CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

Eighteenth meeting of the Conference of the Parties
Colombo (Sri Lanka), 23 May – 3 June 2019

CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II

A. Proposal

Inclusion of the following three species belonging to the subgenus *Holothuria (Microthele)*: *Holothuria (Microthele) fuscogilva, Holothuria (Microthele) nobilis* and *Holothuria (Microthele) whitmaei* in Appendix II, in accordance with Article II paragraph 2 (a) of the Convention and satisfying Criteria A and B in Annex 2a of Resolution Conf. 9.24 (Rev. CoP17).

B. Proponent

European Union, Kenya, Senegal, Seychelles and United States of America[*]:

C. Supporting statement

1. Taxonomy (Miller *et al.* 2017)

1.1. Class: Holothuroidea

1.2. Order: Holothuriida

1.3. Family: Holothuriidae

1.4. Genus, species or subspecies, including author and year

in the three species belong to the subgenus *Holothuria (Microthele)* Brandt, 1835:

Holothuria (Microthele) fuscogilva Cherbonnier, 1980[1]
Holothuria (Microthele) nobilis (Selenka, 1867)[1,2] including *Holothuria (Microthele)* sp. “pentrd”[3]
Holothuria (Microthele) whitmaei Bell, 1887[2]

1.5. Scientific synonyms (WoRMS 2017)

Species	Synonyms, in alphabetical order
Holothuria (Microthele) fuscogilva	*Holothuria fuscogilva* (Cherbonnier, 1980)

[*] *The geographical designations employed in this document do not imply the expression of any opinion whatsoever on the part of the CITES Secretariat (or the United Nations Environment Programme) concerning the legal status of any country, territory, or area, or concerning the delimitation of its frontiers or boundaries. The responsibility for the contents of the document rests exclusively with its author.*

[1] Holothuria (Microthele) fuscogilva *was considered as the same species as* Holothuria (Microthele) nobilis *until 1980 (Cherbonnier 1980).*

[2] Holothuria (Microthele) whitmaei, *occurring in the Pacific Ocean, was separated from* Holothuria (Microthele) nobilis*, present in the Indian Ocean, in 2004 (Uthicke et al. 2004a).*

[3] Holothuria (Microthele) nobilis *seems to be considered as a group of species in which* Holothuria *sp. “pentard” is a form that is currently being described. This species, locally named ‘pentard or flower teatfish’, is important for the Seychelles’ exploitation (Aumeeruddy & Conand 2008; Conand 2008).*

Holothuria (Microthele) nobilis	*Microthele nobilis* (Selenka, 1867) *Mülleria nobilis* Selenka, 1867
Holothuria (Microthele) whitmaei	*Holothuria (Bohadschia) whitmaei* Bell, 1887 *Holothuria mammifera* Saville-Kent, 1890 *Muelleria maculata* (Brandt, 1835)

1.6 Common names: English: Teatfish
French: Holothuries à mamelles
Spanish: Holoturias, holoturoideos, pepinos de mar, cohombros, mojón de mar, carajos de mar

Commons names associated with each species as well as local names used in the range countries are respectively mentioned in **Annexes 1 and 2**.

1.7. Code numbers: None

2. Overview

Sea cucumbers, and their processed form named beche-de-mer, play an important role in the Indo-Pacific region among the many invertebrates that are fished since more than a thousand year (Bruckner *et al.* 2003). Their exploitation has risen for the last 25 years and is filling growing international markets seeking for sea cucumbers (Purcell *et al.* 2013; Tanzer *et al.* 2015). As some of the most prized bêche-de-mer, teatfish (**Figure 1**) are part of the most fished and poached sea cucumbers in the tropical Indo-pacific region (Sweet *et al.* 2016). Indeed, *H. fuscogilva*, *H. whitmaei* and *H.nobilis* are the highest-value species and, thus, under greatest demand (Purcell 2014). Their high commercial value, their ease of capture and their vulnerability (due to their biological characteristics, population dynamic and specific habitat type) encourage their overexploitation and therefore contribute to stocks depletion in many coastal areas Teatfish are particularly vulnerable to overfishing due to their life history-traits, i.e. low mobility, density dependent reproduction and external fertilization, as well as presumed slow growth, and late sexual maturity

Biological and commercial data clearly seem to inform thatsea cucumbers may be included in one of the CITES appendices. Because of the past and current exploitation aiming to satisfy international demand, these species matches with criteria for the inclusion in Appendix II. Commercial data represent only part of the global world exchanges because trade can be complex, exportation are not being fully declared and exchanged products can take diverse aspects, dried, salted and refrigerated; distinction between species is also rarely made in commercial results. Sea cucumbers are traditionally exported to several main markets (mostly Hong Kong, the island of Taiwan, Singapore), and then re-exported to countries with large Chinese populations (Conand & Byrne 1993; Conand 2018).

In the past, the inclusion of sea cucumbers in the CITES Appendices has been blocked by the lack of informative tools allowing the identification of commercialized species, and by taxonomical and biological uncertainties. Only one species (*Isostichopus fuscus*) is included in CITES Appendix III (Toral-Granda 2008; Conand *et al.* 2014).

An inclusion of teatfish in CITES Appendix II will permit to manage and sustain their trade in the greatest interest of fishermen, exporters and importers, while preserving these species and therefore let them play their ecological role, and responding to the future generations need (Bruckner *et al.* 2003).

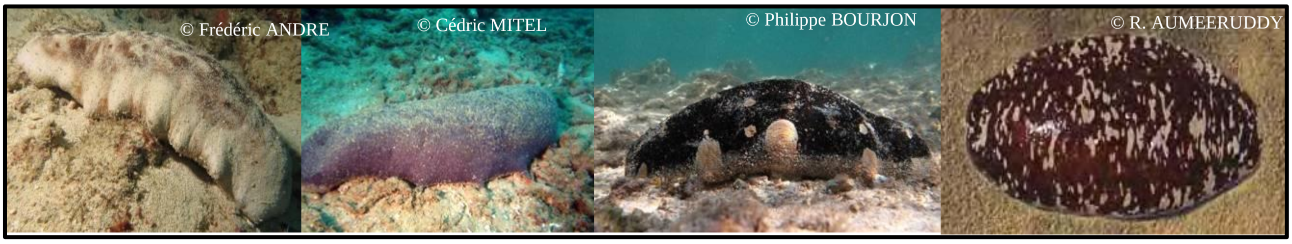


Figure 1. Teatfish species. From left to right: *Holothuria (Microthele) fuscogilva, Holothuria (Microthele) whitmaei, Holothuria (Microthele) nobilis, Holothuria (Microthele) sp. "pentard"*

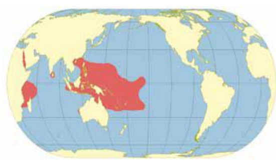
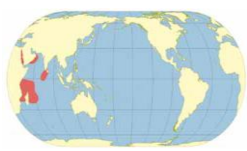
3. Species characteristics

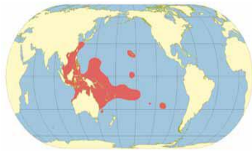
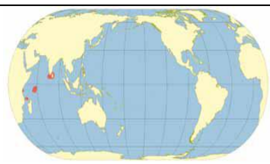
3.1. Distribution (Purcell *et al*. 2012)

Teatfish live in tropical and subtropical waters of the Indo-Pacific region, from the East-African coast to Polynesia (**Figure 2**). The geographical range of each species is mentioned in the **Table 1**.

Figure 2. Distribution of teatfish (modified from Purcell *et al.* 2012)

Table 1. Geographical distribution of each species (Purcell *et al*. 2012)

Species	Ocean/Sea	Country/Region of distribution range	Distribution
Holothuria (Microthele) fuscogilva	Red Sea Indian Ocean Pacific Ocean	Madagascar, Easter Island, from South China to Lord Howe Island, French Polynesia, Réunion, New Caledonia, Scattered Islands, Wallis and Futuna, Mayotte, Salomon Islands, Australia, India, Zanzibar, Tanzania, Madagascar, Philippines, Kiribati, Tonga, Fiji, Papua New Guinea, Sri Lanka, Indonesia, Cook Islands, Egypt, Vanuatu, Kenya, Somalia, Soudan, Eritrea, Yemen, Saudi Arabia, Hawaii (United States of America), Viet Nam, Seychelles, Malaysia, Singapore, Guam, Micronesia, Jordan, Comoros, Djibouti, Samoa, American Samoa, Brunei Darussalam, Christmas Island, Cocos Islands (Keeling), Mozambique, Tuvalu, Marshall Island, small islands away from the United States of America, Northern Mariana Islands, Oman, Palau, Timor-Leste, Norfolk Island, Tokelau, Pitcairn Islands, Nauru, Niue	
Holothuria (Microthele) nobilis	Indian Ocean Red Sea	India, Maldives, Mayotte, Reunion, Scattered Islands, Kenya, Zanzibar, Tanzania, Egypt, Madagascar, Eritrea, Mauritius, Sri Lanka, Seychelles, Mozambique, Sudan, Yemen, Somalia, Israel, Comoros, Jordan, Djibouti, [Chile]	

Holothuria (Microthele) whitmaei	Pacific Ocean	Australia, Hawaii, French Polynesia, South China to Lord Howe Island, 31 ° S (Australia), New Caledonia, French Polynesia, Wallis and Futuna, Kiribati, Viet Nam, Malaysia, Philippines, Tonga, Fiji, Papua New Guinea, Cook Islands, Indonesia, Vanuatu, Cambodia, Singapore, Thailand, Tuvalu, Hawaii (United States), Samoa, American Samoa, Guam, Micronesia, Northern Mariana Islands, Nauru, Niue, Tokelau	
Holothuria (Microthele) sp. "pentard"	Indian Ocean	Comoros, Nosy Be Island (Madagascar), Seychelles, Zanzibar (Tanzania), Maldives, Sri Lanka	

3.2. Habitat (Commission du Pacifique Sud 1995; Purcell *et al*. 2012)

Teatfish live in coastal areas (Conand pers. comm. 2017) at low depth (from the surface to tens of meters), in coral reefs and seagrasses. They are benthic species: they live at the bottom, on sandy substrates. Typical habitats for each species are mentioned in **Table 2**.

Table 2. Species habitats (Conand 1989 ; Commission du Pacifique Sud 1995; Conand 2008; Purcell *et al*. 2012)

Species	**Habitat**	**Depth**
Holothuria (Microthele) fuscogilva	External slopes of coral reefs, fairway of reefs and sandy areas in semi-sheltered reefs. It is also found in seagrasses (Papua-New-Guinea and India). In the Fiji Islands, this species is located in low depth seagrasses and may move to higher depth	- From 10 to 50 meters - From 0 to 40 meters in seagrasses
Holothuria (Microthele) nobilis	- Low depth habitats of coral reefs (lagoons) - In Africa and in Occidental regions of the Indian Ocean: reef flats and reefs slopes - In Madagascar: on the intern slopes and in seagrasses, with a higher abundance on intern slopes - In the Comoros, on coarse sand	- Up to 20 meters - From 0 to 40 meters (Africa et Occidental areas in the Indian Ocean) - From 10 to 40 meters (in the Comoros)
Holothuria (Microthele) whitmaei	In the Occidental central Pacific, the species is found on reef flats and slopes, and sandy seagrasses (not muddy)	From 0 to 20 meters
Holothuria (Microthele) sp. "pentard"	In the Seychelles, this species prefers lagoons on sandy substrate.	From 10 to 50 meters

3.3. Biological characteristics

Teatfish are gonochorist (i.e. separate sex) and reproduce sexually (Conand 1981). As there is no sexual dimorphism, only the microscopic examination of the gonads allows the determination of sex. The teatfish mating strategy consists in the emission of gametes freely in the sea, leading to an external fertilization (Conand 1981; Conand 1986; Toral-Granda 2006). The success of the reproduction directly depends on density of adults to ensure the presence of a sufficient concentration of spermatozoa and oocytes, allowing the encounter and fertilization (Toral-Granda 2006).

For the species *Holothuria fuscogilva, H. nobilis, and H. whitmaei* the reproductive cycle is annual with seasonal spawning periods (Conand 1981; Conand 1989; Conand 1994).The reproduction of *Holothuria (Mictrotele)* sp. 'pentard' is not known (Purcell *et al.* 2012).

The fertilized eggs transform themselves into pelagic larvae that can spend 50 to 90 days in the plankton and are widely dispersed by ocean currents (CITES 2002). In addition to the suspected high mortality of pelagic larvae, other factors affect reproductive success, including low mobility and a small home range. As with other sedentary invertebrates, spawning sea cucumbers must have reached a certain population density to ensure successful fertilization and are particularly sensitive to the Allee effect (defined in section 5 below) (Courchamp *et al.* 2006; Bell *et al.* 2008). The life length of sea cucumbers is at least 20 and 30 years Sexual maturity is reached between 2 and 6 years (CITES 2002), but generally more than 2 years (Uthicke *et al.* 2004b). Sexual maturity is reached at very variable weights according to species (Conand 1989). The sex ratio is balanced for many species (Conand 1986; Conand 1994) including teatfish.

