



Advances in biology through agronomy, aquaculture, coastal and environmental sciences

— Volume II —

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Editors

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**Advances in biology through
agronomy, aquaculture, coastal and
environmental sciences**
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Advances in Biology through Agronomy, Aquaculture, Coastal and Environmental Sciences, Volume II, is an e-book that continues the work of the first version (<https://editorapantanal.com.br/ebooks/2023/advances-in-biology-through-agronomy-aquaculture-coastal-and-environmental-sciences/ebook.pdf>), published in 2023 by Leandris Argente-Martínez and Ofelda Peñuelas-Rubio.

Our e-book compiles 25 manuscripts that present scientific results and reviews based on biological aspects. All of them contribute to explaining the responses of living organisms to agricultural, aquaculture, and coastal ecosystems, as well as those facing fragility or threat of climate change. This e-book was edited by Leandris Argente-Martínez, Ofelda Peñuelas-Rubio, and Joe Luis Arias-Moscote, members of the Consolidated Academic Group ITVAYA-CA-3.

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Notes on the recreational fishing of snook (*Centropomus* spp.) in the coastal zone of Centla, Tabasco, Mexico

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ABSTRACT

Snook sport fishing (*Centropomus* spp.) is a socioeconomic and recreational pillar in southeastern Mexico. This research characterized the recreational fishery in Centla, Tabasco, using biological, operational, and regulatory frameworks. Through access-point intercept surveys and biological sampling during a tournament, 18 specimens were identified across two species: common snook (*C. undecimalis*, n = 14) and Mexican snook (*C. poeyi*, n = 4). Morphometric analysis revealed that compared with *C. undecimalis*, *C. poeyi* was significantly larger in terms of size (86.25 ± 3.7 cm) and biomass ($8,251 \pm 861$ g). Both species exhibited negative allometric growth ($b < 3$), a phenomenon linked to high tournament selectivity for large adults. From an operational perspective, the total cumulative effort reached 193.00 angler hours, yielding an overall catch per unit effort (CPUE) of 0.0933 snook/h. Socioeconomically, the activity generated \$337,000.00 MXN in direct revenue, with an average expenditure per angler of \$18,722.22 MXN. Regulatory analysis confirmed strict compliance with NOM-017-PESC-1994, with sizes exceeding 70 cm, ensuring the harvest of sexually mature organisms. In conclusion, sport fishing in Centla is a high-yield sustainable development driver and a strategic biological refuge for the genus *Centropomus*.

Keywords: Recreational fishing, *Centropomus*, Catch unit effort, economic impact, Centla.

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INTRODUCTION

Snooks (family Centropomidae) comprise 13 species of the genus *Centropomus* Lacépède, 1802, which are distributed along both the Atlantic and Pacific coasts of the Americas (Nelson et al. 2016; Carvalho-Filho et al., 2019; Ferreira et al. 2026). Given their abundance and high commercial value, these species represent a socioeconomic mainstay for western Atlantic fisheries, contributing significantly to regional development across Central and South America (Taylor et al. 2000; FAO 2005).

These species are characterized by their frequent occurrence in mangrove ecosystems and their remarkable euryhaline capacity, which allows them to adapt to extreme salinity fluctuations and even establish themselves in inland waters (Allen; Robertson, 1998; Bussing, 1998). Furthermore, owing to the excellent quality of their flesh, they represent a key resource with high socioeconomic value for both recreational and commercial fisheries (Allen; Robertson, 1998; Bussing, 1998; Ortíz et al., 2015).

The primary objective of sport fishing is the capture of organisms for competitive or recreational purposes. It is distinguished from commercial fishing by the explicit prohibition of sale, export, or use for subsistence. In Mexico, this sector is governed by the General Law of Sustainable Fisheries and Aquaculture and, specifically, by NOM-017-PESC-1994, which prohibits the trade of any resulting catch (DOF 1994, 2013).

Geographically, this activity is distributed across more than 159 inland bodies of water. In the northern and central regions, the exploitation of the largemouth bass (*Micropterus salmoides*) is most prominent. Conversely, in the south southeast, specifically in the states of Campeche, Tabasco, and Chiapas, the focus shifts to species such as common snook (*Centropomus* spp.), macabíl (*Brycon guatemalensis*), tenguayaca (*Petenia splendida*), and Atlantic horse mackerel (*Trachurus trachurus*). Under the National Development Plan for this sector, fishing effort is restricted to a single rod per angler, with a maximum daily bag limit of five specimens (Gaspar-Dillanes., 2023).

