Study on vaquita and totoaba

Decision 18.294 (Rev. CoP19) on Totoabas (*Totoaba macdonaldi*)

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Acronyms

ACRONYMS	DEFINITION
CBP	U.S. Customs and Border Protection
CIRVA	International Committee for Recovery of the Vaquita
CITES	Convention on International Trade Endangered Species of Wild Fauna an Flora
CONANP	National Commission of Natural Protected Areas
CONAPESCA	National Commission of Aquaculture and Fisheries
COP	Conference of the Parties
CPUE	Catch Per Unit Effort
CREMES-IAES	Center of Marine Species Reproduction of the State of Sonora at Institute of Aquaculture of the State of Sonora
CSG	Cetacean Specialist Group
DOF	Diario Oficial de la Federación
EDF	Environmental Defence Fund
EDNA	Environmental DNA
EIA	Environmental Investigation Agency
ELI	Environmental Law Institute
EOF	Earth Ocean Farms
GIS	Intergovernmental Group for the Sustainability of the Upper Gulf of California
ICCWC	International Consortium on Combating Wildlife Crime
IMIPAS	Mexican Institute of Research of Sustainable Fisheries and Aquaculture
INAPESCA	National Fisheries Institute
INTERPOL	International Criminal Police Organization
IUCN	International Union for Conservation of Nature
IWC	International Whaling Commission
MAREM	Regional Administrative Monitoring of Marine Species A.C.
MHC	Major Histocompatibility Complex
MMPA	Marine Mammal Protection Act
MPAS	Marine Protected Areas
NEA	Net Exclusion Area
NGO	Non-Governmental Organization

NOM	Norma Oficial Mexicana
PACE	Programas de Acción para la Conservación de Especies
PAM	Passive Acoustic Monitoring
PROFEPA	Federal Attorney for Environmental Protection
SADER	Ministry of Agriculture and Rural Development
SAR	Special Administrative Region
SC	Standing Committee
SEMAR	Ministry of the Navy
SEMARNAT	Ministry of Environment and Natural Resources
SSC	Species Survival Commission
SSSC	Sea Shepherd Conservation Society
TCOS	Transnational Criminal Organizations
TECG	Trilateral Enforcement Contact Group
UABC	Autonomous University of Baja California
UBP-UABC	Biotechnology in Fish Farming Unit at Autonomous University of Baja California
UG	Upper Gulf
UGC	Upper Gulf of California
UMAS	Units for Environmental Management and Wildlife Conservation
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNTOC	United Nations Convention against Transnational Organized Crime
USMCA	United States-Mexico-Canada Free Trade Agreement
VRA	Refuge Area for the Protection of the Vaquita (Vaquita Refuge Area)
WCO	World Customs Organization
WWF	World Wildlife Fund
Zo	Zero Tolerance Area

Executive summary

Although Mexico's two Gulf of California protected endemic species – the vaquita porpoise (*Phocoena sinus*) and the totoaba fish (*Totoaba macdonaldi*) – are both on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), their biological status and way they are or may be affected by trade are very different. According to a search of the CITES Trade Database (2013-2023), both have small amounts of trade, primarily of samples for scientific purposes, between Mexico and the United States of America. While there is no known domestic or international illegal trade in vaquita, over 6,500 totoaba swim bladders were seized between 2013-2020, primarily by Mexico, the United States, China and Hong Kong Special Administrative Region (SAR) of China.

The Critically Endangered vaquita currently has a very restricted distribution in the Upper Gulf of California, the distribution shrunk from over 10,000 km2 (currently zoned as a gillnet ban area), then mainly to an 1,800 km2 Vaquita Refuge, and now primarily in and around a small no-fishing no-entry Zero Tolerance Area (225 km2). Acoustic monitoring in August-September 2024, showed that vaquita are still present in the Vaquita Refuge. There is abundant data over several decades on the status of the vaquita population, using two independent and robust methods (annual acoustic trend monitoring and periodic visual counts). The species has suffered the sharpest and fastest decline on record – 98.6% from 2011-2018 according to acoustic monitoring – and appears to have recently stabilized, according to visual counts in 2019, 2021, 2023 and 2024, at an estimated minimum of approximately ten individuals, with continued evidence of reproduction. The installation of innovative anti-gillnet devices on the seafloor in and around the Zero Tolerance Area (Zo), combined with improved enforcement in the Zo, has sharply reduced incursions there by gillnetting fishers, although there is still abundant illegal gillnetting in the Vaquita Refuge and larger gillnet ban area.

Totoaba is a migratory fish that moves throughout the entire Gulf of California but concentrates in the Upper Gulf during spring spawning. In 2021 the status of totoaba on the IUCN Red List of Threatened Species was changed from Critically Endangered to Vulnerable. The listing was based on a suspected "past and future three-generation decline (1993–2029) of at least 30%" due to estimated levels of poaching for illegal international trade in its swim bladder. However, multiple scientific sources consulted for this study cast doubt on whether the population is even declining at all. A population estimation model completed after the 2021 Red Listing estimates the wild totoaba population at approximately 350,000 to 750,000. The population exhibits a continuous and unimodal age and size structure, with average values similar to those reported since the late 1950s. Furthermore, the levels of genetic diversity of the wild totoaba population are among the highest reported for the Sciaenid group and have remained relatively constant throughout the last decade. The totoaba population therefore reflects demographic stability without signs of overexploitation.

Unlike the totoaba, the vaquita is not a target species for illegal international trade. Its decline is driven by incidental bycatch in illegal gillnets, used for a variety of seafood in the Upper Gulf, including the protected totoaba. However, the period of its sharpest population decline (average of >45% annually in 2015-2017) coincides not only with the period of highest recorded prices for totoaba swim bladders in illegal trade (USD 8,000/kg in Mexico and USD 150,000/kg in China), but also the highest amount of large-mesh passive totoaba gillnets collected by net removal teams from vaquita habitat (>500). These high prices attracted the involvement of transnational criminal organizations (TCOs), an urgent and persistent challenge for Mexico.

Because of this correlation between a period of high totoaba poaching effort, high prices for totoaba swim bladders, and major vaquita decline, there seems to be a linkage in regulatory and compliance processes for the two species. Efforts to control illegal international trade in totoaba swim bladders have historically focused on the supply State (Mexico) rather than the demand (primarily China) or transit (primarily the United States) countries, and this remains true today. Mexico has been attempting to protect vaquita habitat since the early 1990s and to implement a gillnet ban in the Upper Gulf of California since 2015, but the complexity of this situation, which combines conservation, socioeconomic and illegal trade challenges, has resulted in it being subjected to an unprecedented number of international compliance processes, including a compliance action plan requested by the 75th meeting of the CITES Standing Committee in November 2022.

However, many of the supply side opportunities identified by this study, by Mexico in its compliance action plan, and by the CITES online *Meeting of Range, Transit and Consumer States of Totoaba* in October 2021 are relevant to fishery governance in general and to save the vaquita, rather than controlling the illegal totoaba fishery per se. Because the vaquita is threatened by gillnetting for a variety of seafood, opportunities identified to combat illegal international trade in totoaba specimens, if achieved, would have only indirect and partial impact on vaquita recovery, and are unlikely to be achieved in an urgent near future timeframe.

Therefore, it is suggested that vaquita recovery and controlling international illegal trade in totoaba specimens be conducted on separate but parallel tracks. Vaquita conservation depends on keeping its habitat free of all types of gillnets, not only those set for totoaba. Effective governance of the totoaba fishery requires addressing illegal harvest not only in Upper Gulf vaquita habitat (where it masses in spring for seasonal spawning), but also elsewhere in its migratory range in the Gulf of California.

Totoaba is part of the founding story of the two Upper Gulf communities which fish in vaquita habitat. San Felipe and El Golfo de Santa Clara originated over 100 years ago as seasonal totoaba fishing camps to supply the swim bladder trade. Subsequently totoaba meat was exported to the United States; although exports ceased in 1977 when totoaba became the first fish species included in CITES Appendix I, totoaba meat is still commonly traded and consumed locally in the Upper Gulf. In contrast, vaquitas bycaught in gillnets had no market value and due to its shy habits was seldom seen by fishers out on the water. Efforts to save the vaquita by banning traditionally used gillnet gear has engendered years of counterproductive hostility toward the concept of vaquita conservation by local communities as a consequence of top-down efforts to impose fishing restrictions with little consultative effort to develop economically viable alternative fishing gear. Beginning in fall 2023, an informal consensus has been reached between the government and the communities in a series of negotiations that some relaxation of the gillnet ban is the only practical path forward given the poor development of alternatives, but so far the legal modifications required have not been implemented.

Given the need for community incentives for compliance with gillnet bans in the small area where vaquitas are still known to persist, governance of the totoaba fishery in the Upper Gulf should be aligned with ongoing efforts to implement community transition to selective non-gillnet gear which does not threaten vaquita in the Vaquita Refuge. Mexico could explore limited legalization opportunities including community aquaculture and a hook and line totoaba fishery (a traditional fishing method which is still sometimes used). Totoaba meat is commonly consumed locally and this domestic trade is legal for farmed animals. Furthermore opportunities seem to exist to build a sustainable sport and commercial

fishery using non gillnet gear. Compliance could be incentivized through a harm reduction approach where enforcement prioritizes targeting use of large-mesh totoaba gillnets which threaten vaquita and local intelligence-led investigation of TCOs linkages.

The totoaba issue is an illegal international wildlife trade issue and should be managed under a different approach. This illegal trade involves just a handful of Parties and is best addressed through available but underutilized targeted cooperative platforms of INTERPOL, UNTOC, WCO, ICCWC, and the Trilateral Enforcement Contact Group. Demand reduction strategies and campaigns will be challenging to implement because available evidence suggests few consumers seek out totoaba swim bladders on a species basis – rather, they are purchased on an opportunistic basis (availability due to existing illegal international trade relationships), with the most expensive swim bladders being favored due primarily to their large size. Moreover, there is a risk that totoaba-specific messaging could actually increase species-specific demand for the fish, as consumer preference for rarity is a known phenomenon of illegal wildlife trade. There is a massive legal international trade in swim bladders of many fish species, and growing interest in Asia in meeting this demand through aquaculture.

This leads to another question that this study was tasked with exploring – potential positive and negative impacts of legal trade in totoaba specimens on illegal trade and the conservation status of vaquita and totoaba. It has been posited above that limited legal domestic trade could improve chances of vaquita recovery and reduce potential unsustainable gillnet offtake of totoaba in the region.

The 74th meeting of the CITES Standing Committee in March 2022 approved the inclusion of Mexico's Earth Ocean Farms totoaba aquaculture facility in the CITES Registry of Operations that breed Appendix-I species in captivity for commercial purposes. The registration excludes trade in the swim bladders from the captive bred totoaba. This is a potential future real world case study of legal trade impacts, but currently Mexico's domestic import and export legislation prohibits any totoaba exports for other than scientific purposes, although legislative amendments have been proposed in March 2024 and the proposal is under review of the Mexican Congress.

The report includes a thoughtful exercise aimed at highlighting potentially overlooked threats, untapped opportunities, and research priorities to assist decision-makers in shaping effective conservation strategies for both the vaquita and totoaba. Guided by the idea that clear goals can lead to meaningful change, the approach envisions a path through various 'horizons' focused on habitat conservation, livelihoods of the communities affected, trade and international cooperation and the status of vaquita and totoaba populations leading to a scenario where the vaquita is saved from extinction, and the totoaba is sustainably managed.

The report concludes avenues for the recovery of the vaquita and totoaba as well as key considerations for Mexico, transit and destination countries, the Trilateral Enforcement Group and other Parties relating to further actions.

1. Background

This study was prepared in accordance with the provisions of Decision 18.294 (Rev. CoP19) paragraph c) on *Totoabas (Totoaba macdonaldi*), taking into consideration the outcomes of the "Online Meeting of Range, Transit and Consumer States of Totoaba" held in October 2021. The CITES Secretariat, in

consultation with the Standing Committee through its Chair, revised and finalized the terms of reference (TOR) for the "Vaquita and Totoaba Study". The final revised TOR was made available in Annex 6 to document SC77 Doc. 33.13.2, for the information of Parties and stakeholders. This study focuses on assessing the conservation status of both vaquita (*Phocoena sinus*) and the totoaba (*Totoaba macdonaldi*), the legal and illegal trade in totoaba, and the supply and demand of totoaba specimens, with a specific emphasis on swim bladders. The report is based on a literature review, consideration of reports submitted to the various CITES meetings and interviews with different stakeholders, including relevant authorities, experts and NGO´s (Annex 3).

The Upper Gulf of California (UGC), home to two endangered marine species: the vaquita marina (*Phocoena sinus*) and the totoaba (*Totoaba macdonald*i). The vaquita, a small porpoise, and the totoaba, a large cyanid fish, are interconnected within a complex web of ecological, economic, and conservation challenges, which include both legal and illegal trade of totoaba parts and derivatives (Cisneros-Mata et al. 2009). Understanding their shared history and current status is crucial to foster effective conservation efforts.

The entire network of Marine Protected Areas (MPAs) of the World Heritage Site "Islands and Protected Areas of the Gulf of California" was inscribed on the list of World Heritage in Danger in July 2019, primarily because of "unsustainable illegal fishing practices" (artisanal fishing with illegal gillnets) in one small part: The Upper Gulf of California (UGC).

This study aims to assess the current conservation status of both the vaquita and totoaba, the dynamics of their coexistence, and the effectiveness of international conservation efforts and initiatives. The study will furthermore assess collaboration including synergies between key CITES partners and potential new strategic partnerships that could be explored

2. Setting the Scene: Best Available Information on the Current Status of Vaquita and Totoaba

This section contains an overview of the population status and trends of vaquita and totoaba, threats to the species and their habitat and conservation efforts, including enforcement related actions. It seeks to provide insights into the methodologies employed for population estimation and their potential biases. It also describes the threats faced by both species, emphasizing the intricate connections between these threats and their implications for both species' future survival. Additionally, the section summarizes recent national and international conservation initiatives, with a specific focus on the potential impact of CITES on international policies for both species conservation.

2.1 Vaquita marina (*Phocoena sinus*)

2.1.1 Population status and trends

The vaquita marina (*Phocoena sinus*), recognized as the smallest cetacean of the world, was first identified in 1958 (Norris and McFarland 1958). Despite its discovery, vaquita remained poorly studied for decades, with only 45 confirmed records (skulls and skeletons) until 1986. Additional sightings between 1958 and 1986 and the collection of 43 individuals between 1985 and 1993 added to the limited data available on the species (Brownell 1986; Norris and McFarland 1958; Norris and Prescott 1961; Villa-R. 1976; Wells et al. 1981; Vidal 1995). It is classified as Critically Endangered" on the IUCN Red List of Threatened Species (Rojas-Bracho et al. 2022).

Since attempts to study population status and trends began in the 1980s, several methods have been implemented to estimate vaquita abundance; these range from visual estimates to genetic studies (Annex 1 and summarized in Table 1). Vaquitas are hard to see because of small group size, inconspicuous surfacing and vessel avoidance. Abundance estimates have relatively low precision both because these factors reduce the probability that vaquitas are on the track-line (path) of a survey vessel and because a fairly large proportion of their distribution is too shallow to allow navigation by the large, stable ships needed to accommodate the high-power binoculars required to see vaquitas. Historically, both visual and acoustic detections together have been used to estimate abundance (Jaramillo-Legorreta et al. 1999; Taylor pers. comm.).

Table 1. Vaquita studies in the past 20 years

Year of the studies/ periods	Population estimate	Confidence Interval (CI)	Method	Author
1986-1988	503	CI = 163- 1,551	Visual surveys	Barlow and Gerrodette (1997)
1988-1989	808	CI= 340 - 2,149	Aerial surveys	Barlow and Gerrodette (1997)
1991	572	CI= 73- 4,512	Aerial surveys	Barlow and Gerrodette (1997)

Year of the studies/ periods	Population estimate	Confidence Interval (CI)	Method	Author
1993	224	CI= 106-470	Visual survey	Barlow and Gerrodette (1997)
1997	567	CI= 177–1073	visual survey + acoustic monitoring	Jaramillo-Legorreta *et al*., 1999)
2008	245	CI= 68– 884	visual survey + passive acoustic monitoring	Gerrodette et al. 2011
2000-2015	80% decline acoustic activity annual rate of decline of 34%	(95% Bayesian credible interval –48% to –21%). Only passive acoustic monitoring that can detect trends but does not estimate population numbers	passive acoustic monitoring	Jaramillo-Legorreta 2016
2015	59	5% Bayesian Credible Interval [CRI] 22–145 decrease since 1997 of 92% (95% CRI 80–97%)	visual survey + passive acoustic monitoring	Taylor et al. 2016
2016	30	- overall decline in the acoustic detection rate between 2015 and 2016 of 49%, - total decline between 2011 and 2016 of over 90%.	passive acoustic monitoring	Thomas 2017
2017	48% decline in 2017 and 47% in 2018	Only passive acoustic monitoring that can detect trends but does not estimate population numbers	passive acoustic monitoring	Jaramillo-Legorreta et al. 2019

Year of the studies/ periods	Population estimate	Confidence Interval (CI)	Method	Author
2018	19	Combines the acoustic trends with an independent estimate of population size from 2015, and visual observations of at least seven animals in 2017 and six in 2018. 49% decline from 2016 to 2017 58% decline from 2017 to 2018. The annual average decline between 2011 and 2018 has a mean of 47% annually. Total decline of 99% over the 7-year period.	visual survey + passive acoustic monitoring	Jaramillo-Legorreta et al. 2019
2019	At least from: 7 to15	Observed during the survey: Not a population estimation, but an estimation of the least number of individuals in the population	Expert elicitation	Rojas-Bracho et al 2019 (IUCN cetacean specialist group report)
2021	At least from: 7 to15	Observed during the survey: Not a population estimation, but an estimation of the minimum number of individuals in the population	Expert elicitation	Rojas-Bracho et al 2022
2023	At least 10	Observed during the survey: Not a population estimation, but an estimation of the least number of individuals in the population	Expert elicitation	Jaramillo-Legorreta et al 2023
2024	6 to 8 in Zo area; acoustic detections outside Zo in VRA	Observed during the survey: Not a population estimation, but an estimation of the least number of individuals in the population	Expert elicitation	Cárdenas-Hinojosa et al. 2024a, b;

Initial estimates of vaquita abundance were made utilizing a combination of visual oceanic and aerial surveys (Table 1 and Annex 1). These studies documented a reduction of the population from 885 individuals in 1986 to 224 individuals in 1993, suggesting an annual decline of 18% over seven years (Barlow et al. 1997). Nevertheless, estimates of trends from these early surveys had a great deal of uncertainty, with a 95% confidence interval from a 43.2% decline to a 19.3% increase (Taylor per comm.).

Studies confirmed that the species has a restricted presence in the western side of the UGC, with a 'core area' of about 2,235 square km centered around Rocas Consag, 40 km east of San Felipe, Baja California **(**Figure 1**).** Recent trends potentially restrict the population almost exclusively to the Refuge Area for the Protection of the Vaquita (VRA—Figure 1) (Jaramillo-Legorreta et al., 1999, 2002, 2003, 2005; Taylor 2017).

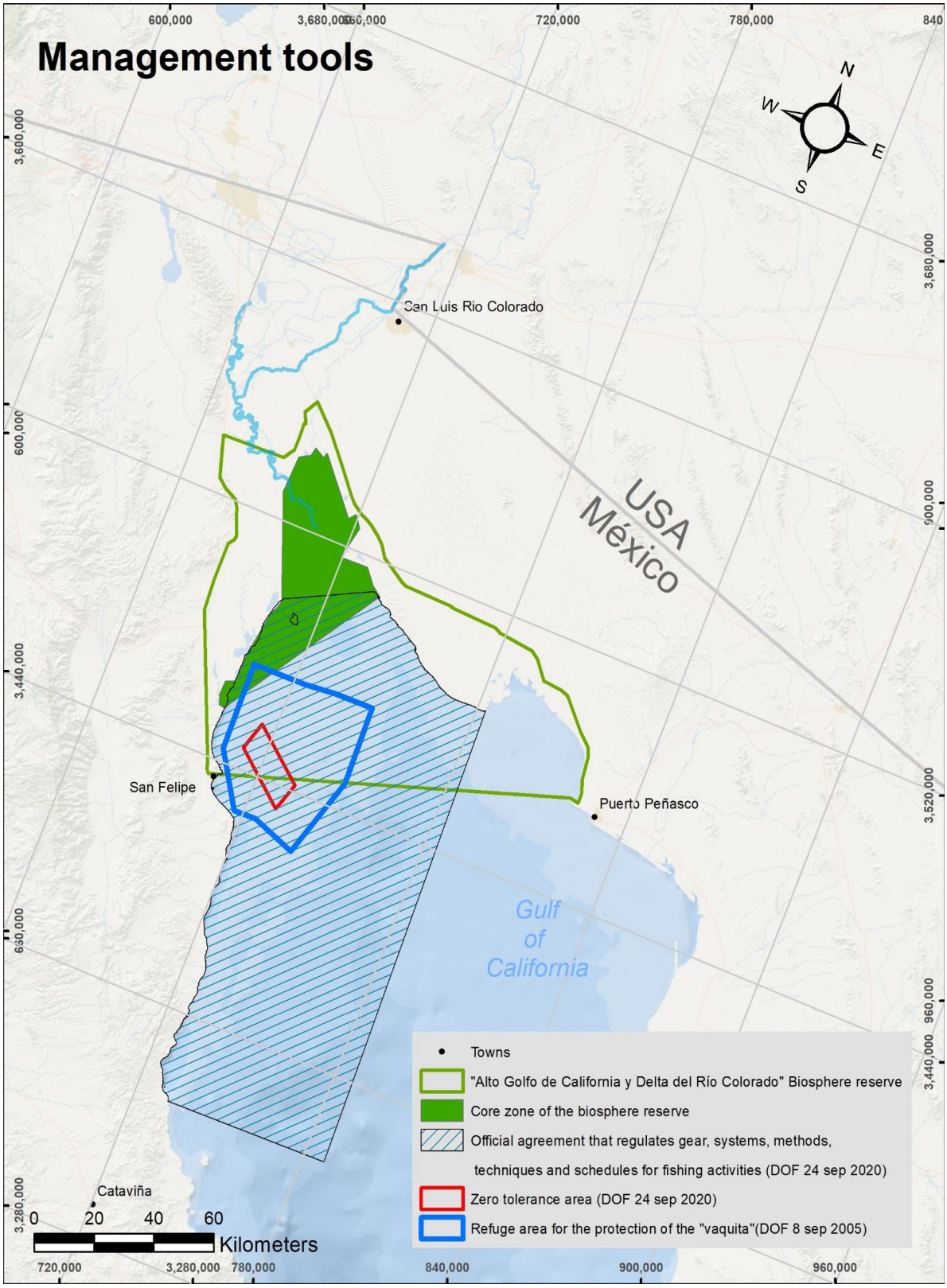

Figure 1. Upper Gulf of California: Vaquita habitat and management polygons

Refinements in methodology led to a 1997 visual survey (Figure 2) estimating a vaquita population of 567 individuals (Jaramillo-Legorreta et al., 1999). Subsequent combined visual surveys and acoustic monitoring in 2008 suggested a population of 245 (Gerrodette et al., 2011), which sharply declined to 59 individuals by 2015, resulting in an overall 92% decrease since 1997 (Taylor et al., 2016). These findings align with results from passive acoustic monitoring techniques (PAM - Figure 2), with studies highlighting an 80% decline in acoustic activity between 2011 and 2015, a 49% decline from 2016 to 2017 and a 58% decline from 2017 to 2018, corresponding to a total decline of 99% over the 7-year period (Jaramillo-Legorreta et al 2019).

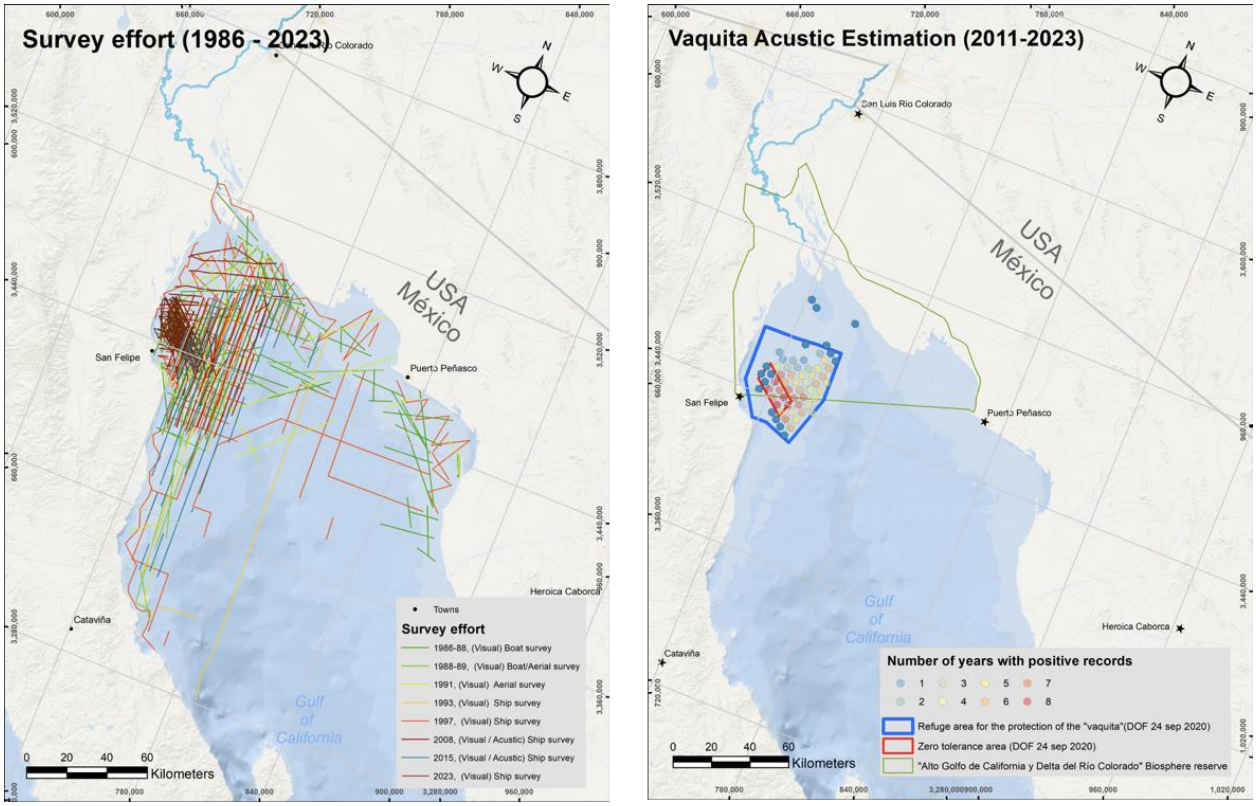

Figure 2. Vaquita surveys and vaquita acoustic from 2011 to 2023 and visual surveys from 1986 to 2008.

