Latin American Journal of Aquatic Research, 54(1): 136-142, 2026
DOI: 10.3856/vol54-issue1-fulltext-3437

Short Communication

Describing the fleet of unregulated modified artisanal vessels "lanchones" targeting grouper and associated species on the Campeche Bank

Iván Oribe-Pérez[1], Alejandra Toro-Ramírez[1]
Armando T. Wakida-Kusunoki[1] & Juan Espinoza-Méndez[1]
[1]Instituto Mexicano de Investigación en Pesca y Acuacultura Sustentables
Centro Regional de Investigación Acuícola y Pesquera-Yucalpetén, Yucatán, México
Corresponding author: Alejandra Toro-Ramírez (aleiux16@gmail.com)

ABSTRACT. The decline in fishery production has driven technological changes and increased fishing effort, threatening sustainability. On the Campeche Bank, artisanal vessels have been modified to enhance their autonomy and their capacity to catch grouper and associated species. These vessels are converted into "lanchones" through transverse, longitudinal, or combined cuts to extend their overall length and beam, followed by raising the gunwale and molded depth. These vessels are not regulated under Mexican law, and their operational dynamics are unknown. The analysis reveals that their average catch volume is comparable to that of the semi-industrial fleet. Still, their species composition is similar to that of the artisanal fleet, positioning them with an operational profile between both fishing segments. However, they use more hooks than either fleet, amplifying fishing effort. While the selectivity of the fishing gear surpasses the minimum legal catch size for red grouper, factors such as depth and hook size also influence this outcome. Given that the red grouper population is considered overexploited, it is crucial to assess the impact of these vessels and strengthen regulatory measures to ensure the sustainability of both the resource and fishing activities.

Keywords: lanchones; fishery; catch; effort; red grouper; Campeche Bank, Gulf of Mexico

INTRODUCTION

Global catch increased from the 1950s until the late 1980s, reached a plateau during the 1990s, and has declined since then (Rousseau et al. 2019). Factors such as population growth, the modernization of fishing gears and technologies, and the uncontrolled increase in fishing effort have exacerbated this situation (Pauly et al. 2005, Pontecorvo & Schrank 2012, Rousseau et al. 2019). In particular, the doubling and expansion of the global fishing fleet have led to overcapacity in fisheries, increasing competition for increasingly scarce resources (Pauly et al. 2005, Pontecorvo & Schrank 2012, Quijano et al. 2018).

In this context, the Campeche Bank (CB), one of the most important fishing regions in the Gulf of Mexico, has not been exempt from these processes. The locally known "escama" fishery is one of the most important demersal fisheries in the region. Its multispecies nature characterizes it, involves the capture of at least 20 species, mainly belonging to the families Serranidae and Lutjanidae, among which the red grouper (*Epinephelus morio*) has traditionally been the principal target species (Quijano et al. 2018, Monroy-García et al. 2019, Oribe-Pérez et al. 2023). It is a sequential fishery, where the artisanal fleet (boats 6.5-8.8 m in length) operates mainly in shallow waters (<40 m deep), targeting juvenile (1-6 years) and young adult red grouper, while the semi-industrial fleet (vessels 10-23 m in length) focuses on larger, primarily adult individuals (7-14 years) in deeper waters, reaching depths of up to 200 m (Monroy-García et al. 2019,

Associate Editor: Sergio Neira

Renán et al. 2022, Oribe-Pérez et al. 2023). Notably, the age at which 50% of females reach sexual maturity is around six years (Renán et al. 2022).

Throughout its history, the red grouper fishery has faced significant pressures, including uncontrolled fleet growth and geographic expansion, the increasing mechanization of fishing gear (e.g. the adoption of longlines with hydraulic reels on semi-industrial vessels), and the modernization of vessels (e.g. engine upgrades). Additionally, the artisanal fleet's high catch of undersized juveniles, below the legal size (36.3 cm total length, TL) and the size at first maturity (50.9 cm fork length, FL), has driven growth overfishing, reducing the spawning biomass (DOF 2014). External factors, including investment and subsidies, such as support programs for marine diesel and coastal gasoline (suspended in 2020), and the temporary authorization of fishing permits for the Cuban fleet (suspended in 2022), have further exacerbated these challenges. Collectively, these factors have led to the classification of the grouper fishery as overexploited (DOF 2014).

