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?	
Criterion A: Declining population in the past or future?	
Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	
Criterion C: Small population size and decline?	
Criterion D: Very small or restricted populations?	
Criterion E: Quantitative analysis?	
Conclusion:	

Case study 4

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

Common Name: Amsterdam Albatross

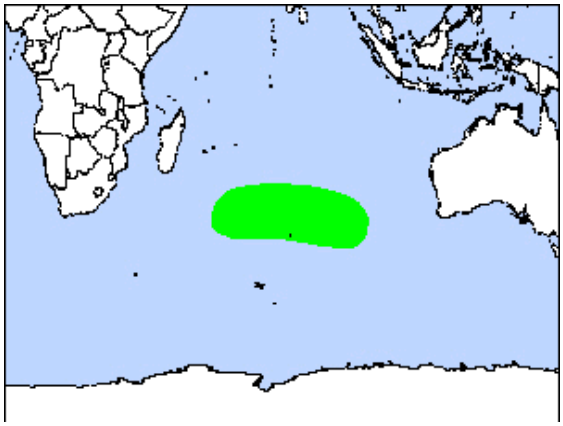
Class: AVES

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**

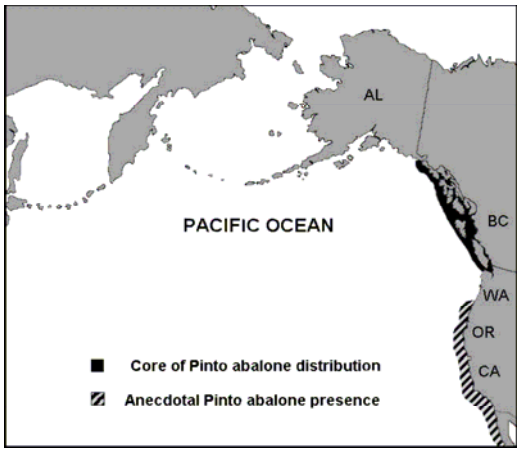
Assessment 4	
Is the taxon eligible for a Red List assessment?	
Criterion A: Declining population in the past or future?	
Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	
Criterion C: Small population size and decline?	
Criterion D: Very small or restricted populations?	
Criterion E: Quantitative analysis?	
Conclusion:	

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?	
Criterion A: Declining population in the past or future?	
Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	
Criterion C: Small population size and decline?	
Criterion D: Very small or restricted populations?	
Criterion E: Quantitative analysis?	
Conclusion:	

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.

