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Rapid Decline of White-lipped Peccary Populations in Mesoamerica

Report based on the 1st Symposium about white-lipped peccary in Mesoamerica
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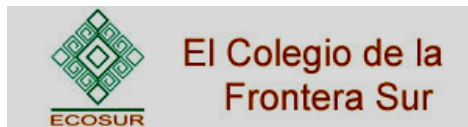
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1. Abstract

The white-lipped peccary (*Tayassu pecari*) is a social ungulate that forms groups of 10 to 300 individuals and travels long distances in well-preserved Neotropical forests. White-lipped peccaries are particularly sensitive to forest fragmentation and hunting pressure and frequently are the first large mammal species to disappear when humans colonize an area. For these reasons, they have become the most endangered ungulate in Mesoamerica. In order to assess and draw attention to reported widespread declines across the region we held a symposium to estimate the current population status and identify the main threats to the conservation of the white-lipped peccary across Mesoamerica. We brought together experts from the 7 countries of Mesoamerica where white-lipped peccaries exist to discuss the status, threats and priority conservation actions for each country. Results indicate that the species has been eliminated from 87% of its historical range, and is in critical shape in all 7 countries, with stable and large populations only remaining in the tri-national (Guatemala, México and Belize) Maya Forest, and in El Darien in Panama. All other populations are either significantly smaller or highly threatened and becoming fragmented and isolated at an alarming pace. Based upon this expansive review conducted by experts across the region, we recommend that the species be uplisted to Endangered at the level of Mesoamerica on the IUCN Red List of Threatened Species.

2. Introduction.

The white-lipped peccary (*Tayassu pecari*) is one of three extant species of peccaries. Peccaries are pig-like animals from the *Tayassuidae*, a family of ungulates found in the Neotropics. White-lipped peccaries are distributed in suitable habitat from northern Argentina to southern Mexico. The largest continuous population is in the Amazon forest, but smaller and isolated populations are scattered from Panama to Mexico (Altrichter *et al.* 2012).

White-lipped peccaries mainly inhabit humid well-preserved lowland tropical forests, although there are and historically were populations in dry and semi-dry forest zones (e.g. the Gran Chaco ecosystem of Paraguay, Bolivia, and Argentina; the Calakmul forest, México; the semi-deciduous forests in Costa Rica and the llanos of Venezuela). They prefer habitats ranging from sea level to up to 1900 m in altitude, including the eastern slopes of the Andes. Typically they prefer to be near water bodies such as rivers, lakes, or water holes, especially during the dry season (Sowls 1997, Reyna-Hurtado *et al.* 2016). Because peccaries live in large cohesive groups and have extensive home ranges, they require large continuous areas of undisturbed habitat (Sowls 1997, Fragoso 1998, Reyna-Hurtado *et al.* 2009, Altrichter *et al.* 2012).

Group size can vary from fewer than 10 to more than 300 individuals (Sowls 1997, Moreira-Ramirez *et al.* 2015, Reyna-Hurtado *et al.* 2016). Historically there were reports of herds of hundreds of white-lipped peccary, however hunting and habitat destruction have dramatically reduced group sizes. White-lipped peccaries are highly prized by subsistence and market hunters (Sowls 1997, Reyna-Hurtado *et al.* 2010; Keuroghlian *et al.* 2013). The white-lipped peccary's social behavior of "protection in groups" makes it easy for hunters to spot and kill numerous individuals of the same group, especially with modern weapons (Peres 1996; Altrichter & Almeida 2002; R. Reyna-Hurtado, pers. obs.) and their proclivity to concentrate near water sources and mud wallows, combined with a tendency towards fearlessness can result in high numbers being killed at a single time. Currently, the species is listed on Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and classified as

Vulnerable on the IUCN Red List (Keuroghlian *et al.* 2013). The white-lipped peccary is presently considered as Endangered, or Critically Endangered, for some areas of Brazil and for all of Mexico by the national environmental authorities (Brazil: Keuroghlian *et al.* 2012, Mexico: Secretaria de Medio Ambiente y Recursos Naturales-SEMARNAT, NOM-059, 2010).