In recent years, the operation of a fishing fleet composed of modified artisanal vessels, known locally as lanchones, has been observed. Their primary objective is to increase the profitability of fishing trips. This phenomenon exacerbates fishing pressure on red grouper, an already overexploited species, posing an additional challenge to sustainable management in the region. In this context, understanding fishing capacity, the allocation of fishing effort, and fleet dynamics are crucial aspects for the management and regulation of fisheries (Coronado-Castro et al. 2013, Quijano et al. 2018, Oribe-Pérez et al. 2023). The objective of this study was to physically characterize the lanchones and compare their effort with that of other vessels used in the region. Additionally, their operational dynamics in fishing were analyzed, including the allocation of fishing effort and the commercial composition of their catches. Finally, the length of the first catch of the main target resource was estimated to assess whether the fishing gear complies with the minimum catch size regulations.

The characterization of the lanchones was conducted by recording the vessels' original factory specifications and measuring physical modifications, including overall length (LOA), beam, and molded depth. Additionally, data were collected on the vessels' maximum provisioning capacities, including fuel, ice, bait, and catch storage, as well as on their spatial arrangement within the vessel. To gather information on the dynamics of fishing operations, monthly visits were conducted between 2019 and 2024 at the main ports of Yucatán (Celestun, Sisal, Progreso, Dzilam de Bravo, San Felipe, and Rio Lagartos). Structured interviews were carried out with the captains of modified small-scale vessels (lanchones) upon their return to port (Bernard 2017). These interviews gathered information on target species, fishing gear, fishing area (heading, distance from shore, and depth), trip duration, effective fishing days, total crew members, and catch per trip (kg). The captains' fishing area data were used to estimate and manage coordinates in Garmin MapSource to determine the spatial distribution of fishing activity. Given the irregular frequency of fishing trips, affected by market demand, prior earnings, opportunity costs, and weather conditions, the sampling approach was opportunistic (Salas et al. 2019). Other factors reducing fishing effort included social conflicts (stemming from the lack of regulation and perceptions that lanchones reduce catches for other fleets), shifts in target species and fishing seasons (e.g. octopus, lobster), bait availability, and temporary port closures due to adverse environmental conditions, all of which limit the number of days at sea.

Since the lanchones fishery primarily targets red grouper, as confirmed through interviews with fishers, landing observations, and the commercial size categories the length at first capture (L_{50}) was estimated, defined as the size at which approximately 50% of individuals in a population are retained by the fishing gear, was estimated using a logistic model (Sparre & Venema 1998), was applied, expressed by the following equation: $S_L = 1/1 + \exp(S_1 - S_2 \times L)$, where S_L is the retention probability (selectivity curve), S_1 (intercept) and S_2 (slope), L represents the size class mark. Twenty-five size classes were used (30-80 cm TL, with a 2 cm interval). Based on observed and estimated data, the fit of the selectivity curve was performed using a nonlinear least-squares model with the *nls* function, and 95% confidence intervals (CIs) were calculated using the *confint* function, applying the maximum likelihood approximation in the R programming language (R Core Team 2024).

A total of 79 fishing trips conducted by the lanchones between 2019 and 2024 were analyzed, with the red grouper (*E. morio*) as the main target species. No fishing trips were recorded during the red grouper closed season (February-March), and from August to December, a decrease in vessel operations was observed, as many fishers redirected their effort toward the octopus (*Octopus maya*) fishery. Of all monitored localities, 96.3% of the trips were carried out by vessels operating from the port of Celestún, while the

remaining 3.7% originated from Progreso. Fishing grounds of the monitored trips were located at variable distances from the coast (15-215 km) and depths (10-120 m), with most operations concentrated around reef habitats (Fig. 1).

