

Research Assessment Exercise 2020

Impact Case Study

University: The University of Hong Kong (HKU)

Unit of Assessment (UoA): 01 - Biological sciences (incl. environmental biology, biotechnology, agriculture & food science, veterinary studies)

Title of case study:

Conserving a valuable and endangered reef fish: from international and national legislation to trade reduction and recovery in a wild population.

(1) Summary of the impact

Research that began at HKU in 2001 produced significant actions that greatly reduced international trade, fostered recovery and facilitated management and enforcement action to conserve the threatened Humphead (Napoleon) Wrasse (HHW) (*Cheilinus undulatus*), among the largest of all reef fishes.

The main impacts since 1 October, 2013 were:

- Improved implementation of the CITES (Convention on International Trade in Endangered Species of Wild Flora and Fauna) Appendix II international conservation listing;
- Development of National Plans of Action for HHW in Indonesia and the Philippines and protection in China;
- Documented recovery of HHW in eastern Indonesia;
- Evaluated population structuring to inform spatial conservation planning;
- Developed novel fish facial recognition mobile phone ‘app’ to assist government enforcement;
- Improved global awareness of large reef fishes through multiple media outlets, including BBC’s Blue Planet II series in 2017.

(2) Underpinning research

The research was initiated in 2001 by Prof. Yvonne Sadovy at the School of Biological Sciences (SBS). Prof. Sadovy was employed at HKU from 1993 to 2018 and led all collaborations, fundraising, and research design.

Between 2001 and 2003, Prof. Sadovy’s team determined the endangered conservation status of the poorly known giant reef fish, the HHW, by synthesizing and analyzing global data [3.1]. This fish is distributed from the Seychelles to Tahiti with a distribution centred on Asia. It is highly valued economically in the international live seafood trade (retailing at USD200–850/kg) which is globally concentrated between Indonesia and Hong Kong, with export/imports estimated at USD1 million annually. The HHW is mostly taken in its juvenile phase (restaurant ‘plate-size’) and often captured using the poison cyanide, which is a threat to the living coral habitat where the species is caught.

At the time of the studies, the fisheries and trade of HHW were largely unmanaged. The combination of its luxury seafood status, longevity (> 30 years), sex-change (female to male), and reproductive mode of aggregation-spawning, combined with unregulated fisheries and trade in juveniles, made the HHW particularly susceptible to overfishing and led to serious concerns about its conservation status. [3.1, 3.2]. This prompted concerns that, without protection, the species would become extirpated from exploited areas within the following few decades.

The team’s research was directly responsible for successfully listing the species as ‘Endangered’ on the IUCN Red List (global standard for conservation status – International Union for Conservation of Nature) in 2004 and for its addition to Appendix II of CITES, the most powerful international protection instrument for threatened wildlife.

Species assessment and sustainable export quota – Indonesia

Following the CITES listing, Prof. Sadovy led a team of fishery experts, the government of Indonesia, and FAO (United Nations Food and Agriculture Organization) staff, to develop an interactive Fishery Stock Assessment Model tailored to the species to develop a sustainable export quota [3.3]. The model built on a novel underwater survey methodology developed for the field assessment of this wide-ranging fish using a Global Positioning System [3.4]. Abundance at six locations was assessed, first as a baseline following the CITES listing, and repeated after 6–9 years at each site to determine protection outcomes. A second model examined the biological and management implications of this fishery, which focuses specifically on juveniles [3.5].

Tackling illegal trade – Hong Kong/China

Hong Kong is the global trade hub and a key importer and consumer of HHW. Surveys of retail outlets between 2015 and 2018 and assessment of international trade data, revealed many more fish on sale than were legally imported under CITES. The research alerted the local Government in 2016 to the need to increase enforcement [3.6]. Since legally imported fish are not physically tagged but are photographed at import, the researchers developed a novel facial recognition mobile phone ‘app’, using the HHW’s complex facial markings like a ‘fingerprint’ (Figure 1), to distinguish them from illegal imports and demonstrated proof-of-concept [3.6]. This system is being trialled by government officers of the Hong Kong CITES office. The study also revealed illegal imports into mainland China.