Recent challenges have hindered both passive acoustic monitoring and visual survey methods for assessing the vaquita population. Fishers operating illegally are removing passive acoustic devices, causing data loss and financial strain to replace these devices, making acoustic monitoring difficult in the absence of effective enforcement. Additionally, estimating abundance using line-transect methods requires estimating the probability of detection from the survey vessel. Making this estimate requires at least tens of sightings, which is difficult to achieve given the very low numbers of vaquitas remaining (Rojas-Bracho et al. 2022; Rojas- Bracho et al. 2021;). Conducting visual surveys using the same vessel that was used in 1997, 2008 and 2015 could yield an accurate estimate, but this ship is costly, posing a financial barrier (Rojas- Bracho et al. 2021).

Due to the conditions described previously, since 2019 it has not been possible to estimate vaquita population size, therefore the only methodology considered to be sufficient to estimate minimum numbers

of vaquitas observed during the surveys in the Zero Tolerance Area (Zo), is the one known as expert elicitation (Annex 1). Using 2019 visual survey data, expert elicitation methodology was used to estimate the number of unique vaquitas observed. The result of this methodology estimates that between 7 and 15 unique individuals were seen in 2019 (Figure 3), including 2 or more calves, and between 5 and 13 unique individuals were seen in 2021, including 1 or 2 calves (Rojas- Bracho et al. 2021; Rojas- Bracho et al. 2022). This is not an abundance estimate, but the minimum number of vaquitas in the Zo. These studies suggest that vaquitas were not declining at the previous rates observed (Rojas Bracho et al. 2022) because at those high mortality rates, the most likely number of vaquitas remaining would be zero.

Figure 3. Pair of vaquitas photographed during 2019 survey Picture: Diego Ruiz Sabio, Museo de la Ballena

Despite vaquitas' rarity and cryptic nature, in 2009 the use of photo-identification (taking high quality photos of vaquitas) was tested (Jefferson et al. 2009). This method was opportunistically resumed in 2017 (Rojas-Bracho et al. 2019), resulting in evidence that vaquitas may be reproducing every year with a maximum growth rate of 11.7% (Jaramillo-Legorreta et al. 2008, Taylor et al. 2019), although 4% is considered most likely (Urrutia-Osorio et al 2015, B. Taylor pers. comm. 2022). At least six different healthy animals were seen during that survey. However, no within-year photographic identifications were done, making abundance estimates using mark-recapture methods impossible (Taylor et al. 2019; Jaramillo-Legorreta 2019; Jaramillo-Legorreta et al. 2023).

Furthermore, in 2017 attempts were made to capture vaquitas, as described further in the conservation efforts section (Rojas-Bracho et al. 2019a). During this process animals were seen to actively avoid nets. Notably, in one instance involving an entangled pair of vaquitas, one of the animals was observed to briefly become entangled and escape from the net (Rojas Bracho et al. 2019a; Rojas Bracho et al. 2022). This observation plus the fact that more vaquitas have survived than expected suggests that the surviving vaquitas may have been learning how to avoid gillnets, these remaining individuals are of immense value, offering hope for the species (Taylor pers com; Rojas Bracho pers comm.)

For the first time ever, the 2023 survey used both visual and acoustic methods. The survey was conducted in May 2023 instead of the usual August-October period. The May survey period was chosen because it is typically less windy and has lower fishing activity. Additionally, it allowed for surveying an area north of the Zo, where high fishing effort in the fall previously prevented surveying (see the "Conservation" section in this chapter). The result was 16 sightings, with observers tracking seven groups of vaquitas for over 30 minutes (Figure 4). During three consecutive survey days, photographic matches confirmed a mother and calf. The mean estimate for the number of vaquitas seen in all 16 sightings was 10.6, with a 76% belief that there were between 8 and 13 vaquitas and a 65% expert confidence that there were at least 10 (Jaramillo-Legorreta et al. 2023).

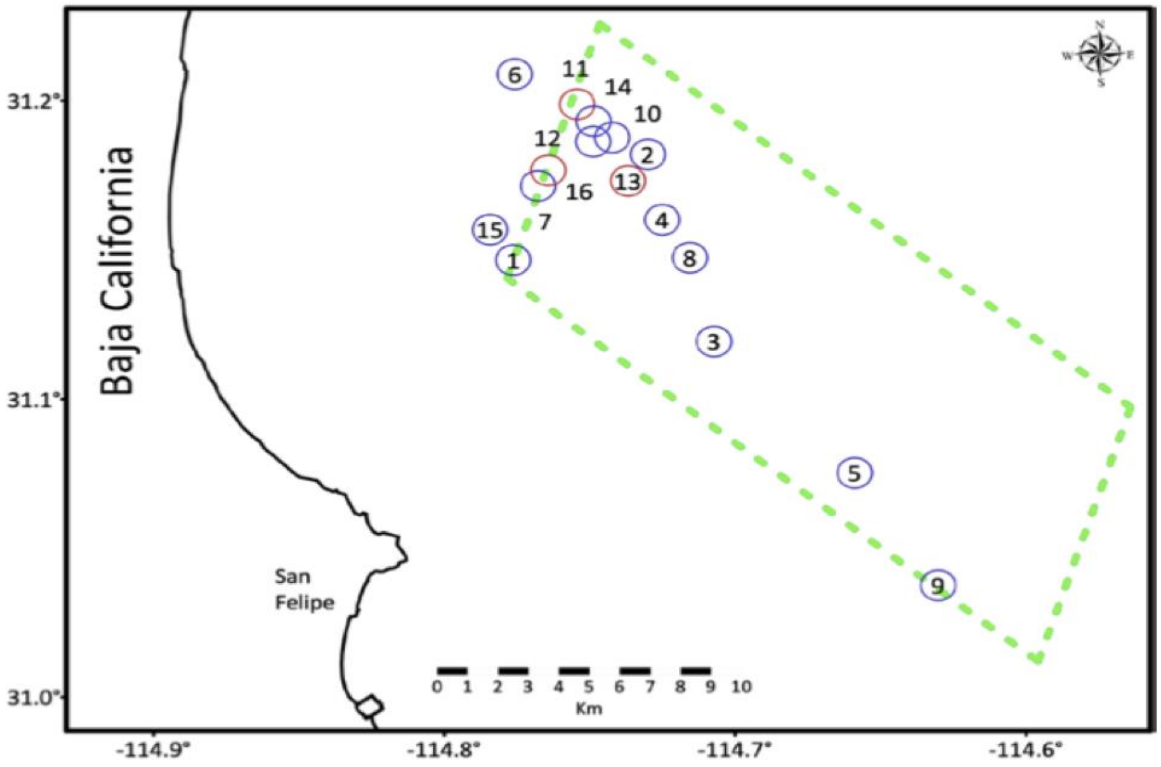

Figure 4. Number of vaquita sightings during the vaquita visual survey 2023, green polygon represents the Zo.

The most recent vaquita visual survey, conducted in May 2024 and the last before the publication of this study, estimated the minimum number of individual vaquitas sighted at of 6 to 8 vaquitas. Although no calves were observed, a healthy one-year-old juvenile was documented. Of the nine sightings, half occurred just outside the Zo (CONANP 2024). Unpublished results from the acoustic monitoring indicate that vaquitas may be re-occupying areas of the VRA that they last used in 2015, offering a glimmer of hope for the species (Rojas-Bracho 2024- youtube conference). This is very encouraging news, as the last two times Passive Acoustic Monitoring (PAM) was conducted in the VRA outside the Zo were 2018 (Jaramillo et al 2019) and 2021 (CICESE 2021), and zero acoustic detections were recorded.

Regarding the genetics of the species, a sample of 45 vaquitas displayed no sequence polymorphism in the control region of mitochondrial DNA despite being collected from diverse times and locations (Rosel & Rojas-Bracho 1999). The distribution of heterozygosity across its chromosomes implies a sustained low diversity resulting from an effective population size of around 5,000 over an extended period (over 200,000 years) rather than a recent bottleneck or inbreeding caused by the decline resulting from gillnet entanglement (Morin et al; 2020).

These findings suggest that the vaquita's population has been relatively small for thousands of years and its genome has had significant time to purge detrimental genetic traits and potentially maintain sufficient diversity for its population well-being (Morin et al. 2021). Genome-informed simulations indicate that the vaquita could recover if bycatch mortality is halted (Robinson et al. 2022).

In 2022 a pilot study was developed to test whether Environmental DNA (eDNA) is a viable method for identifying vaquita (*Phocoena sinus*) presence, and thus expand the toolkit for studying its population. As a promising result vaquita eDNA was positively detected in 5 out of 10 sampled sites (Towns and Valdivia 2022). This project built the capacity in the use of the method and demonstrated it is viable to use eDNA techniques to detect vaquita presence in Mexico's UGC, where such methods have not previously been used. This technique was also applied as an emerging science project during the last 2024 vaquita survey (unpublished results).

Figure 5. Vaquita swimming while fishers deploy a shrimp gill net near San Felipe, Baja California (Vaquita Zo, 2019- Picture: Museo de la Ballena)

2.1.2 Threats to species and its habitat

Vaquitas are vulnerable to extinction because they are naturally rare and have a very limited distribution with a single population (Rojas-Bracho & Taylor 1999). The species has witnessed a significant decline attributed to the elevated rates of incidental mortality in gillnet fisheries (D'Agrosa et al. 1995; Vidal 1995; Jaramillo-Legorreta et al. 2019, Rojas-Bracho et al. 2024). Nets set for totoaba probably account for the highest percentage of incidental porpoise deaths (Siber 1990, Jaramillo-Legorreta et al. 2019).

A minimum of 128 incidental deaths of vaquitas due to gillnets were documented between March 1985 and February 1992. Out of the 128 incidental deaths, 65% of death were in gillnets set for totoaba (25-30 cm mesh size), 28% in nets placed for sharks and rays (10-15 cm mesh size) and 7% in nets set for mackerel and Sierra (8.5 cm mesh size) (Vidal 1995). During 1993-1994 period another 15 observed vaquita died due to gillnet fishing for different fisheries, including blue shrimp and chano gillnets, it is important to note that 93%of those vaquitas died in nets set in the bottom and 75% of those nets were driftnets (D'Agrosa et al. 1995). Most of the information related to vaquitas captured in gillnets came from the Gulf of Santa Clara in Sonora. When relating the reported mortality to fishing effort in the UGC, estimates were that a minimum of 35 vaquitas were killed every year between 1985 and 1991 (Vidal 1995; Figure 6).

Figure 6. Circa 1980´s picture of fishers holding a large totoaba and two vaquitas captured as bycatch in the bottom (Taken from the restaurant "El Delfin", Gulf of Santa Clara, Sonora)

From 1994 to 2020 reports from vaquita deaths in gillnets continued to appear (IUCN-CSG 2018, 2019; Gulland et al. 2020). In 2019 Sea Shepherd Conservation Society (SSCS) reported a dead vaquita still trapped in a gillnet while developing operations related to the net pulling programme (SSCS 2019). The last record of a vaquita trapped in a net is a video published by a fisherman on social media in 2020 (IUCN CSG 2020- Figure 7). Locals indicate that it is currently a "social norm" to avoid talking about any animals trapped in gillnets, particularly vaquitas. This makes it difficult to obtain information about recent entanglements. Because vaquita are so rare, and gillnetting so common, the odds of entangling a vaquita are very low, estimated at one per 2,632 fishing trips by vaquita scientists in 2013 by Urrutia-Osorno et al. 2015 (a time when the vaquita population was ten times higher than it is estimated now). Twenty years previously the odds were estimated at one vaquita entanglement per 50-100 fishing trips (d'Agrosa et al. 2000). Daily number of fishing trips vary by weather, tide and market variables, but on good fishing days likely totaled at least several hundred.

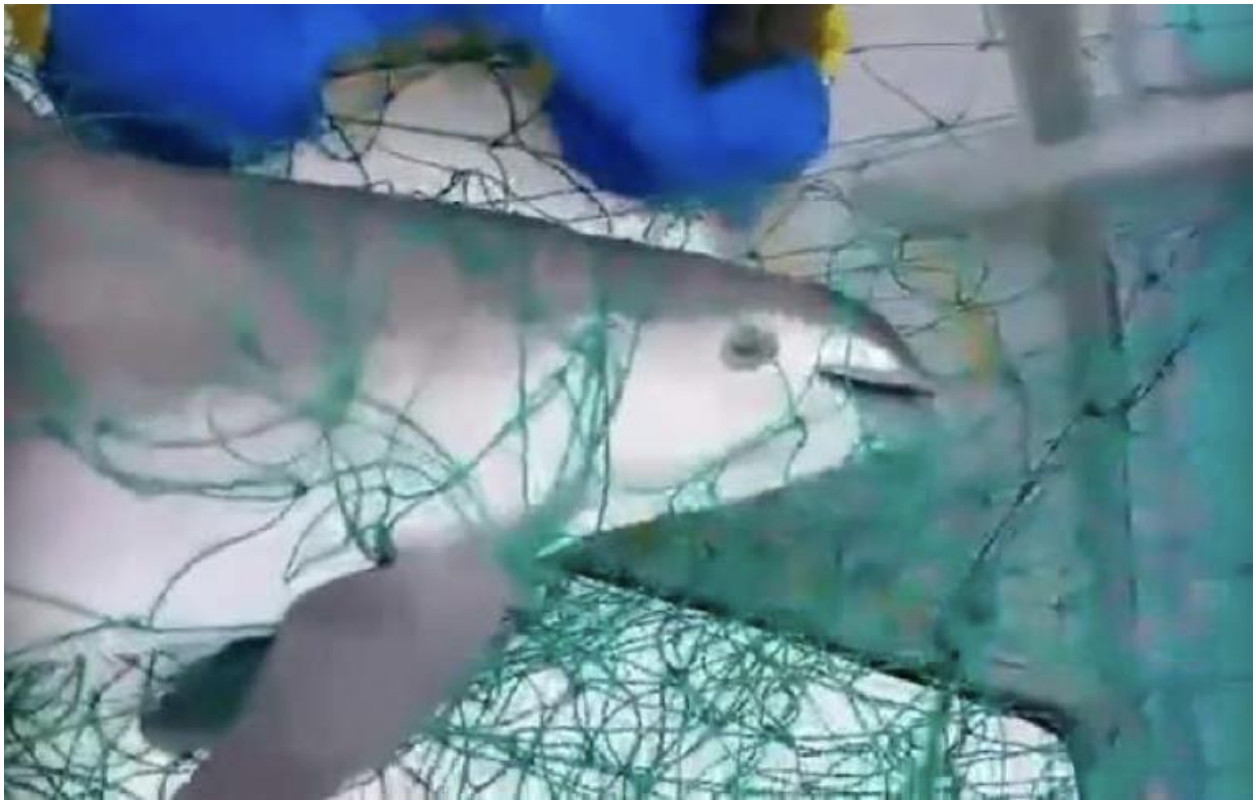

Figure 7. Vaquita caught in what appears to be a totoaba gillnet (Extracted from 2020 video published by fishers — IUCN 2020)

Simulations and modeling suggested vaquitas die in all types of gillnets, regardless of the mesh size, implying that the principal cause of mortality is fishing with gillnets per se (D'Agrosa et al. 2000). An important piece of information is that 92% of vaquita incidental captures were with bottom gill nets and 8% in surface gill nets, 75% in drift gill nets, and 25% in fixed gill nets (all of them gillnets used in different ways depending on the fisheries).

It has long been speculated that vaquitas might be adversely affected by the reduction in freshwater inputs from the Colorado River flow after construction of the Hoover dam in the United States in the

1930s. (Fleischer and Perez Cortez 1996). There has been considerable debate and SEMARNAT is currently funding research into it (SEMARNAT 2024), with recent isotopic analysis suggesting the Upper Gulf primary productivity and food web could be influenced (Rodriguez Perez et al. 2024). Other authors have argued strongly that vaquitas are not a freshwater species and are unlikely to be affected, and that Colorado River inputs have historically been sporadic and minimal and are unlikely to significantly affect primary productivity or vaquita prey species abundance (Brusca et al. 2017; Rojas-Bracho et al. 2019; Flessa et al. 2019). Vaquitas examined at necropsy have presented excellent body condition with no signs of malnutrition (Vidal 1995). None of the vaquitas taken from gillnets showed signs of emaciation, including mothers, calves and sub-adults, which are most likely to be stressed when food is limited (Rojas Bracho & Taylor; 1999, Rojas-Bracho et al. 2019).

Little is known about their predators, but some reports confirmed that sharks, particularly mako and white shark may be amongst the main predators with only one confirmed record of predation by a white shark based on stomach content analysis where vaquita parts were present (Vidal 1995). Sharks are also scavengers so vaquitas in stomach contents do not imply predator/prey direct relation (IUCN letter to Gov of Mexico 2021). Available data do not currently indicate the presence of mortal pollutants like hydrocarbon pesticides or Polychlorinated biphenyl are a threat to the survival of the remaining vaquita population (Rojas Bracho & Taylor; 1999; Gulland et al. 2020).

2.1.3 Conservation efforts

International efforts

The vaquita, “IUCN Red List of Threatened Species (Rojas-Bracho et al. 2022) is listed in Appendix I of the Convention on International Trade in the Endangered Species of Wild Fauna and Flora (CITES 1998). Is also included in the U.S. Endangered Species Act since 1985. The Mexican government listed vaquitas as endangered in 1994 (DOF 1994, NOM-Ecol-059). For many years, several international agencies have been putting pressure onto Mexico to promote measures that ensure vaquita conservation. Recent efforts are summarized below.

In July 2019 “The Network of Marine Protected Areas in the Site Islands and Protected Areas of the Gulf of California,” was the first marine site to be listed as World Heritage in Danger, by the United Nations Educational Scientific and Cultural Organisation (UNESCO) primarily because of “unsustainable illegal fishing practices” (artisanal fishing with illegal gillnets) that is leading vaquita towards extinction (IUCN-SSC Cetacean Specialist Group).

In August 2021 the Chair of the IUCN Species Survival Commission (SSC) sent a letter to governments of Mexico, the United States and Canada, as well as the European Union and other international bodies about the plight of the vaquita, saying, “It is the most threatened marine mammal on the planet and the SSC highest priority. We cannot let this imminent extinction happen, when we know how to prevent it: stopping the continued use of illegal gillnets”. In July 2024 the World Heritage Committee (WHC 2024) approved the set of corrective measures Mexico proposed in its 2024 annual State of Conservation report (GOM 2024) in order to achieve removal of the site from the List of World Heritage in Danger.

From May 30 to June 4, 2022, the second high-level mission to combat the international trafficking of totoaba was conducted in response to the Standing Committee's request to the CITES Secretariat to evaluate progress in implementing Decision 18.293. CITES Decisions 18.293 (Rev. CoP19) urges

Mexico to intensify efforts and to “take immediate actions to further strengthen measures to effectively prevent fishers from using gillnets in the VRA and vessels from entering the Zo and to maintain these areas completely gillnet-free”.

In November 2022, the CITES Standing Committee at its 75th meeting, agreed several recommendations on totoaba (*Totoaba macdonaldi*) addressed to Mexico. This included that Mexico prepare a compliance action plan (CAP) in accordance with paragraph 29 h) of Resolution Conf. 14.3 (Rev. CoP19) on CITES compliance procedures and in consultation with the Secretariat and “focusing on the implementation of the provisions of any decisions directed to Mexico to be agreed at CoP19, and recommendation a i) and ii) agreed at SC75”. This recommendation derived from Mexico's perceived non-compliance with its obligations under CITES.

In March 2023, the CITES Secretariat recommended the suspension of trade with Mexico involving CITES-listed species (CITES E-Notif-2023-037), as the CAP delivered by Mexico after the Secretariat found that the CAP submitted to it insufficiently took into consideration the criteria set by the Standing Committee and concluded that the plan was not adequate. In response, Mexico presented a new CAP to the Secretariat in April 2023, outlining a series of measures aimed at enhancing the enforcement and monitoring of illegal fishing activities in the Gulf of California. Consequently, the Secretariat lifted its recommendation the following month (CITES E-Notif-2023-046), acknowledging Mexico's submission of a comprehensive CAP.

In June 2023, an agreement between WHC-UNESCO and CITES was marked by a Memorandum of Understanding. This agreement represents a new effort to ensure the sustainability of trade in wild animal and plant species in areas of outstanding international importance inscribed on the UNESCO World Heritage List. The agreement could aid support and align efforts of both institutions related to the vaquita totoaba issue.

In August 2023, the International Whaling Commission (IWC) issued the first Extinction Alert statement ever “in order to encourage wider recognition of the warning signs of impending extinctions, and to generate support and encouragement at every level for the actions needed now to save the vaquita”.

At its 77th meeting (SC77, Geneva, November 2023), the Standing Committee adopted Recommendation g) on totoaba (*Totoaba macdonaldi*), requesting the Secretariat to conduct a third technical mission to Mexico, to review and monitor the implementation of the CAP and to assess the situation on the ground. Following an invitation, the mission was carried out from 11 to 15 March 2024. The mission concluded that Mexico was making progress towards the implementation of the CAP, nevertheless, the Secretariat considers that amendments should be made to some regulations, specifically the 2020 “Agreement” (detailed in the following paragraphs): “ensuring its provisions are realistic, clear and practical and that all provisions can be fully implemented and enforced without exception, to safeguard the Zo and VRA ensuring that they remain free of any unauthorized fisher activities and gillnets, and that strict action can be taken against any activities associated with illegal fishing and trafficking of totoaba” (SC78 Doc. 33.12.1 Annex 4).

Conservation efforts – Mexico

From 1992 to 2024, the Mexican government has implemented various conservation and other initiatives, including the establishment of protected areas, fishing bans, different action plans, compensation programmes, military operations and equipment, and scientific research, to safeguard vaquita (see Table 2).

Table 2: Mexico's institutional interventions to protect vaquita

Year	Vaquita population	Event
1991	572	
1992		a. Technical Committee for the Protection of the Totoaba and Vaquita
1993	224	b. Decree of the Upper Gulf of California and Colorado River Delta Biosphere Reserve c. Vaquita Recovery Plan d. Standard NOM-012-PESC-1993 to protect vaquita and totoaba
1994		e. Inclusion of vaquita and totoaba in NOM-059-ECOL-1994
1995		f. Management Plan of Biosphere Reserve
1996		g. Recovery strategy for Phocoena sinus h. International Committee for the Recovery of the Vaquita
1997	567	
2001		i. Technical Advisory Subcommittee for the Recovery and Protection of the Vaquita
2002		j. Standard NOM-EM-139-ECOL-2002 to protect vaquita and totoaba.
2004		k. Compensation programmes to encourage fishermen to adopt alternative livelihoods
2005		l. Decree of the Vaquita Refuge Area and its Management Programme
2006		m. Conservation Programme for Endangered Species, prioritizing vaquita conservation.
2008	245	n. PACE Vaquita published and management actions start
2013		o. Standard NOM-002-SAG/PESC-2013 to ban shrimp gillnets and authorize the trawl net RS-INP-MEX
2015	59 Annual rate of decline of 34%	p. Two-year Presidential ban on gillnets, compensation for fishers and alternative gear trials.
2016	30	q. Net pulling programme to reduce ghost nets in vaquita habitat
2017	48% decline in 2017	r. Agreement for the permanent ban on gillnets Effort to capture and hold vaquitas in captivity
2018	19	s. U.S. embargo on Mexican shrimp caught with gillnets

Year	Vaquita population	Event
	47% decline in 2018	
2019	At least 7-15	*https://www.gob.mx/conanp/articulos/iniciativa-para-la-sustentabilidad-en-el-norte-del-golfo-de-california
2020		t. Publication of "The 2020 Agreement" and establishment of the Zero Tolerance Area
2021	At least 7-15	*entire Vaquita Refuge surveyed acoustically for first time since 2018, with zero detections. also published 3 DOF regs: GIS, GCAL & trigger factors
2022		u. 193 Anti-gillnet structures (blocks) in the Zero Tolerance Zone to deter gillnet fishing
2023	At least 10	v. Working sessions between fishermen and the Mexican government to modify the "2020 Agreement". w. Additional 216 anti-gillnet structures placed west and south of Zo where vaquitas sighted in 2023 survey
2024	at least 6-8 Acoustic detections outside the Zo in VRA for first time since 2017	x. Negotiations with fishers to create a proposal for the "2020 Agreement" modifications y. Mexico's new administration starting September 2024

Regulatory measures and areas in the UGC are complex, and have appeared gradually with different levels of fishing restrictions ranging from flexible regulations in the Upper Gulf of California and Colorado River Delta Biosphere Reserve (1993) to total prohibition (Zero Tolerance Area — 2020, where most recent vaquita detections have occurred), including no commercial fishing with gillnets of any type (Refuge Area for the Protection of the Vaquita —2005 and 2018), to a broad Gillnet Exclusion Zone covering the vaquita's historical range. The 2020 Agreement regulates gear, systems, methods, techniques and schedules for carrying out fishing activities with smaller and larger vessels in Mexican Marine Zones in the Northern Gulf of California and establishes landing sites as well as monitoring systems for such vessels ("The Agreement"). All boundaries are relatively nearshore (40 miles offshore at the farthest – see Figure 1). To date, of all the conservation polygons, only in the Zo has close to full enforcement been achieved.