The lanchones are artisanal vessels modified by longitudinal or transverse cuts or a combination of both. Transverse cut (athwartships): the original vessel is divided by a cut along the athwartships line (perpendicular to the ship's side), with one section containing the bow and the other the stern. The outcome of this cut is an increase in LOA. Longitudinal cut: the vessel is divided by a cut along the keel line (an imaginary line running from bow to stern), increasing the vessel's beam. After joining the cut pieces together, the gunwale is raised. The molded depth of the vessel is also increased to the dimensions of a lanchon (Fig. 2). These modifications allow for greater autonomy compared to artisanal vessels, increasing storage capacity (1,800 L of fuel, 8 t of ice, and 800 L of water). The vessels are equipped with two engines: a main engine for navigation and an auxiliary engine for maneuvering. They are also fitted with advanced technology, including GPS, band radios, very high frequency (VHF) radios, and video sounders. These modifications require significant financial investment from vessel owners, which not all fishers can afford, limiting their adoption within the artisanal fleet. Table 1 summarizes the comparative characteristics of the fishing fleets operating in the CB.

The fishing gear used by the lanchones is the longline, which maintains the same basic configuration as that used by the artisanal fleet. However, the main difference lies in the greater length of the mainline, due to the substantial increase in the number of hooks deployed, up to 5,500 circular hooks, ranging in size from 9/0 to 12/0. The average catch and its standard deviation per fishing trip for the registered lanchones were 969 ± 440.6 kg, ranging from 210 to 2,101 kg. These catches were characterized by high species diversity, comprising 31 commercial categories of both bony and cartilaginous fishes. Within the total catch, the most abundant groups were groupers and snappers, accounting for 45 and 38% respectively, followed by elasmobranchs (8%), other species (5%), and carangids (4%). The species with the highest contributions to the catch were *E. morio* (33%), *Lutjanus campechanus* (10%), *Ocyurus chrysurus* (10%), *Mycteroperca bonaci* (8%), and *Lutjanus analis* (8%). A total of 613 red grouper specimens were measured for biometric analysis. Of these, 96% exceeded the minimum size limit (MSL = 36.3 cm TL). The L_{50} for red grouper was estimated at 45.6 cm TL (95% CI: 44.4-46.9 cm TL; Fig. 3).

The crew operating these lanchones is composed mainly of non-local fishers from Campeche, Tabasco, and Veracruz, many of whom have prior experience with this type of vessel gained in their regions of origin, due to the distance from their usual fishing grounds. The lanchones currently used in Celestun originated as adaptations of modified vessels from Sabancuy, Campeche, where similar changes have been observed since 2013. In response to declining catches, fishers from Sabancuy and nearby communities began modifying their artisanal vessels to expand their fishing areas. This model was later adopted by permit holders in Celestun, giving rise to the current lanchones, designed for longer trips, with greater safety and stability, and the possibility of larger catch volumes.

The NOM-065-SAG/PESC-2014 (DOF 2015) specifies that semi-industrial vessels may use up to four longlines with 500 hooks each or a single longline of up to 2,000 hooks of size 14/0 and 15/0. For artisanal vessels, the limit is 250 hooks of sizes 10/0 and 12/0. However, the lanchones register up to 5,500 hooks and include size 9/0, evidence of a lack of specific regulation for these vessels. From 2022 onwards, a reduction in the use of hooks smaller than 10/0 by lanchones has been observed, associated with social pressures and conflicts with other fleets when catching a wider range of prey, particularly juveniles. Recent surveys (2023-2024) reveal discrepancies according to the Mexican Official Standard (NOM-065) and the National Fisheries Chart (CNP). Semi-industrial vessels use between 1,000 and 4,200 hooks of sizes 13/0 to 15/0, artisanal vessels use between 300 and 1,500 hooks of sizes 9/0 to 12/0. This situation urgently requires specific regulations for lanchones and strengthening of hook size and number inspection for all fleets in CB.

