

# Characterising changes in a decade of Mexican sea cucumber crime (2011–2021) using media reports

Teale N. Phelps Bondaroff,<sup>1</sup> Felix Morrow,<sup>2</sup> Abigail Bennett,<sup>3</sup> Carmen Pedroza-Gutiérrez,<sup>4</sup> Meredith L. Gore<sup>5</sup> and Jorge A. López-Rocha<sup>6</sup>

## Abstract

This paper uses over a decade's worth of media coverage of sea cucumber crime (smuggling and poaching) in Mexico, in order to characterise the spatio-temporal magnitude of the problem and to better understand the *modus operandi* of those engaged in this form of wildlife crime. Towards this goal, we analysed and mapped incidents of crime relating to sea cucumbers taken from Mexican waters between 2011 and 2021; these were compiled from news media reports, government press releases and social media. The 97 incidents analysed revealed 125 arrests, with an average of 1.29 arrests and 1037 kg of sea cucumbers seized per incident. Mexican and United States authorities seized 100.6 tonnes of sea cucumbers, valued at an estimated USD 29.5 million. A qualitative review of these incidents reveals a number of key practises, including false identification, mislabelling, misreporting, stockpiling and invoice manipulation and fraud as means of laundering illicit catches. Also documented is corruption, the use of clandestine drying sites, and private vehicles for transportation. Media coverage of sea cucumber poaching and smuggling operations in Mexico frame the crime as being organised and conspicuous for its association with armed violence.

**Keywords:** Illegal fishing, sea cucumbers, wildlife crime, illegal, unreported and unregulated (IUU) fishing

## Introduction

The poaching and smuggling of sea cucumbers threatens the stability of their populations, marine ecosystems and legal fisheries by undermining conservation and management measures. A better understanding of the nature of sea cucumber crime is, therefore, critical to combatting this ruinous type of wildlife crime. Wherever there are sea cucumber fisheries, wildlife crime will inevitably emerge (Conand 2018). Surveying instances of sea cucumber crime globally reveals certain regions and countries as conspicuous hotspots. Mexico is one country with a globally recognized sea cucumber fishery and a considerable number of documented instances of sea cucumber crime.

Sources report extensive illegal activity in Mexican sea cucumber fisheries with sizable quantities of Mexican sea cucumbers having been seized by law enforcement in recent years. Such is the scale of illegal sea cucumber fishing in Mexico, Cisneros-Montemayor et al. (2013) estimated that the illegal catch may well be twice that of reported catches. Calderon-Aguilera (2019) noted that official sources reported the confiscation of 1,024,813 individual sea cucumbers in the Gulf of California between 2013 and 2018, and posited that the illegal catch was certainly much larger. Between 2013 and 2015, Gamboa-Álvarez et al. (2020) observed an increase in seizures of illegally caught *Isostichopus badionotus* from the Campeche Bank, with 34.1 t seized in 2014. One news story, relying on documents

obtained through transparency laws, reported that between 2007 and 2016, the Secretary of the Navy (SEMAR), seized nearly 42 t of illicit sea cucumbers (Alvarado et al. 2016). However, this same article notes databases maintained by the Federal Attorney for Environmental Protection [Procuraduría Federal de Protección al Ambiente] (PROFEPA) only record the seizure of 3164 kg over this same period (Alvarado et al. 2016).

This paucity of detailed data is echoed by Vidal-Hernández et al. (2019:227), who noted that “actors within the local fisheries sector estimate that over 70% of the trade in this resource is illegal and that trade authorities have no accurate data for the amount that leaves the state by land, sea, and air.” They further remark that “there is also no documentation of the structure of the state’s sea cucumber market network (i.e. how it operates and who participates), be it legal and/or illegal” (Vidal-Hernández et al. 2019:227). Given that sea cucumber populations in Mexico have been severely depleted, and that illegal extraction is a substantial cause of this depletion (Calderon-Aguilera 2019), a deeper understanding of this phenomenon is needed. A previous attempt to better understand Mexican sea cucumber crime was conducted by Calderon-Aguilera (2019), who tabulated 11 instances of sea cucumber crime in Baja California from 2013 to 2018, amounting to the confiscation of over 26.6 t of sea cucumbers. We seek to build on this work with a more comprehensive look at this form of wildlife crime.

<sup>1</sup> Director of Research, OceansAsia, Victoria, BC, Canada. Email: teale@oceansasia.org

<sup>2</sup> Researcher, OceansAsia, Victoria, BC, Canada

<sup>3</sup> Assistant Professor, Department of Fisheries and Wildlife, College of Agriculture and Natural Resources, Michigan State University, Unites States

<sup>4</sup> Senior Researcher, Escuela Nacional de Estudios Superiores, Unidad Mérida, Universidad Nacional Autónoma de México, Mexico

<sup>5</sup> Associate Professor, Department of Geographical Sciences, University of Maryland, College Park, Maryland, United States

<sup>6</sup> Senior Professor, Unidad Multidisciplinaria de Docencia e Investigación, Facultad de Ciencias, Universidad Nacional Autónoma de México, Sisal, Yucatan, Mexico

The goal of this paper is to use media coverage to characterise the spatio-temporal magnitude of the problem and to help gain a better understanding of the *modus operandi* of those engaging in sea cucumber crime in Mexico. Using open-access online search engines, we conducted a detailed search for all publicly available Spanish- and English-language news stories, government press releases, and social media posts documenting seizures, arrests and other illegal incidents, published between 1 January 2011 and 1 December 2021, involving Mexican sea cucumbers. Incidents of sea cucumber crime published in the media were then qualitatively studied and quantitatively coded. We reviewed the details of incidents in order to better understand the *modus operandi* of criminal operations involving sea cucumbers, and the incidents were then mapped in order to better understand spatio-temporal features. Incidents were also tabulated in a database to allow for a quantitative review.

In addition to better understanding sea cucumber crime in Mexico, it is our ambition that this paper may also contribute insight into methods that can be employed to study other forms of wildlife crime. Government reporting of wildlife crimes is inconsistent. A further challenge of studying illicit activities is that they are covert by nature. Some stages of wildlife crime, such as poaching, occur in remote locations characterised by limited human interface, and as a result, it can be difficult to directly observe. Clandestine stages of wildlife crime supply chains only come to light when they are interrupted by law enforcement authorities. These seizures and arrests may occur in different jurisdictions from whence originated the trafficked wildlife. The transboundary and clandestine nature of wildlife crime make it challenging to characterise the supply chain and *modus operandi* of offenders.

Media coverage offers one means of tracking wildlife crime along various stages of the illicit supply chain. Basic descriptive information about the “how”, “where”, “when” and “who” of wildlife crime is reported in media stories. Media coverage is also catalogued, so that decades of coverage can be compiled into a single dataset. Characterising media coverage of wildlife-related issues has become a commonly employed tool in conservation social science and criminology (e.g. Gore et al. 2005; Muter et al. 2013), and can offer a retrospective set of data chronicling conservation activity. Media coverage can, but does not always, influence public perceptions concerning wildlife (Gore and Knuth 2009) because the media does not cover every wildlife-related event. The strength of analysing media coverage is the novel set of data that is produced. A secondary goal of this paper is to demonstrate the effectiveness of using news media reports in order to better understand wildlife crime.

We begin with an overview of sea cucumber fisheries in Mexico, providing a brief history of the various fisheries, outlining relevant laws and regulations, and shining a light on instances of violence associated with the fishery. The paper then examines social drivers and factors motivating illegal sea cucumber fishing in Mexico. Before detailing our methods, we examine the May-orquin case – a multi-year, multi-million-dollar sea cucumber smuggling operation that transported at least USD 13 million

worth of sea cucumbers from Mexico to the United States, and then to Southeast Asian markets, between 2010 and 2012. The results are presented in two broader sections. We begin with a qualitative review of the *modus operandi* of sea cucumber criminals, before exploring elements of the documented incidents (arrests, weights and values of seizures, species, and associated species/products), and conclude with an analysis of the geographic distribution of sea cucumber crime in Mexico.

## Sea cucumber fisheries in Mexico

Mexico’s four coastal regions (Gulf of California, Pacific Ocean, Gulf of Mexico and Caribbean Sea) are home to 113 species of sea cucumbers (Solís-Marín et al. 2014; Solís-Marín et al. 2013). Major sea cucumber fisheries operate in two primary regions: the waters around the Baja California Peninsula (the Gulf of California and the Pacific, hereafter the Baja California Peninsula), comprising the Mexican states of Baja California and Baja California Sur; and the waters off the Yucatan Peninsula, comprising Campeche, Yucatan and Quintana Roo (Bennett and Basurto 2018) (see Fig. 4). The dramatic increase in interest in sea cucumbers in Mexico is linked to increasing demand from Southeast Asian markets, and has made sea cucumbers a highly lucrative opportunity for fishers. The high value of sea cucumbers has led to their being dubbed “oro negro” or black gold (Bennett and Basurto 2018; see also Calderon-Aguilera 2019). Consulting daily landings and payment records from a Yucatan fishing cooperative, Bennett and Basurto averaged the mean daily earnings per boat at USD 459, but noted that this went up to USD 737 during sea cucumber fishing season (2018). In good years, fishers could earn upwards of USD 1628 per day during the sea cucumber fishing season. By comparison, lobster fishing only earned fishers USD 150 per day (Kaplan-Hallam et al. 2017). Sea cucumber fishing quickly increased in importance. As Vidal-Hernández et al. (2019:227) note,

“an estimated 23400 people along the coast of the state of Yucatan depend on the 6000 fishers who participate in the sea cucumber fishing season each year; in other words, 75% of the fishers and one-third of the coastal population. It is clearly an important regional fishery.”

In both regions, fishing is typically carried out from small outboard motor-equipped boats, crewed by three to four fishers using semi-autonomous hookah-type diving gear in waters between 10 and 20 m (López-Rocha and Velázquez-Abunader 2019; Gamboa-Álvarez et al. 2020). Sea cucumbers are typically boiled, dried and salted before export, while lesser quantities are frozen (Solís-Marín et al. 2013:43). As Pedroza-Gutiérrez and López-Rocha note, “one major characteristic of the fishery is that the catch is male dominated, it is very rare to see a female fisher and even rarer to see a female diver” (2021:15). Processing, on the other hand, is mostly performed by women, who are seasonally and often informally employed, and who are “without any voice or influence in the fishery organization” (Pedroza-Gutiérrez and López-Rocha 2021:15).

## Baja California Peninsula

The Gulf of California is home to 64 species of sea cucumbers, and 53 species can be found living in the waters of the Pacific coast of the Baja California Peninsula (Solís-Marín et al. 2013). The main species of sea cucumbers that have been exploited in this region are *Isostichopus fuscus* and *Parastichopus parvimensis*. There are five other species of commercial interest: *Apostichopus californicus*, *Holothuria impatiens*, *H. inornata*, *H. parinhabilis*, and *H. paraprinceps* (Rivera-Téllez and López-Segurajáregui 2021). The first records of captures for *I. fuscus* and *P. parvimensis* date from 1988 (Singh-Cabanillas and Vélez-Barajas 1996). Catches of *I. fuscus* increased rapidly until they reached 2000 t per year in 1991. They then decreased until 1994, when the Mexican government declared *I. fuscus* an endangered species in NOM-059, and as a result, the fishery was closed (SEMARNAT 2020). The administration of *I. fuscus* was transferred from the National Aquaculture and Fisheries Commission [Comisión Nacional de Acuacultura y Pesca] (CONAPESCA) to the Secretariat of Environment and Natural Resources [Secretaría del Medio Ambiente y Recursos Naturales] (SEMARNAT). Illegal fishing persisted, however, despite this closure.

In 2007, the *I. fuscus* fishery was reopened, with a restricted fishing season (June to September) and a quota system. Subsequently, in 2010 and 2019, changes were made to the species protection category, designating it as a species subject to special protection (DOF 2010, 2019). This category allows for the use of the species, but it is managed by the General Directorate of Wildlife of SEMARNAT, and not by CONAPESCA. The conservation and legal extraction of *I. fuscus* is currently managed under a federal management plan in 37 federal areas in Baja California and the Gulf of California, including Sinaloa, Colima, Jalisco and Oaxaca. This management plan also recognises that illegal fishing is the main problem in the fishery (SEMARNAT 2020). At the moment, “*P. parvimensis* is not considered to be at risk or threatened” (Toral-Granda 2008, cited by Vidal-Hernández et al. 2019:227).

## The Yucatan Peninsula

Of the 14 species of sea cucumbers found off the coast of the Yucatan Peninsula, five are commercially exploited: *Astichopus multfidus*, *I. badionotus*, *Holothuria floridana*, *H. mexicana* and *H. grisea*. Of these, *I. badionotus* and *H. floridana* are the most significant commercial species and are the only species for which fishing permits are issued (see Gamboa-Álvarez et al. 2020; Gore and Bennett 2021). Fishing for *I. badionotus* and *H. floridana* started in 2006 and continued in 2010–2012, with permits and quotas being implemented by CONAPESCA (Bennett and Basurto 2018; Pedroza-Gutiérrez and López-Rocha 2021).

Initial permits were “development” permits intended to explore the potential and sustainability of the fishery, and were granted from 2000 to 2012 (DOF 2015). The first commercial permits were issued in 2013 for *I. badionotus*, and a management plan was published in 2015

(Pedroza-Gutiérrez and López-Rocha 2021). The commercial fishery was managed across four fishing zones in Yucatan through vessel permits, quotas, size limits and closed seasons (open seasons have typically run for 10–14 days, 1–2 times per year) (see Pedroza-Gutiérrez and López-Rocha 2021; Bennett and Basurto 2018). The Mexican National Fisheries Institute [Instituto Nacional de Pesca] (INAPESCA) collects the necessary information to recommend whether and when to open fishing seasons based on sea cucumber abundance, size and density determined through transect surveys. CONAPESCA determines regulations and recommendations, and communicates them through the Official Journal of the Federation [Diario Oficial de la Federación] (DOF) (Pedroza-Gutiérrez and López-Rocha 2021:10).

Significant interest in *I. badionotus* and incomplete enforcement of the fishery’s regulations led to overexploitation. This in turn, led to the fishery’s closure in 2019, after nine years of operation. Yet despite these closures, populations of *I. badionotus* show no signs of recovery (Pedroza-Gutiérrez and López-Rocha 2021; see also Glockner-Fagetti et al. 2016; Bennett and Basurto 2018; López-Rocha and Velazquez-Abunader 2019; Gamboa-Álvarez et al. 2020). In Baja California and the Yucatan Peninsula, illegal fishing has remained a constant problem leading to criminal code amendments to expand the ability of regulators and police to crack down on illegal fishing.

## Fisheries enforcement and monitoring in Mexico

As with many sea cucumber fisheries, enforcement of sea cucumber fishing regulations in Mexico has been challenging and unfortunately inadequate. In Mexico, in addition to government authorities such as CONAPESCA, municipal, state and Federal Police, environmental protection and protected area authorities (e.g. PROFEPA, the National Commission of Protected Natural Areas [Comisión Nacional de Áreas Naturales Protegidas, CONANP]), and military (e.g. SEMAR), fishing cooperatives play an important role in the monitoring and enforcement of formal fishery regulations and local rules (Mendez-Medina et al. 2020; McCay et al. 2014). The role of cooperatives in fisheries monitoring and enforcement has been particularly well-documented in the Yucatan Peninsula sea cucumber fishery (Bennett and Basurto 2018; Kaplan-Hallam 2016; Pedroza-Gutiérrez and López-Rocha 2021).

Enforcing harvesting regulations at sea is a challenge for authorities, given limited resources and assets, and in consideration of the geography and size of fishing areas in both Baja California and Yucatan Peninsula sea cucumber fisheries. As a result, instead of enforcing harvesting volumes, CONAPESCA officials “monitor volumes transported out of fishing communities...At roadside checkpoints, CONAPESCA inspected vehicles and weighed sea cucumber to verify that invoices matched the amount of sea cucumber being transported” (Bennett and Basurto 2018:64).

In 2017, the Mexican criminal code was amended to include Article 420 (II Bis), which made it illegal to:

In a fraudulent manner, capture, transform, stockpile, transport, destroy or trade with the aquatic species called abalone, shrimp, sea cucumber and lobster, within or outside the closed season periods, without the corresponding authorization, in a quantity that exceeds 10 kilograms of weight (Government of Mexico, Código Penal Federal, Book 2, Title 25, Chapter 2).<sup>7</sup>

As Mexican law currently stands, those harvesting and transporting sea cucumbers require the proper documentation and official invoices, “which are documents provided to permit holders (e.g. co-ops or patrons) according to the quotas authorized in their permits,” which “restricts permit holders from selling volumes greater than their harvest quotas” (Bennett and Basurto 2018:64).