The estimated 20.5 percent reduction of white-lipped peccary over its entire range over the last 100 years (<http://maps.iucnredlist.org/map.html?id=41778>) includes even more severe reductions in certain regions, as well as some local extinctions. The species has been extirpated from entire countries such as El Salvador and Uruguay (Altrichter *et al.* 2012) and had been reported to have disappeared from more than 80% of its historical range in Costa Rica, Guatemala, Mexico and Honduras in the last 40 years (Altrichter *et al.* 2012; Portillo and Elvir 2016). In another 48% of its current range the white-lipped peccary persists, but with reduced abundance and a low to medium probability of long-term survival. Prior to this analysis major range declines were recorded in Argentina, Paraguay, southern Brazil, Colombia, Venezuela, northeast Brazil, Guatemala, Mexico, and Costa Rica (Altrichter *et al.* 2012; Keuroghlian *et al.* 2012).

These range reductions have been driven by wide-scale habitat loss and degradation, commercial harvesting, unsustainable levels of subsistence hunting, and zoonotic diseases likely spread from domestic livestock (Keuroghlian *et al.* 2013) with populations in the more xeric systems, such as South America's Caatinga, Cerrado, and Pampas, particularly at risk (Altrichter *et al.* 2012.). Forest fragmentation makes white-lipped peccary populations highly vulnerable to extinction because of the species' requirement of high diversity habitats, (Keuroghlian & Eaton 2008), constantly available sources of water (Keuroghlian & Eaton 2008; Beck *et al.* 2010; Reyna-Hurtado *et al.* 2012), diversity and abundance of fruiting sources (Beck *et al.* 2005, Beck 2006, Keuroghlian & Eaton 2008; Keuroghlian & Eaton 2009), and relatively large home ranges that sometimes extend outside protected areas (Fragoso 1998; Almeida-Jacomo *et al.* 2013; Reyna-Hurtado *et al.* 2009).

The vulnerability of the species to human disturbance is escalating due as the rapidly expanding agricultural frontiers and sprawling road networks that are fragmenting forests and allowing hunters access to previously remote areas (Rivera 2014). Unsurprisingly, in areas with human pressure group size is negatively correlated with distance to nearest human settlements, whereas in undisturbed areas group size is dependent upon rainfall, which may be a surrogate variable for resource productivity (Reyna-Hurtado *et al.* 2016).

From Panama through Mexico the situation for the white-lipped peccary is cause of particular concern. The sum of the above-described threats in the increasingly densely populated Mesoamerican isthmus has resulted in exceptionally high threats for the species' survival. White-lipped peccary populations are now fragmented and discontinuous across Mesoamerica, with remnant populations highly jeopardized by hunting and habitat fragmentation. These trends motivated the authors of this paper to hold a symposium in 2016, to undertake a regional review of the species based upon expert opinion, experience and data.

3. Objectives and Goals

Long term monitoring projects in strategic sites in Mesoamerica (Maya forest in Guatemala and Mexico; Darien forest, Panama; Bosawas, Nicaragua) carried out by academic or conservationist organizations (El Colegio de la Frontera Sur; The Wildlife Conservation Society, Yaguara) have suggested that the situation for the white-lipped peccary in this region is quite different than its situation in the Amazon forest. The current global status of Vulnerable in the IUCN red list, which includes vast secure areas in South America, does not represent the status of the species in Mesoamerica, where it is highly jeopardized. Recognizing the need for a regionally focused review, a group of scientists and conservationists convened in Belize in 2016 for a symposium to discuss the status of the species from Panama to Mexico and compile accurate information on current range, status of the populations, main threats and conservation actions needed for white-lipped peccaries in each of the 7 countries of the Mesoamerican region where the species still exists (Mexico,

Guatemala, Belize, Honduras, Nicaragua, Costa Rica and Panama; the species is extinct in El Salvador).

4. Methods

In June of 2016 a questionnaire was sent to a species expert in each of the 7 countries that had been identified to coordinate with other researchers and compile information regarding for one or more of the populations of white-lipped peccary in their country. These experts were selected based upon extensive in-country field research experience, possession of data on white-lipped peccary abundances and distribution, and the confidence of fellow-researchers in their country.

This questionnaire required coordinators and their in-country contacts to gather information on current range of the species in each country, and requested that they review and compile records with spatial information (publications, records of the species) to draw to best of their knowledge the current distribution range of the species, the areas from which the species is known to have disappeared, and areas in need of exploration/additional research. The questionnaire also asked for estimates of population size (within crude categories of 0-1000, 1000 to 5000, more than 5000), estimates of average group size (0-50, 50-100, 100-300, more than 300), main threats to these populations (hunting, habitat loss, diseases, etc.), and whether the population is perceived to be stable, increasing or decreasing.

