Case Studies

The following case studies demonstrate how the *IUCN Red List Categories and Criteria version 3.1* should be applied to a number of different taxa. For the purposes of this exercise, no outside knowledge about the taxa should be used. Please go through these examples and attempt to assess each taxon using the *IUCN Red List Categories and Criteria* booklet and the criteria summary table. The answers to the first two examples are provided along with the reasoning behind the decisions made on these.

Difficulties may be experienced because you are not familiar with the taxon concerned and do not know the biology of the taxon or the particular circumstances that may affect the outcome. Please remember that estimation, inference and projection are perfectly acceptable. Although the majority of people should reach the same conclusion about the status, there will not be total consistency because of people's different approach to using inference and projection and how precautionary they are. There will be even less consistency in the criteria used, which is to be expected. All assessments for the IUCN Red List are carried out by people who know the taxon concerned, and are further evaluated by people who know the situation faced by the taxon and who know the IUCN Red List criteria.

Case study 1

Species: ***Gasterosteus* sp.**

Common Name: Benthic Paxton Lake Stickleback

Class: ACTINOPTERYGII

Order: GASTEROSTEIFORMES

Family: GASTEROSTEIDAE

Taxonomy:

The Benthic Paxton Lake Stickleback is one of a pair of stickleback species in Paxton Lake that currently are being described. Both species can be referred to by the museum number of the type specimens. There are five known Texada Island Stickleback species pairs. Each pair consists of a benthic species and a limnetic species that differ in appearance, diet and habitat.

Map by Jim Stamos, Biological Sciences Dept., University of Buffalo. Based on McPhail 1993

Range:

The Benthic Paxton Lake Stickleback is restricted to Paxton Lake, which is located on Texada Island, between Vancouver Island and mainland British Columbia. Paxton Lake is small (17 ha) and has a maximum depth of about 15 m. Paxton Lake is about 90 m above sea level and the only outlet, now dammed, drops about 80 m in a series of small falls before entering Malisipina Strait, thus isolating the lake and the upper portion of the creek from the sea. There is no permanent surface flow into the lake.

Population:

Its population probably exceeds 100,000 individuals. Although no data exist on trends in population size, it is believed that the population is more or less stable at this time.

Habitat & Ecology:

The fish lives near the bottom of the lake. Adults typically feed along the shallow lake margins predating on amphipods, midge larvae and dragonfly nymphs, snails, etc. Some small individuals feed partially on plankton. In the summer, the fish occupy the littoral zone in open, mud-bottomed situations above the deoxygenated zone, but smaller individuals (<50 mm) are usually found in shallower water. The fish prefer some cover and are often found around sunken logs. They disperse over the entire lake bottom in the winter. Spawning occurs in the shallower waters of the littoral zone and nests are usually found under cover in aquatic vegetation. Adults reach 90 mm in length. Relative to other species in the genus *Gasterosteus*, this species is stout, has a wide mouth, few gill rakers, and a reduced number of lateral plates and dorsal spines.

Threats:

Previous disturbance due to mining near Paxton Lake affected the population numbers of the Benthic Paxton Lake Stickleback, but this has not been a threat since the mine closed. The potential introduction of exotic fish species into the lake is probably the major threat now facing the stickleback. The species of most concern are Brown Bullhead Catfish *Ameiurus nebulosus* and Pumpkinseed Sunfish *Lepomis gibbosus*, both of which are spreading on Vancouver Island through unauthorized public transplants. At least one species pair is already known to have gone extinct in the mid 1990s due to the introduction of catfish into Lake Hadley on Lasqueti Island.

Conservation Measures:

The Benthic Paxton Lake Stickleback is protected under the federal *Species at Risk Act* (SARA). A Stickleback species recovery team has been formed and a recovery action group was formed for the Texada Island species pairs (Paxton Lake and Vananda Creek Sticklebacks) and development and implementation of a Recovery Strategy and Recovery Implementation (action) Plan is underway.

Sources:

Environment Canada. 2007. *Benthic Paxton Lake Stickleback*. Species at Risk web site. http://www.speciesatrisk.gc.ca/search/speciesDetails_e.cfm?SpeciesID=544. Accessed 13th June 2007.

Acroloxus Wetlands Consultancy. 2007. Stickleback Recovery Planning. http://www.acroloxus.com/stickleback-recovery-planning.html. Accessed 13th June 2007.

Assessment 1	
Is the taxon eligible for a Red List assessment?	YES
Although this species currently is undescribed, a description is underway, a museum voucher reference is available, and the current range is well known.	
Criterion A: Declining population in the past or future?	NO
Although disturbance from mining affected population numbers in the past, there is no information on when this occurred. The causes of this disturbance are no longer present (the mine has now closed) and the current population appears to be stable. Therefore criterion A is not applicable in this case.	
Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	NEARLY
Since the area of the entire lake is only 17 ha, both the extent of occurrence (EOO) and area of occupancy (AOO) thresholds for CR B1+2 are met (EOO <100 km² and AOO <10 km²). Although there seem to be no current threats to the species, the main potential threat is introduced species, which are known to be affecting species in other parts of the island. If these species were released into the lake, the entire population would be affected. Therefore the population occurs in only one location (CR B1a+2a). There is no continuing decline in range, habitat, locations or population size, therefore the "b" subcriterion does not apply in this case. Also, there is no information given on fluctuations; the population currently appears to be stable. Therefore subcriterion "c" cannot be used. Not all of the requirements are met for criterion B. But the species nearly qualifies: if alien invasive species were to be introduced into the lake, it would very quickly qualify for CR. So, the species could be given a **Near Threatened** status.	
Criterion C: Small population size and decline?	NO
The population is estimated at more than 100,000 individuals, which clearly exceeds the threshold for the Vulnerable category (<10,000 mature individuals). There is also no evidence of a continuing population decline or extreme fluctuations. Therefore criterion C cannot be applied.	
Criterion D: Very small or restricted populations?	**YES**
The population size is clearly too large for criterion D or D1 to be used. But, the species is restricted to a very small range and only one location, and although there are no current threats, there is a real potential threat from introduced species. Therefore the species does qualify for **Vulnerable** under criterion D2.	
Criterion E: Quantitative analysis?	NO
No information is given on any quantitative analysis therefore criterion E cannot be applied.	
Conclusion: The Benthic Paxton Lake Stickleback *Gasterosteus* sp. is **Vulnerable** **VU D2** Current IUCN Red list status: Not Evaluated	

Case study 2

Species: ***Ambystoma taylori*** **(Brandon, Maruska & Rumph, 1981)**

Common Name: Taylor's Salamander

Class: AMPHIBIA

Order: CAUDATA

Family: AMBYSTOMATIDAE

Taxonomy:

Based on both allozymes and mtDNA, this is a very distinctive salamander. The *Ambystoma* salamanders occurring in other natural lakes around Alchichica are not closely related to this species.

Range:

Taylor's salamander is endemic to Lake Alchichica, a saline crater lake located in eastern Puebla, Mexico, at 2,290 m above sea level. The *Ambystoma* salamanders occurring in the other natural lakes around Alchichica are not closely related to this species. The surface area of the lake is 2.3 km².

Population:

Even at its only known locality this is a rare species, although formerly it was common there. Divers deep in the lake have seen the species recently.

Habitat and Ecology:

This salamander usually does not metamorphose, and most individuals live permanently in water. But, occasional individuals have been known to metamorphose. It breeds in the lake, and is usually found in very deep water, often more than 30 m below the surface.

Threats:

The most serious threat to the species is water extraction and diversion resulting in the lake becoming even more saline. The water level has dropped many meters over the last two decades. Continued transformation and pollution of the lake is likely to result in the disappearance of this species. Attempts to introduce fish in the lake have failed because of its salinity.

Conservation Measures:

Taylor's salamander does not occur in any protected area. Captive breeding may be an essential short-term measure to save this species, if it is not too late. The protection of the Alchichica lake is an urgent priority. This species is protected under the category Pr (Special protection) by the Government of Mexico.

Sources:

Shaffer, B., Parra Olea, G. and Wake, D. 2004. *Ambystoma taylori*. In: IUCN 2004. *2004 IUCN Red List of Threatened Species.* <www.redlist.org>. Downloaded on 13 April 2005

IUCN, Conservation International, and NatureServe. 2004. Global Amphibian Assessment. <www.globalamphibians.org>. Accessed on 15 October 2004.

Filonov, A., Tereshchenko, I., Alcocer, J., 2006. Dynamic response to mountain breeze circulation in Alchichica, a crater lake in Mexico. Geophysical Research Letters 33, L07404, doi:10.1029/2006GL025901.

Assessment 2	
Is the taxon eligible for a Red List assessment?	YES
Taylor's salamander *Ambystoma taylori* is a valid species (original description published in 1981).	
Criterion A: Declining population in the past or future?	NO
Although it is noted that the species was formerly common in its only known location and is now rare, there is no indication of the time period over which this population reduction has taken place; no data are given to be able to estimate the rate of population decline. Therefore, it is not possible (from the information given above) to estimate the rate of decline.	
Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	**YES**
The total area of the lake is 2.3 km² therefore the Critically Endangered thresholds for extent of occurrence and area of occupancy are both met (EOO <100 km² and AOO <10 km²) (CR B1+2). The most serious threat to the species is water extraction and pollution, which is affecting the whole lake and hence the whole population. Therefore, the whole lake can be taken as one location only (CR B1a+2a). The quality of the species' habitat is declining through water extraction leading to increased salinity. It is also stated that the species was once common but is now rare. Given the ongoing habitat degradation, these population declines can be expected to continue unless some remedial action is taken (CR B1b(iii,v)+2b(iii,v)). So, the species qualifies for **Critically Endangered** under criterion B (**CR B1ab(iii,v)+2ab(iii,v)**)	
Criterion C: Small population size and decline?	NO
Although the population is described as rare, it is difficult to estimate actual numbers of mature individuals from this.	
Criterion D: Very small or restricted populations?	YES
Again, actual numbers cannot be estimated from the information given, so criteria D and D1 cannot be applied. The species is restricted to only one small location (AOO <10 km²). Therefore, the species qualifies for **Vulnerable D2**. However, it already meets the thresholds for Critically Endangered under criterion B, we can disregard this category.	
Criterion E: Quantitative analysis?	NO
A quantitative analysis has not been carried out.	
Conclusion: Taylor's Salamander *Ambystoma taylori* is **Critically Endangered** **CR B1ab(iii,v)+2ab(iii,v)** Current IUCN Red List status: CR B1ab(iii,v)+2ab(iii,v) (2004)	

Case study 3

Species: ***Amblyrhynchus cristatus* Bell, 1825**
Common Name: Marine Iguana
Class: REPTILIA
Order: SQUAMATA
Family: IGUANIDAE


Photo © Caroline Pollock, IUCN

Taxonomy:
The seven marine iguana subspecies described to date have been based on morphology. The taxonomic status of the ten subpopulations of *A. cristatus* is unclear.

Range:
A. cristatus is endemic to the Galápagos Islands, Ecuador. The species is known from ten islands, although the populations on seven of these islands have not yet been surveyed or studied. Extent of occurrence is less than 5,000 km^2 and area of occupancy is 500 km^2.