In Yucatan, fishing cooperatives have aided in the monitoring and enforcement of sea cucumber regulations by alerting authorities to the presence of poachers (often non-local fishers) in local fishing grounds, attempting to prevent local fishers from targeting sea cucumber without permits, and lobbying state and federal government (including the national legislature) to invest in enhancing enforcement capacity. Enforcement and governance activities by fishing cooperatives play out differently along the Yucatan Peninsula coast, depending on local social and institutional dynamics. In various efforts to lobby government on issues relating to improving the regulation (management and enforcement) of sea cucumber fisheries, local cooperative fishers have employed a variety of forms of activism, including blocking highways, government buildings and ports to prevent un-permitted boats from accessing fishing grounds (Bennett and Basurto 2018; Tierra Fértil 2016).

### *A sporadic history of conflict and violence*

Local monitoring and enforcement efforts by fishers have at times led to violent conflicts between legal and illegal fishers and fishers from other states and communities. For example, in 2014, when fishing cooperative members approached boats poaching sea cucumbers in Yucatan, the poachers kidnapped a cooperative member. The cooperative member was later returned to his community with serious injuries (see Bennett and Basurto 2018). Conflict has also been driven by territorial struggles over fishing grounds. For example, fishers from both sides of the Yucatan-Campeche border have had multiple violent confrontations over sea cucumber fishing territory, resulting in burned boats and even deaths (Michel 2014; Yucatan Times 2016).

Fishing cooperative members are not deputised and, therefore, do not carry firearms, although sea cucumber poachers are very often armed. This has sometimes led to fishers being vulnerable to attack and robbery. For example, on 29 April 2015, 10 armed men entered the mouth of the port

of El Cuyo, Yucatan on a barge, and attacked three guards protecting a cold storage facility. The criminals absconded with 3.5 t of dried sea cucumber (Jiménez 2019). In another incident, in June 2016 at sea off the coast of Dzilam de Bravo, a group of armed men robbed eight fishers at gunpoint. The armed men allegedly stole half a tonne of sea cucumbers, robbed the fishers and threw them into the sea, leading to the drowning death of two fishers (Tierra Fértil 2016). Property damage, shootings, injuries and fatalities resulting from conflicts between fishers and poachers have been widely reported (Kaplan-Hallam et al. 2017; Medina 2021; Escalante Rosado 2018). Further confounding matters is the fact that port officials are not permitted to carry firearms, leaving them vulnerable and unable to safely engage with armed actors. Only officers from the Navy (SEMAR) are armed.

Even interactions among illegal fishing crews working on the same fishing vessel have led to injury and death. When poachers are approached by authorities, they attempt to flee quickly, and in at least one incident, have sunk their own vessel to avoid apprehension (Ruido 2019). When poaching operations are interrupted, divers may be quickly pulled to the surface of the water, leading to decompression injuries and death. To avoid detection from authorities, illicit fishers experiencing decompression injuries may avoid seeking medical assistance, and in some instances, they have been abandoned at sea by their accomplices.

The risks of decompression sickness are not limited to illicit sea cucumber fisheries. The general risks of decompression sickness and other associated safety issues are increased when depleting sea cucumber populations (as a result of poor regulation, overfishing and illegal fishing), leading to fishers diving deeper and seeking out less exploited, and often more dangerous, fishing areas (see Escalante Rosado 2018; Kaplan-Hallam et al. 2017). Gamboa-Álvarez et al. (2020) report that between 2012 and 2014, there were 468 injuries and 26 deaths caused by decompression sickness from sea cucumber fishing in the Yucatan Peninsula. This rate of injury is considerable given that the region only employs 6000 fishers, 4500 of whom target sea cucumbers (Vidal-Hernández 2019). Hutchim-Lara et al. (2018) report 166 cases from 2014 to 2016 in the Yucatan Peninsula, which they note is striking, given that the fishery was only open for ~17 days per year. Nor has the situation improved in recent years. Pedroza-Gutiérrez and López-Rocha (2021) report 10 cases of decompression sickness and one death in 2017.

In addition to violent confrontations between poachers and legal fishers, the sea cucumber fishery has had a range of socio-economic impacts on local communities. Disruptions caused by a rapid influx of money and outsiders have been documented in a number of sea cucumber fisheries, such as those in Papua New Guinea and Fiji (see Busilacchi et al. 2018; Hair et al. 2019; Cakaunivere 2016; Chen 2003). In Mexico, communities with rapidly emerging and evolving sea cucumber

<sup>7</sup> Translated from Spanish, original reads: “De manera dolosa capture, transforme, acopie, transporte, destruya o comercie con las especies acuáticas denominadas abulón, camarón, pepino de mar y langosta, dentro o fuera de los periodos de veda, sin contar con la autorización que corresponda, en cantidad que exceda 10 kilogramos de peso.”

fisheries have experienced an observed rise in antisocial or “deviant” behaviours, such as drug use, prostitution and theft (Kaplan-Hallam 2016; Bennett and Basurto 2018; Kaplan-Hallam et al. 2017; Gamboa-Álvarez et al. 2020).

### *Select social drivers of sea cucumber crime*

The decision to engage in illegal fishing is driven by a range of socioeconomic factors. Demand for luxury seafood products, such as sea cucumbers, expanded dramatically after the 1970s, alongside Chinese economic development. Rapid urbanisation in China and the rise of a growing middle class, along with the depletion of traditional fisheries, led to increased seafood consumption, such that per capita seafood consumption grew by 665% from 1970 to 2013 (4.53 kg to 34.67 kg) (Food and Agriculture Organization of the United Nations quoted by Fahrenbruch 2018). Chinese seafood imports grew by over 3300% over this same time period. Roving bandits fanned out through the world to uncover easily exploitable fisheries to satisfy this demand (Fahrenbruch 2018), and some of them found Mexico.

In the context of Mexican sea cucumber fishing, economic opportunity, historical processes of neoliberalisation and globalisation, changes in the role of local fishing cooperatives, and difficulty monitoring and regulating an expanding fishery, are all drivers of illegal fishing. Prior to the 1980s, the Yucatan Peninsula fishing industry was relatively small and consisted of locally owned cooperatives. In this period, fishing primarily met local demand, creating food and employment for the region (Pedroza-Gutiérrez and Salas 2011). This changed with the neoliberalisation of the fishery, which led to deregulation, privatisation, and increased private investment. The opening of fisheries to the global market and the reduction in state support for cooperatives, specifically the lowering of financial support to help fund large capital expenditures such as boats, led to actors from outside of communities arriving and taking a greater role in fisheries. Whereas early fisheries development approached investment and commercialisation through strong relationships between the state and fishing cooperatives, neoliberal reforms in the fishery sector helped enable a rise in the private sector, which consists of private fishing firms and patron-client relationships (Young 2001; Bennett 2017).

Patron-client relationships, in particular, serve as mechanisms facilitating investment in capital and migrant fishing labour that can lead to rapid increases in (often illegal) fishing effort in local communities, especially in the context of high market demand (Bennett and Basurto 2018; Pedroza 2013). During the early development of the sea cucumber fishery in Yucatan, some fishing cooperatives argued that the fishery should be modelled after another valuable benthic fishery in the region – the spiny lobster fishery – through spatial fishing concessions, with priority given to cooperatives over the private sector. However, the private sector was able to secure substantial access to fishing permits (Bennett, unpublished interview data).

The neoliberal regime resulted in a decline in regulation, and the state left fishing cooperatives as the primary moderating

force in fisheries (Kaplan-Hallam 2016). The decline of fishing cooperatives in communities that previously have largely been locally fished, has diminished local monitoring and enforcement capacity. As fishers increasingly come from outside of communities and/or are not linked to local cooperatives, the ability for cooperatives to identify and prevent illegal fishing is greatly diminished. Further, issues of real and perceived corruption of regulators allow for illegal fishing and lead locals to not report observed crimes (Kaplan-Hallam 2016). The combination of deregulation and increased investment lead to an intensification of extraction and production and, as a result, ecological decline in sea cucumber populations (Kaplan-Hallam 2016; Pedroza and Salas 2011).

The weakening of local regulatory capacity, increased costs of fishing (costs of fuel and permits and increasing scarcity of sea cucumbers), a lack of economic opportunities in fishing communities and nearby agricultural communities, and the high price of sea cucumbers incentivized local and outside fishers to operate outside of the legal fishery. The sea cucumber boom created economic prosperity and wealth and the bust that soon followed threatened that prosperity. The economic insecurity created by the ecological decline of sea cucumber populations has driven fishers to engage in illegal fishing to maintain their economic standing and avoid poverty. Further, global demand and profitability remain high, making illegal sea cucumber fishing a worthwhile endeavour for organised crime. Given all of these factors driving illicit sea cucumber fisheries, how has this crime manifested in Mexico?

## Methods

### *Sampling*

Building on the method employed in the analysis of sea cucumber crime in India and Sri Lanka (Phelps Bondaroff 2021), we assembled a database of seizures and other illegal incidents involving sea cucumbers in, and pertaining to, Mexico, from 1 January 2011 to 1 December 2021. This timeline is as reasonably far back as one can go given the method, and also, within the context of sea cucumber fisheries in the Yucatan, captures two years before the issuance of the first commercial fishing permits, the height of commercial fishing, and two years after the complete closure of the fishery.

Data were drawn from publicly available news stories that were identified through a series of English and Spanish language keyword searches.<sup>8</sup> Several rounds of searches were conducted using the Advance Search feature on Google, with and without the region filter being set to Mexico. Searches for “Mexico” plus “sea cucumber”, “trepang”, “bêche-de-mer”, “beche-de-mer”, “pepino de mar” and “pepinillo de mar” were also conducted in English and Spanish through Google News. A detailed search for the term “pepino de mar” was also conducted on the Mexican government’s website ([www.gob.mx](http://www.gob.mx)). Finally, we used the Advanced Search feature on Twitter to identify any tweets from fishery-focused Mexican and US government law enforcement agencies, departments and ministries, that con-

tained the terms “sea cucumber” or “pepino de mar.”<sup>9</sup> When an incident was identified, where possible, triangulation was used to confirm the details of the incident, and news stories reporting arrests and later stories documenting successful prosecutions were combined.

Identifying information was recorded for each entry, including date, location, agencies involved, method of transport, weight and/or number of sea cucumbers seized, species, state of seizure (live, fresh, dry, frozen, mixed), value of seizure (as estimated by the authorities), associated commodities (other wildlife products or other illicit products such as weapons or drugs), the number of people arrested (along with their nationalities, names, and ages), and any other seizures (vessels, fishing gear, vehicles). We also recorded the declared origins of the sea cucumbers, any transit points, and the declared destination, along with any legal consequences or sanctions, apart from initial arrests and seizures, including any fines or jail time, as well as any associated crimes (traffic violations, drug trafficking, weapons, etc.). Qualitative descriptions from news reports were also collected and served to inform our understanding of the *modus operandi* of illicit sea cucumber operations.

Arrests or seizures that occurred in different locations but on the same day were recorded as separate entries; this was done to allow us to map individual incidents. Likewise, seizures that occurred at the same location on the same date, but for which different details were provided, were treated as separate entries (Ángeles Rivero 2018). Thus, when federal police seized 17 t of dried *I. badionotus* at the Cancun International Airport on 20 May 2015, two entries were made in the database because 11 t were bound for Hong Kong, while 6 t were being shipped to Florida in the United States (Government of Mexico 2015a)

### Calculating values

Knowing the state and species of the sea cucumbers that were seized allows for an estimate of weight when only a number of animals was reported. While weights or numbers were provided for most incidents, the level of precision varied considerably. In some instances, the state of the sea cucumbers could be observed from photos or inferred from context, such as when authorities interdicted a vessel that was actively fishing, they were assumed to be fresh (see for example Lizárraga 2020), or when sea cucumbers were reported as being transported in boxes by truck, they were assumed to be dried, as processing typically takes place on the beach or in port (see for example Government of Mexico 2013c). In this way, we were able to identify the state of every seizure.

In five incidents, both the weight and number of sea cucumbers seized were reported, such as the 21 May 2014 seizure of 55,960 individuals of *I. fuscus*, or 2.5 t, from a warehouse in Ensenada, Baja California by PROFEPA agents; the more precise number was used for the purposes of calculations and analysis (Government of Mexico 2015b).

We drew on the literature for average live/fresh weights of individual sea cucumbers, and used the following for our

analysis: *I. fuscus* (385.9 g) (Herrero-Pérezul and Reyes-Bonilla 2008; see also Reyes-Bonilla et al. 2018), *Isostichopus badionotus* (551.9 g) (an average wet weight from DOF 2015; Pedroza-Gutierrez and López-Rocha 2021; Hernández-Flores et al. 2018; López-Rocha 2012; de Jesús-Navarrete et al. 2018; Poot-Salazar et al. 2015:18), *Holothuria floridana* (63.6 g) (Ramos-Miranda et al. 2017), and *H. mexicana* (97.9 g) (Guzmán et al. 2003). When the species was unknown, we used an average of all four weights (274.8 g).

Sea cucumbers typically retail in a dry state and, therefore, in order to calculate the value of seizures and compare incidents, we estimated dry weight for each seizure when a dry weight was not reported. Sea cucumbers lose considerable weight when they are processed and dried. We drew upon the literature in order to convert live/fresh weights to dry weights. For *I. fuscus*, we relied on the wet-to-dry recovery rate of 8%, calculated by Acosta et al. (2021), meaning that an average of 8% of the initial weight of the animal remains after processing. For *I. badionotus*, we used a wet-to-dry recovery rate of 7% (DOF 2015). As we were unable to locate literature specific to *H. floridana* and *H. mexicana*, we relied on the wet-to-dry recovery rate of 12% (Ngaluafé and Lee 2013), an average calculated from analysing 10 tropical species. When the species was unknown, we used the wet-to-dry recovery rate of 12%.

### Calculating values

Unlike with most crime reporting, the value of the seizures was seldom reported (only in eight incidents). Consistent with most crime reporting, when the value of a seizure was reported, it was not very reliable (Murtha 2016; and see Coomber et al. 2000). Prices vary at various stages of the fisheries supply chain. For example, Bennett and Basurto reported that a 2012 survey of fishers in Yucatan found that a kilogram of fresh sea cucumbers could be sold for USD 2.0–3.7, while dried sea cucumber could sell for USD 20–26 per kilogram (SAGARPA 2015 cited by Bennett and Basurto 2018; see also Vidal-Hernández 2019). Informal contractual relationships between buyers and sellers, as well as the legal status of a catch, also influence prices. Wholesale and retail prices in Southeast Asian markets, as well as online prices are considerably higher; quality specimens of *I. fuscus* can fetch up to USD 1030 per kilogram in some markets (Purcell 2014, cited by Calderon-Aguilera 2019:42). Further complicating matters is the fact that length, weight and the quality of processing also affect prices (see for example Purcell 2014; Purcell et al. 2018a; Purcell et al. 2018b; Purcell et al. 2017; Govan 2019). Thus, it was unclear as to what prices were used by authorities to calculate seizure values, and as a result, the reported value of seizures was discarded.

Instead, we searched the literature for average market prices for the four target species. We used the average Hong Kong market prices from Purcell et al. (2018b) for *H. mexicana* (USD 117) and *I. badionotus* (USD 313). As market prices were unavailable for *H. floridana* and *I. fuscus*, we calculated prices for these species in the following way. First, we averaged available prices from online sellers for each species, three *H. floridana* (USD 290.7) and six for the *I. fuscus* (USD 460.5).

When we compared the market price used by Purcell et al. 2018b for *I. badionotus* (USD 313) with an average of five online prices for the *I. badionotus* adjusted to 2018 prices using a 2.4% average beche-de-mer price growth rate (Purcell et al. 2018b) (USD 334.9), we found that market prices were 93.5% of online prices. We recognize that as a result, we used slightly inflated values for our price calculi for *H. floridana* and *I. fuscus*, as compared with previous market prices from the literature.

### Method of transportation

Incidents with identified transportation methods were placed into six categories: air, fishing vessel, ship, vehicle, private facility and container. Incidents were placed into these categories reflecting the last known intended method of transport. Thus, if a truck was stopped while entering the parcel area of an airport, the incident would be categorised as “air”, whereas if a car was stopped at a highway check-point, the incident would be classified as “vehicle”. Boats were placed into two separate categories: fishing vessel and ship. “Fishing vessel” describes instances where people were caught in the act of fishing illegally or having just caught illegal sea cucumbers. “Ship” describes instances when illegal product were seized from a boat being used to ship the product. The category of “container” includes incidents where sea cucumbers were seized in a shipping container, but the method of shipment was unclear, such as a shipping container in a port town that could be loaded onto a truck or a vessel where no indication was given in reports.

For the purposes of analysing methods of transport, two incidents were excluded. The first involved a woman walking through the United States border crossing into Baja California with the equivalent of 1.13 kg of dry sea cucumber in her bag (Rohrlich 2019). The second was an incident that occurred in July 2021, where a man was arrested with a small bag of sea cucumbers on a beach near Loreto, Baja California Sur, while he was illegally gleaning (BCS Noticias 2021).