All participants delivered responses to the questionnaire in advance of the meeting that took place on August 24th, 2016 in Belize City as a part of the wider XX Congress of the Mesoamerican Society for Biology and Conservation. The objectives of the review event were described with an opening presentation lead by Dr. Rafael Reyna and Dr. Jeremy Radachowsky followed immediately by 7 presentations, one for each country, summarizing the existing knowledge of the species. The final section of the symposium involved a mapping exercise to plot in a single map the current range of the species from Mexico to Panama. This exercise was led by Dr. Daniel Thornton of Washington State University, who used

polygons and shapefiles as well as drawings to elaborate maps to represent the best knowledge of the species in each country and across the whole region.

5. Results

Respondents were able to identify 29 populations of white-lipped peccaries scattered among 7 countries of Mesoamerica. Twenty of the 29 populations showed a decreasing trend (69%), four were classified as unknown (14%) and four were stable (14%). Only one population was apparently increasing (3%). The majority of national populations were estimated as lower than 1000 animals and in most of the cases current group sizes were estimated at fewer than 50 animals (Table 1), which compared to remote sites, and historic records – are small for this species (Altrichter *et al.* 2012; Reyna-Hurtado *et al.* 2016).

Large, stable populations were reported exist only in the tri-national Maya Forest (Calakmul in Mexico, Maya Biosphere Reserve in Guatemala and Rio Bravo in Belize) and Darien National Park in Panama, with smaller but stable, or increasing, populations in the Maya Mountains of Belize and Corcovado National Park, Costa Rica. All other populations are experiencing rapid decreases due to habitat loss, hunting pressure and loss of connectivity (Table1). Large scale numerical estimates of white-lipped peccaries are problematic due to lack of individual identifying markers, large-scale and variable movements, and in the larger remnant habitats, challenging accessibility. Range reductions, and group size reductions therefore constitute the most universal metrics for white-lipped peccary (Altrichter *et al.* 2012; Reyna-Hurtado *et al.* 2016). Due to the fact that 20 of 29 populations are reported to be decreasing (with 10 of 20 being small and possibly extinct), four of 29 stable, and only one of 29 increasing, and with historical connectivity of the species across much of Mesoamerica now completely disrupted and remnant populations nearly or completely isolated, the overall trends were summarized as negative.

Most experts consider hunting pressure and habitat loss as the main threats to all populations, and, in addition, one population seems affected by limited water

availability (Calakmul forest, Mexico). Diseases are an unknown factor. Lack of connectivity among populations is already a grave concern. At least 10 of 29 populations may consist of few individuals isolated in one or two small groups (Dzilam and Area de Protección de Laguna de Terminos in Mexico; Northern Belize; Donoso, Portobelo, Chagres in Panama; and four populations in Eastern Costa Rica) or may no longer exist. These populations were determined by a single or very few records in the last ten years. Some of those records came from severely fragmented areas of these countries and the small populations may already be extinct (Table 1).

Table 1. Estimated range of population size, group size, main threats and trend of populations of white-lipped peccary from seven countries of Mesoamerica.

Country	Populations	Population size (range)	Group Size (range)	Main Threats	Trend
Mexico	Calakmul	1000-5000	<50	Hunting, Dry up of water sources	Stable
Mexico	Montes Azules	1000-5000	50-100	Hunting, habitat loss	Decreasing
Mexico	Dzilam State Reserve	1-1000	<50	Hunting habitat loss	Decreasing
Mexico	Sian Kaan Biosphere Reserve	1-1000	?	Hunting and habitat loss	Decreasing
Mexico	Chimalapas region	1-1000	?	Hunting, habitat loss	Decreasing
Mexico	Area de Protección de Flora y Fauna Laguna de Terminos	1-1000	<50	Hunting, habitat loss	Unknown

