



Hygienic and commercial issues related to the illegal fishing and processing of sea cucumbers in the Mediterranean: A case study on over-exploitation in Italy between 2015 and 2017



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HIGHLIGHTS

- Harvesting of sea cucumbers become increasingly important in the Mediterranean.
- In the EU, sea cucumbers are harvested in classified production areas.
- Illegal processing of sea cucumbers has been pointed out by the competent authority.
- This increasing trend is threatening the survival of Sea cucumber natural stocks.
- The conservation of the natural resource will be the next key challenge.

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ABSTRACT

Seven species of sea cucumbers can be found in the Mediterranean Sea. In the last decades, the harvesting of sea cucumbers for “bêche-de-mer” has become increasingly important in the Mediterranean region due to increasing consumer demands in Asia as well as moratoriums in many producing countries, particularly from the Pacific Islands Region. In the European Union, the harvesting of sea cucumbers is authorized only in production areas classified by a Competent Authority. However, the over-exploitation of sea cucumbers is a concern and has contributed to low stocks of natural populations in some localities. Recently, illegal fishing of sea cucumbers has been reported with increasing frequency along the Italian coasts of the Mediterranean basin, accounting for 52,930 kg of seized products between 2015 and 2017. Moreover, illegal processing plants where sea cucumbers were being processed without the minimum hygiene requirements have been closed and product seized. In this case study, the main problems related to the illegal fishing, processing and marketing of sea cucumbers in Italy have been analysed through a lens of major sanitary and regulatory requirements.

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1. Introduction

Sea cucumbers belong to the phylum *Echinodermata*, sub-phylum *Echinozoa* class of *Holothuroidea*. Seven different species of *Holothuria* are present in the Mediterranean Sea. These are *Holothuria forskali*, *H. helleri*, *H. impatiens*, *H. mammata*, *H. poles*, *H. sanctori* and *H. tubulosa* (Borrero-Pérez et al., 2009). *Holothuria*

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tubulosa is the main species of sea cucumber and is found in seagrass meadows (predominantly *Posidonia oceanica*) and coastal waters of the Mediterranean Sea (Gustato et al., 1982; Bulteel et al., 1992). Sea cucumbers play a crucial role in the marine ecosystem due to their feeding behaviour, essentially cleaning and oxygenating marine substrates (Coulon and Jangoux, 1993; Meysman et al., 2006; İşgören-Emiroğlu and Günay, 2007; MacTavish et al., 2012). For centuries, sea cucumbers have been a popular luxury food item in Asian dried seafood markets (Conand, 2001; Ferdouse, 2004; Raison, 2008). Sea cucumbers are also consumed in traditional Asian medicine to increase muscle strength, immunity and to ward against arthritis, anaemia and impotence (Bordbar et al., 2011). The Peoples Republic of China (PRC) market is the largest worldwide market of sea cucumbers with 20,000 tons of processed sea cucumber, commonly known as “beche-de-mer” per year being sold with more than 50 tropical species commonly traded (Purcell, 2010). Wholesale prices of sea cucumbers vary from USD 50–400 per kg, depending on the species. Some high-quality species (e.g. *Holothuria scabra*) can exceed USD 1000 per kg (Purcell et al., 2018). With increased standards of living, particularly in the last two decades, the magnitude and extent of trade has rapidly expanded, resulting in the depletion of sea cucumber stocks in many localities worldwide (Conand and Byrne, 1993; Clarke et al., 2006; Anderson et al., 2011).

