



Photo credit: © John E. Randall.

### KEY INFORMATION

#### Areas of Concern

Indo-Pacific region, from the Red Sea to the Tuamotu Archipelago, north to the Ryukyu Islands (Japan), including China and Chinese Taipei, south to New Caledonia, throughout Micronesia; includes the U.S. territories of Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, Howland, Baker, Jarvis and Kingman Islands, and Wake and Palmyra Atoll (Figure 1).

**Year Identified as “Species of Concern”**  
2004

#### Factors for Decline

- Fishing
- Night spearfishing
- Lack of coordinated international management
- Illegal, unregulated, unreported fishing
- Habitat loss

#### Conservation Designations

IUCN: Endangered  
CITES: Appendix II

#### Brief Species Description:

The humphead wrasse is the largest living member of the family Labridae, with a maximum size reportedly exceeding 6 feet (2 m) and 420 lbs (190 kg) (Sadovy et al. 2003a). Humphead wrasses are slow growing as adults and are long-lived with delayed reproduction. Small juveniles are black and white and larger juveniles become pale greenish with a vertically elongate black spot on each scale tending to form bars; two black lines extend posteriorly from each eye in all color phases, clearly distinguishing this species; dorsal profile of head in juveniles is straight to level of eye. Adults are olive green to blue-green with a spindle-shaped dark bar on each scale; the slightly oblique black lines extend posteriorly from the lower half of the eye, often with two more from eye to rear part of upper lip; adults develop a prominent hump on the forehead and thick lips. Males may attain 6 feet (2 m) in length, although females rarely exceed about 3 feet (1 m) (Choat et al. 2006). Individuals become sexually mature at 5 to 7 years, with lifespans estimated at 25 years for males and 30 years for females (Choat et al. 2006, Andrews et al. 2015). Its generation time is estimated to range from 4.5 to 14 years, and the rate of intrinsic population increase or growth rate (0.72) is on the higher end of the productivity scale compared to other finfish (Fishbase.org). The species is a protogynous hermaphrodite (with female-to-male sex change) around 9 years of age (Choat et al. 2006, Sadovy de Mitcheson et al. 2010), which may make it more vulnerable to overharvest than species that do not change sex. The species is a diurnal carnivore (eats during the day and sleeps at night) and primarily eats mollusks, fishes, sea urchins, crustaceans, and other invertebrates and are one of the few predators of toxic animals such as sea hares, boxfishes, and crown-of-thorns starfish (Myers 1991).

*Cheilinus undulatus* is extremely patchily distributed with adults inhabiting steep outer reef slopes, channel slopes, and lagoon reefs in water 3 to 330 feet (1-100 m) deep. Adults appear to be sedentary over a given patch of reef according to multiple accounts by divers that return repeatedly to the same spots and report seeing the same individuals. This species actively selects inshore habitats with abundant branching coral mixed with macroalgae and seagrasses as a nursery at settlement.



# Species of Concern

NOAA National Marine Fisheries Service

Juveniles tend to prefer a more cryptic existence in areas of dense branching corals, mangroves, bushy macroalgae or seagrasses. When seagrass beds are present, densities of juvenile humphead wrasse are significantly higher on coral reefs than in areas without nearby seagrass beds (Dorenbosch et al. 2006). Adults are found in more open habitat on the edges of reefs, channels, and reef passes (Donaldson and Sadovy 2001, Tupper 2007). Humphead wrasses occupy a greater home range than other coral reef teleost fishes from a wide variety of families, ranging from 0.4 km to 14 km, with females occupying the largest range (Weng et al. 2015). Overall, humphead wrasse density is strongly correlated with the percentage of hard bottom or coral cover, while fish size is inversely proportional to coral cover (i.e., the smallest fishes were abundant in areas with high live coral) (Sadovy et al. 2003a). The species is most often observed in solitary male-female pairs, or groups of two to seven individuals (Donaldson 1995, Sadovy et al. 2003a).