3.4. Morphological characteristics

Teatfish are characterized by a suboval body arched dorsaly (bivium) and a flattened ventrally (trivium), a thick and rigid tegument, a large number of ventral podia arranged tightly and without order, small dorsal papillae, and anal teeth (Purcell *et al.* 2012). The mouth, surrounded by tentacles, is ventral (Purcell *et al.* 2012) **(Figure 3)**.

The three teatfish species have a common morphological characteristic that makes them hard to distinguish one another but easy to identify from other sea cucumbers species.

The main characteristic that distinguishes teatfish from other sea cucumber species species is the presence of lateral protuberances ("teat-like") on the tegument, visible in their live and processed forms (Purcell *et al.* 2012; Conand pers. comm. 2017) **(Figure 3, Table 3)**.

Teatfish are large size species, which can range from 30 to 70 cm depending on the species (**Annex 3**). Their color also varies according to species (**Annex 3**).

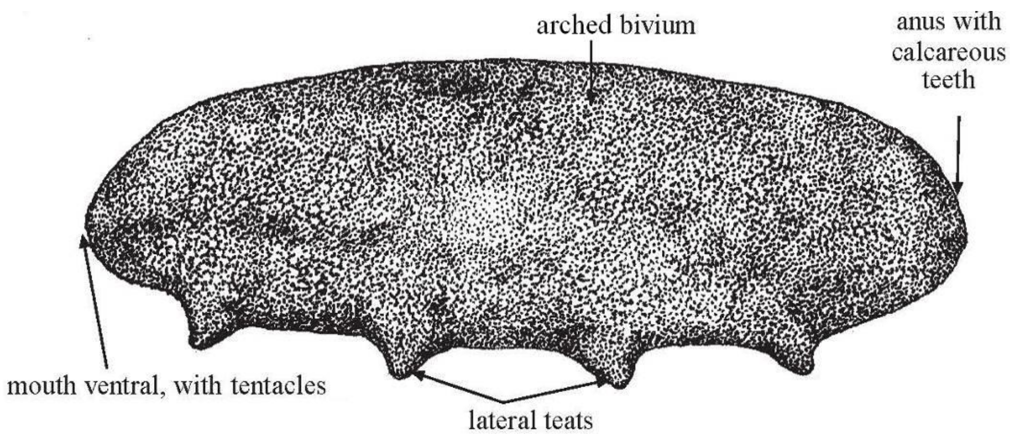
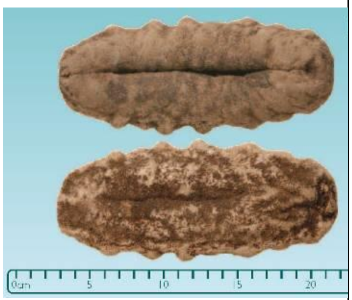


Figure 3. Teatfish schema (here the species *Holothuria whitmaei*) modified from Carpenter & Niem (1998)

Table 3. Appearance of the three teatfish species in their live and dried form (SPC 2004; Purcell *et al.* 2012)

	Holothuria (Microthele) fuscogilva	*Holothuria (Microthele) whitmaei*	*Holothuria (Microthele) nobilis*
Live appearance	Length commonly to : 42 cm Average weight : 2.4 kg Body thickness : 12 mm	Length commonly to : 37 cm Average weight : 1.7 kg Body thickness : 12 mm	Length commonly to : 35 cm Average weight : 2.8 kg Body thickness : 12 mm

			 LIVE (photo by: R. Aumeeruddy)
Processed appearance	- Flat and chunky shape with obvious teats along each side - Surface smooth to slightly wrinkled and powdery - Entire body different shades of grey-brown - One single long straight cut in the upperside - Common size : 18-24cm 	- Flat and chunky shape with obvious teats along each side - Surface powdery, smooth to slightly wrinkled - Powdery cover greyish-brown, but skin underneath black. - One single long straight cut in the upperside - Common size : 16-20cm 	- Flattened, stout shape with obvious teats along both sides of the body - Body surface : powdery greyish-brown, smooth to slightly wrinkled - ventral body wall : usually dirty grey - one single cut dorsally but not completely to the mouth or anus - Common size : 18-24 cm  PROCESSED (photo by: S.W. Purcell)

3.5. Role of the species in its ecosystem (CITES 2002; Purcell *et al.* 2016a)

Teatfish play a role in the functioning of ecosystems and the biological processes of the seabeds (CITES 2002). The role of sea cucumbers can be assimilated to that of earthworms (CITES 2002). Sea cucumbers move and consume sediments and organic matter, returning the upper layers of lagoon sediments, coral reefs and other habitats and promoting the penetration of oxygen (CITES 2002). They represent bioremediators for coastal mariculture (Purcell *et al.* 2016a). Thus, they are important because they determine the habitat structure of other species (CITES 2002). They form an important part of the biomass of the ecosystem (Purcell *et al.* 2016a). In addition, feeding and excretion by sea cucumbers increase the alkalinity of seawater, buffering acidification of the ocean; they contribute tangibly to the resilience of coral reefs (Purcell *et al.* 2016a). However, the potential improvement in calcification of reefs by the influence of sea cucumbers on water chemistry is likely to be effective only in areas where sea cucumbers are present at high densities and where they live close association with coral (Purcell *et al.* 2016a). Sea cucumbers host more than 200 species of symbionts, parasites and commensals (Purcell *et al.* 2016a). These symbiotic relationships increase the biodiversity of the ecosystem, especially in the case of mandatory relationships without which symbionts cannot exist (Purcell *et al.* 2016a). For example, *Holothuria (Microthele) fuscolgiva* is host to four genera of decapod crustaceans and *Holothuria (Microthele) nobilis* that of two genera of annelids (Purcell *et al.* 2016a). They also play a role in the food chain in coral ecosystems at different trophic levels. Some species rely significantly on sea cucumbers as their main food source, including crustaceans, fish and gasteropods (Purcell *et al.* 2016a).

An inscription of teatfish in CITES Appendix II would maintain their ecological roles, essential to the functioning of marine ecosystems, and prevents loss of biodiversity (Purcell *et al.* 2016a). Overexploitation of these species could lead to rapid declines in sea cucumber populations and thus have serious consequences for the survival of other species (predators and sea cucumber symbionts) that are part of the same complex food web, including a “cascading effect” into the ecosystem (CITES 2002; Purcell *et al.* 2016a). This overexploitation would thus have a negative impact on the productivity and diversity of marine habitats where sea cucumbers live: seagrass beds, lagoons and coral reefs (Purcell *et al.* 2016a).

4. Status and trends

4.1. Habitat trends

Three quarters of the world's coral reefs are now threatened, and as a result, the species they host such as sea cucumbers are under strong and increasing pressure (Tanzer *et al.* 2015; WWF 2016). Teatfish range countries have a large area of coral reefs (**Annex 4a**). Pressures on coral reefs that reduce their productivity are numerous: overfishing and destructive fishing (including the use of explosives and cyanide), sediment pollution, nutrients and pesticides, coastal development (deterioration in the quality of water from coastal agriculture, deforestation, coastal navigation and management), but also increased ocean temperatures and acidity due to climate change (Tanzer *et al.* 2015; WWF 2016). If warming and acidification of the oceans reach the levels currently projected, coral reefs may well disappear completely by 2050 (Hoegh-Guldberg *et al.* 2015). Recent studies indicate that coral reefs have lost more than half of their hard corals (reef builders) over the past 30 years (Hoegh-Guldberg *et al.* 2015). Figure 4a shows the strong general decline in the Indo-Pacific coral cover since the 1970s. However, this degradation threatens not only the reefs but the species that depend on them, such as sea cucumbers (Tanzer *et al.* 2015; WWF 2016).

At a global scale, it is estimated that 20% of associated reefs and ecosystems have been irreparably destroyed in recent decades due to anthropogenic and natural pressures. Of the 80% remaining, only 30% would be in a satisfying condition (IFRECOR 2016).

Among the geographic regions where teatfish are located, Southeast Asia is the region most affected by local threats, with 95% of the reefs threatened (Burke *et al.* 2012). As for the Pacific, half of its reefs are threatened (Burke *et al.* 2012). In Southeast Asia and the Indian Ocean where reefs are at their maximum diversity, there are few positive signs of reef recovery as human pressure increases (Wilkinson 2004). Reefs continue to deteriorate as a result of increasing human pressures (Burke *et al.* 2012). The degradation and loss of coral reefs will continue to increase in the future. Demographic growth, increased demand for fish and agricultural products, and coastal development will continue to increase pressure on coral reefs (Burke *et al.* 2012).

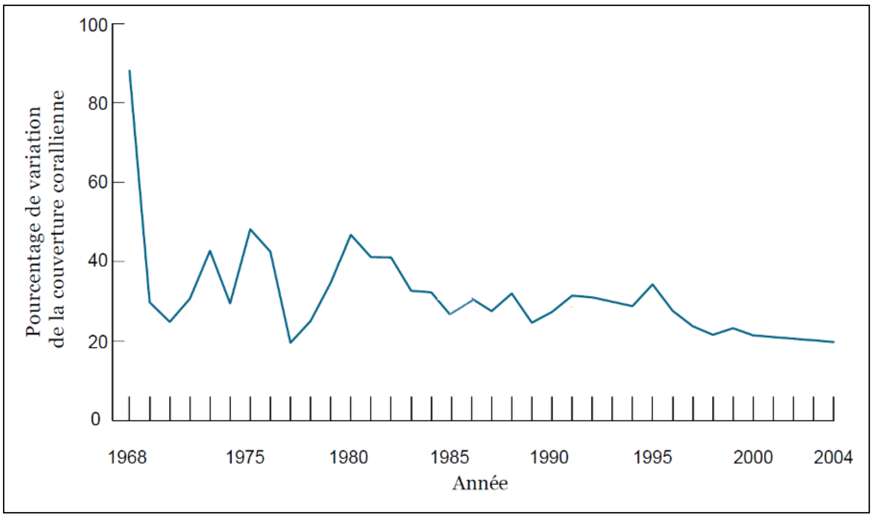


Figure 4a. Percentage of time variation of coral cover in Indo-Pacific region (modified from Tanzer *et al.* 2015)

4.2. Population size

The mean density of each teatfish was estimated in several studies:

– For the species *Holothuria (Microthele) nobilis*, the mean density varies from 0.12 to 10 individuals per hectare (Conand *et al.* 2013a).

– For the species *Holothuria (Microthele) fuscogilva*, the density of its populations does not exceed 40 individuals per hectare (Conand 1989).

– For the species *Holothuria (Microthele) whitmaei*, density does not exceed 12 individuals per hectare in the Pacific (and is much lower in other locations) (Kinch *et al.* 2008). In some sites, the species can be found in higher or lower densities. For example, Purcell *et al.* (2009) showed that the total abundance exceeded 10 individuals per hectare at just 4 sites in New Caledonia. Alternatively, mean density of *H. whitmaei* was calculated at sites of Melanesia, Micronesia and Polynesia between 2002 and 2008, and the mean density did not exceed 4.5 individuals per hectare for each site (except for Palau and New Caledonia) (Pratchett *et al.* 2011).

– In 2008, the density of *H. fuscogilva*, *H. nobilis*, and H. "pentard" was calculated in two regions of Sri Lanka: less than one individual per hectare for all of these species (Dissanayake & Stefansson 2010).

The size of teatfish populations may vary by location, by year and by sampling method; biases may therefore appear.

4.3. Population structure

The sex ratio is balanced for all teatfish species (Conand 1986; Conand 1994).

In general, juvenile sea cucumbers are rarely observed in the field (Conand 1989; Sweet *et al.* 2016). This fact may be due to a number of scenarios (Shiell 2004). Juvenile sea cucumbers have the potential to be misidentified given their potential for morphological differences relative to the adult forms ; they occupy habitats different to that of larger specimens, and they exist in the habitat occupied by the adult form but are obscured from view within sediments or crevices or beneath obscuring objects such as coral (Shiell 2004).

Concerning the genetics of teatfish, *Holothuria whitmaei* has long been taken for *Holothuria nobilis*, but species were separated in 2004 thanks to the use of mtDNA sequences (Uthicke *et al.* 2004a). We find *H. whitmaei* only in the Pacific Ocean and *H. nobilis* in the Indian Ocean. Both species are allopatric (Uthicke *et al.* 2004a). *Holothuria fuscogilva* was also considered to be the same species as *H. nobilis* until 1980 (Cherbonnier 1980; Uthicke *et al.* 2004a).

4.4 Population trends

Overall, sea cucumbers populations are depleted[4] or overexploited in most range countries of teatfish (Purcell *et al.* 2013) (**Annexes 4a and 4b**). These high-value-species are particularly targeted within sea cucumber fisheries.

According to an evaluation of the IUCN (International Union for Conservation of Nature) of Red List published in 2013, populations of *H nobilis, H. whitmaei* and *H. fuscogilva* are declining (Conand *et al.* 2014). While an estimated 60% of global decline was estimated for *H. nobilis* and *H. whitmaei* in the majority of their range, 40% of global declines were estimated for *H. fuscogilva* (Conand *et al*. 2013 a ;b; Purcell *et al.* 2014).