Population:
The global population size is currently unknown because a complete population survey has never been carried out. However, populations are known to undergo dramatic fluctuations as a result of food shortages after El Niño events.

Habitat & Ecology:
A. cristatus is the world's only marine lizard species. The animals live in colonies on rocky coast and intertidal zones. Softer substrate is needed for egg laying. Adult females can be found nesting up to 2 km inland and adult males can be found in marine waters, up to depths of 20 m. The species feeds almost exclusively on marine algae. Average generation length is 5 years for females and 12 years for males.

Threats:
El Niño causes periodic dramatic mortalities. The increased rainfall that accompanies El Niño results in greater food availability for most terrestrial organisms in the Galápagos, but marine life generally suffers. Green and red algal species, which are the marine iguanas' preferred food, disappear and are replaced in intertidal areas by brown algae which the iguanas find hard to digest. Up to 90% of marine iguana populations on islands can die of starvation as a result of these environmental changes. The largest iguanas have the highest mortality because, they feed less efficiently than smaller individuals. Currently, *A. cristatus* appears to be able to cope with such events by increasing their reproduction rate when population densities are low. However, if the frequency of such events increases in future, the species may struggle to survive.

The 2001 "Jessica" oil spill had a particularly severe immediate effect on the Santa Fe subpopulation, comparable to the mortality caused by El Niño.

Introduced predators may be having a negative effect on some subpopulations. Iguanas have evolved anti-predator behaviour towards the native Galapagos Hawk *Buteo galapagoensis* but are not able to cope with introduced feral animals such as dogs. Predation by introduced cats, dogs, pigs and rats of iguanas and their eggs has decimated hatchling populations in many colonies.

Conservation Measures:
A. cristatus is included on CITES Appendix II. It is under "Special Law" in the Galápagos and occurs in three protected areas: Galápagos National Park and National Marine Reserve; Galápagos Islands Man and Biosphere Reserve (UNESCO); and Galápagos Islands World Heritage Site. Conservation actions recommended for the species include: further surveys of the islands, taxonomic and genetic research, and monitoring of the population.

Taxonomic/genetic research is recommended for the different island subpopulations to establish whether any of them should be reclassified. Additionally, the status of seven of the ten subpopulations is unknown. Populations on different islands face different threats and should be included in future surveys.

Sources:

Nelson, K., Snell, H. & Wikelski, M. 2004. *Amblyrhynchus cristatus*. In: IUCN 2006. *2006 IUCN Red List of Threatened Species.* <www.iucnredlist.org>. Downloaded on **14 June 2007**.

Wikleski, M. and Thom, C. 2000. Marine iguanas shrink to survive El Niño. *Nature* 403: 37-38.

Assessment 3

Is the taxon eligible for a Red List assessment?	YES

Although further taxonomic work Is required on this species, it has been described (description published in 1825).

Criterion A: Declining population in the past or future?	NO

The global population size is not known and no information is given about population trends. Dramatic fluctuations in population size are known to occur as a result of El Niño events.

Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	**YES**

Extent of occurrence and area of occupancy meet the threshold requirements for Endangered (EOO <5,000 km² and AOO <500 km²) (EN B1+2).

The number of locations should be determined based on the distribution of the population and the area affected by the most serious threats to the species.

The population occurs on ten separate Galápagos islands. A potential threat comes from El Niño events, which affects the whole population across its range: so far the species appears to be able to recover well from these events, but if the frequency of El Niño events increases, for example through the effects of climate change, this may pose a serious problem to the survival of this species. However, the relationship between El Niño and global climate change patterns is unknown, so considering El Niño as a major threat at present may be premature. So counting the entire range as one location may not be an appropriate application of the criteria.

Other threats to the species include pollution events and introduced terrestrial predators. Both of these threats are likely to affect individual islands rather than the entire area in one sweep. So, each island could be seen as a location: 10 locations. This does not meet the Endangered threshold, but it does meet the **Vulnerable** threshold (VU B1a+2a).

There is no information to say there is continuing decline in habitat, population size, range, etc. So subcriterion “b” cannot be used in this case.

However, there is evidence of extreme fluctuations in population size caused by the consequences of El Niño events: populations can be reduced by as much as 90%. So subcriterion “c” can be used here (VU B1ac(iv)+2ac(iv)).

Criterion C: Small population size and decline?	NO

Current population size is not known, therefore criterion C cannot be applied in this case.

Criterion D: Very small or restricted populations?	NEARLY

Again, there is no information on population size, so criteria D and D1 cannot be used. Although the species is apparently restricted to the Galápagos Islands, the AOO is not extremely small and there are 10 known locations. Criterion D2 would probably not be used in this case, but the species is quite close to meeting D2 (based on potential threats and limited locations), so in the absence of the above Vulnerable assessment, a Near Threatened assessment could be used here.

Criterion E: Quantitative analysis?	NO

Quantitative analysis has not been carried out to determine the probability of extinction, therefore criterion E cannot be used.

Conclusion:

The Marine Iguana *Amblyrhynchus cristatus* is **Vulnerable**

VU B1ac(iv)+2ac(iv)

Current IUCN Red List status: VU B2ac(iv) (2004)

Case study 4

Species: ***Diomedea amsterdamensis* Roux, Jouventin, Mougin, Stahl & Weimerskirch, 1983**

Common Name: Amsterdam Albatross

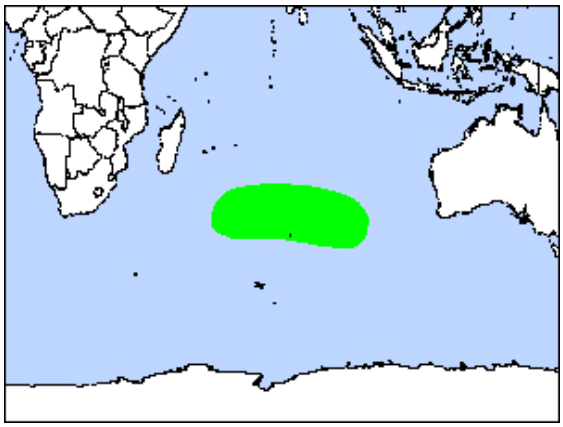
Class: AVES

Order: PROCELLARIIFORMES

Family: DIOMEDEIDAE

Range:

Diomedea amsterdamensis breeds on the Plateau des Tourbières on Amsterdam Island (French Southern Territories) in the southern Indian Ocean. The total island area is around 55 km², but the plateau where these birds breed has an area of only 800 ha. During the breeding season, birds forage both around Amsterdam Island and up to 2,200 km away in subtropical waters, but non-breeding dispersal is unknown, although possible sightings have been reported from Australia and New Zealand.



Population:

There is a total population of around130 birds including 80 mature individuals. There are around 18-25 pairs breeding annually, which is an increase since 1984 when the first census was carried out. The population was probably formerly larger than current numbers when the species' range was more extensive over the slopes of the island. However, there has also been increased chick mortality over recent years with a high chance that this will continue into the future (see threats section) therefore the overall population trend is still considered to be declining.

Habitat & Ecology:

The Plateau des Tourbières covers the highest part of Amsterdam in the centre-west of the island. The plateau is an ancient lava-flow now almost entirely covered with waterlogged peatbog. A number of craters are scattered across the site.

Breeding is biennial (when successful) and is restricted to the central plateau of the island at 500 to 600 m, where only one breeding group is known. The bird's exact diet is unknown, but probably consists of fish, squid and crustaceans.

Threats:

Degradation of breeding sites by introduced cattle has decreased this bird's range and population across the island. Human disturbance is presumably also to blame. Introduced predators are a major threat, particularly feral cats. Interactions with longline fisheries around the island, in the 1970s and early 1980s, could also have contributed to a decline in the population. Today the population is threatened primarily by the potential spread of diseases (avian cholera and *Erysipelothrix rhusiopathidae*) that currently affect the Indian Yellow-nosed Albatross *Thalassarche carteri* population 3 km from the colony. Infection risks are very high and increased chick mortality over recent years suggests that the population is already affected.

Conservation Measures:

The Amsterdam Albatross is included in Annex 1 of the Agreement on the Conservation of Albatrosses and Petrels (ACAP). All birds are banded and annual population is census and monitoring is carried out. In 1987, the number of cattle was reduced and a fence erected to seal off part of the island. In 1992, a second fence was erected with the aim of providing complete protection for the high plateau from possible incursions by cattle.

Sources:

BirdLife International 2006. *Diomedea amsterdamensis*. In: IUCN 2006. *2006 IUCN Red List of Threatened Species.* <www.iucnredlist.org>. Downloaded on **14 June 2007**

Assessment 4

Is the taxon eligible for a Red List assessment?	YES

A description of the species was published in 1983.

Criterion A: Declining population in the past or future?	NO

Although there has been a reduction in population size as suitable habitat and breeding sites have been lost around the island, there are no data available to be able to determine the scale or rate of this decline. So criterion A cannot be applied.

Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	**YES**

If the total range area is taken as both the island (breeding site) and the marine area around the island used for foraging, the extent of occurrence would in effect be the area of a circle of radius 2,200 km; even half of this area would be way above the Vulnerable threshold of 20,000 km² for criterion B1.

However, area of occupancy can be the smallest area essential at any stage for the survival of existing populations of the taxon (see *Guidelines for Using the IUCN Red List Categories and Criteria*). For this species, the nesting site is the smallest essential area; the nesting area is only 800 ha, which clearly meets the Critically Endangered threshold for criterion B2 (<10 km²) (CR B2).

There are several serious threats to the species, including degradation of breeding site, predation by feral cats, and the possible outbreak of disease. All of these can affect the entire population very quickly; therefore we can say the species occupies just one location (CR B2a).

Although numbers have increased since 1984, a continuing decline can be projected owing to the impact of disease, which is probably already causing chick mortality (CR B2ab(v)).

There is no evidence of extreme fluctuations, so criterion B2c cannot be used. But the species already qualifies for **Critically Endangered** under criterion B (CR B2ab(v)).

Criterion C: Small population size and decline?	**YES**

Population size is 80 mature individuals, which meets the criterion C threshold for Critically Endangered (CR C).

There is insufficient information available to say what rate of population decline can be expected, so criterion C1 cannot be used. But, there a continuing population decline is projected due to the expected impacts of disease (CR C2).

Only one population is known, and there are more than 50 mature individuals in this, CR C2a(i) cannot be used. But, all individuals occur in one population, which does meet the requirements for Critically Endangered under criterion C2a(ii) (at least 90% of the population in one subpopulation).

There is no evidence of extreme fluctuations, so criterion C2b cannot be used. But the species already qualifies for **Critically Endangered** under criterion C (CR C2a(ii)).

Criterion D: Very small or restricted populations?	YES

Population size is only 80 mature individuals, which meets the threshold for Endangered under criterion D. Area of occupancy and number of locations are also highly restricted, with threats from disease and feral cats, therefore Vulnerable D2 is also applicable.

Criterion D cannot be used for Critically Endangered in this case as the population size is greater than 50. But the species already qualifies for Critically Endangered under criteria B and C.

Criterion E: Quantitative analysis?	NO

There is no information about any quantitative analysis having been carried out, therefore criterion E cannot be used.