2. Harvesting of sea cucumbers in the Mediterranean Sea

Fishing of sea cucumbers around the globe presents different dimensions ranging from small-scale fishing to semi-industrial and industrial (FAO, 2008). Sea cucumbers are harvested in more than 70 countries world-wide, primarily in small-scale fisheries, particularly in tropical countries with most of these being exported to the PRC and the Hong Kong Special Administration Region (SAR), Singapore and more recently Vietnam (Toral-Granda et al., 2008; Purcell et al., 2013, 2016). Fishing methods in tropical waters involve gleaning, breath-hold diving, and the use of underwater breathing devices such as SCUBA (Choo, 2008; Kinch et al., 2008; Conand et al., 2014; Eriksson and Clarke, 2015). In recent years, fishing and harvesting of sea cucumbers has gained greater importance in the coastal areas of the Mediterranean Sea. Historically, sea cucumbers were of little importance in Mediterranean countries with the exception of the Provence region in France. Today, large quantities are harvested in Greece, Turkey and Spain. Turkey also has an active fishery and exports sea cucumbers to the PRC, Singapore, Hong Kong SAR, and Japan (Aydin, 2008; Chakly et al., 2004; Sicuro and Levine, 2011). In the Mediterranean Sea, sea cucumbers are traditionally hand-harvested in shallow waters, seagrass meadows or on rocky outcrops or cliffs in the inter-tidal zone, as well as by using sharp harpoons in deeper water or in some instances by using bottom trawls (Sicuro et al., 2012). Sea cucumbers have also been used for over a century as bait for sport and professional fishing using longlines, targeting species belonging to the *Sparidae* family (Antoniadou and Vafidis, 2011). Within the European Union (EU) which includes countries that border the northern Mediterranean Sea, the harvesting of sea cucumbers is authorized only in areas classified by a respective country's Competent Authority (CA, see European Commission [EC] Regulations 853/2004; 854/2004, and 558/2010) (European Commission, 2004a, b; European Commission, 2010), which fixes the location and boundaries of particular production areas that it regulates. In doing so, the CA classifies production areas (European Commission, 2015) from which sea cucumbers can be harvested from as being from one of three categories (Class A, B and C) which is determined by the level of faecal contamination (*Escherichia coli*) found in the coastal waters of that respective area (EC Reg. 2285/2015). In 2015 and 2016, two Italian production areas for the harvesting of sea cucumbers have been

classified as Class A with these areas being located off the north-western coast of Sardinia region. In assisting with management and regulation, the respective country CA may, where appropriate, do so in cooperation with Food Business Operators (FBOs).

3. Illegal fishing and over-exploitation of sea cucumbers in the Mediterranean Sea

In some locations around the globe, populations of high-value sea cucumbers have been decimated (Hasan, 2005; Friedman et al., 2011; Purcell et al., 2014) and fishery closures or moratoriums have been imposed in at least 24 countries over the last decade (Purcell et al., 2013). In the Mediterranean Sea, the harvesting of sea cucumbers is now showing sign of systematic exploitation due to strong international market demand (Antoniadou and Vafidis, 2011). Recently, illegal fishing of sea cucumbers in Italy has been reported with increasing frequency in Sardinia and the Puglia region (Table 1). In 2015 alone, it was reported that a total of 29,030 kg of sea cucumbers were illegally harvested resulting in EUR 31,500 given in penalties, the seizure of several vessels, and the breaking up of clandestine processing facilities and storage rooms by the Italian Coast Guard or the Italian Finance Police. The amount of sea cucumbers illegally harvested in 2016 and 2017, accounted for 23,900 kg and EUR 33,656 in penalties.

4. Hygienic issues related to illegal processing and marketing of sea cucumbers

FBOs may market sea cucumbers collected from Class A production areas only if they meet the requirements of EC Regulation 2285/2015 whereby samples of sea cucumbers from these areas must not exceed 230 MPN (Most Probable Number) *E. coli* per 100 g in 80% of all samples. The remaining 20% of samples must not exceed 700 MPN *E. coli* per 100 g. In accordance with Chapter VII of EC Regulation 853/2004, sea cucumbers can only be placed on the market for retail via a dispatch centre, whereby an identification mark must be applied. FBOs that also operate dispatch centres must ensure the compliance with the following requirements: (a) handling of live sea cucumbers, particularly conditioning, calibration, wrapping and packing must not cause contamination of the product or affect their viability; and (b) before dispatch, live sea cucumbers must be washed thoroughly with clean water. The marketing of sea cucumbers in the EU is regulated by EC Regulation 1101/2014 (amending EC Regulation 2658/87) on the tariff and statistical nomenclature used on the Common Customs Tariff (European Commission, 2014) (Table 2). Section 0308 of Chapter 3 details what products are fit for human consumption: (a) aquatic invertebrates other than crustaceans and molluscs, live, fresh, chilled, frozen, dried, salted or in brine; (b) smoked aquatic invertebrates other than crustaceans and molluscs, whether or not cooked before or during the smoking process; and (c) flours, meals and pellets of aquatic invertebrates other than crustaceans and molluscs. Section 1605 of Chapter 16 details the preparation and preservation of crustaceans, molluscs and other aquatic invertebrates. In the EU, the main sanitary issues related to the sale of sea cucumbers as a food is the unregulated and thus illegal processing of sea cucumbers. The number of clandestine facilities for the illegal processing of sea cucumbers in Italy is increasing and these facilities are non-compliant with EC Regulations 853/2004 (Table 1). Environmental concerns from these illegal facilities include the discharge of large quantities of water used in processing (commonly called ‘stick water’ and which has high levels of the poison, *holothurine*) is dumped into rivers and drains. The large amount of seized sea cucumbers observed between 2015 and 2017 were mostly destined for local European-based Asian cuisine restaurants with some destined for the PRC

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