



**Fishing monitoring by implementing PescaData, to determine octopus catches and the use of bait species in the octopus FIP in Yucatán, 2024 season.**

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## Abstract

The Octopus fishery in Mexico remains the largest in the Americas in both production volume and economic value, with the state of Yucatán as the primary producer in the country. This fishery was registered as a Fishery Improvement Project (FIP) in 2018 to achieve certification under the Marine Stewardship Council (MSC) standard. One of the main challenges is to generate reliable fishing data that contributes to improved fishery management, particularly regarding catch composition and bait usage. To address these challenges, 17 individuals from four cooperatives and four fishing companies (eight Fishing Production Units, FPU) incorporated into the FIP were trained in the use of the PescaData (PD) digital application, which enabled fishers to record their catches, octopus biometrics, and bait usage information during the 2024 fishing season. The only registered fishing gear was the jimba. During the 2024 octopus fishing season, **a total of 3,185 fishing logbooks** were recorded, documenting key information on the fishery and specific details regarding bait usage by the FIP participants. **A total catch volume of 1,797,401 kg** was recorded for both species. Small vessels contributed 570,263 kg (31.7%) of the total catch, while medium-height vessels accounted for 1,197,498 kg (68.3%). *Octopus maya* was the predominant species, with a total catch of 1,767,761 kg (98.3%), whereas *O. americanus* accounted for only 29,640 kg (1.7%), indicating a significant decline in its population. The **FPU reported a total bait usage of 81,982 kg**, primarily consisting of the crustacean known locally as Ocol (*Ucides cordatus*), which represented 99.4% of the total bait used, followed by 0.5% of spider crab (*Libinia dubia*) and 0.08% of blue crab (*Callinectes sapidus*). A 31% reduction in bait consumption was achieved through the adoption of artificial lures, including commercial "Tiome" lures and homemade alternatives developed by four FPU. It was verified that the FPU incorporated into the FIP did not use endangered, threatened, or protected (ETP) species such as the horseshoe crab (*Limulus polyphemus*), which is protected under NOM-059-SEMARNAT-2010. However, continuous monitoring is necessary to ensure the complete eradication of non-permitted bait use. Biometric data for *O. maya* showed improved individual weights (0.753 kg average) and mantle lengths (13.1 cm average), while no biometric data were recorded for *O. americanus* due to low catches. The adoption of artificial lures significantly reduced reliance on wild-caught bait, supporting both ecological and economic objectives. The 2024 season also showed a recovery in market profitability compared to 2023, reducing the pressure to restrict fishing effort.

## Introduction

Mexico is one of the largest producers of octopus in the world, ranking third in 2016-2018. This fishery ranks seventh in the country's fishery production and in fourth place for its economic value. During the last ten years, the state of Yucatán has been the largest producer of octopus in the country (CONAPESCA, 2018). The species that are harvested in the state are the maya or red octopus (*Octopus maya*), the common or paton octopus (*O. americanus*, formerly known as *O. vulgaris*) (Avendaño et al., 2020), however, this last specie is not yet officially recognized by the Mexican federal government. The season for octopus fishing in the Yucatan Peninsula runs from August 1st to December 15th of each year.

The *O. maya* and *O. americanus* fishery generates 15,000 jobs and a commercial value of more than 27 million USD per year. Approximately 80% of the catch of this species is exported to Europe and Asia (Rosas et al. 2014). The octopus catch in the state of Yucatán is carried out by two types of fishing fleets, the smallest, which is the most numerous, with vessels between 18 and 29.5 feet in length, and the medium-sized fleet that uses vessels between 39.3 and 72.1 feet in length (DOF, 2014).

The octopus fishery requires large quantities of bait, mainly decapod crustaceans (crabs), which were traditionally obtained in the state of Campeche, such as maxquil (*Libinia dubia*), moro crab (*Menippe mercenaria*) and blue crab (*Callinectes sapidus*) (Solís-Ramírez, 1998; Markaida et al., 2015). The growth of the octopus fishery in recent years has led to an increase in the demand for bait, with its availability and quality being a serious problem. Likewise, it has been documented in the state of Campeche that due to the high demand for bait, imports from neighboring states have been generated. Such is the case of the ocol or land crab (*Ucides cordatus*) that is extracted from the mangroves of Magallanes (Tabasco), the green crab (*Callinectes bellicosus*) from Paredón (Chiapas) or the maxquil that comes from Celestún (Yucatán) (Markaida et al., 2019). In addition to this problem, the use of the sea horseshoe crab (*Limulus polyphemus*) has been documented (Zaldívar-Rae et al., 2009; DOF, 2010; Munguía-Gil, 2010; Salas et al., 2011; Sandoval-Gío et al., 2016; Smith et al., 2017); despite being an illegal activity, as the Mexican Official Standard NOM-059-SEMARNAT-2010 categorizes this species as "endangered" and prohibits its capture (DOF, 2010). However, Munguía-Vega et al. 2023, through genetic analysis in different species of crustaceans used as bait in the octopus fishery, did not find any ETP species used as bait, in this fishery. In addition, since 2016, the International Union for Conservation of Nature has listed *L. polyphemus* on the Red List as a "vulnerable species" and emphasizes that its populations are in gradual decline (Smith et al., 2016).