Conclusion:

The Amsterdam Albatross *Diomedea amsterdamensis* is **Critically Endangered**

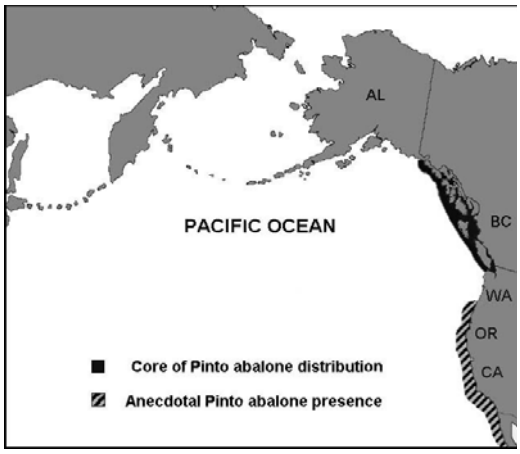
CR B2ab(v); C2a(ii)

Current IUCN Red List status: CR B2ab(v); C2a(ii) (2007)

Case study 5

Species: ***Haliotis kamtschatkana* (Jonas, 1845)**
Common Name: Pinto Abalone
Class: GASTROPODA
Order: ARCHAEOGASTROPODA
Family: HALIOTIDAE

Range:
The Pinto Abalone is predominantly a North American species. Its range extends from Sitka Island, Alaska in the north, along the coast of British Columbia, and to Turtle Bay, Baja California in the south. In central California, the subspecies *H. kamtschatkana assimilis* (threaded abalone) occupies the southern part of the range. Very little is known about populations in this part of the range, with apparently low presence of threaded abalone relative to other abalone species of the south.



Map of pinto abalone distribution. Black shading represents core distribution and the hatched area represents the anecdotal range.

Population:
Alaska and British Columbia are the only two regions where targeted commercial fisheries for pinto abalone ever existed. Although the percentage of the global population occurring in these areas is not known, the core range for the species is believed to be Alaska, British Columbia, and Washington. There seem to be no significant populations of pinto abalone south of San Juan, Orcas and Lopez Islands in Washington State.

Alaskan fishery CPUE data from 1979 to the close of the fishery in 1996 indicates a decline in CPUE of 89.7% over this period. This is the only measure of pinto abalone numbers in Alaska. With the closure of the fishery in 1996, there is no way to determine the current status of Alaskan stocks of pinto abalone.

In British Columbia, fisheries-dependent catch and CPUE data exist from 1977 to 1990 when the fishery closed. Fisheries-independent data consist of abalone densities at survey sites along the coastline. Fishery data show a 41.4% decline in CPUE between 1977 and 1990. The difference in decline rates in CPUE between Alaska and British Columbia is likely a result of different approaches in fisheries management. However, site surveys in British Colombia demonstrate a much steeper decline than do the CPUE data: there was an 88.6% decline in abalone density between 1979/1980 and 2001 in the central coast of British Columbia, and an 85.5% decline in densities recorded in 1978 and the average densities recorded in 1990, 1994, 1998, and 2002 in the Queen Charlotte Islands. There has been no significant increase or decrease in densities observed in that area since 1990.

Although the above figures indicate extreme population declines in the core range area, it should also be noted that the disappearance of one of the abalone's main natural predators, the sea otter *Enhydra lutris*, in the 19th century resulted in pinto abalone numbers increasing immediately prior to the period of heaviest fishing pressure on the species. If this natural predator had remained within the abalone's range, the decline in natural population size caused by fishing pressures would likely be 50-80% since the 1970s.

Habitat & Ecology:
Pinto abalone are sessile gastropods that exist in patchy distributions. Their preferred habitat is rocky-shore coastline. The species is an intertidal zone herbivore and is targeted by a diverse range of predators, depending on the water depth in which they occur. In subtidal waters, predators include asteroids, crabs, fish, octopi, and sea otters. In intertidal waters, birds, sea otters and mink are the major predators. The eradication of the sea otter during the 19th century led to the increased co-occurrence of sea urchins and abalone. Sea urchins out compete pinto abalone for food resources, which has resulted in "sea urchin barrens" — large areas with high sea urchin populations, no macroalgae and little or no abalone. Nevertheless, sea urchins may also provide some enhancement by maintaining encrusting coralline algae cover and by affording shelter under their spine canopy to small abalone.

Generation time for the species is estimated at about 10 years.

Threats:

Poaching of pinto abalone is a lucrative enterprise and is likely placing continued stress on the remaining abalone populations. Illegal harvest of pinto abalone is likely to continue to pose a threat to the recovery of the species. The large and mostly uninhabited coastline is a hindrance to enforcement efforts, and the high value of pinto abalone makes poaching a very lucrative enterprise. The removal of large numbers of mature individuals drastically threatens the reproductive potential of an already depressed population.

There is evidence to suggest that abalone are susceptible to recruitment failure at reduced densities. This renders the population highly susceptible to recruitment over-fishing. Abalone harvesters tend to remove all available individuals from each site visited, and the resulting reduced local populations are at risk of experiencing recruitment failure.

Sea otters are effective natural predators of abalone. Historically, the sea otter's range encompassed the entire range of the pinto abalone. Over-exploitation at the end of the 18th century led to the extirpation of the sea otter throughout most of this range. Following major conservation efforts (translocations and reintroductions) in the 1970s, the sea otter is rapidly re-establishing itself. They currently overlap with pinto abalone only in the northernmost reaches of the pinto distribution and it is doubtful that sea otters are responsible for the observed decline in abalone populations over the last few decades. Nevertheless, sea otter numbers are increasing. A study investigating the impact of sea otters on red abalone *H. rufescens* in California reported that the effects of predators on abalone abundance were greater than the effects of recreational harvesting.

Pinto abalone populations are very susceptible to development and habitat destruction.

The large and continuing decline of black abalone *H. cracherodii* in California is partly a result of Withering Syndrome, and has raised concerns that other species of abalone may also be in danger from contagious pathogens. Laboratory studies of the bacterium responsible for Withering Syndrome, *Candidatus xenohaliotis californiensis*, indicate that it is capable of infecting other species of abalone. However to date there have been no recorded instances of Withering Syndrome in pinto abalone.

Conservation Measures:

Several conservation actions are currently underway on behalf of the pinto abalone. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed the pinto abalone as a threatened species in 1999. This has resulted in development of a National Recovery Action Plan (NRAP), with various recommendations including actions for curtailing illegal harvest; a communications campaign aimed at increasing public awareness of the decline of the species and ongoing efforts to engineer its recovery; and recommendations for research aimed at determining the best methods for abalone rebuilding projects, and many aspects of the biology, physiology and ecology of the species that currently are unknown. The NRAP also encourages ongoing monitoring projects.

In 1994, the Washington Department of Fish and Wildlife closed the pinto abalone fishery but did not initiate any conservation efforts. In 2004, the National Marine Fisheries Service listed the pinto abalone as a Candidate Species in the state of Washington for protection under the Endangered Species Act. This designation, however, does not confer any procedural protections under the Endangered Species Act.

In California, after a series of closures of the various targeted abalone fisheries (of which pinto abalone did not play a significant role), fisheries managers enforced a moratorium on the taking, possessing and landing of all abalone species for commercial or recreational purposes south of San Francisco. The same bill mandated the creation of an Abalone Recovery Management Plan (ARMP). Pinto abalone are included in the ARMP only indirectly, as they are insufficient in numbers to support any form of targeted management or harvest.

Sources:

McDougall, P.T., Ploss, J. & Tuthill, J. 2005. *Haliotis kamtschatkana*. In: IUCN 2006. *2006 IUCN Red List of Threatened Species.* <www.iucnredlist.org>. Downloaded on **14 June 2007**

Assessment 5

Is the taxon eligible for a Red List assessment?	YES

The species was first described in 1845.

Criterion A: Declining population in the past or future?	**YES**

Generation length is estimated at 10 years, therefore the time period population declines are measured over is 30 years (1977-2007).

Although there are no data for the entire range of this species, fisheries-dependent and fisheries-independent data from the core part of the range indicate declines of more than 80% over the last 30-40 years.

These data do not cover the entire global range of the species (but presumably do cover the majority of the global population). Also, the initial population size estimates appear to have been elevated from what would have been the "natural" population size as a result of the main natural predator (sea otter) being eliminated. So, although the initial findings seem to indicate that the species meets the thresholds for Critically Endangered, it would be reasonable to assume that the actual reduction in natural global population size over the last three generations is 50–80%, meaning the species qualifies for **Endangered** (EN A).

Although the initial causes of the population decline (commercial fishing pressure) has ceased, the population is still under threat from poaching and it is not clear that the much reduced abalone population can recover; the growing sea otter population may have disastrous consequences for the species (EN A2).

The above decline rates were derived from direct observation of the population, index of abundance data (CPUE and site surveys), and levels of exploitation (EN A2abd).

Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	NO

Although the extent of occurrence is not given for this species, the overall range is large, extending from Alaska to Baja California. It is impossible to estimate what the area of occupancy may be from the information available in the account. So criterion B cannot be used in this case.

Criterion C: Small population size and decline?	NO

Although available data support the occurrence of serious population declines, there is no indication of what the current global population size may be. Therefore, criterion C cannot be used.

Criterion D: Very small or restricted populations?	NO

Again, population size is unknown, therefore criteria D and D1 cannot be used. Area of occupancy and number of locations are also not known, therefore criterion D2 cannot be applied.

Criterion E: Quantitative analysis?	NO

No quantitative analysis indicating probability of extinction has been carried out, therefore criterion E cannot be used.

Conclusion:

Pinto abalone *Haliotis kamtschatkana* is **Endangered**

EN A2abd

Current IUCN Red List status: EN A2a (2005)

Case study 6

Species: ***Physella johnsoni*** **(Clench, 1926)**
Common Name: Banff Springs Snail
Class: GASTROPODA
Order: BASOMMATOPHORA
Family: PHYSIDAE

Photo © Mark & Leslie Degner

Range:
Physella johnsoni is endemic to thermal springs on Sulphur Mountain, within Banff National Park (BNP), Alberta, Canada (Figure 1). Historic locations were the Upper Hot, Kidney, Middle, Cave and Basin, and Vermilion Cool Springs. Presently, the species survives in five thermal springs: Lower Middle, Cave, Basin, Upper C&B, and Lower C&B (locations circled in figure 1). The latter four of these springs occur in the Cave and Basin National Historic Site (C&BNHS). The Banff springs snail has been extirpated from three thermal springs (Upper Hot, Kidney, Upper Middle) and one cooler spring.

Although this snail is small and inconspicuous, the macrofauna of western North American springs is well studied. Given the human fascination with thermal springs and the human history and extensive use of BNP, it is extremely unlikely that unknown populations of the snail exist.

The current total area that this species occupies is around 170 m².

Population:
Natural exchange of snails among the five presently inhabited thermal springs is unlikely.

From 1996 to 2000, population surveys were carried out every three to four weeks at all historic locations. Due to inaccessibility of some potential occurrence sites, snail numbers from these surveys are considered minimum population estimates.

