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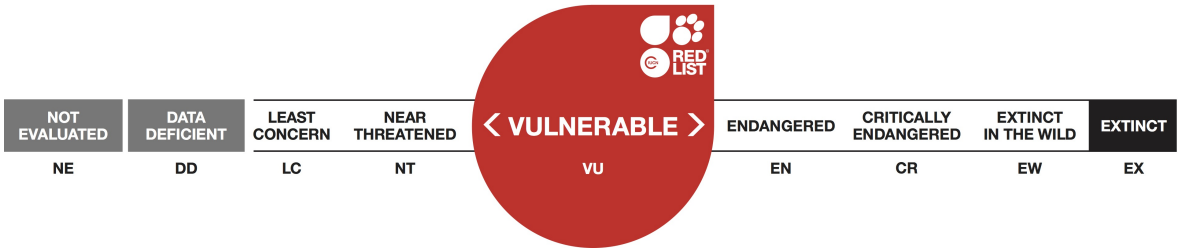
Rhincodon typus, Whale Shark

Assessment by: Norman, B.



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Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Chondrichthyes	Orectolobiformes	Rhincodontidae

Taxon Name: *Rhincodon typus* Smith, 1828

Common Name(s):

- English: Whale Shark
- French: Requin Baleine
- Spanish: Tiburón Ballena

Assessment Information

Red List Category & Criteria: Vulnerable A2bd+3d ver 3.1

Year Published: 2005

Date Assessed: October 1, 2005

Justification:

This assessment is based on the information published in the 2005 shark status survey (Fowler *et al*. 2005).

The Whale Shark (*Rhincodon typus*) is a cosmopolitan tropical and warm temperate species and is the world's largest living chondrichthyan. Its life history is poorly understood, but it is known to be highly fecund and to migrate extremely large distances. Populations appear to have been depleted by harpoon fisheries in Southeast Asia and perhaps incidental capture in other fisheries. High value in international trade, a K-selected life history, highly migratory nature and normally low abundance make this species vulnerable to commercial fishing. Dive tourism involving this species has recently developed in a number of locations around the world, demonstrating that it is far more valuable alive than fished.

Previously Published Red List Assessments

2000 – Vulnerable (VU)

1996 – Data Deficient (DD)

1994 – Indeterminate (I)

1990 – Indeterminate (I)

Geographic Range

Range Description:

Whale Sharks are found in all tropical and warm temperate seas except the Mediterranean (Compagno 1984a, Wolfson 1986, Last and Stevens 1994). Although the range of this species typically lies between latitudes 30°N and 35°S, it has occasionally been sighted at latitudes as high as 41°N and 36.5°S

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(Wolfson 1986). Whale Sharks are known to inhabit both deep and shallow coastal waters and the lagoons of coral atolls and reefs (Demetrios 1979, Wolfson 1983). Iwasaki (1970) reported that they are found in surface seawater temperatures between 18-30°C, but most frequently occur in surface sea-water between 21- 25°C. Archival tags have recorded dives to over 700 m and a water temperature of 7.8°C off the coast of Belize (Graham and Roberts in prep.).

Whale Sharks are found almost all year round off the east coast of Taiwan (Province of China) (Leu *et al.* 1997), Honduras (A. Antoniou pers. comm.) and near the Seychelles (Gudger 1932). Ongoing studies on the population of Whale Sharks around Seychelles inner islands indicate that, although occasional shark sightings are made throughout the year, there are two seasonal peak sighting periods from June to August and October to November (Marine Conservation Society Seychelles, unpubl.). Similar patterns of infrequent year-round sightings and seasonal feeding aggregations of larger numbers (tens, to low hundreds) are recorded from many areas. Aggregations of whale shark occur in Indian coastal waters between December and April (Silas 1986), March-June in Tanzania (Yahya and Jiddawi pers. comm.), in Mozambique and northern KwaZulu-Natal (South Africa) from November to January (Beckley *et al.* 1997), off the coast of Somalia in September, off Chile during October, in the Sea of Cortez around May-June and October-November, in the Gulf of Mexico between August and September (Clark and Nelson 1997), off the coast of Belize in April/May to June (Heyman *et al.* 2001), in the Bohol Sea of the Philippines between April and May (Trono 1996, Alava *et al.* 2002), in the Coral Sea, near the Great Barrier Reef during November and December (McPherson 1990), at Ningaloo Reef in Western Australia in March-May (Norman 1999) and at Christmas Island in the Indian Ocean between November and January. There are also occasional reports from the Florida Keys (E. De Sabata pers. comm.). Although whale sharks have been sighted in numerous other regions, these sightings are generally sporadic and seasonal.

