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## Artisanal fishing in Mexico: Capture strategies

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# Tools and Catch Control Rules in the White Shrimp Fishery *Litopenaeus vannamei* in Marismas Nacionales, Nayarit

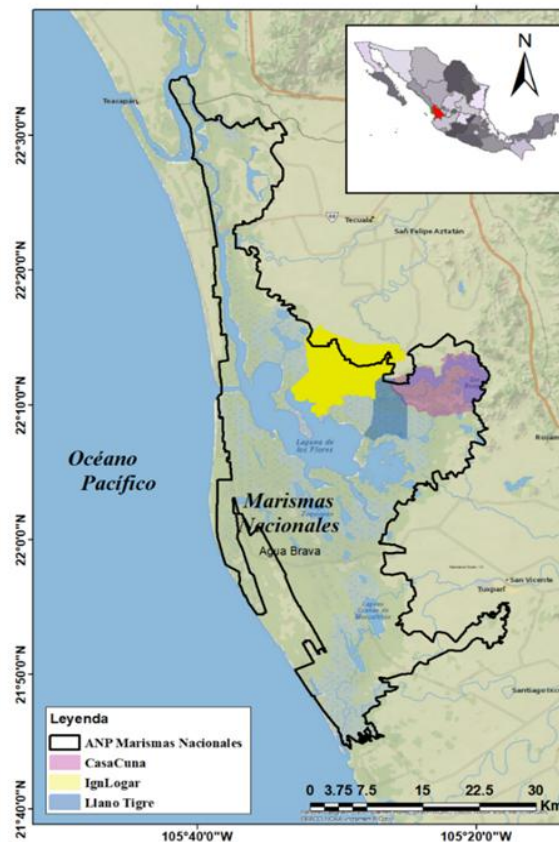
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### I. Introduction

Shrimp fishing is one of the most important fisheries in Mexico, with the Mexican Pacific being the region where the largest share of the total shrimp catch (~92%) in Mexico is extracted (SAGARPA, 2021). This fishery ranks third in terms of production volume; however, in terms of commercial value, it ranks first in Mexico. Shrimp catches in the Mexican Pacific consist primarily of three species: blue shrimp, \**Litopenaeus stylirostris*\* (Stimpson 1871), white shrimp, \**L. vannamei*\* (Boone 1931), and brown shrimp, \**Farfantepenaeus californiensis*\* (Holmes 1900), in addition to other penaeid shrimp species. Shrimp of the genus \**Litopenaeus*\* spend most of their time in areas influenced by or closely associated with river deltas, estuaries, or coastal lagoons. Their migratory movements are dictated by the nature of their life cycle, which is dependent on estuaries or coastal lagoons, which they use as areas for protection, feeding, and growth.

*L. vannamei*, the white shrimp, is distributed from Sonora, Mexico to Peru. In Mexico, the highest catches in marine and protected waters are obtained in southern Sinaloa, Nayarit, and the Gulf of Tehuantepec (Chiapas). It is a species that also inhabits sandy and clay bottoms (Hendrickx, 1996). Data from the industrial fleet indicate that this species has been caught at depths of up to 50 fathoms, although the greatest abundance is found between 5 and 15 fathoms deep in the open sea.

The white leg shrimp fishery that takes place within the Biosphere Reserve Marismas Nacionales in Nayarit (from now on BRMN) is one of the most important economic activities within the federal protected area. Fishing activities are the main source of food and livelihoods for the local communities. According to Carvajal-Rascon et al. (2017), between 12,000 and 14,000 fishers participated in fishing activities that generated up to \$170 million pesos (~\$9 million USD). The average production of white leg shrimp ranged between 4 and 6 thousand tons that represented ~55% of the total annual fisheries' production in the region (Carvajal-Rascon et al. 2017).



**Figure 1.** Location of the Marismas Nacionales Biosphere Reserve and fishing areas corresponding to the fishing cooperatives participating in the FIP.

The most important economic activity is the shrimp fishery, which is carried out by fishers who are divided into free fishers (those who can work with individual fishing permits or carry out the activity illegally) and members of one of the local cooperatives (Carvajal-Rascon et al. 2017). In addition to the authorized gear (cast-nets), local producers in the region use a traditional system of wooden piles (mostly mangrove) that are placed at the sea bottom across the estuary channels, known as tapos.

### Artisanal Fishing Technique

The management program states that around 15 different areas for shrimp extraction exist within the BRMN which are used by ~25 fishing cooperatives that hold authorization for the extraction of different species. The three most important species groups are white leg shrimp (WLS), finfish (or Escama) and oysters (SEMARNAT-CONANP 2013).

The artisanal shrimp fishery in Nayarit is carried out in the lagoon and estuary systems of Marismas Nacionales using small boats (<12 m in length). This fishery comprises 636 vessels belonging to 25 fishing cooperatives. The cast net is the traditional fishing gear and is constructed with monofilament nylon line of 0.20 to 0.25 mm in diameter and a maximum height of up to 6 meters (Fig. 2). Mexican Official Standard NOM-002-PESC-93 establishes that the cast net used for shrimp fishing within lagoon systems must have a mesh opening of 1.5 inches (38.1 mm).



