38
	45+	Reference				
Gender	Female	-0.44	0.21	4.53	0.21	0.65
	Male	Reference				
LR χ^2	20.03					
df	6					
P	*					

9) Giant otter

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	0.07	0.26	0.08	0.78	1.07
	North America	1.20	0.31	15.39	**	3.31
	Others	1.40	0.44	10.24	**	4.04
	South America	Reference				
Age	18-24	0.82	0.33	6.23	*	2.26
	25-44	0.46	0.27	2.87	0.09	1.58
	45+	Reference				
Gender	Female	-0.71	0.21	11.29	**	0.49
	Male	Reference				
LR χ^2	40.74					
df	6					
P	*					

10) White lipped peccary

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	0.32	0.28	1.34	0.25	1.38
	North America	1.37	0.31	19.66	**	3.93
	Others	1.51	0.42	12.94	**	4.54
	South America	Reference				
Age	18-24	0.67	0.33	4.07	*	1.95
	25-44	0.37	0.27	1.89	0.17	1.45
	45+	Reference				
Gender	Female	-0.53	0.21	6.28	*	0.59
	Male	Reference				
LR χ^2						
df						
P						

11) Tapir

Response variables		B	SE	Wald χ^2	P	Exp(B)
Home-continent	Europe	0.53	0.27	3.80	0.05	1.69
	North America	1.37	0.31	19.84	**	3.94
	Others	1.31	0.42	10.01	*	3.72
	South America	Reference				
Age	18-24	0.69	0.33	4.49	0.03	1.99
	25-44	0.36	0.27	1.80	0.18	1.43
	45+	Reference				
Gender	Female	-0.59	0.21	8.03	*	0.55
	Male	Reference				
LR χ^2	32.87					
df	6					
P	*					

Europe results for P=0.051