

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



Thirtieth meeting of the Animals Committee
Geneva (Switzerland), 16-21 July 2018

Species specific matters

Maintenance of the Appendices

Proposals for possible consideration at CoP18

DRAFT PROPOSAL FOR THE INCLUSION OF THE SUBGENUS
HOLOTHURIA (MICROTHELE) IN APPENDIX II

1. The Annex to this document has been submitted by the European Union and developed in consultation with its Member States.*

* *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.*

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CoP18 Prop. XXX

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



Eighteenth meeting of the Conference of the Parties
Colombo (Sri Lanka), 22 May – 3 June 2019

CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II

A. Proposal

Inclusion of the subgenus ***Holothuria (Microthele)*** 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

C. Supporting statement

1. Taxonomy ([WoRMS 2017](#))

- 1.1. Class : Holothuroidea
- 1.2. Order : Aspidochirotida
- 1.3. Family : Holothuriidae
- 1.4. Genus : *Holothuria* Linnaeus, 1767

All species in the subgenus *Holothuria (Microthele)* Brandt, 1835:

Holothuria (Microthele) fuscogilva Cherbonnier, 1980¹

Holothuria (Microthele) fuscopunctata Jaeger, 1833

Holothuria (Microthele) nobilis (Selenka, 1867)^{1,2} including *Holothuria (Microthele)* sp. "pentard"³

Holothuria (Microthele) whitmaei Bell, 1887²

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

² *Holothuria (Microthele) whitmaei*, occurring in the Pacific Ocean, was separated from *Holothuria (Microthele) nobilis*, present in the Indian Ocean, in 2004.

³ *Holothuria (Microthele) nobilis* taxa seems to be considered as a group of species where *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).

1.5. Scientific synonyms ([WoRMS 2017](#))

Species	Synonyms, in alphabetical order
<i>Holothuria (Microthele) fuscogilva</i>	<i>Holothuria fuscogilva</i> (Cherbonnier, 1980)
<i>Holothuria (Microthele) fuscopunctata</i>	<i>Holothuria (Holothuria) fuscopunctata</i> Jaeger, 1833 <i>Holothuria axiologa</i> Clark, 1921
<i>Holothuria (Microthele) nobilis</i>	<i>Microthele nobilis</i> (Selenka, 1867) <i>Mülleria nobilis</i> Selenka, 1867
<i>Holothuria (Microthele) whitmaei</i>	<i>Holothuria (Bohadschia) whitmaei</i> Bell, 1887 <i>Holothuria mammifera</i> Saville-Kent, 1890 <i>Muelleria maculata</i> (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, also named holothurians, 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](#)). Teatfish (**Figure 1**) are part of the most fished and poached Holothurians in the tropical Indo-pacific region ([Sweet et al. 2016](#)). 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 shrinking seen in some areas. Holothurians are easily overexploited due to their life style (low mobility of adults, late sexual maturity, density-dependent reproduction and low recruitment rates), their ease of capture (adults are large, often diurnal, easy see and pick up, and does not require complex fishing or processing methods) ([Bruckner 2006](#)). Despite the size of their geographical range, most of them prefer very specific habitats, for example seagrasses ([Desurmont 2003](#)). They are playing an important role in their ecosystems: they regulate water quality, by digging sediments, by recycling nutrients and being preys to commercialized species that are, especially, crustacean. Overexploitation of holothurians induces a cascading effect in the ecosystem. Some areas without Holothurians become unsuitable for other organisms, because Holothurians dig sand by feeding on organic matter that are in, and the nutrients they secrete can be absorbed by algae and corals ([Purcell et al. 2013](#)).

Biological and commercial data clearly seem to inform that Holothurians 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. Holothurians are mostly exported to a central market in Hong Kong, Singapore or Taiwan, then re-exported around the world ([Conand & Byrne 1993](#)).

In the past, the inclusion of Holothurians 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. Most of these problems have been resolved during the past few years. 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 needd (Bruckner *et al.* 2003).