### Limitations and sources of error

There are a number of limitations and potential sources of error in addition to those highlighted above. Wherever possible, we used triangulation to mitigate potential ambiguities in news stories and government press releases, and we conducted multiple rounds of searches using a range of search terms and on a number of platforms in order to maximise the number of news stories and reports we encountered. Because our approach relies on analysing news, social media posts and government press releases, it typically captures newsworthy incidents; as a result, many routine administrative actions are likely to be missed. This method relies on issues being problematized and, therefore, reported on by the media, and as such it is possible that incidents that occurred close to the origin of fisheries may not have been sufficiently problematized to be considered an issue worthy of media coverage.

Many news media platforms archive stories for a limited period, and may only archive significant stories. As a result,

the further back in time one goes, the fewer stories one is likely to encounter. We observed a lower diversity of sources in earlier years, and this likely indicates that some older incidents may have been missed. Likewise, smaller local news media platforms, the type that are most likely to report less significant incidents such as those involving only a few individuals or smaller seizures, may not publish their content online, or may have only started doing so in more recent years, and are also less likely to be indexed by the search engines that we used. One way we sought to mitigate this potential source of error was by investigating any “recommended stories” links, hyperlinks referring to previous related news stories that are often shared at the bottom of news stories.

Information was not always provided for all categories in the database, as entries were based on government press releases, tweets and news media stories. Some categories were more likely to be reported than others. For example, only 30 incidents had transit points or the declared destinations, legal sanctions or punishments were only available for 11 incidents, and reporting of the details about suspects (first names, ages, nationalities) was inconsistent. On the other hand, location was almost always reported, the weight or number of sea cucumbers seized was reported in most stories (91 of 97), and the species was noted in 47 incidents.

Similarly, the terminology used to describe seized sea cucumbers was not always consistent or clear for the purposes of calculating weight. For example, a 26 July 2021 news story recorded the seizure of 290 kg of cooked semi-dry (*semisecco cocido*) and 214.4 kg of cooked sea cucumbers by SEMAR and CONAPESCA personnel from vehicle stops in Hidalgo and Bustamante, Ensenada (Borbolla 2021). Other common terms used to describe sea cucumbers were stewed (*sancochado*) and pre-cooked or parboiled (*pre-cocido*) (See for example Larios Gaxiola 2015; Government of Mexico 2016b). These incidents were evaluated on a case-by-case basis, with the incident being assigned the nearest reasonable state (dry or wet).

In some cases, it was evident that values had been rounded, while in other cases, seemingly highly precise numbers were provided. For example, on 10 September 2015, a joint operation of SEMAR, CONAPESCA, and the Tax Administration Service led to the seizure of a reported 11 t of sea cucumber (*I. badionotus*, *H. mexicana* and *H. floridana*) from a shipping container in the port in Progreso, Yucatan (Government of Mexico 2015c). These numbers are considerably less precise when compared with, for example, a 13 March 2016 news story that reported the seizure of 144.94 kg of dry, and 191.42 kg of raw/fresh *H. floridana*, by a joint operation, from a processing camp on the Island of Jaina, Campeche (Chi Segovia 2016). Rounding could also be observed with the reporting of numbers seized.

We also noted inconsistencies and errors in press releases and news stories. One prominent example was a widely reported incident that occurred on 22 May 2013, when PROFEPA officers seized a shipping container that was

being used to transport a variety of illicit marine wildlife products at Ensenada (Baja California) Customs. Along with licit cover products, the container reportedly contained 898,660 dried *I. fuscus*, 78,676 seahorses, along with shark fins and nearly 1000 boxes of dry and frozen totoaba (*Totoaba macdonaldi*) fish maw (swim bladders), mixed in with other legal marine products. However, the same press release later noted that 686 kg of *I. fuscus* and 197 kg of seahorses (*Hippocampus ingens*), and 21 boxes of dry swim bladders and 955 boxes of frozen swim bladders, presumably from totoaba. The press release mentioned that the entire value of the illicit cargo exceeded MXN 2 million (~USD 160,300) (Government of Mexico 2013a; Madrigal 2013; CITES 2014). Something is off with these numbers, however. If we were to estimate the weight of 898,660 dry *I. fuscus* using a per sea cucumber dry weight of 31 g, the result would be well over 27 t of sea cucumbers. This weight is approaching the maximum weight for a 40-foot shipping container without factoring in the weight of the rest of the licit and illicit cargo. Likewise, the value of the cargo seems incredibly low, as 27 t of dried *I. fuscus* would have exceeded USD 10 million, and given that at the time, a single totoaba swim bladder fetched over USD 100,000, the value of 955 “boxes” of totoaba would be astronomical (see Alvarado Matrínez and Martínez 2018; Guilford 2015). In this instance, given the unlikelihood that PRO-FEPA counted every sea cucumber and the aforementioned discrepancies between weights and numbers, we opted to include the much more conservative weight estimates in our dataset. Where errors or discrepancies in news stories and press releases could not be corrected through triangulation, we opted for the more conservative number.

Corruption is another factor that could influence reported values. In one instance in May 2018, law enforcement allegedly seized 600 kg of sea cucumber in Chicxulub, near Progreso, Yucatan, but only 402 kg were eventually presented to the authorities. The local media story suggested that the sea cucumbers could have gone missing as a result of corruption (Chavarría 2018). We should note that we attempted to be as conservative as possible when calculating weights and values, however, while the use of averages (as described above) allows for comparison over time and between regions, it reduces the precision of values.

### Mayorquin case

One of the challenges with studying illicit activities is that they are, by their very nature, covert. When Hong Kong reports that volumes of sea cucumber imports are 1.3 times greater than the total of all global exports, we know that the scale of sea cucumber crime is extensive, and that there is a considerable number of successful sea cucumber poachers and smugglers (Anderson et al. 2011). Because we must rely on reports of instances when illicit activities are disrupted by law enforcement, we can only estimate the actual scale of criminal enterprises. Clearly for every smuggler stopped at a roadblock with a truck full of wildlife products, or a traveller caught with sea cucumbers in their luggage, there are numerous successful smuggling operations, and it is difficult to

conceive of the scale and structure of the broader network within which these individuals operate. However, there are instances when a network is successfully identified, disrupted and dismantled by law enforcement, which provides us a glimpse of the scale and structure of their operations.

Therefore, before examining instances where law enforcement apprehended sea cucumber poachers and smugglers in Mexico, we would be remiss if we did not highlight one particularly salient case, notably the Mayorquin sea cucumber smuggling ring. We must also highlight this case because court proceedings revealed that the perpetrators successfully smuggled sea cucumbers from Mexico to Southeast Asia on at least 16 occasions. Because they were successful, these instances were not captured by our method.

Ramon Torres Mayorquin (father) and David Mayorquin (son) operated a seafood company, Blessings Inc., out of Tucson, Arizona (United States). Through this company, the two smuggled Mexican sea cucumbers from Mexico and into Southeast Asian markets. According to court documents, David Mayorquin handled the ordering of sea cucumbers from Mexico, primarily from the Yucatan, and arranged for products to be sold to Southeast Asian markets, while Ramon Torres Mayorquin received sea cucumbers in Mexico and arranged the practical aspects of moving product across the United States border (US Department of Justice 2018; Hickok 2018). The sea cucumbers were brought into the United States through the Otay Mesa port of entry in California. Once there, Ramon Torres would falsify invoices that included using a “non-existent address”, and substantially undervaluing the sea cucumbers. In two instances, the coordination of the payment of bribes to Mexican officials were recorded by the courts, although the defendants were not charged with bribery.

In this way, between 23 January 2010 and 22 July 2012, 16 instances of illicit product with falsified documents were recorded. In total, the court recorded 128,610.5 kg of sea cucumbers (dry), with a total misreported value of USD 733,704 trafficked out of Mexico. The court estimated that the actual value of the over 128 t of sea cucumbers was close to USD 17.5 million when sold to Southeast Asian markets.

The Mayoquins did not have the proper licences or documentation to establish the legality of their products, and they intentionally misreported the value of their shipments (US Department of Justice 2018). Thus, in 2010, they exported 21,780 kg of sea cucumbers from Mexico into the United States in five shipments, and claimed the value to be USD 1.60/kg. In 2011, they exported 54,376 kg of sea cucumbers into the US in six shipments and claimed the value to be USD 1.30/kg. When they made five shipments of sea cucumbers from the United States to Taiwan and Hong Kong in 2012, totalling 52,454.5 kg, they claimed a value of USD 12.00/kg. All of these reported values were as little as one-tenth the actual value of the products (Department of Justice 2017; United States Department of Justice 2018).



On 8 March 2018, David Mayorquin, Ramon Torres Mayorquin and the company Blessings Inc. pled guilty to a 26-count indictment for illegally importing USD 13 million worth of sea cucumbers from Mexico; sea cucumbers that were sold for an estimated USD 17.5 million to Southeast Asian markets. The indictment resulted in the guilty parties forfeiting illegally procured product and profit, and they were required to pay USD 973,490 in fines, USD 237,879 in forfeited assets, and USD 40,000 in restitution to the Mexican government. A large portion of the fine was paid into United States government conservation funds (US Department of Justice 2018). No jail time was awarded to either David or Ramon Mayorquin, despite a number of the charges carrying maximum sentences of between five and twenty years. In addition, the fines were far less than the alleged profits earned by the conspirators over the duration of their operation. Both Mayorquins and Blessings Inc were placed on five years of probation (Putnam 2018; US Department of Justice 2018).

The Mayorquins moved a considerable amount of illicit sea cucumbers out of Mexico and were highly organised and used falsified documents extensively. A more in-depth examination of other incidents across Mexico will help establish whether this case was an outlier or the norm.

## Results and discussion

From news media stories, government press releases, and tweets, we identified 97 instances of sea cucumber crime in Mexico between 1 January 2011 to 1 December 2021 (Table 1). These incidents resulted in 125 arrests and the seizure of the equivalent of 100,611 kg of dried sea cucumbers, with an estimated value of USD 29.55 million (Table 1). The number of incidents was generally on the rise until 2020, when there was a dramatic decrease (Fig. 1). The majority of these incidents (91) occurred in Mexico, while 6 incidents occurred in the United States. Note that our analysis and mapping of Mexican incidents sometimes

exclude these US incidents. The average weight of each of these six incidents was 28.3 kg, and seizures ranged from 0.8 kg to 78 kg. Five people were arrested in four of the six seizures. Three of the seizures in the US occurred at the San Ysidro port of entry, the land crossing between Baja California, Mexico and California, United States. In all but one instance, the sea cucumbers being smuggled were dry, and in three instances, the species was identified as *I. fuscus*.

### *Modus operandi*

Reviewing individual incidents qualitatively allowed us to gain a better understanding of the *modus operandi* of illicit sea cucumber operations. Here, we will highlight a number of salient observations from the incidents examined. Laundering, false labelling, and the bribing of officials have been common practice among those seeking to smuggle sea cucumbers out of Mexico. However, illegal actions have altered according to the availability of sea cucumbers, and the status of the legal fishery.

When the Yucatan Peninsula fishery was open, cooperatives provided one of the avenues and entities used to launder sea cucumbers. Each fishing season, the principal buyers would go to the cooperatives to auction the catch and associated invoices before they would start fishing. Invoices are required in order to legally sell and transport sea cucumber catches in Mexico. Buyers would store the illegal catch for the entire year and, when the season reopened, they would use the invoices to launder the product. A portion of the sea cucumbers stored would be sold using these recently acquired invoices. Thus, the fishing seasons served both as a time to fish, but also as an opportunity to launder sea cucumbers that were caught illegally out of season or above quotas from the previous season (Pedroza-Gutiérrez and López-Rocha 2021). Elsewhere, Bennett and Basurto (2018) described how when a local harvest exceeds the amount that can be legally transported out of the region, “some permit holders re-used invoices that were not

**Table 1:** Incidents, weight, arrests, value and boats seized, 2011–2021.

| Year         | Number of cases | Weight (dry) (kg) | Number of arrests | USD               | Boats seized |
|--------------|-----------------|-------------------|-------------------|-------------------|--------------|
| 2011         | 5               | 1402              | 34                | 450,935           | 2            |
| 2012         | 2               | 6                 | 6                 | 1448              | 0            |
| 2013         | 8               | 8466              | 15                | 2,322,474         | 9            |
| 2014         | 10              | 16,643            | 3                 | 5,258,682         | 0            |
| 2015         | 9               | 31,009            | 15                | 8,713,030         | 2            |
| 2016         | 9               | 6815              | 6                 | 2,006,994         | 1            |
| 2017         | 11              | 10,349            | 8                 | 3,825,755         | 0            |
| 2018         | 14              | 1938              | 9                 | 532,954           | 1            |
| 2019         | 14              | 19,643            | 19                | 5,062,481         | 0            |
| 2020         | 5               | 582               | 4                 | 170,278           | 0            |
| 2021         | 10              | 3761              | 6                 | 1,201,923         | 0            |
| <b>Total</b> | <b>97</b>       | <b>100,613</b>    | <b>125</b>        | <b>29,546,953</b> | <b>15</b>    |

inspected upon initial use,” while others “froze and stored sea cucumber with the intention of selling it under future quotas during subsequent seasons”. Bennet and Basurto (2018:64) describe the rise of an informal market for invoices, whereby “permit holders often sold their invoices to prospecting buyers prior to each season”.

Smuggling and mislabelling have evolved with regulatory changes in the fishery. When the legal fishery was in operation, sea cucumbers would often be labelled as another type of seafood (one for which a legal fishery existed). However, in 2019 the Yucatan Peninsula fishery closed and smugglers began falsely labelling sea cucumbers more broadly as seafood and non-seafood products. This is evidenced in the Mayorquin case and in a variety of incidents that we documented. In one incident, a government press release reported that on 30 March 2019, the Mexican Navy seized approximately 12 t of sea cucumbers that had been labelled as peanuts from a shipping container in the port in Manzanillo, Colima (Government of Mexico 2019a). In another incident, 1116 kg of *Holothuria mexicana* and *H. floridana* that were falsely labelled as bonito were seized by authorities at the International Airport in Merida, Yucatan on 16 April 2016 (Government of Mexico 2016c).

Another seemingly common practice is under-reporting or misreporting. In these incidents, those shipping sea cucumbers may have the appropriate paperwork and permissions, but their paperwork does not correspond with the actual state, quantity or weight of the shipment. For example, on 8 April 2014, PROFEPA officials at the Mesa de Otay border crossing in Tijuana, Baja California, seized a shipment of 10,582 individuals of (700 kg) of *I. fuscus*, which exceeded the declared amount by 1759 units and whose state allegedly did not match the accompanying paperwork (Government of Mexico 2014). In another incident in Tijuana, this one on 10 November 2014, PROFEPA was alerted by some irregularities in the documents accompanying a shipment purporting to contain 32,000 dried *I. fuscus*. Upon inspection, officials counted 58,115 sea cucumbers, and so they seized the shipment and arrested the manager of the shipping company (Government of Mexico 2016a).

A number of other factors and *modus operandi* complicate the effective enforcement of sea cucumber fishing laws. As Gore and Bennett (2021:9) note, “illegal fishing and fish trade activity occurs in the same places and often appears quite similar to legal activities.” The authors also elaborate how:

...permitted and non-permitted fishers may be fishing in the same areas and authorities lacking specific training may be unable to visually recognize the difference. Boat owners who possess legal permits may simply exceed harvesting quotas or copy permits to use more vessels. Vessels permitted to harvest sea cucumber may also harvest other species for which they are not permitted during the same fishing trip, such as lobster (*Panulirus argus*), octopus (*Octopus maya*), and finfish (e.g., snapper [*Lutjanus campechanus*] and grouper [*Epinephelus morio*, *Mycteroperca bonaci*]) (2018:9).

In 2016, an investigative piece in *El Universal* (Alvarado et al. 2016), documented a number of instances of what appeared to be the clandestine stockpiling of sea cucumbers. There were a number of incidents where law enforcement found sea cucumbers being stored in warehouses and in private homes (see for example Government of Mexico 2013b; Expreso 2018). And, there were incidents involving sea cucumbers being stored in wineries, whose cellars seem well-suited to storing sea cucumbers between seasons (El Financiero 2019; Diario de Yucatán 2019; Novedades Yucatán 2019, 2021). In one particularly conspicuous incident, a fire at a winery in Merida, Yucatan led to the discovery and seizure of 3463.8 kg of sea cucumbers (see ProgresoHoy 2019a, 2019b).

Illegal trade has also affected processing activities in which women have been the primary participants. In a normal season of legal fisheries, processing camps were situated next to landing sites, and women would take an active role in processing. However, with the closure of fisheries and the rise in illegal fishing, poachers and processors take measures to obscure their processing operations, as such facilities are potentially vulnerable to identification by authorities. As a result, women are no longer as involved in sea cucumber processing as they once were. A number of incidents involved the authorities identifying processing camps in hidden remote locations.