Recent developments in electronic and satellite tagging of Whale Sharks have demonstrated that these animals undertake multi-annual and very long-distance migrations. These include over 2,000 km from north-west Australia towards Asia (pers. obs. 2002), 550 km within a few weeks (Graham and Roberts in prep.), a 2,000 km two month migration from the Mindanao Sea, inner Philippines, to 280 km south of Vietnam (Eckert *et al.* 2002) and a 13,000 km migration in over 37 months from the Gulf of California, Mexico, to near Tonga (Eckert and Stewart 2001). Three sharks tagged in the Seychelles, Indian Ocean, in 2001 travelled west to Zanzibar, north-west to Somalia, and over 5,000 km to the coast of Thailand, respectively (Rowat 2002).

Country Occurrence:

Native: American Samoa (American Samoa); Angola (Angola); Anguilla; Antigua and Barbuda; Argentina; Aruba; Australia; Bahamas; Bahrain; Bangladesh; Barbados; Belize; Benin; Bonaire, Sint Eustatius and Saba (Saba, Sint Eustatius); Brazil; Brunei Darussalam; Cambodia; Cameroon; Cape Verde; Cayman Islands; Chile; China; Colombia; Congo; Congo, The Democratic Republic of the; Cook Islands; Costa Rica; Côte d'Ivoire; Cuba; Curaçao; Djibouti; Dominica; Ecuador; Egypt; El Salvador; Equatorial Guinea; Eritrea; Ethiopia; Fiji; French Guiana; French Polynesia; Gabon; Gambia; Ghana; Grenada; Guadeloupe; Guatemala; Guinea; Guinea-Bissau; Guyana; Haiti; Honduras; India; Indonesia; Iran, Islamic Republic of; Iraq; Israel; Jamaica; Japan; Jordan; Kenya; Kiribati; Liberia; Madagascar; Malaysia; Marshall Islands; Martinique; Mauritania; Mexico; Micronesia, Federated States of ; Montserrat; Morocco; Mozambique; Myanmar; Namibia; Nauru; New Caledonia; New Zealand; Nicaragua; Nigeria; Niue; Oman; Pakistan; Panama; Papua New Guinea; Peru; Philippines; Pitcairn; Portugal; Puerto Rico; Qatar; Saint Kitts and Nevis; Saint Lucia; Saint Martin (French part); Saint Vincent and the Grenadines; Samoa; Sao Tomé and Principe; Saudi Arabia; Senegal; Sierra Leone; Sint Maarten (Dutch part); Solomon Islands; Somalia;

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South Africa; Sudan; Suriname; Taiwan, Province of China; Tanzania, United Republic of; Thailand; Togo; Tokelau; Tonga; Turks and Caicos Islands; Tuvalu; United Arab Emirates; United States (California, Hawaiian Is., Oregon, Washington); Uruguay; Vanuatu; Venezuela, Bolivarian Republic of; Viet Nam; Virgin Islands, British; Virgin Islands, U.S.; Wallis and Futuna; Western Sahara; Yemen

FAO Marine Fishing Areas:

Native: Atlantic - eastern central, Atlantic - southeast, Atlantic - southwest, Atlantic - western central, Indian Ocean - eastern, Indian Ocean - western, Pacific - eastern central, Pacific - northwest, Pacific - southeast, Pacific - southwest, Pacific - western central