The combination of the complex overlap of the marine areas regulated by different legal instruments with specific and differentiated yet complementary objectives, aims to promote sustainable fishing activities and conserve the region's biodiversity. However, there is room for improvement regarding applying a zero-tolerance policy to address illegal fishing and the necessary productive and technological alternatives are not profitable, making compliance extremely complex, with consequences for local livelihoods (Culture of Legality- Pronatura Noroeste 2021; Villalobos-Cristerna 2022). Three agencies have legal jurisdiction in these marine areas: 1) SEMAR (the Mexican Navy) monitors fishing activity from its vessels and coordinates inter-agency enforcement response; 2) SADER (Agriculture and Rural Development) – CONAPESCA supervises fisheries-related provisions and 3) SEMARNAT (Wildlife and Environment) – with PROFEPA in charge of enforcing species protections and CONANP, the protected areas agency.

Vaquita national conservation efforts date from February 1992, when the Mexican government banned the use of gillnets, with a mesh size greater than 25 cm to protect both vaquita and totoaba (DOF. 1992).

In 1993 the Mexican government created the Upper Gulf of California and Colorado River Delta Biosphere Reserve, whose main objective was to conserve and protect representative ecosystems, biodiversity, and endangered endemic species such as the vaquita and the totoaba (SEMARNAT-CONANP 2007).

Despite regulations such as the prohibition of gillnet fishing near the Colorado River Delta, enforcement has been challenging due to a longstanding and non-written policy of tolerance towards non-compliance in regional fisheries (Vásquez-León 1999). This is exemplified by the curvina fishery (but not limited to it), where the fish's migration into the reserve's core zone leads to frequent net deployment by fishermen, violating environmental legislation outlined in the reserve's decree and management programme (CONANP 1993). The lack of enforcement resulted in a 'culture' of non-compliance within fishing communities, where regulations are often disregarded without consequences (Culture of Legality-Pronatura Noroeste 2021).

In 1996 the Mexican government further announced a recovery strategy for *Phocoena sinus* (REP. INT. WHAL. COMMN 47, 1997) and formed the International Committee for the Recovery of the Vaquita (CIRVA). At its first meeting, the committee recommended that a new estimate of abundance was needed as a first step in a plan for the recovery of the species; this abundance estimate took place during the 1997 visual survey (Jaramillo Legorreta et al. 1999). They also recommended developing alternative fishing methods and alternative livelihoods to support the affected communities.

In 2002, NOM-EM-139-ECOL-2002 was published in response to the CIRVA recommendations to enhance vaquita and totoaba protection. This regulation prohibited the extraction of both species and restricted the use of gillnets larger than 6 inches in the Reserve's buffer zone, and also banned passive nets. Limited use of curvina and shrimp gillnets was permitted. Additionally, compensation programmes were introduced in 2004 and 2005 to incentivize fishermen to transition to alternative livelihoods (Vázquez-León, 2019).

In 2005 an additional Refuge Area for the Protection of the Vaquita (VRA) covering the central part of the vaquita's range was created. Gillnet fishing in the VRA was officially prohibited, but the prohibition was widely ignored due to a lack of enforcement and an adequate compensation plan or viable economic alternatives for fishermen reliant on this area for their livelihoods (Barlow *et al*, 2010).

A year later, in 2006, Mexico's President announced the Conservation Programme for Endangered Species (Programa de Conservación de Especies en Riesgo-PROCER) that required specific Species Conservation Action Programmes (Programas de Acción para la Conservación de Especies- PACE) for a list of selected species. Vaquita topped the list of only five species. PACE-vaquita, the first of its kind to be presented, was Mexico's conservation policy strategy to put into practice CIRVA's recommendations. Monitoring trends in abundance of the vaquita was given high priority.

Prior to 2015, the PACE Vaquita programme spent USD 26 million to reduce fishing effort via exchanging fishing permits for alternative livelihoods businesses like barbershops or convenience stores, they also improved surveillance and enforcement, providing socioeconomic alternatives to fishermen, and testing alternative fishing gear. In addition to this regulatory effort, regulations NOM-002-SAG/PESC-2013 (DOF, 2013) was published in 2013, which allowed the use of gillnets for shrimp fishing in the buffer zone of the Reserve, while prohibiting gillnet fishing in its core zone and the VRA area. This regulation also authorized the use of a trawl net (currently the only official legal fishing gear for shrimp) and established a three-year

deadline for transitioning to these highly selective nets based on tests conducted jointly by fishermen, research centers, NGOs, and government agencies. Compliance was however not enforced.

Fishermen's participation in the PACE Vaquita voluntary programme was influenced by socio-economic factors and permit numbers, with older fishermen and those holding multiple permits more willing to participate (Ávila-Forcada et al., 2012). The most successful businesses emerging were those operated by women, focusing on meeting local needs rather than being related to fishing or tourism (Ávila-Forcada et al., 2020; Sanjurjo-Rivera et al., 2021). However, transitioning to new livelihoods was difficult for fishermen, especially those lacking skills outside this activity (Sanjurjo-Rivera et al., 2021).

It has been hard to persuade fishermen to switch from their roles as independent workers in the fishing industry to becoming temporary, often poorly paid, and seasonal workers in other sectors (Vásquez-León, 2012). Despite these efforts, in 2015 there was an estimate of 876 artisanal boats (pangas) fishing with gillnets within the range of the vaquita (Perez Valencia et al. 2015). Furthermore, during the past years, the navy has informally reported around 1,500 fishing boats using gillnets in the UGC (GIS meetings 2021-2023), meaning that despite all the policies aiming to stop it, the fishing effort using gillnets in the UGC has doubled in the past 10 years.

In response, rather than continuing the shift away from shrimp and other fisheries gillnetting, a temporary ban on gillnets accompanied by a compensation scheme for fishers, was implemented in 2015 (WWF 2016). The complete ban was deemed necessary to facilitate enforcement measures for totoaba illegal fishing. However, this measure resulted in unintended consequences, such as fishermen reinvesting the compensation payments in gillnets (including the ones used to poach totoaba) and an increase in illegal fishing (Equihua, et al., 2020; Sanjurjo-Rivera et al., 2021). This ban was later extended in 2017 (DOF 2017). Despite these measures, there was compelling evidence of a continued precipitous decline in vaquita numbers, attributed to inadequate enforcement and resistance amongst fishers to adopt alternative fishing gear (Comité Internacional para la Recuperación de la Vaquita (CIRVA) 2017, 2018). Fishers argued that the alternative gear is less profitable than gillnets, and that there are limited alternative livelihoods in the area that could offset the opportunity cost associated with changing fishing gear or economic activities (fishers leaders pers comm). In 2017 an emergency field effort was undertaken to try to keep vaquitas in captivity to save at least some specimens taking into consideration that the population was in a roughly 50%/year decline. In 2017 there were 90 experts from 9 countries working in waters near San Felipe. During this effort, two animals were captured using light gill nets. A juvenile was released 4 hours later because it appeared stressed. An adult female died of capture myopathy. The programme was suspended because of the risk of additional mortalities to the population (Rojas-Bracho et al. 2019; Taylor pers comm.).

In 2018, adjustments were made to the VRA Area for the Protection of the Vaquitas (DOF-2018) to encompass the main distribution zone of the species, based on findings from the visual survey and following CIRVA recommendations. However, despite the legal deadline for its publication expiring 180 days after the issuance of a new VRA, the Protection Programme was not published at the time this report was finalized (by December 2024).

The UGC is subject to a very strong tidal flux, and local gillnet fishers tend to fish during spring tides when flux is strongest. Because of this, and because gillnets are illegal, nets are often poorly attended and insufficiently surface-marked, and thus there is a high loss rate. Acknowledging this, the International

Committee for the Recovery of the Vaquita (CIRVA - 2015), emphasized the importance of threat mitigation by establishing efforts to keep vaquita habitat free of entangling fishing gear, both ghost gear and active fishing gear. Because of that, an important net pulling programme was settled in 2016 to reduce the risk of both ghost and active nets in the vaquita habitat, by a combined effort of the Mexican government, Sea Shepherd Conservation Society, Museo de la Ballena y Ciencias del Mar and WWF-Mexico (Jaramillo-Legorreta et al 2019; Aceves-Bueno et al 2023).

As a result over 1,600 derelict and unattended gillnets have been removed, with over 60% being large-mesh totoaba type gillnets (Olimon et al. 2020, Aceves-Bueno et al 2023). In the 2018 totoaba season alone, 400 active totoaba nets were recovered (Jaramillo-Legorreta et al. 2019), measuring an average of 1km each. In November 2021, participants in a scientific vaquita survey documented 117 gillnetting artisanal fishing boats inside the Zo (Rojas-Bracho et al. 2021). Recent efforts to extract ghost gillnets developed by CONANP and local NGO´s Museo de la Ballena, Pronatura Noroeste and Pesca ABC in 2021-2023 showed that at least the Zo and an important part of the VRA now have very low numbers of derelict and unattended gillnets (Castro-Proal et al. in prep; Museo de la Ballena 2020).

It is clear that saving the vaquita marina from extinction can only happen by stopping the widespread use of gillnets for all the fisheries operating in the vaquita distribution range and substitute with alternative fishing gear and other socioeconomic alternatives. Beyond regulation and net pulling efforts, the only long-term solution would be to change the fishing gear used for the main fisheries in the region. Because of that, for the past 20 years, efforts have been made to convert local fishers from gillnets to high-selectivity legal gear. Unfortunately, this has also largely failed, mainly because fishers are reluctant to adopt new fishing technologies (further details contained in Chapter 4).

Most recent conservation efforts include the publication in September 2020 of a national regulatory instrument to continue the first gill net ban established in 2017: “The Agreement regulating gears, systems, methods, techniques and schedules for the performance of fishing activities with smaller and larger vessels in Mexican Marine Zones in the Northern Gulf of California and establishing landing sites, as well as the use of monitoring systems for such vessels” (“The Agreement”), that permanently prohibits the use of gillnets in the large gillnet exclusion zone (Figure 1), but also regulates the transportation of the materials used to build gillnets; regulates the hours and landing sites, amongst others. Once again, “The Agreement” has not been fully enforced and most of the fishers continue to catch shrimp and other finfish using gillnets in the whole gillnet exclusion area as documented by CITES mission in 2022 (SC 75 Doc. 7.5)). This perspective was clearly shared with the Secretariat during the 2024 mission to Mexico: “The fishers stated that in the absence of viable alternative fishing gear, they will continue to use the traditional gear” (SC78 Doc. 33.12.1 Annex 4).

In April 2022 the Navy proposed a deterrence concept of seeding the Zo seafloor with nearly 193 structures (concrete blocks a meter square, with two 3.5 meter tall 1 1⁄2 inch diameter iron rebar hooks protruding from the top), intended to entangle bottom-set gillnets as they drift with the tides. Although there were initial concerns that nets would become entangled in the hooks and pose a new threat to the vaquita, monitoring has shown positive outcomes. According to the results of the 2023 observation cruise, the installation of the blocks and cooperation between the NGO´s and the Mexican Navy to reinforce the ban on gillnets in the Zo has resulted in a 90% reduction in the presence of boats and gillnets in the Zo (Jaramillo-Legorreta et al. 2023). Also, based on the vaquita sightings from this cruise, it is estimated that between 8 to 13 vaquitas, all healthy, remain in the area, indicating that the population might have

remained stable since 2021 (Jaramillo-Legorreta et al. 2023). As of today, the blocks have been the most effective enforcement (deterrence) action to stop gillnetting, at least in the Zo. During 2023, the navy placed additional 216 blocks in an area surrounding the Zo to the south and west, and anecdotal reports from fishing leaders in San Felipe indicate that nets are being snagged there as attempts to gillnet in the area continue (pers. comm.).

Additionally, they indicate that it is possible to stop the use of nets and vaquita bycatch if enforcement efforts are focused in that area, rather than having a ban on gillnets in a large area that is not adequately monitored. Furthermore, any efforts should be accompanied by strict milestones monitoring mechanisms, following the CAP example, and in case of the blocks, permanent gillnet detection and cleaning campaigns.

As part of the CAP presented by the Mexican Government to CITES, starting in August 2023, the Mexican Secretariat of Governance organized working sessions with representatives of the fishing sector to propose modifications to "the 2020 Agreement." This initiative resulted in an area management proposal aimed at balancing the conservation of the vaquita and promoting sustainable fishing in the UGC. The proposal, presented to the GIS in August, suggests expanding the Zo by 25% to the Northeast and establishing a net exclusion area covering 85% of the VRA.

Consensus has been reached on several fronts in negotiations between fishermen and Mexican government agencies regarding aspects such as the need to maintain a permanent ban on gillnets, impose sanctions for violations of regulations, and implement a Special Marking Programme for small vessel equipment. However, discussions continue regarding the extension of the gillnet exclusion area, landing and departure sites, permissions for night fishing, and the removal of abandoned nets.

Nonetheless, the announcement by the Mexican government (GoM 2023) about the expansion of the Zo by 60%, along with the placement of blocks in this area and other measures executed without previous informed consultation with fishers while the other negotiations were taking place in October 2023, impacted negotiations between the fishing sector and the GIS. This has led the fishing sector to perceive the Mexican government as prioritizing foreign interests and approaches instead of engaging the fishing sector in the solution building process.

It is important to note that the National Commission on Protected Areas (CONANP) has played a crucial role in developing various community engagement initiatives, including vaquita monitoring and supporting the adoption of alternative fishing gear and other livelihood-related actions. With its permanent presence in the field, along with the Reserve Advisor Committee, CONANP has earned the trust of local communities and is essential for any future negotiations or community-based initiatives.

2.2 Totoaba (*Totoaba macdonaldi*)

2.2.1 Population status and trends

Totoaba, the largest of sciaenid fish, can reach a maximum weight of over 100 kg and a length exceeding 2 meters (Flanagan & Hendrickson 1976). Originally classified on the IUCN Red List of Threatened Species as Critically Endangered in 1996, it was changed to Vulnerable in 2020 (Cisneros-Mata et al. 2021). Nonetheless, the assessment suspects a past and future three-generation decline (1993–2029)

of at least 30% based on estimated levels of poaching for illegal international trade in its swim bladder. According to the assessment, “a variety of intrinsic characteristics (e.g. late-maturing, long-lived, predictable spawning behavior in a relatively small area) make it particularly susceptible to overfishing.

With a lifespan of 25 years (Román-Rodriguez 1994), these fish undertake annual spawning migrations along the eastern shore of the northern Gulf of California, culminating in the Upper Gulf of California, considered to be their nursery ground, during late winter into spring (Flanagan & Hendrickson 1976; Cisneros-Mata et al. 1995). After spawning, spent adults and two-year-old juveniles migrate southward along the western coast of the Gulf (Arvizu & Chfivez 1972; Flanagan & Hendrickson 1976; Barrera-Guevara 1990). There are also indications of a summer migration of totoaba towards deep waters in the central Gulf of California (Berdegue 1955; Arvizu and Chavez 1972; Flanagan and Hendrickson 1976).

Juvenile totoaba primarily feed on small benthic organisms, including small crabs, fish, amphipods, and shrimp, while adults consume larger, more pelagic items such as sardines and adult crabs (Arvizu & Chavez 1972; Guevara-Escamilla et al., 1973; Flanagan & Hendrickson 1976; Molina-Valdez et al., 1988).

This demersal, migratory species is endemic to the Gulf of California. The original distribution of totoaba extended from the mouth of the Colorado River to Bahia Concepción in Baja California and Baja California Sur, and to the mouth of the El Fuerte River in the States of Sonora and Sinaloa (Figure 8 — Jordan & Everman 1896, cited in Berdegue 1955). The CITES technical sheet (CITES- AC17 inf 6- 2010) suggests a significant reduction in the distribution range of the totoaba towards its southern limit, encompassing large islands like Ángel de la Guarda and Tiburón. However, Valenzuela Quiñonez and colleagues documented the species in south Sonora during winter from December to February 2009, just over 200 km south of the previously indicated reference (Figure 8) close to the southern limit of its original distribution (Valenzuela Quiñones et al. 2011).

Figure 8: Totoaba Distribution Area and representation of various records and reports of the species (1995-2020)

Furthermore, recent reports indicate shifts in distribution patterns. During winter, adults were observed in the Colorado River delta and the core zone, while juveniles were found in Bahía Lobos, Sonora, and at the mouth of the El Fuerte River in Sinaloa (Valenzuela-Quiñonez et al. 2015). Records from sport fishing and photographic evidence confirm the presence of pre-adult and adult totoabas up to the town of El Mármol in Sinaloa, signifying an expanded distribution area further south (Cisneros-Mata 2023).

The exploitation of totoaba fishery began in the early 20th century, driven by the demand for the swim bladder (known as “buche” in the Mexican Slang and “maw" for the Chinese) of females, which was at the time mainly exported to China and the Chinese community in San Francisco, California (Craig, 1926) for consumption in restaurants as a gourmet dish (Cisneros-Mata et al. 1995; Valenzuela-Quiñonez et al., 2011). The remaining parts of the fish were not used except for a small amount that was consumed by local fishermen (Craig 1926; Huey 1953). An increase in the fishery of adult totoaba resulted from an agreement between the U.S. and Mexico to develop a market for the whole fish (Craig 1926; Cisneros-Mata et al. 1995).

An estimated 77,634 kg of totoaba filets from San Felipe were imported into the U.S. from 1924 to 1925 and 834,452 kg from 1927 to 1928 (Chute 1928). Its catch increased until reaching a historical peak in 1942 with 2261 tons, and imports of totoaba filets into the United States peaked at 1,299,243 kg in 1946 (Fitch 1949; Berdegué, 195). However, overfishing and increased demand resulted in a decline in the population, with the lowest recorded catch of 59 tons in 1975 (Cisneros-Mata et al. 1995). It is believed that after the implementation of a fishing ban in the same year initiated a recovery, the positive trend continued until the 1980s; however, in the 2010s, the declining trend increased due to the enormous fishing pressure driven by the high value of the swim bladder in China (Cisneros-Mata et al. 2020).

Historical information about totoaba population status has been based on commercial exploitation. Unfortunately, there is a lack of data since the fishing ban in the 1970s (Valenzuela Quiñones et al.,2011) and illegal captures hinder reliable record-keeping, making it challenging to estimate abundance, growth, and exploitation using standard fisheries biology methods (Pedrín-Osuna et al. 2001). Most of totoaba population studies have been based on simulating historical data and adding information collected with different sampling methodologies throughout time.

Despite the lack of data hindering a comprehensive assessment of whether the population has fully recovered, the totoaba stock size structure has consistently demonstrated stability over several decades (De Anda-Montañez et al. 2013; Valenzuela-Quiñones et al. 2015; Valenzuela Quiñones and Enriquez Paredes pers comm.). The age structure of the species is believed to be relatively complete, encompassing organisms up to 27 years old, and maintaining a geographic distribution range very similar to the one originally reported (Cisneros-Mata 2020). The highest documented abundance of juveniles was observed near San Felipe, Baja California (Barrera-Guevara et al. 1987; Barrera-Guevara y Ortiz de Montellano 1988; Ortiz de Montellano 1987).

Some of the most recent studies regarding abundance, stock and risk assessment are included in a book edited by Cisneros Mata and published by the Mexican National Institute of Fisheries (INAPESCA) in 2020. In this compilation studies conducted during the 2017-2018 period were referenced. In terms of larvae abundance, a significant decline was noted between March 2017 and March 2018. Variations in

the larval index could be attributed to factors like changes in spawning patterns or abundance of adult totoabas (Guevara-Aguirre et al.). Biomass drastically changed between 2017 (36,429 ton) and 2018 (19, 294 tons) (Nevarez - Martinez et al). Nevertheless, some experts attribute this estimation changes to model accuracy rather than an actual population decline (Enriquez Paredes and True pers comm.)

During the 2022 mission to Mexico (SC75 Doc. 7.5) the Secretariat was informed that the National Commission for the Knowledge and Use of Biodiversity (CONABIO) coordinated a project on "Evaluation of the impact and relevance of experimental releases of totoaba produced in captivity" (Enríquez Paredes et al. 2023). As a result of this study, when using genetic markers to evaluate population status, findings align with others in that: 1) genetic diversity indicates that totoaba did not suffer measurable loss due to past population collapse, with sufficient diversity for potential growth indicating that the totoaba population is demographically stable; and 2) the population has a non-critical conservation status, with an stable population structure and effective population size exceeding viability thresholds (Cisneros Mata 2020; Valenzuela Quiñones et al., 2014; 2016; Enriquez Paredes et al. 2023). This indicates that the population has enough individuals to maintain genetic diversity and avoid problems such as inbreeding and genetic drift (Enríquez Paredes pers comm.). Population estimates range between 350,000 when using Monte Carlo model simulation, to 750,000 individuals when using genetic markers and capture recapture models (Enriquez Paredes et al. 2023)

Nevertheless age-structured fisheries modeling exhibited a biomass decrease. This decline was attributed to excessive fishing of pre-adults and adults in the UGC, particularly in 2010 and 2017 when at least 760 tons of totoaba were caught (based on interviews to local fishers; Cisneros Mata 2020). The findings suggest an imminent surge in catches, driven by the illegal market for swim bladders, that could lead to severe overexploitation in the short term (Cisneros Mata 2020). Considering the lack of data and the impending rise in illegal fishing, experts recommend maintaining the fishery closed as a precautionary measure, but concur with the need to build the road towards the fishery sustainable management (Cisneros Mata pers comm; Enriquez pers comm; Felbab-Brown pers comm.)

To effectively manage and preserve totoaba populations, understanding their history, current status, and the impact of exploitation is crucial, therefore it is urgent to develop comprehensive biomass studies to estimate abundance and age structure (Enríquez Paredes and C. True pers comm.). Acoustic biomass estimation may be an effective methodology to address this informational gap as suggested (Cisneros Mata pers comm). The 2020 Red List assessment noted “Given that there are inconsistencies in the available data, with evidence of increased poaching pressure countered by other indications of population resilience, and no direct measures of population trend, this assessment should be updated when additional data allow for a better understanding of this species’ status, especially since declines are expected to continue in the near future due to the ongoing high poaching rate” (Cisneros-Mata et al. 2021).

Table 3. Totoaba studies and results in the past 25 years.

Author and Year	Sampling sites	Samples collected	Seasonality	Parameters estimated
Roman 1997	San Felipe, El Moreno, EL Chinero, Bahía Omejepic — BC Golfo de Santa Clara, Machorro, El Burro, El Tornillal — Sonora	1,125 juvenile totoaba shrimp trawl nets 157 adults were collected in gillnets	1986-1991 Shrimp trawl nets = October to March Gillnets = Feb to April (86-87 & 89-91)	
Valdez Muóñoz 2010	Several	Historical data and mathematical modeling		Density: 6-34 juveniles/km2
Guavara Aguirre 2017-2018	Upper Gulf Area	Water samples	March 2017 and 2018	Larval abundance 2017: 15.3 L/10 m2 2018: 4.1 L/10 m2
Cisneros-Mata 2017-2018	Coast of Sonora, Baja California and the Upper Gulf	104 juveniles collected	October to December	Upper gulf density: 2.48 juveniles/km2 Length vulnerable to capture with shrimp trawl nets: 30-40cm
Nevarez - Martinez et al. 2017-2018	Coast of Sonora, Baja California and the Upper Gulf	Acoustic	2017: April-May 2018: April-May	Biomass 2017: 36,429 ton Biomass 2018: 19, 294
Enriquez Paredes et al. 2023	Totoaba bladder seizures in different Mexican ports including San Felipe, Puerto Peñasco, Nogales and Mexico City	Genetic markers	10 years of seized bladders in Mexico	Individuals: between 350,000 when using Monte Carlo model simulation, to 750,000 when using genetic markers and capture recapture models Biomass: 1, 511 tons

2.2.2 Threats to species and its habitat

The decline in totoaba populations began with the completion of Hoover Dam in the States of Nevada and Arizona, United States during 1935, reducing Colorado River inflow to the delta and the UGC in

Mexico (Flanagan and Hendrickson 1976; Cisneros-Mata et al. 1995). However, “there is no direct evidence that the totoaba population has been reduced by the damming of the Colorado River” (Cisneros-Mata et al. 2021). Totoaba’s decline is also coincident with a sharp increase in fishing pressure (mainly extensive gillnetting of adults and sub-adults) and shrimp trawling (bycatch of juveniles — Cisneros-Mata et al. 1995; Garcia-Caudillo et al. 2000). This combination of altered environmental conditions and intensified fishing activities complicates the identification of the primary threat, making it challenging to draw definitive conclusions. A plausible scenario is that the drastic decline in the totoaba population has been multifactorial (Lercari & Chávez 2007), including habitat alteration, overfishing, bycatch, and illegal fishing (Berdegué, 1955; Flanagan and Hendrickson 1976; Rosales-Juárez and Ramírez-González 1987; Cisneros-Mata et al. 1995, 1997).

The drastic decrease in the totoaba population between 1929 and 1975 correlates with the Pacific Decadal Oscillation Index and Colorado River flow (Lercari & Chávez 2007). Otolith and growth profiles of totoaba that existed before the dams are drastically different from those living after the Colorado River had been diverted. The pre-dam fish appear to have grown faster during their first year and, based on two separate estimates, reached sexual maturity earlier than post-dam fish. (Rowell et al., 2008).

Somehow contrary to these findings, Ortiz Viveros (1999) found that juveniles of *Totoaba macdonaldi* are capable of acclimatizing to different salinities and enduring a wide range of immediate changes in salinity. Additionally, a study developed by Valdez-Muñoz et al. (2010) suggests that salinity does not determine the distribution of totoaba juveniles in the UGC. Supporting these conclusions, in 1993, there was controlled release of water from the river, reducing salinity by approximately 23% along the West coast of the gulf up to 70 km from the river mouth (Lavín and Sánchez 1999), the annual average CPUE (Catch Per Unit Effort) of juvenile totoaba estimated for that year was low, maintaining its pattern of spatial distribution. However, the annual CPUE in the following year had a significant increase. This suggests that salinity does not have a direct effect on the distribution and abundance of juveniles, but it does affect other variables that can benefit them, such as food and turbidity (Valdez-Muñoz et al. 2010).

Fishing with gillnets impacts totoabas congregating for spawning, particularly during the period February to May (Molina-Valdez 1987; Cisneros-Mata and Montemayor-López 1989). Recent studies suggest that the capture of sub-adults and adults has a more significant impact on totoaba biomass than the incidental capture of juveniles in trawl vessels (Cisneros Mata et al. 2020). The increasing threat of illegal fishing, especially for swim bladders, highlights the need for precautionary measures to prevent severe overexploitation (Cisneros-Mata et al. 2020).