Details are given for every species (Conand *et al.* 2013a; b):

- *Holothuria nobilis*: In Madagascar, stocks are assumed to be depleted as very few specimens have been seen in recent years, particularly in areas that have been heavily (Conand *et al.* 2013a). In Egypt, this species has almost completely disappeared because of fishing (Bruckner 2006). In Tanzania, this species comprised a very small percentage of the total of sea cucumber species (Conand & Muthiga 2007). This species previously dominated the catch and now comprises a very small percentage of the catch. In the Chagos Marine Protected Area, populations have also declined over the past 4 or 5 years due to illegal fishing (Price *et al.* 2010). In Seychelles catches for this species from 2003 to 2008, the data were relatively stable from 2003 to 2006, with a peak

[4] Depletion in this sense refers to commercially unviable, and is estimated to represent between 60-80% loss or greater

of 10,371 individuals and then decreased in 2007 and 2008 to 5687 individuals (Conand *et al.* 2013a). This species has also been depleted in Mozambique, India, Sri Lanka, the Red Sea, the Maldives and possibly Kenya due to overfishing. This species is still actively fished in the Seychelles, where it is not depleted. On the basis of these references, it is estimated that there has been at least 60 to 70% decline in more than 80% of its distribution.

- *Holothuria whitmaei:* In Saipan (CNMI), a fishery targeted this species but stopped in 1997 due to a decline in the CPUE (Catch per unit effort). In the Marshall Islands and the Cook Islands, this species is rare. In Tonga, sea cucumber stocks are depleted. In PNG, sea cucumber stocks are depleted, with low densities of commercial sea cucumbers and comparisons with historical catch data show that this species has been grossly overexploited. In the Solomon Islands, the species was observed in low densities (Kinch *et al*. 2008). This species has been overexploited in the Torres Strait since the 1990s, and its population has decreased by 80% in the Great Barrier Reef in recent decades (Conand *et al.* 2013a). Based on the analysis of catch data, *H. whitmaei* was the only known species to be harvested in the Great Barrier Reef in the 1990's (Uthicke 2004; Eriksson & Byrne 2013). Reaching a typical peak in harvest in the early 1990's, catch of *H. whitmaei* underwent a 70% decline in catch in less than a decade despite increase in fishing effort (Eriksson & Byrne 2013). In Ashmore Reef, populations of this species were considered to be severely depleted in 2000 (Choo 2008). In the Philippines, this species is considered as overexploited in view of the decrease in the number of exports. The species is also overexploited in Indonesia.

- *Holothuria fuscogilva*: This species has been depleted in Southeast Asia and parts of the South Pacific (about 30% of its distribution) (Conand *et al.* 2013b). It is considered mainly overexploited in East Africa (40% of its distribution) (Conand *et al.* 2013b). Shallower waters are more severely affected. In the Cook Islands, *H. fuscogilva* is rare. In some countries of South-East Asia, populations of *H. fuscogilva* are considered severely depleted (Choo 2008), as in Indonesia and the Philippines. In New Caledonia, the species is also considered as depleted (Conand *et al.* 2013b).

A visit to a sea cucumber processing plant, conducted at a workshop on the Indian Ocean sea cucumber fisheries in Tanzania (Zanzibar) (Conand *et al.* 2013c), as for exemple allowed the observation that teatfish (*H. nobilis, H. fuscogilva* and *H.* sp 'pentard') which have a high commercial value, accounted for only a tiny fraction of the large amount of drying products. In addition, most individuals were small. This suggests that populations of highly valued species are decreasing (Conand *et al*. 2013c), which explains why catches increasingly concern low- and medium-value species.

4.5. Geographic trends

See Section 4.4

5. <u>Threats</u>

The main threat to teatfish populations is overfishing in order to meet the demand for beche-de-mer (the product after gutting, cooking, salting and drying sea cucumbers) and supply the international markets for luxury foods. The volume of harvests and the number of fishermen began to increase in the late 1980s in South-East Asia and the South Pacific in response to increasing international demand (CITES 2002). These species are among the most sought after: they are overexploited in many tropical countries for exporting to Southeast Asia (mainly China), where they reach very high prices (Purcell *et al.* 2012; Fabinyi *et al.* 2017). The high commercial value of these species, the ease with which these shallow water forms can be harvested, and their vulnerability due to their biology and population dynamics are combined to contribute to overexploitation and collapsing of the fishery industry in some regions. Sea cucumbers are sedentary animals that are particularly vulnerable to overexploitation because they are large in size, easy to collect due to their shallow area of occurrence, and do not require sophisticated fishing techniques. Strong fishing pressure causes a decrease in species biomass density and populations are unable to replenish once they have fallen below critical mass. As gonochorist broadcast spawner, teatfish are particularly vulnerable to the Allee effect, which is characterized failure of reproductive output associated to insufficient density of ripe individuals (Courchamp *et al.* 2006; Bell *et al.* 2008). Moreover, teatfish have a natural low density at many localities compared to some other sea cucumber species (SPC 2013; Purcell, pers. comm. 2019)

Moreover, despite the commercial importance of teatfish, there is still much to learn about their biology, ecology and the dynamics of their populations. This lack of scientific information thus constitutes an indirect threat, since it is essential to establish comprehensive management plans capable of ensuring the conservation of these species and sustainable harvesting schemes (Toral-Granda 2006). The species

Holothuria sp 'pentard' which has not yet been described, demonstrates current gaps in taxonomy even for large commercial species (Conand 2008; Conand 2017a).

Habitat degradation and loss also contribute to the decline of teatfish. These species are found in coral reefs that are degraded by climatic oscillations (e.g. El Niño), ecological disasters (e.g. tsunamis), and many other anthropogenic degradation, including (e.g. the use of explosives and poison), as well as coastal pollution and sedimentation (Toral-Granda 2006).

Teatfish species are now considered as threatened by extinction and are thus listed on the IUCN Red List: *Holothuria (Microthele) nobilis* and *Holothuria (Microthele) whitmaei* are considered "Endangered" and *Holothuria (Microthele) fuscogilva* is considered "Vulnerable" (Conand *et al.* 2014). Indeed, according to the IUCN criteria and as previously mentioned in section 4.4, *H. nobilis* and *H. whitmaei* have undergone a population size reduction of ≥50% over the last 10 years or three generations based on (1) an index of abundance appropriate to the taxon and (2) actual or potential levels of exploitation, whereas *H. fuscogilva* has undergone a reduction of ≥30% over the same period (IUCN 2012). We can explain this lower population size reduction for *H. fuscogilva* compared to the two other species by the fact that *H. fuscogilva* is mostly encountered between 20 and 30 m (Conand *et al.* 2013b ; Eriksson & Byrne 2013) whereas *H. nobilis* and *H. whitmaei* are more common at shallower depth (Conand *et al.* 2013a). Hence, these one are easier to collect and are exposed to a greater risk (Purcell pers. comm. 2019). As a result, the stocks of *H.whitmaei* decreased and effort was transferred to the deeper water *H. fuscogilva* (Eriksson & Byrne 2013).

6. Utilization and trade

6.1. National utilization

6.1.1. Sampling methods

Fishers can operate from the shoreline and harvest sea cucumbers by hand in shallow waters, collecting them on reef flats at low tide by wading, or using small wooden or glass boat, equipped with an outboard or fixed engine, to access populations offshore or in deeper waters.

Sea cucumber fishing gears vary from area to area, ranging from mask only to modern diving equipment (Purcell *et al*. 2016c). Breath-hold diving gears are often used in fishing of other reef resources, such as octopus, lobster and finfish, which may be encountered while searching for sea cucumber (Purcell *et al*. 2016c).

Fishing methods, usually gleaning, breath-hold diving and SCUBA diving, also vary among countries (Purcell *et al*. 2016c). In tropical waters, sea cucumbers are commonly collected by hand on shallow coral reefs and inshore sandy habitats (SPC 2013; Purcell *et al*. 2016c).

In Kiribati, Tonga, New Caledonia and Fiji, the main fishing method was breath-hold diving (Purcell *et al*. 2016c). The dive fishers travelled to fishing sites using sail and paddle-driven canoes or small boats that were usually 5–7 m long with 15–40 hp outboard engines (Purcell *et al*. 2016c). Breath-hold diving gear was sometimes very basic (Purcell *et al*. 2016c). A significant proportion of fishers also glean (wade in ankle to knee-deep waters) on reef flats to collect a variety of species, especially in Kiribati and New Caledonia (Purcell *et al*. 2016c).

Lead bombs, comprising a large weight with a barbed shaft are lowered by rope by divers to access deep-water species, especially white teatfish *Holothuria fuscogilva* (Purcell *et al*. 2016c). Lead bombs were not used in New Caledonia, and used by around one-quarter of fishers in Kiribati and Fiji and more than half of the fishers in Tonga (Purcell *et al*. 2016c). Lead bombs are prohibited in some fisheries through a regulation of collection by hand only, to limit over-exploitation of deep-water stocks and prevent damage to the animals which affects export quality (Purcell *et al*. 2016c). The common usage of lead bomb in Tonga is indicative of over-exploitation of shallow-water stocks (Purcell *et al*. 2016c). In contrast, fishers in New Caledonia were not using lead bombs at the time of survey, even though these were not prohibited in the provincial fisheries (Purcell *et al*. 2016c).

6.1.2. Levels and types of use

The beche-de-mer trade is mainly aimed at supplying the eastern markets with luxury foods. The main consumer markets are China, Hong Kong SAR (Special Administrative Region), the island of Taiwan, Singapore, Korea and Malaysia (Ferdouse 2004; Toral-Granda 2006). Sea cucumbers have a high nutritional value because they are high in protein (up to 50% protein content, (Rodríguez Forero *et al.* 2013) low in lipids, rich in amino acids and trace elements, all of which make it a highly sought-after food (Chen 2004).

Since the late 1990s, additional markets have emerged for biomedical research. Bioprospectors have been interested in sea cucumbers for the research and development of natural products. Sea cucumber harbors various chemical compounds used to prevent anemia, combat certain forms of cancer, strengthen immune defenses and alleviate arthritis pain (Chen 2004). Sea cucumbers contain chondroitin and glucosamine, which are important components for cartilage formation, as well as other bio-active substances that have anti-inflammatory and anti-tumor properties (Mindell 1998). In China, sea cucumbers are considered a traditional remedy and a drug, and their use dates back to the Ming dynasty (1368-1644 AC) (Chen 2004). This has led to the development of ancestral traditions, particularly in coastal communities, where the consumption of sea cucumber is part of the usages and customs (Chen 2004). There is also recreational fishing in Australia, which is subject to regulation (total catch from the recreational and Indigenous sectors is thought to be very small) (Australian authorities, pers. comm. 2018).

Even if subsistence consumption of sea cucumbers is generally uncommon, it does exist in somes countries such as Tonga or Fiji (Purcell *et al*. 2016b). In Tonga, local people occasionally eat some sea cucumber species, including *H. whitmaei* (Purcell *et al.* 2016b). Even though, only 4% of Tongan fishers eat sea cucumbers often.

6.2. Legal trade

Since individual species are rarely differentiated in trade statistics, this item presents the trade of all sea cucumber species. As mentioned in items 4.4, 5 and 6.5, teatfish have a high commercial value. Therefore, we assume that the trend of these trade figures is largely extrapolated to teatfish.

The legal trade in beche-de-mer is a highly lucrative market (Toral-Granda 2006): it is an important source of income for many developed and developing countries (Conand 2006a); it is also one of the oldest forms of trade in the Pacific islands (Conand & Byrne 1993). It aims to meet the needs of oriental markets such as China, where it is mainly consumed as a delicacy (Conand 2006a; Conand 2006b). Most sea cucumbers are imported into Asia, mainly via Hong Kong SAR, Singapore and Taipei, from which they are re-exported to other countries (Ferdouse 2004). The market focuses mainly on dried tropical cucumbers (Ferdouse 2004). In the Pacific region, the main producing countries are Papua New Guinea, Solomon Islands, Fiji and Australia (Ferdouse 2004), while in South Asia the main countries of production and / or export are Sri Lanka, Maldives and India (Toral-Granda 2006). Traditional fishers from Indonesia, Papua New Guinea and New Zealand may also have access to marine resources within the Australian Fishing Zone or contiguous waters under bilateral arrangements (Australian authorities, pers. comm. 2018).

The global fishery for sea cucumbers has increased dramatically over the last 25 years (**Figure 4b**). Indeed, in the 1980s and 1990s, more and more countries began to export sea cucumbers and world production increased (Purcell *et al.* 2013) (**Figure 4b**). The global catch of sea cucumbers was estimated at 25,000 tonnes (live) in 1983. The catch consisted mainly of tropical Indo-Pacific species. World withdrawals increased three-fold between 1985 and 1986 and doubled during the 1987-1989 period, in response to increased demand in Asian markets. In 1989, catches totaled 90 000 tonnes worldwide, broken down as follows: 78,000 tonnes from the South Pacific and South-East Asia.

In the longer term, the global sea cucumber fishery has grown from 4,300 tons in 1950 to a record 23,400 tons in 2000, falling to 18,900 tons in 2001 (fresh or frozen, frozen, dried, salted or in brine, canned) (Vannuccini 2004). The increase is likely due to the combination of several factors: new sea cucumber producing countries, more exploited species, increased fishing effort from deep-sea stocks, and finally, gradual expansion of fishing areas (Bruckner 2006). Some countries have experienced dramatic declines in landings due to overexploitation of wild populations. For all species, Indonesia is the world's largest producer, followed by the Philippines with more than 1000 tons (Conand 2006b; Toral-Granda 2006).