Humphead Wrasse SOC Range

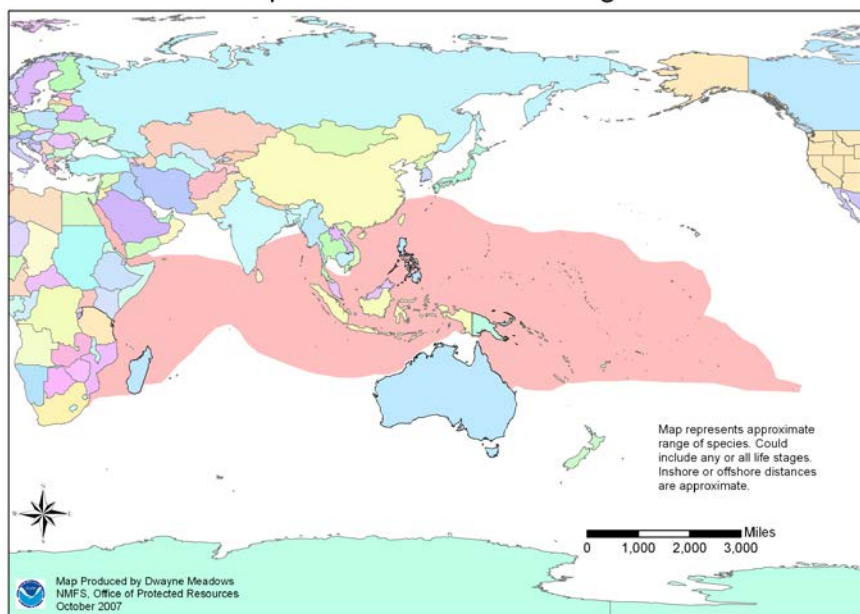


Figure 1: Range of the humphead wrasse. Hoover (1993) reported a specimen found in a Honolulu, Hawaii fish market in 1967. Two additional sightings in Hawaii have been reliably reported (Randall 2007). These are probably strays.

Accounts of reproduction reveal that, depending on location, this species spawns between several and all months of the year, in small (<10 individuals) or large (>100 individuals) groups (Russell 2004). Spawning coincides with certain phases of the tidal cycle, and groups of spawning fish can form daily, at a range of different reef types. Spawning areas and aggregated adults have been noted regularly along specific sections of reef, sometimes associated with no obvious topographical features, sometimes close to the shelf edge on outer reefs, or adjacent to exposed reef passes near fairly steep drop-offs, or on mid-shelf reefs. The species can spawn daily at a local spawning site(s) (i.e., a 'resident' spawner (Domeier and Colin 1997)), or migrate many miles to aggregate at reproductive sites (Pet and Pet-Soede 1999). Probable spawning aggregations have been noted on Australia's Great Barrier Reef, Fiji, New Caledonia, Palau, Wake Atoll, and in the Solomon Islands (Russell 2004). In Palau, more than 50 resident aggregations of *C. undulatus* were anticipated to exist along the outer barrier reef, with groups of up to 150 individuals (10-15 males/100 plus females) observed along the reef slope in a loose aggregation (Colin 2010).



## Species of Concern

NOAA National Marine Fisheries Service

### Rationale for “Species of Concern” Listing:

#### ***Demographic and Genetic Diversity Concerns:***

The species is believed to be naturally uncommon to rare wherever it occurs, and densities are evidently never high even in preferred habitats. Survey results throughout the species’ range in preferred habitats have shown adult densities of humphead wrasse in unfished or lightly fished areas at 2 to 27 individuals per 10,000 m<sup>2</sup> of reef (Sadovy et al. 2003) or 1 to 8 per acre (Donaldson and Sadovy 2001). Once an economically important species in Guam, it is now rarely seen on reefs there, and is infrequently reported on inshore survey catch results. In Wake Atoll, where fishing is prohibited, the species is considered “abundant” between 15 and 100 feet (5 to 30 m) depth. A survey of the area estimated at least 13-27 large fish per 10,000 m<sup>2</sup> in a high visibility area, while juveniles (<30 cm TL) were abundant everywhere (Lobel and Lobel 2000).

Surveys conducted biennially from 2002-2012 on extensive research cruises by the NOAA Pacific Islands Fisheries Science Center’s Coral Reef Ecosystem Division (CRED) found humphead wrasse to be present, but uncommon, around all islands of American Samoa (Swains Island, Rose Atoll, Tutuila, Ofu-Olosega, and Tau), and large individuals to be rare. The species was also observed to be uncommon to rare on analogous CRED surveys conducted during these same years at Howland and Baker Islands, in the U.S. Phoenix Islands, and at Jarvis Island, Palmyra Atoll, and Kingman Reef, in the U.S. Line Islands (unpublished data, PIFSC-CRED). CRED surveys also found the humphead wrasse to be similarly uncommon-rare in the Marianas Archipelago, while relatively most common at Wake Atoll. Graham et al. (2014) also discuss abundance and status data from non-U.S. parts of the species’ range.