2.2.3 Conservation efforts

Early totoaba conservation efforts began in 1949, with the banning of gillnets at the Colorado River estuary during the totoaba spawning period (Arvizu and Chávez 1972). In 1974, the Colorado River estuary was designated a reserve zone where all fishing activities were prohibited (Rosales-Juarez & Ramirez-González 1987). In 1975, the Mexican government took decisive action, closing the totoaba fishery permanently (Flanagan & Hendrickson 1976; DOF 1975). In 1977 totoaba was included in Appendix I of CITES (Barrera-Guevara 1990).

The year 1992 saw the formalization of the Technical Committee for the Protection of the Totoaba and Vaquita (CTPVT), coinciding with the prohibition of gillnets with specific characteristics (mesh size: 20-

30 cm) known as 'totoaba nets' (DOF 1992). In a significant step in June 1993, the Mexican government, driven by the threat of gillnets to vaquita (*Phocoena sinus*), expanded and reinforced the reserve zone, declaring it “The Upper Gulf of California and Colorado River Delta Biosphere Reserve” (Lercari & Chávez, 2007). In 1994, Mexico further reinforced conservation measures, including totoaba in the Mexican endangered species list “NOM-059” (NOM-059-SEMARNAT-2010; Barrera-Guevara 1990; Cisneros-Mata et al. 1995).

In 1994 the Autonomous University of Baja California (UABC), aiming to restock the wild population to protect the totoaba species, successfully reproduced totoaba in captivity (True 2012). Since then, over 618, 000 totoaba juveniles (ages 3-8 months) have been released into the marine environment (Enriquez-Paredes et al. 2023). Currently there are seven authorized wildlife management units for totoaba (UMAs) in Mexico (CITES SC71 Inf. 2), all of them have permission for commercial use of the specimens.

Three of them release totoaba in uncoordinated efforts (Cisneros-Mata press comm.): The UABC and the Center for Marine Species Reproduction of the State of Sonora (CREMES) releases totoaba in the UGC near San Felipe, Baja California, and Bahía Kino, Sonora, respectively. While Earth Ocean Farms (EOF) releases totoaba in Bahía Concepción (Mulegé) on the eastern coast of Baja California Sur (Enriquez-Paredes et al. 2023).

In the "Evaluation of the impact and relevance of experimental releases of totoaba produced in captivity” (Enríquez Paredes et al. 2023), the presence of captive-bred individuals among the wild totoaba population was detected through genetic markers that aided in identifying released individuals, nevertheless their integration into wild populations still remains unclear.

For future management of the restocking programme, having better tracking / monitoring of the released individuals is of crucial importance, but also, it is recommended to reduce the number of releases and release older individuals to increase survival rate while also implementing coordinated strategies with management authorities (EOF pers comm; Cisneros Mata pers comm.)

3. Comprehensive and Integrative Diagnosis of the Illegal and Legal Trade in Totoaba Specimens

This section aims to provide understanding of the totoaba trade, both illegal and legal, and its potential impacts on vaquita and totoaba conservation, enforcement efforts, and market dynamics. It involves data analysis in prices and trend identification, and consultations with key stakeholders to inform future conservation strategies and recommendations.

3.1 Characteristics of illegal trade and enforcement related actions

Totoaba swim bladder, known as "maw" in the Chinese market and "buche" in Mexican slang, has been traded for decades. Initially, it was a legal product primarily exported to China and the Chinese community in San Francisco, California during the 1920s, until its ban in 1975 (Cisneros-Mata et al., 1995; Valenzuela-Quiñonez et al., 2011). Despite the ban, illegal trade continues to this day.

The totoaba, with characteristics similar to the Chinese bahaba (*Bahaba taipingensis* — IUCN 2021*)*, has medicinal and culinary uses (described below) and often called "golden coin maw" or "money maw" in Chinese due to its high value, the female bladder being the most valuable (EIA 2019; ELI 2017; Chavarria 2020). Totoaba prices have soared to the extent that single maws have become investment items (commodities) subject to speculation (Kan, 2005; Guilford, 2015; EIA 2016). Based on 2017 illegal totoaba capture estimates by an INAPESCA study and average local prices paid for swim bladders at the time, the illegal totoaba swim bladder trade that year was estimated to exceed USD 50 million, with an end value in China exceeding USD 200 million (CAT report 2023-Based on Cisneros-Mata, et al. 2020). Other investigations in 2015 and 2016 documented totoaba being offered in China at prices ranging from USD 5,400 and up to USD 80,000 USD per kilogram (Boilevin et. al. 2023).

Illegal fishing of totoaba primarily occurs in the Upper Gulf of California due to its spawning aggregation behavior, which makes it vulnerable to being captured in quantity by large gillnets (Cisneros-Mata et al., 2020, 2021). Evidence suggests that other areas further south in the Gulf of California, such as Puerto Lobos and Guaymas in Sonora, together with Bahía de Los Angeles and El Barril in Baja California (see Figure 8) are also being targeted by illegal fishing depending on the season (Cisneros Mata et al., 2020; Cisneros Mata pers comm; interviews with locals). Fishers illegally set large mesh size gillnets to poach totoaba. Once caught, the swim bladders are extracted and illegally traded to international markets, mainly in China. Anecdotal stories told by fishers indicate that they have been catching totoaba, harvesting the swim bladders for the Chinese market, and sometimes discarding the carcasses for more than 20 years. Unfortunately, this practice of discarding carcasses not only persists to this day (Kira 2000; Chavarria 2020), but has become extensive as a way for fishers to avoid getting caught (EAL 2018; fishers pers comm.)

It is important to note that totoaba fishing has historically played a vital role in the origin and development of communities such as San Felipe, Puerto Peñasco, and the Gulf of Santa Clara, as well as other locations along the entire coastline of Baja California and Sonora. The capture and consumption of totoaba are deeply ingrained cultural practices among the population. Moreover, the species high nutritional value and considerable economic worth pose significant challenges to any strategy or measure aimed at reducing its capture.

The illegal trade in totoaba involves sophisticated and organized criminal networks engaged in smuggling and trafficking operations. These networks often have international reach, spanning multiple countries in the supply chain, from illegal fishing to distribution (Alvarado-Martínez y & Martinez-Lopez 2021; Alvarado-Martínez y & Ibañez-Alonso 2021; Chavarria 2020). Moreover, the illegal trade intersects with other illicit activities like drug trafficking and money laundering, making it a crime convergence problem. Criminal organizations based in Mexico sell the swim bladders to various groups of well-connected traders and businessmen residing in Mexico, mostly of Chinese origin. Trafficking routes are constantly changing, with Mexico City, Nogales, San Francisco, and Cancun documented as important ports, while Vancouver, Canada may also be a significant shipping hub (verified source on totoaba trafficking, EIA pers comm. Felbab-Brown pers comm.).

Totoaba illegal fishing has increased significantly in the past couple of decades, (Cisneros-Mata et al. 1995; Cisneros-Mata et al. 2020) threatening not only the vaquita but also the entire marine ecosystem of the UGC. The nets used to poach totoaba have been documented to be fatal for other marine mammals as well. From 2015 to 2019 SSCS documented the entanglement of 36 marine mammals trapped in illegal gillnets (SSSC 2020) and from December 2023 to May 2024 two whales were rescued from entanglement in totoaba and other large mesh nets near the VRA while approximately 20 dolphins were found stranded with clear sings of entanglement (E. Rizo pers. comm; whale disentanglement local team -RABEN-.)

3.1.1 Source country

Illegal fishing of totoaba primarily occurs in the Upper Gulf of California, with fishermen using large mesh gillnets called 'totoaberas' to catch the fish. Once caught, totoaba swim bladders are immediately extracted and concealed, with the rest of the fish discarded (Chavarria 2020). Fresh female totoaba bladder weighing 1kg or more are the better priced (EAL 2018).

As previously described, the totoaba fishery led to the establishment of fishing communities in San Felipe, BC, Puerto Peñasco, and El Golfo de Santa Clara, Sonora, until its ban in 1975. Criminal organizations of Mexican and Chinese origin infiltrated the illegal trade of totoaba maw and became involved around 2012 (Alvarado-Martínez y & Ibañez-Alonso 2021; Chavarria 2020). In recent years, there has been a shift in the source country supply chain dynamics. Previously, the trade in totoaba was dominated by Chinese elders operating in Mexicali and Tijuana, who amassed significant profits over the past decade (Crosta pers comm.) However, this illegal business has now transitioned to younger Mexican-Chinese individuals who are directly linked with Mexican criminal organizations (local sources and Crosta pers comm. - ELI, Felbab-Brown 2022). This shift has occurred in tandem with changes within the Mexican criminal organizations, where the incarceration of organized crime leaders has led to their children assuming control (Barron-Cruz 2017).

Initially perceived as a lucrative opportunity for local fishers, totoaba illegal fishing has evolved into a highly organized activity with criminal organizations operating within Mexico (COs) involved. This transformation has facilitated the illegal movement of large volumes of totoaba, resulting in a significant increase in illegal fishing from approximately 6,000 individuals in the mid-1980s to nearly 30,000 individuals by 2017 (Cisneros-Mata et al. 1995, 2020), with an average weight of 26-46 kg per individual.

The highest reported ‘ex-vessel bladder prices’ (prices paid to fishers directly when landing product) were from 2016 to 2019, as confirmed by informal interviews with local people and experts (see Table 4). It is estimated that in San Felipe in 2017, at least 100 vessels were routinely engaged in capturing totoaba in

the Upper Gulf of California, with an average ex-vessel price of USD 17,000 (Cisneros Mata, ed. 2020). During the pandemic, prices dropped significantly (Table 4), as reported by local verified sources, and since then they have remained in a range between USD 3,000 and USD 5,000. Simultaneously, it is likely that the capture rate has increased (Boilevin et al. 2023). It is also important to note that prices are now controlled by COs, which have become the sole middlemen in the illegal trade of the bladders.

Table 4: Reported prices between 2016 and 2021.

Season	Highest ex-vessel reported price (Prices of 1kg fresh female swim bladders)	Lowest reported ex-vessel price (Prices of 1kg fresh female swim bladders)	Data source
2016-2017	USD 8,000.00	USD 5,000.00	EAL Report 2018 “Operation Fake Gold”
2018-2019	USD 6,000.00	USD 5,000.00	Hassan et al. 2021 Interviews with locals
2020-2021	USD 1,500.00	USD 800.00	Interviews with locals (Pandemic drop of prices)
2023-2024	USD 5,000.00	USD 3,000.00	Interviews with locals

The profitability of illegal totoaba fishing has attracted fishers from other parts of the country to the UGC communities, exacerbating the issue. These "bucheros" operate for the COs during the illegal fishing season, but also engage in other fisheries (all of them gillnet fisheries that pose a threat to the vaquita), increasing fishing effort in the region, despite bans on gillnet usage (Alvarado-Martínez y & Martinez-Lopez 2021; Culture of Legality- Pronatura Noroeste 2021).

In recent years, COs have increasingly exerted its influence in the fisheries of northwest Mexico, seeking to control legal and illegal fishing activities along the entire seafood supply chain. Even legally high-value fisheries, such as shrimp, are affected. In addition to putting pressure on the supply chain, the provision of stolen fuel to fishermen, extortion of processing plants, transporters, and authorities responsible for the sustainable development of the fishing sector has been documented (Felbab-Brown, 2022).

Criminal organizations have also filled the market gaps that have emerged as a result of imposed embargoes. Previously, legal companies played a crucial role by acting as intermediaries between fishers and external markets, in addition to providing credits for the acquisition and repair of fishing equipment, exclusively gillnets (local fishers pers. comm.) However, with the suspension of the importation of seafood extracted with gillnets in the region, COs have taken on the role of providing fishing gear (gillnets) and boats to both illegal totoaba fishing and other legal fisheries, such as shrimp, corvina, and prawn (Felbab-Brown pers. comm.). Although shrimp is among the Upper Gulf fisheries embargoed since 2020, it continues to be exported to the United States under highly effective product laundering schemes (NOAA 2022).

Secondary actors in the source country include Transnational Criminal Organizations (TCOs) that move illegal consignments and span Mexico, the United States, and China. Chinese criminal organizations operating in Mexicali and Tijuana are reportedly behind much of the wildlife trafficking in the region, leveraging historic Chinese migration to the Mexicali Valley (Barth 2017; Chavarria 2020). Totoaba illegal trade has also seen speculation, with prices peaking in 2014 driven by criminal groups and speculators attracted to rising prices, followed by a drop due to oversupply (Sadovy et al. 2019).

Several enforcement actions have taken place in Mexico in the past years. From 1 January 2018 to 31 July 2019, more than 2,000 totoaba maws were seized in Mexico. During a peak three-week period between April-May 2018, 940 pieces and 40 kg of mostly fresh totoaba maws were seized. The major hotspot for seizures has been the International Airport of Mexico City, where nine cases were reported and over a thousand totoaba maws confiscated (EIA 2019). Between 2016 and 2022, 12 sentences were imposed by the courts, with a total of 16 people convicted (CLIP 2023). In March 2024 at least nine investigations were ongoing (SC78 Doc. 33.12.1 Annex. 4).

A UNESCO-World Heritage Mission in 2018 observed continued illegal fishing and concluded the following: "… law enforcement procedures have been significantly strengthened by the enactment of the permanent gillnet ban, the allocation of greater resources within San Felipe and the UGC and improvements to legal procedures associated with gathering data and investigating illegal activities. However, new nets are still being retrieved, confirming that illegal fishing still occurs". Evidence suggests that >95% of fishers in the two UGC communities bordering vaquita habitat fish illegally with gillnets for both commercial seafood species and protected totoaba fish, and this is done quite openly with little perceived risk of consequences (Felbab-Brown 2020; Boilevin 2023; CBD 2021; IUCN-SSC 2021).

Similar conclusions can be found in CITES document SC2020 Inf. 14, paragraph 10: "From the reporting provided by Mexico, it is evident that, from 1 September 2019 to date, surveillance activities and inspections with a particular focus on the vaquita (*Phocoena sinus*) VRA have significantly increased compared to the period January-August 2019. However, from the information provided by Mexico in its November 2019 and April 2020 reports, the Secretariat concluded that the actions of the authorities were lenient and non-deterrent, and that activities of illegal fishers seemed to continue with impunity. The Secretariat communicated this to Mexico, encouraging the Party to review and strengthen its responses to the illegal fishery activities". Furthermore, the latest IWC Scientific Committee report notes "its grave concern at the unregulated illegal gillnet fishing that occurs elsewhere, including in the VRA" (IWC-SC69B 2024).

The 2023 report prepared by Mexico (SC77 Doc. 33.13.2 Annex 4) on progress made in the implementation of the Compliance Action Plan (CAP) under CITES, indicates a 19% increase in land and marine surveillance in April 2023 compared to April 2022 (the curvina season). Of the 1,631 vessels inspected by July 31, 2023, no administrative sanctions were imposed. The report also indicates that over the past five years, there has been a linear increase of 105% in the reporting of landings at authorized sites in the UGC of California (UGC) (SC77 Doc. 33.13.2 Annex 4). Mexico's reports on inspected boats are clear about the registration of permits needed but not about the fishing gear they were using. Inconsistencies in this information may point to a failure in implementing the gillnet prohibitions in accordance with the "Agreement." Local NGOs and interviews with locals indicated that most boats continued to use gillnets during this period. This raises the question of why there are no sanctions when fishers use forbidden gillnets as fishing gear, and why they are allowed to continue

landing products as if they were caught using legal gear. It is the responsibility of CONAPESCA to verify the use of proper gear and to sanction the use of forbidden gillnets.

Furthermore, Mexico's fisheries authorities, CONAPESCA and the Mexican Institute for Research in Sustainable Fisheries and Aquaculture IMIPAS (formerly known as INAPESCA), have failed in the implementation of alternative gear. While it is true, as reported in Annex 4 to document SC77 Doc. 33.13.2, that INAPESCA has made recommendations for alternative fishing gear and CONAPESCA has issued permits for these alternative gears for commercial fisheries, fishers are not using them. The main argument is that yields are lower, making alternative gear less profitable. During the last CITES 2024 Mission to Mexico “Fishers expressed significant dissatisfaction and frustration noting a lack of support from IMIPAS and CONAPESCA regarding the development and use of alternative fishing gear” (SC78 Doc. 33.12.1 Annex 4). This social resistance to alternative gear use and lack of compliance with several regulatory measures in the area, including the improper use of fishing permits and the lack of enforcement in the VRA and the rest of the gillnet exclusion zone, poses the major long-term threat to the vaquita.

As part of “The Agreement”, a series of triggering factors were published (DOF: 09/07/2021). These are levels of enforcement responses calibrated to increasing levels of violation, with the highest levels resulting in fisheries closures which scale up in area and duration with monthly revisions. There are two types of trigger factors, measured by daily retrievals of illegal nets and/or number of unauthorized vessels in the Zo. According to this regulation, daily levels of 65 unauthorized vessels or >500 m of illegal gillnet retrieved in the Zo could trigger fisheries closure. The sole concept of having boats inside the Zo is incongruent. Despite this, as reported by Sea Shepherd Conservation Society (SSCS) and summarized by Barbara Taylor in 2021; between October and May, SSCS observed 5 days where the number of pangas (fishing vessels) (excluding those equipped for diving) exceeded 65 within the Zo. These number of violations should have triggered a total closure of fishing for shrimp in the Vaquita Refuge (IUCN 2021).

Mexico has struggled to fully enforce the laws and policies designed to protect the vaquita, such as bans on gillnet and fishing, as well as efforts to stop illegal totoaba fishing (Crosta et al., 2018). This challenge is evident in Figure 9, showing the drastic decline of the vaquita population despite more than three decades of dedicated conservation efforts. Yet, there is hope. In recent years, two promising deterrence strategies have emerged, focusing on stopping illegal gillnetting in the Zo and parts of the VRA:

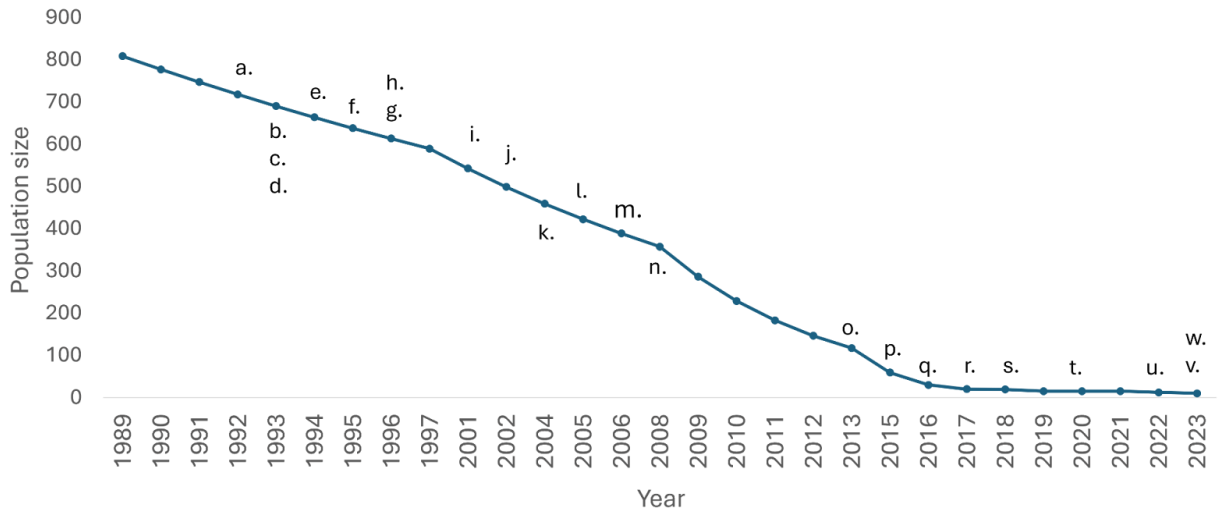

Figure 9. This graph depicts the population trajectory of the vaquita against management actions taken by the Government of Mexico. The increase in the rate of decline starting in 2011 can primarily be attributed to increased illegal gillnet fishing for totoaba. Letters in the graph refers to Mexican Institutional efforts to protect vaquita as listed in Table 2.

1. The net pulling programme: The large volumes of nets (both active and ghost nets) extracted from 2016 to 2020 (Chapter 4) resulted in significant economic losses for illegal fishermen estimated to be approximately USD 3,840,000 (960 nets USD 4,000- based on Boilevin et al. 2023). In response, poachers have adjusted their fishing methods to avoid detection, employing strategies such as "encierro" or using hooks and lines to target fish in deeper waters (ELI 2017 - 2023; interviews with locals). These methods have little to no bycatch risk for vaquitas. However, gillnets are still the most common method used, and even with the increased monitoring by SEMAR, fishers have opted to sometimes stay side by side with drifting gillnets, letting themselves be carried by the currents, instead of leaving them unattended overnight. Eventually, they return to the coast with the net and the extracted swim bladders (Villalobos-Cristerna, 2022).

2. Installation of 193 hooked gillnet deterrents: (as described in section 2). Based on counts made in aerial and visual surveys, but also using SSCS public information on gillnetting counts inside the Zo, from 2019 to 2021 (before the blocks were installed) gillnetting taking place in the Zo was as high as 117 boats in one day in November 2021 (CAT 2023). Since the installation of hooked gillnet deterrent structures on the Zo seafloor in summer 2022, significant progress has been observed in controlling gillnets within the Zo. Reports indicate a reduction in boat activity ranging from 38% to 90%, depending on the season (CAT 2023 and 2024; Jaramillo-Legorreta et al., 2023; Annex 4 to document SC77 Doc. 33.13.2). However, the situation in the rest of the Vaquita Refuge Area (VRA) remains concerning. In January 2023, gillnetting activity in the VRA increased by 32% compared to January 2022 (CAT 2023).

Mexico reported a substantial decline in detected vessels within the VRA, from 2,268 during April to July 2022 to just 137 during the same period in 2023—a reduction of over 90% (SC77 Doc. 33.13.2 Annex 4). However, these figures conflict with concurrent counts by SSCS that reported vessel numbers up to ten times higher (CAT 2023). The persistence of high gillnet activity in the VRA continued into 2024, with Sea Shepherd reporting as many as 55 potential net-fishing boats on 31 October 2024 alone (SSC Daily Science Report) (Figure 11).

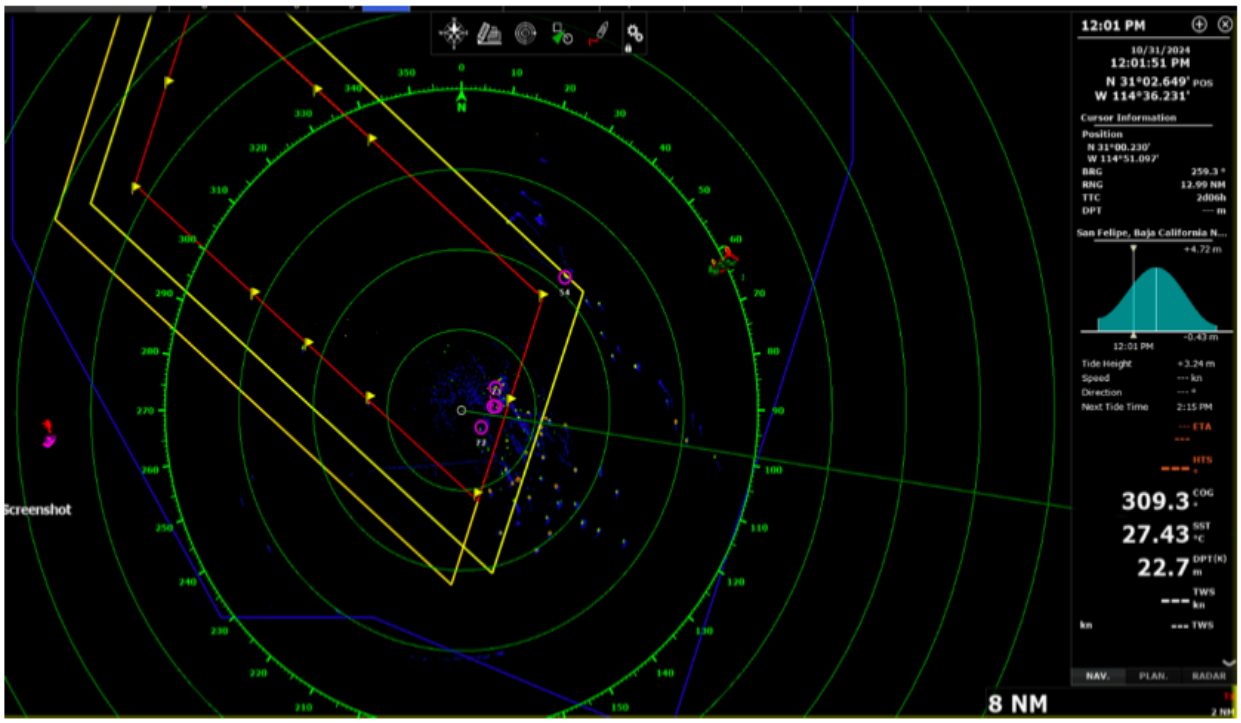

Figure 11. Radar screenshot 31 October 2024 at 12:01, "showing multiple small boats inside the Zo and numerous boats in the Buffer Zone and the Vaquita Refuge" (Sic. SSC - Daily Science Report)

During the 2024 vaquita survey in May, lots of gillnets to catch Sierra finfish were detected landing in the San Felipe "el muelle" official landing port (Vaquita Survey 2024). Furthermore, the CITES Secretariat noted that room for improvement continues to exist regarding applying a zero tolerance policy and appropriate penalties for unauthorized activities in the Zo and the VRA, and that if a strict zero tolerance policy is not applied against unauthorized activities in the Zo and VRA, it could significantly undermine and even undo the progress made by Mexico on other fronts and provide for a continued situation of impunity for offenders to operate (SC77 Doc 33.13.2 Annex 5). It is clear that the provisions of the General Law of Sustainable Fishing and Aquaculture are not being applied consistently (SC78 Doc. 33.12.1 Annex 4).