The lanchones recorded an average catch comparable to that of the semi-industrial fleet but in fewer fishing days (Coronado et al. 2013, Table 1). Their catch composition reflects the multispecies nature of the red grouper fishery, with over 30 species contributing to the total. However, species composition varies notably depending on gear type, season, and fishing area (Monroy-García et al. 2019). Within species groups, lanchones show a pattern similar to that of the artisanal fleet, with groupers and snappers accounting for approximately 80% of the catch (Monroy-García et al. 2019). On the other hand, in the semi-industrial fleet, *E. morio* constitutes up to 64% of the catch, while the dominant snapper, *L. campechanus*,

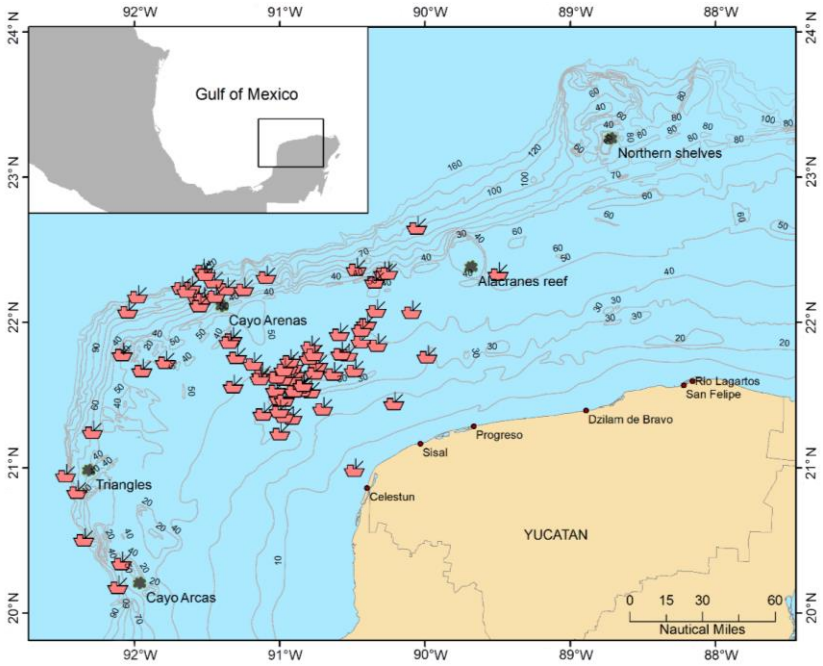

Figure 1. Fishing zone of the lanchones monitored during the study in the Campeche Bank (isobath depths are in meters).

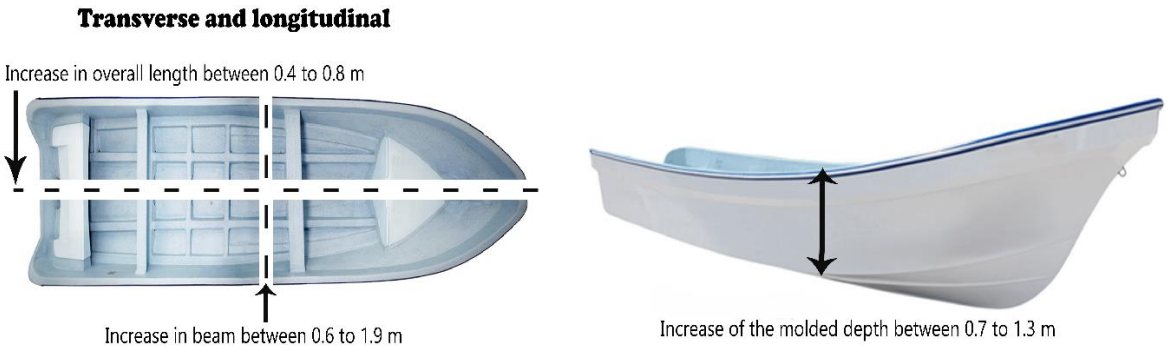

Figure 2. Increase in overall length, beam, and molded depth (m) of the lanchones according to the cuts made.

