CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II

A. Proposal

Inclusion of *Cheilinus undulatus*, Rüppell 1835 in Appendix II. The species meets the criterion listed in Resolution Conf. 9.24, Annex 2a, Paragraph B.

B. Proponent

United States of America

C. Supporting statement

1. Taxonomy

1.1	Class:	Actinopterygii	
1.2	Order:	Perciformes	
1.3	Family:	Labridae	
1.4	Species:	*Cheilinus undulatus*	
1.5	Scientific synonyms:	none	
1.6	Common names:	English:	humphead wrasse, Maori wrasse, Napoleon wrasse, Napoleon fish
		French:	Kakatoi vareur (Seychelles), Napoléon
		Spanish:	Napoleón
1.7	Code numbers:	not applicable	

2. Biological parameters

2.1 Distribution

The species ranges throughout the Indo-Pacific region, from the Red Sea to the Tuamotus, north to the Ryukyus, including China and Chinese Taipei, east to Wake Island, south to New Caledonia, throughout Micronesia (Myers, 1999; Huang, 2001; FishBase, 2002). Its range falls within the jurisdiction of 48 countries and overseas territories, including the proponent. In these areas, *C. undulatus* is extremely patchily distributed with adults confined to steep outer reef slopes, channel slopes, and lagoon reefs in water 1-100 m deep. Adults appear to be sedentary over a given patch of reef according to multiple accounts by divers or dive operations that return repeatedly to the same spots and report seeing the same individuals. Adults, however, move periodically to local spawning aggregation site where they concentrate to spawn at certain times of the year. Juveniles tend to prefer a more cryptic existence in areas of dense branching corals, while larger individuals and adults prefer to occupy limited home ranges in more open habitat on the edges of reefs, channels, and reef passes (Donaldson and Sadovy, 2001). In New Caledonia, surveys of multiple habitat types across six regions and 12 years revealed particular habitat preferences for *C. undulatus*. Overall, humphead wrasse density was strongly correlated with the percentage of hard bottom or coral cover, while fish size was inversely proportional to coral cover (i.e., the smallest fishes were abundant in areas with high live coral) (Sadovy et al., unpublished manuscript). The species is most often observed in solitary male-female pairs, or groups of two to seven individuals (Donaldson, 1995**;** Donaldson and Sadovy, 2001).

2.2 Habitat availability

Humphead wrasse are evidently dependent on healthy coral reef ecosystems for both juvenile and adult life stages. Adults may assemble in small or large numbers at certain spawning sites on outer reefs but it is not known whether or not these sites represent a particular type of habitat or set of water conditions. The threats to coral reefs have been well documented (Barber and Pratt, 1998; Bryant et al., 1998; Burke et al., 2002; Green and Shirley, 1999; Wilkinson, 1998), and include destructive fishing techniques, overfishing, dredging, landfilling, mining of sand and coral, coastal construction, sewage discharge, and sedimentation from upland deforestation and agriculture. Bryant et al. (1998) estimate that 58% of the world's coral reefs are at risk from human activity. In Southeast Asia, the center of *C. undulatus*' distribution, 88% of coral reefs are at risk and half are at high or very high risk (Burke et al., 2002). In the 1997-1998 global coral bleaching event, it is estimated that 18% of Southeast Asian reefs were damaged or destroyed (Burke et al., 2002).

2.3 Population status

There are no global population assessments for the species, but local populations are described from reef surveys and other sources. It is believed to be uncommon to rare wherever it occurs, and natural densities are evidently never high even in preferred habitats. Survey results throughout the species' range in preferred habitats have shown adult densities of *C. undulatus* in unfished or lightly fished areas at 1 to 10 animals per 5,000 square meters of reef (Donaldson and Sadovy, 2001; O'Connell in litt.; Sadovy et al., unpublished manuscript). These surveys are summarized below.

In Papua New Guinea, experimental fish trapping over a 2-3 year period in Kavieng yielded a total of 15 humphead wrasse, and density estimates of 3-5 individuals per 5000 square meters. Underwater visual census noted 2.8-4.6 fish per 5,000 square meters (H. Choat, in litt. 2002).

Surveys conducted in Fiji in 1994 covered six fishing grounds representing varying levels of harvest pressure. The surveys covered a total area of 162,000 square meters and about 100 diver hours. Out of more than 10,000 fish longer than 15 cm, only 5 humphead wrasse were seen in areas of suitable habitat. More recent Fiji surveys have indicated humphead wrasse densities at 0-4 fish per 5000-square-meter area. Despite being a valuable reef fish, numbers of this species were considered to be too few to record during recent UVC surveys of key commercially important reef fishes (particularly groupers) in Fiji (Yeeting, 1999). The species has virtually disappeared from some places in Fiji (Thaman, 1998). Recent surveys in the remote Central Lau Group of eastern Fiji indicated very low numbers of humphead wrasses, as well (Donaldson and Yeeting, unpubl. data).

In Wake Atoll (U.S.), the humphead wrasse is completely protected by regulation of the U.S. Department of Defense. In this unfished habitat, there are reports of several hundred adults along a 5-km section of reef.

In Australia, a preliminary demographic survey (J.H. Choat, in litt. 2002) reported 1.6-2.2 adults per 5000 square meters and noted that the species is naturally rather rare; fishing pressure at the time was unknown.