Belize	Northern Belize	1-1000	Unknown	Hunting	Unknown
Belize	Rio Bravo Area	Unknown	Unknown	Habitat loss, hunting	Unknown
Belize	Maya mountains	Unknown	50-100	Habitat loss and hunting	Increasing
Belize	Sartsoon Temash	1-1000	Unknown	Hunting	Unknown
Guatemala	Maya Biosphere Reserve	1000-5000	50-100	Hunting and habitat loss	Decreasing/Stable
Guatemala	Sierra del Lacandon National Park	1-1000	<50	Hunting and habitat loss	Decreasing
Honduras	Rio Platano, Tawahaka, Consejos Territoriales	1000-5000	<50	Hunting and habitat loss	Decreasing
Honduras	Patuca	1-1000	<50	Hunting and habitat loss	Decreasing
Nicaragua	Bosawas Biosphere Reserve	1-1000	<50	Habitat loss	Decreasing
Costa Rica	7 populations (Santa Rosa, Corcovado, La Amistad, 4 in the Eastern Central area of the country)	1-1000	<50 but one of 150	Hunting and habitat loss	Decreasing/Stable
Panama	Darien National Park	1000-5000	50-300	Hunting and habitat loss	Stable
Panama	Santa Fe National Park	1-1000	<50	Hunting and habitat loss	Decreasing

Panama	Donoso	1-1000	<50	Hunting and habitat loss	Decreasing
Panama	Portobelo	1-1000	<50	Hunting and habitat loss	Decreasing
Panama	Chagres	1-1000	<30	Hunting and habitat loss	Decreasing
Panama	Pila	1-1000	50-100	Hunting	Decreasing
Panama	Palo Seco Bosque Protector	1-1000	50-100	Hunting and habitat loss	Decreasing

Our mapping results indicate that the species has been completely eliminated from 87% of its historical range. This reduction is even more dramatic than the most recent estimate by Altrichter et al. (2012) with data assessment of 2005, upon which the current IUCN categorization for the species was based. The current population range is estimated to be 52% smaller than the 2005 estimate.

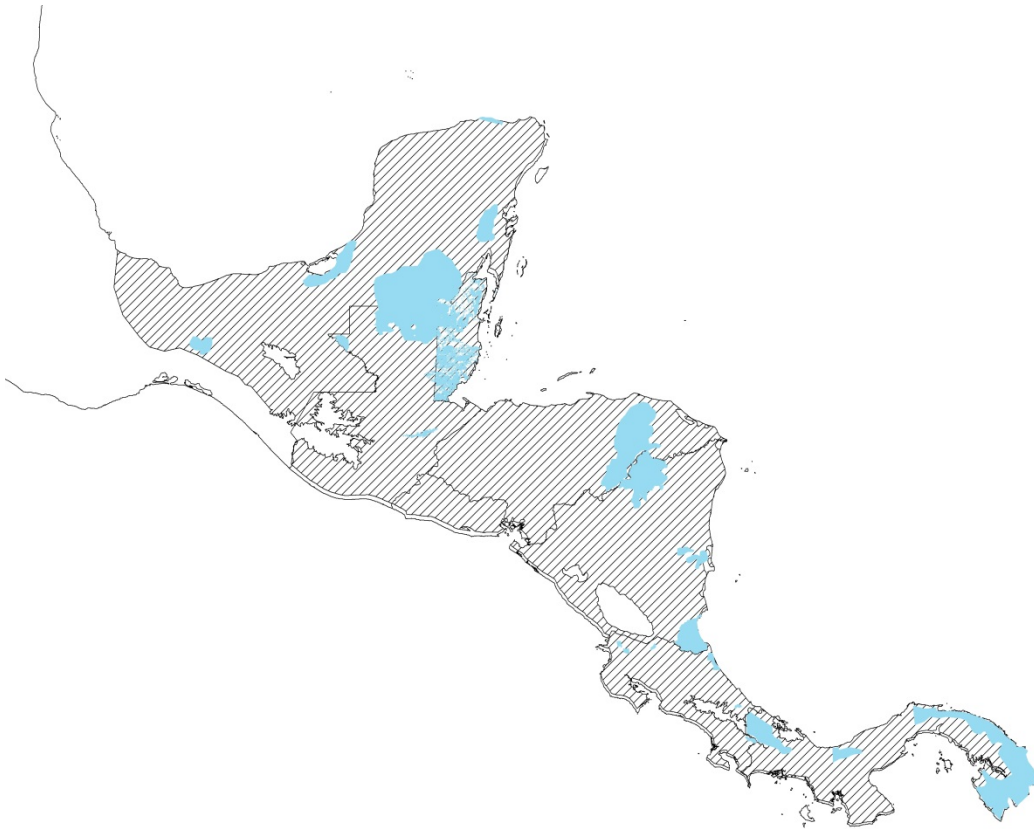


Figure 1. Map of historic (hatched) and current (blue) distribution of white-lipped peccary in Mesoamerica, showing an 87% range reduction in the region.

