CrossMark

Assessing the changes in international trade of marine fishes under CITES regulations – A case study of seahorses

Ting-Chun Kuo*, Amanda Vincent

Project Seahorse, Institute for the Oceans and Fisheries, The University of British Columbia, 2202 Main Mall, Vancouver, Canada V6T 1Z4

ARTICLE INFO

ABSTRACT

Trade regulations may be useful for conserving marine species that are suffering from overexploitation. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) has emerged as an instrument to help tighten fisheries management. However, the impacts of CITES regulations have not been examined for the trade in fully marine fishes. This study used seahorses (*Hippocampus* spp.), the first fully marine fishes listed in CITES Appendix II since treaty inception, as a case study. Drawing on Customs data from Taiwan and Hong Kong SAR (which cover pre-CITES periods), iterative-segmented regressions were applied to investigate changes in seahorse trade corresponding to CITES interventions. Principal component analyses were conducted to understand characteristics of seahorse source countries, and a gravity model of trade was applied to identify predictors of seahorse trade volumes. This study found that the total weight of seahorses in documented trade decreased significantly after CITES implementation, recorded trade became concentrated in fewer countries, and prices increased. Seahorse source countries were found having more fishers, demersal fish catch and general trade with China, compared to other range states. However, countries that reported no exports, unchanged export volumes or declining volumes after CITES were similar. In addition, volumes traded between two countries were found significantly higher when the two countries were closer together or when the source country had a lower per capita GDP or higher demersal catch. This study can help guide targeted actions to maximize CITES effectiveness for marine species.

1. Introduction

Commoditization of wildlife has shifted the driver of wildlife exploitation away from supporting livelihoods toward supporting local and global markets [23], and increased the scale of exploitation to an extent that it poses a significant threat to species survival. Over-exploitation from activities such as logging, hunting, and fishing, directly leads to population declines and habitat destruction as evidenced by the more than 2700 animal species listed as near-threatened or threatened on the IUCN Red List [35]. Wildlife is extracted not only for subsistence use, but also for local and international timber, food, medicine, fashion and pet markets, among many others. The global value of imports of wildlife products was estimated in 2009 at about USD323 billion, coming from trade in tens of thousands of species [22]. Monetizing the value of species could accelerate the exploitation rates of wild animals and plants [17]. For example, despite a long history of local consumption of Sunda pangolins (*Manis javanica*) and Burmese starred tortoise (*Geochelone platynota*), increasing international market demands have driven these species to near extinction in just a few decades

(both species are now considered Critically Endangered on the IUCN Red List).

When trade expands to global levels, its large-scale and asymmetric nature results in disproportionate exploitation among different regions, and difficulties in management [12,18]. Globalization allows consumers to access natural resources across borders. When demand increases beyond what a country can provide, buyers would seek new suppliers in other countries [9]. Such exploitation expansion has been well documented in the trade of many species, including sea cucumber [3] and sea urchin [4]. Following the expansion in trade, serial depletion has been identified in several local resources (e.g., [39]). In addition, industrialized countries consume an unequal proportion of traded environmental resources when compared to less developed countries [55]. This typically leads to over exploitation of natural resources in developing countries because of the lack of capacity and resources to manage such exploitation [13]. While the supply and demand of international trade are separated from local management efforts, collaborations among national governments are urgently required to conserve global biodiversity.

The largest collaboration for regulating the complicated international wildlife trade is the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) [54]. The main purpose of CITES is to ensure the sustainability of wildlife under the globalization of trade [14]. Species listed in different CITES Appendices are according to the degree that they are threatened by trade [14]. Trade in Appendix I species is basically prohibited, while the trade of species in Appendix II has to be accompanied with permits and determined not detrimental to the wild populations. Appendix III includes species that one range state (countries where the species occurs) has asked other countries to assist in protecting their sustainability. To respond to CITES' requirements, countries have used various methods to control their wildlife supply, including limiting the number of hunting licenses, closed seasons, and bans [43,6]. However, if and how those efforts lead to changes in trade are still unclear.

To date, evaluations of changes in wildlife trade linked to CITES listings have varied across countries and species. Multiple factors have been associated with changes in trade under CITES, such as source countries' capacity in improving management and historic/cultural value of the trade to stakeholders [21,44]. For example, for the amphibian and reptile species listed in CITES Appendix II, their trade volume of wild animals has declined globally [38,44]. This was due in part to the success of ranching and captive-breeding activities [38,44]. Such increases in captive-bred animals mostly happened in the countries where funding and expertise are available [29,44]. In addition, increased retail prices have also been documented for various CITES species, including mammals, amphibians, and reptiles [12,17]. However, previous studies about the impacts of CITES regulations on trade have mainly focused on terrestrial species. Currently it is still unclear how CITES may affect the trade of marine fishes – one of the biggest groups that suffer from over-exploitation.