Several underwater visual census surveys have been completed in the last decade in the Palau Islands and Southwest Palau Islands (SWPI). Both areas experience moderate fishing pressure for *C. undulatus*, and reported densities of 0-8.3 individuals per 5000 square meters of reef habitat (T. Donaldson, unpubl. data).

In the Solomon Islands, 22 visual surveys were made in fringing reef barriers, reef lagoons, patch reefs, reef passes and embayments. Surveys covered 5000-square-meter sections and noted a mean of 1 fish (sd = 1.76) between 12 and 150 cm TL per hour in each section (T. Donaldson, unpubl. data).

In Indonesia, surveys of reefs exploited for the live reef food fish trade showed humphead wrasse occurring at densities of 2-7 fish per 5,000 square meters at known aggregation sites from 1998 to 2000 (J. Pet et al., Report to The Nature Conservancy on monitoring carried out in Komodo National Park, 2000).

In the Maldives, 2-10 adults were noted per 5,000 square meters in the mid 1990s (Sluka, 1998).

In New Caledonia, Tonga and Tuamotus, extensive UVC surveys were carried out between 1985 and 1997 in 6 regions and in preferred habitat. Over 1,000 surveys were conducted with a maximum of 0-8 fish per 5, 000 square meters noted in most preferred habitat of 30-100 cm long fish (Kulbicki et al., unpubl. data).

Reef Check underwater visual surveys were carried out with trained divers in the Indo-Pacific, in 34 countries or jurisdictions from 1997 to 2002. In surveys during1997 and 1998, zero fish per 100 square meters were recorded at over 80% of the sites surveyed with virtually no counts of over 0.5 fish per 100 square meters (Hodgson, undated). Throughout the sampling period 1997-2002, mean densities per 100 square meters ranged from zero to 1.4 fish per 100 square meters (Data courtesy of the Reef Check global coral reef monitoring program; www.reefcheck.org). While the scale of such surveys is small for large reef species like the humphead wrasse, the apparently low numbers of these fish in suitable habitat is of note.

Humphead wrasse are listed as Vulnerable in the 2000 IUCN Red List (assessor: Y. Sadovy). In the IUCN classification system, a taxon is considered "vulnerable" when it is not considered Critically Endangered or Endangered (as per IUCN definitions) but is facing a high risk of extinction in the wild in the medium-term future, as defined by a multitude of criteria. For *C. undulatus*, these criteria were:

1. a population reduction in the form of an observed, estimated, inferred or suspected reduction of at least 20% over the last 10 years or three generations, whichever is the longer, based on actual or potential levels of exploitation; and
2. a reduction of at least 20%, projected or suspected to be met within the next ten years or three generations, whichever is the longer, based on
   a) a decline in area of occupancy, extent of occurrence and/or quality of habitat
   b) actual or potential levels of exploitation.

The species was listed as vulnerable due to multiple accounts of marked declines with heavy fishing and in particular with the recent introduction of export fisheries associated with the international live reef fish trade. Given the projected growth in this trade and the probable vulnerability of such a large and long-lived reef fish to overfishing, declines were projected to continue or worsen. This species can live at least 30 years and becomes sexually mature at 5-7 years (Howard Choat, in litt. 10.3.02). This means that its generation time is expected to be in excess of 10 years and that the rate of intrinsic population increase is likely to be low. The species is hermaphroditic (with female-to-male sex change) which may make it more vulnerable to overfishing than species that do not change sex. This would be the case if a given fishery is selective for the larger fish, which are typically male.

2.4 Population trends

There are numerous studies of humphead wrasse population trends throughout the species' range. These sources of information include underwater visual censuses, fishermen's reports, dive operator reports, and anecdotal information. Collectively, these reports show declining populations in nearly all studied locations with suitable habitat subject to commercial fisheries.

As is common in long-lived fishes, recruitment may be highly variable from year to year; under intense fishing pressure this could lead to severe depletions if recruitment remains low for extended

periods (Roberts, 1996). Research at the University of Guam Marine Laboratory has indicated a recent pulse in juvenile recruitment to local reefs, but their source remains unknown (M. Tupper, unpubl. data**)**. It is possible these fish originated from offshore populations in reefs that have yet to be surveyed in U.S. territorial waters because local populations are severely reduced (Donaldson, in litt., 20 May 22, 2002). In some areas juveniles are rarely seen, however. Roberts (1996, in litt. 20/11/00) notes that despite extensive diving in the Red Sea, he never saw a juvenile (i.e., < 40 cm TL) humphead wrasse leading him to suggest that this species may recruit only episodically in some areas.