3.1.2 Consumer and transit countries

Hong Kong SAR of China serves as a major import and transshipment center for seafood, including fish maw (Tuuli et al. 2015). The trade in dried fish maw thrives within Hong Kong SAR of China importing thousands of tons annually from over 110 countries/territories (Sadovy et al. 2019). Fish maw is easily available in Hong Kong SAR of China and Chinese markets. The CITES 2024 mission to China confirmed this and reported that most of those maws are from non-protected species bred domestically in captivity (SC78 Doc. 33.12.1 Annex 6).

Nevertheless, this is not the case for totoaba, that is hard to find and considered an illicit commodity (Wei Ji and Stanley Shea pers comm.) Totoaba is "treated as a first-class key protected species in accordance with national laws of China, Hong Kong SAR of China and Macao SAR of China, which makes provision

for strict penalties" (CITES SC77 Doc. 33.13.2). Regardless of the quantity and origin, penalties on totoaba are related to fixed values: 1. an adult totoaba swim bladder obtained from the wild the established value is CNY 112,000 (approximately USD 15,000), and 2. for a swim bladder from captive bred totoaba it is CNY 56,000 (approximately USD 7,700).

In cases where it can be proven that the specimen was sold at a higher price than these values, the actual transaction price will be used. In cases where the value of the seized specimens is less than CNY20,000 (approximately USD 2,800), the specimens and any illegal gains will be confiscated, and a fine of two to 20 times the value of the seized specimens will be imposed. If the value is between CNY 20,000 to 200,000 (approximately USD 2,800 to USD 28,000), the specimens and any illegal gains will be confiscated, and a fine of two to 20 times the value of the specimens will be imposed, as well as a sentence of less than five years imprisonment. If the value is between CNY 200,000 to 2,000,000 (approximately USD28,000 to USD 280,500), the specimens and any illegal gains will be confiscated, and a fine of two to 20 times the value of the specimens will be imposed, as well as five to 10 years imprisonment. If the value is more than CNY 2,000,000 (approximately USD 280,500), the specimens and any illegal gains will be confiscated, and a fine of two to 20 times of the value of the specimens will be imposed, as well as more than 10 years or up to life imprisonment. for both swim bladders obtained from the wild (established value approximately USD 15,000) and swim bladders from captive bred totoaba (established value approximately USD 7,700 – SC78 Doc. 33.12.1 Annex. 6).

For this study, attempts were made to contact the Totoaba Focal Points in China and Hong Kong SAR of China, but no responses were received. Consequently, the information used was sourced from local reports, NGOs, and CITES documents. Reports from Mainland China, Hong Kong SAR of China, and Macao SAR of China highlight efforts to combat illegal totoaba trade, including seizures, market surveys, and public awareness campaigns (CITES SC77 Doc. 33.13.2; Siu 2015; Dasgupta 2018; Xinhua 2019)

Chinese customs officials have seized significant quantities of maw, with estimates exceeding millions of dollars, leading to prosecutions in mainland China and Hong Kong SAR of China (Dasgupta 2018; Siu 2015; Xinhua 2019). Dry totoaba bladder in China has been reported to reach prices as high as USD 100,000/kg (EIA 2016; Juarez et al. 2016). In December 2018, Chinese Customs revealed the outcomes of an extensive undercover operation named "SY608" conducted in Guangdong and Guangxi, resulting in the apprehension of 16 individuals associated with a significant totoaba trafficking organization. Authorities seized 444 kilograms of dried totoaba swim bladders valued at approximately USD 26,000,000 (Boilevin et al. 2023). In the same year, China reported a case involving the seizure of 393 items by customs, with the offender receiving a 10-year prison sentence. Authorities indicated their intent to impose stricter penalties in future cases (China presentation in the Online Meeting of Range, Transit and Consumer States of Totoaba, 2021).

From January 2020 to May 2023, customs authorities in Guangdong province detected and investigated nine cases of totoaba specimen smuggling (SC77 Doc. 33.13.2). Since 2018, mainland China has seized a total of 5,387 totoaba swim bladders related to 20 cases. Offenders received sentences ranging from less than 5 years to over 10 years, with most cases concentrated in Guangdong, Guangxi, and Hainan. Guangdong was identified as the primary source of smugglers, with Chaozhou and Shantou serving as major consumer markets. Successes in detecting and addressing totoaba trafficking in China have been primarily limited to the efforts of the General Administration of China Customs (GACC) and its Anti-Smuggling Bureau. In contrast, local authorities in various cities within Guangdong province have

struggled to effectively identify or intercept totoaba maws in the illegal market (SC78 Doc. 33.12.1 Annex 6).

Regarding the actions taken by the Hong Kong Special Administrative Region (SAR) of China, which operates under separate administrative authorities with distinct inspection and legal enforcement powers from mainland China, three different seizure cases were reported in 2018. These cases highlighted the various methods used to smuggle totoaba into the region (Hong Kong SAR of China presentation in the Online Meeting of Range, Transit and Consumer States of Totoaba 2021):

1. Two individuals traveling from Hermosillo, Mexico, to Hong Kong SAR of China were found carrying 11 kg and 17 kg of dried totoaba swim bladders, respectively.

2. A shipment from Colombia to a local logistics company included 26 pieces of dried totoaba swim bladders mixed with non-CITES-listed fish bladders.

3. A cargo shipment originating from Los Angeles, California, contained frozen totoaba swim bladders totaling 160 kg.

In both cases, authorities of China and Hong Kong SAR of China indicated their intent to impose stricter penalties in future cases. Market searches and activities regarding totoaba have been conducted in China and Hong Kong SAR of China for at least the past 4 years. China has organized and carried out market research activities regarding totoaba and no trading of totoaba swim bladders was detected in its major domestic aquatic product wholesale markets or dry seafood markets (SC 77 Doc. 3.13.2). During 2020 TRAFFIC was commissioned by the Agriculture, Fisheries and Conservation Department (AFCD) of Hong Kong SAR of China to conduct a market survey regarding dried totoaba swim bladders. It was reported as outlined in document SC77 Doc. 33.13.2, that a total of 201 market outlets in Hong Kong SAR of China were surveyed and no dried totoaba swim bladders were found. They also reported that TRAFFIC conducted a survey on online platforms in Hong Kong SAR of China and did not find any advertisements regarding totoaba swim bladders during this survey.

AFCD continues to conduct inspections at local markets from time-to-time to detect and deter illicit trade in totoaba swim bladder and 460 dried seafood shops were on average inspected per year throughout the territory, between 2020 and 2022, and none of the inspected shops was found selling dried totoaba swim bladders. Similar information was also reported by authorities from mainland China and Macao SAR of China. Likewise, Macao SAR of China reported that from January 2020 to May 2023, no seizures involving totoaba specimens were made, and that the Economic and Technological Development Bureau and the Municipal Affairs Bureau of Macao SAR of China conducted sampling inspections at dried seafood shops, restaurants and catering establishments serving seafood, and no totoaba specimens were detected (SC77 Doc. 33.13.2).

NGO reports align in Guangdong Province as the primary destination for illegal imported dried totoaba swim bladders, although trade also occurs in Fujian Province, Zhejiang Province, Shanghai, and Beijing (Figure 10 — EAL 2018; Boilevin et al. 2023; Crosta pers comm. EIA 2024). Chinese nationals operating at the top of the supply chain, play a key role in facilitating the smuggling of totoaba maws, primarily through the United States (Felbab Brown 2022; ELI, 2023; Crosta pers comm.).

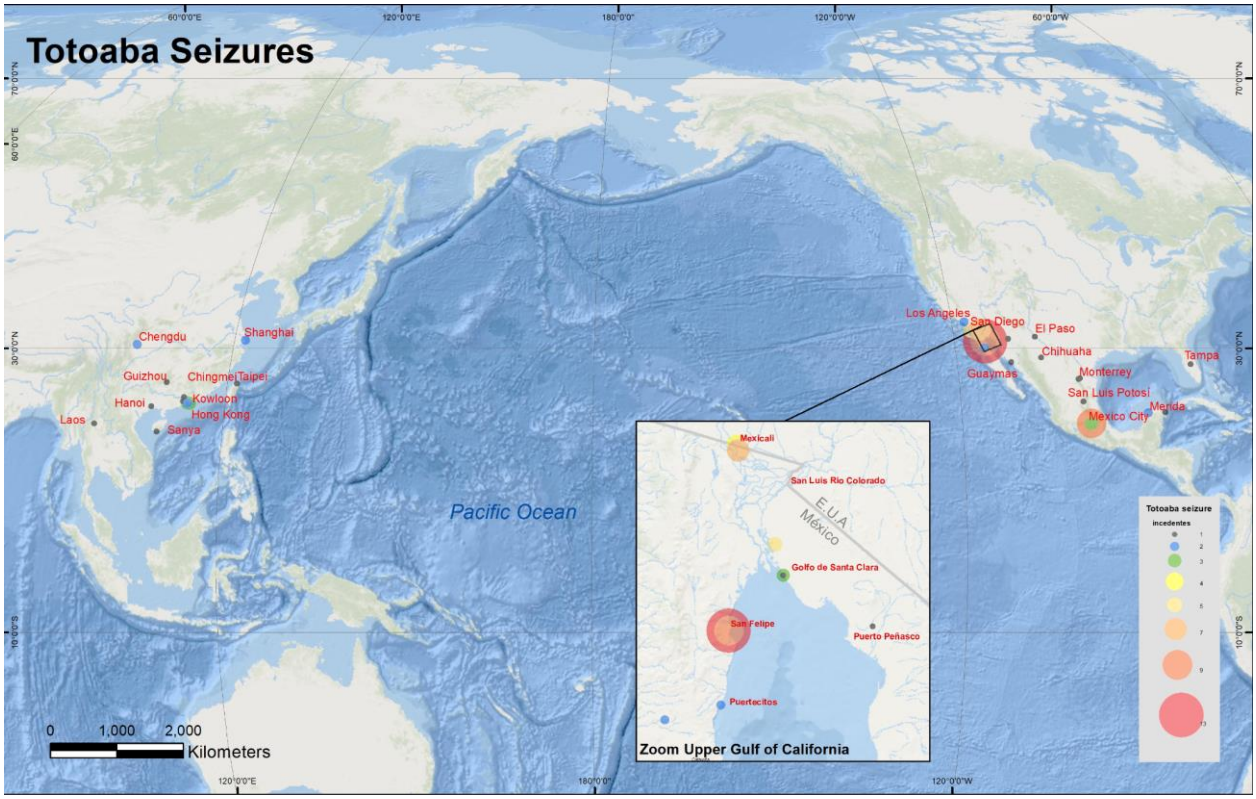

Figure 10. Geographic Scope of Seizures Reported in Global Press (2013-2023): This map illustrates the geographical scope of seizures documented in the global press during the period from 2013 to 2023. The shaded areas represent regions where such seizures have been reported.

With regards to demand reduction, several actions have been taken by different cities in the Guangdong province:

1) In Chaozhou, authorities organized on-site activities, media campaigns, and the Aquatic Wildlife Protection Science Popularization Month, which focused on educating the public about the illegality of totoaba trade.

2) The Chaozhou authorities have distributed over 1,000 posters since 2018 to inform people about totoaba's illegal status, targeting key locations like markets, restaurants, and online platforms.

3) Similarly, in Shantou, awareness campaigns were conducted targeting fishing areas, markets, and schools, using media, fairs, and festivals to spread the message.

4) The Shantou administration also used various media platforms to encourage public awareness of wildlife laws and reporting illegal activities (SC78 Doc. 33.12.1 Annex 6).

In addition, cities like Guangzhou, Huizhou, Meizhou, and Shenzhen have conducted publicity campaigns and distributed awareness materials, further highlighting the fight against illegal totoaba trade. Guangzhou enforced a strict approval process for trading aquatic specimens, and Huizhou distributed over 1,800 publicity materials during events such as the fishing festival and the "Polder Day" celebrations. NGOs working on wildlife issues in China have shared details of several demand reduction and awareness campaigns to combat the illegal trade of totoaba. These efforts included collaborations with

the travel industry, law enforcement training, and tools for identifying totoaba (Traffic pers comm. SC78 Doc. 33.12.1 Annex 6). TRAFFIC, with support from the CITES Secretariat and China, is implementing a pilot project to reduce demand and change behavior regarding totoaba trade. This project will utilize the CITES *Guidance on demand reduction strategies to combat illegal trade in CITES-listed species*, contributing to broader efforts to protect totoaba (SC78 Doc. 33.12.1 Annex 6).

On 11 April 2024, the CITES MA of China issued an Action Plan on Combating Illegal Trade in Totoaba that includes 36 actions to be undertaken and was issued to 13 ministries and associations (SC78 Doc. 33.12.1 Annex 6). It will be important to monitor the implementation of the action plan in the near future.

Several other transit countries have been reported, including Japan, Malaysia and Indonesia. Recently some reports involving Canada, Venezuela and Colombia suggest a larger expansion of transit countries due to its recent use as a commodity by organized crime (Hong Kong SAR of China presentation in the Online Meeting of Range, Transit and Consumer States of Totoaba 2021 Felbab-Brown 2022; Crosta pers comm; EIA 2024 verified source on totoaba trafficking, EIA pers comm. Felbab-Brown pers comm.). It must however be noted that Canada reported to SC77, as outlined in document SC77 Doc. 33.13.2, that after reviewing its records, it can confirm that no violations involving totoaba (*Totoaba macdonaldi*) have been reported in Canada since 2016. Canada in its reporting noted that it continues to be supportive of efforts to strengthen law enforcement measures where relevant and that, if required, it is open to explore additional joint efforts to curb illegal activities. Japan, in a response to the consultation process for this study, indicated that Japanese domestic laws and regulations do not provide for the authority to stop the transit and transshipment of specimens. However, if there is specific information from the exporting country that a specimen is illegally exported and passes through Japan, the importing country can be contacted through the totoaba focal point. Japan indicated they would like to continue to cooperate with the countries concerned in dealing with the illegal trade of totoaba (Fumihiko Koyama; CITES Management Authority of Japan; Ministry of Economy, Trade and Industry)

The United States serves as both a potential consumer and transit country for fish maws, with documented consumption dating back to the 1920s (Ibarrola 2015; Mendoza 2015; Boilevin et. al. 2023). United States ports like El Paso, Nogales, Laredo, and San Diego are key entry points for illegal wildlife shipments from Mexico (Defenders of Wildlife webpage). Available information suggests that the United States plays a key role in the totoaba trafficking trade chain. This information indicates that US-Chinese organized criminal networks in California are linked to the Mexico based criminal groups. Anecdotal information suggests that consumption might occur in Los Angeles and San Francisco. Reports have also suggested the existence of illegal operations in the United States, where fresh totoaba soup may be offered to clients, including at “birth clinics” (ELI ongoing investigation; Crosta pers comm.)

Although there is no official evidence of this consumption, fresh totoaba specimens are illegally entering the United States. Worth noting though is that information gathered by the CITES Secretariat during its mission on totoaba to the United States in March 2024, indicated that a marginal market for totoaba specimens do exist in the United States, mostly for small scale personal use. Authorities noted however that investigations revealed that selling totoaba specimens in the United States is difficult for criminals, since use is not socially acceptable, and for totoaba specimens sold in the United States profit margins are low and do not compare to prices paid in Asia. It was stated that based on available data and information, the domestic market in the United States is insignificant considering its size (SC78 Doc. 33.12.1 Annex 5). This should be continuously monitored to in a timely manner implement measures or activities as needed to address any new or emerging trends. However, awareness-raising activities or

demand reduction campaigns should be undertaken with caution and based on further research to ensure that such campaigns do not inadvertently stimulate demand.

During the CITES Secretariat mission United States authorities confirmed that although organized crime related activities involving totoaba specimen trafficking occurs within the United States, these activities facilitate the movement of illegal consignments from the United States to countries in Asia, using large United States trade volumes to disguise illegal activities (SC78 Doc. 33.12.1 Annex 5).

Law enforcement agencies in the United States have made frequent seizures of totoaba swim bladders, principally at the Mexico–United States border. Since 2016, the United States government had seized over 500 totoaba swim bladders smuggled into the United States, with eleven totoaba smugglers charged (Boilevin et al. 2023). They have also implemented various measures and activities, including developing a coordination and cooperation protocol for enforcement authorities at ports and borders, as well as participating in joint training sessions focused on identifying totoaba swim bladders. Collaboration has occurred at the international level through channels provided by INTERPOL and the WCO, with the United States sharing information with officials from China, Mexico, and the Republic of Korea (CITES SC77 Doc. 33.13.2).

International cooperation is crucial for effectively addressing the issue of illegal totoaba trafficking. This should involve collaboration through official channels and tools such as those provided by INTERPOL and the WCO. On 2 September 2022, a live webinar on totoaba identification was held in partnership with the WCO to tackle trafficking, particularly in Asian markets. The event brought together 44 specialists and customs agents from various countries, including China, Papua New Guinea, the United States, Canada, Singapore, Japan, South Korea, and Mexico. Topics discussed included the historical conservation and protection of totoaba, taxonomic identification of specimens and derivatives (especially swim bladders), and strategies for addressing irregular exportation attempts and detected smuggling methods (Annex 4 to document SC77 Doc. 33.13.2). Continued and strengthened cooperation of this nature is vital for combating illegal totoaba trade.

3.1.3 Main actors and networks engaged in illegal totoaba trade: Illegal trade chain mapping

Wildlife crime is estimated to generate between USD 5 and USD 23 *billion* worldwide in revenue for the poachers, smugglers, and salesmen whose business it is to plunder nature for a quick profit (Barth 2017). As the gateway to the estimated USD 2 billion illegal wildlife trade in the United States, Mexico is *the* major hub for large, transnational criminal organizations that source wildlife from all Central and South America (WWF 2017). Totoaba is part of those illegally traded species and it is believed to be one of the most profitable ones.

The presence of organized crime groups in the fishing communities of the Upper Gulf of California dates back to the 1990s, when they began to establish themselves. Lack of opportunities and marginalization led young people from these communities to engage in drug trafficking, using fishing boats to transport narcotics to the region (Valdez-Gardea, 2001). The intensification of organized crime groups' presence in the region during the war on drugs that began in 2006 led to the selection of high biodiversity areas, such as protected natural areas, as priority targets due to their geographic isolation and lack of police or military presence. The Upper Gulf of California Biosphere Reserve and the Colorado River Delta emerged

as key trafficking routes to the United States, given their proximity to California and Arizona (Bonada-Chavarría, 2020).

During the 1980´s, despite the ban on totoaba fishing since 1975, local fishers persisted in extracting and selling the fish locally or smuggling it to California markets (Vidal, 1995). However, the resurgence in demand for totoaba swim bladders from China, coupled with high prices, attracted both local fishers and organized crime groups. These groups formed alliances with trafficking networks in southern California and Southeast Asia, viewing totoaba trade as more profitable and less risky than drug trafficking (Arroyo-Quiroz & Wyatt, 2019). They leveraged established networks, routes, and sales points for drug and arms trafficking (Alvarado-Martínez & Martínez-López, 2018).

The organization of the illegal totoaba fishing industry in fishing communities can be understood through three categories of actors: 1) local fishers who occasionally engage in extraction on their own; 2) local fishers and teenagers recruited by criminal organizations; 3) fishers from other regions who move to the UGC to fish for totoaba for criminal organizations also involved in drug trafficking from the Gulf of California to the United States. These groups supply boats and fishing gear to fishers, creating the obligation to sell the product and a cycle of debt that is hard to break, and which could have fatal consequences (Crosta et al. 2018; Alberts 2021; Villalobos-Cristerna 2022).

Based on local interviews conducted in 2023, it is clear that from 2018 to date only OC representatives are allowed to collect, safeguard, dry and transport the totoaba swim bladders (if done by any other organization or individual, punishment from organized crime may include death). Anecdotes told by fishers indicate absolute control of fishing by organized criminal groups that, as mentioned above, negotiate with TCOs mainly of Chinese origin that receive (fresh or dried) bladder in safe houses located in San Felipe, San Luis Rio Colorado, Mexicali, Tijuana, and Ensenada (CADS 2017). Primary transportation routes in Baja California start from San Felipe and extend by road to Ensenada, Tijuana, and Mexicali, aligning with established drug trafficking routes. The recent internal breakage of the Sinaloa cartel leadership has resulted in a constant dispute of the factions for the territory in both San Felipe in Baja California and Santa Clara in Sonora (Insight crime 2024).

To move totoaba bladders outside Mexico requires logistical operations, that are permanently changing and evolving, and interface with other instances/activities of Transnational Criminal Organizations (TCOs)-linked Chinese and Mexican traffickers before reaching the Pacific via air, utilizing three modeled routes: a direct one from Tijuana, another from San Felipe to various California cities, and the Tijuana-Mexico City-Asia route. Transit countries include, but are not limited to, the United States, Hong Kong SAR of China, South Korea, Japan, and Taiwan Province of China (Boilevin et al. 2023) (Figure 12). Information gathered from numerous seizures reported by source, transit, and consumer countries indicates that dried totoaba maw is often shipped through various methods, including individuals traveling on commercial airlines and mail shipments mixed with other seafood products. In contrast, fresh totoaba maw is typically shipped alongside other fresh fish products, often as part of international cargo shipments.

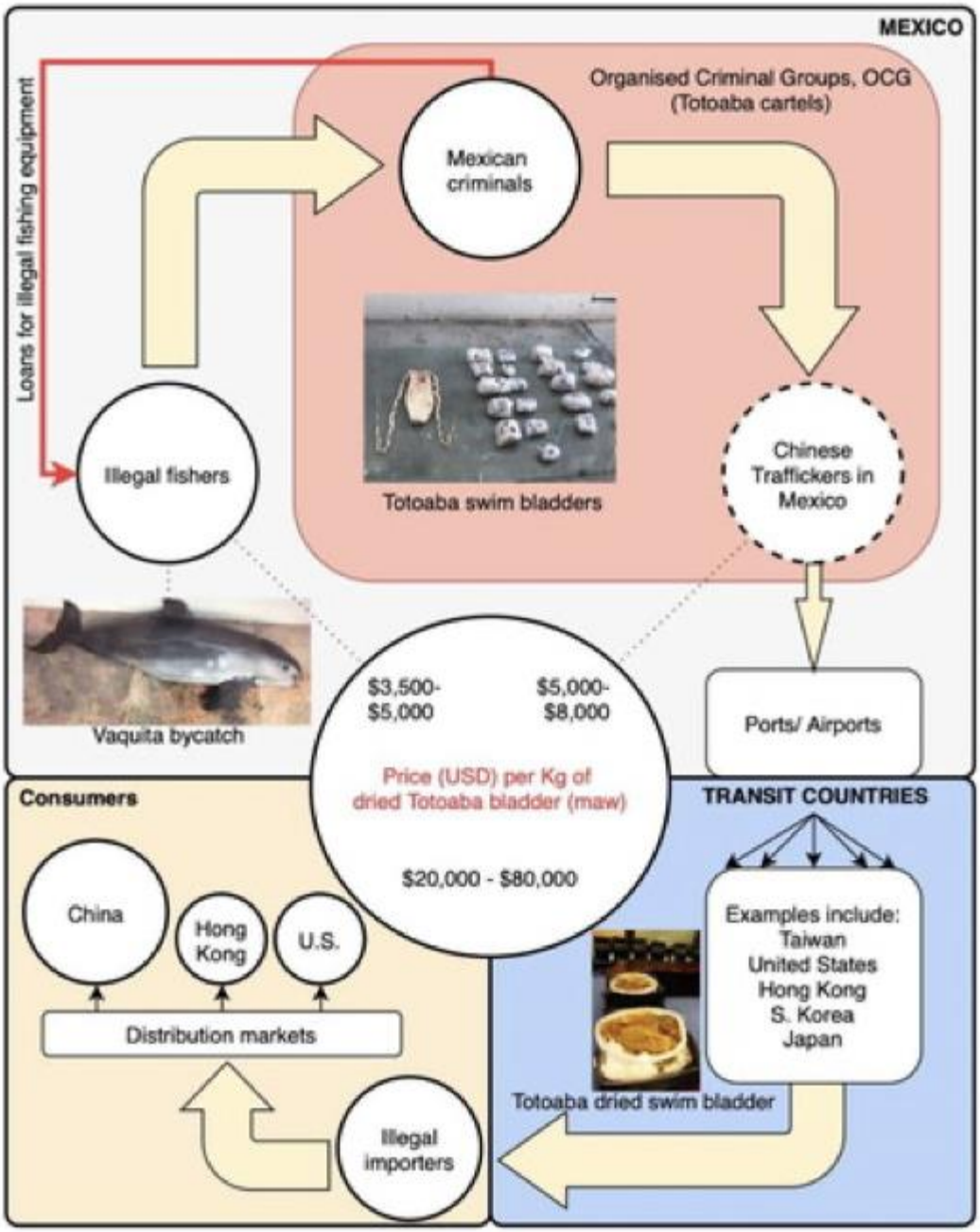

Figure 12. Totoaba illegal transnational trade. Circles depict the five main levels of the supply chain. The dotted circle indicates a point in the supply chain where disruption would be effective in impacting the larger supply chain (extracted from: Boilevin et. al. 2023).

3.2 Challenges and opportunities

3.2.1 Legal trade

In 1994, the Autonomous University of Baja California (UABC) initiated a captive breeding programme for conservation purposes and aiming to benefit local communities (True pers comm.). The Biotechnology in Fish Farming Unit (UBP) at UABC is where the technology for producing totoaba juveniles for restocking or supplementation of the wild population was developed, which later led to a parallel experimental farming programme in farms and enclosures for commercial purposes (True 2012). Currently, there are five registered Wildlife Management Units (UMAs) for totoaba , all of them have commercial permits: (1) Unidad de Biotecnología en Piscicultura de la UABC; (2) Centro Reproductor de Especies Marinas del Estado de Sonora (CREMES); (3) Earth Ocean Farms, S. de R.L. de C.V; (4) Pacifico Acuaculture S. de R.L. de C.V; (5) CYGNUS OCEAN FARMS, S.A. DE C.V. (6) ACUARIO OCEÁNICO, S. DE R.L. DE C.V. (7) Desarrollo del Alto Golfo de California.