This fishery was pre-assessed in 2018 under the Marine Stewardship Council (MSC)<sup>1</sup> standard, identifying various areas of opportunity that require improvement in order to comply with the 28 performance indicators (PI)<sup>2</sup>. One of the main challenges of the octopus fishery is the generation of fishing information, which allows for more variables to be documented during the fishing task (date, fishing time, type of gear used, catch area, type of bait used, volume captured of the target species and biometric data of the organisms). This information will allow evaluating and designing strategies to improve the current management of the fishery, as well as the species that are used as bait.

Due to the fact that this fishery intends to obtain the certification of sustainable fishing by the MSC standard, during this 2022 octopus fishing season actions are being taken to improve the qualification of the ICs scored with qualifications below 60. These actions are mainly related to 1) the recording of fishing information through the [PescaData](#) (PD) digital logbooks and its analysis, to improve the capture strategy and not exceed the total allowable catch (TAC); 2) registration and identification of the species that are being used as bait to establish a management strategy; 3) promote with various government actors the updating of the octopus fisheries management plan and incorporate specific objectives, and 4) establish a system of random audits to verify compliance with sustainable practices among FIP members.

Since 2021, actions 1 and 2 mentioned above have been addressed through the digital tool PD to develop Octopus Fisheries Monitoring with the FPU incorporated into the Unit of Certification (UoC). PD is a free access mobile app, designed by and for people dedicated to small and medium-scale fishing, which allows the recording and storage of daily catches, as well as the expenses involved in the fishermen's days and the fisherwomen from Mexico, Latin America and the Caribbean.

PD records fishing logbooks and includes additional information to keep track of income and expenses on a daily basis. It has a market section in which its users can offer their products and services. It presents a specific section to add biometric data of the captures. It has an extensive

<sup>1</sup> <https://www.msc.org/es/estandares-y-certificacion/los-estandares-de-msc/el-estandar-de-pesquerias-msc>

<sup>2</sup> <https://www.msc.org/standards-and-certification/fisheries-standard/how-the-standard-works>

list of marine species that shows the common name, scientific name and photo of the organism, making it easier for the fishers to register the captured resource. It offers a specific section to record sizes, weight, sex and state of maturity of the captured specimens. Users have the possibility of managing a profile of the fishing organization to find potential buyers. It is possible to register a user as an administrator of each fishing cooperative/organization in the dashboard to register/deregister fishers and boats from each organization. The application has an internet page called PD Board in which it is possible to consult and download catch data from fishers of their respective fishing organization. PD tries to modernize the management of fishing cooperatives through cutting-edge technology, combating the technological barrier of the sector and putting it at your fingertips for free.

The red octopus (*Octopus maya*) and common octopus (*Octopus americanus*) fishery in the Yucatán Peninsula, Mexico, has been participating in the *In-Transition to MSC* (ITM) program since 2023<sup>3</sup>, a pilot initiative by the Marine Stewardship Council (MSC) designed to help fisheries move toward sustainability certification. While not yet meeting the standard or using the ecolabel, they commit to undergoing a formal assessment within five years and implementing improvements verified by independent assessors. Organized into "Assessment Units," the fishery aims to maintain healthy populations, reduce ecosystem impact, and strengthen fishery management. The program, in its pilot phase until the end of 2024, allows for adjustments in costs and participation conditions, reflecting the commitment of cooperatives, authorities, and scientists to responsible practices such as seasonal closures, stock monitoring, and selective fishing, ensuring both resource recovery and community stability.

## Objective

Present the progress made during the octopus fishing season in Yucatan 2024 in terms of information and monitoring of octopus catches, the use of bait registered by the fishing production units incorporated into this FIP through the PD electronic logbooks.

## Specific objectives of fisheries monitoring

1. Record information on the quantities, costs and species of bait used by the UoC of the Octopus-FIP of Yucatan during the 2024 fishing season.
2. Record information on the quantities and species of octopus caught per fishing trip by the UoC's small and medium-sized vessels, during the 2024 fishing season.
3. Record biometric information of the captured octopus's species during the 2024 fishing season.
4. Track the progress in the adoption of artificial lures by the UoC to reduce bait usage.

## Methodology and results

### *Fishing monitoring*

For fishing monitoring, the mobile application PD<sup>4</sup> was used as a tool, which, within its multiple functions, serves as an electronic logbook to record fishing information in real time. With the aim of implementing Octopus Fisheries Monitoring during the 2024 fishing season in Yucatan, 16 people from four cooperatives and six fishing fishing organizations incorporated into the FIP-Octopus (Table I) were trained in person on July 18th and 19th, 2024 in the use of PD as an

<sup>3</sup> <https://fisheries.msc.org/en/fisheries/red-and-common-octopus-fishery-yucatan-peninsula-mexico/@@view>

<sup>4</sup> <https://pescadata.org/>

electronic logbook, topics related to sustainable fishing, Fisheries Improvement Projects, and the octopus taxonomy in the region, in order to give context to the importance of implementing adequate fisheries monitoring in the project. The importance of both the FIP and the octopus fishery having all the fishing information of their affiliates was detailed, they were explained how to obtain and register the information of their vessels and fishing permits in the PD Dashboard, the filling and saving of fishing logbooks, recording information on the daily octopus catches, the species of bait, the quantities used and their cost (ANNEX II).