In Australia, there is conflicting information on humphead wrasse abundance. Queensland fisheries data show a sharp rise in catch rates for *C. undulatus*, from approximately 6 kg/day/boat in 1989 to almost 25 kg/day/boat in 1992, coinciding with rising interest in the live reef fish trade with Hong Kong. Catch rates then stabilized at approximately 20 kg/day/boat from 1993-1998, suggesting no decline in local humphead wrasse stocks in Queensland (Samoilys, *in litt*. 1 June 2002). However, according to the CITES Management Authority, evidence of decline is most obvious in Queensland waters (O'Connell in litt. 1 May 2002). Reports from several dive operators in northern Queensland indicate there has been a decline in *C. undulatus* at the sites they frequently visit. In addition, these operators report that the average size of humphead wrasse at these locations is much smaller than 10 years ago. Queensland volunteer diver surveys indicate local aggregations have never exceeded 10 individuals since 1999. However, in the past spawning aggregations of several hundred fish have been noted but have since completely disappeared for unknown reasons (Johannes and Squire, 1988). Dive operators have observed decline or disappearance of the species at six different reefs. The species may be more common on the Queensland outer reefs but the catches on outer reefs are much lower than historic levels (O'Connell in litt. 1 May 2002). The Australian Institute of Marine Science (AIMS) has been monitoring the Great Barrier Reef biota since 1992, and reports that the species is not common and may no longer be found at sites where it once occurred. Queensland Museum scientists have studied the Swain and Pompey outer reefs annually for the last three years, and have observed only four individuals. Historical information shows that the species was very common on these reefs in the 1950's and 1960's, and that declines have coincided with increased fishing activity (O'Connell in litt. 1 May 2002).

In Indonesia, catch rates have evidently been declining based on information obtained from traders and fishermen. Catches of humphead wrasse declined from 50-70 kg per month in the early 1990s to 10-50 kg by the end of the decade. Many fishermen note that this species is scarcer now compared to five years ago when 45-kg fish could be caught; now individual fish of over 25 kg are rare and fishermen have to travel further from home ports to maintain catches of this species. The cause of these declines is not known, but may be due to availability or changes in fishing practices and tightening of controls (Bentley, 1999). Multiple anecdotal or popular accounts from experienced ichthyologists, divers and fishers indicate severely reduced numbers of humphead wrasse in many areas of Indonesia according to their previous personal experiences. The sum of these accounts suggests depletions in much of the Indonesian archipelago. On a one-month dive trip in Indonesia (Sulawesi, Moluccas, Komodo and Bali) of 4-5 dives most days at remote islets and reefs only one small *Cheilinus undulatus* was seen (J.E. Randall, in litt. 11.19.00). In many areas around Indonesia frequented by divers, *C. undulatus* is uncommon where once individuals were readily seen, although juveniles may be seen again once live reef fishery operations cease (M. Erdmann, pers. comm. 12/3/00).

2.5 Geographic trends

Although it does not appear that the overall geographic range of the species has changed significantly over recent history, localized depletions and extirpations have been noted (see above). Experiences in the live reef food fishery, which targets *C. undulatus* and several large grouper species (Family Serranidae) for luxury Asian restaurants, indicate serial overfishing has occurred in the Indo-Pacific. Numbers are now negligible at edge-of-range sites such as Hong Kong compared

with previous low occurrences. This species has evidently become rare in the South China Sea. It used to be taken occasionally in Hong Kong and was once abundant in nearby reefs (e.g. Pratas Reef) but is no longer taken in these areas (Sadovy and Cornish, 2000; P. Chan, pers. comm.; J. Wong, pers. comm. 30.11.00). Although occasionally taken around the islands off southern Chinese Taipei (Orchid and Green Is.), young fish are rarely seen underwater and there is only a "limited amount of population left" (Shao, in litt. 20/11/00).

Hong Kong is the chief consumer in the live reef food fishery, and has a fleet of vessels for transporting live specimens of humphead wrasse and other reef fishes across Southeast Asia to Hong Kong ports. Once the populations around Hong Kong were depleted, fishing fleets of small boats targeted the Philippines. Fish buyers from Hong Kong and Singapore now consider the Philippines grouper (and presumably the sympatric humphead wrasse) populations to be depleted (Sluka, 2001). Fishing effort in the live reef food fish trade has grown, and larger vessels are now fishing farther abroad from the Maldives to the west and east to many of the Pacific nations (Sluka, 2001). Humphead wrasse became so depleted in the Maldives from export fisheries that the government banned exports of the species in 1997.

2.6 Role of the species in its ecosystem

The humphead wrasse is the largest member of the wrasse family (Labridae), growing to over 2 meters and 190 kilograms. It is a large carnivorous predator in reef ecosystems, feeding particularly on fishes, molluscs, sea urchins, crustaceans, and other invertebrates (Randall et al., 1978) although the full extent of its role in the ecosystem is unknown. It is one of the few predators of toxic animals such as sea hares, boxfishes, and crown-of-thorns starfishes (Randall et al., 1978; Myers, 1999; FishBase, 2002) and has been implicated in ciguatera poisoning in the live reef fish trade (Myers, 1999; Donaldson and Sadovy, 2001; O'Connell, in litt., 1 May 2002).

Its role as a predator of crown-of-thorns starfishes (*Acanthaster planci*) may help in maintaining ecosystem balance. *Acanthaster* "outbreaks", or population explosions, occur across Indo-Pacific coral reefs (Moran, 2002) and result in massive coral mortality in short periods of time. Overexploitation of *C. undulatus* may remove controls on crown-of-thorns populations and the resulting damage to coral reefs.