Apparently natural seasonal fluctuations in population size occur, with maxima occurring in late inter/early spring and minima occurring from May to July; the causes of these fluctuations are unknown. Yearly averages from 1996 to 2000 (see figure 2) show a significant increase in total snail numbers between 1996 and 1997, with subsequent levels in 1998, 1999 and 2000 not significantly different from those of 1997. As these are the only population data in existence, it is impossible to indicate a most recent 10-year trend.

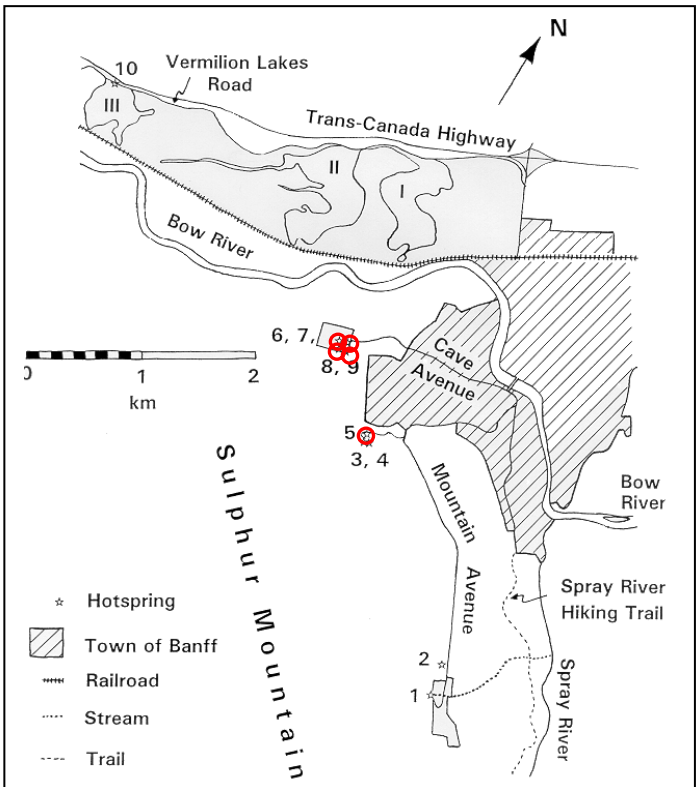


Figure 1: Thermal springs near Banff Townsite, Banff National Park, Alberta. I, II, and III = First, Second, and Third Vermilion Lakes.
1 = Upper Hot Spring; 2 = Kidney Spring; 3 & 4 = Upper Middle Springs; 5 = Lower Middle Spring; 6, 7, 8, 9 = Basin, Cave, Lower Cave & Basin, and Upper C&B Springs of the Cave and Basin National Historic Site; 10 = Vermilion Cool Springs at Third Vermilion.

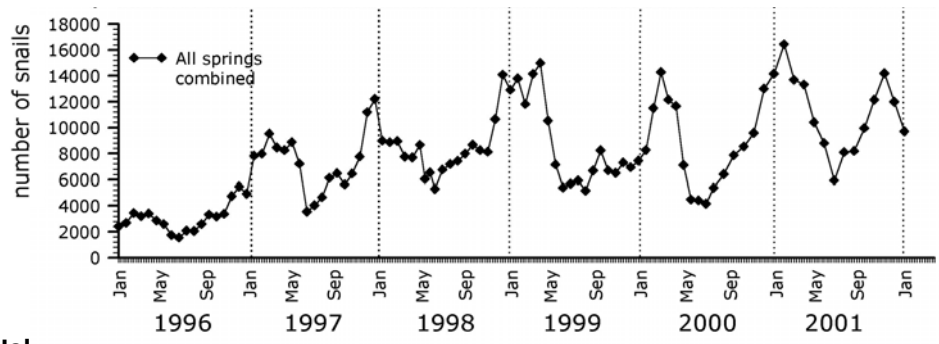


Figure 2: Number of *Physella johnsoni* in all springs combined, Banff National Park, Alberta, January 1996 to January 2002

Habitat & Ecology:

The Banff springs snail is a small (approximately 5.0 mm shell length), inconspicuous freshwater mollusc. It lives in thermal springs, and even within these springs the species is limited to a restricted microclimate. The critical components of their habitat are unknown.

There are no publications on the reproductive biology and longevity of *P. johnsoni*. Most likely, they are hermaphroditic. It has been suggested that Banff springs snail may be a keystone species and that Banff's thermal spring ecosystems could shift with the loss of this important grazer.

Threats:

P. johnsoni is confined to very discrete, highly localized, and extremely small habitat patches. On a geological time scale, thermal springs are not permanent.

The hot springs have been a major tourist attraction over the past 100 years and all the historic and presently inhabited thermal springs have been affected by human activities to a varying degree. The least altered habitats are in the Middle Springs area. Since 1995, these springs have been located within areas closed to the public. Unfortunately, even with these restrictions human use of the Upper Middle Springs cave continues, including the construction of rock dams to increase the depth of the origin pool for soaking. Human use of the Kidney Spring also continues: people enjoy soaking in the concrete cistern. The Upper Hot Spring has experienced severe water flow reductions and flow cessations in recent years. During reduced flows, excess water is not shunted down the outflow stream, which may result in water near the spring's origin being too hot for the snail (~47°C).

Illegal swimming has, until recently, been a recurring problem at the Basin Spring pool. This activity can directly kill snails and eggs by crushing them, removing them from substrates, or stranding them above the water. Indirect mortality can result from the destruction or modification of microhabitat components. Potentially lethal substances (e.g., alcohol, body lotions, deodorants, sunscreens, insect repellents, perfumes, antimicrobial soaps, lantern fuels, human wastes, bacteria, etc.) are introduced to the water by swimmers and significant changes in water physicochemistry and snail microdistribution have been detected in areas used by swimmers.

Less obvious than swimming, but certainly more prevalent, the dipping of feet or hands into the springs occurs with high regularity. The same potentially toxic substances can be introduced through this. Observations of visitor behaviour has found that, on average, 73% of visitors to the Cave Spring dipped their hands in the water. With nearly 165,000 people visiting the C&BNHS during 1998/99, this means potentially over 120,450 people per year dipping their limbs into the Cave Spring water.

Other forms of habitat alteration include littering with garbage and coins; throwing and kicking snow balls and pieces of ice; and removing and moving natural objects such as the microbial mat, twigs, logs, and rocks. These activities have killed adult snails and eggs. Littering with coins may be particularly damaging as copper sulphate was once used as a molluscicide; both the Canadian penny and nickle still contain copper.

Even the removal of garbage from the thermal springs by well-meaning visitors could result in the death of snails if the garbage is not first examined carefully for the small snails.

The effects of thermal spring flow cessations on the snail are unclear. However, *P. johnsoni* has been extirpated from the two thermal springs where water flow stoppages have been recorded: the Upper Hot and Upper Middle Springs. There is some concern that recent flow anomalies at the Upper Middle and Upper Hot Springs may signal the beginning of severe water flow problems in the thermal springs of Sulphur Mountain.

Conservation Measures:

The Banff Springs Snail Research and Recovery Program began in 1996. A draft Resource Management Plan (RMP) for the recovery of the snail has been in place since 1998.

Data continue to be collected on the biology and ecology of the species in the thermal springs through periodic surveys. An environmental assessment under the guidelines of the Canadian Environmental Assessment Act has been written for snail reintroductions.

A communications strategy has been formalized by Parks Canada, with the objective of increasing understanding, awareness, and appreciation of the Banff springs snail amongst Parks Canada staff, local residents, Albertans, Canadians, and international visitors. Sectors of the public suspected of causing the most snail habitat disturbance will be specifically targeted in order to curb their activities.

Many of the provisions to ensure the continued survival of the species and the protection of its habitat are contained in the *National Parks Act*. The species is also protected by federal law under Schedule 1 of the *Species at Risk Act*.

Sources:

Lepitzki, D.A.W. 2002. Status of the Banff Springs Snail (*Physella johnsoni*) in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division, and Alberta Conservation Association, Wildlife Status Report No. 40, Edmonton, AB.

Image from Environment Canada web site: http://www.speciesatrisk.gc.ca/species/search/SearchDetail_e.cfm?SpeciesID=311 (Accessed: 4 February 2003)

Assessment 6

Is the taxon eligible for a Red List assessment?	YES

Originally description published in 1926.

Criterion A: Declining population in the past or future?	NO

Population decline has occurred in the past, with at least two subpopulations disappearing entirely. However, population trend over the last ten years cannot be fully determined (data are available only up to January 2002). In fact, between 1997 and 2002, the population appears to have been stable to increasing (although not significantly increasing). Therefore, criterion A cannot be applied.

Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	**YES**

Both the extent of occurrence and area of occupancy meet the Critically Endangered thresholds (EOO <100 km² and AOO <10 km²) (CR B1+2).

The species currently occurs in only five springs, with no natural interchange between subpopulations. Most of the threats to the species appear to be habitat degradation and human disturbance, which affect the sites individually; therefore based on current threats five locations can be counted, which does not meet the locations threshold for CR (1 location), but does meet the EN threshold (no more than 5 locations). Note that a potential threat comes from future water flow problems, which could quickly affect all springs in the area, therefore if this threat was considered it can be interpreted that there is one location: a precautionary, but less certain, assessment could indicate 1 location based on this.

However, the population appears to be severely fragmented so this can be used to apply criterion B1a+2a for the Critically Endangered category.

In spite of the apparently stable population trend, habitat degradation continues due to human activities in and around the springs. So, CR B1b(iii)+2b(iii) applies.

The species undergoes natural seasonal fluctuations, which would not be considered to be extreme fluctuations, so subcriterion “c” cannot be used for this species

The snail therefore qualifies for **Critically Endangered** (CR B1ab(iii)+2ab(iii)).

Criterion C: Small population size and decline?	NEARLY

For species that undergo natural fluctuations in population size, a lower estimate should be used to determine the population size. Based on figure 2, a lower estimate (less than the mean) for population size would fall below the Vulnerable threshold of 10,000 for criterion C (VU C).

However, the population appears to be at least stable, so the continuing decline requirement for criterion C is not met. However, with the potential for future population declines if the water flow of these springs declines, the species could be said to nearly meet this criterion so a Near threatened status could be used here. But the species already qualifies for CR under criterion B, so that status takes priority.

Criterion D: Very small or restricted populations?	YES

The population size exceeds the thresholds for D and D1. However, the species is restricted to no more than five locations, therefore the D2 criterion can be used (VU D2).

The species qualifies for **Vulnerable** under criterion D (VU D2). But, it already qualifies for CR under criterion B, and that higher category takes priority.

Criterion E: Quantitative analysis?	NO

A quantitative analysis has not been carried out.

Conclusion:

The Banff Springs Snail *Physella johnsoni* is **Critically Endangered**

CR B1ab(iii)

Current IUCN Red List status: NE

Case study 7

Species: ***Phycodurus eques* (Günther, 1865)**

Common Name: Leafy Seadragon

Class: ACTINOPTERYGII

Order: GASTEROSTEIFORMES

Family: SYNGNATHIDAE

Range:

Leafy seadragons are endemic to Australia and are most abundant in South Australia (SA) and southern Western Australia (WA). Until recently, the range was considered to form a continuous stretch of coastline from near Perth on the southern west coast of WA to Wilson's Promontory in Victoria. Recent sightings of live animals by divers have extended the known range along the WA coastline as far north as the Abrolhos Islands, west of Geraldton. There are also unconfirmed reports of the species around the Bass Strait Islands of northwest Tasmania.