IUCN Criteria and White-Lipped Peccary in Mesoamerica

According to one of the criteria of the IUCN (International Union for Conservation of Nature) an Endangered species is one where the population has been reduced by 50% or more from its historical levels (IUCN Guidelines, Version 12) and where the causes of this reduction have not ceased, or do not show a reverse trend (Criteria A2). White-lipped peccaries meet both of these criteria, and we propose that the populations of white-lipped peccary in Mesoamerica be listed under the IUCN Endangered species category at the regional level.

6. Discussion

The future for the white-lipped peccary in Mesoamerica is not optimistic. Seventy percent (20) of the isolated remnant populations were reported to be decreasing

with only 17% (5) located in large protected areas showing a stable or increasing trend. Given the large areas ($>100 \text{ km}^2$) that groups need for their survival (Fragoso 1998; Reyna-Hurtado et al. 2009; Almeida-Jacome *et al.* 2013), it is not surprising that only Mesoamerica's largest areas of forest, such as the Maya forest ($>30,000 \text{ km}^2$) and Darien National Park in Panama ($>5,790 \text{ km}^2$) contain stable populations in the region. It was estimated that less than 2000 white-lipped peccaries may survive in the Calakmul area of the Maya forest (Reyna-Hurtado *et al.* 2010), but together with the contiguous forests of the Maya Biosphere Reserve in Guatemala and Rio Bravo in Belize, the entire Maya forest in the largest stronghold of the populations in Mesoamerica with an estimated population of around 5000 individuals.

Other similarly large forest blocks currently represent the most secure future for white-lipped peccaries, including the vast Darien National Park of Panama, which is contiguous with forests in Colombia. The remote forests of the bi-national complex of the Rio Platano and Tawahka Asangni Biosphere Reserves in Honduras, and the Bosawas Biosphere Reserves in Nicaragua and Honduras may also harbour significant populations. Two stable, and likely increasing, populations include the Corcovado National Park in Costa Rica and the one in the Maya Mountains of Belize. Both populations are smaller than those in the Maya Forest or Darien but conservation interventions are relatively effective and these populations can persist if habitat is conserved and connectivity with other populations is restored. The remaining two-thirds of white-lipped peccary populations are small and living in highly fragmented landscapes. Some of them may not even exist anymore as they were recorded several years ago and with scant records (Donoso, Panama; Dzilam in Mexico; Northern Belize in Belize).

The major threats identified across all countries were hunting pressure and habitat loss. Although it is difficult to define which one is paramount there is evidence that severe hunting pressure may eliminate whole populations even from areas of well-preserved forest (large communal forest of southern Mexico, *ejidos*;

Reyna-Hurtado et al 2010). Hunting in combination with habitat loss is the worst scenario for the conservation of white-lipped peccaries in Mesoamerica.

The status of white-lipped peccaries in Mesoamerica is graver than the current IUCN classification of the species as Vulnerable (Keuroghlian et al 2013). Approximately 100 years ago this species occurred across virtually all of Mesoamerica's Caribbean slope from Belize through Panama. Populations also extended well into the semi-deciduous forests of Costa Rica. More than 50% of the historic range was lost by 2005 and a further 50% of that remnant was lost in the last eleven years. Based upon this exercise the species is predicted to persist, with adequate protection, only in the tri-national Selva Maya, the Darien National Park in Panama, Corcovado National Park in Costa Rica and areas of the bi-national Mosquitia spanning Honduras and Nicaragua. The species is in jeopardy with the remaining two-thirds of the populations already being small, genetically isolated, highly threatened and some likely already extinct. Today's current strongholds are effectively just remnants in a precipitous regional decline in range and group size that justifies a regionally accurate classification in the IUCN Red List to help provide a mechanism to arrest or at least slow the trends.