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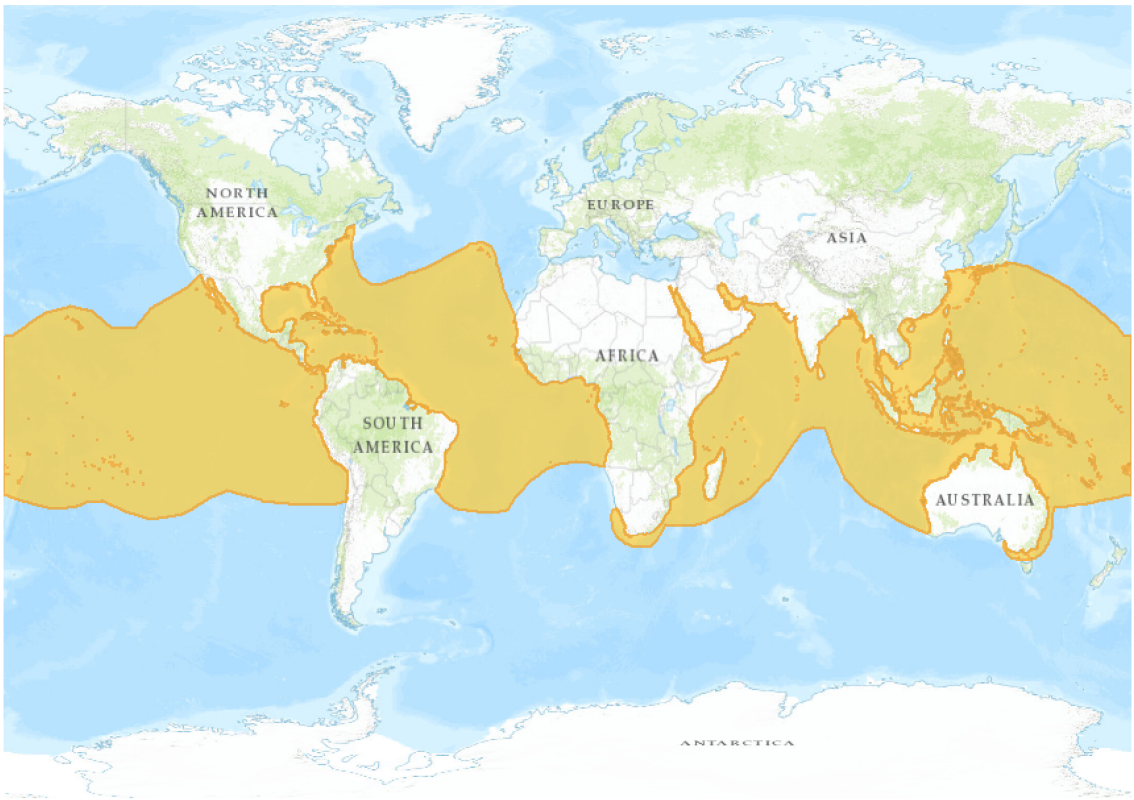
Distribution Map



0 8,000
kilometer

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

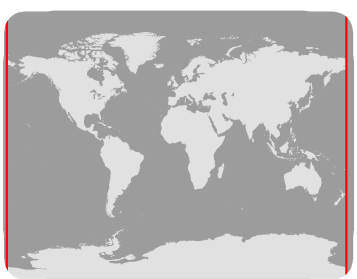
Rhincodon typus

Range

Extant (resident)

Compiled by:
International Union for Conservation of Nature (IUCN)

NE DD LC NT VU VULNERABLE EN CR EW EX



The boundaries and names shown and the designations used on this map do not imply any official endorsement, acceptance or opinion by IUCN.

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Population

Current Population Trend: Decreasing

Habitat and Ecology **(see Appendix for additional information)**

Joung *et al.* (1996) established that whale sharks are ovoviviparous when they reported a female (~10.6 m TL) harpooned off Taiwan (Province of China) containing approximately 300 embryos. These embryos ranged in length from 48-58 cm. One juvenile from this litter, born at 58 cm (TL), attained a length of 143 cm (TL) when raised in an aquarium for 143 days (Leu *et al.* 1997). Sixteen whale sharks measuring 3.1-6.3 m (TL) have previously been held in captivity at the Okinawa Expo Aquarium, Japan (Uchida *et al.* 2000). Growth rates of three sharks held from 458-2,056 days ranged from 21.6-29.5 cm per annum, but may not be comparable to growth rates in the wild. There have been few reports of pregnant females or juvenile whale sharks under 3 m (TL) in the literature (Wolfson 1983). The largest female so far reported is an estimated 20 m, 34 t Whale Shark landed in Taiwan (Province of China) (Chen *et al.* 1997, 2002), although other sources suggest a 15 m maximum total length (TL).