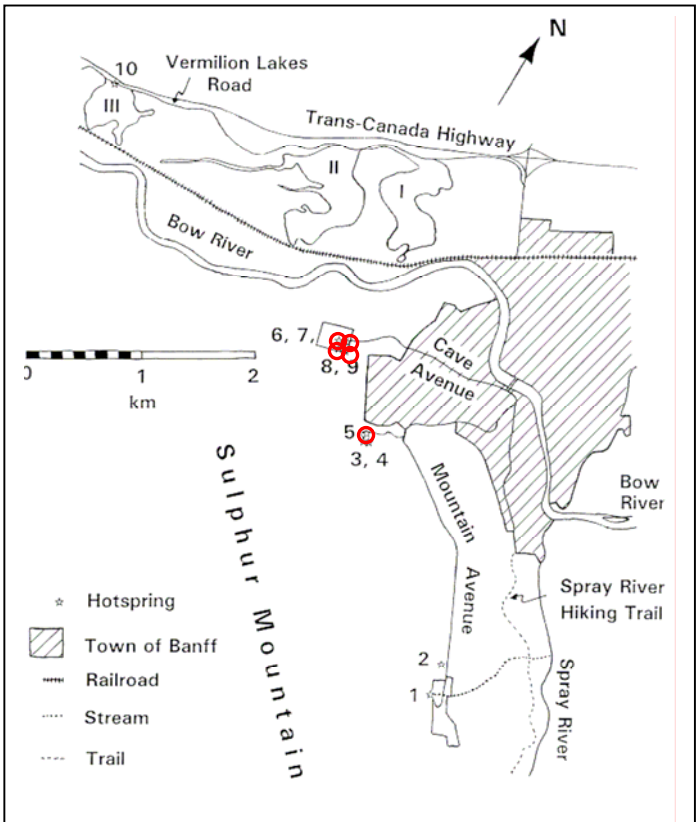


Figure 1: Thermal springs near Banff Townsite, Banff National Park, Alberta. I, II, and III = First, Second, and Third Vermilion Lakes.
1 = Upper Hot Spring; 2 = Kidney Spring; 3 & 4 = Upper Middle Springs; 5 = Lower Middle Spring; 6, 7, 8, 9 = Basin, Cave, Lower Cave & Basin, and Upper C&B Springs of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

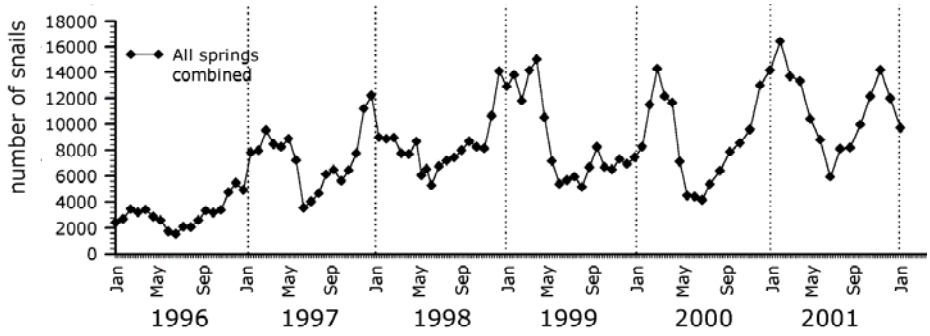


Figure 2: Number of *Physella johnsoni* in all springs combined, Banff National Park, Alberta, January 1996 to January 2002

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?	
Criterion A: Declining population in the past or future?	
Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	
Criterion C: Small population size and decline?	
Criterion D: Very small or restricted populations?	
Criterion E: Quantitative analysis?	
Conclusion:	

Case study 7

Species: ***Epinephelus striatus*** **(Bloch, 1792)**

Common Name: Nassau Grouper

Class: ACTINOPTERYGII

Order: PERCIFORMES

Family: SERRANIDAE

Range:

The Nassau Grouper occurs from Bermuda and Florida, throughout the Bahamas and Caribbean Sea. A second subpopulation has been reported along the coast of Brazil, roughly from Forteleza to Rio de Janeiro. However this may be an error as there do not appear to be any specimens or verifiable photographs of the Nassau grouper from Brazil.

Population:

Time series landings and CPUE data sets show some annual fluctuations and even some large ones, but not order of magnitude fluctuations. Current population size is estimated at more than 10,000 mature individuals.

A population reduction of 60% over the last 30 years is estimated. Ideally, percentage decline would be calculated from estimates of the original Nassau subpopulation within each country for which the decline applies and the overall decline would be the percentage difference between the original global population size and the current one. Unfortunately, estimates of country stock size are rare. Therefore, past declines were weighted by coral reef area (rather than population size) to give an overall decline figure. This method assumes that pristine densities of Nassau grouper were the same at all localities. This is probably not likely to have been the case but it enables a single figure to be derived, which is likely more representative of the global situation than the alternative, which would be to say that the decline lies between 55 and 99.5% (the lowest and highest documented decline rates).

From the available data and most recent reports, current Nassau subpopulations are likely to either be stable (e.g., the U.S.) or in decline (e.g., Cuba, Belize). It seems very likely that overall, the global population of Nassau grouper will continue to decline over the foreseeable future.

Base on genetic studies, there is no evidence of distinct subpopulations of Nassau grouper, therefore it is considered that all individuals occur in only one population and that it is not severely fragmented.

Habitat & Ecology:

The species occurs to at least 130 m depth and is most abundant in clear water with high relief coral reefs or rocky substrate. Post-settlement fish inhabit *Laurencia* macroalgal clumps, seagrass beds and coral. Generation time is estimated at 9 to 10 years.