The fishing cooperatives and their fleet are located in Celestún and the fishing companies are located in Puerto de Progreso, Yucatán, where their MHV fleet is also located. In the case of the SV, MASPESCA has them in Puerto de Progreso, PESMAR in Dzilam de Bravo and PROMARMEX has them distributed in the fishing municipalities of Celestún, Progreso (ports of Chuburná and Chicxulub), Telchac, Dzilam de Bravo and JOKARA has their SV fleet in El Cuyo, in the state of Yucatán (Figure 1).

Table I. Training in octopus fisheries monitoring with PD to octopus fishing organizations incorporated to the FIP for the 2024 season.

Fishing Production Units	Trained people	Date
<b>PROMARMEX S.A. DE C.V.</b>	1	18/07/24
<b>MASPESCA S.A. DE C.V.</b>	2	18/07/24
<b>PESMAR S.A. DE C.V.</b>	1	18/07/24
<b>CONGELADOS JOKARA S.A. DE C.V.</b>	2	18/07/24
<b>SZ SEAFOOD S.A. DE C.V.</b>	2	18/07/24
<b>ALSUR S.A. DE C.V.</b>	1	18/07/24
<b>S.C.P.A.S. CAYO ARENAS</b>	1	19/07/24
<b>HULKIN S.A. DE C.V.</b>	2	19/07/24
<b>NOVELOS S.C. DE R.L. DE C.V.</b>	2	19/07/24
<b>PULMEMAR S.C. DE R.L. DE C.V.</b>	1	19/07/24
<b>CHICHAN CUCH S.C. DE R.L. DE C.V.</b>	1	19/07/24
<b>TOTAL</b>	<b>16</b>	

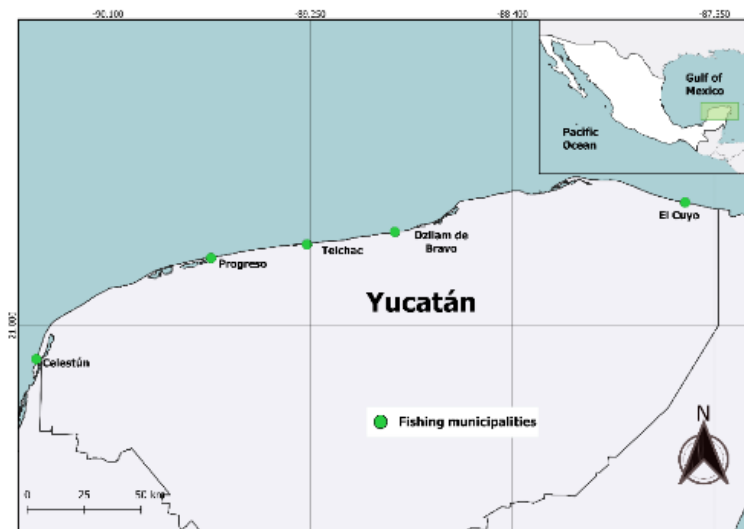


Figure 1. Map showing the four coastal municipalities where the SV and MHV of the fishery production cooperatives and the fishery production companies are located (map generated by Torres-Núñez, 2025).

During the 2024 octopus fishing season in the Yucatán Peninsula, fishing effort was notably higher compared to previous years, driven by the elevated price of octopus and the reduced cost of inputs, particularly bait. The favorable price of octopus in both national and international markets was influenced by several factors, including the depreciation of the Mexican peso against the U.S. dollar, high inventories from the previous season, and a decline in demand from major consuming countries due to economic instability. However, despite the favorable market conditions and the substantial Mayan octopus catch quota set by IMIPAS for 2024, some cooperatives operating SVs experienced low catches due to adverse weather conditions, particularly northerly winds that hindered fishing efforts. This was reflected in their failure to reach the catch quota, even after the fishing season at Banco Campeche was extended until December 31st, 2024. Adverse weather conditions primarily affected small vessels, as they must fish daily to recover their investment within a short timeframe. In contrast, MHVs benefit from extended trips at sea, enabling them to recoup their investment gradually. Additionally, their greater range of movement allows them to access more favorable fishing grounds.

The fleet registered in the FIP UoC was larger in the 2024 season compared to previous years, it was also the year with the highest production (Table V). This increase was reflected in the total production of the Unit of Assessment (UoA), as CONAPESCA's preliminary report indicated that the 2024 catch quota for Octopus maya (29,267 tons) was nearly reached<sup>5</sup>. For context, total octopus production in the Campeche Bank region reached 27,240 tons in 2024 (pers. comm.), exceeding the average annual production for the Yucatán Peninsula alone (21,000 ± 4,000 tons). This suggests that 2024 was a productive season for *O. maya*, whereas the same was not observed for *O. americanus* (29,640 tons).

Table II. Number of logbooks and small vessels (SV) and medium-height vessels (MHV) registered by the FPU incorporated into the FIP's UoC during the 2024 octopus fishing season in Yucatan.