The length of coastline along which the species occurs is approximately 14,000 km and the width of the strip of habitat suitable for it to occupy along this coastline is on average around 0.1 km. Seadragons have been sighted at numerous locations within the range but it is impossible to determine how fragmented the population is. The depth range of leafy seadragons is not well documented; most sightings are by divers in waters of less than about 20 m, however seadragons have been recorded down to 30 m in some areas.

Population:

There are no direct data for population estimates for *P. eques*. However, the density of leafy seadragons around West Island, in Encounter Bay (SA) based on a mark/re-sighting method and a capture/recapture algorithm indicates that the density of larger juveniles and adults at this site at 57 fish per ha. Since this study site was chosen because of relatively frequent sightings of the species, it can be assumed that densities elsewhere in the range would be lower. So, taking just 10% of this estimate (5 fish per ha), and a total range area of 1,400 km² (140,000 ha), the total global population estimate would be approximately 700,000 (based on quite loose assumptions).

Habitat & Ecology:

Leafy seadragons were, until recently, thought to occur predominantly near rocky reefs supporting stands of kelp or other macroalgae, where they have been observed feeding on mysids and other crustaceans. However, more recent data has shown that this species is just as prevalent over shallow (5 to 15 m depth) *Posidonia* seagrass meadows and patches of sand amongst seagrass.

Individuals typically remain within well-defined home ranges of up to 5 ha. As with other syngnathids, male seadragons carry the fertilized eggs. For Leafy Seadragons, the male carries about 200 eggs on the exposed surface of the underside of its tail (there is no pouch). It can survive for at least two to three years in aquaria if supplied with its specific live food requirements. Longevity *in situ* is not known. Mating reportedly occurs during summer months. The genetic structure of populations has not been measured, nor has any aspect of reproduction been quantified.

Phycodurus eques is particularly well camouflaged, with a number of frond-like appendages that resemble kelp. The species also rocks back and forth with wave action, increasing its resemblance to coastal algae swept by coastal surge.

Threats:

Leafy Seadragons lack a caudal fin and are weak swimmers; in conjunction with a lack of a dispersive egg phase, this potentially makes them vulnerable to habitat loss and degradation as well as to incidental harvesting during commercial fishing. These are the two main threats. The species is associated with seagrass beds and reefs supporting macroalgae. These habitats have been adversely affected by human activities and loss in quality and quantity of habitat has been documented. The loss of habitat is most severe near major urban centres, where discharge of storm water and treated sewage leads to eutrophication and increased sedimentation. Losses of seagrass have been particularly severe along the metropolitan coasts.

There is anecdotal evidence that leafy seadragons are killed as incidental bycatch in the trawling industry in SA. Fishers have indicated that on occasions they catch "large numbers" of the species. However neither the rate nor distribution of incidental catch have been substantiated.

The current legal collection of wild specimens is unlikely to cause long-term changes in population sizes. The small numbers taken under legally issued permits could result in the reduction or loss of groups of animals at particular sites, but this is unlikely to result in measurable effects on regional populations. If demand increases substantially, illegal collection could threaten local and perhaps regional populations, although this possibility should remain unlikely given the difficulties associated with illegal international export.

This species is a major attraction for the dive industry in southern Australia, and it has been made the official fish emblem in South Australia. Recreational divers often harass or disturb individuals. Suitable protocols for divers should be encouraged to protect local populations, but the disturbance probably does not harm the long-term prospects for regional populations.

Conservation Measures:

The species is protected species in South Australia, Victoria, and Western Australia Waters. It is subject to export controls in the Commonwealth Wildlife Protection (Regulation of Exports and Imports) Act 1982 and is listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

All states of Australia are currently implementing systematic series of Marine Protected Areas (MPAs). The most important development for Leafy Seadragons is that a new MPA is close to being declared (it was released as a draft plan earlier in 2005) in southern Gulf St Vincent in the state of SA. The proposed MPA will include areas (e.g., Encounter Bay and northeastern Kangaroo Island) in which a large proportion of public sightings of seadragons occur. The protection of these areas could substantially decrease the perceived vulnerability of the species to human activities, in particular to commercial fishing.

Sources:

Connolly, R. 2006. *Phycodurus eques*. In: IUCN 2006. *2006 IUCN Red List of Threatened Species.* <www.iucnredlist.org>. Downloaded on **15 June 2007**

Assessment 7

Is the taxon eligible for a Red List assessment?	YES

The original description of this species was published in 1865.

Criterion A: Declining population in the past or future?	NO

There is no information available to be able to determine population declines, so criterion A cannot be used.

Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	**NEARLY**

The extent of occurrence is the total area of coastline the species occurs in: 1,400 km². This falls within the threshold for Endangered under criterion B1 (<5,000 km²). There is insufficient information to be able to give and estimate of area of occupancy, so criterion B2 cannot be used.

Locations are noted as “numerous”, and the degree of fragmentation is not known, so criterion B2a cannot be used.

Habitat loss and degradation is ongoing at least in parts of the species’ range (declining quality and quantity of seagrass beds and reefs with macroalgae are documented), so there is continuing decline in habitat area and quality (EN B2b(iii)).

There is no information to support the occurrence of extreme fluctuations, so criterion B2c cannot be used.

The species does not quite meet all the requirements for criterion B, but almost meets Endangered under this criterion. Therefore, a **Near Threatened** status can be given to the species.

Criterion C: Small population size and decline?	NO

There are no direct data on population size, but an estimate of 700,000 has been made which is well above the 20,000 threshold for Vulnerable under criterion C. So this criterion does not apply.

Criterion D: Very small or restricted populations?	NO

Both population size and range are too large for criterion D to apply.

Criterion E: Quantitative analysis?	NO

No quantitative analysis has been carried out as far as we know. So criterion E cannot be used.

Conclusion:

The Leafy Seadragon *Phycodurus eques* is **Near Threatened**

NT

Current Red List status: NT (2006)

Case study 8

Species: ***Fratercula arctica*** **(Linnaeus, 1758)**

Common Name: Atlantic Puffin

Class: AVES

Order: CHARADRIIFORMES

Family: ALCIDAE

Photo © Caroline Pollock, IUCN

Range:

This species breeds on the coasts of northern Europe, Faroe Islands, Iceland and eastern North America, from well within the Arctic Circle to northern France and Maine. The winter months are spent at sea far from land: in Europe as far south as the Mediterranean and in North America to North Carolina. Extent of occurrence is somewhere between 100,000 and 1,000,000 km².

Population:

It has a large global population estimated to be over five million individuals. There is evidence of a population decline, but this is not believed to be anywhere near as much as 30% over three generations.

Habitat & Ecology:

Atlantic Puffins are colonial nesters, using burrows on grassy cliffs. They will also nest amongst rocks and scree. The only time spent on land is to nest, and mates are found prior to arriving at the colonies. The species is sexually mature at age 5 to 6 years.

Feeding areas are usually located far offshore from the nest. Atlantic Puffins can dive down to approximately 200 feet underwater and are propelled by their powerful wings which are adapted for swimming. Puffins collect several small fish when hunting, and line them up in their bills facing alternately to each side. They use their tongues to hold the fish against spines in their palate, leaving their beaks free to open and catch more fish. Additional components of their diet are crustaceans and mollusks.

Natural predators of the Atlantic puffin include the great black-backed gull, which can catch a puffin in flight, or pick off one separated from the colony, and herring gulls, which are not capable of hunting adult puffins but will take eggs or recently hatched chicks.

Threats:

The population was greatly reduced in the 1800s when they were hunted for meat and eggs. More recently, some populations have declined due to predation by large gulls and the inadvertent introduction of rats, cats, dogs and foxes onto some islands used for nesting.

Since the Atlantic Puffin spends its winters on the open ocean, it is susceptible to human impacts such as oil spills. If an accidental oil spill occurs and pelagic birds are exposed, toxins are inhaled or ingested which leads to kidney and liver damage. This damage can contribute to a loss of reproductive success and damage to developing embryos.

Sources:

BirdLife International (2007) Species factsheet: *Fratercula arctica*. Downloaded from http://www.birdlife.org on 15/6/2007

Wikipedia. 2007. www.wikipedia.org/wiki/Atlantic_Puffin. 15th June 2007.

Assessment 8

Is the taxon eligible for a Red List assessment?	YES

This is a well-known species, first described in 1758.

Criterion A: Declining population in the past or future?	NO

Although there is evidence of population decline, this is not believed to be anywhere near the thresholds for Vulnerable under criterion A. So this criterion cannot be used.

Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	NO

The global range for this species is very large and well above the threshold for Vulnerable under criterion B. So this criterion cannot be used.

Criterion C: Small population size and decline?	NO

In spite of an apparent declining trend, the population size is over five million birds. Therefore criterion C cannot be used.

Criterion D: Very small or restricted populations?	NO

For reasons outlined above, criterion D cannot be used.

Criterion E: Quantitative analysis?	NO

No quantitative analysis has been carried out therefore criterion E cannot be used.

Conclusion:

The Atlantic Puffin *Fratercula arctica* is **Least Concern**

LC

Current Red List status: LC (2004)

Case study 9

Species: ***Andrias davidianus*** **(Blanchard, 1871)**
Common Name: Chinese Giant Salamander
Class: AMPHIBIA
Order: CAUDATA
Family: CRYPTOBRANCHIDAE

© Sumio Okada, Kawasaki Medical School Dept of Molecular Biology (Nov. 2000)

Range:
The Chinese Giant Salamander is widespread in central, south–western and southern China, although its range is now very fragmented.

Population:
The species was once reasonably common but populations have declined catastrophically over the last thirty years. The species is now very rare, with few surviving populations known. Trade data, observed distribution shrinkage and anecdotal information on habitat destruction suggest the population has declined by at least 80% over the last 45 years.

Habitat & Ecology:
This is the largest of all amphibian species with adults reaching a total length of more than 100 cm. Generation length is estimated to be 15 years.

The salamander lives and breeds in large hill streams, usually in forested areas (100 to 1,500 m altitude), where the animals occupy hollows and cavities under water. The salamanders spend their whole lives in water. Females lay their eggs in a string in a burrow underwater that is occupied by a male. Larvae then develop in the streams.

Threats:
Population declines are principally due to over-exploitation. The Giant Salamander is considered to be a delicacy and is collected for culinary and commercial purposes. The species has also suffered from habitat destruction (e.g. from construction of dams) and habitat degradation (e.g. water pollution from mines). Although there are commercial farms of this species, the vast majority of giant salamanders traded (>75%) are believed to originate from the wild.

Conservation Measures:
The species is at present listed on CITES Appendix I. In China, and it is a Class II State Major Protected Species of wildlife nationally. It also occurs in many nature reserves within its range. The trend in wild offtake/harvest in relation to total wild population numbers over the last five years is decreasing, and the trend in offtake/harvest produced through domestication/cultivation over last five years is stable.