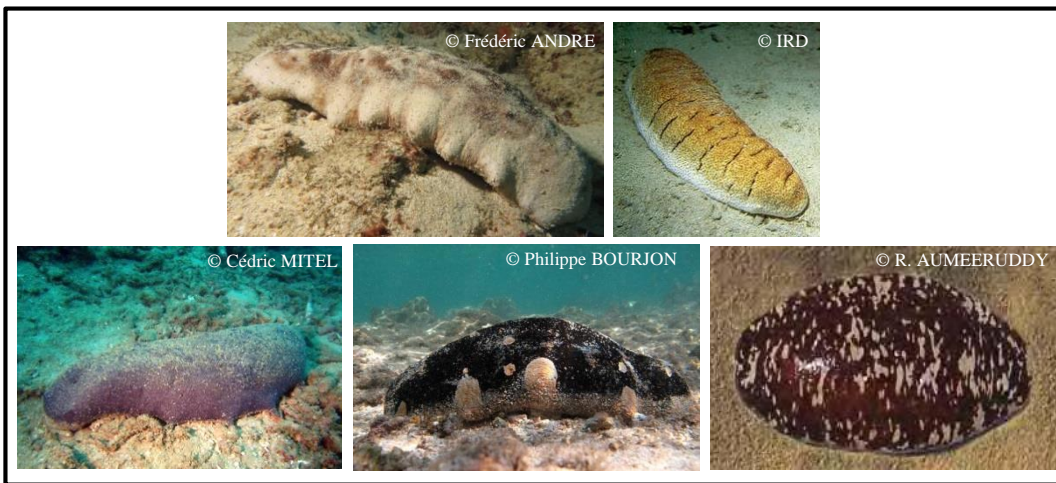


Figure 1. Teatfish species. From left to right at the top: *Holothuria (Microthele) fuscogilva*, *Holothuria (Microthele) fuscopunctata*. From left to right at the bottom: *Holothuria (Microthele) whitmaei*, *Holothuria (Microthele) nobilis*, *Holothuria (Microthele) sp. "pentard"*

3. Species characteristics




3.1. Distribution (INPN 2017; Purcell *et al.* 2012)

Teatfish live under the tropics. They only occur in reefs ecosystems of the Indian and Pacific Oceans, 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 (INPN 2017; Purcell *et al.* 2012)

Species	Ocean/Sea	Country/Region of distribution range	Distribution
<i>Holothuria (Microthele) fuscogilva</i>	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, Solomon 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	
<i>Holothuria (Microthele) fuscopunctata</i>	Pacific Ocean Indian Ocean	Zanzibar, Tanzania, Philippines, Tonga, Wallis and Futuna, New Caledonia, Mayotte, Kenya, Madagascar, Australia, Fiji, Kiribati, Papua New Guinea, Maldives, Indonesia, Vanuatu, South Africa, Viet Nam, China, Taiwan, Somalia, Mozambique, Samoa, Samoa américaines, Micronesia, Guam, Northern Mariana Islands, Marshall Islands, India, Myanmar, Tuvalu, Brunei Darussalam, Palau, Solomon Islands, Timor-Leste	
<i>Holothuria (Microthele) nobilis</i>	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	

<i>Holothuria (Microthele) whitmaei</i>	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	
<i>Holothuria (Microthele) sp. "pentard"</i>	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 habitat for each species are mentioned in **Table 2**.

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

Species	Habitat	Depth
<i>Holothuria (Microthele) fuscogilva</i>	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
<i>Holothuria (Microthele) fuscopunctata</i>	Reefs slopes, lagoons and seagrasses on sandy substrats. Mostly found on coarse sand or coral debris	- From 3 to 25 meters
<i>Holothuria (Microthele) nobilis</i>	- Low depth habitats of coral reefs (laggons) - 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)
<i>Holothuria (Microthele) whitmaei</i>	In the Occidental central Pacific, the species is found on plateau, reefs slopes and sandy seagrasses (not muddy)	From 0 to 20 meters
<i>Holothuria (Microthele) sp. "pentard"</i>	In the Seychelles, this species prefers lagoons on sandy substrate.	From 10 to 50 meters

3.3. Biological characteristics

Teatfish have a sexual reproduction (Conand 1981). However, there is no sexual dimorphism, only the microscopic examination of the gonads can determine the individual sex. The teatfish mating strategy is reflected as the emission of gametes (ovula and spermatozoa) 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.

Ocean currents play an important role in reproduction by transporting gametes; however, there is no information showing that currents can, in themselves, induce reproduction (Toral-Granda 2006). For the species *Holothuria fuscogilva*, *H. nobilis*, *H. whitmaei* and *H. fuscopunctata*, the reproductive cycle is annual (Conand 1981; Conand 1989; Conand 1994). However, the reproduction of *Holothuria (Microtelele)* sp. 'pentard' is not known (Purcell *et al.* 2012). Teatfish are oviparous (Conand 1986). 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, holothurians that produce gametes directly must have reached a certain population density to ensure successful fertilization. The life of sea cucumbers is still poorly known but probably exceeds 10 years, and sexual maturity is reached between 2 and 6 years (CITES 2002). 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 dorsally (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 (absent in *Holothuria (Microthele) fuscopunctata*) (Purcell *et al.* 2012). The mouth, surrounded by tentacles, is ventral (Purcell *et al.* 2012) (Figure 3).