(3) References to the research

- (3.1) **Sadovy, Y.**, Kulbicki, M., Labrosse, P., Letourneur, Y., Lokani, P. & Donaldson, T.J., 2003. The humphead wrasse, *Cheilinus undulatus*: synopsis of a threatened and poorly known giant coral reef fish. *Reviews in Fish Biology and Fisheries* 13(3): 327–364. (172 citations)
- (3.2) **Sadovy de Mitcheson, Y.**, Liu, M. & Suharti, S. 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. (22 citations)
- (3.3) **Sadovy, Y.**, Punt, A.E., **Cheung, W.**, Vasconcellos, M., Suharti, S. & Mapstone, B. D., 2007. Stock assessment approach for the Napoleon fish, *Cheilinus undulatus*, in Indonesia: A tool for quota-setting for data-poor fisheries under CITES Appendix II non-detriment finding requirements. Food and Agriculture Organization of the United Nations, 2007. 71 pp. <http://www.fao.org/docrep/012/a1237e/a1237e00.htm> (33 citations)
- (3.4) **Sadovy de Mitcheson, Y.**, Suharti, S., & Colin, P. L. 2019. Quantifying the rare: Baselines for the endangered Napoleon Wrasse, *Cheilinus undulatus*, and implications for conservation. *Aquatic Conservation: Marine and Freshwater Ecosystems*. 29: 1285-1301. DOI:10.1002/aqc.3124 (1 citation)
- (3.5) Kindsvater, H. Reynolds, J. **Sadovy de Mitcheson, Y.** & Mangel, M. 2017. Selectivity matters: rules of thumb for management of plate-sized, sex-changing fish in the live reef food fish trade. *Fish and Fisheries* 18:821-836 /doi/10.1111/faf.12208/abstract (10 citations)
- (3.6) **Hau, C. Y.** & **Sadovy de Mitcheson, Y.** 2019. A facial recognition tool and legislative changes for improved enforcement of the CITES Appendix II listing of the humphead wrasse, *Cheilinus undulatus*. *Aquatic Conservation: Marine and Freshwater Ecosystems*. DOI:10.1002/AQC.3119 17 pp.

(HKU staff/students in bold italic)

(4) Details of the impact

Between 2013 and 2019, research, engagement and outreach work carried out by SBS from 2001 onwards prompted and enabled significant multiple practical benefits and outcomes. Overall, there was substantial progress towards improving the conservation status of HHW, effectively implementing the CITES listing, increasing awareness, and understanding the condition of, and

threats to, this species. Enforcement was improved in Hong Kong using an identification tool developed to expose laundering* of fish through substitution of legally imported fish by illegal imports. Building on initial research, a genetic analysis has advanced spatial planning options by demonstrating HHW to be a metapopulation requiring management across a broad spatial scale [5.1]. Government and public awareness were improved regarding threats from the international seafood trade to large reef fishes. As the first commercial coral reef food fish under CITES, the HHW has become a case study for other similarly listed marine fishes [5.2]; Malaysia banned export of the species entirely and two National Plans of Action (NPOAs) (Philippines and Indonesia) were completed and are being implemented [5.3a, b]. Recognizing the positive impacts of the SBS work, a key high-ranking official, an exporter and an FAO officer acknowledged its value [5.4 a,b,c].

Exporter – Indonesia: Government/trader responses

As the major exporter of HHW globally, accounting for 20% of the coral habitat of this species, conservation action by Indonesia was crucial. Indonesia used information provided by SBS research to reduce its exports by 75%, from > 30 tonnes annually, prior to the CITES listing, to <3 tonnes after 2013, a quota determined to be sustainable [3.3]. Indonesia also tightened control on foreign vessels (2015), limited exports to air-only transport (2018) and started confiscating illegal fish [e.g. 5.5]. HHW populations were monitored by government staff adopting the GPS method Prof. Sadovy developed (six citations by Indonesian scientists in [3.4]). The 2016–2020 NPOA, released last year, established a conservation protocol and species action plan [5.3a]. Mr Andi Rusandi, Director of Marine Conservation and Biodiversity, Indonesia, wrote: “*Her work in Napoleon population and distribution survey have been used for: i) the design and establishment of conservation areas (e.g., Anambas National Marine Conservation), ii) planning for continued population surveys in Indonesia, and iii) predictions of Napoleon wrasse habitat areas*” [5.4a].

The largest trader/exporter of the species from Indonesia ceased its exploitation across his 55 capture locations in Indonesia after working with the SBS research team (5.4b). This created a unique opportunity for SBS work to document population recovery in eastern Indonesia, which became evident by 2016 when a significant increase in abundance was noted in surveys [3.4]. This developing story was featured in a Radio Television Hong Kong (RTHK) documentary in 2014 [5.6]. Importantly, this example demonstrated that recovery can begin within a decade of protection and that understanding can change trader behaviour [3.4, 5.4c].