In its July 2020 report to the Standing Committee and subsequent reports, Mexico addressed the matter of totoaba UMAs (UMAS are the Mexican legal instrument to manage wildlife either intensively or extensively) highlighting their role in tangible totoaba conservation efforts and their significance for the recovery of wild totoaba populations. Mexico emphasized that breeding totoaba in captivity facilitates sustainable management of the species, primarily for reproduction, research, repopulation, and commercial use. This approach is viewed as a viable and sustainable alternative that does not negatively impact wild totoaba populations, while potentially contributing to the reduction of exploitation and illegal trade (SC74 Doc. 59.1.1). Mexican experts working with totoaba emphasize that captive breeding of totoaba should not be seen as a sole solution to illegal trade but as part of a comprehensive strategy to identify sustainable development alternatives for local communities (Enriquez Paredes and True pers comm.)

In March 2022, at the 74th meeting of the Standing Committee (SC74 Doc. 28.5), the Standing Committee considered an application by Mexico and agreed to the registration of “Earth Ocean Farms, S. de R.L.” (EOF) in the CITES Register of operations breeding Appendix-I animal species for commercial purposes, enabling the international trade of totoaba fillet or meat. Currently, EOF is the only CITES-registered totoaba UMA.

During the CITES Secretariat’s mission in 2022 (SC 75 Doc. 7.5), the Secretariat visited the EOF and EOF described the process of swim bladders registration and storage. Swim bladders were sealed in packages that are each individually weighed and marked with a unique identification code but not yet destroyed. These packages are then further sealed in boxes, also uniquely marked (SC 75 Doc. 7.5). The CITES 2022 mission team in Mexico prompted authorities to, as a matter of priority, make progress on and conclude discussions on the destruction of the farmed swim bladders as indicated to the Standing Committee. As a response EOF made a series of proposals that were presented during the 19th meeting of the Conference of the Parties (CoP 19). To date EOF are using destroyed swim bladders to manufacture fertilizers (EOF pers. comm.). Mexico has officially proposed implementing a traceability system as described in the Official Mexican Standard NOM-169-SEMARNAT- 2018. The traceability system enables determining the parental specimens for each totoaba bred in captivity. It covers the entire operational chain from parental stock, hatching, tracking through the fattening farm phase, processing and eventual sale and distribution. Parental breeding stock is identified through a coded microchip in the back of the fish behind its head. Larval tanks are assigned a batch number when stocked and parentage

of all offspring can be determined using 24 micro satellite markers. Therefore, legally bred totoaba is claimed to be fully traceable and should not be considered part of the illegal trade problem (Enriquez Paredes pers comm.).

Nevertheless, local communities have not fully accepted aquaculture and there are two main reasons why: 1) they claim they are fishers and aquaculture is a totally different productive activity that engages other skills and responsibilities and 2) aquaculture is expensive, requires long term investment, and it would be very difficult for fishers to make such an investment and sustain it. Regardless of this, important progress is being made by the Mexican Government to establish a pilot totoaba aquaculture project (consultation with the Mexican scientific and administrative authorities; True pers comm.). Mexico views totoaba aquaculture as a sustainable solution for conservation, focusing on captive breeding for reproduction, research, repopulation, and commercial use. This approach aims to reduce illegal trade, support local communities, and maintain high operating standards (SC75 Doc 7.5) Totoaba aquaculture is a good example of what should happen with aquaculture worldwide, because it is an endemic species that is being sustainably harvested in its original habitat, which could contribute to both, population recovery through managed livelihoods and local communities livelihoods (Enriquez Paredes pers comm.). Experience in totoaba aquaculture should be useful to start experimenting with other endemic fish that are also in high demand by Asian countries including corvina maw and chano (meat and maw) (Interviews with locals; Enriquez Paredes and True pers comm. EOF pers comm.)

It has been proven with other marine endangered species, that farming can become a scalable solution. The caviar industry stands as a success in transforming the management of an endangered fish species into a profitable and sustainable activity, exemplified by the conservation efforts surrounding sturgeon populations. Historically, sturgeon species faced severe declines due to overfishing, habitat degradation, and pollution (Dulvy et al., 2003). However, the adoption of sustainable practices, particularly through the development of sturgeon aquaculture, has revolutionized the industry. Strict regulatory frameworks, such as those provided by CITES, ensure that caviar production adheres to sustainable practices, controlling trade, monitoring populations, and enforcing quotas to prevent overexploitation (Harrison et al., 2016). This transition to sustainable caviar production has not only stabilized wild sturgeon populations but also provided significant economic incentives for aquaculture investments, creating jobs and supporting local economies (Johnson et al., 2020).

These success stories underscore the importance of promoting aquaculture, implementing stringent regulations, highlighting economic incentives, and raising public awareness to replicate similar conservation and economic benefits in other endangered species fisheries, such as totoaba (Sustainability of Caviar Production, 2012). By drawing lessons from the caviar industry's triumphs, the totoaba fishery and aquaculture could transition towards sustainability, ensuring the species' survival while benefiting local communities and ecosystems.

4. Overview and Analysis of Supply and Demand for Illegally Sourced Totoaba Specimens

4.1 Supply side

4.1.1 Current Status

The illegal harvesting of totoaba primarily occurs in specific hotspots, notably the Upper Gulf of California (UGC), where totoaba's spawning aggregation behavior makes it susceptible to exploitation using large gillnets (Cisneros-Mata et al., 2021). Illegal fishers target these areas due to the high concentration of totoaba during the spawning season, making it easier to catch them in large volumes. However, evidence suggests that illegal fishing also extends to other areas along the coastline of Baja California and Sonora, such as Puerto Lobos, Guaymas, Bahía de Los Angeles, and El Barril (Cisneros Mata et al., 2020).

Poachers utilize large mesh gillnets to ensnare totoaba, with devastating consequences for other marine mammals caught unintentionally. Totoaba fishing has deep cultural roots in communities along the UGC, where it has historically played a vital economic role (Enriquez Paredes; Cisneros Mata; True pers comm.) The high nutritional value and economic worth of totoaba pose significant challenges to conservation efforts, as its capture and consumption are deeply ingrained cultural practices among the local population. Furthermore, local communities value totoaba as a wealth symbol and unfortunately vaquitas are seen as the “enemy” to the fishers (interviews with locals; Villalobos-Cristerna et al. 2019). Even the recently created San Felipe Municipality (2021) has a totoaba in its shield of arms but not a vaquita (Figure 13).

Figure 13: San Felipe Municipality official shield of arms has a totoaba, a fisher and a shrimp but not a vaquita on it.

Despite regulatory measures, illegal totoaba harvesting persists. Mexico has engaged in many strategies to curb the illegal capture of the species, unfortunately the enforcement approach alone is not sufficient and must be complemented with other measures (Felbab-Brown pers comm.) Addressing the supply side of the illegal totoaba trade requires a multifaceted approach, combining strengthened law enforcement, international collaboration, community engagement, and targeted interventions enhancing the promotion of alternative livelihoods for affected communities. It is urgent to build voluntary and assisted compliance by, for example, considering subsidies and support to people that are working with non-gillnet gear, considering these even for totoaba illegal fishery (harm reduction) is crucial to save vaquita.

4.1.2 Alternatives and ongoing conservation efforts

1. Alternative fishing gear and livelihoods

Sustainable fishing that involves fishing gear alternatives to gillnets is the only long-term solution to solve the vaquita issue and may be the way towards a future sustainable management of totoaba populations. Beyond being non detrimental to both species, alternative fishing gear must be economically viable to sustain the communities' livelihoods in the UGC.

The legal fishing gear in the UGC, as determined by the "2020 Agreement" is limited to small trawls, suripera cast nets, hook and line, box traps, and "hooka" diving (divers forage on the sea bottom while

breathing from an air tube and held by a safety line to a fishing skiff). Nevertheless, as explained through this study, and as reported by IUCN-CITES Livelihood factsheet (2022), there are at least 1,000 fishers in the region, most of whom still illegally use gillnets for fishing (shrimp and other commercially exploited and valuable species), and some of whom are involved in illegal totoaba fishing and/or irregular fishing of other species.

The CITES Secretariat's Meeting of Range, Transit and Consumer States of Totoaba (*Totoaba macdonaldi*) in October 2021 document states that: "*Mexico is encouraged to explore opportunities to incentivize sustainable and legal fishing practices in the Upper Gulf, including by [...] significantly scaling up efforts to teach fishers to build and use gear that does not pose a vaquita bycatch risk and conducting awareness raising work to shift attitudes more favourably towards the use of vaquita friendly gear and to change negative perceptions towards the vaquita as the cause of the ban of the traditionally preferred gillnet gear"* (CITES 2021).

For the past 20 years, lots of efforts have been made to stop the widespread use of gillnets in the UGC, as the only way to save vaquita. From intensive net pulling to international sanctions, but the only long-term solution is to change the course towards the use of alternative fishing gear (S. Meshnick pers comm.) It has been widely documented that fishers are often "steeped in tradition and reluctant to voluntarily change their fishing activity (Eayrs et al; 2015)". This is the case of the UGC, where an intricate maze of social, economic and political conditions has resulted in a low acceptance of new fishing gear.

Recently, the IWC Scientific Committee expressed "deep concern and disappointment at the Government of Mexico's lack of progress in carrying out a rigorous and transparent assessment of alternative fishing gear. Despite decades of advice and recommendations from both CIRVA and the IWC Committee, it appears as though the process for such an assessment has not been developed, much less implemented" (IWC-SC69B). Furthermore, as a result of the 2024 Mission to Mexico, the Secretariat stated that "at present the lack of dedicated efforts to support the development and use of alternative gear is the single most important aspect that undermines the good work being done in accordance with the other lines of action in the CAP." The Secretariat urged Mexico to take steps to address this (SC78 Doc. 33.12.1 Annex 4)

Beyond the many failures in public policies intended to stop gillnets and save vaquita, there has been a lack of effective coordination between the fisheries and environmental ministries, which in part arises from their conflicting mandates to promote exploitation and protection, respectively (Rojas-Bracho & Reeves, 2013). Historically, fisheries agencies (CONAPESCA and IMIPAS) have prioritized productivity and earnings over sustainability, leading to technological innovations following a similar logic of increasing captures (Alcalá, 2003; Marín, 2007; Vásquez-León, 1999). This prioritization conflicts with the conservationist logic of "fishing less, earning more," and has led fishers to value species that can be caught in high volumes and sold for profit, while devaluing others that may be ecologically important but economically worthless, such as the vaquita (Greenberg, 2006; Rojas-Bracho et al., 2006). Consequently, this logic contributes to fishers resistance to adopting alternative fishing methods that may yield lower catches than traditional nets (Villalobos-Cristerna, 2022).

The two main traditional fisheries in the UGC are blue shrimp and different species of finfish. Both are volume fisheries developed with the use of gillnets. Blue shrimp is one of the most profitable, equivalent to about 70% of the income of the local fishing sector (INAPESCA 2009). Achieving voluntary compliance,

establishing traceability mechanisms, and having the fishing community recognize and accept that it is financially viable and personally safer to transition to legal (non-gill net) fishing is a critical component for achieving conservation benefits for the vaquita and totoaba.

There are a couple of proposed alternatives to the use of gillnets in the shrimp fishery: small trawl and suripera cast nets (CITES Factsheet 2022). Nonetheless, the fishers are reluctant to use these, arguing that the fishing yields of the alternative gear are usually lower than those of the gillnets. The first step to transition requires that the fishers learn how to use the alternative gear and gradually make it more efficient under the UGC specific conditions (Nowell 2022), but more important is to guarantee added value markets that pay for the price of fishing less.

In the past 4 years, trials have been conducted with suriperas (Figure 14) in both San Felipe and Santa Clara and the results show that the volume of shrimp captured, particularly in the Gulf of Santa Clara, can be profitable and comparable to gillnet caught shrimp, if added value is granted (Table 5). Most of the trials have been done using research (fomento) fishing permits, and several complaints have been made regarding the authorities issuing the permits late, at least a couple of months after shrimp season starts (reports by fishers, CITES vaquita mission 2021). Currently, there is only one commercial permit for the use of suriperas issued by the Mexican authorities (CONAPESCA) to one Cooperative in the Gulf of Santa Clara.

Figure 14: Suripera (left) and finfish fishery with hook and line (right) trials in 2021 and 2023 respectively

Table 5: Comparison of Suripera and gillnet total profit using 2021 prices and suripera catch volumes

Shrimp size	Total suripera catch Oct-Dec 2021 (7 vessels)	Suripera Price USD (2021)	Total cost (USD) Suriperas	Gillnet Price USD (2021)	Total cost (USD) Gillnet
U10	52	22.75	1,182.74	11.76	611.76
U12	246	$18.51	$4,554.32	$11.76	$2,894.12
U15	501	$13.19	$6,608.69	$11.76	$5,894.12
16-20	280	$10.99	$3,077.90	$11.76	$3,294.12
21-25	132	$9.26	$1,221.92	$0.00	No se compra
TOTAL	**1,211**		**$16,645.58**		**$12,694.12**

Small trawl or “chango ecológico” (as known locally) is the official fishing gear for shrimp in the UGC according to the NORMA OFICIAL MEXICANA NOM-002-SAG/PESC-2013, which is a modified trawl net designed by IMIPAS (formerly known as INAPESCA) (Official Mexican Standard NOM-061-PESC-2006). Its establishment as the official fishing system for the region is partly supported because it does not pose a risk to the vaquita marina. Therefore, since 2008, numerous efforts have been made to explore adaptations and technological alternatives to make the “chango ecológico” work in the region, particularly concerning the reduction and symmetry in the net body; as well as the footrope; the weights, and other components. The results of these tests conclude that this net can efficiently capture blue shrimp and that the tested designs can be efficient if adapted to the conditions of the fishing area (Ramirez and Rodriguez-Valencia; 2012). Few local fishers use “chango” during specific times (September - October and February to March) to catch blue shrimp and more extensively to catch the less valued brown shrimp (interviews with locals).

With regards to the finfish fishery, the context is different, although the finfish in the UGC is mainly caught using gillnets, there are some fishers that have been using hook and line for a while because, even if it yields less, the fish has better quality and prices (Figure 15). Currently a Fishery Improvement Project (FIP) is being developed by local NGOs (Pronatura Noroeste and Pesca ABC) together with fishers aiming to strengthen the sustainable management of this fishery and the ability to reach new added value markets to be able to increase demand and give the opportunity to more fishers to participate in the process. The United States market plays an important role in shaping this opportunity, effective control of product sources (traceability) that verifies and promotes gillnet free products is crucial to guarantee Mexican fishers’ involvement in alternative gear and fisheries development.

Month	Price 1 (hook and line finfish)	Price 2 (gillnet finfish)
May	$25,944.40	$14,195.50
June	$115,629.70	$64,650.85
July	$98,139.10	$37,024.70
August	$124,000.00	$72,000.00
September	$60,688.80	$23,280.10
October	$124,167.80	$76,490.30

Figure 15: Graphic and table comparing the total profit of hook and line catches of different finfish species: curvina plateada (*Cynoscion parvipinnis*), baqueta roja (*Epinephelus acanthistius*), chano (*Chanos chanos*), extranjera (*Paralabrax auroguttatus*), and sierra (*Scomberomorus concolor*) during 2022. Price 1 represents the actual price paid in the hook and line fishery, while Price 2 represents the hypothetical prices that would have been paid if the fish were caught using gillnets.

Currently, the majority of the permits issued in the UGC to catch shrimp are for the use of the small trawl, and for finfish, other alternative gear including hook and line (Annex 4 to document SC77 Doc. 33.13.2 to document SC77 Doc. 33.13.2). However it has been widely documented that Upper Gulf permit holders continue to use gillnets (Annex 4 to document SC77 Doc. 33.13.2 shows a picture of the inspections developed by Mexican authorities in the official landing and departure sites, where the inspected boat is clearly carrying an illegal gillnet) and have engaged in illegal fishing and trade of shrimp and other finfish species via filing of fraudulent documents (Nowell pers comm.), this includes landing the product as if it was caught using alternative gear using the issued permits (Garcia Caudillo pers. comm).

Building capacity, creating new fisheries and markets, and constructing the formal and informal agreements needed to incentivize the responsible use of natural resources requires time and dedicated effort (Vaquita enforcement group). What is clear is that more effective enforcement would accelerate this process, as financial and social incentives from legal fishing will never be sufficient on their own to counter the lucrative totoaba illegal fishing. The only way to rebuild the Upper Gulf community fishing

economy is for fishers to convert to legal and sustainable fishing. Otherwise, not only species, but also human livelihoods, will continue to decline.

2. Community engagement

Community engagement strategies in the UGC are critical to the success of conservation efforts aimed at saving the vaquita and sustainably managing totoaba populations. The fishing communities in the Upper Gulf have long expressed concerns about the lack of support and attention from both government and international bodies (Islas 2021). This disconnect has fostered a sense of distrust and skepticism among locals, with many even doubting the existence of the vaquita (Bessessen 2018) and denying the link between gillnet usage and the decline of the species (Villalobos et al. 2021).

To bridge this gap, local NGOs have placed a significant emphasis on community engagement and education. These strategies involve actively listening to the concerns of the fishing communities, providing tangible support, and fostering a sense of ownership and responsibility towards conservation efforts. By integrating the knowledge and expertise of local fishers, NGOs aim to develop sustainable fishing practices that can replace harmful gillnets, thus protecting the vaquita while also ensuring the economic stability of the local population. Additionally, comprehensive awareness campaigns are crucial to inform and educate the community about the ecological importance of the vaquita and the detrimental effects of gillnets fishing, this include disentanglement strategies and citizen science for vaquita and other marine mammals monitoring.

These engagement strategies are not just about imposing regulations but about creating a collaborative environment where the needs and perspectives of the local communities are acknowledged and addressed. This approach is essential for fostering a cooperative relationship that can lead to the successful implementation of conservation measures. By involving the community in decision-making processes and providing the necessary resources and alternatives, there is a greater likelihood of achieving long-term sustainability for both the vaquita and totoaba fisheries.

The National Commission on Protected Areas (CONANP) has long been a key player in promoting community-led conservation initiatives, particularly through the implementation of the PACE Vaquita programme. Their work extends to supporting alternative fishing gear and aquaculture projects. Recently, in collaboration with other NGOs and the Mexican Ministry of Governance (SEGOB), CONANP has also been fostering the creation of internal codes of conduct and creating a platform for stakeholder dialogue through its “Reserve Advisor Committee.” Currently, CONANP is leading a project to train local communities to monitor the vaquita, aiming to establish a team that can continuously track the species. This initiative marks an exciting step forward, as it directly involves local communities in the conservation and scientific efforts surrounding the vaquita, a much-needed breakthrough in bringing conservation closer to the people who live alongside it.

4.2 Demand side

4.2.1 Current Status

The consumption of fish maw, namely dried fish swim bladder, known as "Hua Jiao" or "fish stomach" in southern coastal provinces of China, has a long history associated with medicinal properties (Lin 1939),

mainly used as a health tonic or dietary supplement. Fish maws, sourced primarily from croaker species, vary in value based on various factors (Conover and Dong 1998b; Sadovy and Cheung 2003; Clarke 2004). While the consumption of swim bladders is part of traditional Chinese cuisine, totoaba swim bladder has mostly been used for business gifts, investments, and collections (Boilevin et al. 2023). Species like the totoaba and the Chinese bahaba (*Bahaba taipingensis*) have received protection due to trade pressure, with the totoaba listed under CITES Appendix I since 1977 and the Chinese bahaba designated as a "State Protected Species" in China since 1988. The consumption of fish maw has a long history in the coastal provinces of southern China, where it is valued both as a health supplement and a delicacy. During the 2024 mission of the CITES Secretariat to China, a representative from a pharmaceutical company informed the Secretariat that fish maw, being rich in collagen, is consumed for its supposed health benefits. In 2023, China's healthcare products market was estimated at approximately USD 45.5 billion, with a growing trend. Fish maw is part of this expanding industry, which mainly operates within the legal market framework. It should be noted that this relates to health products, and not traditional medicine.

Traditionally, the dried swim bladder derived from the Chinese bahaba (*Bahaba taipingensis*), a species endemic to China, is called the “money maw” and most highly priced thanks to its special shape and large size (Conover and Dong 1998b). The wild population of Chinese bahaba significantly declined due to heavy harvest. As the swim bladder of the totoaba from the Gulf of California greatly resembles the characteristics of the swim-bladder of the Chinese bahaba, the Chinese expats that settled and migrated to the east coast of the Pacific started to exploit totoaba and make totoaba swim-bladder a substitute of Chinese bahaba fish swim bladder since the beginning of last century (et al. 2023).

The exorbitant prices fetched by totoaba swim bladders, driven by their scarcity and high demand, have turned them into symbols of wealth and status. The status of investing in totoaba swim bladders as a commodity or luxury item has created a lucrative market for collectors and investors, further fueling demand (ELI 2021). Beyond cultural symbolism, totoaba swim bladders are prized for their purported health benefits, including post-surgery or post-natal recovery and as a source of collagen for beauty products (Sadovy et al. 2019, Cruz-López et al. 2023). Efforts to regulate and enforce bans on totoaba trade face significant challenges, including sophisticated smuggling networks. Information suggests that on the demand side illegal trade in totoaba specimens takes place in clandestine markets and that more needs to be done regarding clandestine markets by focusing on information and intelligence gathering regarding individuals managing and organizing this illegal trade within the countries where demand exist, analyzing available data to map out their criminal networks, and targeting their activities through intelligence-driven operations and investigations.

Raising awareness about the ecological impact of totoaba illegal fishing and the plight of endangered species like the vaquita is essential for shifting consumer behavior and reducing demand. Education campaigns, targeted messaging, and sustainable seafood initiatives can help foster a culture of conservation and responsible consumption.

In terms of awareness-raising activities, the United States has posted information on seizures and prosecutions on its Office of Law Enforcement website. They have also supported the production of public reports and a film by the Environmental Investigation Agency (EIA) to draw attention to the illegal totoaba trade and its impact on vaquitas. Additionally, the United States has provided technical expertise, including DNA verification of seized totoaba specimens, and conducted training sessions for Mexican

wildlife officials based on the United States 'experiences (CITES SC77 Doc. 33.13.2). China also did extensive work and implemented important interventions relating to demand reduction and educational campaigns. This includes through the distribution of thousands of brochures, posters and banners, as well as short messages and short videos that have been produced and made available. In May 2024 an exhibition was held at the National Maritime Museum of China in Tianjin, where posters and educational materials on totoaba were displayed and that attracted approximately 170,000 visitors. China also conducted multiple other activities as outlined in Annex 6 to document SC78 Doc. 33.12.1.

4.2.2 Emerging trends

An emerging situation is related to the growing market of the dietary supplement industry. One very recent example that show that Parties must be alert to this emerging trend is what happened in 2023 with Blue Formula, a health supplement company. The company prominently features totoaba extract in its marketing, boasting that its products include "unique marine collagen, derived from totoaba fish extract." Moreover, The Blue Formula claims that purchasing its products contributes to conservation efforts by "freeing" a totoaba in the wild. They assert that their fish are sourced from Cygnus Ocean Farms, a Mexican aquaculture company specializing in totoaba production and commercialization with legal permits and constituted as an UMA.

In December 2023 NGO´s alleged that Blue Formula was violating international trade law by selling a health supplement made from endangered totoaba fish to several countries including the United States and China. The product, which the company describes as "nature's best kept secret," is a small sachet of powder containing collagen taken from the fish that is designed to be mixed into a drink (Associated Press 2023).

While there are concerns about managing these products, developing alternative markets for totoaba could bring positive results (True, pers comm.), as long as it benefits local communities and encourages a shift away from gillnet fishing to other livelihoods. This could be a great opportunity, especially for young professionals and women's groups in the area who are looking for new ways to earn a living.

The potential of totoaba aquaculture in China presents an intriguing avenue for meeting demand while potentially alleviating pressure on wild populations. Wei Ji (pers comm.) suggests that developing aquaculture solutions could be a viable path forward. However, Mexican law currently poses significant restrictions. A legislative initiative in 2023 resulted in the law on general import and export taxes being modified to permit the trade of totoaba meat exclusively, while prohibiting the export of live totoaba and totoaba swim bladders (buche). These legal constraints reflect ongoing efforts to balance economic interests with conservation imperatives. Furthermore, Nagoya Protocol (CBD 2011) states that "access to genetic resources for their utilization shall be subject to the prior informed consent of the Party", thus any of these initiatives should be done bilaterally. And the handbook on CITES livelihoods (2015) asserted the Parties to "Establish a plan and mechanisms that facilitate access to both the resource and land tenure as a strategy for sustainable use of the resource and the long-term welfare of the communities". Therefore, totoaba aquaculture in Mexico must be a priority.

In conclusion, the emerging trends in totoaba consumption illustrate a complex interplay of market dynamics, legal frameworks, and conservation efforts. Innovative solutions such as aquaculture and

responsible fishing, that may include sport fishing offer a path forward, provided they are implemented within robust regulatory frameworks to protect this endangered species.

5. Cooperation: Assessment of Ongoing Activities and Potential Synergies

Mexico is subject to an unprecedented number of international and bilateral compliance processes oriented towards improving vaquita and totoaba protection and fisheries governance generally in the Upper Gulf of California; these are reviewed in section 5.1. International cooperation to achieve these governance goals has been limited; these are reviewed in section 5.2. Section 5.3 proposes ways to improve synergies between the ongoing compliance processes and international cooperation mechanisms.

5.1 Ongoing cooperation activities

Three compliance processes stem from international environmental agreements – 1) the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 2) the World Heritage Convention (WHC) and 3) the US-Mexico-Canada free trade agreement (USMCA). Two are bilateral based on US domestic laws – 4) the Pelly amendment to the 1978 Fisherman's Protection Act (Pelly) and 5) the Marine Mammal Protection Act (MMPA). All, except the WHC process, include trade sanctions as potential consequences if Mexico fails to comply with conditions, and all but USMCA have a clearly defined set of conditions that Mexico must meet to regain compliance.