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

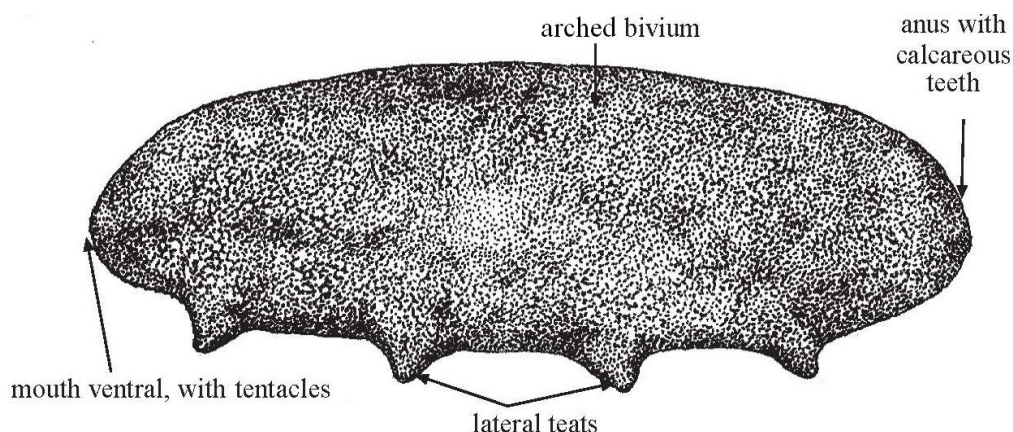


Figure 3. Teatfish schema (here the species *Holothuria whitmaei*) modified from Carpenter & Niem (1998)

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

Teatfish play an essential role in the functioning of ecosystems and the biological processes of the seabeds. As detritivores and more particularly deposit feeders, they move and intensively mix the substrate while recycling detritic materials. The role of sea cucumbers can be assimilated to that of earthworms. Holothurians consume

and grind sediments and organic matter into fine particles, returning the upper layers of lagoon sediments, coral reefs and other habitats and promoting the penetration of oxygen. They represent bioremediators for coastal mariculture. Thus, they are important because they determine the habitat structure of other species. They form an important part of the biomass of the ecosystem. In the absence of fishing pressure, sea cucumbers may occupy the flat parts of indopacific reefs at densities that may exceed 35 per m² where individuals process a huge amount of sediment daily. This process avoids the accumulation of decomposing organic matter and can help to control populations of parasites and pathogenic organisms, including certain bacteria and cyanobacterial mats. In some areas, the disappearance of sea cucumbers has resulted in hardening of the ocean floor, eliminating the habitat of other benthic organisms. 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. 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. Holothurians host more than 200 species of symbionts, parasites and commensals. These symbiotic relationships increase the biodiversity of the ecosystem, especially in the case of mandatory relationships without which symbionts can not exist. For example, *Holothuria (Microthele) fuscolgiva* is host to four genera of decapod crustaceans and *Holothuria (Microthele) nobilis* that of two genera of annelids. They also play an important role in the food chain in coral ecosystems at different trophic levels. Some species rely heavily on sea cucumbers as their main food source, including crustaceans, fish and shellfish.

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. Overexploitation of these species could lead to rapid declines in Holothurian populations and thus have serious consequences for the survival of other species (predators and Holothurian symbionts) that are part of the same complex food web, including a “cascading effect” into the ecosystem. This overexploitation would thus have a negative impact on the productivity and diversity of marine habitats where holothurians live: seagrass beds, lagoons and coral reefs.

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 Holothurians are under strong and increasing pressure (Tanzer *et al.* 2015; WWF 2016). Teatfish range countries have a large area of coral reefs (Annex 4). 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 4 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 holothurians (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).

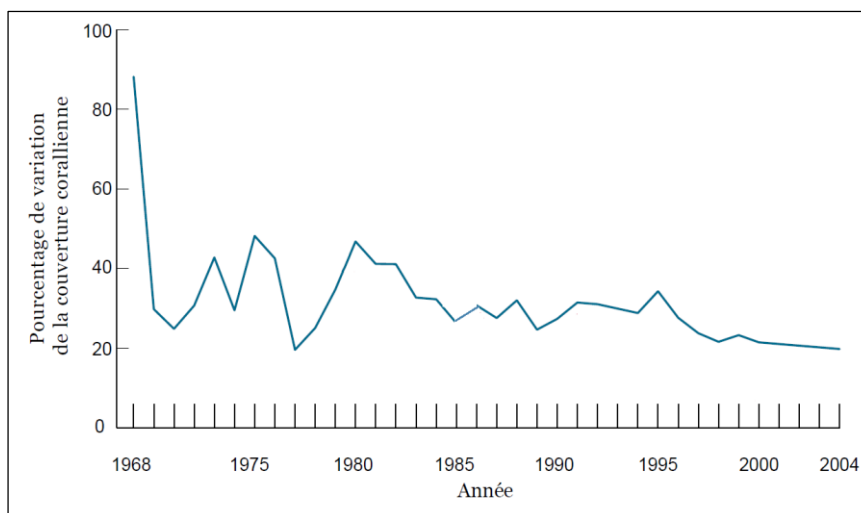


Figure 4. Percentage of time variation of coral cover in Indo-Pacific region (modified from Tanzer *et al.* 2015)