Can CITES also provoke changes in the trade of marine fishes? If so, what are the determinants of such changes? In 2014, more than 78% of seafood products, of which 81 million tonnes were wild-caught marine fishes, entered international trade [23]. Analysis of FAO trade data for fisheries products indicated that bilateral trade volume was determined by geographical distance between two countries, the production volume of the source country, per capita consumption in the destination country, and regional trade agreements [37]. But when there is a global trade restriction, do these factors still associate with the variations in trade volume? Previous analyses of the effects of food safety standards set by the United States, Japan and European Union found such restrictions in seafood imports benefit developed countries rather than developing countries [2,8]. Trade regulations for combating illegal fishing, e.g., EU's "yellow cards", were not found to have impacts on the sources of seafood imports, at least not when the analysis was done in 2014 [20]. However, trade sanctions on selected countries issued by regional fisheries management organizations (e.g., ICCAT) have resulted in decreasing imports of regulated fish species from those states [31]. Since 2002, an increasing number of marine fishes have been proposed for CITES listing [16,54]. However, the impact of CITES on the global trade patterns of marine fishes has not been studied.

Seahorses (*Hippocampus* spp.), the first marine fishes listed in CITES Appendix II since its inception, serve as an invaluable example to examine the impacts of CITES on trade. Seahorses are mainly traded dry for traditional medicine and curios, but also live for aquarium uses. Around 37 million dried seahorses are caught incidentally by non-selective gears each year, and the trade is widely occurring across the globe with as many as 80 countries involved [24,32,54]. All seahorse species were listed in CITES Appendix II in 2002, and the listing was implemented in mid 2004. Customs records from two major seahorse markets, Hong Kong and Taiwan, contain seahorse import data from the pre-CITES period (1983 and 1998, respectively) and provide an opportunity to investigate the changes in seahorse trade coinciding CITES interventions.

This study aims to investigate if and how CITES affects the trade

volumes, prices, and trade routes of marine fishes, using seahorses as a case study. Moreover, different country-level characteristics were examined across countries to find indicators for the changes in each country's seahorse exports. This study focuses on the trade of wild, dried seahorses, which accounted for 97% of all seahorses reported in trade [24]. The hypotheses in this study are: the global trade volume of seahorses would decline and the supply of seahorses would be dominated by few countries after CITES listing, because countries that were unable to ensure the sustainability of their trade would have to suspend their exports. In contrast, prices would increase since the demand was not satisfied by the decreased volumes.

2. Methods

To identify the changes in trade after CITES interventions, seahorse trade data were collected from two Customs datasets and the CITES trade database. Then, country attributes were examined to determine if they were associated with (1) whether a range state reported as exporting seahorses; (2) whether exports from a seahorse source country were reported as significant dropping or stopping after CITES implementation; and (3) the bilateral trade volumes. The datasets and analyses are described as follows.

2.1. Trade data

Three independent data sets were used to examine the changes in global seahorse trade over time: (1) import and re-export data from Hong Kong Census and Statistics Department (CSD) [30], (2) import data from Taiwan Customs (https://portal.sw.nat.gov.tw/APGA/GA03, accessed October 31, 2015), and (3) the CITES trade database (http://trade.cites.org, accessed June 24, 2016). While Hong Kong and Taiwan data include both import quantity and price of dried seahorses, CITES data include only the quantity traded.

The data from Hong Kong Census and Statistics Department were sourced from 1998 to 2014 (CSD, Hong Kong Department of Census and Statistics 2015). The analyses of Hong Kong's data focused on the imports from the Countries of Origin – countries where products were produced or had undergone the last permanent transformation [30]. Countries of Consignment, the products' last stop before Hong Kong, were not considered in this study because they were usually not the sources of seahorses [30]. The import prices in CSD statistics were converted from Hong Kong Dollars to US Dollars, based on the exchange rate of each year, (http://www.usforex.com, accessed June 20, 2016,). Note that Hong Kong CSD data are independent of Hong Kong's reports to CITES, since CSD are Customs records and CITES reporting in Hong Kong is controlled by the Agriculture, Fisheries and Conservation Department (AFCD). The reports from AFCD are based on the CITES permits submitted by the importers and re-exporters.

Seahorse trade data from Taiwan's Customs covers 1983–2014 (https://portal.sw.nat.gov.tw/APGA/GA03, accessed October 31, 2015). Taiwan's data included the annual dried seahorse import weights from the origin and the import values (in USD), however the import values in the dataset were only broken down by country after 2002. The annual import values were divided by the import weights to calculate the mean price per kilogram for seahorses from each country. Since Taiwan is not a member of CITES, the Customs data is independent to the data in the CITES database. The data of seahorse traded to or from Taiwan in the CITES database are reported by CITES members.

The data for global dried seahorse trade were extracted from the CITES trade database (http://trade.cites.org, accessed June 24, 2016) for 2005–2013, to examine the global pattern of seahorse trade in the post-CITES period. The CITES data before 2005 were excluded in the analyses, since CITES implementation for seahorses started in May 2004 and prior to this countries were not required to report their trade. Only commercial trade of *Hippocampus* species was considered, and the