Fishing Production Units	SV Information		MHV Information		Total fleet
	Number of SV	Number of logbooks	Number of MHV	Number of logbooks	Total logbooks
S.C.P.A.S. CAYO ARENAS, S.C. DE R.L.	10	383	NA	0	383
S. C. P. A. S. CHICHAN CUCH S.C. DE R.L. DE C.V.	1	60	0	0	60
CONGELADOS JOKARA S.A. DE C.V.	62	810	0	0	810
MASPESCA S.A. DE C.V.	6	655	12	43	698
S.C.P.A.S. NOVELOS S.C. DE R.L.	9	265	0	0	265
PESMAR S.A. DE C.V.	19	29	0	0	29
PROMARMEX S.A. DE C.V.	51	0	26	49	49
PULMEMAR S.C. DE R.L.	5	51	0	0	51
ZS SEAFOOD S.A. DE C.V.	2	0	3	0	0
<b>TOTAL</b>	<b>165</b>	<b>2,253</b>	<b>41</b>	<b>92</b>	<b>2,345</b>

The only registered fishing gear used was the jimba, which is the regulatory gear described in the Management Plan (DOF, 2014). This gear is highly selective and complies with fishing regulations. The total recorded catch volume for both octopus species across the eight FPU was

<sup>5</sup> [https://dof.gob.mx/nota\\_detalle.php?codigo=5743608&fecha=25/11/2024#gsc.tab=0](https://dof.gob.mx/nota_detalle.php?codigo=5743608&fecha=25/11/2024#gsc.tab=0)

1,797,401 kg. Of this total, SV contributed 31.7%, while MHV accounted for 68.3%. The species with the highest catch volume was *O. maya*, with a total of 1,146,372 kg (98.3%). In contrast, *O. americanus* was only recorded in the MHV catches, with a total of 29,640 kg (1.7%) during the 2024 fishing season.

Based on data on the total number of individuals and total catch weight per fishing trip, the average individual weight for *O. maya* was estimated at 753 g, with an average catch depth of 13 m. Meanwhile, *O. americanus* was caught at an average depth of 36 m. Fisher monitors conducted and recorded 6,401 biometric measurements for *O. maya*. *O. americanus* was not included in Table III due to its low capture frequency. Biometric analyses revealed that 99% of the individuals met the legal size requirement (mantle length > 11 cm) or legal weight (total body weight > 0.450 kg), indicating a high compliance rate with fishery regulations.

Table III. Record of catches for each species of octopus by the UoC, according to small vessels (SV) and medium-height vessels (MHV) and biometric information of each species. Mantle length (ML), number samples (n).

	Catches Information			Biometric information			Cost information
	SV catches (kg)	MHV catches (kg)	Total catches	Average weight (kg)	Avarage ML (cm)	Records (n)	Cost: MXN per kg
<b><i>Octopus americanus</i></b>	-	29,640	29,640	-	-	0	100.0
<b><i>Octopus maya</i></b>	439,032	1,197,498	1,767,761	0.753	13.1	6,401	100.00
<b>TOTAL</b>	<b>439,032</b>	<b>1,227,138</b>	<b>1,797,401</b>	-	-	<b>6,401</b>	-

### Use of bait

#### PescaData bait monitoring

To achieve accurate compliance with this activity, the FPU recorded through PD the data on the bait they use for octopus fishing (species, volume, price) throughout the season. Simultaneously, a photographic record of the purchase notes and the bait is kept at the time of purchase (Annex I).

During the octopus fishing season, the FPU utilized a total of 81,982 kg of bait, with the most commonly used species being the crustacean known locally as ocol (*Ucides cordatus*), which accounted for 99.4% of the total. This was followed by the spider crab or maxquil (*Libinia dubia*) at 0.5% and the blue crab (*Callinectes sapidus*) at 0.1% (Table IV).

The mangrove-land crab (ocol) is harvested under a legally established fishery, with fishing permits granted by the national fisheries authority and its inclusion in the National Fisheries Charter (CNP, 2012), a scientific and regulatory document issued by the government agency responsible for fisheries research (IMIPAS). Ocol is primarily caught in the states of Tabasco and Veracruz, where authorized fisheries operate. The bait is then transported to the Yucatán coast in frozen, fresh, or live form, where it is purchased almost daily by small vessels. In contrast, the mid-sized fishing vessels acquire bait several days in advance to stock the boats prior to fishing trips.

Unlike ocol, maxquil is not yet a regulated species; however, it is harvested locally by women using traditional fishing methods. Research efforts are currently being planned to establish biological and fishery parameters for this species.

Bait prices fluctuated depending on several factors, including the supplier, quality, and date of purchase (pers. comm.), with costs ranging from 90.00 to 150.00 MXN/kg (4.50 to 7.50 USD/kg). Throughout the 2024 octopus season, 99.5% of the bait used by the Units of Certification (UoC) consisted of legally permitted species. While maxquil is not yet formally regulated, research and monitoring efforts will begin in 2025 through promotional fishing permits (research fisheries).

Nevertheless, it remains crucial to identify and eliminate the use of non-permitted bait species. In this regard, verification confirmed that the FPU participating in the FIP did not utilize endangered, threatened, or protected (ETP) species, such as the horseshoe crab (*Limulus polyphemus*), which is protected under NOM-059-SEMARNAT-2010. However, previous documentation has reported its use in the Yucatán octopus fishery (Sandoval-Gio et al., 2016).

A 31% reduction in bait consumption was observed in 2024, as evidenced by a decrease in the bait-to-catch ratio from 0.067 in 2023 to 0.046. This reduction was primarily driven by the widespread adoption of artificial lures during the 2024 fishing season (Table V).