#### ***Factors for Decline:***

Threats include: 1) intensive and species-specific removal for the live reef food fish trade (LRFFT) where it is considered a delicacy and fetches a high price; 2) spearfishing at night with SCUBA gear; 3) destructive fishing techniques, including sodium cyanide and dynamite; 4) habitat loss and degradation; 5) removal of juveniles from the wild and raised or “cultured” in floating net cages until saleable size for the LRFFT; 6) lack of coordinated, consistent national and regional management; and 7) illegal, unregulated, or unreported (IUU) fisheries.

The most serious threat to this species is overharvest for the commercial LRFFT. Targeted and opportunistic artisanal/subsistence fishing does occur in certain areas throughout its range, but this threat has decreased significantly in recent years due to regulations. This species is long-lived, and since it is a protogynous hermaphrodite it is particularly vulnerable to fishing pressure (Sadovy et al. 2003a). Moreover, being one of the largest of all reef fishes, they have few natural predators, which means that fishing mortality may rapidly exceed natural mortality, possibly accounting for the rapid declines noted once fishing intensifies.

The species’ essential coral reef habitat is threatened by human activity throughout the Indo-Pacific region and coral bleaching, sedimentation, and other disturbances are degrading juvenile habitat. Destructive fishing practices, such as sodium cyanide use, which stuns animals for capture and incidentally kills living coral, is still a major fishing method in Southeast Asia (primarily in the Philippines and secondarily in Indonesia), but is presently much less of a concern throughout the rest



## Species of Concern

### NOAA National Marine Fisheries Service

of the Indo-Pacific region (Sadovy de Mitcheson and Yin 2015). Other than for the LRFFT, there are few “directed” fisheries for the humphead wrasse due to its natural rarity and the inherent difficulty of capturing the fish (Gillett 2010) by any means other than by nighttime capture.

Humphead wrasse are cultured or “farmed” to supply the demand for the species in the LRFFT. However, culture techniques currently used may actually pose a threat to wild populations in certain circumstances. Typically, juveniles are taken from the wild and raised in floating net cages until reaching saleable size. This activity is commonly referred to as ‘culture’, or ‘cultivation’, but is essentially a capture fishery of juveniles and their maintenance in captivity to legal or marketable size (Sadovy et al. 2003). The impact on the age structure and reproductive potential of wild populations depends on the size of fish taken and their likelihood of reaching adulthood and reproduction (Sadovy and Pet 1998). Early life history mortality is unknown for this species, and thus surplus production at small size classes cannot be determined. The controlling factors in their sequential sex change are not well understood, but selective removal of particular size classes of fish could significantly impact a population’s reproductive potential through excessive targeting of males (large fish), or juveniles likely to survive to adulthood. Although there are two established mariculture facilities in Indonesia, neither has reportedly been successful in culturing and rearing humphead wrasse to adult size (Sadovy 2006).

#### **Status Reviews/Research Underway:**

In August 2006, the National Marine Fisheries Service (NMFS) Pacific Islands Regional Office (PIRO) Protected Resources Division held its first Species of Concern workshop in Honolulu, Hawaii, for species in the Pacific Islands Region. The purpose of the workshop was to have experts share their knowledge and research in order to compile updated information on the species, their habitat, threats, research, and conservation ideas. After the open discussion on the species, threats were prioritized, recovery actions/conservation efforts addressing each threat were identified, and data and research needs for each species were identified. These efforts contributed to the development of a NMFS PIRO conservation action plan for the species. This conservation action plan is a living document that will aid NMFS PIRO to identify, prioritize, and fund conservation and research projects in the U.S. for each Pacific Islands Region Species of Concern over the coming years.

From 2008-2010, the Commonwealth of the Northern Mariana Islands (CNMI) Coastal Resources Management Office (CRMO) undertook an assessment of status and habitat specificity for the species in the southern islands of the CNMI (CRMO 2011).