On 12 October 2015, officers from PROFEPA and SEMAR interdicted two small fishing vessels that were actively and illegally fishing for sea cucumbers 150 km south of San Felipe in Baja California. After arresting the two fishers, authorities were then able to identify the location of their processing camp, which was located inside the Valley of the Candles Flora and Fauna Protection Area [Área de Protección de Flora y Fauna Valle de los Cirios]. Authorities arrested four adults and two minors at the processing camp, for a total of eight arrests, and seized 137 kg of *I. fuscus* along with the fishing vessels (Milenio 2015). Another camp was found operating in this same protected area by PROFEPA, Ministry of National Defence [Secretaría de la Defensa Nacional] (SEDENA), and SEMAR officers on 15 June 2017. On this occasion, authorities seized 256 *I. fuscus* from what they described as an abandoned camp (Government of Mexico 2017a). Federal and state authorities raided and dismantled an illicit sea cucumber processing facility on the remote island of Jaina on 4 March 2016. The island, which is home to an important Maya archaeological site, is located in a poorly accessible corner of Los Petenes–Ría Celestún National Park in Campeche. The authorities disrupted processing operations, and while the perpetrators fled into the park, 144.94 kg of dried, and 191.42 kg of unprocessed, *H. floridana* were seized, along with processing equipment, vehicles and coolers (El Sol De México 2016).

Such sites are ideal for clandestine sea cucumber processing because they are away from prying eyes and offer numerous avenues of escape. Because they are set up in remote locations, poachers can use lookouts and other intelligence assets to tip them off about law enforcement activities in advance

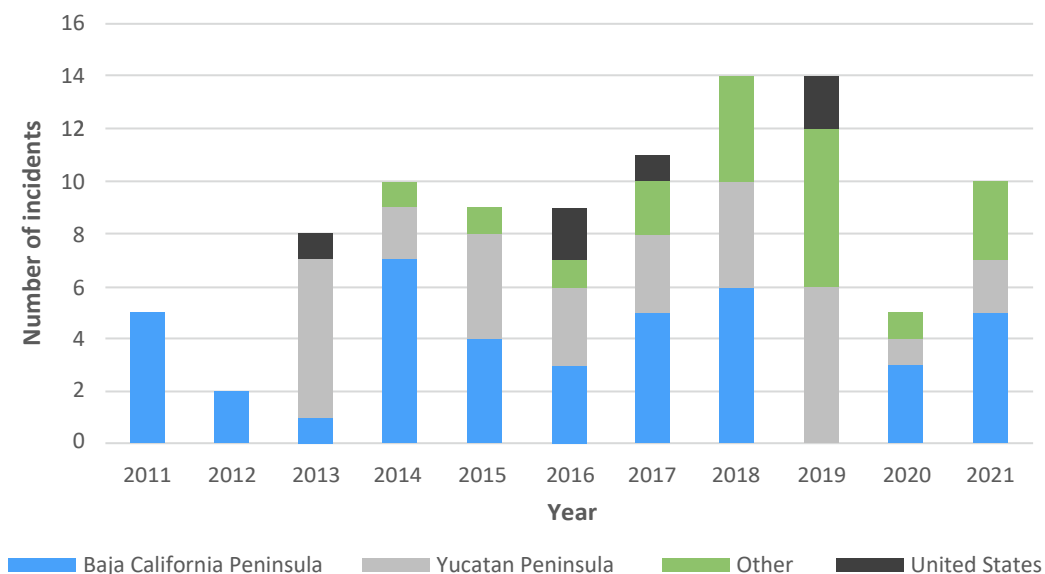
of possible raids. According to the local fishing chief in the port of Celestun, Yucatan, poachers have a hidden landing site guarded by armed men. Any person not in association with them might be at risk if approaching the site, with the exception of “gaviotas”. Gaviotas (seagulls) are women who approach fishers when they land and offer to do work (such as cleaning the vessel) in exchange for fish or sea cucumbers. Gaviotas can also serve as intelligence and information assets for illicit sea cucumber operations. These women convey valuable information to poachers about the fishing activities and business operations of cooperatives and/or private fishing companies (interview with author, June 2019). On the other hand, Bennett and Basurto (2018:65) report how “a group of women from Celestún, many of whom were wives of co-op members, undertook monitoring efforts to search for temporary camps where patrons were processing sea cucumber either without a permit or outside of the legal season”. After locating a camp, the women would report them to the authorities. These efforts were later disrupted by patrons paying bribes to some of the women to alert them as to when monitoring activities were planned. As a result, suspicion within groups led to their disintegration. Adequately monitoring for illegal activities in lightly populated and remote protected areas and parks will remain a challenge for Mexican law enforcement.

Sea cucumbers were typically transported by private vehicle (see for example Huard 2020), or commercial transport vehicle (see Government of Mexico 2017b; El Vigia 2014), and when they were being carried across the border, they might be concealed in a space tire, within hidden coolers or compartments, or concealed among cover products such as licit marine products (Adams 2014; Government of Mexico 2013a; Gore and Bennett 2021:7; Alvarado et al. 2016). While transport typically involved a single vehicle or multiple commercial trucks, on one occasion, smugglers appeared to be employing countermeasures to protect their

shipment from the scrutiny of authorities. On 10 October 2013, Federal Police stopped a truck carrying 4014 kg of sea cucumbers in Cancun, Quintana Roo. At the same time, the police also stopped another vehicle that was apparently operating as a “blocker car”. The sea cucumbers were seized and both drivers were arrested (Government of Mexico 2013c).

Corruption was a common feature of many incidents. A number of academic studies report rumours that bribes are “paid to authorities allowed transportation and commercialization of undocumented sea cucumber” (Bennett and Basurto 2018:64; and see Kaplan-Hallam et al. 2017). The payment of bribes at road stops to avoid trouble is common (Pedroza-Gutiérrez and López-Rocha 2021). For example, on 27 March 2019, a transport truck carrying 1500 kg of sea cucumbers was stopped by Federal Police in the verification area at Merida Airport in Yucatan. A newspaper story covering the incident alleged corruption on the part of local customs officials (Grillo de Yucatán 2019). This same news story noted that a previous deputy administrator for customs in Progreso in Yucatan resigned due to allegations of corruption, and that this individual was still running a protection racket relating to customs (Grillo de Yucatán 2019). Allegations of corruption extend beyond officers in the field, and high-ranking officials have been accused of corruption. In an interview with *VICE*, Mexican Senator Daniel Ávila Ruiz accused state and federal authorities of being part of the mafia (Escalante Rosado 2018).

The level of sophistication and organisation of illicit sea cucumber operations appears to be considerable, observable throughout the illicit sea cucumber supply chain. Criminals operate their own fleets of vessels, processing and drying facilities, warehousing, and transport networks, armed security for shipments, and employ bribery, corruption and false documentation to facilitate the flow of their illicit products.



**Figure 1.** Number of incidents of sea cucumber crime by region, 2011–2021.

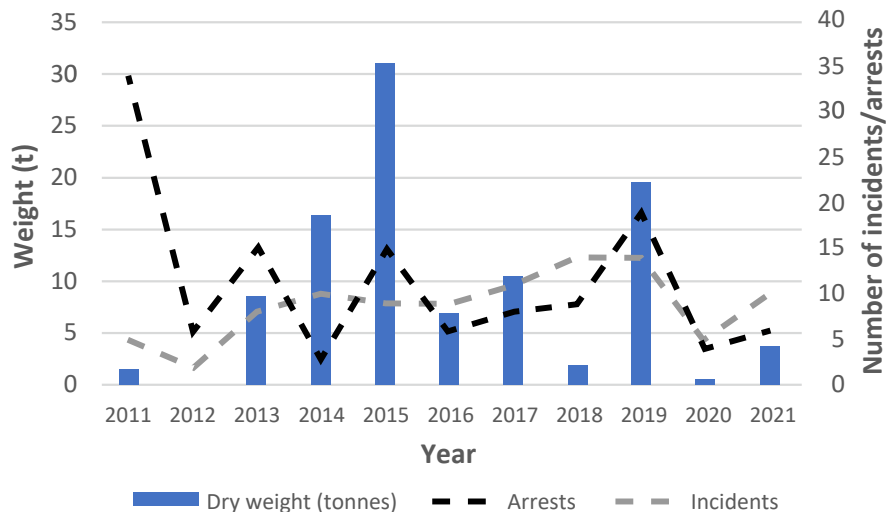


Figure 2. Weight (dry) of sea cucumbers seized, and the number of arrests and incidents, 2011–2021.

### Documented arrests

The average number of people arrested per incident was 1.3 but ranged between 0 and 24, with a mode of 0. The number of incidents and arrests that occurred in the United States (4) have been excluded from Table 2. In addition to arrests, authorities seized 15 boats, along with a variety of equipment (e.g. fishing gear, dive equipment) (Table 1). The seizure of boats is significant, as boats are heavily relied on by fishers to harvest marine wildlife. Oftentimes, asset forfeiture is one punitive tool used by law enforcement. Given the number of incidents, the number of boats seized appears low, although arrests on active fishing vessels were less common, occurring on only eight occasions. It should be noted that these incidents resulted in a larger number of arrests (an average 7.6 arrests per incident).

Arrests on land were recorded in 34 out of 97 incidents, and when arrests occurred on land, an average of 1.9 people were arrested. Overall, 64 (51.2%) arrests occurred on land and 61 (48.8%) occurred on active fishing vessels. Thus, while rare, at-sea interdictions tended to result in more arrests than land-based incidents, which is consistent with the fact that it takes more personnel to operate an active fishing vessel than to transport illicit cargo in a vehicle or stockpile sea cucumbers in a warehouse. By far the largest number of arrests resulting from one incident took place on 22 September 2011, when a joint operation of PROFEPA, SEMAR and the Attorney General's Office arrested 24 fishers in seven vessels, along with 387 kg of illegally caught *I. fuscus* in the Calamajué fishing ground, off the coast of Ensenada in Baja California (El Vigía 2011) (Fig.2).

Given the number of people involved in both sea- and land-based operations, it is apparent that sea cucumber operations are coordinated, and that most would meet international definitions of organised crime (see Phelps Bondaroff et al. 2015). The United Nations Convention against

Transnational Organized Crime, for example, defines an organised crime group as:

a structured group of three or more persons, existing for a period of time and acting in concert with the aim of committing one or more serious crimes or offences established in accordance with this Convention, in order to obtain, directly or indirectly, a financial or other material benefit (United Nations General Assembly 2000:2(a)).

The number of arrests per incident is low when compared to incidents in India and Sri Lanka, where an average of four people were arrested per incident (Phelps Bondaroff 2021). This can be partially explained by the fact that many of the incidents involved the seizure of shipments at airports and from transport trucks. In these incidents, the general practice is that products are seized, but the driver(s) of the vehicle was not often arrested, likely owing to the fact that many of the truck drivers or shipping company staff were unaware of the nature of the cargo they were transporting. For example, on 28 May 2019, Federal Police seized 44 boxes of sea cucumber from the cargo hold of a commercial aeroplane at the Mexico City International Airport. The boxes contained 1,041 kg of dried sea cucumber from Merida, Yucatan (Government of Mexico 2019b).

Most incidents (45%) occurred in the region of the Baja California Peninsula sea cucumber fishery (Baja California (41%) and Baja California Sur (4%)), while 34% of incidents occurred on the Yucatan Peninsula: Yucatan (25%), Quintana Roo (6%) and Campeche (3%) (Figs. 1 and 3). Mexico City was also another major location for incidents, comprising 8% of incidents (combined with "Other" category in Fig. 3). It is noteworthy that despite the Yucatan Peninsula comprising 34% of sea cucumber crime incidents, this region constituted 71% of the overall weight of sea cucumber seized; whereas the Pacific and Baja California comprised

45% of incidents constituting 12% of overall weight of sea cucumbers seized. This is likely explained by the fact that sea cucumber populations in the Baja California Peninsula were already depleted prior to the time frame studied.

The transportation and storage method was identified in 92 of 97 incidents (94.8%), with 2 incidents not fitting our categories and thus having been excluded from the following numbers. The most common mode of transportation was “vehicle”, representing 31 out of 90 (34.4%) of incidents, followed by “air” (17 or 18.8%) and “shipping vessels” (3 instances or 3.3%). The number of instances where fishing vessels were interdicted (11 or 12.2%) was low by contrast. This reflects the challenges faced by law enforcement when trying to monitor large maritime areas. Rather than focusing monitoring and enforcement at sea, it appears as though Mexican law enforcement relies more heavily on land-based actions, specifically road blocks. Seizures occurred in private storage facilities (e.g. warehouses, wineries, private homes) on 20 occasions (22.2%), and these are explored in more detail below.

While many arrests were reported, there were few news stories about prosecution, conviction and sentencing. News stories and government press releases would often include mention of the maximum fines and sentences associated with the reported crimes, and a handful of incidents detailed court proceedings (see for example Adams 2014), but follow-up stories noting the actual punishments levied were rare. Actual sentences for criminals successfully prosecuted for sea cucumber-related crimes were only recorded in eight incidents. One incident was that of Alan Ren, a United States citizen and owner of two Chinese restaurants in New York. He and his girlfriend, Wei Wei Wang, a Taiwanese woman, were arrested by United States authorities at the San Ysidro Port of Entry in February 2016 with 78 kg of dried sea cucumber and 37.6 kg of frozen black abalone in a suitcase. Ren ultimately pled guilty. He was sentenced to 10 months in prison, and was required to pay a USD 7500 fine and USD 16,600 in restitution to Mexico. Wang was ultimately acquitted on four charges, including smuggling and the unlawful importation of wildlife (see Government of Mexico 2018; Davis 2018; Fox 5 2017).

In another incident from the United States, former Border Patrol Agent Cesar Daleo was given concurrent sentences of 30 and 24 months, respectively, for his role in fentanyl and sea cucumber smuggling conspiracies. The US Attorney’s Office claimed that Daleo had paid someone to smuggle *I. fuscus* into the US at least 80 times between 2014 and 2016. He was also charged with conspiring to distribute 4-anilino-N-phenethyl-4-piperidine (4ANPP), a primary ingredient in fentanyl. Daleo was initially apprehended on 29 August 2017 when trying to enter the US from Mexico with a package containing what he believed to be 4ANPP. US Customs and Border Protection had previously intercepted the package sent from China at the Los Angeles International Airport, and replaced the 4ANPP with a harmless substance, before sending it back in transit, to the post office in San Ysidro, from whence Daleo recovered it. Daleo had worked as a border agent for 11 years, and was allegedly the leader of a larger network, which

was under investigation and being surveilled by authorities (Alvarado 2018; Avitabile 2019). In one other incident, a federal judge in San Diego in the US, sentenced Claudia Castillo, a Mexican citizen from Tijuana, to eight months in prison and ordered her to pay USD 12,000 in restitution to the Mexican government for smuggling sea cucumbers from San Ysidro into the US in 2018 and 2019. The estimated value of the sea cucumbers Daleo smuggled exceeded USD 250,000 (Associated Press 2020; Pozzi 2021).

Despite two of the aforementioned incidents featuring women, the vast majority of people arrested for sea cucumber poaching, smuggling and related crimes in Mexico according to media coverage were men. We know women can assume a number roles in wildlife crime, and also in fisheries governance (e.g. Agu and Gore 2020), including offenders, victims, defenders and influencers. At the same time, it is well documented that women’s role along the fisheries value chain is mostly concentrated in processing and transformation activities, and it is still rare to see a fisherwoman (Pedroza-Gutiérrez 2019). The lack of media coverage about the roles of women in sea cucumber crime in Mexico is noteworthy, although it is beyond the scope of our data to determine why the roles of women are not being more comprehensively profiled in the media.

Another feature of incidents where sentences were reported was the modest value of the fines levied and light prison sentences. In addition to the preceding, incidents where fines were reported included the following.

- In February 2020, a fisher from Progreso in Yucatan, was sentenced to 11 months in prison and ordered to pay a fine of MXN 14,681 (~USD 787), after he was caught with 154.1 kg of sea cucumbers in his fishing vessel (ProgresoHoy 2020).
- In January 2020, a court in Yucatan sentenced a man to one year in prison and a fine of MXN 24,260 (~USD 1287), and MXN 154,534 (~USD 8,200) after he was caught illegally transporting 572.35 kg of dried *H. floridana*, while on a suspended sentence for a previous sea cucumber smuggling offence (Diario de Yucatán 2020; Rompecabeza 2020).
- John Jaimes Torres, a Tijuana resident, was given a six-month prison sentence and ordered to pay USD 10,000 in restitution to the Mexican government for attempting to smuggle 136 kg from Mexico into the United States in his truck at the Otay Mesa Port of Entry in 2019. News articles noted that the value of the sea cucumbers exceeded USD 60,000 (Huard 2020).

