



Atlantic sharpnose shark *Rhizoprionodon terraenovae* (Elasmobranchii, Carcharhinidae) diet from Veracruz, Mexico

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Abstract: A stomach content analysis was performed on 55 samples of Atlantic sharpnose shark *Rhizoprionodon terraenovae* collected from a fishing cooperative Veracruz, Mexico during October 2019-March 2020. Finfish species, as *Mugil curema* were the dominant items and the shark trophic level was 4.1.

Key words: Feeding habits, trophic level, Levin's index.

Dieta del cazón de playa *Rhizoprionodon terraenovae* (Elasmobranchii, Carcharhinidae) de Veracruz, Mexico. Resumen: Se hizo el análisis estomacal de 55 muestras de *Rhizoprionodon terraenovae* coleccionados por la cooperativa pesquera de Veracruz, México durante octubre 2019 – marzo 2020. Los peces óseos, como *Mugil curema* fueron el ítem más importante y el nivel trófico de los tiburones fue de 4.1.

Palabras clave: Hábitos alimentarios, nivel trófico, índice de Levin.

The Atlantic sharpnose shark *Rhizoprionodon terraenovae* is distributed in the Western Atlantic from New Brunswick, Canada, the Gulf of Mexico and Brazil. It is the most captured resource by the Mexican artisanal fishery in the coastal zone of the Gulf of Mexico, being the states of Veracruz and Campeche the ones with the highest catch records (Zea de la Cruz 2012, Reyna-Matezans 2015). In the locality of Chachalacas, Veracruz, the species *R. terraenovae* has a high capture rate generating the highest economic source (Recio-Silva 2016, Rios-Fuentes 2018). Although the importance of knowing the food habits of sharks and their role within the food has been stressed, few elasmobranch species in the area of Veracruz have been studied under these parameters (Wetherbee *et al.* 2012, Barría-Oyarzo 2017). On the other hand, the trophic level is the position of a species within the food web based what it feeds on and its proportion of each prey. This gives us the idea of the role that a species play within the ecosystem and knowing this, the species

exploitation management should consider not only the target species but also the whole ecosystem. The present work aims to describe the diet of the sharpnose shark *R. terraenovae* caught around the area of Chachalacas, Veracruz, emphasizing its trophic level within the food web.

Stomach samples of *R. terraenovae* were collected in the fishing area of Chachalacas, Veracruz (19°24'48.53"N, 96°19'25.92"O, Fig. 1). The samples were taken once a week from October 2019 to March 2020, sex was determined based on the presence or absence of claspers. The Relative Importance Index in percentage was calculated as $IRI = (\%N + \%W) * \%FO$ (Cortés, 1997). The Morosita-Horn Index between sexes. The Trophic Level (TL) was estimated by means of the Chritensen and Pauly methodology (1992) and using our data complemented from Fishbase web page:

$$TL = 1 + \sum_{j=1}^n ((DC_{ij} TL_j))$$

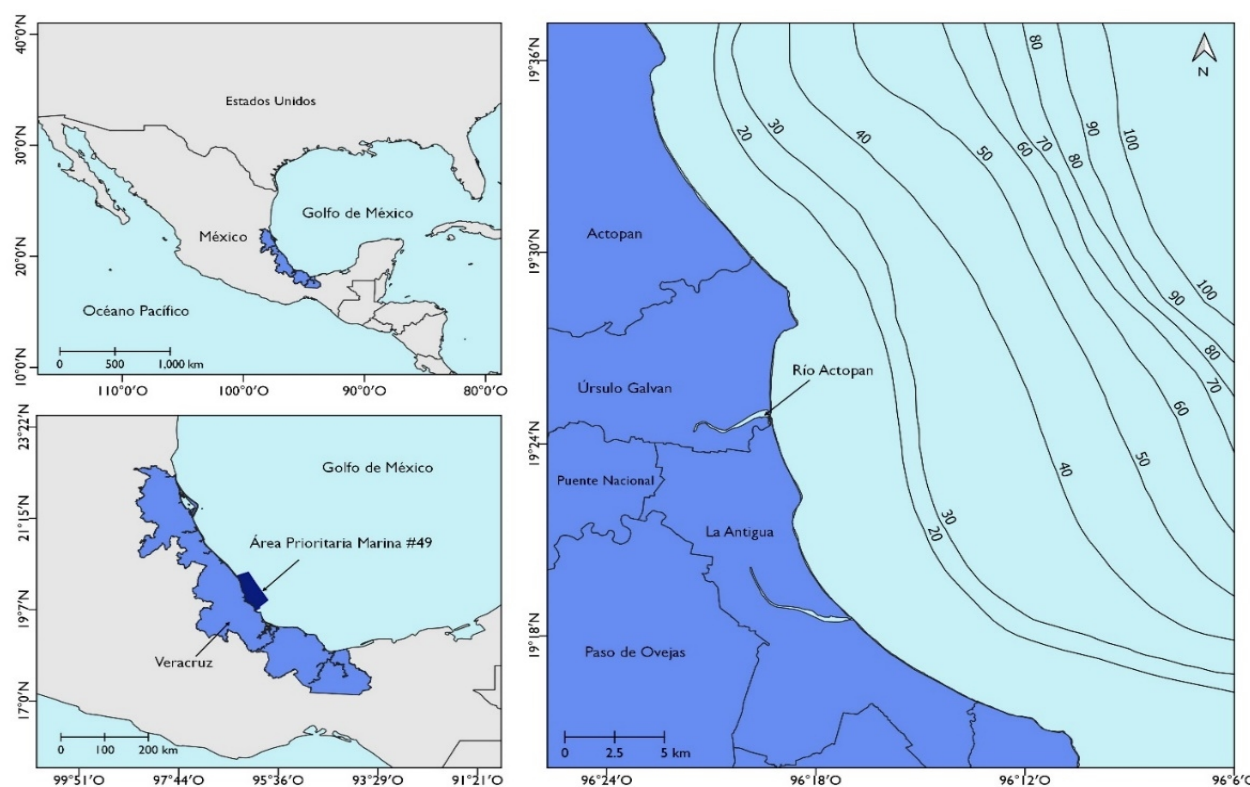


Figure 1. Study area where Atlantic sharpnose shark *Rhizoprionodon terraenovae* were collected in the fishing area, close to Río Actopan in the state of Veracruz, Mexico.

where DC is the proportion of prey (j) within the diet of the predator (i); TL_j is the trophic level of each prey.

A total of 55 stomachs of *R. terraenovae* were collected, of which 31 (56%) were females and 24 (44%) males. Empty stomachs represented 60% and 24% (13) had scanty items. It was observed that of the total number of preys found ($n=22$), 10 (45.5%) were in an advanced or complete state of digestion, while the remaining 12 (54.5%) had fresh or in an intermediate state of digestion (Table I). The species with the highest IRI was *Mugil curema* (Table I) even after sharing Unidentified Organic Matter proportionally with the other items based on their importance.

Considering the sex of the sharks, males have a higher number of food items hence the Morisita-Horn Index between sexes is low ($C_h = 0.19$) (Table II). The trophic niche breadth resulted in a value of 0.46. The TL of *R. terraenovae* calculated from the TL of each of the prey species (Table III) corresponded to a value of 3.8. However, by proportionally including the Unidentified Organic

Matter (UOM) shared with the other items, the TL increased to 4.1.

The mullet (*Mugil curema*) is one a common species within the longline fishery in the study area, with a higher abundance in the months of September to May (Recio-Silva 2016). To date, the capture of mullet has not been recorded in the state of Campeche, which would explain why this species has not been found in the diet of *R. terraenovae* in that area of the southern Gulf of Mexico (García-Alvarez 2014, Flores-Martínez 2017), and therefore, its preference for *Sardinella aurita* (Avendaño *et al.* 2013, García-Alvarez 2014, Viana-Morayta *et al.* 2020). The trophic level estimated after proportionally sharing the unidentified matter is similar to those presented in other studies (Betha *et al.* 2006, Avendaño *et al.* 2013, García-Álvarez 2014, Delorenzo *et al.* 2015). Even though the small sampling size, the results showed that the Atlantic sharpnose shark stands at the top of the trophic web probably helping in a top-down control at some areas of the ecosystem. This idea should be studied in detail in order to develop a better fishery plan in the area.