Captive raising of animals has achieved some success, but these projects are mainly to meet the market demand. It is also not clear that animals are actually being bred in captivity for commercial purposes.

Sources:

IUCN, Conservation International, and NatureServe. 2004. Global Amphibian Assessment. <www.globalamphibians.org>. Accessed on 15 October 2004.

AmphibiaWeb: Information on amphibian biology and conservation. [web application]. 2003. Berkeley, California: Available: http://amphibiaweb.org/. (Accessed: 29 January 2003).

Image from The Andrias Homepage/2000-2001. © Sumio Okada. http://www3.ocn.ne.jp/~herpsgh/photos.html (Accessed: 31 January 2003)

Assessment 9

Is the taxon eligible for a Red List assessment?	YES

Description first published in 1871.

Criterion A: Declining population in the past or future?	**YES**

Generation length is noted as 15 years, therefore for rates of decline the time period we must look at is 45 years rather than 10 years. It is estimated that there has been a reduction in population size of at least 80% over the last three generations (CR A2).

This decline rate is based on trade data, anecdotal information on the level of habitat loss and the observed diminishing range area (CR A2abc). Over-exploitation is recorded as one of the main threats to the species and has also contributed to population declines (CR A2d).

The species qualifies for **Critically Endangered A2abcd**.

Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	NO

The species is described as "widespread", but no estimates of actual extent of occurrence or area of occupancy are given. Criterion B cannot be applied in this case.

Criterion C: Small population size and decline?	NO

It is noted that past population declines have resulted in the species becoming very rare with few populations surviving in the wild. However, there is no estimate of current population size, and no figures are given for the population three generations ago, therefore population size cannot be calculated from the estimated rate of decline over this time. Criterion C cannot be used confidently in this case.

Criterion D: Very small or restricted populations?	NO

For the same reasons outlined under criterion C, criteria D and D1 cannot be used. The range is widespread and number of locations is unknown, therefore criterion D2 cannot be used either.

Criterion E: Quantitative analysis?	

A quantitative analysis has not been carried out.

Conclusion:

The Chinese Giant Salamander is **Critically Endangered**
CR A2abcd

Current Red List status: CR A2ad (2004)

Case study 10

Species: ***Aspideretes nigricans*** **(Anderson, 1875)**

Common Name: Black Soft-shelled Turtle

Class: REPTILIA

Order: TESTUDINES

Family: TRIONYCHIDAE

Photo © Peter C. H. Pritchard.

Range:
This species is only known to exist in an artificial pond (Baizid Bostami shrine) near Chittagong, Bangladesh. In 1912, its distribution was given as in between the Brahmaputra river system and the Arakan streams, but this may have been an incorrect assumption based on the distributions of *A. gangenticus, A. leithi,* and *A. hurum*.

Population:
The total population is approximately 400 individuals and is dependant upon artificial food supplied by visitors and pilgrims.

Habitat & Ecology:
The species is a large freshwater, soft-shelled, carnivorous turtle. Males are larger than females. The specific natural habitat of this species is not known, since it has not been recorded outside of the shrine pond.

Threats:
The very confined distribution, reduction of potential nesting grounds, and egg predation are major threats to its survival. Fungal infection is also suspected to be a further stress.

Conservation Measures:
The species is completely dependent upon food supplied by humans.

Sources:

Ahsan, M.F. The Bostami or Black Softshell Turtle, *Aspideretes nigricans*: Problems and Proposed Conservation Measures In: *Conservation, Restoration, and Management of Tortoises and Turtles — An International Conference*. Proceedings of the 1993 International Conference 11–16 July 1993, State University of New York, USA.

Asmat, G.S.M 2002. *Aspideretes nigricans*. In: IUCN 2004. *2004 IUCN Red List of Threatened Species*

Assessment 10

Is the taxon eligible for a Red List assessment? YES

Description published in 1875.

General rationale:

The species is known only from one artificial pond. The species has not been recorded in the wild. Since the IUCN Categories and Criteria should only be applied to "wild populations inside their natural range, and to populations resulting from benign introductions" only, this population cannot be included in an assessment. Since it has not been recorded in the wild, it can be assumed that it no longer exists there. The species is **Extinct in the Wild**.

Conclusion:

The Black Soft-shelled Turtle is **Extinct in the Wild**

EW

Current Red List status: EW (2002)

IF THE ONLY KNOWN LOCATION HAD BEEN IN THE WILD, THEN:

Criterion A: Declining population in the past or future? NO

No data are given for population sizes or declines. Therefore criterion A cannot be used.

Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation? YES

The area of the pond is not given. However, it can probably be assumed that extent of occurrence is <100 km², and area of occupancy is <10 km² (CR B1+2). Only one location is known (CR B1a+2a).

It is stated that there is a reduction in potential nesting ground in the area. This could be interpreted as decline in habitat quality (possibly CR B1b(iii)+2b(iii)).

There is no information on fluctuations.

Therefore, the species could qualify for **Critically Endangered B1ab(iii)+2ab(iii)**.

Criterion C: Small population size and decline? NO

No data are available on population size therefore criterion C cannot be used.

Criterion D: Very small or restricted populations? YES

There are no data on population size, therefore criterion D for CR or EN and criterion D1 for VU cannot be used. BUT, the species is known from only one location and area of occupancy is probably less than 10 km² (VU D2).

The species qualifies for **Vulnerable D2**.

Criterion E: Quantitative analysis? NO

A quantitative analysis has not been carried out.

Conclusion: <u>If the location was in the wild</u>, the Black Soft-shelled Turtle would be at least **Vulnerable D2**, or at most **Critically Endangered B1ab(iii)+2ab(iii)**

Case study 11

Species: ***Diospyros xoloctzii* Madrigal & Rzedowski**
Class: MAGNOLIOPSIDA
Order: EBANALES
Family: EBENACEAE

Distribution:
D. xoloctzii is endemic to La Mintzita, Michoacan de Ocampo, Mexico (see Figure 1 below). It is known only from an area of 25 ha, in a highly fragmented habitat. Despite many surveys since 1998, no other locations have been found.

Population:
In 2005, a census for this species found 36 trees, but in 2006 only 34 individuals remained. One was felled for agricultural activities, and the other was severely damaged by human-caused fire in February 2006 and died in July 2006. The remaining population is fragmented.

Habitat & Ecology:
D. xoloctzii grows in subtropical dry forest and woodland. It is a dioecious plant with a low rate of pollination success (based on the low number of fruits observed). It apparently reaches sexual maturity around 25 years old. There is no trade for this species. But, the fruit is commonly eaten, and the species can be used as an ornamental plant. The plant can also be used in the genetic improvement of other species in the same genus.

Threats:
Agriculture: The species' habitat is severely impacted through agriculture (corn subsistence cultivation), which directly threatens the remaining trees. For example, in 2006, one tree was felled to allow for agricultural expansion. In addition to this, farmers use insecticides (e.g., Malathion), which indirectly affect the tree by removing pollinators. Agricultural fire is a serious threat to the plant: in 2006 one tree was lost to human-caused fire, and more than five adults trees were severely damaged. Clear-cutting in the area is also common practice to control the plants growth and to open new areas for agriculture.

Livestock: The presence of cows and goats in the area threatens the remaining trees. Livestock eat young plants and near-ground level foliage, severely affecting the surrounding habitat and compacting the ground.

Urban development: The human population is increasing in the area, and urban expansion is ongoing. This has several impacts on *D. xoloctzii*, as there is an increase in solid waste, human-caused fire, wood collection, and the introduction of alien species of plants (e.g., Eucalyptus and Casuarina trees) and animals (e.g., cows and goats). The growing human population also brings an increase in water extraction.

Recreation: The area is used for recreation purposes, because there is a small lagoon present there. Many people use the area and often they start fires, leave solid waste behind, and cut many of the plants. The area is not protected and vandalism is frequent, with trees being damaged.

Conservation Actions:
The species is included Mexico's official listing of species at risk (the NOM 059 SEMARNAT 2001), in the category of Special Protection. However, this is not enforced for this species and there is no specific programme for conservation or policy to protect the species. To ensure the future survival of this species, conservation actions should be put in place locally and by the State or Federal government.

Sources:

Carranza González, E. 2000. *Flora del Bajío y Regiones Adyacentes. Fascículos 83*. Instituto de Ecología, A. Centro Regional del Bajío. Pátzcuaro, Mich. México.

Garduño Monroy, V.H. 2004. Contribuciones a la Geología e Impacto Ambiental de la Región de Morelia. *Instituto de Investigaciones Metalúrgicas - UMSNH* Vol. 1:156-166.

Norma Oficial Mexicana NOM 059 SEMARNAT 2001. *Protección Ambiental- Especies nativas de México de la flora y fauna silvestres - Categorías de riesgo y especificaciones para su inclusión, exclusión o cambio- Lista de especies en riesgo*. Diario Oficial de la Federación. 6 de marzo 2002. México. D. F.

Madrigal Sánchez, X. 1997. Ubicación fisiográfica de la vegetación en Michoacán, México. *Rev. Ciencia Nicolaita* No. 15 65:75.

Madrigal Sánchez, X. and Guridi Gómez, L. 2002. Los árboles silvestres del Municipio de Morelia, Michoacán. México. *Rev. Ciencia Nicolaita* No. 33: 29-57.

Madrigal Sánchez, X. and Rzedowski, J. 1988. Una especie nueva de *Diospyros* (Ebenaceae) del municipio de Morelia, estado de Michoacán (México). *Acta Botánica Mexicana* 1: 3-6.

Madrigal Sánchez, X. and trujillo García, M.P. 2001. Algunas consideraciones para la planeación de plantaciones en la cuenca de Cuitzeo, Mich. México. *Rev. Ciencia Nicolaita* No. 27: 45-61.

Villaseñor Gómez, L. 2005. *La biodiversidad en Michoacán. Estudio de Estado*. CONABIO-SUMA-UMSNH, México.