2.7 Threats

Threats include 1) intensive and species-specific removal in the live reef food fish trade (see below); 2) spearfishing at night with SCUBA gear; 3) lack of coordinated, consistent national and regional management; and 4) illegal, unregulated, or unreported (IUU) fisheries (Donaldson and Sadovy, 2001). In addition, the species' essential coral reef habitat is seriously threatened by human activity throughout the Indo-Pacific region (see Section 2.2 Habitat Availability). Destructive fishing practices, such as sodium cyanide use which stuns animals for capture and incidentally kills living coral, have been well documented and are spreading in the Indo-Pacific region (Barber and Pratt, 1998; Jones and Hoegh-Guldberg, 1999; Burke et al., 2002; Bryant et al., 1998; Johannes and Riepen, 1995). Despite its prohibition in many countries (including major exporters such as the Philippines and Indonesia), cyanide is still the preferred method for capturing certain live reef fish for international trade in some areas (Burke et al., 2002, Bryant et al., 1998; Johannes and Riepen, 1995; Barber and Pratt, 1998). Indeed, larger fish are difficult to catch any other way, other than by nighttime capture. When cyanide is applied, the fish often retreats into a crevice and becomes increasingly lethargic as the toxin reduces its ability to take up oxygen. Divers may break away the living coral to get access to the hiding area, and remove the fish to clean water where it will often recover for shipment or holding in net pens (Sadovy et al., unpublished manuscript**).**

The most serious threat to this species is overfishing. This species is long-lived, and if it is similar to other reef fishes of similar size and biology (e.g., sequential hermaphroditism) it is expected to have low rates of replacement and therefore be particularly vulnerable to fishing pressure (Donaldson and

Sadovy, 2001). 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.

There has been speculation that humphead wrasse, and other reef fishes, can be cultured or "farmed" to meet international demand. However, it appears that the use of cultured fish may actually pose a threat to wild populations in certain circumstances. In some areas, small fish are taken from the wild and raised in floating net cages until 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. In Indonesia, while regulations prohibit the take of fish < 1 kg and > 3 kg for direct export, fish of prohibited sizes can be taken for culture. In the case of small fish, this simply means that they are grown out to market size, which is typically less than the size at sexual maturation. Moreover, there is a developing export market for juvenile humphead wrasse for the marine aquarium trade (Y. Sadovy, pers. obs. Hong Kong Tung Choi Street aquarium shops). 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. Humphead wrasse are sequential hermaphrodites, meaning they first mature as females at smaller sizes then can subsequently mature into males. The controlling factors in this sequential 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. Sexual maturity takes from 5 to 7 years, and, according to life history strategy theory, many older juveniles of such species are very likely to be able to survive to adulthood.

Misleading trade data also threaten conservation efforts for the species. For example, the definition of mariculture in Hong Kong regulations is "any operation involving the maintenance, propagation, and promotion of the growth of fish in captivity" (Lau and Parry-Jones, 1999). Therefore, fish taken from the wild and raised in pens can appear as 'cultured' in trade records, resulting in under-reporting of wild catch.

3. Utilization and trade

3.1 National utilization

The live reef food fish trade involves more than ten popular taxa of groupers and wrasses, which are traded live for luxury restaurant markets in Hong Kong, mainland China, Singapore, and other nations. Rare species such as *C. undulatus* command the highest prices, ranging from USD 90 to USD 175 per kilogram (retail, 1997 prices) in Hong Kong markets (Lau and Parry-Jones, 1999). Over-fishing occurs as a result of targeting spawning aggregations (which can be well known spatially and temporally), and by taking large numbers of sexually immature individuals (smaller specimens are often preferred by consumers for low cost and are required by grow-out facilities) (Lau and Parry-Jones, 1999). Due to overfishing, humphead wrasse are banned from export in many areas of the Indo-Pacific (Maldives, Palau, Palawan Island Philippines, Western Australia, and Niue). Researchers remain concerned over the species' future because its status as a luxury food item will prevent demand from shrinking even as humphead wrasse become rarer and more expensive. Exploitation is expected to continue as stocks continue to decline (Donaldson and Sadovy, 2001). There are no regional (and few national) efforts to manage the live reef fish trade, and significant importers (e.g., Hong Kong) do not require landings reports by locally licensed vessels involved in the fishery (although informal and voluntary data collection occurs from these vessels). In a 1999 study by TRAFFIC East Asia, researchers found that Hong Kong had over 4,000 locally licensed fishing and transport vessels of which 1,600 operated primarily outside of Hong Kong waters. The reporting exemption for a fleet this large is significant, and results in serious underestimation of the Hong Kong import volumes. Hong Kong customs data indicated the province

imported 21,000 tons of live reef fish (all species) in 1997, while independent interviews with Hong Kong fish wholesalers indicated imports of 32,000 tons worth USD$500 million in the same year (Lau and Parry-Jones, 1999).

Although an important part of the live reef fish trade because of its high unit value, the humphead wrasse makes up a very small proportion of the total trade in live reef fish and its apparent traded volumes are extremely low for a commercially exploited fish species. Recent minimum annual imports of humphead wrasse to Hong Kong (the single largest importer), for example, ranged from 38 to 132 tons during 1997-2000. Most of these declared shipments arrived from the Philippines and Indonesia via Hong Kong-licensed vessels that voluntarily reported landings to customs officials.