represents 10% of the total catch (Coronado-Castro & Salas 2012, Coronado-Castro et al. 2013). It is important to note that *L. campechanus* is rarely found in landings from the artisanal fleet, as this species typically inhabits depths greater than 30 m (Froese & Pauly 2024) and shows higher abundance in the Sonda de Campeche, southern Gulf of Mexico (Valle-Esquivel et al. 2019). These data suggest that the lanchones operate within a depth range that overlaps with the fishing grounds of both the artisanal and semi-industrial fleets, allowing them to capture species characteristic of both fleets. In addition, their concentration around reef areas, which are inaccessible to the artisanal fleet, represents an advantage resulting from the adaptations made to these vessels, enabling them to reach hard-bottom and coral habitats where adult red grouper is commonly found, offshore and dominating the continental shelf north of the Yucatán Peninsula (DOF 2014). In terms of gear selectivity, the L_{50} estimated for red grouper in this study was higher than the MSL established in NOM-065-PESC-2014 (DOF 2015), as well as the L_{50} reported for the same gear in the artisanal fleet east of CB (Ruiz-Pineda 2019). Brulé et al. (1999) estimated the length of first sexual maturity for red grouper at 50.9 cm FL. In this study, 34% of the individuals exceeded this length (Fig. 3). Caution is advised when interpreting these results, as they indicate that the fishing gear is selective and allows a considerable proportion of fish to reach or exceed the minimum legal size before being caught. Nonetheless,

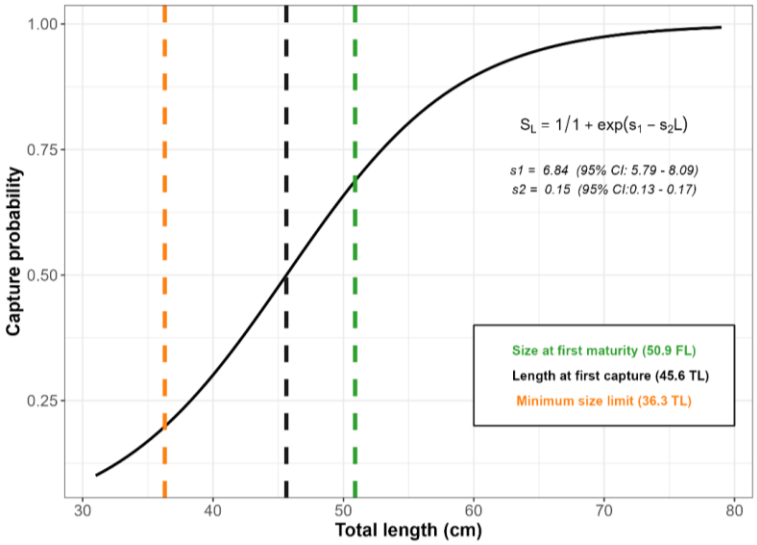

Figure 3. Selectivity model of red grouper captured by lanchones with 95% confidence intervals (CI) and reference values. FL: fork length, TL: total length.

Table 1. Characterization of the vessels that catch red grouper in the Campeche Bank (minimum-maximum capacity). OE: outboard engine. The average and standard deviation per trip for the period from 2019 to 2024 were calculated by the Mexican Institute for Research in Sustainable Fisheries and Aquaculture. SD: standard deviation.

Characteristic	Artisanal fleet	Lanchones	Semi-industrial fleet
Overall length (m)	6.5-8.8	8-10.3	10-23
Engine type	OE	Main OE (90-150)	Stationary engine
(HP)	(30-90)	OE auxiliar (75-90)	(115-500)
Number of vessels	4,000	Approximately 30	517
Operating range (m)	<40	<150	<300
Travel time (d)	1-2	5-20	22
Number of crew members	2-3	4-6	4-6
Product storage capacity (t)	1	> 2	> 10
Average catch per trip (kg) ± SD	51.6 ± 67.3	969 ± 440.6	1,322 ± 756

selectivity can vary according to factors such as hook size and fishing depth, which directly affect the species and size composition of the catch.