One feature that is apparent in all of these incidents is the discrepancy between the value of the smuggled goods and the fines and restitution levied. It is the case, as with many forms of wildlife crimes, that fines and punishments are lower than the value of the seized cargo, and low as compared with punishments handed out for smuggling other illicit goods.

## Weights of seizures

Between 1 January 2011 and 1 December 2021, authorities in Mexico and the United States seized 100,611 kg of illicit sea cucumbers (Table 1). The weight of seizures ranged from 0.3 kg to 12,000 kg, with the average weight of sea cucumbers seized per incident being 1037 kg. The largest individual seizure occurred on 31 March 2019, in which SEMAR and PGR officials seized 12,000 kg of sea cucumbers from a shipping container in Manzanillo, Colima and arrested two people. The shipment, which was destined for Shanghai, China was labelled as “peanuts”, when it actually contained dried *H. mexicana* and *H. floridana* (Government of Mexico 2019a; Pinto 2019). We should also note that Federal Police seized 17,000 kg of dried *I. badionotus* at Cancun International Airport on 20 May 2015, but this was treated as two separate entries because 11 t were bound for Hong Kong, while 6 t were being shipped to Florida (United States) (Government of Mexico 2015a).

The greatest weights of sea cucumbers seized during our study period were those seized in 2015 (31,009.2 kg) and 2019 (19,642.6 kg) (Table 1, Fig. 2). We were only able to identify two seizures in 2012, both of which occurred in the US. The average size of individual seizures has been decreasing over time, since a peak in 2015 (Table 1), which is consistent with declines in sea cucumber populations over time. A similar downward trend is not quite as apparent with respect to arrests and incidents (Fig. 2). This suggests that while illegal fishing has continued after the closure of overexploited fisheries, the amount of sea cucumbers being extracted is on the decline, hence smaller shipments. A decline in the size of seizures could serve as an indicator of an overexploited fishery.

The majority of sea cucumbers, by weight, were seized in the Yucatan Peninsula (71%) at Yucatan (43%), Quintana Roo (26%) and Campeche (2%), while 12% of sea cucumbers by weight were seized in Baja California. The scale of seizures in the Yucatan Peninsula peaked in 2014, and has generally declined since this time (Fig. 3).

It is interesting to note the rise of Mexico City, and specifically the Mexico City International Airport, as a major exit point for illicit sea cucumbers in 2018 and 2019, and the site of arrests. Seizures in Mexico City were typically small (seven total, averaging 259 kg), with the average being lower as a result of a number of incidents involving individuals being caught attempting to smuggle small amounts of sea cucumber out in their personal luggage. This compares to incidents in Tijuana International Airport (5), where the average size of seizures was 123 kg, with weights ranging between 3.4 kg and 281 kg. In contrast, at Cancun International Airport in Quintana Roo there were four seizures, ranging between 2100 kg and 11,000 kg, with an average of 5438 kg. Similar to Tijuana International Airport, the Tijuana border crossing saw seizures that were considerably smaller than those at Cancun International Airport. The average size of the eight seizures that involved crossing the United States/Mexico Border at Otay May Port of Entry in

Tijuana was 401 kg, with seizure sizes ranging from 0.8 kg to 1794.1 kg. This disparity reflects the tendency for the Yucatan fishery to have considerably larger weights involved in seizures.

It should be noted that sea cucumbers seized in one state does not necessarily mean the sea cucumbers originated from that state. Sea cucumbers transiting through the major export points – Cancun Airport, Merida Airport, the Port of Progreso, Mexico City and Tijuana – could have originated anywhere in Mexico. That being said, we found no instances involving the seizure of *H. floridana* or *H. mexicana* in Tijuana, and it would make little sense to transport sea cucumbers from Baja California or Yucatan to Quintana Roo for export.

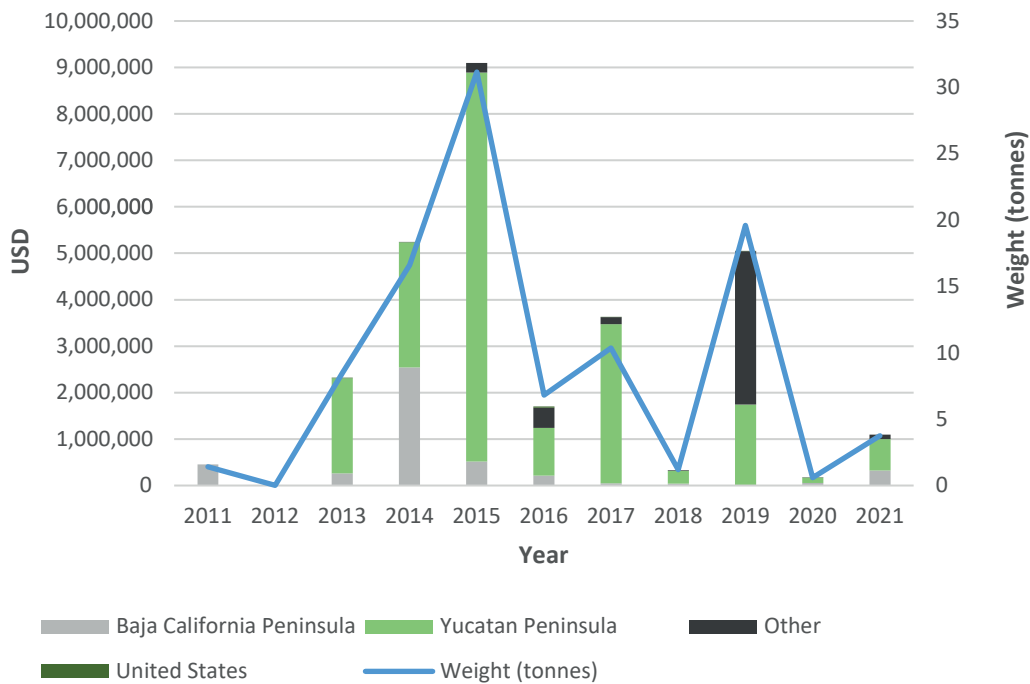
## Value of seizures

The total estimated value of Mexican sea cucumbers seized by authorities over the time period we examined was USD 29.5 million, of which all but USD 50,000 was seized by authorities in Mexico. The value of the average seizure was USD 304,608, and the most valuable seizure was USD 3.2 million. On 20 May 2015, Federal Police at customs at Cancun International Airport seized 11 tonnes of dried *I. badionotus*, destined for Hong Kong, with an estimated value of USD 3.2 million. On the same day, the Federal Police also seized 6 tonnes of dried *I. badionotus* destined for Florida in the US, with a value of USD 1.7 million, and a combined value of USD 4.9 million (Government of Mexico 2015a).

The value of the seized sea cucumbers is considerable, especially when we consider that this does not represent all of the illegally caught sea cucumbers; there is an unknown but not insignificant number of successful smuggling efforts. The value of seizures is also large when contrasted to the size of the legal sea cucumber fishery. Estimated values of annual Mexican sea cucumbers vary. According to CONAPESCA data quoted in one news story, between 2014 and 2018, 5736 t of sea cucumbers were caught in Mexico, with an estimated value on the beach of MXN 178.86 million (USD 9.32 million, 2018 dollars) (Pradilla 2019). Another news story quoted official data saying that the annual market value of Mexico's sea cucumber exports from 2014 to 2017 amounted to USD 126 million, or more than USD 30 million a year (Terrazas 2020). While these numbers are relatively imprecise, they throw into sharp relief the value of seized sea cucumbers, which amounts to at least USD 3 million a year, or at least 10% of the value of the annual legal catch.

## Species

The species of sea cucumbers was identified in 47 out of 97 incidents, and in three incidents more than one species was reported. The most commonly trafficked species was *I. fuscus* (29 incidents total), followed by *I. badionotus* (12 incidents), *H. floridana* (6 incidents), and *H. mexicana* (3 incidents). It is interesting to note that there were no recorded seizures of *H. floridana* or *H. mexicana* prior to 2015 (Table 2).



**Figure 3.** Value of seizures by region compared to dry weight (overall) by year, 2011–2021.

Sea cucumbers were found with other illicit commodities in 28 out of 97 incidents. The three most common categories were “marine products” (30), “live animals” (12), “drugs” (4) and “guns” (2). The most common marine species and/or products were seahorses (6), octopuses (4), totoaba (4), shark fins (4) and abalone (3). Live animals included baby crocodiles on two occasions, as well as tropical birds and other reptiles. Drugs included methamphetamines, marijuana, opioids, and precursors. In a majority of incidents (59%), when associated commodities were identified, they fell into the category of “marine products”. This is consistent with the idea that clandestine networks are used to traffic a variety of products from different wildlife, as well as other illicit products. After all, many trafficked endangered species, such as abalone and totoaba, are even caught in similar locations by the same fishers, and sometimes using the same methods. It is too soon to draw any conclusions from the appearance of a number of recent incidents involving the seizure of live exotic animals such as turtles and baby alligators alongside dried marine products that have appeared in a number of more recent incidents (Novedades Yucatán 2021; Anaya 2021).

In the incidents involving drug seizures, the sea cucumbers appeared to be a minor component of the operation, and there were no instances of large amounts of sea cucumbers being found with large amounts of drugs or drug precursors. In November 2021, Michoacán Police in coordination with PGR, raided a home in Apatzingán that was being used to manufacture drugs for the United Cartel [Cárteles Unidos]. Along with 1 kg of fentanyl, authorities found a variety of precursors (e.g. acetone, caustic soda), cocaine, marijuana, and 2.5 kg of sea cucumbers (InfoBae 2021). Given the situation, it was clear that the focus of the criminal enterprise was drugs, although the presence of sea cucumbers certainly

raises questions. In another incident, between 31 January and 2 February 2020, law enforcement in and around Ensenada in Baja California engaged in a series of raids. Over 72 hours, they arrested 505 people, including a significant number of individuals with outstanding warrants, and others for a variety of crimes, including burglary, theft and other property crimes, manslaughter, drug and firearms offences, and two instances of environmental crimes. At the same time, authorities seized a .22 calibre revolver, drug paraphernalia, and 18 sea cucumbers (El Vigia 2020). In this incident, the small number of sea cucumbers did not appear to be part of some broader smuggling operation. Finally, Federal Police seized 112 litres of liquid methamphetamine (labelled as paint thinner), along with 20 kg of sea cucumbers on 9 April 2018 (El Vigia 2018). Unfortunately, no additional details concerning this incident were available.

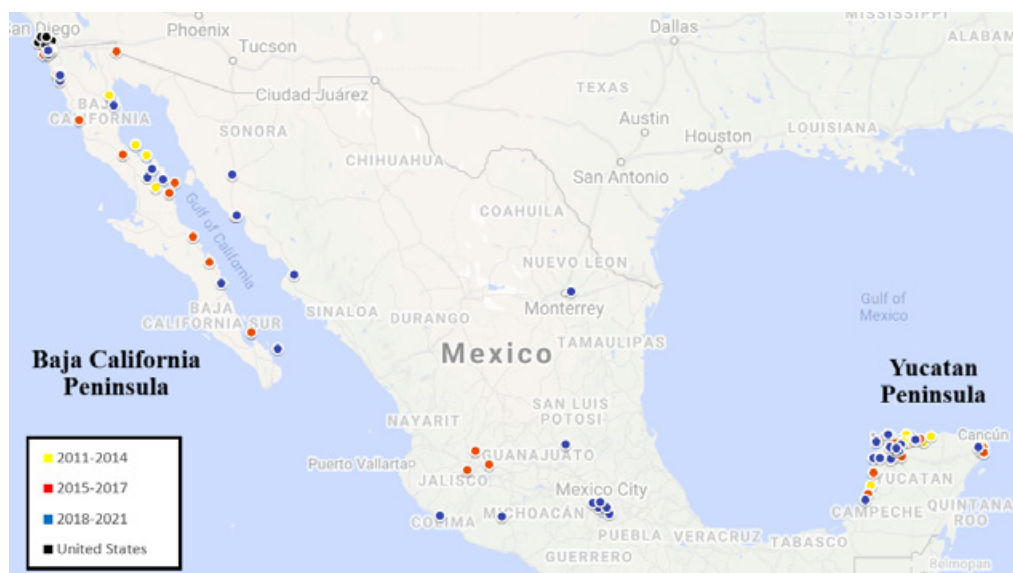
### Geographic distribution

When all identified incidents are mapped, there are evident sea cucumber crime hotspots in Baja California Peninsula and the Yucatan Peninsula, which is consistent with these areas being the key sea cucumber fishing regions in Mexico. Also of note are a number of areas of concentration: in and around Merida, Yucatan and, to a lesser extent, Cancun; Tijuana, in Baja California, particularly the ground border crossings and airport; and Mexico City, specifically Mexico City International Airport (Fig. 4). Tijuana has consistently been a key point for exporting sea cucumbers, while Mexico City has only become a key exit point since 2018.

Mapping the number of incidents and weight seized by state over time revealed a number of interesting trends. The circles on the heat maps are all relatively proportional so that they represent the difference in scale of the total weight

**Table 2:** Species of Mexican sea cucumbers found in seizures, 2011–2021

| Year         | <i>I. badionotus</i> | <i>I. fuscus</i> | <i>H. floridana</i> | <i>H. mexicana</i> |
|--------------|----------------------|------------------|---------------------|--------------------|
| 2011         | 0                    | 4                | 0                   | 0                  |
| 2012         | 0                    | 0                | 0                   | 0                  |
| 2013         | 2                    | 2                | 0                   | 0                  |
| 2014         | 2                    | 2                | 0                   | 0                  |
| 2015         | 4                    | 5                | 1                   | 1                  |
| 2016         | 0                    | 4                | 2                   | 1                  |
| 2017         | 1                    | 6                | 0                   | 0                  |
| 2018         | 2                    | 5                | 1                   | 0                  |
| 2019         | 1                    | 1                | 1                   | 1                  |
| 2020         | 0                    | 0                | 1                   | 0                  |
| 2021         | 0                    | 0                | 0                   | 0                  |
| <b>Total</b> | <b>12</b>            | <b>29</b>        | <b>6</b>            | <b>3</b>           |



**Figure 4.** Sea cucumber seizures across Mexico, 2011–2021.

(Fig. 4) or number of incidents (Fig. 6) of each region, over time. Due to limited number of seizures in Baja California Sur, we merged seizures from this state with Baja California, while this was not done for states on the Yucatan Peninsula because each state had a sufficient number of incidents to register on the maps. Note that each map represents two years, and that they begin with 2012, given that there were limited data for 2011.

These maps reveal how early incidents of sea cucumber crime began in Baja California, reaching their height in 2013 and 2014, after which time the majority of incidents shifted to states on the Yucatan Peninsula (Fig. 4). The number of incidents between regions is relatively similar, with the Baja fishery having 36 incidents and the Yucatan Peninsula fishery having 31 between 2012 and 2021 (Fig. 6). However, the heat maps (Figs. 5 and 6) also reveal a discrepancy between the two major sea cucumber fishing regions in Mexico, namely that while there may be a consistent

number of incidents in the Baja California Peninsula, the scale of these incidents (by weight of sea cucumber seized) is considerably lower than seizures occurring on the Yucatan Peninsula. Seizures associated with the Baja California Peninsula fishery had an average weight of 316 kg (ranging between 0.3 kg and 2500 kg), and over all, authorities seized the equivalent of 11,832 kg of dry sea cucumber. On the Yucatan Peninsula in contrast, the average weight of sea all cucumbers seized per incident was considerably greater, at 2291 kg (ranging between 3.4 kg to 11,000 kg), which amounts to the equivalent of 71,015 kg of dry sea cucumber. The average weight of a seizure of sea cucumbers from the Yucatan Peninsula was 7.2 times greater than seizures from the Baja California Peninsula. This can be explained in part by the fact that sea cucumber populations in the Baja California Peninsula fishery are depleted such that it is no longer possible for poachers to extract large quantities, and by extension, large seizures are rare.