No long-term studies have produced validated growth rates in the wild, age at maturity, or maximum age for this species, although Pauly (2002) has tentatively suggested a slow growth rate and a 5-6% annual mortality rate for adult *R. typus* and estimated longevity as 60 to >100 years, for a total length of 14 m. Wintner's (2000) study of vertebral growth rings recorded three mature males with 20, 24 and 27 growth rings at 903, 922 and 945 cm TL respectively, and an immature female with 22 rings and 577 cm TL (calculated from a precaudal length of 445 cm). The presence of scars and abrasions on the claspers of several sharks over 9 m (TL) at Ningaloo Marine Park (Norman 1999) also suggests that sexual activity, at least in males, is not common prior to attaining this length. Wintner (2000) also found that adding a theoretical data point at 100 years and 14 m TL produced a Bertalanffy growth curve with lower standard errors and Linf closer to the reported maximum length than did 60 years and 14 m TL.

The Fishbase (www.fishbase.org) default life history tool for this species is set at a maximum length of 20 m TL and, strangely, Linf of 14 m TL. This yields an estimated age at maturity of nine years at 560 cm TL, a generation time of 21 years and longevity of 59 years. Most of these parameters are clearly too low. Recalculating these data for Linf 20 m TL yields an age at maturity of 21 years at 770 m TL (still low). Generation time becomes an estimated 63 years and longevity almost 150, which seems too high for a warm water species, although recorded for some species of sturgeon Acipenseridae.

Chang *et al.* (1997) considers that a breeding ground for whale sharks apparently lies close to Taiwan (Province of China). However, the length of gestation, localities of birth, and frequency of reproduction are not yet known for this species and require further study.

Because of their large size, Whale Sharks are probably not subject to extensive predation after reaching maturity. There are only two reports of juvenile whale sharks taken by another animal: a Blue Marlin (A. Goorah pers. comm.) and a Blue Shark (Kukuyev 1996). Several Whale Sharks from Ningaloo Reef possess scars that may be the result of shark attack at an early age (Norman 1999) and two orcas *Orcinus orca* have been filmed attacking, killing and consuming an 8m whale shark (O'Sullivan and Mitchell 2000).

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The Whale Shark is one of only three species of shark that filter feeds, the other two being the Megamouth (*Megachasma pelagios*) and Basking Shark (*Cetorhinus maximus*) (Compagno 1984a). Unlike these two, the Whale Shark does not rely on forward motion for filtration, but is able to hang vertically in the water and suction feed by closing its gill slits and opening its mouth (Compagno 1984a). *Rhincodon typus* is believed to be able to sieve zooplankton as small as 1 mm in diameter through the fine mesh of their gill-rakers (Taylor 1994), typically feeding on a variety of planktonic and nektonic prey, small crustaceans and schooling fishes and even occasionally ingesting small tuna and squid (Last and Stevens 1994, Clark and Nelson 1997, Norman 1999).

Systems: Marine

Threats (see Appendix for additional information)

Small-scale harpoon and entanglement fisheries have taken place in various regions of the world, including India (whale shark fishing banned in 2001), Pakistan, Taiwan (Province of China), the Philippines (banned in 1998) and the Maldives (prior to protection in 1995). These took Whale Sharks primarily for their meat, liver oil, and/or fins (Compagno 1984a, Ramachandran and Sankar 1990, Trono 1996, Hanfee 2001, Alava *et al.* 2002). Liver oil was traditionally used for water-proofing boat hulls. The huge fins are low quality but of high value as restaurant "signboards" in east Asia, and the soft meat (known as "tofu shark") is in great demand in Taiwan (Province of China).

Fishermen in the Maldives used to take 20-30 Whale Sharks per year for their oil, but reported declining catches during the 1980s to early 1990s (Fowler 2000). In a study in the Philippines, it was found that in 1997 there was a 29% decline in the whale shark catch at two of the primary sites, despite an increase in effort due to rising prices for exported products (Alava *et al.* 2002). The increased fishing effort and falling catches led to the 1998 fishery ban, although illegal fishing and attempted export of meat still continues on a small scale, with shipments having been impounded by customs authorities (Anon 2002b).