In 2012 we were petitioned by WildEarth Guardians to list the species under the Endangered Species Act (ESA). We completed a comprehensive [status review](#) (Graham et al. 2014) and determined that the humphead wrasse did not meet the definition of a threatened or endangered species, and thus did not warrant ESA listing in 2014 ([79 Federal Register 57875](#); September 26, 2014).

#### **Data Deficiencies:**

Needs include: 1) continue to survey in all areas of occurrence; 2) identify individual populations using DNA sampling; 3) characterize and determine locations of spawning aggregations and their usage patterns; 4) continue to collect creel, artisanal, and commercial fisheries data throughout the U.S.





## Species of Concern

NOAA National Marine Fisheries Service

range; 5) determine if this species makes sound; and 6) if it makes sound, understand when and why the sound is made and use acoustic monitoring to assess population parameters such as presence/absence, spatial distribution, and temporal patterns of occurrence.

### Existing Protections and Conservation Actions:

The humphead wrasse is listed as Management Unit Species (MUS) (Currently Harvested Coral Reef Taxa) in the Coral Reef Ecosystems Fishery Management Plan of the Western Pacific Regional Fishery Management Council. MUSs are those species that are managed under a Fishery Management Plan or a Fishery Ecosystem Plan. In fisheries management, MUS typically include those species that are caught in quantities sufficient to warrant management or specific monitoring. In the U.S. Pacific Islands region where the humphead wrasse is found, federal annual catch limits are set at 5% of the total estimated stock biomass of each island area.



Photo Credits: Wikipedia Commons (top), Jim Maragos USFWS (below)

In the U.S. Pacific Islands region, American Samoa banned the use of spearfishing with SCUBA gear in 2001 after declines in grouper and wrasse populations coincided with the advent of commercial harvest in 1994. They also strictly prohibit any interaction with the species (i.e., possess, sell, kill). While the CNMI and Guam have not enacted a complete moratorium on fishing for the species similar to American Samoa, they have implemented gear and use restrictions that significantly limit capture and prohibit fishing with non-selective and destructive gear types (e.g., poisons, explosives, unattended gillnets, etc.). In the Pacific Remote Island Areas, there is no fishing of any fish including the humphead wrasse within 12 nm of Rose Atoll, Howland, Baker, and Jarvis Islands, Kingman Reef, Johnston Atoll, Wake Atoll, and Palmyra Atoll. A number of no-take marine protected areas (MPAs) for the U.S. Pacific Islands region also exist and may protect the humphead wrasse. More information can be found in Graham et al. (2014).



Internationally, a number of regulations and conservation actions exist for the humphead wrasse. Table 1 from Graham et al. (2014) summarizes these regulations and conservation actions. More information can be found in Graham et al. (2014).



# Species of Concern

NOAA National Marine Fisheries Service

Table 1: International regulations and/or conservation actions of humphead wrasse by implementing country. (Source: Russell 2004, unless cited otherwise)

Country	Date	Humphead Wrasse Regulations / Conservation Actions
<b>Australia</b>	2003	Capture of humphead wrasse for both live and frozen markets is prohibited (Sadovy et al. 2003b).  Queensland: Coral Reef Fin Fish Management Plan prohibited all take and possession of humphead wrasse, other than for limited educational purposes and public display.
	1998	Western: Complete protection because stocks determined to be insufficient and susceptible to overfishing.
<b>British Government</b>		Chagos Marine Reserve: No-take MPA out to 200 nmi; includes 55 islands and over 250,000 km <sup>2</sup> of reef & habitat. Largest reserve in world (Western Pacific Regional Fishery Management Council 2013).
<b>China</b>		Permits are required for the sale of this species in Guangzhou province, southern mainland China, for conservation purposes.
<b>Fiji</b>	2004	Ban on SCUBA-assisted spearfishing; ban on night free-dive spearfishing (Western Pacific Regional Fishery Management Council 2013).
		Ban on the commercial take, capture for sale, offer for sale, or possession of live or dead specimens of humphead wrasse (Gillett and Moy 2006; Sadovy de Mitcheson et al. 2010).
<b>Federated States of Micronesia</b>		Ban on export for LRFFT (Western Pacific Regional Fishery Management Council 2013).
<b>Indonesia</b>	1985; 1995	Regulation 375/Kpts/IK.250/5/95 prohibits the capture of humphead wrasse except for research and traditional fisheries (Sadovy et al. 2011). Allowable fishing methods are hook and line, fish trap, and gill net.  Fisheries Law No. 9 (1985) prohibits the use of destructive fishing techniques such as explosives and poison. Penalties are up to 10 years of jail and/or US\$ 1.7 million dollar fine (Pet and Pet-Soede 1999).  Commercial export of < 1 kg and > 3 kg is prohibited. However, under specific conditions, local fishers are able to sell humphead wrasse to aquarium collecting companies that have obtained a business permit (Sadovy et al. 2003b).
	2013	Export quota of 1,800 fish per year total amongst all of the provinces (down from 8,000 in 2005) (IUCN 2013).
	2007	Phoenix Islands Protected Area: 157,626 m <sup>2</sup> of MPA where fishing and other extractive activities are banned or highly regulated (Western Pacific Regional
<b>Kiribati</b>	2007	Phoenix Islands Protected Area: 157,626 m <sup>2</sup> of MPA where fishing and other extractive activities are banned or highly regulated (Western Pacific Regional