Threats:

Nassau Grouper are fished commercially and recreationally by handline, longline, fish traps, spear guns and gillnets. Aggregations are mainly exploited by handlines, or by fish traps, although gillnets have recently been used in Mexico. Declines in landings, catch per unit effort (CPUE) and, by implication, abundance have been reported throughout its range and it is now considered to be commercially extinct in a number of areas. The fact that much of the catch in many areas comes from spawning aggregations is also worrying given that targeted aggregations have evidently collapsed in many countries.

Suitable habitat for the Nassau grouper is also likely to be in decline. Of the estimated 20,000 km² of coral reef in the Caribbean, 29% is estimated to be under high risk of degradation from human activities, 32% is at medium risk and 39% is at low risk. Although the Nassau grouper also inhabits rocky reefs, these are unlikely to be able to compensate for the loss of quality coral reef habitat.

Conservation Measures:

There is a complete ban on the fishing of Nassau grouper in the US federal and state waters, including in federal waters around Puerto Rico and the U.S. Virgin Islands. The species is a candidate for the US Endangered Species List.

In Mexico the fishery authority has completely banned fishing Nassau grouper "during spawning aggregations" (December to February).

In the Bahamas, three spawning aggregation sites were protected by law from Dec 1999 to February 2000.

Fishing for the species was also banned throughout the Bahamas from February 2000. As of 2003, there is no enforcement (other than voluntary at one site) of fishery bans on aggregations at any site in the Bahamas.

In Belize, spawning aggregation sites were open to fishing on a rotational basis but in at least one recent case, there was no enforcement of a fishing ban and it was fished. As a result of growing concern, all Nassau grouper aggregations were closed to fishing at the end of 2002 in Belize.

In the Cayman Islands, there are three main grouper 'holes' in the Cayman Islands which only residents are allowed to fish during spawning season. Only line fishing is permitted. Recognizing further declines new legislation is to be introduced in January 2003 to protect Nassau grouper at designated spawning areas.

It is also forbidden to fish for groupers during spawning seasons in the Dominican Republic, there is a moratorium on fishing for Nassau groupers in Bermuda, and a quota system was introduced for the capture of Nassau's in Cuba.

The degree to which the Nassau grouper receives protection through no-take marine protected areas is not known.

Sources:

Cornish, A. & Eklund, A-M. 2003. *Epinephelus striatus*. 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?	
Criterion A: Declining population in the past or future?	
Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	
Criterion C: Small population size and decline?	
Criterion D: Very small or restricted populations?	
Criterion E: Quantitative analysis?	
Conclusion:	

Case study 8

Species: ***Rhinoptera bonasus*** **(Mitchill, 1815)**

Common Name: Cownose Ray

Class: CHONDRICHTHYES

Order: RAJIFORMES

Family: RHINOPTERIDAE

Taxonomy:

This species is sometimes confused with *Rhinoptera brasiliensis*. While Gallo-da-Silva (1997) confirmed the distinction between the two species by providing a comparison of cranial anatomy, others have suspected that these two species are actually the same. This issue clearly requires a continued effort at taxonomic resolution.

Range:

This species is found along continental shelves in warm temperate and tropical waters of the western Atlantic, from southern New England, USA to southern Brazil, including coastal waters of the Gulf of Mexico and parts of the Caribbean (whilst recorded from Cuba, apparently it is not confirmed from Jamaica, Hispaniola or the Lesser Antilles). It is known to frequent bays and estuaries of these areas, and has been reported as especially abundant in the Chesapeake Bay during summer months. The exact southern limit of range in Brazil is uncertain due to confusion with the very similar *R. brasiliensis*.

Population:

There are no existing population size estimates for this species, but they are common in parts of their range at certain times of the year. During suspected seasonal migrations, they often occur in groups of thousands of individuals. The populations in the Western Atlantic (Southern New England to Brazil) and the Gulf of Mexico (Florida to the Yucatan Peninsula) are believed by some to be separate, but there are insufficient existing data to support this idea.