Table I. Trophic spectrum of Atlantic sharpnose shark *Rhizoprionodon terraenovae* in the fishing zone of Chachalacas, Veracruz. Percent occurrence frequency (%FO), numerical (%N) and gravimetric (%W) data, and the relative importance index (%IRI) are presented. The second set of columns of the same frequencies correspond to values that have been subsequently integrated on the proportional part of the UOM = Unidentified Organic Matter.

PREYS	With UOM				Without UOM			
	%FO	%N	%W	%IRI	%OF	%N	%W	%IRI
TELEOST FISHES								
MUGILIDAE								
<i>Mugil curema</i>	10	9.09	30.51	28.06	12.5	11.37	31.41	30.30
CLUPEIDAE								
<i>Sardinella aurita</i>	5	4.54	6.97	3.41	6.25	5.68	7.87	5.65
CARANGIDAE								
<i>Caranx</i> sp.	5	4.54	9.59	4.55	6.25	5.68	10.49	6.79
OPHICHTHIDAE								
<i>Myrophis punctatus</i>	5	4.54	5.05	2.57	6.25	5.68	5.95	4.81
<i>Myrichthys breviceps</i>	5	4.54	26.15	11.75	6.25	5.68	27.06	13.99
SYNODONTIDAE								
<i>Synodus foetens</i>	5	4.54	9.59	4.55	6.25	5.68	10.5	6.79
Unidentified teleosts	30	36.36	1.22	21.38	37.5	43.18	2.12	23.62
CRUSTACEANS								
SQUILLIDAE								
<i>Squilla empusa</i>	5	4.54	1.83	1.17	6.25	5.68	2.74	3.41
MOLLUSCS								
LOLIGINIDAE								
<i>Loligo</i> sp.	10	9.09	0.95	2.35	12.5	11.37	1.85	4.59
Unidentified Organic Matter	20	18.18	8.1	20.17	-	-	-	-

Table II. Trophic spectrum for males (15) and females (7) of Atlantic sharpnose shark *Rhizoprionodon terraenovae* in the fishing zone of Chachalacas, Veracruz, Mexico from October 2019 to March 2020. Percent frequency of occurrence (%FO), numerical (%N) and gravimetric (%W) data.

Sex	Group	Species	%N	%FO	%W
Males	Fishes	<i>Mugil cephalus</i>	2	2	34
		<i>Myrophis punctatus</i>	1	1	5.8
		<i>Synodus foetens</i>	1	1	11
		<i>Myrichthys breviceps</i>	1	1	30
		Not identified	10	8	10.5
	Mollusks (Cephalopods)	<i>Loligo</i> sp.	2	2	1.1
Females	Fishes	<i>Sardinella aurita</i>	1	1	8
		<i>Caranx</i> sp.	1	1	11
		Not identified	2	2	0.2
	Crustacean	<i>Squilla empusa</i>	1	1	2.1

Table III. Trophic level, habitat type and number of studies on Atlantic sharpnose shark *R. terranovae* prey published by Cortés (1999) and Froese and Pauly (2022). These data were used to compute the trophic level of *R. terranovae* in the present study. (UOM = Undentified Organic Matter). N – number of preys.

Prey	N	Trophic level	Habitat
<i>Mugil curema</i>	2	2.5	Bentho-Pelagic
<i>Sardinella aurrita</i>	1	3.4	Pelagic
<i>Caranx</i> sp.	1	3.56	Pelagic
<i>Myrophis punctatus</i>	1	4.1	Coast
<i>Myrichthys breviceps</i>	1	3.5	Coral reef
<i>Synodus foetens</i>	1	4.5	Coast
Not identifies fish	8	3.24	
<i>Squilla empusa</i>	1	2.2	Benthic
<i>Loligo</i> sp.	2	3.2	Benthic
UOM	4	1	

Ethical statement

The present investigation did not involve the use of regulated animals and did not require approval by an ethical Committee.

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