



Productivity Susceptibility Analysis (PSA) of bycatch in Yucatan Peninsula red and black grouper (*Epinephelus morio* and *Mycteroperca bonaci*) long-line fishery

Fisheries Improvement Project Mexico Yucatan red and black grouper - longline



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Summary

This work applies the risk assessment method known as Productivity and Susceptibility Analysis (PSA) to the fish collected in long-lines, and sometimes hand line in the Yucatan red grouper fishery. List of species include fish caught or registered by FIP members and/or fish reported by regional authors in recent research in Yucatan. In the region there are a large number of researchers who have published many of the articles reviewed. Due to the above, we consider that this is a preliminary report that must be analyzed and validated by the group of experts. This activity is planned to be carried out during the second half of 2022.

List of species included as follows:

Family name	Scientific name	Nombre común	Common name
Balistidae	Balistes capriscus	Escochin, Cochino Gris	Gray Triggerfish
Carangidae	Seriola zonata	medregal rayado, coronado	Banded rudderfish
Carangidae	Trachinotus carolinus	Pampano amarillo	Florida Pompano
Dasyatidae	Dasyatis americana	Raya grande	Southern stingray
Haemulidae	Haemulon plumieri	Chac-chi, boquilla	White grunt
Labridae	Lachnolaimus maximus	Boquinete	Hogfish
Lutjanidae	Lutjanus analis	Pargo criollo, pargo lunarejo	Mutton snapper
Lutjanidae	Lutjanus buccanella	Huachinango boca negra	Blackfin snapper
Lutjanidae	Lutjanus campechanus	Huachinango de castilla	Northern red snapper
Lutjanidae	Lutjanus cyanopterus	Pargo Cubera	Cubera Snapper
Lutjanidae	Lutjanus griseus	Pargo mulato, pargo gris	Grey Snapper
Lutjanidae	Lutjanus jocu	Pargo perro, cabellera	Dog snapper
Lutjanidae	Lutjanus synagris	Rubia, villajaiba	Lane Snapper
Lutjanidae	Lutjanus vivanus	Huachinango ojo amarillo	Silk snapper
Lutjanidae	Orthopristis chrysoptera	Rubia, canane	Yellowtail snapper
Lutjanidae	Rhomboplites aurorubens	Besugo	Vermilion snapper
Malacanthidae	Lopholatilus chamaeleonticeps	Corvinato	Great northern tilefish
Rachycentridae	Rachycentrum canadum	Esmedregal	Cobia
Serranidae	Cephalopholis cruentata	Cabrilla o cherna enjambre	Graysby
Serranidae	Cephalopholis fulva	Mero payaso, cabrilla roja,	Coney
Serranidae	Dematolepis inermis	Mero mármol	Marbled grouper
Serranidae	Epinephelus adscensionis	Cabrilla, payaso verde	Rock hind
Serranidae	Epinephelus drummondhayi	Speckled Hind	Lenteja abadejo Speckled
Serranidae	Epinephelus guttatus	Red Hind	Mero colorado Red hind
Serranidae	Epinephelus itajara	Cherna	Atlantic goliath grouper
Serranidae	Epinephelus mystacinus	Mero listado	Misty grouper
Serranidae	Epinephelus striatus	Mero del caribe, cherna	Nassau grouper
Serranidae	Hyporthodus flavolimbatus (an	Mero negro, fiat	Yellowedge grouper
Serranidae	Hyporthodus nigritus (antes E.)	Cherna pintada	Warsaw grouper
Serranidae	Hyporthodus niveatus (antes E.)	Corvinato	Snowy grouper
Serranidae	Mycteroperca interstitialis	Gallina, mero boca amarilla	Yellowmouth grouper
Serranidae	Mycteroperca microlepis	Abadejo, Gag	Gag
Serranidae	Mycteroperca phenax	Cabrilla, negrilla, abadejo	Scamp
Serranidae	Mycteroperca tigris	Cuna gata o vampiro	Tiger grouper
Serranidae	Mycteroperca venenosa	Guacamayo, arigua	Yellowfin grouper
Sparidae	Calamus bajonado	Mojarron	Jolthead Porgy
Sparidae	Calamus calamus	Pluma calamo	Saucereye Porgy
Sparidae	Calamus campechanus	Cachipluma	Campeche Porgy
Sparidae	Calamus nodosus	Mojarra, pluma, cachipluma	Knobbed Porgy
Carcharidae	Carcharhinus acronotus	Cazón	Blacknose shark
Sphyrnidae	Sphyrna tiburo	Cornuda cabeza pata	Bonnethead