Habitat & Ecology:

These rays occur in marine and brackish waters, often swimming into estuaries and bays. They have been reported in river portions of estuaries, at salinities as low as eight parts per thousand. They are assumed to make mass schooling migrations, triggered at least in part by water temperature. Their primary prey includes benthic invertebrates, especially bivalve molluscs. Feeding activities by schooling rays have been implicated in extensive damage to seagrass and commercial shellfish beds.

R. bonasus are pelagic swimmers, benthic feeders, and are found at depths between 0 to 22 m. Reproduction is aplacental viviparous, with mature females giving birth usually to only one pup (although up to six embryos have been reported). There is confusion as to whether there are one or two annual reproductive events. Generation length is around 9 to 11 years.

Threats:

There is currently no commercial fishery for this species in the Northwestern Atlantic, but there have been suggestions to establish one because of the damage that large feeding schools can do to shellfish and seagrass beds.

In the USA, present commercial fisheries for other species can pose a threat to cownose rays, which are caught as bycatch within pound nets, haul seines and shrimp trawls. This species is quite hardy and is likely to survive netting and short amounts of time on the deck of fishing vessels. However, a venomous spine makes handling difficult and their reputation as a nuisance species may encourage persecution.

Although no information is currently available on its presence or contribution to artisanal fisheries throughout the species' Central and South American range, given its inshore habitat and the occurrence of fishing activities in coastal zones throughout its range it is most certainly commonly taken. In many regions of the species' southern range inshore fishing is intense and generally unregulated. For example, in parts of Brazil there is intensive fishing pressure by beach seine and benthic pair trawl fisheries and in southern Brazil these have had detrimental effects on the population of the congener *R. brasiliensis*, which appears to be been extirpated from some areas.

Its inshore habitat, schooling behaviour and low productivity makes *R. bonasus* highly susceptible to overexploitation. The generally heavy fishing pressure on the inshore environment throughout large parts of Central and South America will most certainly be having an effect on *R. bonasus*.

Conservation Measures:

There is no existing legislation involving this species. Elasmobranch fisheries are generally unmanaged throughout Central and South America. Attempts to monitor and regulate fisheries in these regions would greatly improve conservation of *R. bonasus* and other chondrichthyans. Monitoring (including species-specific catch details) of any directed elasmobranch landings and bycatch in Central and South America are necessary to provide valuable information on the biology and population status of these rays. Fishery-independent surveys of this and other elasmobranchs are necessary to provide estimates of abundance and biomass. Due to the transient nature of this schooling ray, coordinated national and international efforts are necessary to adequately assess movements, abundance, and fishery impacts.

Sources:

Barker, A.S. 2005. *Rhinoptera bonasus*. In: IUCN 2006. *2006 IUCN Red List of Threatened Species.* <www.iucnredlist.org>. Downloaded on **15 June 2007**

Assessment 8	
Is the taxon eligible for a Red List assessment?	
Criterion A: Declining population in the past or future?	
Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	
Criterion C: Small population size and decline?	
Criterion D: Very small or restricted populations?	
Criterion E: Quantitative analysis?	
Conclusion:	

Case study 9

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 9	
Is the taxon eligible for a Red List assessment?	
Criterion A: Declining population in the past or future?	
Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	
Criterion C: Small population size and decline?	
Criterion D: Very small or restricted populations?	
Criterion E: Quantitative analysis?	
Conclusion:	

Case study 10

Species: ***Vanvoorstia bennettiana* (Harv.) Papenf.**

Common Name: Bennett's Seaweed

Class: RHODOPHYCEAE

Order: CERAMIALES

Family: DELESSERIACEAE

Taxonomy:

The genus *Vanvoorstia* contains four species. *V. spectabilis* and *V. coccinea* are common tropical Indo-Pacific species. While some confusion exists as to the exact differences between these two species, both are easily distinguished and considered very different from *V. bennettiana*, a very much smaller- and finer-meshed species in which the tetrasporangial stichidia are also easily defined. A fourth species *V. incipiens* occurs a single bay along the east coast of Zanzibar.