Hong Kong SAR import statistics show an increase in the number of countries exporting dried, salted or brine cucumbers: 25 countries in 1989, 49 in 2001 and 78 in 2005 (**Annex 6**) (Toral-Granda 2006). In 2005, eight countries exported more than 1000 tonnes of sea cucumbers each to the Hong Kong

SAR, six countries exported between 500 and 1000 tons, 10 countries between 150 and 500 tons, and the remaining 54 countries recorded lower catches to 150 tonnes (Toral-Granda 2006). The main exporting countries to the Hong Kong SAR are Indonesia, the Philippines, Papua New Guinea, Singapore and Fiji (Toral-Granda 2006).

It is estimated, however, that the available trade figures would underestimate the total volume of world trade, given that trade chains are complex, incomplete export data and individual species rarely differentiated in trade statistics (Ferdouse 2004). FAO trade figures on world exports are low due to the lack of data published by exporting countries (Ferdouse 2004; Toral-Granda 2006).

Additional information on the principal values and markets of each Teatfish species is listed in Annex 5.

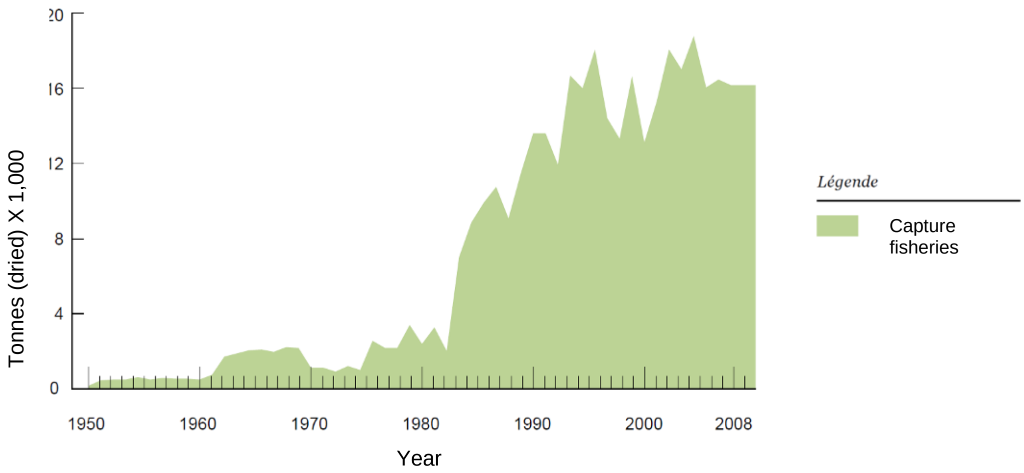


Figure 4b. Global wild captures of sea cucumbers over time; in metric tonnes

Source: FAO Fishstat (Purcell *et al.* 2013)

Despite overexploitation, global catches have increased (Conand 2017b) (**Annex 7**). However, it is also possible that catches are better reported than before and / or that more species are harvested.

Based on an analysis of Purcell *et al*. (2013), the current sea cucumber fisheries in the Indo-Pacific regions are predominantly overexploited or depleted (Purcell *et al.* 2013) **(Annex 8)**.

6.3. Parts and derivatives in trade

As stated in section 6.1, commercial products of sea cucumbers are used mainly for food, but also pharmaceutical and cosmetic purposes (**Figure 5**). Some pharmaceutical companies produce derivatives from the "trepang". These products are in the form of oils, creams and cosmetics, but sometimes also dried specimens (**Figure 5**). There is currently no publication for including or excluding teatfish from pharmaceutical and cosmetic use.

- *Foodstuffs*: The most important product of the sea cucumber is the tegument (i) dried (called trepang, beche-de-mer or hai-som), intended mainly for the Chinese market; (ii) boiled or salted; (iii) dried and (iv) in a traditional dish, cooked in coconut milk (Conand 1990) (**Figure 5**). Specialty products are prepared from viscera such as the fermented intestines (konowata) and dried gonads (kuchiko) of teatfish and are marketed in Japan, Korea and China (Stutterd & Williams 2003).

- *Medical products*: In some countries in East Asia, sea cucumbers are also used as medicines. It has been found that their chemical composition helps to reduce arthritic pain and joint pain, and that the saponins contained in sea cucumbers have anti-inflammatory and anti-cancer properties (Awaluddin 2001). Several commercial products made from sea cucumber extracts have been marketed in recent years, including ArthiSea and SeaCuMax (anti-arthritis medicines), nutritional supplements and Sea Jerky (for joint problems in dogs). In Japan, chondroitin sulfate from sea cucumber is patented for the treatment of HIV / AIDS (Toral-Granda 2006).

The sea cucumber tegument contains chemicals with antibacterial and antifungal properties (Hamel & Mercier 1997), and is also considered aphrodisiac in China (Uthicke & Klumpp 1996; Rodríguez Forero *et al.* 2013).

Figure 5. Examples of sea cucumber products commercialized. On the 4 photos above, teatfish for sale in dried seafood retail shop in Sheung Wan, Hong Kong (2013). In the bottom, cooked meals made from sea cucumbers (undetermined species) (sea cucumbers in the sauce on the left and fried sea cucumber on the right).

6.4. Illegal trade

Overall, illegal sea cucumber fisheries are characterized by:

- poaching and exports by nationals in remote areas, MPAs (marine protected areas), the use of illicit devices, the existence of different regulations between regions of a country;
- poaching and exporting by foreigners in the majority of cases by temporary bandits 'poach and go', Chinese entrepreneurs, in remote areas, countries with low regulations, poor countries (Conand 2016; Conand 2017a).

Most illegal activities are fueled by international buyers who put pressure on local fishermen by offering high prices for sea cucumbers. In general, fishermen find themselves in a 'loan-to-debt' cycle that favors illegal activities (e.g. prohibited species, animals that are too small or harvested outside the fishing season). Illegal sea cucumber fishing can lead to over-exploitation of the most popular species. It should be emphasized, however, that illegal trade, both national and international, can cause serious problems in some regions and that the support of all countries of the world should be sought to halt this practice and ensure the conservation of sea cucumbers (Toral-Granda 2006).

Illegal sea cucumber fishing is a long-standing issue. In the 1700s, the inhabitants of Macassar, the capital of the island today called Sulawesi (Indonesia), crossed the Timor Sea to fish in the region now known as the Northern Territory in Australia (Stutterd & Williams 2003). In northern Australia, there is an accreditation process (MoU). In some areas, illegal Indonesian or Vietnamese fishermen come to fish high value species (including *H. fuscogilva*) and are sometimes apprehended (Conand 2017a). Since regular surveillance and monitoring have been put in place, the number of reported IUU incidents in Australian waters has declined over the past decade (Australian authorities, pers. comm. 2018).

In several islands and territories of the tropical Pacific (Hawaii, Palau for example) illegal fishermen have recently been arrested and their boats burned by the authorities, for example. Elsewhere, as in New Caledonia and Fiji, activities have been modernized, attention has been drawn to scientific research and the quality of treatment improved (Conand 2017a). Finally, in some islands, this fishery is prohibited (Conand 2017a).

Re-export data from Hong Kong indicate that since 2004, Vietnam has replaced China as the primary recipient for products re-exported from Hong Kong (To & Shea 2012) (**Figure 6**), however, it is expected that re-exported products are still destined for consumers in China (Eriksson & Clarke 2015). The altered trade route could potentially be a response to circumvent new tariffs that made direct importation unattractive for traders (Eriksson & Clarke 2015). Vietnam has become a regional center for wildlife trafficking (Ngoc & Wyatt 2013) and it is possible that sea cucumbers may be caught up in this dynamic (Eriksson & Clarke 2015). It is believed that products still flow through traders in Hong Kong (i.e. rather than being shipped directly to Vietnam) for the sake of maintaining long-established trading networks (Eriksson & Clarke 2015).

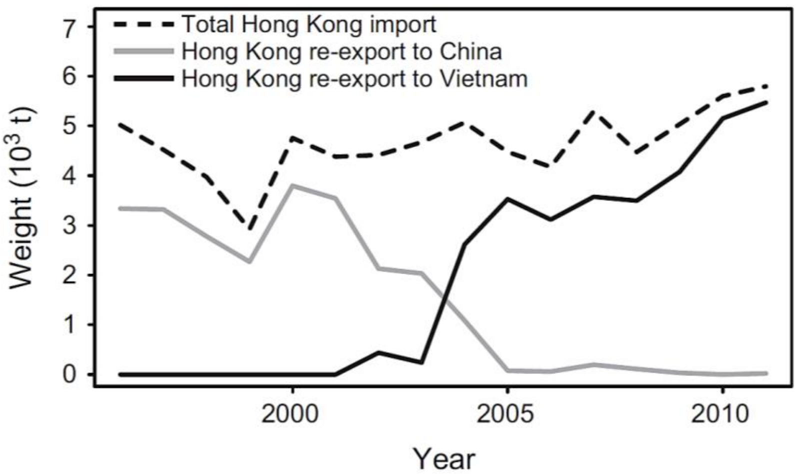


Figure 6. Total Hong Kong imports and shifting trends in re-export of sea cucumber to China and Vietnam (data: Hong Kong Census and Statistics Department)

Since 2016, Vietnamese fishermen have been illegally fishing sea cucumbers off New Caledonia. If they still live in numbers in the waters near New Caledonia, sea cucumbers have been the victims of overfishing elsewhere, which is why Vietnamese poachers move to New Caledonia. Under the aegis of the General Secretariat of the Sea, a meeting on illegal fishing in New Caledonian waters was scheduled for mid-March 2017 in Paris to set up an inter-ministerial plan (Sciences & avenir 2017).

In several countries of the Western Indian Ocean, recent arrests of poachers are taking place in Marine Parks (e.g. Mombasa Park, Kenya). In Tanzania, fishermen were apprehended in the Chumbe and Mafia Parks; they were trying to bring their catch to Zanzibar where fishing is not prohibited (Eriksson *et al.* 2012; Conand 2017a).

In Madagascar, there are old fisheries, for which research projects and management plans have been implemented by regional bodies (IOC, WIOMSA, FAO). Knowledge has advanced (Conand & Muthiga 2007) but illegal fisheries have various forms;

The Seychelles, the Chagos and the Scattered islands are characterized by many isolated reef islands, where surveillance is difficult to enforce, favors illegal fishing by domestic or foreign fishermen. In the Seychelles, the legal diving fishery targets different species, mainly *H. (Microthele) sp*. 'pentard' (Conand 2017a). In May 2001, 110 Malagasy fishermen were arrested for illegal fishing in the Seychelles, and several tonnes of sea cucumbers were confiscated (Rasolofonirina *et al*. 2004). In the

Eparse Islands (French) managed by the TAAF, the apprehension of poachers occurs quite often and the collaboration between supervisory and research organizations should make it possible to better fight against this scourge (Conand 2017a). Also, Philippine vessels fish illegally in the waters of Malaysia.

By its very nature, it is difficult to establish the volume and value of illegal, unreported and unregulated trade (IUU) (Toral-Granda 2006).

In order to limit the scale of this illegal trade, it would be necessary to improve fishery statistics, monitor market trends, carry out inspections at sea and on coasts, promote cooperation between customs, enforcement of international regulations and penalties (Conand 2017a).

6.5 Actual or potential trade impacts

The international demand for the trade of sea cucumbers is the main cause of the marked decline of teatfish populations (Bruckner *et al.* 2003). The occurrence of serial depletions have been observed in many sea cucumbers fisheries with a shift of fishing operations from shallow to deeper waters, with a change in dominant catch species from high-value to low-value species and with a decrease in the size of targeted specimen (Friedman *et al*. 2011; Eriksson & Byrne 2013).Teatfish populations are typically part of the first species to become depleted because of their particularly high commercial value, as happened typically in early stage of sea cucumber fishery in the Great barrier Reef Park (Eriksson & Byrne 2013).

Sea cucumber populations are declining everywhere in the countries where they are exploited (Bruckner *et al.* 2003). Even after the closure of the fishery, sea cucumber populations may not recover, and some studies show that it may take up to 50 years without any fishing pressure to allow the populations of sea cucumbers in overexploited sites to recover (Bruckner *et al.* 2003 ; Bell *et al.* 2005). In addition, teatfish are very popular; they have a very high commercial value, thus exacerbating the risk of extinction (Purcell *et al.* 2012; Purcell 2014; Conand *et al.* 2014; Purcell *et al.* 2016c).

7. Legal instruments

7.1. National

Several countries prohibit the taking of certain species or protect sites to compensate for localized disappearances. These sea cucumber protection measures are summarized by country in **Annex 9** (CITES 2002)**.** These are explained in point 8.1 of this document.

7.2. International

There is currently no existing international instrument to legally protect teatfish.