Humphead wrasse have significant cultural value in many small island developing states. In several countries it has long been an important ceremonial fish, sometimes reserved for kings or special community festivities (Sadovy, in litt., 31 March 2002). In addition, many of these nations utilize humphead wrasse and other reef fishes in artesenal fisheries or small-scale spearfisheries to supply local demand (Birkeland and Friedlander, 2001). Free diving with spearfishing equipment is the typical method of capture in these domestic fisheries, but even this minimal technology has resulted in overfishing in Guam especially when replaced by spearfishing on SCUBA (Donaldson, in litt., 20 May 2002).

C. undulatus was targeted for export during the 1985-1986 peak of the Palau live reef fish trade, which was suspended in 1998 due to fears of overfishing. Market data for 1990-1991 indicate that 142 humphead wrasse were sold through the PFFA (Palau Federation of Fishing Associations) representing about 63% of the total humphead wrasse landings in Palau that period. In 1992, market landings of adults totaled 225 kg, mainly in July-September, while 197 kg of juveniles were landed, mostly in May. In the mid 1990s, a 2-year summary report was made of all fish going through the three main markets in Palau. Of 9,000 fish sampled from night-time spearing (the principle capture method for this species for domestic use), only 6 were humphead wrasse and these measured from 60-150 cm TL. Annual landings of humphead wrasse at Palau's commercial markets ranged from 500 to 3,500 kg between 1976 and 1990 and have dropped yearly from 3,409 kg in 1985 to 454 kg in 1990. In 1993, 1994, 1995 and 1996, annual catches dropped from 682 kg to 138 to 26 to 0 kg, respectively (Sadovy et al., unpublished manuscript).

The species is exploited fairly heavily in Fiji, with 5.42 tonnes recorded from markets in 1990, then only 1.07 tonnes reported three years later (Sadovy et al., unpublished manuscript). Malaysia exhibits active "culturing" or net pen grow out for humphead wrasse, catching sizes of 20-40 cm (Sadovy et al., unpublished manuscript). Malaysia also exports a small number of *C. undulatus* at marketable size for the live reef fish trade.

In non-consumptive use, the humphead wrasse is valuable to SCUBA diving operators. Individual fish maintain consistent home ranges on particular reefs, and become familiar to operators in the area. There are campaigns in progress to collect information on the species from recreational divers and promote its conservation for such uses, citing higher value in the non-consumptive vs. consumptive markets. (O'Connell, in litt., 1 May 22, 2002; Donaldson, in litt., 20 May 2002; Sadovy, in litt., 31 March 2002; Napwatch- http://www.divesociety.ch/napwatch.htm).

3.2 Legal international trade

Sadovy et al. (unpublished manuscript) reviewed the current legal trade of humphead wrasse into Hong Kong, China and their results are summarized in this section. Minimum annual imports of humphead wrasse to Hong Kong (the single largest importer) ranged from 38 to 132 tons during 1997-2000. Most of these declared shipments arrived from the Philippines and Indonesia via Hong Kong-licensed vessels that voluntarily reported landings to government officials although they are not required to do so. Other source countries included Kiribati, Viet Nam, Australia, China, and

more recently, Thailand. This voluntary system records an unknown subset of imported fish although it is the major importers who provide data. As an example, a survey designed to ground-truth Hong Kong customs data in April-June 2001, directly recorded 6,701 kg of humphead wrasse in a sub-sample of vessels while customs data only recorded a total of 3,270 kg of the species over the same sampling period.

Australia monitors exports of *C. undulatus* as "Maori wrasse", and volumes have grown almost 10 fold from 555 kg in 1996 to 5,170 kg in 2000. This increase is directly attributable to demand in the Asian live reef food fish trade (O'Connell, in litt., 1 May 2002). It should be noted that Queensland has banned the sale of this fish domestically and for export because of ciguatera concerns.

Surveys of the major live reef fish markets in Hong Kong, between December 1995 and November 2001, provided details on sizes and on the relative importance of different species of fish in the live reef fish trade for sale to the public for both food and aquarium trade. The humphead wrasse was one of the most highly valued economically and the ninth most abundant species in the markets prior to 1998. Individuals being sold at two of the three major markets were between 25 and 95 cm with the majority between 30 and 60 cm TL (sexual maturation occurs between 40 and 60 cm so many of these are juveniles). In September 2001, small numbers of juveniles, measuring about 4-10 cm TL (N = 12) started to appear on retail sale in local aquarium fish shops. Since the average size of sexual maturation appears to be about 50 cm TL, the majority of fish on sale are juveniles. In recent years, there appears to be a trend toward smaller humphead wrasse in Chinese markets (Lau and Parry-Jones, 1999; Donaldson, in litt., 20 May 2002). Some of the traders in Hong Kong reported a declining availability of larger reef fishes overall, and surmised this was due to overexploitation in nearby nations (Lau and Parry-Jones, 1999). Other explanations could be a desire for smaller fish by consumers, lower shipment costs (by air), export size limits (e.g., Indonesia), and lower mortality in transit when compared to larger fish.