Range:

Bennett's seaweed was first collected in 1855 as a single plant from the east end of Spectacle Island, in the Parramatta River, Port Jackson, Sydney Harbour, NSW, Australia. The second collection was in 1886 by dredging of approximately 15 individual plants from between Shark Island and Point Piper, Port Jackson (8 kilometres east of Spectacle Island).

Population:

There is no information on any current populations. The species was only ever collected from two sites in the world. The site of the type locality is now operated by the Royal Australian Navy as an explosives storage (barge), administrative offices and a mooring site for destroyers and other large Naval vessels. The shoreline has been altered and strengthened and the seabed is regularly dredged to allow ample draught for large ships. This site was surveyed eight times between December 1988 and April 2001 and no specimens were discovered there.

The only other known site has also been surveyed 11 times since December 1988. The seabed in this area now has no solid rocky substrata to which any seaweed could attach, the sediment is approximately 1 m thick and is easily stirred up by divers and passing ferry traffic. The surrounding rocky foreshore of both Point Piper and Shark Island have only small amounts of the kelp *Ecklonia radiata* and the green alga *Caulerpa filiformis* growing on them. Both are known to tolerate heavily disturbed conditions. No specimens of *Vanvoorstia bennettiana* have been rediscovered since 1886.

Within Parramatta River and Port Jackson proper, some 50 dives have been carried out at 12 different sites, all of which have reasonable coverage of a few marine algal species typical of the NSW coastline. Based on knowledge of two other species in the genus *Vanvoorstia*, in addition to known growth strategies and environmental preferences of other genera and species of the red algal family Delesseriaceae, the species should be found in such areas. In 1913, the then Curator of Algae at the Royal Botanic Gardens Sydney, Arthur Lucas, published a paper in which he states "I have never obtained it [*Vanvoorstia bennettiana*] either cast up or by dredging." Lucas was an active collector of algae along the NSW coast up until his death in 1936. The next Curator of Algae was Ms Valerie May who was also an active collector until her retirement in 1988. She was also unable to rediscover this species.

Since 1980, in excess of 540 dives have been logged along the NSW coast as part of a state government research priority to document the entire marine algal flora of the coast. *Vanvoorstia bennettiana* has not been discovered during any of these dives.

Habitat & Ecology:

The species' habitat was unknown when it was collected in 1855 and 1886. The two sites, and much of Sydney Harbour, presently has soft sediment seabed with scattered rocky reef and rocky intertidal shores. Scattered shells and solid waste products (cans, bottles etc.) also lie on the seabed.

Threats:

Sydney Harbour is in the middle of the Sydney, the largest metropolis in Australia with a population of more than four million people. In the 200+ years since settlement, the harbour has been seriously degraded by the population explosion. Use of the harbour as a recreational facility, port, source of food, and sewer has seriously impacted on the native flora and fauna. Even by 1880, the harbour was found to be overfished by a Royal Commission. Large and small scale fisheries (particularly trawling), infrastructure development

(including industry, human settlement, and tourism/recreation), dredging for ship passage, fisheries- related bycatch by netting, and water pollution from agriculture, domestic, commercial/ industrial, oil, sedimentation, and sewage are all thought to have contributed to serious declines of Bennett's seaweed.

The water quality of the harbour has improved since the 1972 passage of the New South Wales Clean Waters Act and the more recent removal of sewage outfalls some kilometers offshore. More fish species have moved to the upper estuarine portions of the Parramatta River and whales have returned to the outer harbour. However, for sessile species of limited distribution like Bennetts seaweed, swimming out of the harbour was not an option.

Sources:

Millar, A.J.K. 2003. *Vanvoorstia bennettiana*. In: IUCN 2006. *2006 IUCN Red List of Threatened Species.* <www.iucnredlist.org>. Downloaded on **15 June 2007**.