In 2024, fisher Carlos Novelo, a member of the NOVELOS fishing cooperative, patented a new type of lure and founded the company Tío Me Señuelos®<sup>6</sup>, which successfully marketed a total of 6,000 units. Of this quantity, approximately 1,000 units were purchased by the FPUs within the FIP. According to calculations derived from an ongoing study pending publication, each lure replaces approximately 16.87 kg of bait when used throughout an entire fishing season. Based on this estimation, the use of these lures prevented the consumption of approximately 101,220 kg of bait during the 2024 season. Specifically for the FIP, the reduction is estimated at 16,870 kg. This decrease was reflected in the bait used (kg) / octopus catch (kg) ratio, which showed a reduction compared to the previous three seasons, significantly contributing to the sustainability of the fishery along the Yucatán coast (Table V).

The positive impact of this innovation lies in the reduction of marine resources traditionally used as bait, supporting the potential of lures as a key tool in the transition toward more responsible fishing practices. It is worth noting that these lures can be used in combination with traditional bait or independently, depending on the fishers's preference. At the beginning of the season, skepticism existed among fishers regarding their effectiveness, leading many to initially use them in limited quantities. However, as the season progressed and their effectiveness was confirmed—along with their low cost, especially in the case of homemade lures—their use increased progressively, resulting in a gradual reduction in the use of natural bait. This phenomenon was particularly evident in the community of Celestún, where Tío Me Señuelos originated and where a study on their effectiveness was conducted in 2023. It is expected that this trend will continue expanding from the western coast toward the eastern coast of Yucatán, potentially leading to increased lure usage in the 2025 season.

Another relevant effect of lure adoption was its potential impact on bait price stability during the 2024 season. Unlike previous years, when bait prices could reach 150 Mexican pesos per kilogram, in this season, prices remained stable at approximately 100 Mexican pesos per kilogram. It is presumed that the lower demand for bait may have influenced this stability (Table IV).

<sup>6</sup> [https://www.facebook.com/TioMESenuelos?locale=es\\_LA](https://www.facebook.com/TioMESenuelos?locale=es_LA)

Additionally, the reduced use of bait had repercussions on the fishing of maxquil (*L. dubia*), a species traditionally used as bait by cooperatives in Celestún. In previous seasons, its use was significantly higher; however, the increasing adoption of lures and competition with Ocol bait prices led local maxquil fishers to refrain from capturing this species, reducing its availability in the bait market. Consequently, the amount of maxquil used by the FIP during the 2024 season was considerably lower compared to previous years. These findings suggest that the incorporation of lures in the octopus fishery not only contributes to the resource’s sustainability but also has economic and ecological implications for the dynamics of local fishing communities. Their progressive adoption could become a key strategy to reduce dependency on natural bait and promote more sustainable fishing practices in Yucatán.

Table IV. Information on the total amount of bait species and lures used by the SV and MHV registered during the fishing monitoring of the octopus FIP in Yucatán.

Species used as bait and lures in the 2024 season by SV and MHV of the octopus FIP							
No.	Common name	Specie	Quantity (kgs)	Relationship: bait (kgs)/octopus catch (kgs)	Average price (MXN/1kg)	Logbook numbers	%
1	Mangrove-land crab or Ocol	<i>Ucides cordatus</i>	81,496	0.05	98.60	2,449	99.4
2	Spider crab or Maxquil	<i>Libinia dubia</i>	421	0.06	98.00	146	0.5
3	Blue Crab	<i>Callinectes sapidus</i>	65	0.065	100.00	65	0.1
4	Lures	Tío Me and homemade	1,000 pieces	-	100.00-20.00 per piece	525	-
<b>Total</b>				<b>0.046</b>		<b>3,185</b>	

Table V. Comparison of indicators recorded by the UoC of the FIP in octopus fishing monitoring from the 2021 to 2024 season.

Season	2021	2022	2023	2024	Accumulated
<b>Number of logbooks registered in the FIP</b>	1,883	1,340	3,429	3,185	9,837
<b>Kilos of octopus produced by the FIP</b>	1,407,700	986,523	788,687	1,797,401	4,980,311
<b>Recorded octopus species</b>	<i>O. maya</i> and <i>O. americanus</i>	<i>O. maya</i> and <i>O. americanus</i>	<i>O. maya</i> and <i>O. americanus</i>	<i>O. maya</i> and <i>O. americanus</i>	<i>O. maya</i> and <i>O. americanus</i>
<b>Kilos of bait registered in the FIP</b>	86,330	67,640	52,473	81,982	288,425
<b>Relationship: bait (kgs)/octopus catch (kgs)</b>	0.061	0.069	0.067	0.046	0.058
<b>Bait species used</b>	<i>U. cordatus</i> , <i>L. dubia</i> and <i>C. sapidus</i>	<i>U. cordatus</i> , <i>L. dubia</i> and <i>C. sapidus</i>	<i>U. cordatus</i> and <i>L. dubia</i>	<i>U. cordatus</i> , <i>L. dubia</i> and <i>C. sapidus</i>	<i>U. cordatus</i> , <i>L. dubia</i> and <i>C. sapidus</i>