In Pakistan, the flesh was traditionally eaten either fresh or salted, and liver oil used for treating boats (Compagno 1984a). The number of sharks taken each year was small and often accidental bycatch (Silas 1986, Seshagiri Rao 1992). Recent landings are unknown.

A traditional small-scale seasonal harpoon fishery in India took whale sharks for their liver oil (Prater 1941, Rao 1986, Silas 1986, Vivekanandan and Zala 1994). About 40 were harpooned during April 1982 (Silas 1986), but demand for "tofu shark" meat in Taiwan (Province of China) led to increased fishing effort in Gujarat during the 1990s (Hanfee 2001). Prices rose significantly after 1997, with 279 Whale Sharks taken in January-May 1999. One hundred and forty-five sharks were taken offshore (10-15 km) in December 1999, and 160 in coastal waters in January-May 2000. The fishery closed in May 2001, when the Indian Ministry of Environment and Forests legally protected whale sharks in territorial waters.

Whale Sharks have been targeted for many decades in Taiwan (Province of China), but catches appear to have declined since the 1980s (Chen *et al.* 1996, Joung *et al.* 1996). Billfish harpooners from Hengchun Harbour, fishing south of Penghu, reportedly landed 50-60 Whale Sharks each spring in the mid-1980s, but annual landings at this location subsequently declined to about 10 sharks, and fewer still in 1994 and 1995. In 1995, landings throughout Taiwan (Province of China) were approximately 250-272, around 158 taken as bycatch in set nets, 114 by harpoon (Chen *et al.* 1996). The government introduced a

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Whale Shark reporting system in 2001. This and other sources indicate that the total number of Whale Sharks caught during 2001 was 89 (38 by set nets, 36 in the billfish harpoon fishery and 15 by other methods), and that 94 sharks weighing about 104 t in total were landed during the 12 months from March 2001 to March 2002 (Anon 2002b, Chen and Phipps 2002). The domestic catch has apparently declined by 60-70% since surveyed by Chen *et al.* (1996). Chen and Phipps (2002) note that the sum of the reported catch and imports is smaller than the quantity of Whale Shark meat on the domestic market, indicating that official data under-represent imports.

Wholesale Whale Shark meat prices in Chinese Taipei peaked at US$7.00/kg in the late 1990s (Liu *et al.* 2002) when a 10 t shark was worth approximately US$70,000, subsequently falling to US$2.00/kg in 2001 (Chen and Phipps 2002).

Although Ramachandran and Sankar (1990) considered that *R. typus* was an underexploited species, there are now concerns that Whale Shark populations are decreasing in many locations as a result of stock depletion by unregulated fisheries (Anon 2002b). Ecotourism industries based on viewing Whale Sharks are now developing in several locations, including Mexico, Australia, Philippines, south-eastern Africa, Seychelles, Maldives, Belize and Honduras (Norman 1999, Anon 2002b, Newman *et al.* 2002). The number of people swimming with Whale Sharks at Ningaloo Reef, Western Australia, during the short whale shark season from March to June, increased from 1,000 in 1993 to almost 5,000 in 2002 (Colman pers. obs. 1997). This well-managed industry contributes significantly to the national and regional economy (overseas participants make up 65-75% of participating tourists).

Ecotourism has taken over from hunting as a significant source of income for Maldivian operators, since the small fishery that once existed ceased after legislation was introduced in 1995 to protect whale sharks (C. Anderson pers. comm.). Similarly, the development of an important whale shark ecotourism industry in areas of the Philippines that experience large seasonal aggregations of whale sharks is now underway (Anon 2002b).

In the Seychelles, 162 tourists/week interacted with *R. typus* in November 1996 and the industry could be worth US$3-5 million annually there (Newman *et al.* 2002). Revenues are also significant in several other range states, indeed rather higher than revenues from fisheries for this species (Anon 2002b). To ensure that high levels of tourism do not have an adverse effect on the behaviour of Whale Sharks at these locations and other aggregation sites identified in future, monitoring must continue as a priority.