		Fishery Management Council 2013).
<b>Malaysia</b>	2010	Malaysia reduced their export quota to zero and they continue to maintain a zero export quota (Sadovy 2010; IUCN 2013). Leading up to this ban, the Department of Fisheries Sabah and other management agencies decided to buy back some of the remaining stocks of humphead wrasse that were being held in cages by exporters in remote islands in Sabah. A total of 885 fish were purchased and 874 were released at 4 sites around Sabah that were kept confidential to reduce the potential for poaching of newly released fish (Kassem and Wong 2013).
<b>Maldives</b>	1995	Ban on all exports of humphead wrasse.
<b>New Caledonia</b>		All exports of humphead wrasse are banned (Sadovy et al. 2003a).
<b>Niue</b>		The interference, take, kill, or bringing to shore of the humphead wrasse is prohibited without written approval. All exports of humphead wrasse are banned (Sadovy et al. 2003a).
<b>Palau</b>	2006	Illegal to fish, buy or sell humphead wrasse. Export has been banned since 1998 (Gillett 2010).
	2014	All commercial fishing for any marine species is planned to be banned within the 200 nautical mile exclusive economic zone (Lederer 2014).
<b>Papua New Guinea</b>		There is a 65 cm TL minimum size limit for exporting humphead wrasse but this does not prevent fishers from catching and holding smaller humphead wrasse in cages (culturing) until they attain 65 cm TL. All live fish operators are required to obtain licenses.  Species can no longer be exported (Sadovy de Mitcheson et al. 2010).
<b>Philippines</b>		Bans exports of CITES marine species.
	1990s	The Philippines Cyanide Fishing Reform Program implemented policy reforms in source and consumer countries to create anti-cyanide fishing incentives and enforcement mechanisms as well as development of partnerships with fishing communities, focusing on transfer of non-destructive technology and improvement of local livelihoods (Barber and Pratt 1997).
	1994	The Wildlife Resources Conservation and Protection Act (Republic Act of 9147) allows collection of humphead wrasse solely for scientific, breeding, or propagation purposes. The commercial trade of the species, whether for seafood or the aquarium trade, is punishable by law (Yan 2011).
	1998	Possession of humphead wrasse is prohibited under Section 97 of Republic Act 8550 of the Fisheries Code, with stiff fines for illegal possession.
<b>Samoa</b>		No person shall SCUBA fish without a license, and many different types of traditional rules (e.g., MPAs, minimum size limits, and restricting use of underwater lights when spearfishing) exist in 324 villages (Western Pacific Regional Fishery Management Council 2013).
<b>Seychelles</b>	2005	Bans all live fish exports (Gillett 2010).
<b>Solomon Islands</b>		Ban on night free-dive spearfishing (Western Pacific Regional Fishery Management Council 2013).