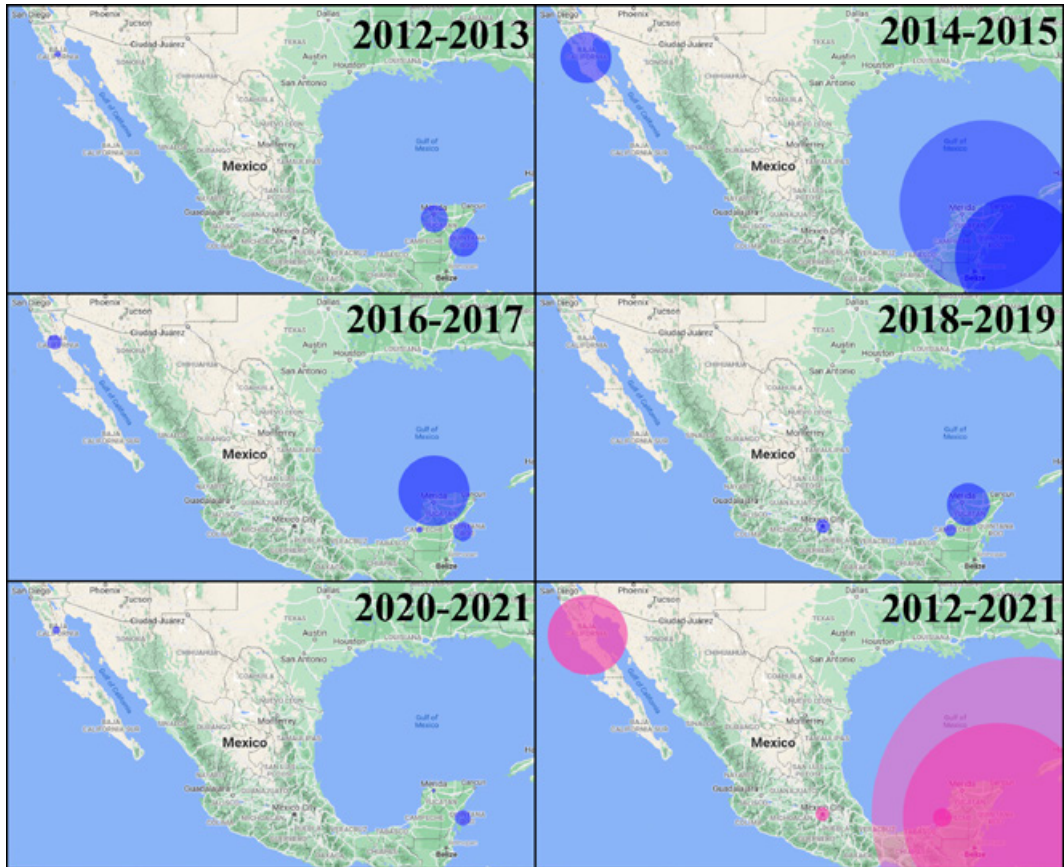


Figure 5. Heat maps of sea cucumber seizures in Mexico by weight (dry), 2012–2021.

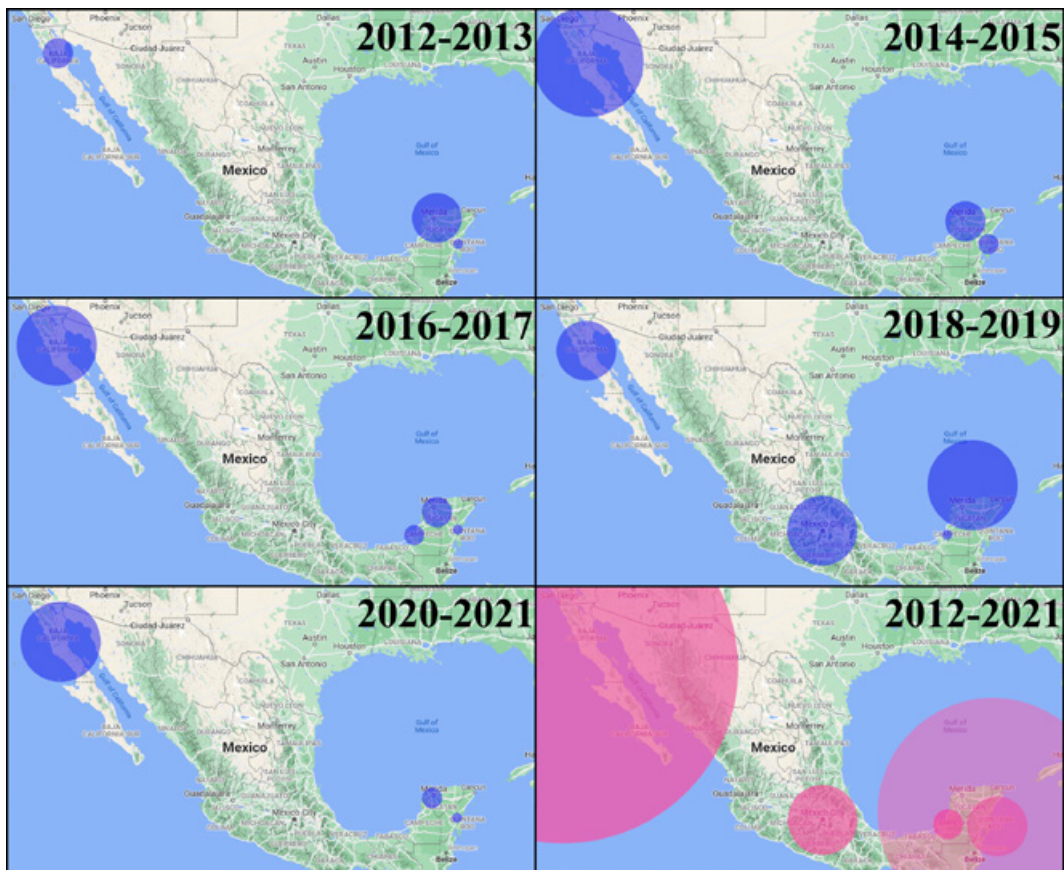


Figure 6. Heat maps of sea cucumber incidents in Mexico, 2012-2021.

## Conclusion

Media coverage of sea cucumber poaching and smuggling operations in Mexico frames the crime as being organised and associated with armed violence. A brief survey of other instances of sea cucumber crime around the world over the same period yields few examples of armed violence, and yet we can see instances of violence sporadically throughout news coverage of Mexican sea cucumber fisheries. The stockpiling of illicitly caught sea cucumbers between seasons and the use of invoice manipulation and fraud to launder products is a practice that seems particularly adapted to the Mexican legal setting.

In other ways, sea cucumber crime in Mexico bears similarities to sea cucumber crime elsewhere (see for example Phelps Bondaroff 2021; Hakki and Aydin 2021): 1) we can observe clusters of seizures and incidents in and around key sea cucumber fishing areas; 2) illegal fishing constitutes a significant portion of catches, undermining management efforts and threatening the sustainability of sea cucumber populations; 3) there is a large discrepancy between the value of the smuggled goods and the fines and restitution levied; and 4) law enforcement faces challenges with monitoring and enforcement. One of the ways in which Mexican law enforcement has apparently sought to overcome monitoring and enforcement challenges is by targeting the ground transport of illicit sea cucumbers. Additional research linking seizures and/or incidents to changes in fisheries management policy and changes in law enforcement efforts and strategies would be informative, as would comparative research evaluating the efficiency and effectiveness of the approach adopted by Mexican law enforcement.

This study has relied on descriptive analysis, and additional approaches may facilitate the development of theories from these data and help us better understand sea cucumber crime. We found, for example, that the size of seizures shrank with declining sea cucumber populations and the closure of fisheries, suggesting that the declining size of seizures could serve as an indicator of declining wild populations. Ultimately, if we are to effectively combat this pernicious form of wildlife crime, more work is needed to increase our understanding of sea cucumber crime, not just in Mexico, but worldwide.

One of the secondary goals of this project was to demonstrate the effectiveness of using news media reports to study wildlife crime. The approach used in this paper has a number of strengths and drawbacks. It is particularly useful when official data are unavailable or undetailed as it helps provide insight beyond the report of raw seizure numbers, offering details as to the *modus operandi* of wildlife crime operations. In this way, this approach can help shed light on illicit and clandestine activities that might otherwise be very difficult to study. In addition to the limitations outlined, the approach ultimately relies on the issue under investigation being problematized to the extent that it receives media attention. Many forms of wildlife crime are treated as administrative issues and, as a result, do not receive extensive media coverage. Thus, it is

likely that our approach did not capture those incidents of sea cucumber crime that were considered “commonplace” or “routine”. Similarly, as an issue becomes increasingly problematized, such as when wild populations of sea cucumbers become depleted or when criminals employ violence, we are likely to see an increase in media attention and news stories. As such, an increase in the number of incidents recorded through our approach may not indicate an increase in wildlife crime, or even an increase in police attention to wildlife crime, but more so an increase in media coverage, and by extension public concerns over wildlife crime.

There are also limitations with respect to mapping incidents gleaned from media stories. Many of the news stories used in this study documented the point of seizure of sea cucumbers and not their point of extraction or the final destination. This approach affords us a snapshot of various stages of illicit sea cucumber supply chains but does not necessarily provide a clear picture of the entire chain. Additional qualitative research could help increase understanding of the nature of sea cucumber crime in Mexico. Our approach is a helpful tool to identify concentrations of wildlife crime and *modus operandi*, and when employed in conjunction with other approaches, such as rich qualitative interviews that add nuance and detail, could further increase our knowledge of illicit sea cucumber supply chains. It would also be informative to employ this method to investigate other forms of wildlife crime. Ultimately, better understanding and knowledge will help combat wildlife crime.

## Acknowledgements

The authors would like to thank Vanessa Ultreras for her assistance with data collection, as well as Darrell Gurevitch, and Stan Phelps for his help with editing.

## References

- Acosta E.J., Rodríguez-Forero A., Werding B. and Kunzmann A. 2021. Ecological and reproductive characteristics of holothuroids *Isostichopus badiotus* and *Isostichopus* sp. in Colombia. *PLoS One* 16(2):e0247158. <https://doi.org/10.1371/journal.pone.0247158>
- Adams A. 2014. Man admits to smuggling sea cucumbers. NBC San Diego. Retrieved from Web 25 Dec. 2021. <https://www.nbcsandiego.com/news/local/man-admits-to-smuggling-sea-cucumbers/1972273/>
- Agu H.U. and Gore M.L. 2020. “Women in wildlife trafficking in Africa: A synthesis of literature. *Global Ecology and Conservation* 23:e01166. <https://doi.org/10.1016/j.gecco.2020.e01166>
- Alvarado E., Estrata A.M. and Melgoza A. 2016. Arrasan con manjar mexicana. *El Universal*. Retrieved from Web 25 Dec. 2021, <https://www.eluniversal.com.mx/articulo/periodismo-de-investigacion/2016/03/6/mafia-china-arrasa-con-pepino-de-mar>

- Alvarado Matrínez I. and Martínez E.R. 2018. Trafficking of totoaba maw. p.149–170. In: Green crime in Mexico: A collection of case studies. Arroyo-Quiroz, I., and Wyatt, T. (eds). Switzerland: Palgrave Studies in Green Criminology.
- Alvarado I. 2018. Así fue cómo un exagente fronterizo lideró una red de tráfico de una extraña especie marina. Univision, Los Angeles. Retrieved from Web 25 Dec. 2021 <https://www.univision.com/local/los-angeles-kmex/asi-fue-como-un-exagente-fronterizo-lidero-una-red-de-trafico-de-una-extrana-especie-marina>
- Anaya F. 2021. FGR detuvo a tres personas con animales marinos en peligro de extinción. Retrieved from Web 25 Dec. 2021, <https://www.tvazteca.com/aztecanoticias/fgr-detuvo-perconas-animales-marinos-peligro-extincion-mm>
- Anderson S.C., Mills Flemming J., Watson R. and Lotze H.K. 2011. Serial exploitation of global sea cucumber fisheries. *Fish and Fisheries* 12(3):317–339. <https://doi.org/10.1111/j.1467-2979.2010.00397.x>
- Ángeles Rivero, M.d.R. 2018. Decomisan más de una tonelada de pepino de mar en Campeche. *Televisa.News*. Retrieved from Web 16 Dec. 2021, <https://noticieros.televisa.com/ultimas-noticias/decomisan-mas-mil-kilos-pepino-mar-campeche/>
- Associated Press. 2020. Woman who smuggled endangered sea cucumbers from Mexico into San Diego sentenced to 8 months in prison. *KT LA*. Retrieved from Web 25 Dec. 2021, <https://ktla.com/news/local-news/woman-who-smuggled-endangered-sea-cucumbers-from-mexico-into-san-diego-sentenced-to-8-months-in-prison/>
- Avitabile R. 2019. Former BP agent sentenced for smuggling sea cucumber, fentanyl precursor. *NBC, San Diego*. Retrieved from Web 25 Dec. 2021, <https://www.nbcsandiego.com/news/local/former-bp-agent-sentenced-for-smuggling-sea-cucumber-fentanyl-precursor/133337/>
- BCS Noticias. 2021. Detienen a sujeto con producto marino, sustraído de forma ilegal, en Loreto. Retrieved from Web 22 Dec. 2021, <https://www.bcsnoticias.mx/detienen-a-sujeto-con-producto-marino-sustraido-de-forma-ilegal-en-loreto/>
- Bennett A. 2017. The influence of neoliberalization on the success and failure of fishing cooperatives in contemporary small-scale fishing communities: A case study from Yucatán, Mexico. *Marine Policy* 80:96–106. <https://doi.org/10.1016/j.marpol.2016.06.024>
- Bennett A. and Basurto X. 2018. Local institutional responses to global market pressures: The sea cucumber trade in Yucatán Mexico. *World Development* 102:57–58. <https://doi.org/10.1016/j.worlddev.2017.09.006>
- Borbolla D. 2021. Aseguran productos pesqueros en Tijuana y Ensenada. *TV Azteca*. Retrieved from Web 25 Dec. 2021, <https://www.tvazteca.com/aztecanoticias/aseguran-productos-pesqueros-tijuana-ensenada-mg>
- Busilacchi S., Butler J.R.A., Rochester W.A. and Posu J. 2018. Drivers of illegal livelihoods in remote transboundary regions: the case of the Trans-Fly region of Papua New Guinea. *Ecology and Society* 23(1):46. <https://doi.org/10.5751/ES-09817-230146>
- Cakaunivere Walesi T. 2016. Overfishing sea cucumbers: The demise of sea cucumbers in Vanua Balavu, Fiji Islands: Review from green criminological perspective and outlook on future policy measures. Thesis report. Retrieved from Web 25 Dec. 2021, [https://www.researchgate.net/publication/323943731\\_Overfishing\\_Sea\\_Cucumbers\\_The\\_Demise\\_of\\_Sea\\_Cucumbers\\_in\\_Vanua\\_Balavu\\_Fiji\\_Islands\\_Review\\_from\\_Green\\_Criminological\\_Perspective\\_and\\_outlook\\_on\\_future\\_policy\\_measures](https://www.researchgate.net/publication/323943731_Overfishing_Sea_Cucumbers_The_Demise_of_Sea_Cucumbers_in_Vanua_Balavu_Fiji_Islands_Review_from_Green_Criminological_Perspective_and_outlook_on_future_policy_measures)
- Calderon-Aguilera L.E. 2019. Illegal fishing of the sea cucumber *Isostichopus fuscus* is rampant in the Gulf of California, Mexico. *SPC Beche-de-mer Information Bulletin* 39:42–46. [http://www.spc.int/DigitalLibrary/Doc/FAME/InfoBull/BDM/39/BDM39\\_42\\_Calderon.pdf](http://www.spc.int/DigitalLibrary/Doc/FAME/InfoBull/BDM/39/BDM39_42_Calderon.pdf)
- Chavarría J.L. 2018. Reportan menor cantidad de pepino de mar decomisado. *Peninsular*. Retrieved from Web 19 Dec. 2021, <https://punto medio.mx/reportan-menor-cantidad-de-pepino-de-mar-decomisado/>
- Chen J. 2003. Overview of sea cucumber farming and sea ranching practices in China. *SPC Beche-de-mer Information Bulletin* 18:18–23.
- Chi Segovia J. 2016. Desmantelan en Campeche campamento de pepino de mar. *El Solde Mexico*. Retrieved from Web 16 Dec. 2021. <https://www.elsoldemexico.com.mx/republica/Desmantelan-en-Campeche-campamento-de-pepino-de-mar-164426.html>
- Cisneros-Montemayor A.M., Cisneros-Mata M.A., Harper S. and Pauly D. 2013. Extent and implications of IUU catch in Mexico's marine fisheries. *Marine Policy* 39(1):283–88. <https://doi.org/10.1016/j.marpol.2012.12.003>
- CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora). 2014. Twenty-seventh meeting of the Animals Committee, Veracruz (Mexico), 28 April – 3 May 2014. Retrieved from Web 24 Dec. 2021. <https://cites.org/sites/default/files/eng/com/ac/27/E-AC27-26-05.pdf>
- Conand C. 2018. Recent information on worldwide illegal fisheries for sea cucumbers. *SPC Beche-de-mer Information Bulletin* 38:68–71.