Assessment 10	
Is the taxon eligible for a Red List assessment?	
Criterion A: Declining population in the past or future?	
Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	
Criterion C: Small population size and decline?	
Criterion D: Very small or restricted populations?	
Criterion E: Quantitative analysis?	
Conclusion:	

Case study 11

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 11	
Is the taxon eligible for a Red List assessment?	
Criterion A: Declining population in the past or future?	
Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	
Criterion C: Small population size and decline?	
Criterion D: Very small or restricted populations?	
Criterion E: Quantitative analysis?	
Conclusion:	

Case study 12

Species: ***Tubastraea floreana* Wells, 1982**

Common Name: Floreana Coral

Class: ANTHOZOA

Order: SCLERACTINIA

Family: DENDROPHYLLIIDAE

Range:

Tubastraea floreana is a rare endemic species to the Galapagos Islands. The species is presumed to have been widespread and not uncommon prior to 1983 because it was recorded at six sites during a time of very little underwater survey activity. Since then, colonies have disappeared from all six known sites, and despite intensive searches the species is recently only known from two sites. At one of these sites, the species has not been seen since 2001.

Population:

Before 1983 it was Before 1983 it was known from Caleta Iguana, **Isabela**; Buccaneer Cove, **Santiago**; **Cousins** near Santiago; **Pinzón**; Playa Prieta, **Floreana**; and **Gardner Islet** near Floreana. However, after El Niño 1982/83, the species was not reported from any site until the early 1990s, when three colonies were observed at Cousins, near Santiago. These colonies were observed annually until 2001, but have not been seen since. Despite targeted searches throughout the Archipelago, the only colonies found during the past decade were located at Gardner Islet, near Floreana in 2004.

Habitat & Ecology:

Tubastrea floreana occurs in cryptic habitats; on ceilings of caves, ledges and rocks overhangs. It has been reported at depths of 2 to 46 m depth. Generation length is not known but is likely to be more than 10 years.

Threats:

Despite a lack of information on the thermal tolerances of *Tubastrea floreana*, the dramatic reduction in the distribution of the species immediately after the 1982/83 El Niño event suggests that El Niño was the cause of this reduction. Presumably climate change is an additional threat.

Conservation Measures:

The species occurs inside one protected area in the Eastern Tropical Pacific region: Ecuador: Galapagos Marine Reserve (IUCN category VI); Galapagos Archipelago Particularly Sensitive Area (PSSA); Galapagos Island World Heritage Site (UNESCO N (i)(ii)(iii)(iv), and Galapagos Island Man and Biosphere Reserve (UNESCO). It is also included with corals in CITES appendix II.

Sources:

Global Marine Species Assessment (GMSA). 2006. Eastern Tropical Pacific Corals and Macroalgae Assessment Workshop. Galapagos Islands, Ecuador, 27-30 May 2006.

Assessment 12	
Is the taxon eligible for a Red List assessment?	
Criterion A: Declining population in the past or future?	
Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	
Criterion C: Small population size and decline?	
Criterion D: Very small or restricted populations?	
Criterion E: Quantitative analysis?	
Conclusion:	

Case study 13

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 13	
Is the taxon eligible for a Red List assessment?	
Criterion A: Declining population in the past or future?	
Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	
Criterion C: Small population size and decline?	
Criterion D: Very small or restricted populations?	
Criterion E: Quantitative analysis?	
Conclusion:	

Case study 14

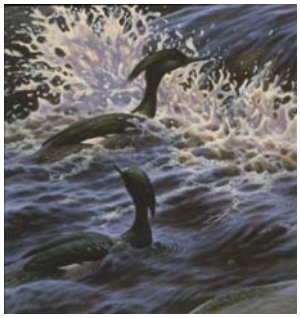
Species: ***Mergus octosetaceus*** **Vieillot, 1817**

Common Name: Brazilian Merganser

Class: AVES

Order: ANSERIFORMES

Family: ANATIDAE



Range:

Mergus octosetaceus occurs in extremely low numbers in a few, highly disjunct localities in south-central Brazil. The strongholds are a recently discovered population on tributaries of the rio São Francisco in west Bahia, and in and (mostly) around Serra da Canastra National Park, Minas Gerais, where there were six pairs in 1996.