## Species of Concern

NOAA National Marine Fisheries Service

### Videos:

In French aquarium (1:32) <http://www.youtube.com/watch?v=2UdJ2LLicmk>

World Wildlife Fund Conservation video showing aspects of live reef food trade (in Chinese, 3:00)  
<http://www.youtube.com/watch?v=AyyBswrD3xs>

### References:

- Andrews, Allen H., et al. 2015. Refined bomb radiocarbon dating of two iconic fishes of the Great Barrier Reef. *Marine and Freshwater Research* 66.4: 305-316.
- Barber, C.V., and V.R. Pratt. 1997. Policy reform and community-based programmes to combat cyanide fishing in Philippines. *SPC Live Reef Fish Information Bulletin* #3 – Dec 1997.
- Birkeland, C. and A.M. Friedlander. 2001 The importance of refuges for reef fish replenishment in Hawai'i. The Hawaii Audubon Society and Pacific Fisheries Coalition, Honolulu, Hawaii. 19 p.
- Choat, J., et al. 2006. Age structure and growth in a large teleost, *Cheilinus undulatus*, with a review of size distribution in labrid fishes. *Mar Ecol Prog Ser.* 318:237-246.
- Coastal Resources Management Office. 2011. [CNMI proactive species conservation: Assessment of status and habitat specificity of \*Cheilinus undulatus\* and \*Bolbometopon muricatum\* in the southern islands of the CNMI](#). CNMI Proactive Species Conservation Grant FY08 Final Report. 10 pp.
- Colin, P.L. 2010. Aggregation and spawning of the humphead wrasse *Cheilinus undulatus* (Pisces: Labridae): general aspects of spawning behavior. *Journal of Fish Biology* (76): 987-1007.
- Domeier, M.L. and P. L. Colin, 1997. Tropical reef fish spawning aggregations: defined and reviewed. *Bulletin of Marine Science.* 60:698-726.
- Donaldson, T.J. 1995. Courtship and spawning of nine species of wrasses (labridae) from the western Pacific. *Japanese Journal of Ichthyology* 42:311-319.
- Donaldson, T.J. and Y. Sadovy. 2001. Threatened fishes of the world: *Cheilinus undulatus* Ruppell, 1835 (Labridae). *Environ Biol Fishes* 62:428.
- Dorenbosch, M., et al. 2006. Seagrass beds and mangroves as nurseries for the threatened Indo-Pacific Humphead wrasse, *Cheilinus undulatus* and Caribbean Rainbow parrotfish, *Scarus guacamaia*. *Biological Conservation* 129, 28 pp. In: Connectivity between fish assemblages of seagrass beds, mangroves and coral reefs: Evidence from the Caribbean and the western Indian Ocean. Thesis, Faculty of Science, Radboud University Nijmegen, the Netherlands.
- Gillett, R. and W. Moy. 2006. Spearfishing in the Pacific Islands: current status and management issues. Secretariat of the Pacific Community, Noumea. Food and Agriculture Organization, Rome.
- Gillett, R. 2010. Monitoring and management of the humphead wrasse, *Cheilinus undulatus*. *FAO Fisheries and Aquaculture Circular.* No. 1048. Rome, FAO. 62 p.