8. Species management

8.1. Management measures

While sea cucumber fisheries are still not regulated in a number of developing countries, other countries have adopted management measures at various levels (**Annexes 10a and 10b**). In general, these measures include specific areas of permitted and prohibited harvesting, licensing, quota, seasonal harvesting, rotating harvesting and other strategies. One of the most commonly used regulatory measure is minimum size limits (Purcell, pers. comm. 2019). In several countries, sites were closed soon after the opening of the fishery due to overexploitation and rapid biological or commercial disappearance (CITES 2002). In the Great Barrier Reef Park, depletion of *H. whitmaei* stocks prompted the implementation of moratoria for this species (Eriksson & Byrne 2013).

In some places, management of sea cucumber fisheries is based on tenure* systems owned by local communities, particularly in traditional fishing areas. However, with the expansion of this activity into non-traditional areas, loss of ancestral crops and increased demand, commercial fisheries are often poorly managed, resulting in the implementation of an inventory once depletion has already begun. In most developing countries, new fisheries are starting up under open access regimes, and management plans or regulations such as prohibitions (eg. closure of an area) or fishing seasons are not introduced in order to try to mitigate the decline of the resource.

In the tropics, fishing is done at a small-scale (small-scale fisheries in the sense of the artisanal fishing gears and boats) but is of great socio-economic importance (**Annex 4a**) (Conand 2006 a,b). Management measures have been taken in some tropical countries (Altamirano *et al.* 2004; Toral-Granda & Martínez 2004). In most of teatfish range countries, government management of sea cucumber fisheries is in place (**Annex 4a**). Unfortunately, such management is generally poorly applied, probably due to poor human resources and other resources, capacity to implement and control regulations, effective scientific monitoring mechanisms and adequate management measures taking scientific information into account (Bruckner 2005a).

The different types of management measures taken for sea cucumbers are as follows

– **Fishing zones prohibited:** around the world, fishing zones are recognized for the benefits they bring to exploited species (Gell & Roberts 2003). There are a few rare examples for sea cucumbers. In Egypt, prohibited fishing areas had a greater diversity and density of commercial species of sea cucumber (Lawrence *et al.* 2004). In Australia, *Holothuria whitmaei* densities were 75% lower in fished zones than in unfished (Uthicke 2004). Prohibited fishing areas can be beneficial especially when they have been established and approved in conjunction with actors such as fishermen. However, their success depends largely on the continued support of fishing communities, the effectiveness of police measures and the fight against fraud, and tangible benefits for local actors. Selection criteria for the establishment of prohibited fishing areas should take into account the type, size, shape and number of habitats, as well as the characteristics of other prohibited fishing areas (Bruckner 2006).

– **Complete closure of fisheries:** in India, in 2001, all species of commercialized sea cucumbers were listed in annex I of the Wildlife Protection Act, which prohibits all fishing activities. This decision was aimed at promoting the recovery of overexploited populations; nevertheless, illegal fishing continues and most stocks are or remain severely depleted (Nithyanandan 2003). Despite its potential benefits for wild populations, a total ban on sea cucumber fishing has significant socioeconomic consequences and has not proved to be effective in practice. For fishermen, such a prohibition, if not accompanied by an alternative, means a significant loss of income and may incite them to fish illegally. Such situation may be even more detrimental to wild sea cucumbers and unfavorable to humans because they can not enforce biological thresholds and pay a fair and equitable price.

** tenure: system of social relations, demands, rights and obligations through which people are able to use the marine spaces and control both the access and the exploitation of the resource*

– **Limited access:** in general, limited access is a licensing system whereby the number of fishers or vessels involved in fishing is limited. This management tool can curb the competition between fishermen and help maintain a fishery. This system also improves compliance with management measures and can help ensure that economic benefits accrue to local communities. In addition, granting land rights to fishermen's cooperatives can help manage open access fisheries. This management approach appears to be effective in developed countries where there are other alternatives for sea cucumber fishers who have been displaced (eg. in Australia). However, in traditional systems, this procedure is difficult to apply since all fishermen have equal rights to exploit their resources. Moreover, this procedure may, as such, prove to be binding on the managing authorities fishing, and even social disturbances and conflicts. Fishermen's cooperatives should be organized so that licenses are only granted to people whose main source of income is the sea cucumber fishery and not to any member of the cooperative. In Fiji, only indigenous fishermen are allowed to fish for sea cucumbers (Stutterd & Williams 2003).

– **Quotas:** quotas or total allowable catches (TACs) are the maximum number of individuals or biomass that can be exploited each year during a fishing season, fishing season or fishing expedition in certain areas, etc. In the sea cucumber fisheries on the eastern coast of Australia a TAC for the species *Holothuria fuscogilva* was introduced after the collapse of the *Holothuria whitmaei* fishery in 1999. The TAC for *Holothuria fuscogilva* is examined each year while *Holothuria whitamei* is banned from fishing (Stutterd & Williams 2003). In Australia, in the Northern Territory, a TAC of 127 tonnes was set for *Holothuria fuscogilva* (Bruckner 2006). It is combined with a mixture of input and output controls, including temporal and spatial management tools, size and gear restrictions (Australian authorities, pers. comm. 2018) (**Annex 11**). In Papua New Guinea, a quota has been set for each province but is often exceeded (D'Silva 2001).

– **Minimum size limits:** the minimum size limits are based on size at maturity to ensure reproduction of the stock at least once before entering the fisheries. This can help prevent a population collapse due to recruitment failure. In addition, this management tool facilitates the targeting of large individuals who reach higher prices in the market. However, the size and weight of sea cucumbers are largely dependent on the amount of live and processed individuals in the water, which can pose problems in the fight against fraud. However, for many commercial species, biological information is lacking to determine the minimum harvest size. This management tool is also used in Australia, Papua New Guinea, Fiji and Tonga, with other regulatory methods such as quotas. Nevertheless, the minimum sizes set vary by country, region and species. For example, on the west coast of Australia, the minimum landing size was set at 15 cm for all commercial species, while in the western region this minimum size varies by species (Stutterd & Williams 2003). It is important to improve the training of fishermen so that they avoid taking too small individuals. It is also possible that cucumbers rejected because of their small size are sold on the black market at lower prices (Toral-Granda 2006).

Additional information on the management measures applied is in **Annexes 10a, 10b** and **12**.

8.2 Population monitoring

See Section 8.1

8.3 Control measures

8.3.1 International

See Section 8.1

8.3.2 Domestic

See Section 8.1

8.4 Captive breeding and artificial propagation

To protect their sea cucumber populations from overfishing, countries have developed new methods to produce beche-de-mer. These measures have gained importance since methods of reproduction and rearing of larvae and juveniles have been developed for some commercial species (Lovatelli *et al.* 2004).

Kiribati Fisheries on Tarawa are having great success in rearing juvenile teatfish. 20,000 juveniles *Holothuria fuscogilva* have been released locally, on the reefs around Tarawa and neighbouring Abaiang Atoll in 2004 (Friedman & Tekanene 2005).

The sand Holothuria *Holothuria scabra* has been identified as one of the most promising species of sea cucumbers for aquaculture (Pitt & Dinh Quang Duy 2004; Purcell & Kirby 2006), and has been subjected to captive breeding experiments in Australia, India and Viet Nam. Unfortunately, the results to date with other experimental species in aquaculture enterprises have not been positive (Toral-Granda 2006), especially for the species *Holothuria nobilis* (Preston 1990). Ranching operations have also been developed in the Northern Territory of Australia, since 2015, with further juvenile releases planned for 2019 (Australian authorities, pers. comm. 2018).

8.5 Habitat conservation

Some coral reefs in the Pacific and Indian oceans where teatfish live are included in MPAs. An MPA includes areas with restrictions on human activities such as fishing and coastal development. MPAs are one of the most widely used management tools in reef conservation. There are also locally managed marine areas (LMMAs), similar to MPAs but managed locally by people or groups living nearby. Of the coral reefs included in MPAs (27%), more than three-quarters are in Australia (Burke *et al.* 2012).

However, some MPAs are ineffective or offer only partial reef protection. Some sites are ineffective simply because the management framework is ignored or is not enforced. In others, even if the rules are fully implemented and effective, they are insufficient to counter threats within their borders. Also, MPAs are rarely placed in areas where threats are greatest. Another problem is that many reefs are affected by remotely occurring threats, particularly pollutants and sediments from poor land practices or coastal development in areas outside MPA boundaries. Although healthy reefs in MPAs are more resilient to such stresses, MPAs alone cannot provide adequate protection. In some cases, MPAs have enabled considerable progress to be made in land management, pollution reduction and decreased sediment levels from neighboring areas through well-coordinated community consultation surrounding (Burke *et al.* 2012).

Outside these protected areas, there are alternative management methods to preserve the health and resilience of reefs such as fisheries management tools often applied independently of MPAs. Other protective measures apply to marine threats; such as control of spills from ships, sea lanes and anchorage in sensitive areas. Land-based sources of sediment and pollution are managed through coastal zone planning and strengthening, wastewater treatment and integrated watershed management to reduce erosion and releases of agricultural organic materials. Communication efforts, education, capacity building and economic incentives are also essential tools for better understanding of risks to stakeholders, ensuring ongoing implementation of management and monitoring measures for fish stocks and the state reefs (Burke *et al.* 2012).

Actions have been taken to improve the conservation of coral reefs, in particular by the International Coral Reef Initiative (ICRI), which has implemented the Global Coral Reef Monitoring Network (GCRMN) the health of the reefs. If the reefs have concentrated attention for several years, the associated ecosystems, herbaria, have also recently been considered. This is also the case for problems related to chemical contaminants, including pesticides (IFRECOR 2016).

However, there has been no systematic study to determine what proportion of the known habitat or sites of teatfish is found in protected areas, where there may be forms of habitat protection.

9. Information on similar species

Teatfish are easily identifiable by their lateral protrusions, which are clearly visible in the form of "teats". These protuberances are visible in their living form but also in their dried form (when they are processed to be marketed) (**Figure 7**).

Figure 7. Presence of protuberances in the form of "teats" allowing to recognize the subgenus *Holothuria (Microthele)*. Here the species *Holothuria fuscogilva*, in its living form (left) and dried (right).

10. Consultations

A draft proposal was presented as an information document to the 30th meeting of the CITES Animals Committee (Geneva, 16-21 July 2018). A consultation was distributed by the European Union to all range States in April and October 2018, and range State responses are summarized in Annex 13.

11. Additional remarks

No additional remarks.

12. References

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Annex 1

Common English and French names for every teatfish species
(Conand 1990; Purcell *et al.* 2012; Toral-Granda *et al.* 2008)

Working languages of the Convention	**Species**	**Common name**
French	*Holothuria (Microthele) fuscogilva*	Holothurie blanche à mamelles
	Holothuria (Microthele) nobilis	Holothurie noire à mamelles (Océan Indien)
	Holothuria (Microthele) whitmaei	Holothurie noire à mamelles (Pacifique)
	Holothuria (Microthele) sp. "pentard	Holothurie « *pentard* »
English	*Holothuria (Microthele) fuscogilva*	White teatfish
	Holothuria (Microthele) nobilis	Black teatfish
	Holothuria (Microthele) whitmaei	Black teatfish
	Holothuria (Microthele) sp. "pentard	Flower teatfish

Annex 2

Local names of each teatfish species in their range countries
(Purcell *et al.* 2012; Toral-Granda *et al.* 2008)

Range country	Species	Local name
Égypte	*Holothuria* (*Microthele*) *fuscogilva*	Bawny white
	Holothuria (*Microthele*) *nobilis*	Bawny black
Érythrée	*Holothuria* (*Microthele*) *nobilis*	Abu habhab aswed
Fiji	*Holothuria* (*Microthele*) *fuscogilva*	Sucuwalu
	Holothuria (*Microthele*) *whitmaei*	Loaloa
Inde	*Holothuria* (*Microthele*) *fuscogilva*	White mammyfish, Kal attai
	Holothuria (*Microthele*) *nobilis*	Pauni mweusi
Kiribati	*Holothuria* (*Microthele*) *fuscogilva*	Temaïmamma
	Holothuria (*Microthele*) *whitmaei*	Teromamma
Madagascar	*Holothuria* (*Microthele*) *fuscogilva*	Benono
	Holothuria (*Microthele*) *nobilis*	Benono
Malaisie	*Holothuria* (*Microthele*) *whitmaei*	Susu
Maurice	*Holothuria* (*Microthele*) *nobilis*	Barbara
Nouvelle-Calédonie	*Holothuria* (*Microthele*) *fuscogilva*	Le tété blanc
	Holothuria (*Microthele*) *whitmaei*	Le tété noir
Philippines	*Holothuria* (*Microthele*) *fuscogilva*	Susuan
	Holothuria (*Microthele*) *whitmaei*	Black teatfish, Bakungan, Kagisan, Sus-uan
Seychelles	*Holothuria* (*Microthele*) sp. "pentard"	Pentard
Tonga	*Holothuria* (*Microthele*) *fuscogilva*	Huhuvalu hinehina
	Holothuria (*Microthele*) *whitmaei*	Huhuvalu uliuli
Viêt Nam	*Holothuria* (*Microthele*) *whitmaei*	Ñoät ñen ña, Đỏn đột vuù
Wallis-et-Futuna	*Holothuria* (*Microthele*) *whitmaei*	Le tété noir
Zanzibar (Tanzanie)	*Holothuria* (*Microthele*) *fuscogilva*	Pauni myeupe
	Holothuria (*Microthele*) *nobilis*	Pauni mweusi
	Holothuria (*Microthele*) sp. "pentard"	Pauni kaki