There has been a marked surge in interest in recreational angling within Mexico's coastal waters. This trend is particularly evident in the southern region, where the activity's growing popularity has spurred the organization of annual tournaments targeting local species, such as snook in southern Veracruz, Tabasco, and Campeche. The objective of the present study was to characterize the recreational snook fishery in the coastal zone of Centla, Tabasco.

MATERIALS AND METHODS

Study site

This study was conducted in the coastal region of the municipality of Centla, Tabasco, within the influence zone of the Pantanos de Centla Biosphere Reserve (CONANP, 2000) and the estuaries of the Grijalva and Usumacinta Rivers. This ecosystem is considered essential for the life cycle of the genus

Centropomus spp. because of the presence of salinity gradients and extensive mangrove forests that support their development.

Study design

We conducted a descriptive and cross-sectional study in the coastal region of Centla, Tabasco. Access-point intercept surveys (Creel Surveys) were employed according to the methods of Pollock et al. (1994). This methodology is the recognized benchmark for assessing fisheries where fishers return to discrete access points, including marinas, boat ramps, and docks.

Socioeconomic and operational data

Structured collection questionnaires were administered to recreational anglers throughout the duration of the tournament. The variables measured included fishing effort, effective fishing time (hours/day) and the number of fishing gear used. Angler Profile: Origin, level of experience, and direct trip-related expenses (fuel, bait, and guide services).

Catch and effort: Catch per unit effort (CPUE) was calculated and defined as the number of snook caught per angler per hour ($CPUE = N/\text{angler-hour}$).

Biological sampling: For the biological characterization of species within the genus *Centropomus*, data were recorded from specimens caught during the tournament:

Identification: Dichotomous keys by Rivas (1986) were used to differentiate sympatric species, such as *Centropomus*.

Morphometrics: Measurements of total length (TL) and total weight (TW).

Size structure: Data were grouped into size-class intervals to analyze the distribution of the exploited population.

Regulatory analysis: Compliance with NOM-017-PESC-1994, which regulates recreational fishing in Mexico, was evaluated by verifying daily bag limits (5 specimens per angler in inland/coastal waters) and the minimum size limits suggested in local management plans.

Statistical Analysis

Data normality was assessed using the Shapiro–Wilk test, and homogeneity of variance was evaluated with Levene’s test. To compare the mean total length (TL) between *C. undecimalis* and *C. poeyi*, an independent samples Welch’s t test was performed, with the significance level set at $\alpha = 0.05$.

RESULTS AND DISCUSSION

Socioeconomic and operational results

The analysis of angler profiles and economic impact revealed significant regional dynamics within the municipality of Centla. According to the intercept surveys, the total direct expenditure generated by participants was \$337,000.00 MXN, with an average expenditure per angler of \$18,722.22 MXN (Table 1).

Table 1. Distribution of economic impact and participation by the origin of recreational anglers.

Origin	n	Total expenditure (MXN)	Average expenditure (MXN)	Participation (%)
Villahermosa, Tabasco	8	\$105,000	\$13,125	44.4
Campeche, Campeche	4	\$91,000	\$22,750	22.2
Palenque, Chiapas	2	\$40,000	\$20,000	11.1
Tampico, Tamaulipas	1	\$38,000	\$38,000	5.6
Mérida, Yucatán	1	\$25,000	\$25,000	5.6
Emiliano Zapata, Tabasco	1	\$20,000	\$20,000	5.6
Tenosique, Tabasco	1	\$18,000	\$18,000	5.6
Total/Average	18	\$337,000	\$18,722	100%

Note: *n* = number of anglers; MXN = Mexican Pesos. Expenditures include fuel, guide services, registration fees, and travel logistics.

Although the highest turnout of anglers originated from Villahermosa (44.4%), out-of-state participants from regions such as Tamaulipas and Yucatán recorded the highest average expenditures (> \$25,000 MXN). This highlights the capacity of the Grijalva–Usumacinta system to attract long-range trophy fishing tourism. The economic impact per unit of biomass is significantly greater than that generated by local commercial fisheries, which is consistent with the findings of Espinoza-Tenorio et al. (2011) regarding the potential of recreational fishing as a driver of sustainable economic development in the riparian communities of Tabasco.