## Conclusions

1. The Octopus Fishery Monitoring Program in Yucatan will continue to be implemented during the next seasons through PD, incorporating the new FPU that are integrated into the FIP. This database will be shared with IMIPAS to improve its fishing analysis. In addition to this, a model is being developed that will use the catch data of the UoC to predict the total catches of the UoA.
2. Differential Impact of Climatic Conditions on Small and Medium-Sized Fleets: Small vessels were significantly more vulnerable to adverse weather conditions (northern winds), limiting their operational capacity and profitability. In contrast, medium-sized vessels demonstrated greater resilience due to their autonomy and ability to access more stable fishing grounds. These findings highlight the need for tailored climate risk management strategies for each fleet type.
3. Correlation Between Lure Adoption and Economic Stability: The introduction of artificial lures not only reduced natural bait usage by 31% but also contributed to price stability, particularly for ocol, preventing extreme fluctuations. This balance suggests that technological innovation can play a key role in the economic sustainability of the fishery, in addition to its environmental benefits.
4. Potential Bias in Biometric Data Due to the Exclusion of *O. americanus*: The minimal representation of *O. americanus* in biometric records (only 1.7% of total catches) limits the understanding of its population status and response to environmental changes. This underscores the urgent need to develop specific monitoring protocols for minority species, especially given its historical decline.
5. Influence of Macroeconomic Factors on Fishing Effort: The depreciation of the Mexican peso against the US dollar and high international demand acted as catalysts for increased fishing effort in 2024. The relationship between macroeconomic variables and fishing pressure underscores the importance of integrating external economic analyses into fishery management.
6. Need for Specific Regulation of Secondary Bait Species: Although *Libinia dubia* (Maxquill) accounted for only 0.5% of the total bait used, its extraction lacks a clear regulatory framework. The absence of formal permits and biological studies increases the risk of local overexploitation, particularly given competition with alternative baits such as ocol.
7. There wasn't records of the use of ETP species (for its acronym in English: Endangered, Threatened and Protected) by the FPU incorporated to the FIP or in the Yucatan coast during the 2024 fishing season, such as the horseshoe crab (*L. polyphemus*), which is protected both nationally by NOM-059-SEMARNAT-2010 (DOF, 2010), and internationally (Smith et al., 2016, 2017; Zaldívar-Rae, 2009).
8. Although PD is effective for recording information on the bait used for octopus fishing, it is recommended that it continue to be accompanied by photographic evidence along with the information in the logbooks to identify the species and support the veracity of the information, as it was implemented in the present monitoring.

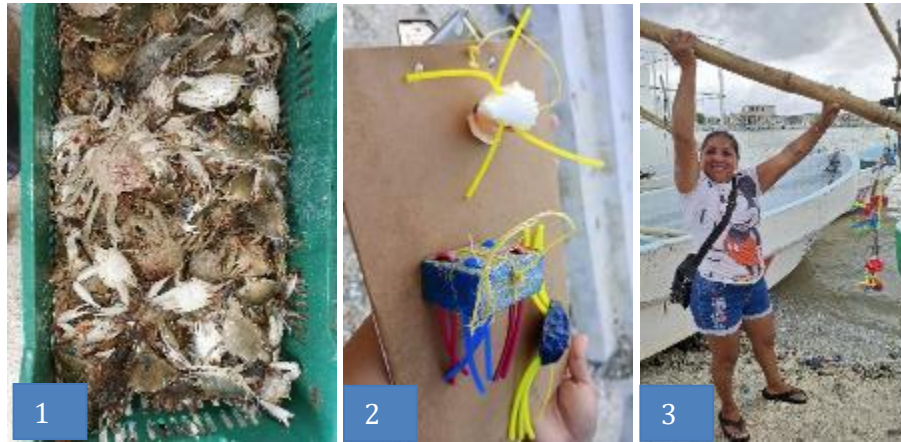
9. The people trained in the use of PD from the FPU incorporated into the FIP showed great ease in acquiring the expertise to record their fishing information and in using the PD dashboard to share information.
10. The PD electronic loookg used as a tool to monitor the octopus fishery by the FPU incorporated into the FIP, proved to be extremely practical in terms of the ease of uploading, saving and downloading fishing information at any time and place.
11. PD proved to be a timely tool in terms of the short time required to record information and the possibility of immediate review by people involved in the issue such as CSOs, academics and/or government agencies, which in certain cases, like the octopus fishery, they require access to information promptly and accurately.
12. The people trained in the use of PD will continue to be monitored to implement the Octopus Fisheries Monitoring during the rest of the 2025 season, in the same way new people from the new UFP (PULMERO S.A. de C.V. and BLUEBAK S.A. de C.V.) that join the octopus FIP will be trained.

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## Annex I. Photographic evidence of the FPU bait and lures use in the 2024 season.



1. Fresh bait purchase (Blue Crab and Maxquil) in August 2024, Municipality of Celestún in Yucatan.
2. Three types of homemade lures used in Celestún in November 2024.
3. Fisherwoman holding a jimba (bamboo pole) with attached homemade lures, in October, in Celestún.
4. Reception of fresh bait (Ocol) for MASPESCA in August 2024, Municipality of Progreso in Yucatan.
5. Reception of fresh bait (Ocol) for PROMARMEX in September 2024, Municipality of Progreso in Yucatan.
6. Comparison of a Maxquil crab with a Tío Me lure.
7. Carlos Novelo capturing octopus using his patented lures.

## Annex II. Evidence of the Octopus Fisheries Monitoring Training with PescaData to the octopus FIP fishing organizations for the 2024.



Figure 1. People trained in octopus fisheries monitoring and PescaData from the fishing organizations incorporated into the FIP in Progreso, Yucatán.