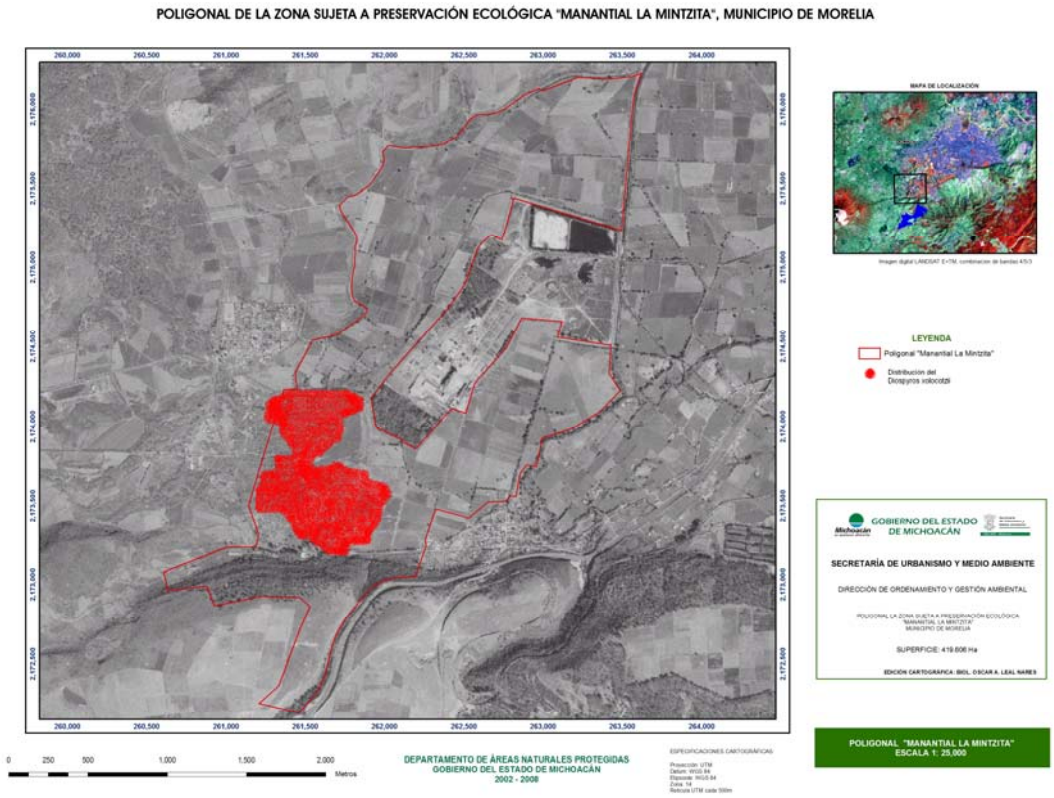


Figure 1. The shaded area indicates the range of *Diospyros xolocotzii*

Assessment 11

Criterion A: Declining population in the past or future?

Although there are clearly declines in the population (past, present and future), however, there is no quantitative information provided to be able to estimate, infer or even suspect what the population reduction could have been or would be in the future. Hence criterion A cannot be applied.

Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?

- With a range of only 25 ha the species qualifies for CR under the thresholds for both extent of occurrence and area of occupancy (CR B1+2).
- Although the habitat is highly fragmented, it is not clear if this constitutes severe fragmentation or not. But perhaps the low rate of pollination indicates that the trees are becoming isolated from each other, in which case they would be severely fragmented. There are a number of threats that would affect the whole area, so it could also be considered a single location (B1a+2a).
- There is clearly a continuing decline in the remaining number of individual trees because of ongoing threats and the habitat is under constant pressure, with intensive agriculture all around (B1b(ii,iii,v)+2b(ii,iii,v).

The plant thus qualifies as **Critically Endangered B1ab(ii,iii,v)+2ab(ii,iii,v)**

Criterion C: Small population size and decline?

- The population of 34 plants is well below the threshold to qualify for CR under criterion C.
- There is continuing decline in mature individuals as discussed under criterion B above, but the rate is hard to estimate (C2).
- There is only a single subpopulation (C2a(ii))

The plant qualifies as **Critically Endangered C2a(ii)**

Criterion D: Very small or restricted populations?

With a population size of 34, it meets the threshold under criterion D.

The plant qualifies as **Critically Endangered D**

Criterion E: Quantitative analysis?

A quantitative analysis has not been carried out.

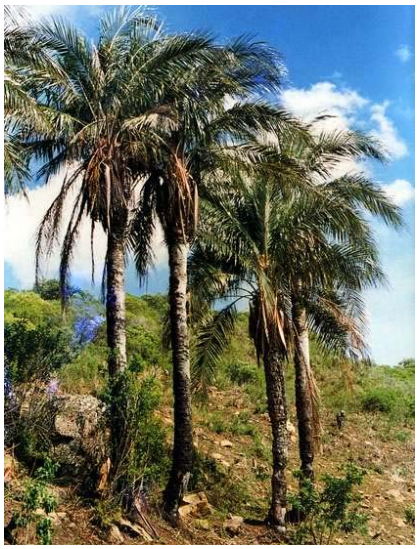
Conclusion:

***Diospyros xoloctzii* is Critically Endangered B1ab(ii,iii,v)+2ab(ii,iii,v); C2a(ii); D**

(Will be in 2007 Red List)

Case study 12

Species: ***Parajubaea sunkha* Moraes**
Common Name: Sunkha Palm
Class: LILIOPSIDA
Order: ARECALES
Family: PALMAE / ARECACAE



Distribution:
Parajubaea sunkha is endemic to only a few inter-Andean valleys in the province of Vallegrande, in the department of Santa Cruz, Bolivia (Vargas 1994). Using Figures 1 and 2 below, the extent of occurrence (EOO) and area of occupancy (AOO) for *P. sunkha* can be determined.

Population:
According to Vargas (1994) (see Figure 3) there are 14 subpopulations, most of which comprise only a few individuals (1 to 100). The only significant subpopulations are to be found in locations numbered 11 (Mataralcito) and 12 (El Palmar) with an estimate of up to 17,000 mature individuals. The degree of fragmentation is high. Approximately half of the subpopulations are fragmented and are thought to be barely viable. Figure 4 shows the population structure at four sites.

Habitat:
P. sunkha is a montane palm species which grows at an altitude of 1,700 to 2,500 m above sea level in subtropical forest, dry forest and even grassy areas. Mean annual precipitation in this region is about 550 mm per year with a marked dry season of five months between June and October; in some years it lasts even longer. In the wet season frosts can occur at night. This makes the palm suitable for cultivation in Mediterranean localities with similar climates (Vargas 1994). Seedlings and young plants prefer shady conditions, but as they grow they out-compete the adjacent vegetation and become a canopy plant in full sunlight. In the dark *Parajubaea* understorey, the humid microclimate and rotten leaves forming a humic topsoil provide ideal conditions for the germination of the palm seeds. After pollination, the fruit ripens for about 20 months. When the fruits fall to ground, the seed is dispersed by rodents that feed on the fruit. It is estimated that rodents do not disperse the seeds further than 100 m from the parent tree. Under natural conditions, the seeds need another 17 months until they germinate (Vargas 1994), but with the help of *in vitro* cultivation the germination time of *P. sunkha* and *P. torallyi* can be brought down to only several weeks (Ibisch 2004).

Threats:
If the palm is left undisturbed it shows abundant natural regeneration, but overgrazing, land clearing, fires and human use of the palm's fibres have a strong impact on the regeneration dynamics of this species (Vargas 1994).

At many sites the palm is a direct competitor to agriculture. The custom of felling the tallest trees when their productivity ceases, clearly shows that a palm will not be preserved unless it provides important socio-economic benefits to the farmers. This means that there is a dilemma between the usefulness and the subsequent overexploitation of the species, and the uselessness and clear cutting of the remaining populations.

A first inventory was carried out in January 2001. The diagrams of the forest inventory (see Figure 4) depict the population structure of four representative palm stands of one hectare in size that belong to four different farmers. The diagrams show that the population structure is skewed: while two to five year old palm plants are very abundant in all subpopulations, the number of 0.5 m tall palm trees is missing in subpopulations P1 and P2 and is underrepresented in populations P3 and P4.

The absence of palms around 0.5 m of height (+/-20 years old) can be traced back to the construction of a road that connects the rural area with the town. Before the road was built, farmers transported the palm fibre to the local market on the backs of donkeys. This limited them in terms of the quantity they could transport which meant that adult palms could produce enough fruit to ensure adequate regeneration. Since the road was built in 1984, it has been possible to harvest and transport much larger quantities of palm fibre. Farmers confirm that after the road was built almost all palms were over-exploited. As a result, regeneration almost came to a halt. This is shown by the absence of the 0.5 m tall palms in subpopulations 1 and 2 (Figure 4).

The subpopulations 3 and 4 belong to farmers that live within about an hours walk from the road. As a result, exploitation in these palm stands was not as intensive and regeneration could occur to some degree. This is testified by the presence of more young palms between 0.5 and 1 m of height compared to subpopulations 1 and 2 (Figure 4).

Utilization

The palm produces a fibre, which grows in its leaf axils and is locally used to make mattresses, ropes and saddle pillows. Apart from subsistence use these products are sporadically sold on local markets.

The leaves are used to manufacture hats, baskets and fans (Vargas 1994). Leaves and fruits serve as fodder for livestock. Furthermore, the species is internationally traded as an ornamental plant.

Sources:

Fundación Amigos de la Naturaleza (FAN-Bolivia). 2003. Perfil de proyecto: Conservación, manejo y commercializavión de la palmera endémica *Parajubaea sunkha* Moraes. Santa Cruz, 04/2003 (unpublished).

Ibisch, P.L. 2004. Degradation and loss of terrestrial biodiversity through direct use. In: P.L. Ibsich and& G. Mérida (eds) *Biodiversity, the richness of Bolivia*, pp: 209- 429. Fundación Amigos de la Naturaleza (FAN) 2004.

Moraes, R.M. 1996. Novelities of the genera *Parajubaea* and *Syagrus* (Palmaea) from inter-Andean valleys of Bolivia. *Novon* 6: 85–92.

Vargas, C.I. 1994. Ecology and uses of *Parajubaea torallyi* in Bolivia. *Principes* 38: 146–152.