One limitation of the analysis of groupers caught by this fleet is that small specimens may be underrepresented in the samples due to the dynamics of unloading and product distribution by the vessels' crews. Smaller fish are usually consumed by the crews themselves or sold directly at the local market, reducing their availability for biometric analysis. This behavior occurs across all fleets operating in the region, although the exact value remains unknown. Ramos-Miranda et al (2021) mention that in artisanal fishing, this value is around 5%. The lanchones classify groupers into commercial categories based on size: small (<0.6 kg), medium (0.6-1.5 kg), large (1.5-2.3 kg), and up (2.3-2.8 kg). According to the weight-length relationship obtained from fishery-independent research cruises between 1986 and 2018 (weight = $0.0051TL^{3.24}$, R^2 = 0.97, n = 11,496), the MSL corresponds to a weight of 577 g. Although smaller individuals were not available for direct biometric measurements, their relative abundance was inferred from the commercial size categories reported by the lanchones. Based on these records, the proportion of small groupers ranged from 0 to 48%, with an average of 12% of the total catches. These results indicate that this fleet exerts higher fishing pressure on juvenile red grouper.

The operation of lanchones in the CB fishery illustrates how technological adaptations, driven by historical declines in catches, can exacerbate overfishing. These vessels combine the versatility of

the artisanal fleet with lower fuel costs, capture a broad diversity of species, and have an operational capacity comparable to the semi-industrial fleet, thus expanding fishing effort across a bathymetric range shared by both fleets. Technical modifications to lanchones (e.g. higher hook density, extended fishing duration, and greater engine power) enhance their catchability, leading to elevated extraction rates of vulnerable stocks such as red grouper. The excessive and unregulated use of hooks in all fleets threatens resource sustainability and fosters inter-fleet competition. In conclusion, our findings highlight that the expansion of lanchones increases fishing pressure on red grouper, an already overexploited resource, and contributes to conflicts with other fleets. This fleet represents an emerging challenge that requires specific regulation and harmonized operational limits to ensure sustainability.

Additionally, the scarcity of juveniles in the samples suggests a potential impact on early life stages that should be considered in future assessments and management measures. It is also important to quantify the provisioning and operational costs associated with lanchones fishing trips, as these represent a substantial economic burden for operators. A future cost-benefit analysis would therefore be valuable to evaluate the profitability and long-term viability of this fishing strategy within the artisanal sector.

Credit author contribution

I. Oribe-Pérez: conceptualization, validation, methodology, formal analysis, writing and original draft; A. Toro-Ramírez: funding acquisition, project administration, review and editing; A.T. Wakida-Kusunoki: conceptualization, validation, methodology, supervision, review and editing; J.C. Espinoza-Méndez: methodology, data curation and editing.

Conflict of interest

The authors declare no conflict of interest.

REFERENCES

Bernard, H.R. 2017. Research methods in anthropology: Qualitative and quantitative approaches. Rowman & Littlefield, Maryland.

Brulé, T., Déniel, C., Colás-Marrufo, T., et al. 1999. Red grouper reproduction in the southern Gulf of Mexico. Transactions of the American Fisheries Society, 128: 385-402. doi: 10.1577/1548-8659(1999)128<0385:RGRITS>2.0.CO;2

Coronado-Castro, E. & Salas, S. 2012. Características de operación de tres flotas que inciden sobre el mero rojo y especies asociadas en Yucatán, México: Potenciales efectos de externalidades. Proceedings of the 64th Gulf and Caribbean Fisheries Institute, Puerto Morelos, Mexico, pp. 258-268. [http://hdl.handle.net/1834/36176]. Reviewed: March 13, 2025.

Coronado-Castro, E., Salas, S. & Brulé, T. 2013. Estimación de la composición de las capturas y la cuasi-renta de diferentes flotas dirigidas a la pesquería de mero rojo en Yucatán, México. Proceedings of the 65th Gulf and Caribbean Fisheries Institute, Santa Marta, Colombia, pp. 375-383. [http://hdl.handle.net/1834/36338]. Reviewed: March 13, 2025.

Diario Oficial de la Federación (DOF). 2014. Acuerdo por el que se da a conocer el Plan de Manejo Pesquero de Mero (*Epinephelus morio*) y especies asociadas en la Península de Yucatán. Órgano del Gobierno Constitucional de los Estados Unidos Mexicanos. [https://www.dof.gob.mx/nota_detalle_popup.php?codigo=5371525]. Reviewed: March 8, 2025.