Figure 2. People trained in octopus fisheries monitoring and PescaData from the fishing organizations incorporated into the FIP in Celestún, Yucatán.



Figure 3. Fisherwomen trained in fisheries monitoring conducting octopus biometric assessments at the Novelos Cooperative in Celestún, 2024.

## Annex III. OCTOPUS FISHERIES MONITORING TRAINING WITH PESCADATA SEASON 2024

### AGENDA

**Place and Date:**

Stella Maris, Progreso, Yucatán on Thursday, July 18 from 9:30 a.m. to 12:30 p.m. (Mexico City/Merida time).

Celestún, Yucatán (place to be defined) on Friday, July 19 from 9:30 a.m. to 12:30 p.m. (Mexico City/Merida time).

**Particular objective:** To provide the monitors of each fishing organization that participate in the FIP-Octopus with the necessary capacities to implement a Fishery/Biological Monitoring of Octopus with PescaData in a correct and timely manner.

**Dynamics of the sessions:** Theoretical presentations of an hour and a half and practical of an hour and a half with spaces for questions.

July 18 in Progreso and July 19 in Celestún 2024		
Timetable	Job Title	Speaker/Institution
<b>PHASE I: GENERAL THEMES</b>		
09:30 - 10:30	<ul style="list-style-type: none"> <li>● Sustainable fishing</li> <li>● FIP-Octopus</li> <li>● Fisheries Monitoring</li> <li>● PescaData</li> </ul>	<b>Polo Bajaras (COBI)</b>
<b>PHASE II: BIOLOGICAL INFORMATION OF OCTOPUSES</b>		
10:30 - 11:30	<ul style="list-style-type: none"> <li>● Octopus sexing</li> <li>● Identification of Yucatan octopus species</li> <li>● Biometrics (mantle length and weight)</li> </ul>	<b>Polo Barajas (COBI)</b>
<b>PHASE III: PESCADATA AND BOARD</b>		
11:30 - 12:30	<ul style="list-style-type: none"> <li>● PescaData- PescaData Sections</li> <li>● Electronic log logging</li> <li>● Dashboard information display</li> <li>● Updating information in directory</li> </ul>	<b>Polo Bajaras (COBI)</b>

# Technical sheet for the collection and registration of octopus biometrics in PescaData

Prepared by: M. en C. Marco Polo Barajas-Girón y Biol. Mar. Lorena Rocha-Tejeda

July 2024



### Points to remember when uploading an octopus log in PescaData:

- For **smaller boats** , a log per boat is uploaded daily for each day of fishing.
- For **medium-height** boats, a log is uploaded per boat for each fishing trip.
- The bait used must be recorded in each log (species, quantity in kilos and cost) As evidence of the registered bait, it is important to take a photo of the notes / purchase receipts and the bait purchased, and upload it to Google Drive in its folder corresponding to your fishing organization:  
[https://drive.google.com/drive/folders/1Bbbj2oy36YXynaQrRIKLSkzKUOqbGeA7?usp=\\_sharing](https://drive.google.com/drive/folders/1Bbbj2oy36YXynaQrRIKLSkzKUOqbGeA7?usp=_sharing) →

### Characteristics to identify between species:












Especie	Falso ocelo	Patrón dorsal	Patrón umbrella	Ventosas agrandadas
 <i>Octopus maya</i>			NO PRESENTA	En la 8ª y 9ª fila
 <i>Octopus hummelincki</i>			NO PRESENTA	?
 <i>Octopus insularis</i>	NO PRESENTA			En la 8ª y 9ª fila
 <i>Octopus americanus</i>	NO PRESENTA		NO PRESENTA	En la 7ª y 8ª fila

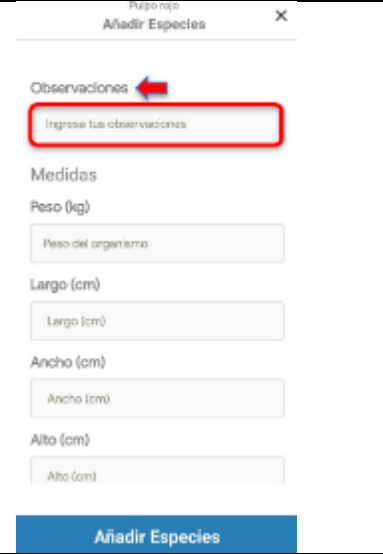
Figure 1. File with images and information of Dr. Otilio Avendaño y Biol. Celso Cedillo

In the log, within the section to add the species caught (PescaData), add in observations the characteristics by which you identified the species (Figure 1), for example:

- False Ocelo
- Dorsal pattern
- Umbrella pattern
- Enlarged suction cups

The common names of the species in PescaData are:

- Paton octopus (*O. vulgaris*)
- Red octopus (*O. maya*)
- Brazilian reef octopus (*O. insularis*)



### 1. To measure HEIGHT Dorsal mantle length (LMD) and total length (LT)→

1.1. Octopus extended with eyes up (dorsal part).

1.2. With a tape measure, measure from the middle of the eyes to the tip of the mantle, taking to the rigid part, without stretching the skin. 1.3. Write down the length in centimeters.