Annex 3

Comparative table of the morphological characteristics of teatfish
(Commission du Pacifique Sud 1995; Purcell *et al.* 2012; Purcell *et al.* 2016a)

Species	Size	Morphology	Color	Photo
Holothuria (Microthele) fuscogilva	Maximum length about 57 cm. Average fresh weight from 2 400 g (Madagascar, India and Papua New Guinea) to 3 000 g (Egypt); average fresh length from 40 cm (India and Madagascar), 42 cm (Papua New Guinea) to 60 cm (Egypt). In New Caledonia, average live weight about 2 440 g and average live length about 28 cm.	No Cuvierian tubules Presence of 6 to 8 characteristic large lateral protrusions ('teats') at the ventral margins. The tegument is usually covered by fine sand. Mouth is ventral with 20 stout grey tentacles Anus surrounded by inconspicuous teeth	Colour variable, from completely dark brown, to dark grey with whitish spots, or whitish or beige with dark brown blotches. In the Western Indian Ocean, it tends to be reddishbrown dorsally and white ventrally and the anus is yellow. Ventral surface is greyish to brown. Juveniles are yellowish-green or yellow, with black blotches	
Holothuria (Microthele) nobilis	Maximum length about 60 cm; average length about 35 cm. Average fresh weight: 230 g (Mauritius), 800–3 000 g (Réunion), 1 500 g (Egypt); average fresh length: 14 cm (Mauritius), 35 cm (Réunion), 55 cm (Egypt).	Presence of 6 to 10 characteristic large lateral protrusions ('teats') at the ventral margins. Dorsal podia are sparse and small, while the ventral podia are numerous, short and greyish The tegument is usually covered by fine sand. The mouth is ventral, with 20 stout tentacles. Anus surrounded by 5 small calcareous teeth. Cuvierian tubules absent.	This species is black dorsally with white blotches and spots on the sides of the animal and around the lateral protrusions ('teats'). Juveniles probably differ in colour from adults.	
Holothuria (Microthele) whitmaei	Maximum length about 54 cm; average length is 34 cm. In New Caledonia, average live weight was recorded at 1 800 g and average live length about 23 cm.	Cuvierian tubules are few, short, and not expelled. It possesses 5–10 large stout, pointed, protrusions ('teats') at the lateral margins of the ventral surface, which may retract totally when handled or preserved. The tegument is usually covered by fine sand. Dorsal podia are sparse and small, while the ventral podia are numerous, short and brown to grey	This species is uniformly black dorsally, and dark grey ventrally. Juveniles may have beige or white markings on the dorsal surface but ventrally are usually dark grey.	
Holothuria (Microthele) sp. "pentard"	Average fresh length is 30 cm. Average fresh weight is about 1 675 g.	Presence of 6 to 8 characteristic large lateral protrusions ('teats') at the ventral margins.	Dorsal surface is dark brown and mottled with irregular-shaped, cream coloured, blotches.	

Annex 4a

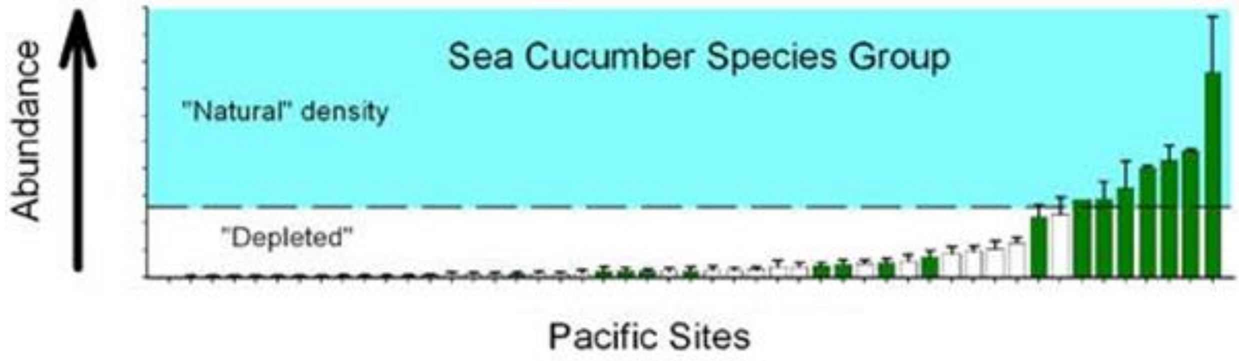
Status and general characteristics of the various fisheries examined
(Purcell *et al.* 2013)

Countries / Independent fisheries	**Scale[a]**	**Status[b]**	**Fishing mode[c]**	**Annual av. export or landing (dried t)**	**Coral reef area (km²)**	**Total No. fishers**	**No. Species harvested**	**Management system[d]**	**Enforcement capacity[e]**
Africa + Indian Ocean									
Chagos	L	O	D	0				G	2
Comoros	L	O	D		430		20	G	1
Egypt	L	D	D	8	3,800	100	14	G	2
Eritrea	S+I	O	D	260	3,260	620	9	G	1
India	L	D	D		5,790		5	G	1
Iran	L		D		700		2	G	
Kenya	S	O	D	25	630	500	13	C	1
Madagascar	S+I	D	D	728	2,230	13,000	22	C	1
Maldives	S	O	D	117	8,920	7,150	9	G	1
Mauritius	L	O	D	300	870	1,200	6	G	2
Mayotte	L	M	D	6	570	85	8	G	2
Mozambique	S	D	D		1,860		21	N	0
Oman	S	O	D	15	530	400	3	G	1
Saudi Arabia	L	D	D	1.3	6,660		9	C	1
Seychelles	I	F	D	27	1,690	100	15	G	3
Sri Lanka	S	O	D	215	680	4,500	24	G	1
Sudan				0.6	2,720				
Tanzania	L	O	D	12	3,580	100	20	G	1
(Zanzibar)	S	O	D	60		800	28	G	1
United Arab Emirates				20	1,190				
Yemen				9	700				
Asia									
Indonesia	S	O	D	1,500.0	51,020	810,000	35	N	1
Philippines	S	O	D	849.0	25,060	930,000	47	G	1
Malaysia	S	O	D	41.2	3,600		19	G	1
Rep of Korea (South Korea)	S			752.8					1
Japan	S	F	D	386.5	2,900	10,000	11	G	3
China	I	F	D	0.0	1,510		27		
Viet Nam	S	O	D		1,270		11	N	1
Myanmar	S	O	D		1,870		17	N	1
Thailand	S	O	D		2,130		8	N	1
North Korea								G	1

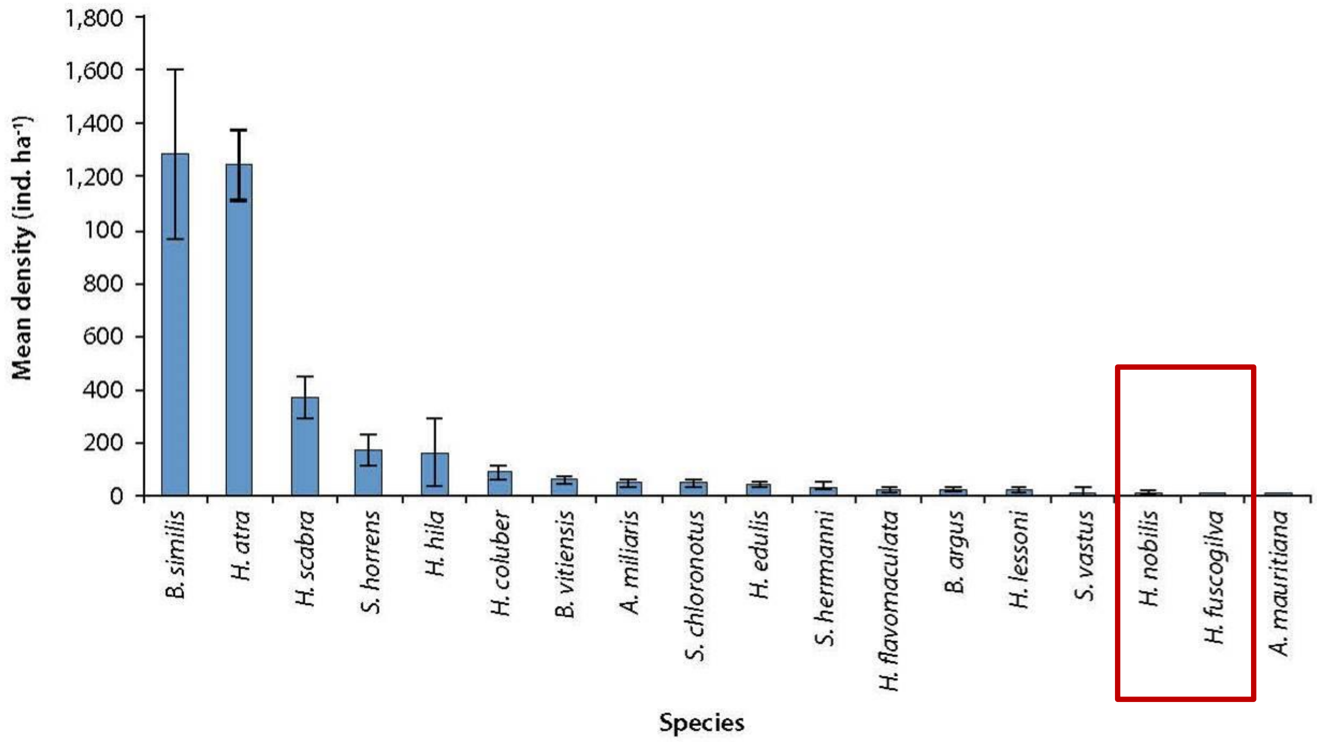
Countries / Independent fisheries	Scale[a]	Status[b]	Fishing mode[c]	Annual av. export or landing (dried t)	Coral reef area (km^2)	Total No. fishers	No. Species harvested	Management system[d]	Enforcement capacity[e]
W and Central Pacific + Australia									
Australia (Coral Sea)	I	F	D	15.8	1,912	24	12	G	1
Australia (Great Barrier Reef)	I	F	D	40.2	20,640	42	14	G	3
Australia (Moreton Bay)	S	U	D	2.4		4	1	G	3
Australia (Northern Territory)	I	F	D	26.1	2,850	36	6	G	2
Australia (Torres Strait)	S	O	D	18.2	1,782	130	16	G	2
Australia (Western Australia)	I	F	D	7.3	7,423	36	6	G	2
CNMI	S	O	D	0.0	50	0	10	G	1
Cook Islands	U	O	D	1.0	1,120		9	G	2
Federated States of Micronesia	S	D	D		4,340		24	G	1
Fiji	S	D	D	178.0	10,020		23	C	2
French Polynesia	S	O	D	15.7	6,000	26	13	G	1
Guam	U	F	D	2.0	220	30	15	G	1
Kiribati	S	O	D	95.0	2,940	5,000	17	G	1
Marshall Islands	S	D	D		6,110		5	G	1
Nauru	U	M	D	0.0	50		4	G	1
New Caledonia	S+I	O	D	71.2	5,980	78	25	G	1
New Zealand	I	M	T	1.3		20	1	G	3
Niue	S	D	D	0.0	170		7	C	1
Palau	S	M	D	0.0	1,150		21	G	1
Papua New Guinea	S	D	D	550.0	13,840	250,000	26	G	1
Samoa	U	F	D	11.8	490	11,000	14	C	3
Solomon Islands	S	D	D	73.8	5,750		29	G	1
Tonga	S	D	D	176.0	1,500	1,500	21	G	1
Tuvalu	S	D	D		710		11	C	1
Vanuatu	S	O	D	11.4	4,110	527	21	G	3
Wallis	S	M	D	0.40	940	7	4	G	3

[a] I = industrial; L = illegal fishery; S = small-scale; U = subsistence.
[b] U = under-exploited; M = moderately exploited; F = fully exploited ; O = over-exploited; D = depleted.
[c] D = dive fishery; T = trawl/drag fishery.
[d] G = government managed ; C = co-managed; N = no management.
[e] 1 = weak; 2 = moderate; 3 = strong.

Annex 4b
Abundance and density of sea cucumbers species at Pacific sites



Surveys conducted across the Pacific reveal that most sites are seriously depleted of commercial sea cucumber species (healthy densities are noted in the blue band) (Friedman & Chapman 2008).



This graph shows the mean density for 18 sea cucumber species from Reef benthos transect assessments from a Pacific Island site (Pakoa *et al.* 2014). Standard errors indicate the spread in the range of data that was used to calculate the mean. It demonstrates densities of individual species and allows for comparisons among species : it clearly shows that teatfish (*H.whitmaei** and *H.fuscogilva)* occured in significative lower densities than others (Pakoa *et al.* 2014).

**The graph indicates the species* H. nobilis*, which is actually* H.whimaei*, present in the Pacific*.

References :

Friedman, K. and Chapman, L. *(*2008*)* A Regional Approach to Invertebrate Export Fisheries. Secretariat of the Pacific Community Policy Brief 2/2008. Noumea, New Caledonia.