4.2. Population size

The mean density of each teatfish was calculated 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).
- For the species *Holothuria (Microthele) fuscopunctata*, the density is usually around 0.005 individual per m² (Conand *et al.* 2013b).

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 holothurians are rarely observed in the field (Conand 1989; Sweet *et al.* 2016). The holothurian population is composed mainly of mature individuals (Guzman *et al.* 2003). This may be due to high natural mortality (predation) during the juvenile phase (Conand 1989). For example, harvests of the species *H. fuscogilva* were made in the Tubbataha reef natural park (Philippines), and the mean length of the total individuals taken was calculated to be 33.57 cm and the minimum length to 30 cm. However, this species reaches its first sexual maturity at a size of about 30 cm (Conand 1989). Out of a total of 14 individuals, all individuals are mature (Dolorosa 2015).

Concerning the genetics of teatfish, *Holothuria whitmaei* has long been taken for *Holothuria nobilis*, but species were separated in 2004. We find *H. whitmaei* only in the Pacific Ocean and *H. nobilis* in the Indian Ocean.

Both species are allopatric (DORIS 2017). *Holothuria fuscogilva* was also considered to be the same species as *H. nobilis* until 1980 (Cherbonnier) (Conand 1989; DORIS 2017).

4.4 Population trends

Overall, teatfish populations are depleted¹ or overexploited in most range countries (Annex 4).

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* et *H. fuscogilva* are declining (Conand et al. 2014). Details are given for every species (Conand et al. 2013a; Conand et al. 2013b):

- *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 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 holothurians (21 per hectare) 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. In Ashmore Reef, populations of this species are severely depleted (Conand 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). It is considered mainly overexploited in East Africa (40% of its distribution). 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. 2005).

A visit to a holothurian treatment plant, conducted at a workshop on the Indian Ocean Holothurian 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.

On the other hand, the trend of the population of the species *Holothuria fuscopunctata* is not known.

4.5. Geographic trends

See Section 4.4

5. Threats

¹ Depletion in this sense refers to commercially unviable, and is estimated to represent between 60-80% loss or greater

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. Teatfish are also requested for biomedical research. 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. To reproduce, teatfish release their genital products in water and the success of the fertilization depends on the proximity of the individuals during the laying period (and therefore on the density of the population). Due to the reduction in population density caused by fishing, individuals may be unable to reproduce, the distance between males and females being too large (CITES 2002).

Moreover, despite the commercial importance of teatfish, there is still much to learn about their biology, ecology and the dynamics of their populations. The 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).

Three out of five 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). Some species, some of which are commercially exploited in several countries (Purcell *et al.* 2012 ; Purcell 2014), were not included in the assessment because they had not yet been the subject of a taxonomic description and were designated only by their common name (ex. *Holothuria* sp. 'pentard') (Conand *et al.* 2014).

6. Utilization and trade

6.1. National utilization

6.6.1. *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 or at wading, or using small wooden or glass boat, equipped with an outboard or fixed engine, to access populations offshore or in deeper waters. When they dive, the fishermen can use a hookah (air supplied by a compressor on the mother ship) or in a diving suit. Few are the traditional fishermen who are still diving in order to reach stocks in calm sea. Small trawlers (beam trawl, scallop drag, etc.) are also used in softwood habitats. To capture sea cucumbers, divers use the spear, hook, dip net or their hands (Conand 1986; Toral-Granda 2006).

Generally, fishing equipment and methods include small bottom trawls (crank nets and trawl nets) for sandy bottoms, spears, hooks and dip nets for reefs, and deeper reefs and lagoons (CITES 2002).

6.6.2. Levels and types of use

The beche-de-mer trade is mainly aimed at supplying the eastern markets with luxury foods. The main consumer countries are China, Hong Kong SAR (Special Administrative Region), 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 and use in private aquariums. 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). Holothurians 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).

6.2. Legal trade

Since individual species are rarely differentiated in trade statistics, this item presents the trade of all sea cucumber species.