**NOTE:** it is measured in centimeters (cm), only the number is recorded in PescaData and the millimeters are pointed, for example: 13.5



Image by Dr. Otilio Avendaño



Image by COBI

<p>Image by Dr. Otilio Avendaño</p> <p>LMD: Mantle length LT: Total length FO: False ocelo</p>	<p>Image by Dr. Otilio Avendaño</p> <p><b>NOTE:</b> Be careful not to measure stretched skin as seen in this photo.</p>
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**2. To measure the WEIGHT Total weight →devierated**

<ol style="list-style-type: none"> <li>2.1. Turn on the scales</li> <li>2.2. Place a container on the balance.</li> <li>2.3. Press the "Tare" or "Z/T" button to mark zeros.</li> <li>2.4. Choose an octopus at random, <u>drain the excess water</u> and place it in the container on the scale.</li> <li>2.5. Write down the weight in grams.</li> </ol> <p><b>NOTE: the whole octopus is weighed and recorded in kilos (Kg), only the number is registered in PescaData, for example: if an octopus weighs 855 grams it will be written: 0.855</b></p>	<p>Free access image</p>
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**3. To do the SEXING between male or female**

3.1. Place the octopus with the eyes upwards. 3.2. Count the third arm on the right side and check it. If it has a white channel (hectocotyl), then it is male, otherwise it is female. In case of being mutilated of the third arm, it will be undifferentiated, so no sex data will be put.

Step 1: Accommodate the octopus



Image by Dr. Otilio Avendaño

Step 2. Identify hectocotyl

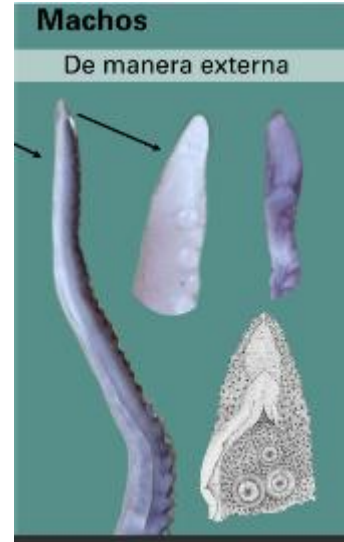


Image by Dr. Otilio Avendaño

Hectocotilo



Image by Sheila Castellanos

#### 4. REGISTRATION OF MEASURES IN [PESCADATA](#)

<p><b>Step 1.</b> Login to PescaData</p>	<p><b>Step 2.</b> Open a new log (+ sign)</p>	<p><b>Step 3.</b> Select desired options and click "Continue" (blue bar)</p>
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<p><b>Step 4.</b> Select the "Capture" and "Add species" option</p>	<p><b>Step 5.</b> Select the desired species</p>	<p><b>Step 6.</b> In the "Measurements" section, record the devierated weight in the "Weight (kg)" option and enter LM in the "Length (cm)" section (number only)</p>

**5. REGISTRATION OF BAIT IN [PESCADATA](#)**

**Step 1.** Press black circle with "+" sign to add more biometrics



Fuipo rojo  
Añadir Especies

Falso ocelo, patrón dorsal red saturada

Medidas:  
Alto (cm)  
Alto (cm)

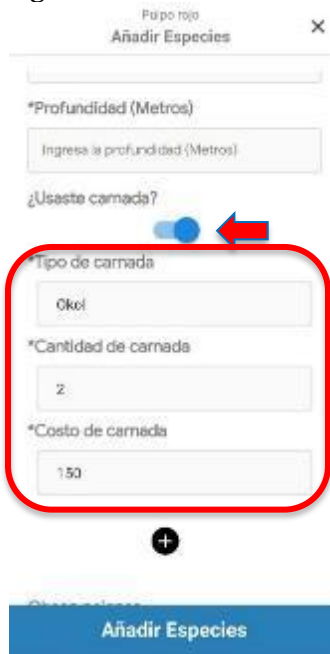
Madurez  
Madurez

Datos de sexo  
Macho Hembra

+

Añadir Especies

**Step 2.** Scroll down to the "Did you use bait?" option., and slide the blue ball to the right to activate it.



Fuipo rojo  
Añadir Especies

\*Profundidad (Metros)  
Ingresar la profundidad (Metros)

¿Usaste carnada?

Tipo de carnada  
Okal

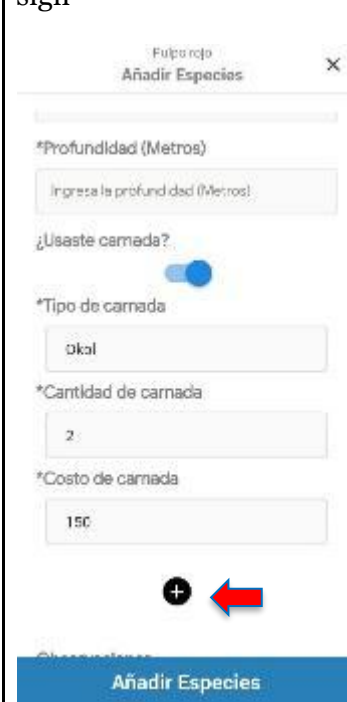
\*Cantidad de carnada  
2

\*Costo de carnada  
150

+

Añadir Especies

**Step 3.** Record bait data. If different baits were used, add more records in the "+" sign



Fuipo rojo  
Añadir Especies

\*Profundidad (Metros)  
Ingresar la profundidad (Metros)

¿Usaste carnada?

\*Tipo de carnada  
Okal

\*Cantidad de carnada  
2

\*Costo de carnada  
150

+

Añadir Especies