From an operational perspective, the total cumulative effort reached 193.00 angler hours, yielding an overall catch per unit effort (CPUE) of 0.0933 snook/h. When the data were disaggregated, the species-specific CPUE values were virtually identical: 0.0931 for *C. undecimalis* and 0.0937 for *C. poeyi*. This index reflects a requirement of nearly 11 effective hours per catch and highlights that high-end centropomid fishing demands significant technical proficiency. Furthermore, these results support the hypothesis that *C. poeyi* is less susceptible to lures than to congener within these estuarine environments.

Biological sampling results

A total of 18 specimens of the genus *Centropomus* were analyzed, all of which were harvested during a recreational fishing tournament in the coastal region of Centla, Tabasco. Taxonomic identification using the keys of Rivas (1986) confirmed the sympatric occurrence of two species: common snook (*C. undecimalis*, n = 14) and Mexican snook (*C. poeyi*, n = 4). The predominance of *C. undecimalis* in the landings suggests either a greater relative abundance or a heightened susceptibility of this species to sportfishing efforts at the Grijalva and Usumacinta River mouths during February. These observations are consistent with the distribution patterns reported by (Arévalo-Frías; Mendoza-Carranza., 2014; Mendoza-Carranza et al. 2010) for this deltaic system.

Morphometric analysis revealed significant dimensional differences between the two species (Table 2). Compared with *C. undecimalis* (77.12 ± 4.9 cm), *C. poeyi* was significantly longer (86.25 ± 3.7 cm), as validated by Welch's t test (Welch, 1938) ($t = -3.96$, $p = 0.0067$). This disparity in size suggests that, within the context of the tournament, the Mexican snook serves as the primary “trophy” target because of its substantially higher mean biomass ($8,251 \pm 861$ g).

Table 2. Biometric parameters and length-weight relationship of the captured species.

Species	n	Mean TL (cm)	Mean BW (g)	b	R ²	K
<i>C. undecimalis</i>	14	77.12 ± 4.9	$5,483 \pm 990$	2.37	0.65	1.19 ± 0.13
<i>C. poeyi</i>	4	$86.25 \pm 3.7^*$	$8,251 \pm 861$	2.29	0.96	1.28 ± 0.04

Note. Asterisk (*) indicates a significant difference ($p < 0.01$). TL = Total Length; BW = Body Weight; b = allometry coefficient; K = condition factor.

The obtained allometry coefficients (2.37 for *C. undecimalis* and 2.29 for *C. poeyi*) indicate negative allometric growth ($b < 3$). These values are lower than those reported by Perera-García et al. (2008), who reported growth near isometry ($b = 2.98$) in wild populations within the Pantanos de Centla Biosphere Reserve. However, this divergence can be attributed to the selectivity of the landing site intercept surveys (Creel Surveys); by focusing on large individuals, these surveys introduce a statistical bias that flattens the slope of the length-weight regression. Despite the low allometry, the condition factor (K) remained above 1.1 for both species, indicating a robust physiological state and adequate energy availability within the estuarine ecosystem during the sampling period.

Regulatory compliance analysis

The analysis confirmed strict adherence to NOM-017-PESC-1994, as no recorded catches exceeded the daily limit of five specimens per angler. Furthermore, all individual lengths exceeded 70 cm,

ensuring that the harvested organisms were above the size at first sexual maturity reported for these species in the Gulf of Mexico.

CONCLUSIONS

Biological and operational assessments of the 2025 Frontera Sport Fishing Tournament in Centla, Tabasco, demonstrate the coexistence of two sympatric species of high ecological and recreational value: *C. undecimalis* and *C. poeyi*. The statistically validated morphometric superiority of *C. poeyi* establishes it as the quintessential trophic species of the region, despite the need for significantly greater fishing effort (CPUE). While both taxa exhibited negative allometric growth ($b < 3$), this phenomenon is identified as an artifact of the tournament's high selectivity for large adults; this, coupled with an optimal condition factor (K), confirms the robust population health of centropomids within the Grijalva–Usumacinta Delta.

From a socioeconomic perspective, the results underscore that recreational fishing within the Pantanos de Centla Biosphere Reserve is a high-yield development driver, generating a per capita economic impact that far exceeds that of traditional artisanal fishing. Strict compliance with NOM-017-PESC-1994, as evidenced by the exclusive landing of mature organisms (>70 cm), validates this activity as a model for sustainable use. In conclusion, the coastal zone of Centla is reaffirmed as both a strategic biological refuge and a premium recreational sanctuary; its proper management is not only an environmental necessity but also an indispensable economic investment for the sovereignty of aquatic resources in southeastern Mexico.

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