Importer – Hong Kong/mainland China; illegal trade and government responses

Acknowledging high levels of illegal HHW in the city (from SBS work [5.7]), in 2016 the Hong Kong government issued a dining advisory excluding serving HHW at official functions [5.8a]. The Hong Kong government’s Agriculture, Fisheries, and Conservation Department (AFCD), enforced CITES in the city, and tightened its scrutiny of HHW traders based on this study, resulting in increased confiscations and successful prosecutions for illegal possession as confirmed by government official [5.8b]. Ongoing surveys suggest that illegal retail trade in the city dropped by two-thirds between 2016 and 2018 [3.6]. Use of Napoleon facial features in expert witness testimony to Hong Kong government enforcers produced successful legal action [3.6, 5.8b]. In 2018, mainland China listed the HHW as a Class II protected species.

Informing the public about conservation-dependent reef fishes

Extensive outreach and communication on the originally little-known HHW led to significant media coverage, reaching millions of people over the last five years. Although impact is difficult to evaluate, a combination of TEDx [5.9] and Rotary Club talks, TV documentaries in Hong Kong (e.g., Pearl TV), multiple press, as well as magazine, radio, and podcast outputs exposed the threats faced by this species to thousands of people [5.10]. The vulnerabilities of aggregating reef fish, like

Napoleon, and Prof. Sadovy's work on that subject, featured in the BBC's Blue Planet II series in 2017 (Episode 3), reaching tens of millions of people globally.

(5) Sources to corroborate the impact

[5.1] Ma, K. Y., Colin, P. L., Sadovy de Mitcheson, Y. & Dawson, M. N. 2019. Phylogeography and conservation biogeography of the humphead wrasse, *Cheilinus undulatus*. *Frontiers of Biogeography* 11;doi.org/10.21425/F5FBG42697

[5.2] Vincent, A. C. J., Sadovy de Mitcheson, Y., Fowler, S. L., Lieberman, S. 2014. The role of CITES in the conservation of marine fishes subject to international trade. *Fish and Fisheries* 15: 563-592. DOI: 10.1111/faf.12035 (78 citations)

[5.3] Two National Plans of Action, both, heavily using SBS's work: (a) Indonesia "Rencana Aksi Nasional Konservasi NAPOLEON NPOA 2016–2020" (2016), and (b) the Philippines NAPOLEON WRASSE (*Cheilinus undulatus*) "Mameng" PHILIPPINE STATUS REPORT AND NATIONAL PLAN OF ACTION 2017-2022 (2017)

[5.4] Letters of acknowledgement of SBS role in conservation (a) Letter from Mr Andi Rusandi, Director of Marine Conservation and Biodiversity, government of Indonesia, highlighting influence of SBS work on Indonesia policy and action for HHW (2019) (b) Email from Dr Kim Friedman, Senior Fisheries Officer, FAO (2019); (c) Letter from Pulau Mas company headed by the major Indonesian trader/exporter of HHW who stopped trading HHW at 55 stations and introduced more sustainable practices for live fish trading, in general, due to SBS's work in Indonesia (2019). Recovery at one of these sites is documented in [3.4]

[5.5] Confiscated fish released in Indonesia – article in Jakarta Post 2016: all Indonesia initiatives are outcomes of the CITES listing which was largely based on SBS's work (2016).

[5.6] RTHK documentary on Napoleon wrasse Indonesia (2014) co-produced by SBS team: http://podcast.rthk.hk/podcast/item_epi.php?pid=649&lang=en-US&id=40642

[5.7] Wu, J., and Sadovy de Mitcheson, Y., 2016. Humphead (Napoleon) Wrasse *Cheilinus undulatus* trade into and through Hong Kong. IUCN and TRAFFIC. Hong Kong, SAR. 32 pp (2016).

[5.8] (a) Government Action: Government Updated Seafood Policy prohibits consumption of HHW at government events: <https://www.wwf.org.hk/en/?17760/WWF-Welcomes-the-Government-Updated-Seafood-Policy> (2016). (b) Letter from Mr Boris Kwan of AFCD CITES office on government work prompted by SBS studies expert witness testimony by Prof. Sadovy leading to prosecutions (2017)

[5.9] TEDx talk - Hope for the Humphead: <https://www.youtube.com/watch?v=D57teKLakC4> (2,600 views) (2018)

[5.10] Media exposure examples: (a) 'Stopping the Traffic' article in Hong Kong Tatler included Humphead wrasse (2018); (b) (2018); 'The HHW: one of the world's most endangered coral reef fish.....' in the South China Morning Post (2019); (c) Four-part series PODCAST on exotic seafood-HHW in #2: <https://chinadialogueocean.net/9554-podcast-chinas-trade-in-exotic-marine-species> (2019) (reaching thousands of people).

Figure 1 Detailed facial markings of the HHW can be used like 'fingerprints' to trace individuals and reduce laundering (*i.e. replacement of legally imported fish by illegal imports) in Hong Kong. A mobile phone 'app' is being trialled by officers of the Hong Kong government to improve enforcement and has already been part of successful prosecutions [3.6, 5.7b].