Our results indicate that effective conservation of white-lipped peccaries requires large connected areas of forest free of heavy hunting pressure. The species has the most stringent needs for large areas of relatively undisturbed forest of all the ungulates and large mammals in the region. The presence of resident herds of white-lipped peccaries is an indication of conservation success. Based on herd home range estimates of 100 km² (Fragoso 1996, Reyna-Hurtado et al. 2009) and groups of 50 animals or less, a population of at least 500 animals (minimum viable population size from genetic criteria; Soulé 1987), requires areas of forest of at least 1000 km² to hold at least 10 groups. Given that the species is highly dependent on mature, well-conserved tropical forest, it is reasonable to suggest that adequate conservation of white-lipped peccaries would confer protection for other species such as Central American Tapir (*Tapirus bairdii*),

Jaguar (*Panthera onca*), brocket deer (*Mazama temama* and *M. pandora*), and Puma (*Puma concolor*).

7. Conclusion

In a very short time the white-lipped peccary has disappeared from 87% of its historical distribution range in Mesoamerica, and now occurs in less than 50% of the area where it was reported just eleven years ago (Altrichter et al. 2012). All indications are that if not swiftly arrested, this rapid negative trend will continue. Of the remaining 29 scattered populations 20 are decreasing and only 5 are stable or increasing. We consider that the global IUCN Red List status of the species (Vulnerable, Keuroghlian *et al.* 2013) does not accurately represent the status of the Mesoamerican populations. We therefore strongly recommend that the status of white-lipped peccaries be raised to Endangered in the Mesoamerican region (from Mexico to Panama).

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9. Appendix

Questionnaire

White-lipped peccary in Mesoamerica: Status, Threats and Conservation Actions

Dear Symposium participant:

We are glad that you will be participating in the Symposium in Belize and will share data and knowledge on the white-lipped peccary distribution and status from your area of expertise. To achieve the goals of this symposium we are asking you to **respond to the queries below by August 17** and to bring the following data and your presentation structured in the way described below. We are very happy to have you with us and look forward to seeing you in Belize!

Rafael, Jeremy and Lee

1. Map of Current Distribution

Please provide a schematic map of your country/ies of expertise with the current distribution of white-lipped peccaries drawn to the best of your ability, according to the following three categories:

- (a) Areas of known current distribution (please label each area with a name)
- (b) Areas where the species does not currently exist
- (c) Unknown areas / areas (within the historical distribution range, for which expert knowledge is not available)

Hand-drawn or digital map images are fine, as well as shapefiles or ArcGIS project files.

2. Short questionnaire on population status and group size per area:

Please respond the following questions for each area where you have knowledge on the status of the species. If you have knowledge of more than one population or area please feel free to copy and paste the table and respond as many times as possible (an example of answer is provided in yellow, please delete and replace with your information).

Name of area	Extension (km²)	West geog. coord. (decimal degrees from a point in the center of the area)	North geog. coord. (decimal degrees from a point in the center of the area)	Legal status of the area (protected or unprotected)
Population size	1-1,000 ind.	1,000-5,000 ind.	5,000-20,000 ind.	More than 20,000 ind.
<i>In which range would you classify the current population size?</i>				
Population trend	Decreasing	Stable	Increasing	Not known

How would you classify the trend of the last 20 years of the population of this area?				
Main threats	Habitat loss or fragmentation	Hunting pressure	Diseases	Other (please describe)
What is the main threat (if any) to the population of this area?				
Group size	1-50	50-100	100-300	More than 300
What is the range of average group size reported for the area?				
What is the maximum group size reported for this area?				

Some open questions for this population:

1. Is this population connected with other populations?
2. What kind of research has been done in this population?
3. Main methods used?

3. Geographic data:

From the extent of your knowledge only, and within the historical distribution range of the species in your country, please send as many points (geographic coordinates in decimal degrees) of the three following categories of area from your country:

Type of area	Areas with current confirmed presence of the species (in the last ten years)	Areas where the species has disappeared	Unknown areas
Number			
1	West/north	West/north	West/north
2			
3.....and as many as possible!			

4. Presentation:

Each presentation will be 20 minutes (15 minutes for the presentation and 5 minutes for questions /discussion). So, please feel free to prepare your presentation in your favorite style and format, but be sure to use the following structure:

1. An overview status of the species in your country (10 min)
 1. Estimated current distribution range and estimated range reduction in the last 20 years
 2. Population trend of the species in your country
 3. General main threats to the species
2. Your main results from your research or experiences with the species in your specific area(s) (5 min)
3. Questions/ discussion on the country (5 min)