Pakoa, K., Friedman, K., Moore, B., Tardy, E. & Bertram, I (2014) *Assessing Tropical Marine Invertebrates : A Manual for Pacific Island Resource Managers*. Secretariat of the Pacific Community, Noumea, New Caledonia, 118 pp.

Annex 5

Market value and principal market for each species of Teatfish
(Purcell *et al.* 2012; Purcell *et al.* 2017). *English only*

	Main market and value
Holothuria fuscogilva	It is a high-value species. In Papua New Guinea, it was previously sold at USD17–33 kg^{-1} dried. It has been traded recently at USD42–88 kg^{-1} dried in the Philippines. In New Caledonia, this species is exported for USD40–80 kg^{-1} dried and fishers may receive USD7 kg^{-1} wet weight. In Fiji, fishers receive USD30–55 per piece fresh. Prices in Hong Kong China SAR retail markets ranged from USD128 to 274 kg^{-1}. Prices in Guangzhou wholesale markets ranged from USD25 to 165 kg^{-1} dried
Holothuria nobilis	Markets are Hong Kong China SAR, the island of Taiwan, Singapore, China and Malaysia. It is sold at USD20–80 kg^{-1} dry wet, depending on size and condition. Prices in Hong Kong China SAR retail markets ranged from USD106 to 139 kg^{-1} dried.
Holothuria sp 'pentard'	Main Market: Hong Kong China SAR. It is sold at USD17–26 kg^{-1} dried. Retail prices in Hong Kong China SAR were up to USD188 kg^{-1} dried.

Annex 6

Hong Kong SAR imports of beche-de-mer (dried, salted or in brine; in kg)
1999 – September 2005 and annual gross income (in USD)

Source: Census and Statistics Department, Hong Kong SAR, China, 2005 (Toral-Granda 2006).

Country / Territory of origin	1999	2000	2001	2002	2003	2004	2005	Total
Indonesia	762.707	1.041.559	1.068.768	1.010.698	977.893	859.486	498.332	6.219.443
Philippines	591.092	1.070.154	737.232	802.023	666.841	593.512	469.093	4.929.947
Papua New Guinea	350.321	524.101	54.122	380.595	447.632	518.296	412.755	2.687.822
Fiji	168.264	364.369	291.093	235.503	264.253	272.276	223.565	2.054.444
Japan	58.343	75.528	110.558	137.999	206.359	259.120	209.098	1.819.323
Yemen	3287	0	4848	102.414	134.919	478.744	196.856	1.265.351
Singapore	165.911	284.804	249.278	284.657	409.315	486.299	174.180	1.186.988
USA	112.283	170.423	88.816	154.837	113.119	93.189	157.523	1.057.005
Madagascar	166.364	178.392	194.129	193.551	216.354	175.671	140.890	924.350
Solomon Islands	49.737	149.115	259.727	248.751	222.763	153.255	103.640	921.068
Australia	125.289	146.524	185.952	124.665	118.827	128.075	95.018	890.190
Sri Lanka	21.381	53.867	33.288	54.523	64.972	106.858	75.711	609.456
Malaysia	19.854	67.975	73.158	144.754	147.523	96.653	59.539	574.065
Tanzania	41.352	118.166	56.382	91.672	67.555	94.509	50.598	520.234
Thailand	60.331	133.858	101.020	78.528	69.207	95.197	35.924	410.600
Island of Taiwan	40.958	37.830	40.143	40.800	34.570	88.971	28.943	312.215
Mozambique	500	109	853	37.000	63.363	41.900	24.021	219.724
Seychelles	0	7.121	15.678	5662	13.028	18.413	23.189	197.014
Kenya	1707	51.580	39.444	20.429	22.658	21.809	17.345	185.639
Peru	4170	7331	3881	1828	8354	19.906	15.760	179.518
Micronesia and Palau	0	0	0	6.368	2252	17.798	14.680	178.286
United Arab Emirates	140	9.100	256	17.141	4508	140.281	14.213	174.972
Australia and Oceania	32.294	24.227	37.574	22.558	21.256	27.000	13.377	167.746
Egypt	0	677	0	6.510	17.220	17.813	13.102	161.063
Canada	4.883	13.837	58.541	17.861	60.506	51.580	12.516	147.793
Ethiopia	0	0	0	0	0	12.000	12.200	83.091
Ecuador	24.567	15.285	991	10.130	3.026	11.322	12.123	81.371
Cuba	2.920	19.023	13.941	3800	7648	5080	8641	77.444
Viet Nam	34.093	600	3.274	756	5415	2735	6576	69.773
Vanuatu	7.966	28.467	16.647	8363	9001	5305	5622	61.230
Morocco	0	0	7438	1932	0	5124	4890	61.053
South Africa	10.149	27.876	30.178	53792	37800	14945	4778	57.546
Republic of Korea	0	0	0	651	510	796	4159	55.322
Oman	180	960	490	507	0	3842	4015	53.449
Saudi Arabia	782	0		30	0	8973	3350	49.924
Kiribati	6.523	9.073	22.774	8561	5528	1932	3155	41.310
Nicaragua	0	0	0	0	252	0	2959	41.098
Chile	0	22.318	7599	2906	527	4485	2934	40.769
Maldives	4.170	53.915	27.928	37.829	49.013	21.347	2812	24.200
India	6610	1906	9810	2391	5655	21.029	2523	19.384
Mexico	0	150	1818	3302	1270	4294	2378	16.459
China	25.020	14.946	4031	37.400	30.657	47.226	1783	13.212
Colombia	0	0	540	0	0	0	1646	13.135
New Zealand	530	7583	317	1440	3471	1668	1450	11.627
Russian Federation	0	0	0	0	0	3259	1314	11.300
Mauritania	0	0	0	1860	0	1930	862	10.680
Sudan	0	0	0	0	0	0	490	9994
Venezuela	0	0	0	0	0	0	456	6116
Comoros	0	600	0	0	0	700	300	5718
Panama	0	0	0	0	0	281	138	4652
Tonga	0	0	0	0	296	1130	94	4573
Netherlands	0	0	8	0	0	0	42	4565
Djibouti	0	0	1	4133	134.999	8.660	0	3835
African Nes.*	0	0	0	2340	19.977	18.993	0	3211
Tunisia	0	0	0	0	11.300	0	0	3000
Haiti	0	0	0	1000	9680	0	0	2739
Mauritius	300	3185	0	667	3682	3793	0	2607
Marshall Islands	0	0	0	0	2739	0	0	2186
Turkey	0	0	0	1290	1995	1280	0	1600
Hong Kong SAR	0	0	0	0	874	0	0	1520

Democratic People's Republic of Korea	0	0	0	0	284	0	0	1300
Sao Tome and Principe	0	0	0	0	202	0	0	1268
Asia Nes.*	0	0	0	0	96	0	0	1200
Dominican Republic	0	0	0	2562	45	0	0	1081
Costa Rica	108	664	325	0	7	164	0	874
Serbia and Montenegro	0	0	0	200	0	0	0	645
France	0	0	155	0	0	0	0	494
Brazil	0	0	444	50	0	0	0	490
Spain	0	1000	0	0	0	81	0	456
Porto Rico	0	0	0	1300	0	0	0	419
Macao	0	0	1200	0	0	0	0	354
Somalia	0	0	0	3835	0	0	0	284
Senegal	0	0	0	3000	0	0	0	202
Swaziland	0	354	0	0	0	0	0	200
US Oceania	11.528	17.623	40.622	0	0	0	0	195
Samoa	5.718	0	0	0	0	0	0	155
Central and South American Nes.*	0	0	0	0	0	645	0	96
Myanmar	0	0	0	0	0	195	0	50
Total imported (kg)	2.922.332	4.758.719	4.382.272	4.417.354	4.655.496	5.069.825	3.171.558	29.377.556
Average Exchange rate USD to HKD°	7,76	7,79	7,80	7,80	7,79	7,79	7,78	
Total gross income to Hong Kong SAR in USD	33.559.536	55.541.207	50.422.051	56.362.564	77.305.777	99.817.587	79.897.153	452.897.153

* Nes : Not elsewhere specified

Explanation of the table above: Hong Kong SAR is the main Chinese import port for sea cucumber, with a total of more than 29 200 tonnes for the period 1999 to September 2005 and more than 5 000 t for 2004 only (Toral-Granda 2006). Hong Kong SAR re-exports the products, mainly to China (64.1%), Viet Nam (24.5%) and the island of Taiwan (4.7 %) (Toral-Granda 2006). The aggregate value of beche-de-mer imported and re-exported to and from the Hong Kong SAR between 1999 and 2005 was USD 453 million, with a gradual increase from USD 33 million in 1999 to USD 79 million during the nine first months of 2005 (Toral-Granda 2006).

Hong Kong SAR imports statistics show an increase in the number of countries exporting dried, salted or brine cucumbers, from 25 countries in 1989 to 78 in 2005 (Toral-Granda 2006). In 2005, eight countries exported more than 1000 tons each to the Hong Kong SAR, with the main exporters to Hong Kong being Indonesia, the Philippines, Papua New Guinea, Singapore and Fiji, and income ranging between USD 33 million and USD 99 million (Toral-Granda 2006).

The second largest market for sea cucumber imports is Singapore. Its imports decreased from 820 tonnes in 1997 to 629 tonnes in 2000, mainly due to the economic recession (Ferdouse 2004). The main exporters to Singapore are the Hong Kong SAR, India, Yemen, the United States of America and the South Pacific island countries. Most imports are poor quality sea cucumbers, with high-quality products imported from Australia and other sources in the Pacific region (Ferdouse 2004, Toral-Granda 2006).

Annex 7

Sea cucumber captures annual tonnage mean (t mean p.a.) for the period 2009 to 2014, by country in Pacific and Indian Oceans.

The means are presented from FAO yearly statistics (1) and corrected in equivalent dry weights (2) when the data are in fresh weight (*), using 8% of fresh weight, as correction for weight loss during processing. Modified from Conand (2017b)

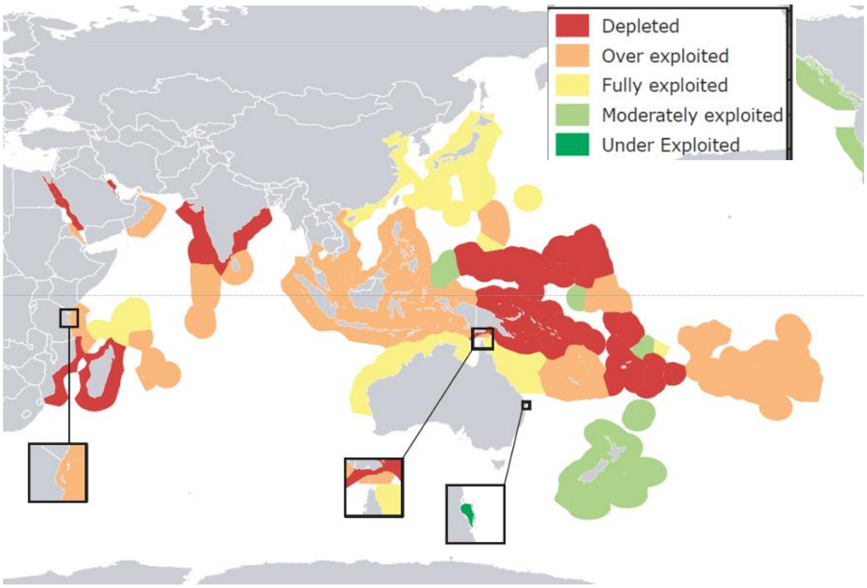
Fishing area country	(1) t mean p.a.	(2) t dry p.a.
PACIFIC NORTH WEST	12 590*	1008
Japan	10 073	
Korea, Republic of	2 517	
INDIAN OCEAN WEST	1 555	1 555
Egypt	3	
Kenya	31	
Madagascar	1336	
Maldives	131	
Mauritius	33	
Mozambique	0	
Tanzania, United Rep. of	0	
Yemen	20	
INDIAN OCEAN EAST	4 179	4 179
Indonesia	484	
Sri Lanka	3695	
PACIFIC CENTRAL WEST	6 675	6 675
Fiji, Republic of	75	
Indonesia	5003	
Kiribati	75	
Malaysia	0	
New Caledonia	368	
Papua New Guinea	96	
Philippines	844	
Solomon Islands	199	
Vanuatu	1	
Wallis and Futuna Is.	16	
PACIFIC CENTRAL EAST	935	935
French Polynesia	178	
Mexico	306	
Nicaragua	85	
Tonga	127	
United States of America	238	
New Zealand Pacific Southwest	17	

Explanation of the table above: Recent catch data for sea cucumbers identified by FAO from 2009 to 2014 by country were analyzed to allow the average tonnage (t p.a.) to be calculated during these six years in the main fishing areas. The data were separated into two categories:

- traditional driedsea cucumbers, called trepang, whose treatment results in a product weighing only 5 to 8% of the fresh weight.
- other products, frozen and in brine, the weights of which do not differ considerably from those which are fresh. The data for the regions where they appear mainly as other products turn into a comparable dry weight, taking 8% of the values, which is an average reduction coefficient during treatment, although it varies between species (Purcell *et al.* 2016a).
- The countries with the highest catches are in the Western Central Pacific with 6,675 tonnes in 6 years and the Western Indian Ocean with 4,179 tonnes**.**