In Goiás, there are records from Emas and Chapada dos Veadeiros National Parks. In 1995, a small population was discovered on the rio Tibagi, Paraná, but searches in 1998 were unsuccessful. 2002, another small population was discovered on the rio Novo, in Jalapão State Park, Tocantins. It is believed to be regionally extinct in Mato Grosso do Sul, Rio de Janeiro, São Paulo, and Santa Catarina. Despite extensive surveys, there is only one recent record from Misiones, Argentina (recorded in 2002). In Paraguay, it was last recorded in 1984 and there is little (if any) habitat left. However, local reports indicate that a few individuals may still survive.

Population:

The population is likely to be lower than the 250 birds estimated in 1992. The species has an extent of occurrence of 32,000 km^2, but the area of occupancy is less than 2,000 km^2. The range currently continues to decline.

Only six subpopulations are known with fewer than 50 mature individuals in each. The population decline is estimated at 30 to 50% in the last 10 years, with a predicted decline of 30 to 50% over the next 10 years.

Habitat & Ecology:

The species inhabits shallow, fast-flowing rivers, requiring rapids and clear waters. It occurs especially in the upper tributaries of watersheds, but ranges into small rivers with patches of gallery forest surrounded by campo cerrado vegetation. Pairs have used 8 to 14 km stretches of rivers. It nests in tree-cavities and possibly rock-crevices.

The breeding season is probably June-August, but may vary geographically. The diet comprises fish, small eels, insect larvae, dobson flies (*Corydalis* sp.) and snails. In Serra da Canastra it eats mainly *Astyanax fasciatus*.

Threats:

The species is threatened mainly due to perturbation and pollution of rivers resulting largely from deforestation, agricultural expansion and, in the Serra da Canastra area, diamond-mining. Mining has ceased in the immediate area in Serra da Canastra but there is no habitat available for dispersing birds. Dam building has flooded suitable habitat, especially in Brazil and Paraguay. In Argentina, hunting and collection of exhibition specimens were presumably contributory factors for threat.

Conservation Measures:

The species occurs in three Brazilian national parks. There is a draft species action plan.

Sources:

Birdlife International. 2000. *Threatened Birds of the World*. Lynx Edicions and BirdLife International, Barcelona and Cambridge, UK.
BirdLife International. 2004. Species factsheet: *Mergus octosetaceus*. Downloaded from <http://www.birdlife.org> on 4/22/2005

Assessment 14	
Is the taxon eligible for a Red List assessment?	
Criterion A: Declining population in the past or future?	
Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	
Criterion C: Small population size and decline?	
Criterion D: Very small or restricted populations?	
Criterion E: Quantitative analysis?	
Conclusion:	

Case study 15

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: C*onservation, 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 15	
Is the taxon eligible for a Red List assessment?	
Criterion A: Declining population in the past or future?	
Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	
Criterion C: Small population size and decline?	
Criterion D: Very small or restricted populations?	
Criterion E: Quantitative analysis?	
Conclusion:	

Case study 16

Species: ***Sargassum setifolium* (Grunow) Setchell**

Common Name: String Sargassum

Class: PHAEOPHYCEAE

Order: FUCALES

Family: SARGASSACEAE

Taxonomy:

Taylor (1945) doubted the validity of this species because it is difficult to distinguish from *S. galapagense*. He favoured varietal status: *Sargassum galapagense* var. *setifolia*. However, the species is accepted as valid by current algae taxonomists.

Range:

Sargassum setifolium is endemic to the Galápagos Islands. Prior to 1983, it was reported from **Fernandina** (Punta Espinosa), **Isabela** (Caleta Black and Caleta Tagus), **Floreana** (Champion and Black Beach Anchorage), **San Cristobal** (Wreck Bay), **Santiago** (Bartolome), and **Santa Cruz**. Since 1983, it has been recorded only from drift material collected from Santa Cruz (Tortuga Bay in 1995) and one drift specimen collected from Isabela (Las Marielas in 2001). Currently it is impossible to tell whether these drift specimens are from populations near the collection sites or from further afield.