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 *et al.* 1993). It aims to meet the needs of oriental markets such as China, where it is mainly consumed as a very refined met (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 of all varieties, with a small amount of skinless and frozen sea cucumbers sent by air freight (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).

The global fishery for sea cucumbers has increased dramatically over the last 25 years (Figure 4). Indeed, in the 1980s and 1990s, more and more countries began to export Holothurians and world production increased (Purcell *et al.* 2013). 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. The sea cucumber fishery continued to increase, with a global harvest of 120,000 tonnes in the early 1990s (Conand 1997).

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.

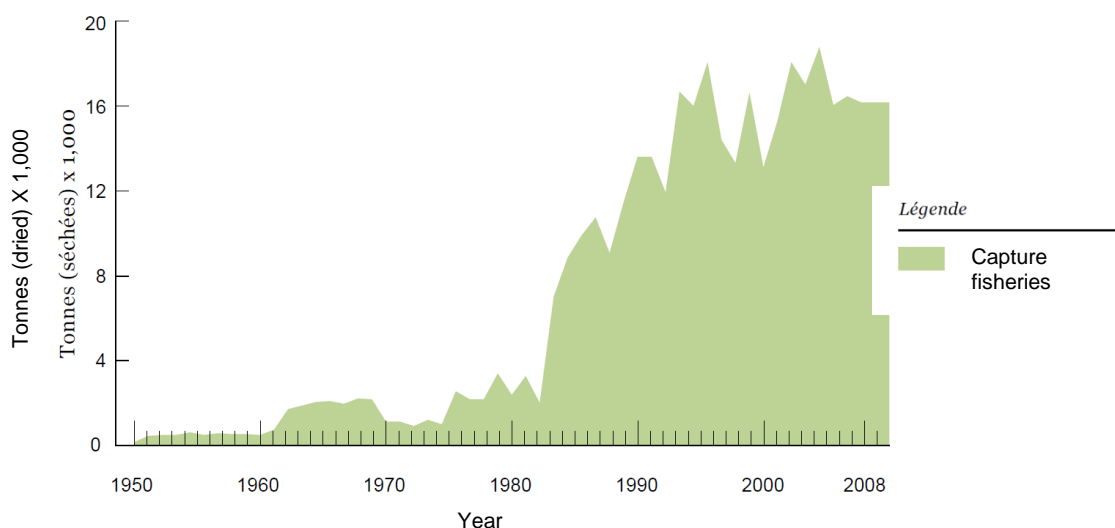


Figure 4. Global wild captures of sea cucumbers over time; in metric tonnes

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

Despite overexploitation, global catches have increased (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 Holothurian 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 Holothurians 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).

- *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, mainly for the Japanese market; and (iv) in a traditional dish, cooked in coconut milk (Conand 1990) (Figure 5). The muscle bands of certain species are consumed in Asia, the United States of America and Spain. Specialty products are prepared from viscera such as the fermented intestines (konowata) and dried gonads (kuchiko) of teatfish (except *Holothuria fuscopunctata*) 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).

- *Cosmetic products*: “Gamat” oil and by-products are found in a range of products including liniments, toothpastes, body lotions and soaps (Conand 2006b; Toral-Granda 2006).