Hong Kong traders re-export a certain amount of live reef fish. Although Hong Kong customs data in 1997 did not show re-exports of humphead wrasse, interviews with Hong Kong traders that same year revealed that 10-20% of all live reef fish imported to that jurisdiction were re-exported to southern mainland China (Guangzhou, Shenzhen, and Zhuhai). The vast majority of these re-exports were the high value species such as giant grouper (*Epinephelus lanceolatus*), humphead wrasse, and coral trout (*Plectropomus* spp.) (Lau and Parry-Jones, 1999).

3.3 Illegal trade

As noted below, several nations prohibit the export of humphead wrasse by province, by size class, or nationwide. Nonetheless, these banned specimens still appear in Hong Kong markets and traders have acknowledged that smuggling is common (Lau and Parry-Jones, 1999; Sadovy et al., unpublished manuscript; Johannes and Riepen, 1995). In addition, *C. undulatus* are sometimes harvested with cyanide despite widespread prohibition of its use. Although local companies cannot legally export large humphead wrasse, they can sell them to foreign vessels which do not necessarily comply with local regulations (Sadovy et al., unpublished manuscript; Johannes and Riepen, 1995; Donaldson and Sadovy, 2001).

3.4 Actual or potential trade impacts

International trade appears to be the major threat to the persistence of this species on local and regional scales because of high demand, and current levels appear unsustainable in many jurisdictions. Demand is projected to grow as the live reef fish trade expands and wealth in Asia grows. The increasing ease of international trade, both because of trade barrier reduction and air transport improvement will facilitate the international trade in live fish, including humphead wrasse. The large vessels that transport live fish across the Indo-Pacific have access to the most remote locations and significant refugia for this species will probably disappear if market demand, and the

species' value, continue to increase. A CITES Appendix-II listing should result in consistent terminology in trade data (e.g., wild vs. cultured), improved understanding of trade routes, and stricter regulation of harvesters and transshippers. Most importantly, the requirement for non-detriment findings prior to issuance of CITES export permits should result in improved domestic management and monitoring programs. The proper implementation of an Appendix-II listing for *C. undulatus* is likely to reduce availability of the species in international trade, if it is assumed that 1) current harvest levels are unsustainable and must be adjusted downward for non-detrimental trade to occur, and 2) that some shipments are illegally obtained and will not be allowed under CITES protocol. Domestic trade and traditional use of humphead wrasse would not be directly affected by CITES requirements, but improved localized management may reduce allowable harvest in the near term to effect stock restoration. 3.5 Captive breeding for commercial purposes (outside country of origin)

Closed system (or hatchery) culture (e.g., no reliance on wild broodstock) appears difficult or impossible because of small larval sizes, rare broodstock, and feeding regimen problems (Donaldson, in litt.; Sadovy et al., unpublished manuscript; Mike Rimmer, pers. comm. April, 2002).). Research on raising humphead wrasse is in its early stages. The basic biology of the species (longevity, fecundity, triggers for sex change in females) is poorly understood, although Chinese Taipei is reportedly carrying out spawning research. Juveniles are said to be hardy, tolerant of crowding, and can be grown out in net pens after intensive culture. However, closed-system culture is apparently too costly to be commercially viable (Johannes and Riepen, 1995; Donaldson in litt., 20 May 2002). Artificial production is also limited by inadequate numbers of suitable spawning stock from the wild (Donaldson in litt., 20 May 2002). As noted in Section 2.7, the "farming" or culturing of humphead wrasse simply consists of growing out wild-caught juveniles until they reach marketable or legal size for export. This situation is complicated by the definition of mariculture in Hong Kong regulations, which includes "any operation involving the maintenance, propagation, and promotion of the growth of fish in captivity" (Lau and Parry-Jones, 1999). Therefore, it appears the *C. undulatus* listed in Hong Kong trade statistics as "cultured" are simply wild-caught fish held for grow-out. Such classifications obfuscate the real magnitude of wild harvest for international trade.

4. Conservation and Management

4.1 Legal status

4.1.1 National

The humphead wrasse occurs in northern Australia waters off Western Australia, Northern Territory, and Queensland and is prohibited from harvest in Western Australia under the Fish Resources Management Act 1994. This action was taken in 1998 when it was determined that the local stocks were not large and were highly susceptible to overfishing. It has been assessed as "lower risk" (conservation dependent) using the IUCN guidelines by the Conservation Overview and Action Plan for Australian Threatened and Potentially Threatened Marine and Freshwater Fishes and is being considered for listing as a threatened species under the Environmental Protection Biodiversity Conservation Act 1999 (O'Connell, in litt., 1 May 2002). Recent events may end the Australian fishery**,** because humphead wrasse have been implicated in ciguatera poisoning in Hong Kong. In response, the Australian Quarantine Service and the fishing industry agreed to ban the export of *C. undulatus* from Queensland waters. In addition, Sydney Fish Markets have decided to reject imports of all humphead wrasse from the Pacific rim, and industry in Northern Territory, Queensland, New South Wales, and Victoria has agreed to this policy (O'Connell, in litt., 1 May 2002).

The Maldives banned the export of humphead wrasse in 1995 based on concerns about loss of this fish from recreational diving sites. Despite this regulation, Hong Kong import

statistics show the Maldives exporting 100,965 kg of humphead wrasse worth USD$635,000 to Hong Kong in 1998 (Shakeel, 1994; Lau and Parry-Jones, 1999).