Population:

Population trend: unknown over the past decade; decline over the past three decades. There is little information on population trends for *S. setifolium*, although in 1975 it was reported as one of the most prevalent brown algae at Punta Espinosa. At present, populations seem to be restricted to the western archipelago. Recent surveys (2000 to 2004) have failed to find populations from San Cristobal, Bartolome, and Santa Cruz. This represents a contraction of available habitat from about 20,000 km² to one small area; estimated to be substantially less than 500 km² in area of occupancy, and less than 5,000 km² in extent of occurrence.

Habitat & Ecology:

The species has been reported from the low intertidal to 7.2 m depth. Nothing is known about generation length.

Threats:

Presumably El Niño and climate change are the main threats to the species. Ecosystem interactions involving these two factors appear to have caused widespread decline in algal populations because of an increase in density of grazing sea urchins and other herbivores, following overexploitation of predators along with El Niño Southern Oscillation (ENSO) disturbances. The locations where this species was previously found in the central archipelago are no longer suitable *Sargassum* habitat as a consequence of herbivore overgrazing.

Conservation Measures:

S. setifolium is present within the Galapagos Marine Reserve (IUCN category VI); Galapagos Archipelago Particularly Sensitive Sea Area (PSSA); Galapagos Island World Heritage Site (UNESCO N (i)(ii)(iii)(iv)), and Galapagos Island Man and Biosphere Reserve (UNESCO).

Sources:

Global Marine Species Assessment (GMSA). 2006. Eastern Tropical Pacific Corals and Macroalgae Assessment Workshop. Galapagos Islands, Ecuador, 27-30 May 2006.

Assessment 16	
Is the taxon eligible for a Red List assessment?	
Criterion A: Declining population in the past or future?	
Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	
Criterion C: Small population size and decline?	
Criterion D: Very small or restricted populations?	
Criterion E: Quantitative analysis?	
Conclusion:	

Case study 17

Species: ***Hippocampus subelongatus* Castelnau, 1873**
Common Name: Tiger Snout Seahorse
Class: ACTINOPTERYGII
Order: GASTEROSTEIFORMES
Family: SYNGNATHIDAE

Range:

H. subelongatus is known from Freemantle, Perth, Swan River, and Houtman Abrolhos Islands in Western Australia.

Population:

There are no data available on size of the global population or population trends. Numbers reportedly declined substantially in the Swan River near Perth, purportedly due to over-collection.

Habitat & Ecology:

This seahorse occurs on the edge of rocky areas, muddy bottoms, and areas of high sediment load; jetty piles and mooring; and it is often associated with sponges or sea squirts or attached to man-made objects. They have been reported to occur at depths of 1 to 25 m and to move to deeper waters in winter.

The species may be particularly susceptible to decline. All seahorses have vital parental care and many species studied to date have high site fidelity, highly structured social behaviour, and relatively sparse distributions. The importance of life history parameters in determining response to exploitation has been demonstrated for a number of species.

Threats:

H. subelongatus is collected for the aquarium trade, but the effects of this collection on the persistence of populations is debated. In addition to exploitation for the aquarium trade, habitat degeneration is a potential threat to the species.

Conservation Measures:

The entire genus of *Hippocampus* is listed in Appendix II of CITES (as from 2004). Management of Australian populations was placed under the Environment Protection and Biodiversity Conservation Act (2001).

Sources:

Lourie, S.A., Foster, S.J., Cooper, E.W.T. and Vincent, A.C.J. 2004. *A Guide to the Identification of Seahorses*. Project Seahorse and TRAFFIC North America. Washington D.C.: University of British Columbia and World Wildlife Fund.

Project Seahorse 2002. *Hippocampus subelongatus*. In: IUCN 2006. *2006 IUCN Red List of Threatened Species.* <www.iucnredlist.org>. Downloaded on **20 June 2007**

Assessment 17	
Is the taxon eligible for a Red List assessment?	
Criterion A: Declining population in the past or future?	
Criterion B: Small distribution, population fragmented or in few locations, and continuing decline or fluctuation?	
Criterion C: Small population size and decline?	
Criterion D: Very small or restricted populations?	
Criterion E: Quantitative analysis?	
Conclusion:	