- Coomber R., Morris C. and Dunn L. 2000. How the media do drugs: quality control and the reporting of drug issues in the UK print media. *International Journal of Drug Policy* 11(3):217–225. [https://doi.org/10.1016/S0955-3959\(00\)00046-3](https://doi.org/10.1016/S0955-3959(00)00046-3)
- Davis K. 2018. Restaurateur gets prison, girlfriend acquitted in sea cucumber-smuggling case. *Los Angeles Times*. Retrieved from Web 25 Dec. 2021. <https://www.latimes.com/local/lanow/la-me-sea-cucumber-smuggling-20180215-story.html>
- De Jesús-Navarrete A.D., May-Poot M.N. and Medina-Quej A. 2018. Density and population parameters of sea cucumber *Isostichopus badionotus* (Echinodermata: Stichopodidae) at sisal, Yucatan. *Latin American Journal of Aquatic Research* 46(2):416–423. <https://doi.org/10.3856/vol46-issue2-fulltext-17>
- Department of Justice. 2017. Three charged with illegal trafficking of \$17 million worth of sea cucumbers. US Attorney's Office, Southern District of California. Retrieved from Web 19 Dec. 2021. <https://www.justice.gov/usao-sdca/pr/three-charged-illegal-trafficking-17-million-worth-sea-cucumbers>
- Diario de Yucatán. 2019. Aseguran tres toneladas de pepino de mar en predios de Mérida. Retrieved from Web 2015 Dec. 2021. <https://www.yucatan.com.mx/merida/aseguran-tres-toneladas-de-pepino-de-mar-en-predios-de-merida>
- Diario de Yucatán 2020. Condenan a tres por delitos federales en Yucatán. Retrieved from Web 25 Dec. 2021. <https://www.yucatan.com.mx/merida/condenan-a-tres-por-delitos-federales-en-yucatan>
- DOF (Diario Oficial de la Federación). 2010. Norma Oficial Mexicana NOM-059-SEMARNAT-2010, Protección ambiental-Especies nativas de México de flora y fauna silvestres-Categorías de riesgo y especificaciones para su inclusión, exclusión o cambio-Lista de especies en riesgo. *Diario Oficial de la Federación*, 30 Dec. 2010. Órgano del Gobierno Constitucional de los Estados Unidos Mexicanos. Retrieved from Web 25 Dec. 2021. [https://dof.gob.mx/nota\\_detalle\\_popup.php?codigo=5173091](https://dof.gob.mx/nota_detalle_popup.php?codigo=5173091)
- DOF. 2015. Acuerdo por el que se da a conocer el plan de manejo pesquero de pepino de mar café (*Isostichopus badionotus*) y lápiz (*Holothuria floridana*) en la península de Yucatán. *Diario Oficial de la Federación*. 12 May 2015. Órgano del Gobierno Constitucional de los Estados Unidos Mexicanos. Retrieved from Web 25 Dec. 2021. [http://www.dof.gob.mx/nota\\_detalle.php?codigo=5391774&fecha=12/05/2015](http://www.dof.gob.mx/nota_detalle.php?codigo=5391774&fecha=12/05/2015)
- DOF. 2019. Modificación del Anexo Normativo III, Lista de especies en riesgo de la Norma Oficial Mexicana NOM-059-SEMARNAT-2010, Protección ambiental-Especies nativas de México de flora y fauna silvestres-Categorías de riesgo y especificaciones para su inclusión, exclusión o cambio-Lista de especies en riesgo, publicada el 30 de diciembre de 2010. *Diario Oficial de la Federación*, 14 Nov. 2019. Órgano del Gobierno Constitucional de los Estados Unidos Mexicanos. Retrieved from Web 25 Dec. 2021. [https://www.dof.gob.mx/nota\\_detalle.php?codigo=5578808&fecha=14/11/2019](https://www.dof.gob.mx/nota_detalle.php?codigo=5578808&fecha=14/11/2019)
- El Financiero. 2019. Detienen a 4 personas en Celestún por posesión de especies marítimas en veda. Retrieved from Web 25 Dec. 2021. <https://www.elfinanciero.com.mx/peninsula/detienen-a-4-personas-en-celestun-por-posesion-de-especies-maritimas-en-veda/>
- El Sol De México. 2016. Desmantelan en Campeche campamento de pepino de mar. Retrieved from Web 25 Dec. 2021. <https://www.elsoldemexico.com.mx/republica/Desmantelan-en-Campeche-campamento-de-pepino-de-mar-164426.html>
- El Vigía. 2011. Detienen a 24 pescadores. Retrieved from Web 22 Dec. 2021. <https://www.elvigia.net/el-valle/2011/9/24/detienen-pescadores-56778.html>
- El Vigía. 2014. Decomisa especies protegidas. Retrieved from Web 25 Dec. 2021. <https://www.elvigia.net/911/2014/12/22/decomisa-especies-protegidas-182248.html>
- El Vigía. 2018. Decomisan metanfetaminas y pepino de mar. Retrieved from Web 16 Dec. 2021. <https://www.elvigia.net/911/2018/4/9/decomisan-metanfetaminas-pepino-300672.html>
- El Vigía. 2020. Agarra la Policía a 505 en tres días. Retrieved from Web 22 Dec. 2021. <https://www.elvigia.net/911/2020/2/5/agarra-la-policia-505-en-tres-dias-343173.html>
- Escalante Rosado J. 2018. El mercado negro de pepinos de mar en Yucatán. *Excelsior*. Retrieved from Web 18 Dec. 2021. <https://www.excelsior.com.mx/nacional/el-mercado-negro-de-pepinos-de-mar-en-yucatan/1229783>
- Expreso. 27 February 2018. La PGR detiene a 2 personas y aseguran 41 kilos de pepino de mar en Guaymas. Retrieved from Web 25 Dec. 2021. <https://www.expreso.com.mx/seccion/seguridad/32546-agentes-de-la-pgr-detienen-a-2-personas-y-aseguran-41-kilos-de-pepino-de-mar-en-guaymas.html>
- Fahrenbruch M.L. 2018. 'Like scooping money out of the sea': Chinese luxury seafood consumption, roving bandits, and the book-and-bust jellyfish fishery on the Miskitu Coast of Nicaragua. *Journal of Latin American Geography* 17(2):209–238. <http://dx.doi.org/10.1353/lag.2018.0028>

- Fox 5. 2017. Restaurant owner admits smuggling abalone, sea cucumber from Mexico. Retrieved from Web 25 Dec. 2021. <https://fox5sandiego.com/news/restaurant-owner-admits-smuggling-abalone-sea-cucumber-from-mexico/>
- Gamboa-Álvarez M.Á., López-Rocha J.A., Poot-López G.R., Aguilar-Perera A. and Villegas-Hernández H. 2020. Rise and decline of the sea cucumber fishery in Campeche Bank, Mexico. *Ocean and Coastal Management* 184:105011. <https://doi.org/10.1016/j.ocecoaman.2019.105011>
- Glockner-Fagetti A., Calderon-Aguilera L. E. and Herrero-Perez M.D. 2016. Density decrease in an exploited population of brown sea cucumber *Isostichopus fuscus* in a biosphere reserve from the Baja California peninsula, Mexico. *Ocean and Coastal Management* 121:49–59. <https://doi.org/10.1016/j.ocecoaman.2015.12.009>
- Gore M.L. and Bennett A. 2021. Importance of deepening integration of crime and conservation sciences. *Conservation Biology*, advance online publication, 6.
- Gore M.L. and Knuth B.A. 2009. Mass media effect on the operating environment of a wildlife-related risk-communication campaign. *Journal of Wildlife Management* 73(8):1407–1413. <https://doi.org/10.2193/2008-343>
- Gore M.L., Siemer W.F., Shanahan J.E., Shuefele D. and Decker D.J. 2005. Effects on risk perception of media coverage of a black bear-related human fatality. *Wildlife Society Bulletin* 33(2):507–516. <https://doi.org/10.1080/10871200902856138>
- Govan H. 2019. 2018 market price update for beche-de-mer in Melanesian countries. *SPC Fisheries Newsletter* 158:16–20.
- Government of Mexico. 2013a. Asegura Profepa millonario cargamento ilegal de pepino duro de mar, hipocampos y buche de totoaba. Retrieved from Web 21 Dec. 2021. [https://www.profepa.gob.mx/innovaportal/v/5078/1/mx.wap/asegura\\_profepa\\_millonario\\_cargamento\\_ilegal\\_de\\_pepino\\_duro\\_de\\_mar\\_\\_hipocampos\\_y\\_buche\\_de\\_totoaba.html](https://www.profepa.gob.mx/innovaportal/v/5078/1/mx.wap/asegura_profepa_millonario_cargamento_ilegal_de_pepino_duro_de_mar__hipocampos_y_buche_de_totoaba.html)
- Government of Mexico. 2013b. Asegura Conapesca diversas cantidades de pepino de mar en Yucatán. Retrieved from Web 17 Dec. 2021. <https://www.gob.mx/conapesca/prensa/asegura-conapesca-diversas-cantidades-de-pepino-de-mar-en-yucatan?idiom=es>
- Government of Mexico. 2013c. Policía Federal asegura más de cuatro toneladas de pepino de mar en Quintana Roo. Retrieved from Web 16 Dec. 2021. <https://www.gob.mx/policiafederal/prensa/policia-federal-asegura-mas-de-cuatro-toneladas-de-pepino-de-mar-en-quintana-roo>
- Government of Mexico. 2014. Asegura Profepa en Baja California 10,852 piezas de pepino de mar. PROFPEPA. Retrieved from Web 25 Dec. 2021. [http://www.profepa.gob.mx/innovaportal/v/5895/1/mx/asegura\\_profepa\\_\\_en\\_baja\\_california\\_\\_10\\_852\\_piezas\\_de\\_pepino\\_de\\_mar.html](http://www.profepa.gob.mx/innovaportal/v/5895/1/mx/asegura_profepa__en_baja_california__10_852_piezas_de_pepino_de_mar.html)
- Government of Mexico. 2015a. Asegura Policía Federal 17 toneladas de pepino de mar en el aeropuerto de Cancún, Quintana Roo. Retrieved from Web 16 Dec. 2021. <https://www.gob.mx/policiafederal/prensa/asegura-policia-federal-17-toneladas-de-pepino-de-mar-en-el-aeropuerto-de-cancun-quintana-roo>
- Government of Mexico. 2015b. Asegura PROFPEPA dos y media toneladas de pepino de mar en Baja California. Retrieved from Web 16 Dec. 2021. [http://www.profepa.gob.mx/innovaportal/v/6000/1/mx/asegura\\_profepa\\_dos\\_y\\_media toneladas\\_de\\_pepino\\_de\\_mar\\_en\\_baja\\_california.html](http://www.profepa.gob.mx/innovaportal/v/6000/1/mx/asegura_profepa_dos_y_media toneladas_de_pepino_de_mar_en_baja_california.html)
- Government of Mexico. 2015c. Autoridades federales aseguran un contenedor con 11 toneladas de pepino de mar en Yucatán. Retrieved from Web 16 Dec. 2021. <https://www.gob.mx/conapesca/prensa/autoridades-federales-aseguran-un-contenedor-con-11-toneladas-de-pepino-de-mar-en-yucatan-20473>
- Government of Mexico. 2016a. Dicta juez federal auto de formal prisión a 1 persona por posesión ilegal de 58,115 ejemplares de pepino de mar, en Baja California. Retrieved from Web, 31 Dec. 2021. <https://www.gob.mx/profepa/prensa/dicta-juez-federal-auto-de-formal-prision-a-1-persona-por-posesion-ilegal-de-58-115-ejemplares-de-pepino-de-mar-en-baja-california>
- Government of Mexico. 2016b. CONAPESCA y PF Aseguran tonelada y media de Pepino de Mar en el Aeropuerto de Guadalajara. Retrieved from Web 16 Dec. 2021. <https://www.gob.mx/conapesca/prensa/conapesca-y-pf-aseguran-tonelada-y-media-de-pepino-de-mar-en-el-aeropuerto-de-guadalajara>
- Government of Mexico. 2016c. Contribuye SAGARPA en aseguramiento de pepino de mar en el aeropuerto de Mérida. Retrieved from Web 17 Dec. 2021. <https://www.gob.mx/agricultura/prensa/contribuye-sagarpa-en-aseguramiento-de-pepino-de-mar-en-el-aeropuerto-de-merida>
- Government of Mexico. 2017a. Asegura PROFPEPA, SEDENA, y SEMAR cargamento de 256 piezas de pepino de mar, en Baja California. Retrieved from Web 25 Dec. 2021. <https://www.gob.mx/profepa/prensa/asegura-profepa-sedena-y-semar-cargamento-de-256-piezas-de-pepino-de-mar-en-baja-california>
- Government of Mexico. 2017b. Oficiales Federales de Pesca de la CONAPESCA retienen 3,000 kilogramos de Pepino de Mar en Yucatán. Retrieved from Web 25

- Dec. 2021. <https://www.gob.mx/conapesca/articulos/oficiales-federales-de-pesca-de-la-conapesca-retienen-3-000-kilogramos-de-pepino-de-mar-en-yucatan-139122?idiom=es>
- Government of Mexico. 2018. PROFEPA apoya a la corte federal de EUA en case de traficante de pepino de mar. Retrieved from Web 25 Dec. 2021. <https://www.gob.mx/profepa/prensa/profepa-apoya-a-la-corte-federal-de-eua-en-caso-de-trafficante-de-pepino-de-mar>
- Government of Mexico. 2019a. La Secretaría de Marina-Armada de México asegura 12 toneladas aproximadamente de pepino de mar en Manzanillo, Colima. Retrieved from Web 21 Dec. 2021. <https://www.gob.mx/semar/prensa/la-secretaria-de-marina-armada-de-mexico-asegura-12-toneladas-aproximadamente-de-pepino-de-mar-en-manzanillo-colima>
- Government of Mexico. 2019b. Más de una tonelada de pepino de mar fue asegurada en el aeropuerto Internacional de la Ciudad de México. Retrieved from Web 22 Dec. 2021. <https://www.gob.mx/sspc/prensa/mas-de-una-tonelada-de-pepino-de-mar-fue-asegurada-en-el-aeropuerto-internacional-de-la-ciudad-de-mexico>
- Grillo de Yucatán. 2019. En complicidad con la aduana, envían pepino de mar ilícito vía aérea. Retrieved from Web 22 Dec. 2021. <https://grillodeyucatan.com/2019/03/28/en-complicidad-con-la-aduana-envian-pepino-de-mar-ilicito-via-aerea/>
- Guilford G. 2015. How China's fish bladder investment craze is wiping out species on the other side of the planet. *Quartz*. Retrieved from Web 21 Dec. 2021. <https://qz.com/468358/how-chinas-fish-bladder-investment-craze-is-wiping-out-species-on-the-other-side-of-the-planet/>
- Guzmán H.M., Guevara C.A. and Hernández I.C. 2003. Reproductive cycle of two commercial species of sea cucumber (Echinodermata: Holothuroidea) from Caribbean Panama. *Marine Biology* 142(2):271–279. <http://dx.doi.org/10.1007/s00227-002-0939-x>
- Hakki D. and Aydin M. 2021. Sea cucumber fishery in Turkey: Management regulations and their efficiency. *Regional Studies in Marine Science* 41:101551. <https://doi.org/10.1016/j.rsma.2020.101551>
- Hair C., Foale S., Kinch J., Frijlink S., Lindsay D. and Southgate P.C. 2019. Socioeconomic impacts of a sea cucumber fishery in Papua New Guinea: Is there an opportunity for mariculture? *Ocean and Coastal Management* 179:104826. <https://doi.org/10.1016/j.ocecoaman.2019.104826>
- Hernández-Flores A., Cuevas-Jiménez A., Poot-Salazar A., Condal A. and Espinoza-Méndez J.C. 2018. Bioeconomic modeling for a small-scale sea cucumber fishery in Yucatan, Mexico. *PLoS One* 13(1):e0190857. <https://doi.org/10.1371/journal.pone.0190857>
- Herrero-Pérezul M.D. and Reyes-Bonilla H. 2008. Weight-length relationship and relative condition of the holothurian *Isostichopus fuscus* at Espíritu Santo Islands, Gulf of California, México. *Revista de Biología Tropical/International Journal of Tropical Biology* 56(supplement 3):273–280. <https://doi.org/10.15517/RBT.V56I3.27143>
- Hickok K. 2018. Men fined \$1 million for trafficking \$17 million worth of squishy sea cucumbers. *Live Science*. Retrieved from Web 19 Dec. 2021. <https://www.livescience.com/63755-smuggled-sea-cucumbers.html>
- Huard C. 2020. Man sentenced to six months for smuggling protected sea cucumbers across border. Retrieved from Web 25 Dec. 2021. <https://timesofsandiego.com/crime/2020/12/14/man-sentenced-six-months-for-smuggling-protected-sea-cucumbers-across-border/>
- Hutchim-Lara O., Hernández-Flores A., Villanueva-Poot R. and Gracia E. 2018. The cost of decompression illness: The case of lobster and sea cucumber fishery in Yucatan, Mexico. *Undersea and Hyperbaric Medicine: Journal of the Undersea and Hyperbaric Medical Society, Inc.* 45(5):531–539. <https://pubmed.ncbi.nlm.nih.gov/30428242/>
- InfoBae. 2021. Desmantelaron supuesto narcolaboratorio de Cárteles Unidos y detuvieron a cuatro “Viagras” en Michoacán. Retrieved from Web 22 Dec. 2021. <https://www.infobae.com/america/mexico/2021/11/19/desmantelaron-supuesto-narcolaboratorio-de-carteles-unidos-y-detuvieron-a-tres-viagras-en-michoacan/>
- Jiménez J. 2019. Cada vez hay más gente tratando de meter pepinos de mar de contrabando en EEUU: la fiebre del ‘oro negro’ del Yucatán no se frena.” *Xataka*, Mexico. Retrieved from Web 18 Dec. 2021. <https://www.xataka.com/ecologia-y-naturaleza/cada-vez-hay-gente-tratando-meter-pepinos-mar-contrabando-eeuu-fiebre-oro-negro-yucatan-no-se-frena>
- Kaplan-Hallam M. 2016. Social shocks in social-ecological systems: The impact of sea cucumber booms for coastal communities in Mexico. Masters Thesis, University of British Columbia. UBC Open Collections. <https://open.library.ubc.ca/media/stream/pdf/24/1.0339982/3>
- Kaplan-Hallam M., Bennett N.J. and Satterfield T. 2017. Catching sea cucumber fever in coastal communities: Conceptualizing the impacts of shocks versus trends on social-ecological systems. *Global Environmental Change* 45:89–98. <https://doi.org/10.31230/osf.io/4k9se>