5.1.1. CITES

Totoaba (linked to vaquita) matters were first added to the agenda of CITES meetings in 2016 when Mexico took the initiative to submit two slightly different documents, both titled "*Totoaba: Opportunities for Collaboration in the CITES framework,*" to the 66th meeting of the Standing Committee (SC66, Geneva, January 2016, document SC66 Doc. 58) and to the 17th meeting of the Conference of the Parties (CoP17, Johannesburg, September 2016, document CoP 17 Doc. 74). Decisions adopted at CoP17 reflected Parties recognition of the importance of Mexico, China and the United States in this issue, and called for all Parties to share seizure information, raise awareness for vaquita and totoaba conservation, address supply and demand issues for totoaba swim bladder, and increase law enforcement. The Secretariat was also requested to commission the scientific study which is the present document. The origin of this issue under CITES reflects a dynamic which remains true nearly a decade later – Mexico requests international cooperation and support and is the subject of international pressure to "strengthen implementation of CITES provisions that are applicable to totoaba" (SC66 SR p 84). That it took this length of time to gather the financial resources and organize the technical expertise for this study also reflects the difficulty Mexico, and other Parties, have had in resolving the challenges associated with this issue.

Totoaba became a CITES compliance agenda item at SC74 in March 2022, following the Secretary-General's high-level mission to Mexico in 2019 (CITES 2019), Decisions adopted at CoP18 (decisions referred to in document SC74 Doc. 28.5), and the Secretariat's hosting of an Online Meeting of Range, Consumer and Transit States of Totoaba in October 2021 (SC74 Doc. 28.5 Annexes 4 and 5). At the request of SC74, the Secretariat undertook a second mission to Mexico in June 2022 (SC75 Doc. 7.5), and SC75 (SC75 SR page 16) approved the Secretariat's recommendation to request Mexico to prepare a compliance action plan (CAP). Mexico's submitted action plan was not assessed as satisfactory by the

CITES Secretariat before the 28 February 2023 deadline, and trade sanctions were imposed on 27 March 2023 (CITES Notification to the Parties No. 2023/037) for failure to meet the deadline. This is the first time in its 50-year history that CITES has imposed trade sanctions, an extraordinary measure, on Mexico. Sanctions were lifted soon after on 13 April 2023 (CITES Notification to the Parties No. 2023/046) after Mexico revised the action plan in consultation with the Secretariat in Geneva. Mexico's most recent reporting on its CAP implementation is included in SC78 Doc 33.12.1).

5.1.2. World Heritage Convention (WHC)

The Gulf of California is the only primarily marine site currently on the List of World Heritage in Danger (UNESCO 2019). The entire network of marine protected areas (MPAs) in the site Islands and Protected Areas of the Gulf of California was placed on this list in July 2019, following two joint UNESCO World Heritage Centre/IUCN Reactive Monitoring Missions in 2017 and 2018 (UNESCO Because of "unsustainable illegal fishing practices" (artisanal fishing with illegal gillnets) the Upper Gulf (UNESCO Decision: 43 COM 7B.26). The 46th meeting (UNESCO 2024) of the World Heritage Committee in New Delhi, India (21-31 July 2024) adopted Decision: 46 COM 7A.43 (UNESCO 2024) which approved *"the Desired state of conservation for the removal of the property from the List of World Heritage in Danger (DSOCR) proposed by the State Party in its January 2024 state of conservation report on the property."* This is the first key procedural step towards delisting since the In Danger status was adopted and represents an opportunity for synergy with the Mexico CITES CAP process, something the Secretariats of the two Conventions are working towards under a Memorandum of Understanding for cooperation between CITES and UNESCO signed in June 2023 (CITES-UNESCO 2023).

The DSOCR Indicators include elements of Mexico's CITES CAP and are summarized in Decision 46 Com 7A.43 (page 71) as:

a) Sustainable fisheries based on legal fishing gear systems that do not cause entanglement of marine mammals, sharks and turtles have been successfully adopted and modified as necessary in the property, the "Upper Gulf of California Colorado River Delta Biosphere Reserve (marine portion)" in particular, in collaboration with the relevant stakeholders,

b) As an attribute of the Outstanding Universal Value (OUV) of the property, the vaquita species population has been increasing for at least 5 years, individuals appear healthy and are producing calves,

c) The property is effectively protected from illegal fishing activities through increased surveillance and prosecution of illegal acts,

d) The Vaquita Refuge and the "Upper Gulf of California - Colorado River Delta Biosphere Reserve (marine portion)" are free of illegal fishing gear, while the use, sale, possession, manufacture, and transport of gillnets has been eliminated, including among the surrounding communities,

e) International cooperation is operating systematically to combat illegal totoaba fish poaching and trafficking.

5.1.3. US-Mexico-Canada Agreement (USMCA)

There are two parallel compliance processes concerning totoaba and vaquita ongoing under this trilateral trade agreement. The first is a bilateral process between the United States and Mexico which has

potential synergy with Mexico's CITES compliance process. In February 2022 the US requested the first Environment Consultations with Mexico under this instrument under concerns that Mexico was not meeting a requirement to enforce its environmental laws protecting vaquita and totoaba and preventing illegal fishing in the UGC (USTR 2022). These ongoing consultations aim for Mexico to develop a plan of action to remedy the situation that is crafted in the context of Mexico's CITES CAP (USTR 2024). Failure to agree on this action plan could escalate the issue to a trade resolution dispute panel (USMCA Article 24.32).

The second is a trilateral process under the Commission for Environmental Cooperation, a trilateral body set up in 1994 under the first iteration of the trilateral trade agreement NAFTA. Responding to an August 2021 public submission that Mexico was failing to enforce its environmental laws to protect the vaquita, the CEC Secretariat (CEC A24.27/SEM/21-002/01/), after reviewing responses from Mexico published January 31 2022 (CEC SEM-21-002), determined in April 2022 that a "factual record" (independent review of Mexico's enforcement of its environmental laws in the UGC) was warranted (CEC A24.28/SEM/21-002/59/). The trilateral governing CEC Council approved this in June 2024 (CEC C/C.01/24/RES/02/FINAL) and the CEC Secretariat published its factual record workplan in July (CEC A24.28/SEM/21-002/83/FR-OP). One of Mexico's laws that will be focused on is the "2020 Agreement" which is a key element examined by this study and by the CITES 2024 mission to Mexico. Time extensions were allocated both to Mexico and the CEC Secretariat (CEC 2024) If the CEC Secretariat's factual record is finalized and published with Council approval, it is expected to form the basis for the USMCA Environment Committee (senior government representatives from the three member states) to recommend cooperative activities to redress the matters raised (CEC 2023).

5.1.4. US certification of Mexico under the Pelly amendment to the 1978 Fishermen's Protective Act

On 7 April 2023 the United States settled a lawsuit brought by US NGOs and agreed to determine by 19 May 2023 whether to certify Mexico under the Pelly amendment to the Fishermen's Protective Act for its' nationals undermining the effectiveness of CITES through illegal take of vaquita and totoaba (USCIT Court No. 1:22-cv-00339). On 26 May 2023 the Secretary of Interior notified Congress that Mexico was certified and that President Biden would announce within 60 days what actions he would direct (DOI 2023). On 17 July 2023 President Biden linked this process to Mexico's CITES CAP, announcing the start of consultations with Mexico and pledging US coordination and capacity building support (USG 2023). One notable output was that totoaba trafficking was discussed in October 2023 at the third meeting of the US-Mexico High Level Security Dialogue, the primary bilateral mechanism for dealing with organized crime and corruption (USDS 2023). A US assessment of Mexico's progress implementing its CITES CAP will form "the basis for assessing whether additional steps, including potential trade restrictions, will be necessary" (USG 2023).

5.1.5. US Marine Mammal Protection Act (MMPA) seafood import restrictions

Mexico's Upper Gulf of California is globally distinctive as the region subject to the first and currently only fishery import bans (NOAA 2024) under the US Marine Mammal Protection Act (MMPA) since the final rule was issued in 2016 implementing its fish and fish product import provisions (NOAA Docket No. 0907301201-6406-03). Significant UGC shrimp and finfish fisheries in the region were prohibited starting in 2018 with gillnet fisheries and strengthened in 2020 to include vaquita-safe fishing gear (NOAA RTID

0648-XG619), based on the US finding that Mexico "lacks a regulatory programme comparable in effectiveness to the US regulatory programme for mitigating fishery bycatch of marine mammals."

The US was the primary export market for most commercial Upper Gulf seafood, and the import ban would be more devastating in its impact on Upper Gulf communities if Mexican and US companies had not devised methods to evade it. Shrimp is the most egregious (SFP 2021) (as noted previously, shrimp gillnets pose a significant bycatch risk to vaquita). As documented by the New York Times, artisanal fishers in Upper Gulf catch premium large-sized shrimp under permits issued for legal high-selectivity gear but use illegal gillnets instead (NYT 2021).

The US is currently "investigating exporters, importers, and vessels associated with the illegal harvesting, export, and importation of shrimp harvested in the Upper Gulf of California into the United States" (NOAA 2024b). The result is a catch-22 in which there is little incentive for fishers to adopt legal vaquita-safe fishing gear because seafood caught with it is banned to enter the primary market the US, but gillnetted shrimp caught with permits for vaquita-safe gear is laundered in high volume into the US in violation of its only MMPA import restrictions, with Upper Gulf fishers being paid lower prices as part of the corruption (Excelsior 2024).

5.2 Potential synergies

The compliance processes described in the previous section involve a considerable number of cooperative interactions with Mexico. For example, there have been multiple missions to Mexico, including the CITES and WHC missions described above as well as a March 2024 visit to San Felipe by the US Ambassador to Mexico, US Fish and Wildlife Service, and US Trade Representative (GoM 2024). The US MMPA seafood import restrictions were imposed only after extensive interaction between US and Mexican fishery authorities (CIRVA 2019). The Pelly process calls for regular meetings with Mexico "at least quarterly" (USG 2023), and the USCMA processes are both centered on consultation.

These interactions are largely aimed at compelling Mexico to improve its own law enforcement. However, Mexico has repeatedly emphasized that its own efforts to control illegal totoaba supply would be aided by much more effort to control illegal totoaba transit and demand. For example, at SC77, "Mexico called on the international community, in particular transit and consumer Parties, but also other Parties, observers and civil society, to play their part in addressing this trade" (SC77 SR). With regard to Parties, there are two significant avenues for cooperation specifically designed to address the trade: the TECG (section 5.2.1) and the recommendations of the CITES Online Meeting of Range, Consumer and Transit States of Totoaba (section 5.2.2).

5.2.1. The Trilateral Contact Group on Law Enforcement to Combat Illegal Trade of Totoaba (TECG)

The idea to establish a cooperative mechanism between law enforcement authorities in China, Mexico and the United States arose at a meeting between the three Parties in Ensenada, Mexico in August 2017 (SC 69 Doc. 65.2) (Figure 16). However, as described in SC77 Doc. 33.13.1 and SC78 Doc. 33.12.2, its

Figure 16. 2017 Trilateral Meeting to combat illicit trafficking of totoaba, which envisioned creation of the TECG (picture CITES)

Terms of Reference were not agreed until September 2023, and the first inaugural meeting in March 2024. TECG members at the meeting in March agreed to create a smaller subgroup consisting of enforcement authorities that will engage to share enforcement information and undertake related activities. Representatives from the TECG subgroup joined a closed working meeting convened on the sidelines of the November 2024 Wildlife Inter-Regional Enforcement Meeting (WIRE) in Cape Town, South Africa, by the CITES Secretariat, INTERPOL and UNODC with support of ICCWC (SC78 Doc. 38.2), and the US volunteered to convene a virtual meeting in December 2024 "to follow up on case information," and Mexico to host an in-person TECG meeting in March 2025 (SC78 Doc 33.12.2).

These recent developments and more frequent interaction are encouraging progress towards tangible cooperation that could produce intelligence-led investigations to dismantle international trafficking networks. A report on the Trilateral Enforcement Contact Group will be considered by the 78th meeting of the Standing Committee (SC78, February 2025, Geneva) (SC78 Doc. 33.12.2).

Another outcome of the Cape Town meeting was INTERPOL's commitment to convene a Regional Investigative and Analytical Case Meeting (RIACM) on totoaba in accordance with the outcomes of the Meeting of Range, Transit and Consumer States of Totoaba (October 2021), possibly aligned with the planned March 2025 meeting in Mexico (SC78 Doc 33.12.2). This is another welcome development, and the next section will evaluate to what degree the October 2021 meeting agreements have been implemented by Parties.

5.2.2. Outcomes of the Meeting of Range, Transit and Consumer States of Totoaba (October 2021)

Decision 18.294 requested the CITES Secretariat to "…consider convening before the end of 2019 a meeting of range, transit and consumer States of totoaba, and selected organizations and stakeholders, to evaluate progress made in combating illegal fishing of totoaba, eliminating supply and demand for illegally-sourced specimens of totoaba, and strengthening law enforcement measures to prevent and address their illegal trade". Due to the COVID-19 pandemic, the meeting was delayed and then conducted

virtually over 3 days in October 2021. It brought together national CITES, law enforcement and other relevant agency representatives from Canada, China including Hong Kong SAR of China, Japan, Mexico, the USA and Viet Nam, as well as representatives from the partner organizations within the ICCWC and other inter-governmental and non-governmental organizations. The Republic of Korea was also invited to participate in the meeting but declined the invitation (SC74 Doc. 28.5). The meeting culminated with an agreement on 37 measures and activities to be undertaken internationally and a further 11 measures to be undertaken by Mexico (SC 74 Doc. 28.5 Annex 4). Mexico's activities are largely captured in its CAP and this section will examine only to what degree agreed international measures from the online Meeting of Range, Transit and Consumer States of Totoaba have been implemented.

5.2.2.1 Strengthening law enforcement and international collaboration to address illegal totoaba specimen trafficking

The most significant activity – "intelligence-led enforcement and collaboration within Mexico and at the international level" – has received the least attention, as noted in the Secretariat's mission reports from Mexico, China and the United States of America (SC78 Doc 33.12.1). However, based on Party government sources consulted for this study, there is significant progress on this element, but details cannot be shared due to an ongoing confidential law enforcement investigation, except to note the key role of information provided by NGOs.

Mexico made a series of prominent arrests in San Felipe and Santa Clara in November 2020 of the "Cartel de Mar" (SC74 Doc. 28.5), but only one of the detainees was prosecuted, and found innocent (Martinez 2023). Another prominent arrest of an ethnic Chinese man in Mexicali in May 2021 with 224 totoaba swim bladders (LatinUs 2021) resulted in a pre-trial "compensation settlement" and release, according to June 2024 reporting by Vice News (Vice 2024). The Secretariat's 2024 mission to Mexico final remarks and conclusions reiterates and highlights the need for Mexico to undertake intelligence-driven enforcement operations (SC78 Doc 33.12.1), but Mexico has been ineffective in prosecuting those arrested in its major operations undertaken in recent years, this may undermine international cooperation in this regard.

Similarly, the Secretariat's report on its mission to China highlights the success of a 2018 intelligence led investigation which "resulted in the arrest, prosecution and conviction of 16 criminal organization members and the seizure of approximately 2,621 totoaba swim bladders and involved cooperation between various stakeholders, including local authorities from some cities in Guangdong and Guangxi, Customs authorities in Hong Kong SAR of China and authorities in Viet Nam." The report states that this is in contrast to the results of extensive and widespread market inspections and checks and recommends that intelligence-led investigation should be the key tool to dismantling clandestine trade networks (SC78 Doc. 33.12.1).

Another key outcome is to explore opportunities to exploit controlled deliveries of illegal totoaba shipments as an element of intelligence led law enforcement, as opposed to the more common practice of immediate seizures when illegal consignments are detected. However, this review was only able to identify a few instances where a Party reported on totoaba controlled deliveries: Hong Kong SAR of China made four attempts between 2020-2022, involving three shipments from Mexico and one from the US, although only one, in 2022, resulted in successful prosecution, and for a small amount (1.15 kg) (SC77

Doc. 33.13.2 Annex 2). The US also used controlled delivery for a shipment of totoaba bladders from Mexico in 2013, resulting in a successful prosecution (C4ADS 2017).

It should be noted that this United States 2013 case is the only one for *Totoaba macdonaldi* contained in UNODC's Sherloc case law database (Sherloc No. 13:CR-131-1), which is meant to facilitate information sharing in support of the United Nations Convention Against Transnational Organized Crime. This is illustrative that Parties should be doing much more to avail themselves of international specialized tools and measures to combat organized crime convergence with totoaba trafficking, the subject of numerous agreements in part two of the Outcomes document, particularly concerning the exchange of financial intelligence.

The Secretariat's report on its mission to China notes that "the China Anti-Money Laundering Monitoring and Analyses Center (CAMLMAC) signed memoranda of understanding (MOU) with FIUs (Financial Intelligence Units) in Mexico in 2006 and the United States of America in 2015." However, the Secretariat was not able to ascertain if any information associated with totoaba trafficking had been shared between the three Parties' FIUs, and emphasized that "the outcomes of the online Meeting of Range, Transit and Consumer States of Totoaba places strong emphasis on the importance of strengthening the mobilization of financial investigations and FIU engagement in the fight against totoaba trafficking. All opportunities to exchange information in accordance with the MOUs established should be pursued and utilized to the fullest extent possible to facilitate targeting those individuals at the helm of the illegal totoaba trafficking trade chain" (SC78 Doc. 33.12.1).

The third grouping of international measures in the Outcome document are aimed at eliminating demand for illegally sourced totoaba swim bladders. The Secretariat's report on its mission to China describes the Secretariat was informed of "a vast array of awareness raising and demand reduction activities" (SC78 Doc. 33.12.1 Annex 6). However, just like the law enforcement efforts to distinguish the relatively small volume of illegal totoaba swim bladders from the massive legal international trade in fish maw, such activities should also be "intelligence-led" and targeted.

In SC78 Doc. 29, the Secretariat reports on an ongoing pilot demand reduction project which "aims to target a relatively small region in the country where the demand for totoaba maw (dried form of swim bladder) is known as most prevalent among small demographic groups. The project features a campaign towards the most likely consumers in the region via tailored messages through mobile apps." This study encourages this specific kind of actions and cooperation to target and better understand illegal totoaba trade networks.

6. Discussion: Progress, Challenges and Opportunities

6.1 Progress

For the past 20 years, Mexico has made significant efforts to protect vaquita and stop illegal totoaba poaching and trade. The recommendation from the CITES Secretariat to temporarily suspend trade of CITES-listed species with Mexico (CITES Notification to the Parties No. 2023/037) published on 27 March 2023 and withdrawn on 13 April 2023 (CITES Notification to the Parties No. 2023/046), has prompted a significant response from the Mexican government, who has presented a *Compliance Action Plan to Prevent Illegal Fishing and Trade of Totoaba, its parts, and/or derivatives for the Protection of the Vaquita Marina* (CAP).

Mexico has taken stronger measures to protect the vaquita marina. In this context, actions against illegal fishing in the vaquita's distribution area have intensified. Initiatives such as the installation of hooked gillnet deterrents in the Zo, and increased surveillance by SEMAR and SSCS have yielded positive results. The net pulling programme has resulted in considerable losses for the illegal fishers and has also been an effective measure to keep active and passive nets out of the water. Recent efforts made by CONANP, Museo de la Ballena and Pesca ABC resulted in very few ghost nets being detected inside the Zo and most of the VRA since 2021. Nevertheless, this is not the case for active gillnets that continue to be used as described in this report.

The United States government has also taken significant actions to contain the trafficking of totoaba with promising efforts such as the USFWS Attaché Programme and collaboration within the TECG, the training provided to officials and the promotion of international collaboration through INTERPOL and the WCO. It exchanged information with China, Mexico, and South Korea on trafficking methods and routes of wild species and information obtained in investigations with Mexican authorities. In addition to the more than 860 bladders seized between 2017 and 2022 and the seizure, in 2023, of more than 360 kg valued at more than USD $1,800,00, reports and films have been produced to raise awareness about the illegal totoaba trade and the critical situation of the vaquita marina.

China, including the Special Administrative Regions (SAR) of Hong Kong and Macao, has taken various actions to combat the illegal totoaba trade: The Chinese government implements strict legal measures to sanction the trafficking and consumption of totoaba; having detected and investigated smuggling cases and carried out public awareness and educational campaigns aimed at the food industry in different regions of the country, including Guangdong and Hainan, including hundreds of posters installed in aquatic product markets. Similarly, the China Aquatic Product Processing and Marketing Alliance, the China Gastronomy Association, and the China Hospitality Association have launched a joint initiative to prevent the illegal consumption of totoaba by avoiding its sale, purchase, and consumption.

In Hong Kong SAR of China, the import, export, and possession of totoaba for commercial purposes have been prohibited. Cases of seizures have been reported, and strict sanctions have been implemented. Additionally, the local market has been closely monitored, with no totoaba specimens found in wholesale markets or online. In Macao SAR of China, the trade of totoaba has also been banned, awareness raising activities have been conducted, and inspections at seafood shops and catering establishments have been carried out.

6.2 Challenges

Despite these achievements, significant challenges persist, hindering progress in the conservation of the vaquita marina and totoaba. Seizures of totoaba swim bladders continue, highlighting the persistence of illegal trade in clandestine markets. Well organized smuggling networks and concealment methods that are often difficult to detect facilitate the smuggling of totoaba swim bladders from Mexico and the United States, increasing incentives for illegal fishing and posing a greater challenge for Mexico. International cooperation and action taken by transit and consumer countries are essential to curb illegal trade.

For the United States government, limited resources for enforcement, challenges in monitoring seafood shipments, and a poorly understood illegal domestic market highlight the need for further action. The Secretariat has encouraged the United States to enhance traceability measures, allocate more resources to enforcement, and make better use of intergovernmental tools to strengthen its efforts and effectively combat wildlife crime (SC78 Doc. 33.12.1 Annex 5).

Besides, the laundering of gillnet-caught blue shrimp into the United States market remains a significant threat to vaquita habitat, particularly during the September to March shrimp season, when large quantities of shrimp gillnets are actively used in the VRA. It is crucial to consider insights from the IPBES Sustainable Use Assessment, Chapter 6, which highlights that bans may not always serve as effective enforcement tools. As noted, "...bans have often been mismanaged, struggle to regulate illegal trade, and may inadvertently spur trade by increasing scarcity" (Park M. S. et al. 2022).

China has been called upon to step up its efforts to combat the illegal totoaba trade by engaging its national police, gathering intelligence, and carrying out targeted operations to dismantle the criminal networks driving this crisis. Sharing information between affected cities and using financial investigations to trace the flow of illicit money are essential steps in tackling the problem at its roots. Strengthening international partnerships through platforms like TECG and INTERPOL offers a powerful opportunity for China to demonstrate the impact of its recent actions and plans (SC78 Doc. 33.12.1 Annex 6). Building on the intelligence efforts highlighted in Chapter 5, these initiatives should happen more often and in a more coordinated way, ensuring that the mechanisms for international cooperation are fully used.

The lack of information in other potential transit countries like the Republic of Korea, Japan, Colombia, Venezuela, Canada and Viet Nam regarding totoaba traffic in their territory also pose challenges to obtain a full understanding of the possible role these countries could play in assisting in eradicating the trafficking and consumption of totoaba.

The Secretariat has acknowledged the significant progress Mexico has made under the CAP. However, there are still areas that need attention, and the Secretariat continues to work closely with Mexican authorities to address these ongoing challenges (SC78 Doc. 33.12.1 Annex 4). It is clear that the main challenge to protect vaquita remains the widespread use of gillnets in its habitat. This is exacerbated by the continued permissiveness in the use of gillnets in the main fisheries within the gillnet exclusion zone.

It is essential to recognize that, while there has been progress in inspection and surveillance actions taken by SEMAR, CONAPESCA, and PROFEPA, a gillnet-free zone cannot be maintained without interventions to sustain UGC communities' livelihoods, including technological advancements in the development of alternative fishing gear as well as the development of markets for products harvested

with alternative fishing gear. Although there are advancements in the development of alternative fishing gears, these have been insufficient and their adoption faces resistance from local fishers, who have concerns about lower catches and lack economic incentives to adopt non-harmful fishing practices for the vaquita.

The historical lack of continuity and consistency in government actions aimed at protecting the vaquita among different administrations represents another significant challenge, as it jeopardizes the continuous and effective implementation of any action plan. In this sense, international pressure has played a role in encouraging Mexico to commit to long-term conservation measures that transcend six-year administrations. Currently, the “2020 Agreement” provides the regulatory framework for fishing activities in the UGC, including monitoring systems and landing sites. However, concerns about its implementation and enforcement highlight the need for amendments to make its provisions clearer, more practical, and strictly enforceable (SC78 Doc. 33.12.1 Annex 4).

Recently, a group of fishers representing the formal legal sector of the Upper Gulf of California (UGC) proposed modifications to the "2020 Agreement" to the Government of Mexico (Excelsior, 2020). This proposal is a result of the actions taken to achieve the objectives of the Compliance Action Plan (CAP), specifically addressing Goal 6.2 on fostering "peace dialogues”. Changes include the creation of a Limited Use Zone adjacent to the Zo to allow sustainable fishing of mollusks and bivalves. It has also been proposed to adjust the gillnet exclusion area to match the current dimensions of the VRA, where fishing with alternative fishing gear may be allowed (Fishers leaders pers comm.).

Additionally, a Special Marking Programme and a remote monitoring system are proposed to be implemented (aligned with Mexico's CAP) along with measures such as the removal of nighttime fishing hours, the removal of derelict lost or discarded fishing gear, increasing the presence of authorities responsible for inspection and surveillance actions at authorized departure and arrival sites, and the consolidation of all sanctions for violating regulations into a single article (Fishers leaders pers comm.).

6.3 Opportunities

To assist decision-makers shape effective conservation strategies for both the vaquita and totoaba, the following section offers a thoughtful exercise designed to highlight potentially overlooked threats, untapped opportunities, and research priorities. Guided by the idea that clear goals can lead to meaningful change, this approach envisions a path where the vaquita is saved from extinction, and the totoaba is sustainably managed.

Horizon Zero or departure point reflects the current status including the progress and challenges discussed in previous sections. It captures the state of policy and law enforcement, actions taken to protect the vaquita and its habitat, efforts to curb poaching and totoaba trafficking, and initiatives promoting sustainable fishing and supporting coastal communities. It also considers trends in totoaba demand and the role of international cooperation.