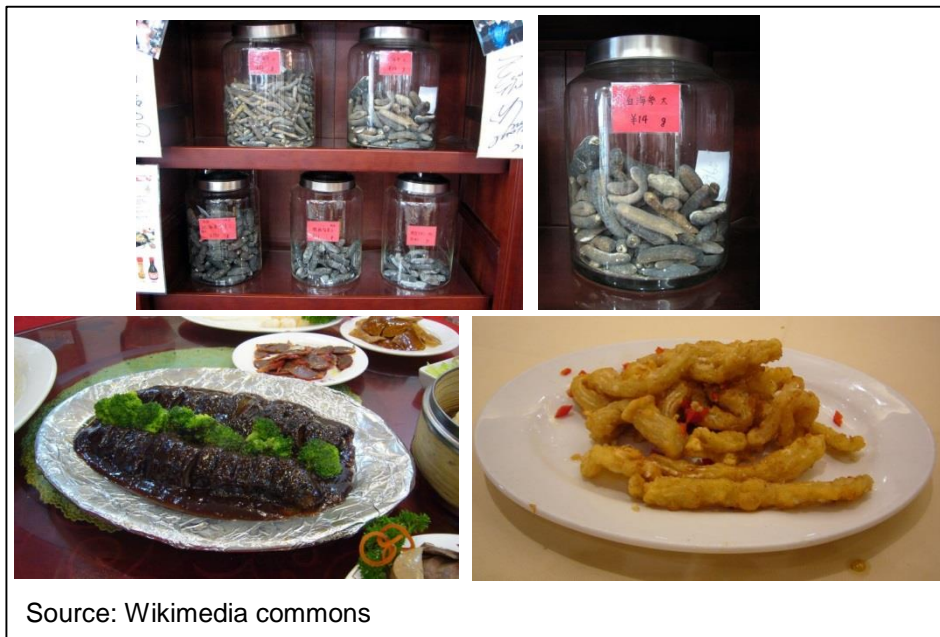


Figure 5. Examples of Holothurian products commercialized. In the top, Holothurians dried and stored in a jar in a pharmacy, used for medicinal purposes by Chinese medicine. In the bottom, cooked meals made from holothurians (sea cucumbers in the sauce on the left and fried sea cucumber on the right)

6.4. Illegal trade

Overall, illegal Holothurian 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). Currently, there is still illegal fishing in Australian

waters (Torres Strait), night and day, despite the ban on hunting introduced in 1993 (Stutterd & Williams 2003). In northern Australia, there is an accreditation (MoU), but in some areas of illegal Indonesian or Vietnamese fishermen come to fish high value species (including *H. fuscogilva*) and are sometimes apprehended (Conand 2017a).

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 (Purcell 2014). Finally, in some islands, this fishery is prohibited (Conand 2017a).

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, the Holothurians 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 et 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 (Conand 2017a; Eriksson *et al.* 2012).

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; sea husbandry (*H. scabra* mariculture) has developed and the recent catch prohibition should promote mariculture (Conand 2017a).

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 Eparses 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 better to 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). Holothurian populations are declining everywhere in the countries where they are exploited (Bruckner *et al.* 2003). Even after the closure of the fishery, Holothurian 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). In addition, teatfish (excepted *Holothuria fuscopunctata*) are very popular; they have a very high commercial value, thus exacerbating the risk of extinction (Conand *et al.* 2014).

7. Legal instruments

7.1. National

Several countries prohibit the taking of certain species or protect sites to compensate for localized disappearances. These Holothurian 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 Holothurian fisheries are still not regulated in a number of developing countries, other countries have adopted management measures at various levels to avoid overfishing (**Annex 10**). In general, these measures include specific areas of permitted and prohibited harvesting, licensing, quota, seasonal harvesting, rotating harvesting and other strategies. In several countries, sites were closed soon after the opening of the fishery due to overexploitation and rapid biological or commercial disappearance. At some sites, the taking of Teatfish species is prohibited today because of their rarity (CITES 2002).

Historically, 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 a once inventory 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 but is of great socio-economic importance (**Annex 4**) (Conand 2006a,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 4**). 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% higher in prohibited fishing areas than in fishing areas (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).

* *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*

- **Complete closure of fisheries:** in India, in 2001, all species of commercialized Holothurians 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.

- **Limited access:** in general, limited access is somehow a license or 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 whitmaei* 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). In Papua New Guinea, a quota has been set for each province but is often exceeded (D'Silva 2001).

- **Minimum catch sizes:** the minimum catch sizes 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 for each species is in **Annex 10**.

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 Holothurian 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). However, access to technology for juvenile production is not sufficient to initiate stock rebuilding and enhancement programs.

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 species *Holothuria nobilis* (Preston 1990) and *Holothuria fuscogilva* (Battaglione 1999).

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 can not 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 6**).



Figure 6. 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

Not applicable at this time.

11. Additional remarks

Not applicable at this time.