- Larios Gaxiola F. 2015. Asegura PGR especies en peligro de extinción en Sonora. Milenio. Retrieved from Web 16 Dec. 2021. <https://www.milenio.com/estados/asegura-pgr-especies-peligro-extincion-sonora>
- Lizárraga K. 2020. Aseguran pepino de mar extraído de manera ilegal de la bahía de La Paz. El Sudcaliforniano. Retrieved from Web 26 Dec. 2021. <https://www.elsudcaliforniano.com.mx/policiaca/aseguran-pepino-de-mar-extraido-de-manera-ilegal-de-la-bahia-de-la-paz-5294770.html>
- López-Rocha J.A. 2012. Distribución y abundancia del pepino de mar *Isostichopus badionotus* frente a la costa de Sisal, Yucatán. *Proceedings of Gulf and Caribbean Fisheries Institute* 64:153–160. <http://hdl.handle.net/1834/36154>
- López-Rocha J.L. and Velázquez-Abunader I. 2019. Fast decline of the sea cucumber *Isostichopus badionotus* as a consequence of high exploitation in Yucatan, Mexico. *Regional Studies in Marine Science* 27:100547. <https://doi.org/10.1016/j.rsma.2019.100547>
- Madrigal N. 2013. Valían 2 mdp las especies decomisadas. *El Vigía*. Retrieved from Web 25 Dec. 2021. <https://www.elvigia.net/general/2013/5/26/valan-especies-decomisadas-115291.html>
- McCay B.J., Micheli F., Ponce-Díaz G., Murray G., Shester G., Ramirez-Sanchez S. and Weisman W. 2014. Cooperatives, concessions, and co-management on the Pacific coast of Mexico. *Marine Policy* 44:49–59. <http://dx.doi.org/10.1016/j.marpol.2013.08.001>
- Medina E. 2021. Chocan guateros y cooperativistas de Isla Magdalena. *El Sudcaliforniano*. Retrieved from Web 18 Dec. 2021. <https://www.elsudcaliforniano.com.mx/local/chocan-guateros-y-cooperativistas-de-isla-magdalena-7302264.html>
- Méndez-Medina C., Schmook B., Basurto X., Fulton S. and Espinoza-Tenorio A. 2020. Achieving coordination of decentralized fisheries governance through collaborative arrangements: A case study of the Sian Ka'an Biosphere Reserve in Mexico. *Marine Policy* 117:103939. <https://doi.org/10.1016/j.marpol.2020.103939>
- Michel V.H. 2014. Campeche y Yucatán: la peor crisis por el pepino de mar. Milenio. Retrieved from Web 18 Dec. 2021. <https://www.milenio.com/estados/campeche-y-yucatan-la-peor-crisis-por-el-pepino-de-mar>
- Milenio. 2015. Decomisan 137 kilos de pepino de mar en BC. Retrieved from Web 18 Dec. 2021. <https://www.milenio.com/estados/decomisan-137-kilos-pepino-mar-bc>
- Murtha J. 2016. When it comes to drug busts, journalists often don't ask the right questions. *Columbia Journalism Review*. Retrieved from Web on 3 Jan. 2021. [https://www.cjr.org/analysis/drug\\_bust.php](https://www.cjr.org/analysis/drug_bust.php)
- Muter B., Gore M., Gledhill K., Lamont C. and Huveneers C. 2013. Australian and U.S. news media portrayal of sharks and their conservation. *Conservation Biology* 27(1):187–196. <https://doi.org/10.1111/j.1523-1739.2012.01952.x>
- Ngaluafé P. and Lee J. 2013. Change in weight of sea cucumbers during processing: Ten common commercial species in Tonga. *SPC Beche-de-mer Information Bulletin* 33:3–8.
- Novedades Yucatán. 2019. Aseguran una tonelada de pepino de mar y pulpo. Retrieved from Web 25 Dec. 2021. <https://sipse.com/novedades-yucatan/aseguramiento-pulpo-pepino-celestun-bodega-arrestos-veda-mar-326941.html>
- Novedades Yucatán. 2021. Decomisan tortugas y una cría de cocodrilo, así como un cargamento de mariscos en veda. Retrieved from Web 25 Dec. 2021. <https://sipse.com/novedades-yucatan/decomisan-tortugas-cria-cocodrilo-cargamento-mariscos-veda-dzilam-bravo-404383.html>
- Pedroza C. 2013. Middlemen, informal trading and its linkages with IUU fishing activities in the port of Progreso, Mexico. *Marine Policy* 39:135–143. <http://dx.doi.org/10.1016/j.marpol.2012.10.011>
- Pedroza-Gutiérrez C. 2019. Managing Mercado del Mar: A case of women's entrepreneurship in the fishing industry. *Maritime Studies* 18:335–346. <https://doi.org/10.1007/s40152-019-00157-y>
- Pedroza C. and Salas S. 2011. Responses of the fishing sector to transnational constraints: From reactive to proactive change, Yucatan fisheries in Mexico. *Marine Policy* 35(1):41–44. <https://doi.org/10.1016/J.MARPOL.2010.08.001>
- Pedroza-Gutiérrez C. and López-Rocha J.A. 2021. Ungovernable systems: The strength of informal institutions in the sea cucumber fishery in Yucatan, Mexico. *PLoS ONE* 16(3):e0249132. <https://doi.org/10.1371/journal.pone.0249132>
- Phelps Bondaroff T. 2021. Sea cucumber crime in India and Sri Lanka during the period 2015-2020. *SPC Beche-de-mer* 41:55–65. <https://purl.org/spc/digilib/doc/eu33f>
- Phelps Bondaroff T., Reitano T. and van der Werf W. 2015. The illegal fishing and organized crime nexus: Illegal fishing as transnational organized crime. *The Global Initiative Against Transnational Organized Crime and the Black Fish*. Retrieved from Web 1 January 2022. <https://globalinitiative.net/wp-content/uploads/2015/04/the-illegal-fishing-and-organised-crime-nexus-1.pdf>

- Pinto C. 11 November 2019. Dos enfrentan proceso por el megadecomiso de pepino de mar en Manzanillo. Estación Pacífico. Retrieved from Web 22 Dec. 2021. <https://estacionpacifico.com/2019/11/11/dos-enfrentan-proceso-por-el-megadecomiso-de-pepino-de-mar-en-manzanillo/>
- Pozzi S. 2021. El pepino de mar se convierte en la 'commodity' más deseada en EEUU. La Información. Retrieved from Web 25 Dec. 2021. <https://www.lainformacion.com/mundo/el-pepino-de-mar-se-convierte-en-la-commodity-mas-deseada-en-eeuu/2827911/?autoref=true>
- Pradilla A. 2019. Conflicto por el pepino de mar golpea a la pesca en el poblado de San Felipe, Yucatán. Animal Politico. Retrieved from Web 29 Dec. 2021. <https://www.animalpolitico.com/2019/09/conflicto-pepino-mar-san-felipe-yucatan/>
- ProgresoHoy. 2019a. Descubren bodega de pepino de mar en el Centro de Mérida gracias a un incendio. Retrieved from Web 25 Dec. 2021. <https://progresohoy.com/noticias/descubren-bodega-de-pepino-de-mar-en-el-centro-de-merida-gracias-a-un-incendio-10114967/>
- ProgresoHoy. 2019b. Aseguran en Mérida tres bodegas clandestinas de pepino de mar. Retrieved from Web 25 Dec. 2021. <https://progresohoy.com/noticias/aseguran-en-merida-tres-bodegas-clandestinas-de-pepino-de-mar-10115080/>
- ProgresoHoy. 2020. Dan 11 meses de cárcel a pescador de Progreso detenido con 154 kilos de pepino de mar. Retrieved from Web 25 Dec. 2021. <https://progresohoy.com/noticias/dan-11-meses-de-carcel-a-pescador-de-progreso-detenido-con-154-kilos-de-pepino-de-mar-10119645/>
- Purcell S.W. 2014. Value, market preferences and trade of beche-de-mer from Pacific Island sea cucumbers. *PLoS ONE* 9(4):e95075. <https://doi.org/10.1371/journal.pone.0095075>
- Purcell S.W., Ngaluafé P., Wang G., and Lalavanua W. 2017. Market value of flower teatfish ("pentard"): A highly exploited Indian Oceans holothuroid. *SPC Beche-de-mer Information Bulletin* 37:53–56.
- Purcell S.W., Ngaluafé P., Lalavanua W. and Ceccarelli D.M. 2018a. Market price trends of Latin American and Caribbean sea cucumbers inform fisheries management. *Regional Studies in Marine Science* 17:129. <http://dx.doi.org/10.1016/j.marpol.2018.02.005>
- Purcell S.W., Williamson D.H. and Ngaluafé P. 2018b. Chinese market prices of beche-de-mer: Implications for fisheries and aquaculture. *Marine Policy* 91:58. <https://doi.org/10.1016/j.marpol.2018.02.005>
- Putnam N. 2018. Father and son businessmen avoid jail time must repay Mexico. *The Star News*. Retrieved from Web 26 Oct. 2021. <https://www.thestarnews.com/father-and-son-businessmen-avoid-jail-time-must-repay-mexico/>
- Ramos-Miranda J., del Río-Rodríguez R., Flores-Hernández D., Rojas-González R.I., Gómez-Solano M., Cu-Escamilla A.D., Gómez-Criollo F., Sosa-López A., Torres-Rojas Y.E. and Juárez-Camargo P. 2017. Reproductive cycle of the sea cucumber *Holothuria floridana* in the littorals of Campeche, Mexico. *Fisheries Science* 83:699–714. <http://dx.doi.org/10.1007/s12562-017-1100-6>
- Reyes-Bonilla H., Calderón-Aguilera L.E., Galaviz-López J.M. and Herrero-Pérez M.D. 2018. Size and relative condition index of the brown sea cucumber *Isostichopus fuscus* in the northern Gulf of California, Mexico. *Latin American Journal of Aquatic Research* 46(4):831–836. <http://dx.doi.org/10.3856/vol46-issue4-fulltext-21>
- Rohrlich J. 2019. International sea cucumber kingpin implicated in new smuggling case. *Quartz*. Retrieved from Web, 1 January 2022. <https://qz.com/1764439/a-border-arrest-exposes-lucrative-black-market-for-sea-cucumbers/>
- Rivera-Téllez E. and López-Segurajáuregui G. 2021. Guía de identificación de los pepinos de mar de interés comercial en México. CONABIO. México. 47 p. Retrieved from Web 1 January 2022. [https://www.biodiversidad.gob.mx/media/1/planeta/cites/files/PEPINOS\\_IPAD\\_ALTA.pdf](https://www.biodiversidad.gob.mx/media/1/planeta/cites/files/PEPINOS_IPAD_ALTA.pdf)
- Rompecabeza. 2020. Vinculan a sujeto por tráfico de 'pepino de mar'. Retrieved from Web 25 Dec. 2021. <https://rompecabeza.mx/index.php/merida/item/6387-vinculan-a-sujeto-por-trafico-de-pepino-de-mar>
- Ruido. 2019. No pueden frenar furtivismo de pepino de mar. Retrieved from Web 18 Dec. 2021. <https://www.hazruido.mx/reportes/no-pueden-frenar-furtivismo-de-pepino-de-mar/>
- SEMARNAT (Secretaría de Medio Ambiente y Recursos Naturales). 2020. Plan de manejo tipo para la conservación y aprovechamiento sustentable de pepino de mar (*Isostichopus fuscus*) en México. Secretaría de Medio Ambiente y Recursos Naturales. Subsecretaría de Gestión para la Protección Ambiental. Dirección General de Vida Silvestre. Mexico, 48 pp. Retrieved from Web 1 January 2022. [https://www.gob.mx/cms/uploads/attachment/file/574166/Plan\\_de\\_Manejo\\_pepino\\_de\\_mar\\_2020.pdf](https://www.gob.mx/cms/uploads/attachment/file/574166/Plan_de_Manejo_pepino_de_mar_2020.pdf)



- Singh-Cabanillas J. and Vélez-Barajas A. 1996. La pesquería del pepino de mar *Isostichopus fuscus* en la costa oriental de Baja California Sur y propuestas de regulación. *Ciencia Pesquera* 12:13–18. Retrieved from Web, 1 January 2022. <https://www.inapesca.gob.mx/portal/documentos/publicaciones/cienciapesquera/CP12/CP12-03.pdf>
- Solís-Marín F.A., Honey-Escandón M.B.I., Herrero-Perzrul M.D., Benitez-Villalobos F., Díaz-Martínez J.P., Buitrón-Sánchez B.E., Palleiro-Nayar J.S. and Durán-González A. 2013. The echinoderms of Mexico: Biodiversity, distribution and current state of knowledge. p. 11–54. In: *Echinoderm Research and Diversity*. Alvarado, J.J. and Solís-Marín F.A. (eds). Heidelberg Berlin: Springer-Verlag.
- Solís-Marín F.A., Laguarda-Figueras A. and Honey-Escandón M. 2014. Biodiversidad de equinodermos (Echinodermata) en México. *Review of Mexican Biodiversity* 85 (supplemental, January). <http://ref.scielo.org/wjjmwy>
- Terrazas R. 2020. Pepino de mar, la mina de oro de la pesca ilegal. *Animal Politico*. Retrieved from Web 29 Dec. 2021. <https://www.animalpolitico.com/atarraya/pepino-de-mar-la-mina-de-oro-de-la-pesca-ilegal/>
- Tierra Fértil. 2016. Captura de pepino de mar dejó derrama de 54 mdp para Yucatán. Retrieved from Web 18 Dec. 2021. <https://www.tierrafertil.com.mx/captura-pepino-mar-dejo-derrama-54-mdp-yucatan/>
- United Nations General Assembly. 2000. United Nations Convention Against Transnational Organized Crime. A/RES/55/25.
- United States Department of Justice. 2018. Illegal sea cucumber trade nets more than \$1.2 million dollars in fines, forfeiture and restitution. US Attorney's Office, Southern District of California. Retrieved from 26 October 2021. <https://www.justice.gov/usao-sdca/pr/illegal-sea-cucumber-trade-nets-more-12-million-dollars-fines-forfeiture-and>
- United States of America v. Blessings Inc., David Mayorquin, and Ramon Torres Mayorquin. S.D. Cal. Case No. 3:17-cr-01254. Retrieved from Web 17 Dec. 2021. <https://storage.courtlistener.com/recap/gov.uscourts.casd.533480/gov.uscourts.casd.533480.1.0.pdf>
- Vidal-Hernández L., Canto-Lugo E., Carmona-Escalante A., Huerta-Quintanilla R., Garza Lagler C. and López-Rocha J. 2019. Properties, communities and robustness in the Yucatán sea cucumber trade network. *Ocean and Coastal Management* 168:226–237. <http://dx.doi.org/10.1016/j.ocecoaman.2018.10.036>
- Young E. 2001. State intervention and abuse of the commons: Fisheries development in Baja California Sur, Mexico. *Annals of the Association of American Geographers* 91(2):283–306. <https://www.jstor.org/stable/3651261>
- Yucatan Times. 20 May 2016. Clashes over 'sea cucumber' continue in Yucatan. Retrieved from Web 18 Dec. 2021. <https://www.theyucantimes.com/2016/05/sea-cucumber-conflict-continues-in-yucatan/>