In Palau, the species was targeted for the live reef fish trade, which peaked between 1985-1986. The export of humphead wrasse was then suspended in 1998 due to fears of overfishing. National laws also prohibit trade in specimens < 25 cm in total length (Palau, Domestic Fishing laws 1998).

In the Philippines, the province of Palawan banned the export of humphead wrasse because of overfishing concerns in 1994 (Johannes and Riepen, 1995). It is unclear if other provinces have enacted similar laws or whether the Palawan ban is still in effect.

In New Caledonia, catch of humphead wrasse is not permitted during spearfishing competition (M. Kulbicki, pers. comm.)

In Niue the interference, take, kill, or bringing to shore is prohibited without the written approval of the government (Niue Domestic Fishing Regulations, 1996).

4.1.2 International

There are no international protections in place for *C. undulatus*.

4.2 Species management

4.2.1 Population monitoring

There are a variety of visual census surveys designed to monitor coral reef health, which detect humphead wrasse incidentally or as part of a standardized sampling protocol. These surveys are summarized in Sections 2.4 and 2.5 above, and involve a gamut of techniques including volunteer diver surveys (e.g., ReefCheck, Napwatch, GreenReef etc.), scientific censuses (e.g., Australian Institute of Marine Science efforts, Great Barrier Reef Marine Park monitoring, IRD-New Caledonia), and incidental observations made during other research initiatives.

4.2.2 Habitat conservation

An increasing number of marine protected areas (MPAs) are being established throughout southeast Asia, including Indonesia, Malaysia, the Philippines, Singapore and Thailand. Nonetheless, there are often conflicting responsibilities for the resources, a lack of coordination among different agencies, limited funding and technical expertise and/or lack of enforcement. Burke et al. (2002) assessed 646 marine protected areas throughout Southeast Asia and determined that only 46 (14%) were managed effectively with adequate funding, personnel, and planning. There is no known effort to specifically conserve reef habitat for *Cheilinus undulatus*, but marine reserves and regulations that control human activity on coral reefs incidentally protect and conserve the species.

4.2.3 Management measures

In Queensland waters, the recreational limit is 1 fish per person with a minimum length of 75 cm (no maximum size limit). The Great Barrier Reef Marine Park Authority is considering a possession ban for the species within the park boundaries.

In Indonesia, a Ministerial Decree of Agriculture from 16 May 1995 prohibits the catch of humpheads except for research and “cultivation”. The Directorate General of Fisheries issued a rule on 6 September 1995 which allows traditional fishermen to catch humpheads

in certain fishing areas with boats < 5 gross ton displacement, by hook and line, fish trap, and gill net. Size limit is between 1 and 3 kg, and the specimens are then available for export by third party companies. Any company purchasing or exporting such fish must have a permit. A Ministerial Decree of Trade issued on 24 May 1996 bans the export of all humphead wrasse except those caught in compliance with the regulations above. Under this regulation, Directorate General of Fisheries No: 330/DJ.8259/95 (6th Sept. 1995), fish that are outside of the permitted size range can be used for mariculture (undefined) or must be freed. Data on the number of fishing permits, geographic information on fishing grounds as well as mariculture operations, quantity for both wild capture and mariculture and port of export for humphead wrasse should, under the regulation, be reported to the Directorate General of Fisheries every three months. These data were not obtained by the proponents. As noted above, mariculture for this species involves the holding of wild-caught until they reach legal (> 1 kg) size. In Hong Kong, many traders still obtained large, illegal-sized, humpheads from Indonesia in 1997. Therefore, enforcement of export laws for humphead wrasse appears to have been lacking in recent years. There also appear to be exemptions in Indonesian regulations for foreign cargo vessels transporting live specimens out of national waters (Sadovy et al., unpublished manuscript).

Mitigation of harvest through hatchery supplementation appears economically unfeasible (see above section on captive breeding). Other drawbacks include high predation on juveniles and genetic "bottlenecking" if fingerlings are derived from limited numbers of broodstock (Donaldson, in litt., 20 May 2002).

4.3 Control measures

4.3.1 International trade

There are no international trade control measures for *C. undulatus.*

4.3.2 Domestic measures

American Samoa (U.S.) banned the use of spear-fishing with SCUBA gear in April 2001, after declines in grouper and wrasse populations coincided with the advent of commercial harvest in 1994. When this fishery moved to neighboring Independent Samoa, two districts comprising 20 villages immediately imposed an identical ban and are advocating a national prohibition (Birkeland and Friedlander, 2001). All U.S. Pacific territories require licenses to export marine fishery products, and American Samoa requires that export ventures are locally owned. The U.S. Exclusive Economic Zone (to 200 nautical miles seaward of any territory or state) is regulated by a federal council that sets licensing and other regulations for commercial fisheries, including any future development of live reef food fish trade.

Other than the national management measures mentioned in Section 4.2.3 above, there are few known trade controls or licensing requirements imposed by range states.

5. Information on Similar Species

In international trade, humphead wrasse are traded exclusively as live specimens for the luxury food market. Given the species' unique appearance (including distinctive markings, large adult size, cranial "hump") at all stages of its life history, it is unlikely to be mistaken for other species such as groupers, snappers, or coral trout found in the same markets. Shipments arrive by sea or air terminals, where inspections by customs and wildlife officials are routinely carried out for other species (Lau and Parry-Jones, 1999; Sadovy, in litt., 31 March 2002).