Acronyms

ERAEF	Environmental Risk Assessment for the Effects of Fishing
GMFMC	Gulf of Mexico Fishery Management Council
MSC	Marine Stewardship Council
PSA	Productivity-Susceptibility Analysis
RBF	Risk-Based Framework

Introduction

Productivity-Susceptibility Analysis (PSA) is a semi-quantitative method used to assess the vulnerability of species associated within data deficient fisheries. The method has been refined by the Commonwealth Scientific and Industrial Research Organization (CSIRO) of Australia, based on the method developed by Stobutzki et al. (2001) to evaluate the probability of sustainability of the species of the companion fauna in a fishery. The PSA is part of a broader hierarchical methodology developed by CSIRO, called the Environmental Risk Assessment for the Effects of Fishing (ERAEF), which can be applied to species, habitats or communities with low fishing impact (Hobday et al., 2004; Hobday et al., 2007) and has been used to assess all fisheries managed by the Australian Fisheries Management Authority (Smith et al., 2007) and it is part of the Marine Stewardship Council (MSC) framework.

Data

A preliminary list of species that have appeared within longline used in the fishery was made in the samplings carried out between 2017 and 2021. The data was gathered by fisherman, or at the reception center of FIP members. All the fish that is caught and taken to the reception areas is sold, to the processors or to small local restaurants or used as bait. A total of 43 species were identified as secondary species.

Methodology

In order to determine the risk level for each species, a bibliographic search was carried out in order to get the information available on the species in the region. When species-specific information was not available, information from similar species within the same genus or family was used. When this was not possible, a precautionary approach was considered by assigning the highest risk value.

Productivity and Susceptibility attributes were scored based in tables 1 & 2, and on the information gathered. Trophic level attributes were obtained from Fishbase (2022), or any other detailed information for the species, genus or family.

The score for each component of the PSA was recorded in the “MSC RBF Worksheet”.

The PSA (Figure 1) is based on the assumption that the potential risk of fishing to a species that is directly or indirectly impacted depends on two main components (Stobutzki et al., 2001; Stobutzki et al., 2002; Hobday et al., 2007; Patrick et al., 2010; Hobday et al., 2011; Clarke et al., 2018):

- ❖ Its natural productivity, related to the recovery capacity of the species. This attribute is associated with the biology and ecology of the species..
- ❖ Its susceptibility to being fished, which reflects how exposed it is to fishing activities. This component is related to the characteristics of both the fishing gear and the spatial distribution of the fishery in relation to its natural distribution in the area.

The potential risk associated with the productivity or susceptibility of a particular species was determined with the tools provided by MSC (v 2.1) for applying the RBF.

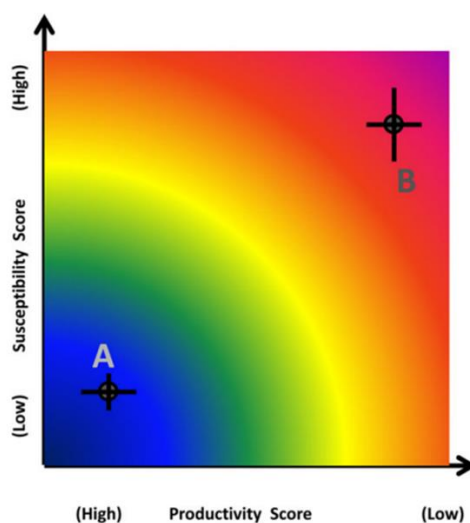


Figure 1. PSA graph with productivity and susceptibility axes, and the risk space divided into regions. If the vulnerability is <math><1.80</math>, the risk is low; if the vulnerability is between 1.80 and 2.20, the risk is medium; and if the vulnerability is > 2.20, the risk is high. The graph has been modified from Stobutzki et al. (2001b), inverting the productivity scale that starts with 3 (high productivity) instead of 1 (low productivity).

The PSA considers eight productivity attributes: average age at maturity, average size at maturity, average maximum age, average maximum size, fecundity, reproductive strategy, trophic level and density dependence (only for invertebrates). The average maximum age and average maximum size are not used for the evaluation of invertebrates. For each of these attributes there are ranges associated with different levels of productivity as presented in Table 1. If the level of productivity associated with the attribute is high, a score of 1 (low risk) is given; if it is medium, 2 (medium risk); and if it is low, 3 (high risk).