Figure 2. Cast net fishing gear used in the shrimp fishery in Marismas Nacionales, Nayarit.

The shrimp fishery in Marismas Nacionales is governed by Mexican Official Standard NOM-002-PESC-1993 (DOF, 1993) and its subsequent amendments (DOF, 1997; DOF, 2006) to regulate the harvesting of shrimp species in federal waters of the United Mexican States. The National Fisheries Charter (CNP) is also in place, a legal and regulatory instrument that includes, among other things, the status of shrimp populations and fisheries, as well as regional management guidelines and strategies for fisheries in Mexico. Both legal instruments contain regulations for the sustainable use and preservation of the natural resources found therein, in a way that is compatible with obtaining economic benefits derived from the activities carried out for this purpose by the social groups that inhabit it. This will be the General Law of Ecological Balance and Environmental Protection (LGEEPA) and its regulations, regarding Natural Protected Areas (ANP).

### **Current State of the Fishery**

The current state of the Mexican shrimp fishery is defined as being exploited to its maximum sustainable yield. In general, the shrimp fishery in these lagoon systems has been little studied, and the research conducted has focused primarily on understanding the biological aspects of the species, neglecting the assessment of the resource and its fishery. Consequently, there are no estimates of mortality and exploitation rates that would analytically define the status of the resource in terms of its fishery.

It is important to note that, in general, shrimp populations in protected waters show signs of decline. This is due not only to the effects of fishing activity but also to factors related to alterations in their growth and feeding areas. These alterations are caused by the excessive logging of mangroves, the main source of detritus for the crustaceans, as well as by the silting up of the mangroves themselves. Therefore, to contribute to the recovery of shrimp populations in protected waters, it is necessary to strengthen conservation and protection measures for the resource. These measures include closed seasons, the establishment of no-fishing zones, regulations on fishing gear, and the elimination of unauthorized gear that is harmful to the fishery. It is also essential to implement public awareness programs to prevent further mangrove deforestation and to mitigate the effects of deforestation through reforestation of affected areas.

## Management Measures Established in the Shrimp Fishery

The current management measures for the Pacific shrimp resource (National Fisheries Charter, 2017) applicable to coastal lagoon systems are listed in Table VII.

**Table VII** . Current management measures for shrimp capture in the REBIEN.

( [https://www.gob.mx/cms/uploads/attachment/file/334832/DOF\\_-\\_CNP\\_2017.pdf](https://www.gob.mx/cms/uploads/attachment/file/334832/DOF_-_CNP_2017.pdf) )

Handling Control	But	Provisions	Livelihood
Official Mexican Standard	Yeah	NOM-002-SAG/PESC-2013	Official Gazette of the Federation (DOF): 11/07/2013
Fisheries Management Plan	No	In the process of being developed	
Access type	Yeah	Commercial permit or fishing concession for shrimp	Technical opinion of IMIPAS
minimum size	No	Not applicable	
Fishing gear and capture method	Yeah	Larger vessel: trawl net with a mesh size of 50.8 mm (2 in) and 38.1 mm (1.5 in) in the bag; equipped with Turtle Excluder Devices (TEDs) and Fish Excluder Devices (FEDs). The top rope must not exceed 36.57 m (120 ft). Smaller vessel: trawl net with a minimum mesh size of 44.4 mm (1.34 in) and 38.1 mm (1.5 in) in the bag; bottom rope with a maximum length of 18.3 m (60 ft). Cast net with a minimum mesh size of 37.5 mm (1.5 in). Seine net with a minimum mesh size of 31.75 mm (1.25 in). Line seines with a minimum mesh size of 63.50 mm (2.5 inches) and a maximum length of 200 m, with an overlap of between 50 and 70%.	Sections 4.3.2.1 and 4.3.2.3, NOM-002-SAG/PESC-2013 Normative Appendices "A", "B" and "C" of NOM-002-SAG/PESC-2013 6/11/2018 DOF
Ban	Yeah	Temporary ban to protect reproduction and growth with variable dates, generally between March and September of each year	Section 4.4, NOM002-SAG/PESC2013 Technical opinion of IMIPAS
Share	No	Not applicable	
Fishing unit	Yeah	Small boats. Fiberglass boats 10.5 meters in length with outboard motor.	Technical opinion of IMIPAS
Effort	Yeah	15 commercial shrimp fishing concessions	Technical opinion of IMIPAS

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			NOM-002-SAG/PESC-2013
			Official Gazette of the Federation (DOF): 07/12/2016
Fishing area	Yeah	Small craft in: a) inland waters including lagoon-estuary systems of the Pacific Ocean, b) coastal marine waters in North Central Sinaloa and coastal marine waters of Sonora, and c) marine waters in the Upper Gulf of California	Official Gazette of the Federation (DOF): 01/09/2000
			Official Gazette of the Federation (DOF): 25/09/2009
			Official Gazette of the Federation (DOF): 08/09/2005

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**\*DOF:** OFFICIAL GAZETTE OF THE FEDERATION;

**\*IMPAS:** MEXICAN INSTITUTE FOR RESEARCH IN SUSTAINABLE FISHERIES AND AQUACULTURE

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