In Tanzania Whale Shark sightings are apparently on the increase. Surprisingly, fishermen do not actively hunt whale sharks and do not consume the meat; nor do they recognise that the fins may have any value. Four individuals caught in March 2001 were not consumed nor were their fins sold. A very small amount of meat was taken, possibly for medicinal purposes (S. Yahya and N. Jiddawi pers. comm.). They are avoided by net fishermen because of potential damage to the nets. Whale sharks have been sighted for the last few years during the inter-monsoonal period of March-June off Zanzibar. They are caught in purse, drift and gillnet fisheries.

Conservation Actions **(see Appendix for additional information)**

Whale Sharks are legally protected in Australian Commonwealth waters and the states of Queensland, Tasmania and Western Australia (regulations control human interactions in the latter state), the Maldives, Philippines, India, Thailand, Malaysia, Honduras, Mexico, US Atlantic waters and a small area

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off Belize (Fowler 2000, Anon. 2002b). Full legal protection is under consideration in South Africa and Taiwan (POC) has recently introduced an annual quota for its fishery. In 1999 the whale shark was listed on Appendix II of the Bonn Convention for the Conservation of Migratory Species of Wild Animals (CMS). This identifies it as a species whose conservation status would benefit from the implementation of international cooperative Agreements (Fowler 2000). A US proposal to add the Whale Shark to Appendix II of the Convention on International Trade in Endangered Species (CITES) was rejected by the 11th Conference of Parties in 2000, but a revised proposal, submitted by Philippines and India, was accepted by the 12th Conference in 2002 and came into force at the end February 2003. This requires fishing states to demonstrate that any exports were derived from a sustainably managed population and to enable exports and imports to be monitored.

Credits

Assessor(s): Norman, B.

Reviewer(s): Musick, J.A. & Fowler, S.L. (Shark Red List Authority)

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Disclaimer

External Resources

For Images and External Links to Additional Information, please see the Red List website.

Appendix

Habitats
(http://www.iucnredlist.org/technical-documents/classification-schemes)

Habitat	Season	Suitability	Major Importance?
9. Marine Neritic -> 9.1. Marine Neritic - Pelagic	-	Suitable	-
9. Marine Neritic -> 9.8. Marine Neritic - Coral Reef -> 9.8.4. Lagoon	-	Suitable	-

Use and Trade
(http://www.iucnredlist.org/technical-documents/classification-schemes)

End Use	Local	National	International
Food - human	Yes	Yes	No
Medicine - human & veterinary	Yes	No	No
Manufacturing chemicals	Yes	No	No

Threats
(http://www.iucnredlist.org/technical-documents/classification-schemes)

Threat	Timing	Scope	Severity	Impact Score
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.1. Intentional use: (subsistence/small scale)	Ongoing	-	-	-
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.3. Unintentional effects: (subsistence/small scale)	Ongoing	-	-	-
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.4. Unintentional effects: (large scale)	Ongoing	-	-	-
6. Human intrusions & disturbance -> 6.1. Recreational activities	Ongoing	-	-	-
	Stresses:	2. Species Stresses -> 2.2. Species disturbance		

Conservation Actions in Place
(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Actions in Place
In-Place Education

http://dx.doi.org/10.2305/IUCN.UK.2005.RLTS.T19488A8913502.en

Conservation Actions in Place
Included in international legislation: Yes
Subject to any international management/trade controls: Yes

Additional Data Fields

Distribution
Lower depth limit (m): 700
Upper depth limit (m): 0
Population
Population severely fragmented: No

http://dx.doi.org/10.2305/IUCN.UK.2005.RLTS.T19488A8913502.en

The IUCN Red List Partnership

The IUCN Red List of Threatened Species™ is produced and managed by the IUCN Global Species Programme, the IUCN Species Survival Commission (SSC) and The IUCN Red List Partnership. The IUCN Red List Partners are: BirdLife International; Botanic Gardens Conservation International; Conservation International; Microsoft; NatureServe; Royal Botanic Gardens, Kew; Sapienza University of Rome; Texas A&M University; Wildscreen; and Zoological Society of London.