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ANNEXES




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	<i>Holothuria (Microthele) fuscogilva</i>	Holothurie blanche à mamelles
	<i>Holothuria (Microthele) fuscopunctata</i>	Holothurie trompe d'éléphant
	<i>Holothuria (Microthele) nobilis</i>	Holothurie noire à mamelles (Océan Indien)
	<i>Holothuria (Microthele) whitmaei</i>	Holothurie noire à mamelles (Pacifique)
	<i>Holothuria (Microthele) sp. "pentard</i>	Holothurie noire à mamelles du Pacifique
English	<i>Holothuria (Microthele) fuscogilva</i>	White teatfish
	<i>Holothuria (Microthele) fuscopunctata</i>	Elephant trunkfish
	<i>Holothuria (Microthele) nobilis</i>	Black teatfish
	<i>Holothuria (Microthele) whitmaei</i>	Black teatfish
	<i>Holothuria (Microthele) sp. "pentard</i>	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	<i>Holothuria (Microthele) fuscogilva</i>	Bawny white
	<i>Holothuria (Microthele) nobilis</i>	Bawny black
Érythrée	<i>Holothuria (Microthele) nobilis</i>	Abu habhab aswed
Fiji	<i>Holothuria (Microthele) fuscogilva</i>	Sucuwalu
	<i>Holothuria (Microthele) fuscopunctata</i>	Dairo-ni-cakao
	<i>Holothuria (Microthele) whitmaei</i>	Loaloa
Inde	<i>Holothuria (Microthele) fuscogilva</i>	White mammyfish, Kal attai
Indonésie	<i>Holothuria (Microthele) fuscopunctata</i>	Kunyi
Kenya	<i>Holothuria (Microthele) fuscopunctata</i>	Ngoma
	<i>Holothuria (Microthele) nobilis</i>	Pauni mweusi
Kiribati	<i>Holothuria (Microthele) fuscogilva</i>	Temaïmamma
	<i>Holothuria (Microthele) fuscopunctata</i>	Terebanti
	<i>Holothuria (Microthele) whitmaei</i>	Teromamma
Madagascar	<i>Holothuria (Microthele) fuscogilva</i>	Benono
	<i>Holothuria (Microthele) fuscopunctata</i>	Betaretry
	<i>Holothuria (Microthele) nobilis</i>	Benono
Malaisie	<i>Holothuria (Microthele) whitmaei</i>	Susu
Maurice	<i>Holothuria (Microthele) nobilis</i>	Barbara
Nouvelle-Calédonie	<i>Holothuria (Microthele) fuscogilva</i>	Le tété blanc
	<i>Holothuria (Microthele) fuscopunctata</i>	L'éléphant
	<i>Holothuria (Microthele) whitmaei</i>	Le tété noir
Philippines	<i>Holothuria (Microthele) fuscogilva</i>	Susuan
	<i>Holothuria (Microthele) fuscopunctata</i>	Sapatos
	<i>Holothuria (Microthele) whitmaei</i>	Black teatfish, Bakungan, Kagisan, Sus-uan
Seychelles	<i>Holothuria (Microthele) sp. "pentard"</i>	Pentard
Tonga	<i>Holothuria (Microthele) fuscogilva</i>	Huhuvalu hinehina
	<i>Holothuria (Microthele) fuscopunctata</i>	Elefanite
	<i>Holothuria (Microthele) whitmaei</i>	Huhuvalu uliuli
Viêt Nam	<i>Holothuria (Microthele) whitmaei</i>	Ñoät ñen ña, Đồn đọt vuù
Wallis-et-Futuna	<i>Holothuria (Microthele) whitmaei</i>	Le tété noir
Zanzibar (Tanzanie)	<i>Holothuria (Microthele) fuscogilva</i>	Pauni myeupe
	<i>Holothuria (Microthele) fuscopunctata</i>	Barangu mwamba
	<i>Holothuria (Microthele) nobilis</i>	Pauni mweusi
	<i>Holothuria (Microthele) sp. "pentard"</i>	Pauni kaki

Annex 3. Comparative table of the morphological characteristics of teatfish (Commission du Pacifique Sud 1995; Purcell *et al.* 2012; Purcell *et al.* 2016)

Species	Size	Morphology	Color	Photo
<i>Holothuria (Microthele) fuscogilva</i>	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.	<p>No Cuvierian tubules</p> <p>Presence of 6 to 8 characteristic large lateral protrusions ('teats') at the ventral margins.</p> <p>The tegument is usually covered by fine sand.</p> <p>Mouth is ventral with 20 stout grey tentacles</p> <p>Anus surrounded by inconspicuous teeth</p>	<p>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.</p> <p>Juveniles are yellowish-green or yellow, with black blotches</p>	
<i>Holothuria (Microthele) fuscopunctata</i>	Maximum length about 70 cm; average length about 48 cm. Average adult weight 3 kg; maximum 5.5 kg.	<p>Mouth ventral with 20 stout, brown, tentacles</p> <p>Anus is large and black, has no teeth, and is surrounded by five groups of papillae.</p> <p>No Cuvierian tubules</p> <p>This species has characteristic deep, brown wrinkles dorsally (like part of an elephant's trunk).</p> <p>The tegument is usually covered by fine sand.</p>	<p>Coloration varies a little from golden to light brown or creamy dorsally with numerous brown spots (around papillae), shading to whitish ventrally</p>	
<i>Holothuria (Microthele) nobilis</i>	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).	<p>Presence of 6 to 10 characteristic large lateral protrusions ('teats') at the ventral margins.</p> <p>Dorsal podia are sparse and small, while the ventral podia are numerous, short and greyish</p> <p>The tegument is usually covered by fine sand.</p> <p>The mouth is ventral, with 20 stout tentacles. Anus surrounded by 5 small calcareous teeth.</p> <p>Cuvierian tubules absent.</p>	<p>This species is black dorsally with white blotches and spots on the sides of the animal and around the lateral protrusions ('teats').</p> <p>Juveniles probably differ in colour from adults.</p>	