Annex 8

Current status of sea cucumber fisheries in the Indo-Pacific region
(modified from Purcell *et al.* 2013)



Annex 9

Examples of fishery management measures in the tropical western Pacific
(Bruckner 2006)

Location and species	Permits	Harvest area, species and season	Gear type	Quota
Australia: Great Barrier Reef	Licensing system and logbooks. Quota on number of licenses; 18 active fishermen .	Great Barrier Reef Marine Park Act 1975 closed several reefs to fishing. *H. whitmaei* fishery * closed in October 1999.		Minimum size: 15 cm; TAC = 500 mt (90% of the estimated yield .
Australia: Torres Strait	Permit system through Island Community Councils.	None?	Hand or hand-held non-mechanical implements only; a ban on SCUBA and hookah gear; 7 m maximum length of Islander dinghies.	Total allowable catch of 260 mt and minimum size limits of 18 cm.
Australia: Northern Territory	6 commercial licenses, 3 per management zone, 4 divers per license	2 management zones; collection restricted to areas covered by water at low tide; no take in marine parks, reserves or sanctuaries and around particular islands and shoals.	Hand collection only by diving.	TAC is 380 mt (127 mt white teatfish and 253 mt of other spp.; minimum sizes.
Fiji	Harvesting and processing restricted to Fiji nationals .	A 5.6 square mile area around Namena Atoll closed to harvest in 2001. No export of *H scabra.*	Use of SCUBA gear prohibited, but hookah was not prohibited.	7.6 cm 3 inch minimum export size.
Papua New Guinea (PNG)	PNG citizens only; license for storing or export.	Open season from 16 Jan-Sep 30. Quota divided into two value groups (high and low). Torres Strait fishery closed in 1992.	Hookah, SCUBA and lights prohibited.	TAC for each province; Minimum sizes for 17 species (live and dried) .
Tonga	Exporters limited to 10 licenses.	Scheduled closed season and closed areas; 10 year moratorium in 1999.	Ban on SCUBA and hookah.	Min size for some species (live and dried).
Solomon Islands		Moratorium in certain areas of Makira in 1994. 1998 ban on collection and sale of sandfish.	Ban on SCUBA and hookah in the Western Province.	

* *previously named* H.nobilis, *became* H.whitmaei *in 2004*

Annex 10a

Management measures for every species
(Purcell *et al.* 2012)

	Regulations
Holothuria (Microthele) fuscogilva	Before a moratorium in Papua New Guinea, regulations included a minimum size limit (35 cm live and 15 cm dry). On the Great Barrier Reef, Australia, there is an overall TAC of 89 tonnes y^{-1}, which is reviewed periodically. In other fisheries in Australia, a size limit of 32 cm is imposed. In New Caledonia, the minimum size limit is 35 cm for live animals and 16 cm dried, and harvesting using compressed air is prohibited. In Maldives, there is a ban on the use of SCUBA to protect the stocks of this species
Holothuria (Microthele) nobilis	It is currently banned in Egypt. Mauritius has a proper Sea cucumber Management Plan which is reviewed as and when required.
Holothuria (Microthele) sp pentard	This fishery is managed in Seychelles by means of a restricted number of fishing permits and no-take reserves.

Annex 10b

Management measures for the species Holothuria fuscogilva and H. whitmaei in the US territories
(US authorities, pers. comm. 2018)

Species	US territories	Management measures and harvest
Holothuria fuscogilva, H. whitmaei	Hawaii	• Commercial consumptive take and sale is prohibited (state waters). • Personal use is limited to 10 sea cucumbers per person per day.
H. whitmaei	Guam	Guam allows harvest of sea cucumbers for personal consumption: export is prohibited. • Marine invertebrates taken locally for personal use shall not be sold, traded or bartered. • Harvest shall be limited to one hundred (100) pieces combined per person per day. • There shall be no export of locally-caught marine invertebrate species.
Holothuria fuscogilva, H. whitmaei	American Samoa	American Samoa may have a sea cucumber flshery but little specific information is available. Available information indicates: • In 2013 the Department of Marine and Wildlife Resources (DMWR) initiated a 6-month harvest moratorium on all sea cucumber species. • DMWR extended this moratorium for another 6 months while they conducted assessments. The moratorium became permanent in 2015. Prior to the assessment there were no commercial regulations on the harvest of sea cucumbers. Using assessment data a permanent moratorium is being codified into law.
Holothuria fuscogilva, H. whitmaei	Commonwealth of the Northern Mariana Islands (CNMI)	Any harvest of invertebrates requires direct authorization from the CNMI Secretary of the Department of Lands and Natural Resources. • In 1999 the CNMI Government placed a 10-year moratorium on the harvest of sea cucumbers • In 2007, the harvest moratorium was extended for at least 10 more years. • If the harvest moratorium is lifted:There are three no-take marine protected areas (MPAs) on Saipan, as well as a sea cucumber preserve that encompasses the whole of Lau Lau Bay (East side of Saipan). A no-take sea cucumber preserve at Bird Island is included in that area.
Holothuria fuscogilva, H. whitmaei	Saipan (within the CNMI)	• There has been no commercial activity since the Saipan fishery ended in 1997. • Prior to the closure of the fishery in 1999, H. whitmaei represented only 1% of the landed sea cucumbers

Annex 11

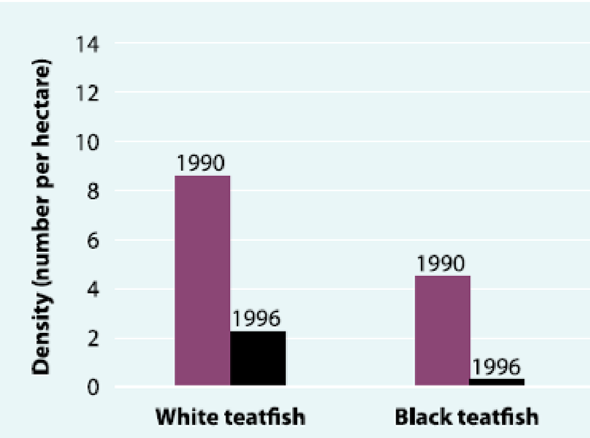
Summary of the most recent harvest controls for *H. fuscogilva* and *H. whitmaei* in Australia
(Australian authorities, pers. comm. 2018)

Jurisdiction	Fishery	***Holothuria (Microthele) fuscogilva*** **White Teatfish**	***Holothuria (Microthele) whitmaei*** **Black Teatfish**
Queensland	Sea Cucumber Fishery	60 t limit via permit conditions	0 t limit via permit conditions
Northern Territory	Trepang Fishery	Does not target these species.	
Western Australia	Sea Cucumber Fishery	*H. fuscogilva* and *H. whitmaei* are not key target species in Western Australian fisheries but are managed via input controls such as spatial management, as well as size limits.	
Commonwealth	Coral Sea Fishery	2016/17*: 4.0 t total allowable catch and minimum size limits 2.4 t caught	2016/17*: 1.0 t total allowable catch and minimum size limits 0.08 t caught
Torres Strait	Beche-de-mer Fishery	2016-17*: 15.0 t total allowable catch, size limits and input controls (limited entry, gear restrictions, vessel length restrictions) 0.1 t caught	2016-17*: 0.0 t total allowable catch, size limits and input controls (limited entry, gear restrictions, vessel length restrictions) 0.0 t caught

Annex 12

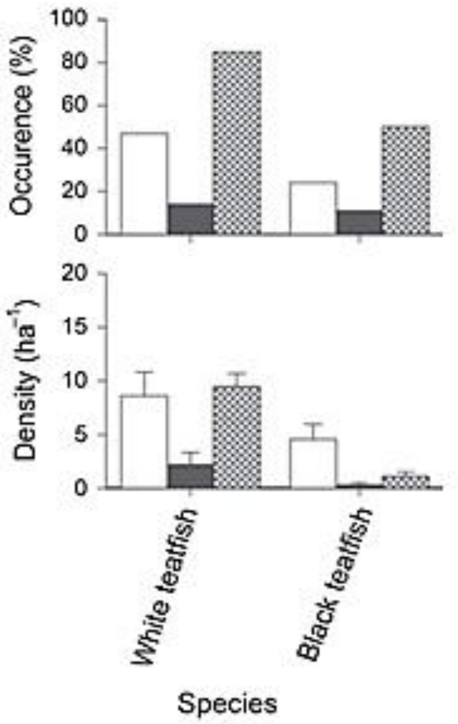
Recovery of *H.fuscogilva* and *H.whitmaei* stocks impacted by fishing

Case study: Tonga



Decrease in density of Holothuria fuscogilva (White teatfish) and H. whitmaei (Black teatfish) in Tonga following heavy fishing between 1990 and 1996 (Friedman *et al.* 2008)

Unsustainable heavy fishing between 1990 and 1996, which reduced the density of *H.fuscogilva* and *H.nobilis*, caused managers to close the fishery in 1997. It remained closed for more than 10 years. (Friedman *et al.* 2008)



Occurrence (percentage of stations, top graph) and density (individuals ha^{-1} ± SE, bottom graph) results for Holothuria fuscogilva (White teatfish) and H. whitmaei (Black teatfish) recorded in 1990 (white bar), 1996 (filled bar) and 2004 (hatched bar) from Ha'apai, Tonga (Friedman *et al.* 2011)

As seen above, the results from Tonga suggest a marked decline in the density of *H.fuscogilva* and *H.whitmaei* stocks between 1990 and 1996. The 1996 survey proceeded after there were complaints that the resource was overfished and resulted in the introduction of a moratorium on exports. A mixed picture of recovery is recorded after 7 years of closure, with the majority of high-value sea cucumber species again showing densities similar to those seen in 1990. Here we can see that *H.fuscogilva* shows densities similar to those seen in 1990 (before the heavy fishing). (Friedman *et al.* 2011)

Even if *H.whitmaei* does not display a density similar to those seen in 1990, its occurence has increased.

Therefore, it reveals that a 'recovery' of stocks following cessation or, even better, well managed of fishing is possible. An inclusion in CITES Appendix II should improve management of stocks with trade management.

References : Friedman K, Eriksson H, Tardy E, Pakoa K (2011) Management of sea cucumber stocks: patterns of vulnerability and recovery of sea cucumber stocks impacted by fishing. Fish Fish 12: 75–93.

Friedman, K., Purcell, S., Bell, J. and Hair, C. (2008) Sea Cucumber Fisheries: A Manager's Toolbox. Australian Centre for International Agricultural Research (ACIAR) Monograph Series 135, Canberra, pp. 32.

Annex 13
Summary of range States responses

Range State	Response
Australia	No final decision at the time of proposal submission
Bangladesh	Consulted on 23/10/2018, no response received
Brunei Darussalam	Consulted on 23/10/2018, no response received
Cambodia	Supports listing in Appendix II
Chile	Supports listing in Appendix II
China	Consulted on 23/10/2018, no response received
Comoros	Consulted on 23/10/2018, no response received
Djibouti	Consulted on 23/10/2018, no response received
Egypt	Consulted on 23/10/2018, no response received
Eritrea	Consulted on 23/10/2018, no response received
Fiji	Consulted on 23/10/2018, no response received
India	Consulted on 23/10/2018, no response received
Indonesia	Consulted on 23/10/2018, no response received
Israel	Consulted on 23/10/2018, no response received
Japan	No final decision at the time of proposal submission
Jordan	Consulted on 23/10/2018, no response received
Kenya	Supports listing in Appendix II
Madagascar	Consulted on 23/10/2018, no response received
Malaysia	No final decision at the time of proposal submission
Maldives	No final decision at the time of proposal submission
Mauritius	Consulted on 23/10/2018, no response received
Mozambique	Consulted on 23/10/2018, no response received
Myanmar	No final decision at the time of proposal submission
New Zealand	No final decision at the time of proposal submission
Oman	Consulted on 23/10/2018, no response received
Pakistan	Consulted on 23/10/2018, no response received
Palau	Consulted on 23/10/2018, no response received
Papua New Guinea	Consulted on 23/10/2018, no response received
Philippines	Supports listing in Appendix II
Samoa	Consulted on 23/10/2018, no response received
Saudi Arabia	Consulted on 23/10/2018, no response received
Seychelles	Supports listing in Appendix II
Singapore	Consulted on 23/10/2018, no response received
Solomon Islands	Consulted on 23/10/2018, no response received
Somalia	Consulted on 23/10/2018, no response received
South Africa	Consulted on 23/10/2018, no response received
Sri Lanka	Consulted on 23/10/2018, no response received
Sudan	Consulted on 23/10/2018, no response received
Thailand	Consulted on 23/10/2018, no response received
Tonga	Consulted on 23/10/2018, information provided on the status and trade in the species
United Republic of Tanzania	Consulted on 23/10/2018, no response received
USA	No final decision at the time of proposal submission
Vanuatu	Consulted on 23/10/2018, no response received
Viet Nam	Consulted on 23/10/2018, no response received
Yemen	Consulted on 23/10/2018, no response received