The First Horizon imagines an ideal future where the vaquita population thrives, its habitat is free from harmful gillnets, and the totoaba trade is responsibly managed. This scenario envisions a sustainable fishing sector that supports both marine life and the communities of the Upper Gulf of California.

The Second Horizon maps out a realistic transition toward that ideal future. It relies on building momentum in law enforcement, conservation policies, and actions to regulate totoaba fishing and trade. It also highlights the need for innovative programmes and solutions to address the challenges of fishing practices including gear, foster sustainable livelihoods, and strengthen international collaboration. Key steps include eliminating gillnets in the VRA and supporting local communities with alternative fishing methods and market opportunities.

The Fourth Horizon warns of a worst-case scenario if meaningful progress isn't made. This grim outlook includes the extinction of the vaquita, escalating illegal fishing and totoaba trafficking, and a lack of sustainable alternatives for local fishers. Without stronger enforcement and collaboration, the fishing sector and coastal communities in the Upper Gulf of California could face significant decline, leaving conservation efforts fragmented and ineffective.

Horizon 0 "Current situation"

a. Habitat

i. Mexico's Compliance Action Plan (CAP) to prevent illegal fishing and protect vaquita populations has achieved measurable progress. Enhanced inspection, surveillance, and law enforcement efforts have significantly reduced the presence of vessels and gillnets within the Zo.

ii. Gillnet fishing persists in the Vaquita Refuge Area (VRA) and remains widespread in the rest of the gillnet exclusion zone. Legally registered vessels operating in the UGC are not efficiently monitored, and unregistered vessels continue to operate extensively.

iii. The "2020 Agreement" serves as the current Mexican regulatory framework in the UGC, though various analyses highlight the need for amendments to enhance its clarity and enforceability.

iv. A programme for the removal of lost, discarded and derelict fishing gear is implemented but active nets are still present in the VRA.

b. Livelihoods

i. Development of alternative fishing gear has advanced but has been insufficient and adoption remains limited. Resistance from local fishers to alternative fishing gear continues due to perceptions of lower catches and lack of innovation and incentives to support livelihoods, including lack of:

a) economic incentives to support the use of alternative fishing gear;

b) technological advancements in the development of fishing gear; and

c) innovation relating to the development of fair markets for products harvested with alternative fishing gear.

ii. Totoaba aquaculture has achieved significant technical advancements and promising results, but its accessibility to local communities remains limited, with minimal impact on their livelihoods.

iii. Few co-management and community led conservation strategies for sustainable fisheries are being supported. Conservation efforts are enforcement focused.

iv. Limited collaboration in the development of alternative fishing gear and the partial implementation of bans hinder progress. Additionally, the lack of coordinated efforts to establish alternative seafood market incentives within Mexico—combined with insufficient support from consumer countries like China and the United States—negatively impacts compliance efforts and the livelihoods of fishers.

c. Trade and international cooperation

i. The demand for totoaba swim bladders (maw) persists, thus trafficking of totoaba swim bladders continues, facilitated by well-organized smuggling networks and concealment methods that are often difficult to detect, as well as persistent clandestine markets.

ii. Significant actions by the United States, including the USFWS Attaché Programme, TECG collaboration, and seizures of totoaba swim bladders in the country, but there are still limited resources for enforcement, little understanding of the role of the United States as a potential consumer country and insufficient traceability measures for seafood shipments.

iii. A Trilateral working group (TECG) is set up and there is room for numerous improvements in collaboration, communication, and multilateral coordination.

iv. Seafood companies in Mexico and United States launder marine products caught with gillnets from the Upper Gulf of California to meet the demand for fish, shrimp, and other seafood in international markets, including the United States and China.

v. Gillnet shrimp and finfish laundering to the United States continues despite the bans.

vi. Awareness campaigns and stricter regulations in China, along with its Special Administrative Regions (SARs) of Hong Kong and Macao, have led to bans on totoaba trade and monitoring of local markets. However, there are opportunities to implement more targeted intelligence efforts and demand reduction campaigns in the region.

vii. While most international efforts focus on pressuring Mexico to strengthen its enforcement and regulatory policies, there has been limited progress in: a) providing multilateral support for these efforts, and b) expanding international actions to curb illegal trade and demand.

d. Vaquita and totoaba populations

i. Vaquita acoustic monitoring showed, for the first time in years, vaquita activity outside the Zo, giving hope to the species recovery. Yet, vaquita remains critically endangered and, without decisive action, vaquita extinction remains a possibility.

ii. Vaquita monitoring and abundance estimations relies on future funding to engage communities and to continue having scientific expertise and visual surveys.

ii. Knowledge about totoaba population status remains a big gap that should be addressed in order to have the best information for decision making over the potential population sustainable management.

Horizon 1: "Ideal"

a. Habitat

i. The UGC gillnet ban areas remain free of gillnets.

ii. Regulatory frameworks and other policies are fully enforced. Progress is measurable and continuously monitored.

ii. An integrated and multisectoral programme is implemented for the maintenance and removal of derelict, lost or discarded fishing gear.

iii. International cooperation exists by sharing costs, trained observers, analytical expertise, and technical support for permanent enforcement, vaquita and totoaba population monitoring and sustainable fishing gear development.

iv. A special international cooperation fund for vaquita and totoaba conservation actions exists.

b. Livelihoods

i. Technological advancements in the development of alternative fishing gear and fair markets for products harvested using alternative fishing gear with an added value innovation programme for sustainable non gillnet seafood including shrimp and other finfish fisheries thrives.

ii. A well-defined and effective management agreement is developed and implemented for small-scale fisheries within the communities of the UGC.

iii. Fishing communities actively participate in the design and enforcement of regulations regarding fishing gear, commercialization of seafood products and access to financing.

iv. All fishing is done with alternative fishing gear. Exportation bans are lifted and consumer countries responsibly demand non gillnet sourced seafood.

v. Totaba meat and possibly bladder can be sustainably and legally harvested, either wild (hook and line fishing and sport fishing) or farmed (Totoaba UMAS), and this directly benefits local community livelihoods.

c. Trade and international cooperation

i. The trade and global demand for totoaba and its parts is well regulated by national and international policies under the observation of CITES. Effective traceability mechanisms are implemented.

ii. Protocols are improved to detect and secure any illegal totoaba shipments at Customs check points. All Parties work in a coordinated manner and share intelligence and training through mechanisms such as the TECG and INTERPOL.

iii. International cooperation is evident through shared resources, including costs, trained observers, analytical expertise, and technical support. These efforts focus on permanent enforcement and monitoring vaquita and totoaba populations.

iv. A special International Cooperation for Vaquita and Totoaba Conservation Fund exists.

d. Vaquita and totoaba populations

i. Permanent financing to assess vaquita and totoaba populations exists and monitoring programmes include local community participation and leadership.

ii. Vaquita population abundance increases.

iii. Totoaba fisheries and/or farms are sustainably managed, genetic information (traceability markers) is available for traceability purposes and re-population strategies are well planned and coordinated.

Horizon 2. "Transitional"

a. Habitat

i. The VRA remains free of gillnets.

ii. The “2020 Agreement” is revised to ensure full enforceability and clarity, incorporating fishers' perspectives and proposals through an ongoing, open dialogue between fishers and authorities.

ii. An integrated and multisectoral programme is implemented for the maintenance and removal of derelict, lost or discarded fishing gear.

iii. Fishing activities with alternative fishing gear are developed within the VRA.

iv. Additionally, outside the VRA, fishing activities are monitored, and a programme for the progressive adoption of alternative and sustainable fishing gear, equipment, and methods is active.

v. Inspection and surveillance measures successfully displace illegal fishing using gillnets away from the main habitat of the vaquita marina.

vi. A socio-ecological harm reduction approach exists, and Mexican authorities target gillnet use reducing the negative interaction with vaquitas.

b. Livelihoods

vii. An added value innovation programme with international participation and focused on institutional development, technological development of alternative fishing gear, and promotion of fair markets for products harvested with alternative fishing gear is successful in the creation of market opportunities for sustainable non gillnet shrimp and finfish fisheries.

vii. The fishing communities actively participate in the added value innovation programme.

viii. Fisheries monitoring programmes are active for at least two significant fisheries (shrimp and corvina).

ix. Fishing organizations actively participate in designing gear and voluntarily comply with regulations that boost the commercialization of sustainable seafood products.

xi. In compliance with the population assessments needed, totoaba meat and bladder legal trade is explored for either wild (hook and line fishing and sport fishing) or farmed (Totoaba UMAS), and this directly benefits local community livelihoods. Totoaba farms are created and financed to directly benefit local communities and represent an alternative livelihood for women and youth.

c. Trade and international cooperation

i. Authorities recognize and provide regulatory frameworks for alternative gear fishing markets and support them by truly enforcing traceability.

ii. TECG fully established and works together with INTERPOL and WCO to curb illegal trade.

iii. Traceability mechanisms with international cooperation and coordination are created in order to enable a legal totoaba specimen trade.

iv. Protocols are improved to detect and secure illegal totoaba shipments. Seizures at borders, ports, and airports, along with intelligence, succeed in dismantling networks of TCOs involved in totoaba trafficking.

v. In addition to awareness campaigns, legal frameworks to address the possession and consumption of illegal sourced totoaba and its derivatives are strengthened. Moreover, consumers of illegal specimens in destination countries are detained to curb demand.

d. Vaquita and totoaba populations

i. A multilateral cooperation fund for vaquita and totoaba populations is created.

ii. Monitoring programmes promote local community participation and leadership.

iii. An effort to estimate vaquita abundance at least every two years in its whole range is developed and the population shows stability and recovery.

iv. Totoaba fisheries and/or farms are sustainably managed, genetic information (traceability markers) is available for traceability purposes and re-population strategies are well planned and coordinated.

Horizon 3 "Worst case scenario"

a. Habitat

i. There is an extensive use of gillnets in the vaquita core area, combined with inefficient enforcement of inspection and surveillance actions, weak law enforcement and conservation policies and Mexico fails to implement its CAP.

ii. No effective removal of lost, discarded and derelict fishing gear exist, posing a major threat for marine wildlife.

iii. There is a complete lack of monitoring of vessels, permits, and fishing activities in the UGC landing ports. The region is overrun with unregulated fishers, and landings are frequently used to launder seafood by falsely claiming it was caught using alternative gear, while in reality, gillnets were used.

iv. Gillnet shrimp and finfish laundering to the United States continues despite the bans.

v. Although some individuals are detained and fishing gear and vessels are seized, inspection and surveillance measures are insufficient to contain illegal totoaba fishing and the use of gillnets in vaquita core area.

vi. Concerns about the implementation and enforcement of the "2020 Agreement" continue and no changes are made in order to provide clarity and enforceability.

b. Livelihoods

i. Fisheries authorities fail to advocate for technological alternatives for fishing gear or offer economic or social incentives to facilitate the adoption of sustainable fishing gear and practices.

ii. Isolated efforts towards innovation of institutional arrangements, technological advancements in fishing gear development, and fair market development for sustainable fisheries are abandoned before implementation.

iii. The idea of implementing a pilot programme for co-management of fisheries resources is completely discarded due to lack of interest and support.

iv. Minimal participation from fishing organizations in the Upper Gulf of California, coupled with the absence of governmental backing, leads to the total abandonment of the dialogue, perpetuating the lack of legitimacy and enforcement of fisheries regulations.

v. The youth lack opportunities and alternative livelihoods, leaving them vulnerable to potential involvement with organized crime and totoaba poaching to generate family income and improve their living conditions.

c. Trade and international cooperation

i. The demand for illegal totoaba specimens increases across all international markets.

ii. Bans and sanctions on Mexico increase but seafood laundering continues.

iii. There are few seizures of totoaba at borders, ports, and airports of transit and consumer countries.

iv. Parties´ Customs authorities operate independently, lacking effective collaboration and communication with each other.

v. Networks of international criminal organizations consolidate their control over both legal and illegal fishing-related supply chains and violence associated with these activities reach unprecedented levels.

d. Vaquita and totoaba populations

i. There is absolute lack of multilateral support for Mexico to strengthen vaquita conservation and science, including regular surveys.

ii. Vaquita is likely extinct.

ii. Totoaba poaching continues and no information about population status is gathered.

iii. The whole UGC habitat is threatened by the extensive presence of gillnets.

7. Conclusions and key considerations

7.1 Conclusions

7.1.1 Avenues for the recovery of vaquita

Accidental entanglement in large-mesh illegal gillnets set to poach totoaba has been the primary driver of the vaquita's collapse over the last decade. The vaquita is also entangled in other types of illegal gillnets used to harvest commercial species of shrimp and other finfish. Saving the vaquita relies on keeping gillnets out of the water, at least in their core area, the Vaquita Refuge (VRA). Anti-gillnet devices in and around the Zo have proven an effective deterrent to gillnetting, but further deployment of these structures in the VRA would be both impractical and controversial. Getting gillnets out of the VRA will require a different approach: mainly securing much higher levels of voluntary compliance from fishers, because enforcing the entire area will be difficult.

Community commitment: Fishers are proposing to modify the "2020 Agreement" to shrink the gillnet ban area to the VRA and legalize their use outside it. While such action carries the risk that the VRA will continue to see high levels of illegal gillnetting, and that efforts to transition to vaquita-safe gear will be set back if gillnets are legalized, it should be considered because voluntary compliance in the VRA is key for vaquita recovery. This study supports the Secretariat's Mission to Mexico finding that "Various concerns and challenges regarding implementation and enforcement of some aspects of "the Agreement" in its current form were raised and these needs to be addressed by amending "the Agreement". This should be done in a manner that would strengthen "the Agreement" to safeguard the Zero Tolerance Area (Zo) and Vaquita Protection Refuge Area (VRA) ensuring that they remain free of any unauthorized fisher activities and gillnets" (SC78 Doc. 33.12.1).

Community-Led Conservation: Embrace a community-centered approach that recognizes that fishers in the region may harbor resentment or animosity towards vaquitas due to perceived threats to their livelihoods. Instead of dismissing these concerns, engage fishers in constructive dialogue and involve them as key stakeholders in conservation efforts and decision-making processes, to foster a sense of ownership and cooperation towards protecting the vaquita and its habitat, mainly by being open to adopting new fishing technologies and voluntarily complying with a non-gillnetting policy, at least in the VRA. Empower local communities within the vaquita habitat to take ownership of conservation efforts, including vaquita monitoring, totoaba farming and citizen science, acknowledging their concerns and aspirations while searching for mutual understanding and collaboration.

Sustainable Livelihoods through Alternative Gear and Value-Added Fisheries: Invest in alternative fishing gear and value-added fisheries that offer economic opportunities beyond gillnet fishing, which not only reduce bycatch but also enhance the quality and market value of the catch. Encourage the establishment of cooperatives or community-based enterprises that focus on value-added processing, such as smoking or curing fish, or ikejime sacrifice to create niche markets and premium products. This approach could generate higher profit for fishers, covering the opportunity cost of fishing less while contributing to the conservation of vaquitas and their habitat.

The US plays a significant role as a market for gillnet fisheries, particularly shrimp and the emerging sole (california halibut) industry, making sustainable fishing a shared responsibility. Similarly, China is a key

consumer of UGC products, including corvina (*Curvina golfina*) fish bladders (maw) and chano fish (*Chanos chanos*). Collaborative efforts between stakeholders in both countries are essential to promote sustainably sourced seafood. This involves ensuring market access, certification, and consumer education on the environmental and social benefits of sustainable fisheries management. This also includes, considering that "There is strong evidence that total bans can negatively affect species conservation and that in turn they tend to generate conflict in local communities, leading to reduced interests in species conservation, increasing resistance and undermining the voluntary participation of residents in conservation efforts" (Park M. S. et al. 2022).

By implementing targeted marketing campaigns and certification programmes, demand could be cultivated for responsibly sourced seafood products, creating economic incentives for fishers to transition from gillnet fishing to more sustainable practices. Such initiatives directly address the concern raised by the CITES Secretariat's Mission to Mexico that "the lack of dedicated work to support the development and use of alternative fishing gear is the single most important aspect that undermines the good work being done in accordance with the other lines of action in the CAP" (SC78 Doc. 33.12.1X).

Effective Enforcement of Gillnet Bans: To effectively enforce gillnet bans, it is crucial to enhance monitoring and surveillance efforts in the Vaquita Refuge and surrounding areas. This can be achieved through the deployment of advanced technologies such as drones, satellite imagery, and automatic identification systems (AIS) to track fishing vessels' movements. Strengthening the capacity and resources of local enforcement agencies, including the Navy and environmental authorities, is essential to ensure they can effectively patrol and respond to illegal fishing activities. Collaboration with international organizations and neighboring countries can provide additional support and resources for enforcement efforts. Additionally, implementing strict penalties for violations and establishing a clear legal framework for the prosecution of offenders will act as a strong deterrent against illegal gillnet use. Community involvement in monitoring and reporting illegal activities can also play a critical role in enforcement, fostering a sense of shared responsibility and stewardship among local fishers.

7.1.2 Avenues for the recovery of totoaba

The totoaba issue is an illegal wildlife trade issue and should be managed under a different approach. There is evidence that the totoaba population may be in conditions to support a sustainably managed fishery. Furthermore, totoaba aquaculture is not just possible, but successful.

Addressing the threat posed by the use of harmful fishing gear. The biggest challenge with totoaba fishing is the fishing gear, which has proven fatal to many other marine species (vaquita is just one species affected — local disentanglement teams have attended at least 5 whale disentanglements in the past 2 years and registered hundreds of dolphin and sea lion deaths by entanglement— CAT, PescaABC pers. comm.), however, this issue is not exclusive to the totoaba gillnet. How gillnets interact with marine mammals worldwide is a concern. The United States is evaluating this interaction under the Marine Mammal Protection Act (MMPA).

Sustainable farming and harvest of totoaba. Totoaba can be farmed and caught sustainably. Many similar examples exist, but the prime example for this case is possibly the sturgeon and caviar. Delicate management of the species and the regulations imposed by CITES have generated sufficient confidence to build a sustainable market, benefiting thousands of communities while conserving the species. The

big question is: *Can the Vaquita Refuge be kept free of gillnets while developing a legal wild and harvested totoaba trade?*

Effective use of legal provisions in respective countries. Currently, the totoaba trafficking network is under the control of organized criminal groups that mainly, but not exclusively, operate in China, the Hong Kong SAR of China, the United States and Mexico. Totoaba maw has become a commodity targeted by TCOs. Understanding differences in the legal processes in each country is key to developing effective strategies to save both vaquita and totoaba. All CITES Parties should assume that they could be potential transit countries as smuggling networks evolve and adapt. Seizures are not the only indication of illegal trade, because seizures may not take place if countries are not aware and therefore do not detect totoaba. International cooperation is crucial to disrupt the totoaba trafficking network, including increased efforts to trace and intercept illegal trade routes and stronger penalties for traffickers. By integrating these strategies, negative impacts of totoaba fishing on the vaquita and other marine species can be mitigated, while supporting the livelihoods of local communities.

Systematic analysis of conservation actions. The lack of systematic analysis of past conservation actions to strengthen existing conservation initiatives has been a challenge in the governments' efforts to conserve the vaquita. This lack of proper evaluation has resulted in a discontinuity in governmental actions aimed at protecting this species.

Implementation of totoaba harm reduction strategies. To reduce the harm caused by totoaba fishing, it is essential to develop and promote alternative fishing methods that do not endanger other marine species. Research and investment in selective fishing gear that minimizes bycatch should be prioritized, and in the interim, a well-communicated harm reduction policing approach could target totoaba gillnets and take a lenient approach to hook and line, thus "disentangling" the problem of totoaba trafficking from vaquita recovery (Shailer 2024). Expanding totoaba aquaculture initiatives can provide a sustainable source of totoaba products, reducing the incentive for illegal fishing. Public awareness campaigns targeting both local communities and international consumers can highlight the ecological impact of totoaba gillnets and promote the benefits of sustainable practices. Engaging with local fishers to develop community-based monitoring and enforcement programmes can help ensure better compliance with regulations and foster a culture of conservation.

7.2 Key considerations

7.2.1 Source/Range State (Mexico)

A. Vaquita conservation and science

The Agreement regulating fishing activities in the Northern Gulf of California has not been fully enforced and may be challenging to implement. Modifications to the Agreement could make enforcement more feasible. It is suitable that such modifications be designed together with the fishing communities and other important stakeholders.

Full enforcement of the gillnet ban within the Vaquita Refuge Area (VRA) is critical for vaquita recovery. Collaboration with local fishers is essential to raising voluntary compliance in the VRA, transition to alternative fishing gear and exploration of socioeconomic alternatives.

Further acoustic monitoring and visual surveys outside the Zero Tolerance Area (Zo) are needed (see recommendations of Cardenas-Hinojosa 2024 and Cardenas-Hinojosa et al. 2024). Protection and security for monitoring equipment must be ensured by both authorities and fishers.

Environmental DNA (eDNA) should be explored as a potential monitoring tool.

Citizen science efforts and community involvement in vaquita monitoring should be strengthened.

B. Totoaba conservation and science

For better survival rates, it is essential to reduce the frequency of totoaba releases throughout the year while increasing the age of the fish being released. Additionally, improved coordination with management authorities is crucial to ensure better monitoring and oversight of re-population efforts.

A comprehensive evaluation of totoaba biomass is urgently needed.

Transitioning the totoaba fishery towards alternative, less harmful for vaquita, fishing gear should be explored with a short-term targeted harm reduction policing approach prioritizing enforcement of the gillnet ban and deprioritizing other gear such as hook and line, given the urgency to maintain vaquita habitat free of gillnets.

C. Enforcement in the Upper Gulf

Greater effectiveness in combating illegal fishing and prosecuting organized crime is required, including convictions resulting in strong and deterrent sentences.

An assessment of challenges in addressing organized crime involving totoaba specimens should be conducted.

Full implementation of the compliance action plan is crucial.

D. Enforcement in the remainder of the range

Regulations must be enforced throughout the totoaba distribution range, especially in areas with recent illegal fishing activity, such as Bahía de los Ángeles and Bahía de Kino.

7.2.2 Transit countries

A. Enforcement

Improved communication between transit, source and destination countries is necessary for effective enforcement.

Transit countries should utilize all available information to identify potential transit points, noting the possibility of involvement by their nationals in illegal activities.

Risk assessments should regularly be done to develop or further strengthen risk management practices and profiles specific to totoaba.

Where possible, opportunities to initiate controlled deliveries in collaboration with destination countries should be explored.

7.2.3 Consumer/Destination countries

A. Enforcement and Demand Reduction

The United States may function as both a consumer and transit country for totoaba swim bladders and should undertake further studies regarding its potential role as being a consumer and transit country.

Demand reduction strategies should target specific buyers, as the primary consumers may differ from the broader wealthy diaspora. One option that could be considered is messaging that totoaba swim bladder health benefits do not differ in any way from lower-priced legal swim bladders.

Continued enforcement efforts and information sharing among Parties are vital.

The *Guidance on demand reduction strategies to combat illegal trade in CITES-listed species* should be drawn upon to inform demand reduction efforts.

7.2.4 Trilateral Enforcement Contact Group

Enhanced cooperation through the TECG is essential. Information sharing through the TECG subgroup on enforcement should be actively pursued, including by, where appropriate, drawing upon credible and actionable information and intelligence provided by civil society or private sector entities.

The use of communication channels and tools provided by INTERPOL and the WCO should be actively pursued by Parties.

7.2.5 All Parties

Support to Mexico's vaquita conservation initiatives is essential. An international fund to support vaquita science and conservation, together with the development of alternative fishing gear and technology could be a way to support Mexico´ ongoing efforts and commitments.

Efforts to eliminate supply of and demand for illegally sourced specimens of totoaba to address and prevent their illegal trade should be supported.

F. The study supports the Secretariat's mission key findings regarding:

United States of America: "...despite the efforts deployed by enforcement authorities in the United States, criminals continue to be able to transit through the territory of the United States with illegal specimens of totoaba. It is unclear how those criminals are supported or assisted by individuals operating within the United States to receive and store the illegal consignments until re-exporting them to Asian markets. There is a risk that commercial shipments of seafood could be used to conceal and smuggle illegal

consignments, including totoaba swim bladders. The United States is therefore encouraged to review its practices regarding the traceability and inspection of commercial shipments of seafood, with the aim of ensuring that current measures are adequate to address this risk and to determine if further strengthened measures might be needed".

China: "... More needs to be done regarding the clandestine domestic markets and China is therefore encouraged to strengthen national level police engagement in the fight against illegal totoaba specimen trade occurring within China, through its Ministry of Public Security. This could focus on information and intelligence gathering regarding individuals within China managing and organizing this illegal trade, analyzing available data to map out their criminal networks, and targeting their activities through intelligence-driven operations and investigations".

Mexico: "The lack of dedicated work to support the development and use of alternative fishing gear is the single most important aspect that undermines the good work being done in accordance with the other lines of action in the CAP. Mexico informed the Secretariat that funds would be made available for these activities after the Secretariat's mission and is urged to take urgent steps to address this gap, including consultations with the fishers on alternative fishing gear".

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9. Methods to study vaquita population

1. Acoustic Monitoring:

- Hydrophones and acoustic monitoring systems are actively deployed in the vaquita's habitat to detect and record their echolocation clicks.

- The unique acoustic signatures of vaquita clicks allow researchers to estimate their presence and distribution.

2. Passive Acoustic Monitoring (PAM):

- PAM involves deploying stationary hydrophones in the vaquita's habitat to passively record their vocalizations over extended periods.

- This method is useful for continuous monitoring and obtaining data on seasonal variations in vaquita presence.

3. Aerial Surveys:

- Aerial surveys involve flying over the vaquita's habitat in small planes or drones to visually locate and count individuals.

- Observers on board carefully scan the water surface for vaquitas and other marine life.

4. Vessel Surveys:

- Researchers use boats to conduct systematic surveys of the vaquita's range.

- Visual sightings are used to estimate population size using distance models (Buckland et al. 2015)

6. Photo-Identification:

- Researchers use distinctive markings and features, such as dorsal fin patterns, scars, and pigmentation, to identify and track individual vaquitas.

- Photo-identification catalogs are created to monitor population trends and understand the social structure.

5. Genetic Analysis:

- Genetic analysis of tissue samples, can provide insights into the population structure, genetic diversity, and relatedness among vaquitas.

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