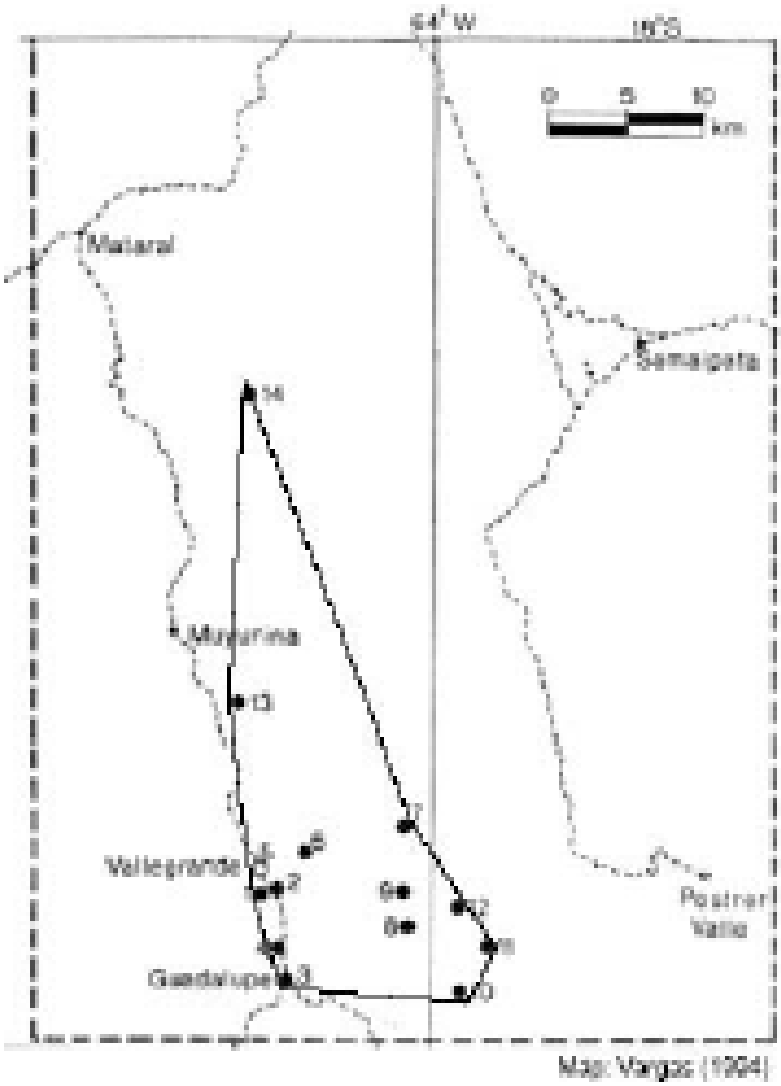


Figure 1. Extent of occurrence for *Parajubaea sunkha*

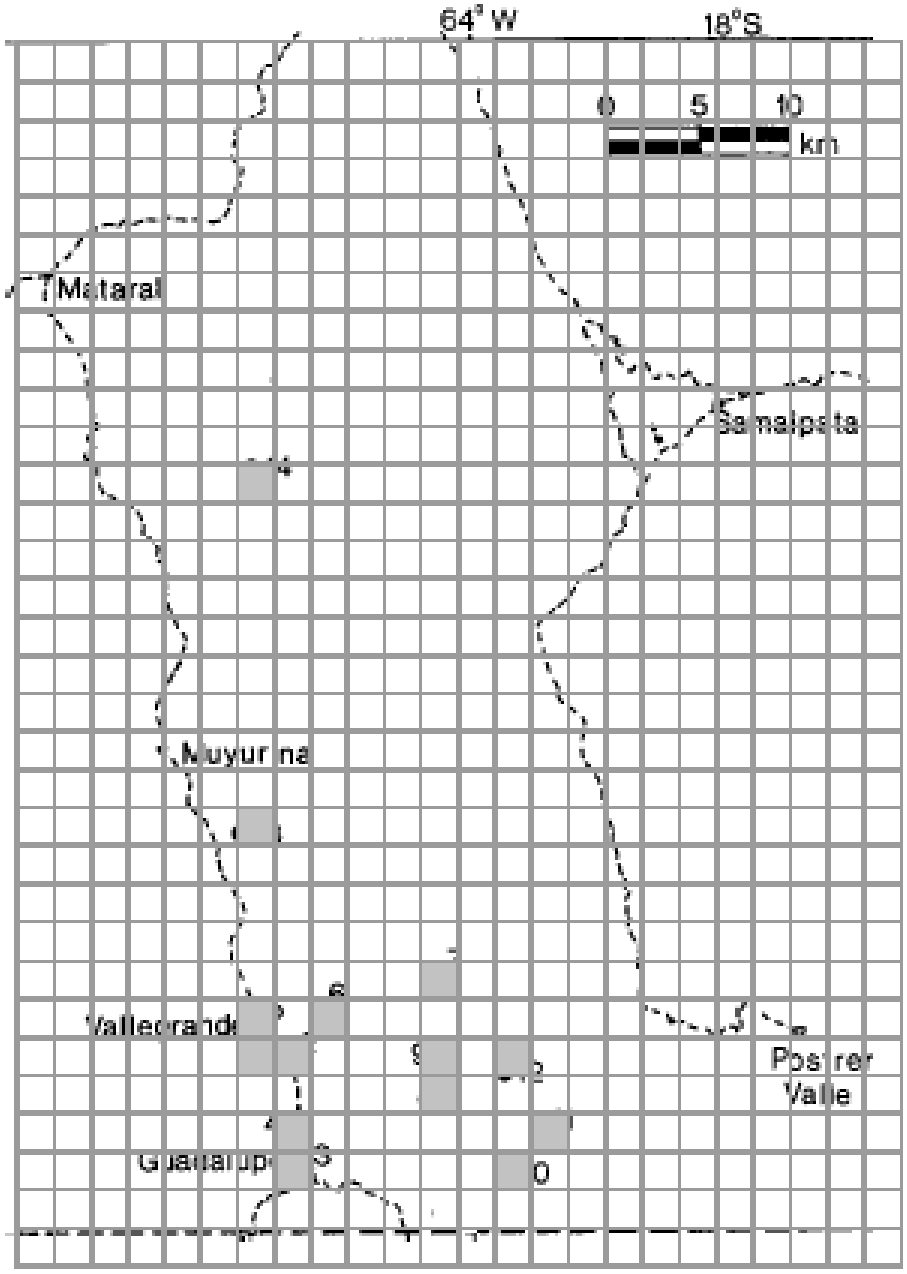
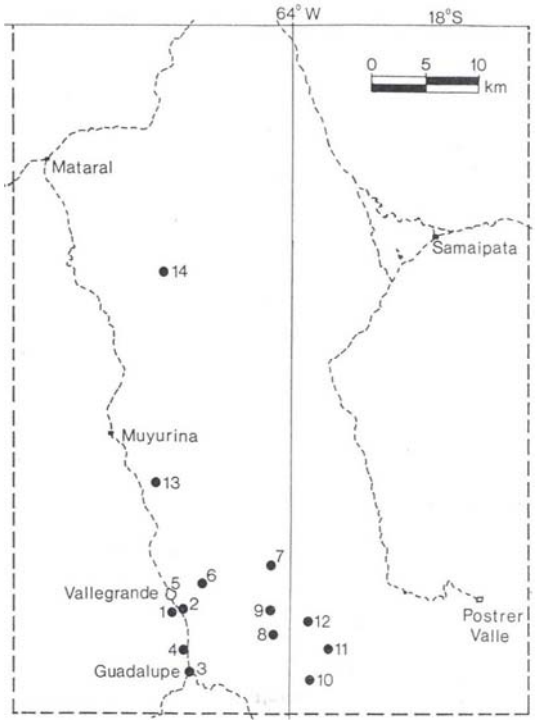


Figure 2. Area of occupancy (AOO) for *Parajubaea sunkha*



1. *Quebrada del Zorro* (3 old individuals)
2. *San Antonio*, on the road from Vallegrande to Guadelupe (3 individuals)
3. *Guadelupe* (3 cultivated individuals)
4. *Quebrada Huasacañada* (2 cultivated trees)
5. *Vallegrande* (single young tree)
6. *Cañada Arteaga*, three km NE to Vallegrande (2 very tall individuals, formerly palm grove)
7. *Río San Blas* (2 tall trees and many small ones, formerly abundant in this area but cut down)
8. *Río San Blas – Río Rodeo* (only small trees in this population)
9. "Nameless" (many trees in the ravines)
10. *Río Piraymirí* (10 young trees in a steep valley)
11. *Mataralcito* (a number of larger trees which are under fibre exploitation)
12. *Alto El Palmar* and *Peñon* (the biggest population of *Parajubaea sunkha*, as well as under exploitation; according to rough estimates (Enssle) approx. 17,000 mature individuals)
13. *Abra Qunia-Quina* (steep canyon with scattered trees with regeneration in association with *Ceroxylon* sp.)
14. *Quebrada La Palma* (several mature individuals)

Figure 3. Location of *Parajubaea sunkha* subpopulations (Vargas 1994)

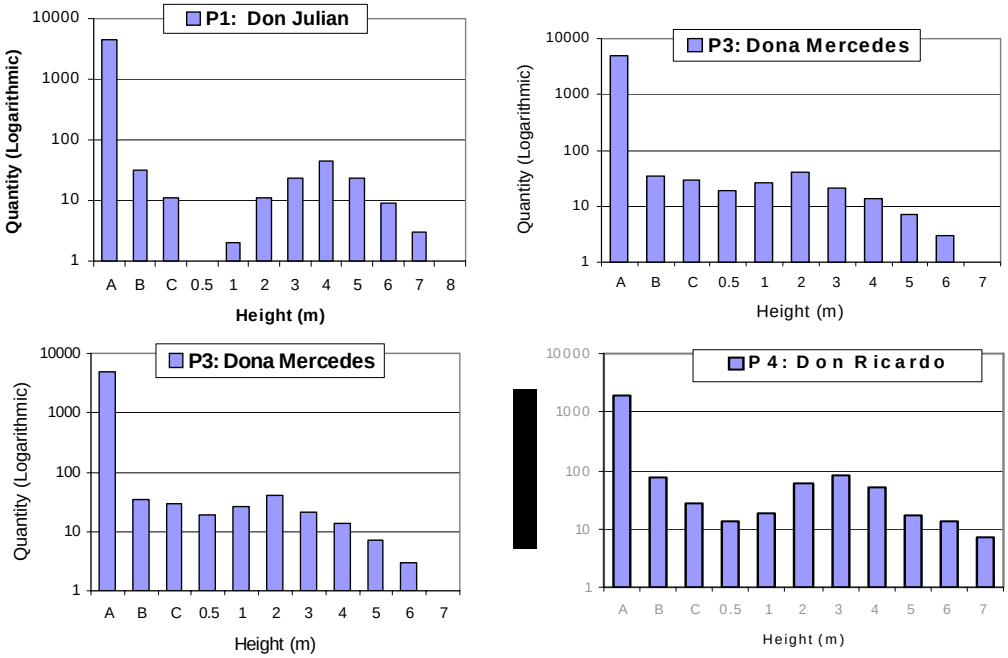


Figure 4. Population structure of four representative palm subpopulations. Where A = 1–2 years (Saplings); B = 3–5 years (Rosettes); C = stem smaller 0.5 m

Assessment 12

Criterion A: Declining population in the past or future?

It is suspected that the taxon might meet the criteria for Endangered under A2acd (population decline of at least 50% over the last three generations and the threats have not ceased) but these criteria cannot be evaluated properly due to the lack of adequate survey data over time.

The future population trend is also unknown and depends on local socio-economic developments. A second inventory is planned for the year 2008 and a reassessment will be carried out then to evaluate whether criterion A4acd applies.

Possibly Endangered A2acd+A4acd.

Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?

P. sunkha has a restricted range; extent of occurrence (EOO) is 288 km^2 (using a rough calculation EOO might be estimated to be 640 km^2 which is still well within the threshold for Endangered); and area of occupancy (AOO) is 56 km^2 (EN B1+2).

More than 50% of its total AOO is in habitat patches that are smaller than would be required to support a viable population, and separated from other habitat patches by a large distance, hence it is severely fragmented (B1a+2a).

Quality of habitat is degrading rapidly due to the many Threats (B1b(iii)+2b(iii)

Extreme fluctuations in the number of mature individuals have been directly observed (measured) and can be traced back to harvest intensities (B1c(iv)+2c(iv).

The species qualifies as **Endangered B1ab(iii)c(iv)+2ab(iii)c(iv)**.

Criterion C: Small population size and decline?

The population size is too large to qualify under any of the criteria C thresholds (>10,000 mature individuals).

Criterion D: Very small or restricted populations?

The population is too large to qualify under the D1 criterion.

The species has a fairly restricted range, but with an AOO of 56 km^2 that is probably too large to qualify the species under Vulnerable D2. Likewise the number of locations is 14, so much greater than the typical five or fewer guideline. With the small AOO and clear threats, Near Threatened could be an option if no other criteria were met.

Criterion E: Quantitative analysis?

A quantitative analysis has not been carried out.

Conclusion:

Parajubaea sunkha **qualifies as Endangered B1ab(iii)c(iv)+2ab(iii)c(iv)**

(In 2006 Red List)