## Species of Concern

NOAA National Marine Fisheries Service

- Graham, K.S., et al. 2014. Status review report: humphead wrasse (*Cheilinus undulatus*). Report to National Marine Fisheries Service, Office of Protected Resources. September, 2014. 123 p. + Appendices.
- Hoover, J.P. 1993. Hawaii's Fishes. 183 p. Mutual Publishing, Honolulu.
- IUCN. 2013. Reports on trade and underwater visual census. Available at: [http://www.iucn.org/about/work/programmes/species/who\\_we\\_are/ssc\\_specialist\\_groups\\_and\\_red\\_list\\_authorities\\_directory/fishes/groupers\\_wrasses\\_sg/hhw\\_gwsg\\_home/hhw\\_gwsg\\_cites/](http://www.iucn.org/about/work/programmes/species/who_we_are/ssc_specialist_groups_and_red_list_authorities_directory/fishes/groupers_wrasses_sg/hhw_gwsg_home/hhw_gwsg_cites/)
- Kassem, K., and I. Wong. 2013. Report of humphead wrasse buy-back and release programme in Sabah, Malaysia. Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security, Indonesia. 22 p.
- Lederer, E. M. 2014. Palau to ban commercial fishing, promote tourism. Associated Press. Available at: <http://news.yahoo.com/palau-ban-commercial-fishing-promote-tourism-043457332.html>
- Lobel, P. S., and L. K. Lobel. 2004. Annotated Checklist of the Fishes of Wake Atoll. Pac. Sci. 58(1): 65-90.
- Myers, R.F. 1991. Micronesian reef fishes. 2nd ed. Coral Graphics, Barrigada, Guam. 298 p.
- Pet, J.S., and L. Pet-Soede. 1999. A note on cyanide fishing in Indonesia. SPC Live Reef Fish Information Bulletin #5 – April 1999. 21-22.
- Randall, J.E. 2007. Reef and Shore Fishes of the Hawaiian Islands. 546 p. Sea Grant College Program, University of Hawaii, Honolulu.
- Russell, B. 2004. *Cheilinus undulatus*. In: IUCN 2006. 2006 IUCN Red List of Threatened Species. [www.iucnredlist.org](http://www.iucnredlist.org). Downloaded on 09 January 2007.
- Sadovy, Y. 2006. Development of fisheries management tools for trade in humphead wrasse, *Cheilinus undulatus*, in compliance with Article IV of CITES. Final report of CITES Project No. A-254. 100 p.
- Sadovy, Y. 2010. Humphead wrasse and illegal, unreported and unregulated fishing. SPC Live Reef Fish Information Bulletin #19 – August 2010. Pg. 19-21.
- Sadovy, Y. and J. Pet. 1998. Wild collection of juveniles for grouper mariculture: Just another capture fishery. SPC Live Reef Fish Information Bulletin. 4:36-39.
- Sadovy, Y., et al. 2003a. The humphead wrasse, *Cheilinus undulatus*: synopsis of a threatened and poorly known giant coral reef fish. Reviews in Fish Biology and Fisheries, 13:327-364.
- Sadovy, Y., et al. 2003b. While stocks last: The live reef food fish trade. Asian Development Bank. 169 p.
- Sadovy, Y., et al. 2011. Napoleon wrasse status and protection workshop. SPC Live Reef Fish Information Bulletin #20, Dec 2011. 3 pp.
- Sadovy de Mitcheson, et al. 2010. Gonadal development in a giant threatened reef fish, the humphead wrasse *Cheilinus undulatus*, and its relationship to international trade. Journal of Fish Biology 77: 706-718.



## Species of Concern

NOAA National Marine Fisheries Service

Sadovy de Mitcheson, Y., and X. Yin. 2015. Cashing in on coral reefs: the implications of exporting reef fishes. *Ecology of Fishes on Coral Reefs*: 166-179.

Tupper, M. 2007. Identification of nursery habitats for commercially valuable humphead wrasse *Cheilinus undulatus* and large groupers in Palau. *Marine Ecology Progress Series* 332:189-199.

Weng, K.C., et al. 2015. Umbrella species in marine systems: using the endangered humphead wrasse to conserve coral reefs. *Endangered Species Research* 27.3: 251-263.

Western Pacific Regional Fishery Management Council. 2013. Public comment submitted on the 90-day finding on the petition to list the humphead wrasse as threatened or endangered, 78 FR 13614, February 28, 2013. Available at: <http://www.regulations.gov/#!documentDetail;D=NOAA-NMFS-2013-0001-0005>

Yan, G. 2011. Endangered mameng (humphead wrasse) openly traded. In: SPC Live Reef Fish Information Bulletin #20, December 2006. Pg 19-21.

### **Point(s) of contact for questions or further information:**

For further information on this Species of Concern, or on the Species of Concern Program in general, please contact NMFS, Office of Protected Resources, 1315 East West Highway, Silver Spring, MD 20910, (301) 713-1401, [soc.list@noaa.gov](mailto:soc.list@noaa.gov); <http://www.nmfs.noaa.gov/pr/species/concern/>, or Krista Graham, NMFS, Pacific Islands Regional Office, 1845 Wasp Blvd., Building 176, Honolulu, HI 96818, (808) 725-5152, [Krista.Graham@noaa.gov](mailto:Krista.Graham@noaa.gov); or John Henderson, NMFS, Pacific Islands Fishery Science Center, 1845 Wasp Blvd., Building 176, Honolulu, HI 96818, (808) 725-5704, [John.R.Henderson@noaa.gov](mailto:John.R.Henderson@noaa.gov).