6. Other Comments

Consultation letters describing the live reef food fish trade, exploited taxa, and potential benefits of CITES trade controls were sent to all Parties within the range of *Cheilinus undulatus*. To date, the proponent has received five responses from Australia, Israel, Thailand, France, and China (Hong Kong SAR).

Thailand indicated that they had limited suitable habitat for the species, but noted that it was rare even in those areas. The response stated support for "listing in the Appendices".

France indicated it was a range country via its overseas territories, and expressed support for an Appendix-II listing for humphead wrasse.

Israel indicated that geopolitical boundary changes eliminated almost all the suitable habitat for humphead wrasse in Israeli waters of the Red Sea. Nonetheless, researchers reported that the species is rare in the remaining coastal zones of the Sinai.

Australia provided detailed information on national laws, export controls, fishery management measures, survey results, and anecdotal information from various institutions within the country. The response indicated support for listing (no Appendix specified) on the basis of ensuring sustainable trade, rather than on the basis of the species being threatened with extinction.

China (Hong Kong SAR) authorities responded that insufficient data were presented in the consultation letter, and that it was therefore difficult to ascertain the benefits of a CITES listing. They stated the conservation benefit of a CITES listing might be diminished by the fact that destructive fishing practices posed the greatest threat to the species. The response highlighted recent efforts in the Asia-Pacific Economic Cooperation (APEC) forum to develop industry standards for the live reef food fish trade, and that these need to be evaluated before judging a potential CITES proposal.

At a 1997 APEC workshop on the impacts of destructive fishing practices on the marine environment, the head of the Hong Kong Agriculture, Fisheries, and Conservation Department (Capture Fisheries Division) made the following statement in his publication from his oral presentation:

Regarding the alleged cyanide fishing activities reported to take place in foreign waters, direct enforcement from Hong Kong is not possible. The most effective way to address the issue is for the producing economies to direct effective enforcement measures against cyanide fishing and to control trade in fish species that may become, or are already endangered, by listing them under CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora). This will provide the necessary legal framework and impetus for concerned governments to take effective control over cyanide fishing and trade in such species. (Sham, 1998).

7. Additional Remarks

The IUCN has developed a Grouper and Wrasse Specialist Group to address the conservation and research needs for these vulnerable taxa. In response to consultations by the proponents, the group submitted the remarks in Attachment B.

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Comments of the IUCN Grouper and Wrasse Specialist Group

Assessment of the humphead wrasse using CITES biological criteria

The proposal for the listing of the humphead wrasse on Appendix II of CITES is based on an assessment of the species' biological status, as follows and using the CITES Appendix II listing criterion in Conf. 9.24 Annex 2a, paragraph B(i) ('It is known, inferred or projected that the harvesting of specimens from the wild for international trade has, or may have, a detrimental impact on the species by: exceeding, over an extended period, the level that can be continued in perpetuity).

1. The species is most threatened by overfishing at all size classes. It has been subjected to unsustainable fisheries in several parts of the world, especially in Southeast Asia, including Indonesia, the Philippines, South China Sea, and Fiji. Data and multiple anecdotal accounts, including comments from the live reef fish industry, from these fisheries presented in the preceding pages clearly show that catches have fallen substantially over relatively short periods, especially after introduction of a live reef fish export trade. The export based live reef fish trade and unregulated local fisheries (especially if SCUBA is used) appear to be the greatest threats.

2. Illegal exports have been noted from Indonesia and probably also occur or have occurred from the Philippines (Palawan) and Maldives. The species is easily exported illegally for the live reef fish trade when this is conducted by boats.

3. The value of this species is expected to increase if numbers continue to decline because it is part of a luxury export market wherein rarity tends to be inversely proportional to value. This means that it continues to be viable to seek fish even at low population levels well past the points of biological overfishing. Demand for this species is expected to grow as wealth in demand centres and interest in live reef fish increase. On the other hand, the value of this species as an object of eco-tourism may be considerable.

4. The apparently heavy take of juveniles of this species is sometimes considered to fall under a category of mariculture and may be permitted where a fishery might be prohibited. For this species, the term mariculture is misleading since it involves the capture of animals from the wild and their subsequent grow-out and never includes full cycle (or hatchery) production. As such, mariculture is a further contributing factor in overfishing.

Assessment of the humphead wrasse under criteria recommended by FAO for CITES listings of marine fishes

The UN Food and Agriculture Organization (FAO) has considered extinction risk for marine fishes in the context of CITES listings proposals. FAO (2000) notes that large, long-lived, and late-maturing species are vulnerable to exploitation and are at relatively high risk of extinction from exploitation.

The ability to sustain exploitation, or productivity, is the single most important consideration when assessing population status and vulnerability to fisheries. Generation time is a useful surrogate for productivity. The most vulnerable species are those with an intrinsic rate of population increase (r) of < 0.14 and a generation time of > 10 years (FAO 2000). Population status data presented and calculated from Fishbase (2002) indicate that this species falls within FAO's lowest productivity category.