Diario Oficial de la Federación (DOF). 2015. NOM-065-SAG/PESC-2014. Para regular el aprovechamiento de las especies de mero y especies asociadas, en aguas de jurisdicción federal del litoral del Golfo de México y Mar Caribe. Órgano del Gobierno Constitucional de los Estados Unidos Mexicanos. [https://www.dof.gob.mx/nota_detalle_popup.php?codigo=5399372]. Reviewed: March 8, 2025.

Froese, R. & Pauly, D. (Eds.). 2024. FishBase. World Wide Web electronic publication. [www.fishbase.org]. Reviewed: March 8, 2025.

Monroy-García, C., Gutiérrez-Pérez, C., Medina-Quijano, H., et al. 2019. La actividad pesquera de la flota ribereña en el estado de Yucatán: Pesquería de escama: Instituto Nacional de Pesca y Acuacultura, Guadalajara.

Oribe-Pérez, I., Velázquez-Abunader, I. & Monroy-García, C. 2023. Factors affecting the relative abundance in an overfished stock: Red grouper (*Epinephelus morio*) in the southeastern Gulf of Mexico. PeerJ, 11: e16490. doi: 10.7717/peerj.16490

Pauly, D., Watson, R. & Alder, J. 2005. Global trends in world fisheries: Impacts on marine ecosystems and food security. Philosophical Transactions of the Royal Society B: Biological Sciences, 360: 5-12. doi: 10.1098/rstb.2004.1574

Pontecorvo, G. & Schrank, W.E. 2012. The expansion, limit and decline of the global marine fish catch. Marine Policy, 36: 1178-1181. doi: 10.1016/j.marpol.2012.03.005

Quijano, D., Salas, S., Monroy-García, C., et al. 2018. Factors contributing to technical efficiency in a mixed fishery: Implications in buyback programs. Marine Policy, 94: 61-70. doi: 10.1016/j.marpol.2018.05.004

R Core Team. 2024. R: A language and environment for statistical computing. R Foundation for Statistical Computing. [https://www.R-project.org/]. Reviewed: March 8, 2025.

Ramos-Miranda, J., Cabrera, M.A., Salas, S., et al. 2021. Especies comerciales de la pesca artesanal en la Península de Yucatán. Universidad Autónoma de Campeche, Centro de Investigación y de Estudios Avanzados del IPN Unidad Mérida, Universidad Nacional Autónoma de México, Ciudad de México.

Renán, X., Brulé, T., Galindo-Cortes, G., et al. 2022. Age-based life history of three groupers in the southern Gulf of Mexico. Journal of Fish Biology, 101: 857-873. doi: 10.1111/jfb.15145

Rousseau, Y., Watson, R.A., Blanchard, J.L., et al. 2019. Evolution of global marine fishing fleets and the response of fished resources. Proceedings of the National Academy of Sciences, 116: 12238-12243. doi: 10.1073/pnas.1820344116

Received: May 19, 2025; Accepted: November 28, 2025

Ruiz-Pineda, C. 2019. Caracterización de las operaciones de la pesca artesanal del recurso escama en Río Lagartos, Yucatán. Master's thesis, Instituto Politécnico Nacional, Mérida.

Salas, S., Torres-Irineo, E. & Coronado, E. 2019. Towards a métier-based assessment and management approach for mixed fisheries in southeastern Mexico. Marine Policy, 103: 148-159. doi: 10.1016/j.marpol.2019.02.040

Sparre, P. & Venema, S.C. 1998. Introduction to tropical fish stock assessment. Part 1. FAO Fisheries Technical Paper. No. 306.1, Rev. 2. FAO, Rome.

Valle-Esquivel, M., Adlerstein-González, S. & Chávez-Villegas, J.F. 2019. Pre-assessment of the red snapper (*Lutjanus campechanus*) fishery in the Campeche Bank, Gulf of Mexico, Mexico, using bottom and vertical longlines. Report No. US 2624. MRAG Americas, Florida.