<p><i>Holothuria (Microthele) whitmaei</i></p>	<p>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.</p>	<p>Cuvierian tubules are few, short, and not expelled.</p> <p>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.</p> <p>The tegument is usually covered by fine sand.</p> <p>Dorsal podia are sparse and small, while the ventral podia are numerous, short and brown to grey</p>	<p>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.</p>	 <p>© S.W. PURCELL</p>
<p><i>Holothuria (Microthele) sp. "pentard"</i></p>	<p>Average fresh length is 30 cm. Average fresh weight is about 1 675 g.</p>	<p>Presence of 6 to 8 characteristic large lateral protrusions ('teats') at the ventral margins.</p>	<p>Dorsal surface is dark brown and mottled with irregular-shaped, cream coloured, blotches.</p>	

Annex 4. 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 (km ²)	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
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 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	
<i>Holothuria fuscogilva</i>	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
<i>Holothuria fuscopunctata</i>	Main market: China. It has been traded recently at about USD8 kg-1 dried in the Philippines. In Papua New Guinea it was previously sold at USD2.7 kg-1 dried. In Fiji, fishers receive USD0.8–1.7 per piece fresh. Prices in Guangzhou wholesale markets ranged from USD11 to 19 kg-1 dried.
<i>Holothuria nobilis</i>	Markets are Hong Kong China SAR, Singapore, Taiwan Province of China, 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.
<i>Holothuria</i> 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, RSA de Hong Kong, Chine, 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
Taiwan Province of China	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 (mainland)	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

Country / Territory of origin	1999	2000	2001	2002	2003	2004	2005	Total
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 ^o	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

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). Since the Hong Kong SAR does not produce beche-de-mer, it re-exports the products, mainly to mainland China (64.1%), Viet Nam (24.5%) and Taiwan, province of China (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 increased from 820 tonnes in 1997 to 629 tonnes in 2000, mainly due to the economic recession (Ferdouse 2004). The main exporting countries 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	

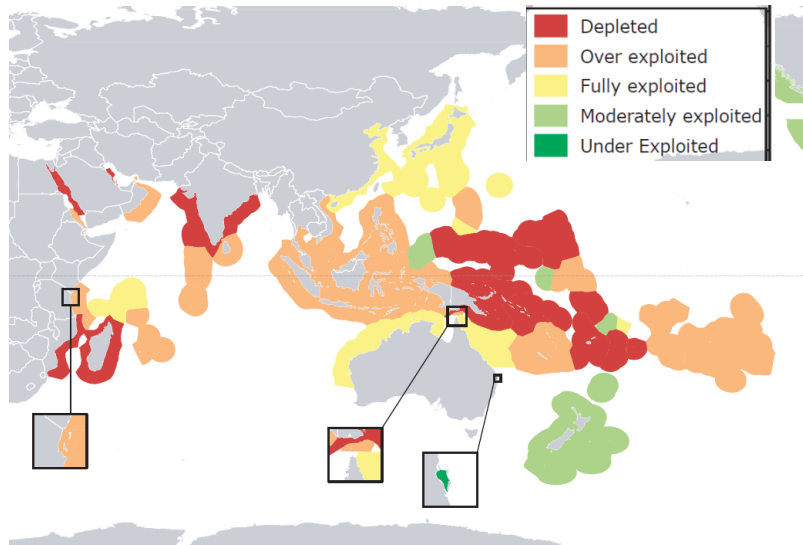
Explanation of the table above: Recent catch data for Holothurians identified by FAO from 2009 to 2014 by country were analyzed to allow the average tonnage (t p.a.) to be calculated during these six years in the main fishing areas. The data were separated into two categories:

1) traditional dried holothurians, called trepang, whose treatment results in a product weighing only 5 to 8% of the fresh weight.

2) 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.* 2016](#)).

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. <i>H. whitmaei</i> 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 <i>H scabra</i> .	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 10. Management measures for every species (Purcell *et al.* 2012).

	Regulations
<i>Holothuria (Microthele) fuscogilva</i>	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
<i>Holothuria (Microthele) fuscopunctata</i>	Before a fishery moratorium in Papua New Guinea, fishing for this species was regulated by minimum landing size limits (45 cm live; 15 cm dry) and other regulations. In Torres Strait (Australia), there is a size limit of 24 cm live.
<i>Holothuria (Microthele) nobilis</i>	It is currently banned in Egypt. There is no management for exploitation of this species in Mauritius.
<i>Holothuria (Microthele) sp pentard</i>	This fishery is managed in Seychelles by means of a restricted number of fishing permits and no-take reserves.