Table 1. PSA productivity attributes and scores (from MSC V 2.0)

Productivity attribute	High productivity (Low risk, score = 1)	Medium productivity (medium risk, score = 2)	Low productivity (high risk, score = 3)
Average age at maturity	<5 years	5-15 years	>15 years
Average maximum age	<10 years	10-25 years	>25 years
Fecundity	>20,000 eggs per year	100-20,000 eggs per year	<100 eggs per year
Average maximum size (not to be used when scoring invertebrate species)	<100 cm	100-300 cm	>300 cm
Average size at maturity (not to be used when scoring invertebrate species)	<40 cm	40-200 cm	>200 cm
Reproductive strategy	Broadcast spawner	Demersal egg layer	Live bearer
Trophic Level	<2.75	2.75-3.25	>3.25
Density dependence !! (to be used when scoring invertebrate species only)	Compensatory dynamics at low population size demonstrated or likely.	No dependatory or compensatory dynamics demonstrated or likely.	Depensatory dynamics at low population sizes (Allee effects) demonstrated or likely.

In the case of susceptibility, there are four attributes: availability, which refers to the portion of the horizontal distribution of the species that coincides with the areas in which the fishery takes place; encounterability, which refers to the vertical overlap between the usual position of the fishing gear and the species in the water column; selectivity of fishing gear, and post-capture mortality (Hobday, 2007; Smith et al., 2007). Selectivity of the fishing gear is evaluated based on two criteria: the relationship between the size of immature individuals and the probability of their capture; and the possibility that these immature individuals may escape the fishing gear alive or may evade it.

Each attribute receives a score of 1, 2, or 3, depending on whether it is associated with low (low risk), medium (medium risk), or high (high risk) susceptibility, in accordance to criteria shown in the Table 2.

TABLE 2. Susceptibility attributes (MSC version 2.1)

Susceptibility attribute	High productivity (Low risk, score = 1)	Medium productivity (medium risk, score = 2)	Low productivity (high risk, score = 3)
Areal overlap (availability) Overlap of the fishing effort with a species concentration of the stock	<10% overlap	10-30% overlap	>30% overlap
Encounterability The position of the stock/species within the water column relative to the fishing gear, and the position of the stock/species within the habitat relative to the position of the gear	Low overlap with fishing gear (low encounterability).	Medium overlap with fishing gear.	High overlap with fishing gear (high encounterability). Default score for target species (Principle 1).
Selectivity of gear type Potential of the gear to retain species	a Individuals < size at maturity are rarely caught.	a Individuals < size at maturity are regularly caught.	a Individuals < size at maturity are frequently caught.
	b Individuals < size at maturity can escape or avoid gear.	b Individuals < half the size at maturity can escape or avoid gear.	b Individuals < half the size at maturity are retained by gear.
Post-capture mortality (PCM) The chance that, if captured, a species would be released and that it would be in a condition permitting subsequent survival	Evidence of majority released post-capture and survival.	Evidence of some released post-capture and survival.	Retained species or majority dead when released. Default score for retained species (Principle 1 or Principle 2).

Results and Discussion

Specific information for each species, references and information of each score is in preparation. Most of the scores were evaluated from bibliographic information. In some cases where specific information was not found, genus or family information was taken into consideration as reference. Fish trophic level was taken from Fishbase in all cases (Froese & Pauly, 2019). Precautionary scores were considered in the Susceptibility attribute. The following tables show some of the information gathered and considerations taken.

Family name	Scientific name	Nombre común	Common name	Snapper target species, CNP 2018	Especies Comerciales de la pesca artesanal PY Ramos-Miranda, et al. 2021	CNP 2018 Grouper fishery	NOM 065 grouper fishery	Average age at maturity	Average max	Fecundity
Balistidae	<i>Balistes capriscus</i>	Escochin, Cochino Gris	Gray Triggerfish		***			< 5 años	14	> 20,000 eggs per year
Carangidae	<i>Seriola zonata</i>	medregal rayado, coronado	Banded rudderfish			***	***	< 5 años		> 20,000 eggs per year
Carangidae	<i>Trachinotus carolinus</i>	Pampano amarillo	Florida Pompano		***			< 5 años	7	> 20,000 eggs per year
Dasyatidae	<i>Dasyatis americana</i>	Raya grande	Southern stingray			***		5-15 años	13	< 100 eggs per year
Haemulidae	<i>Haemulon plumieri</i>	Chac-chi, boquilla	White grunt			***	***	< 5 años		100-20,000 eggs per year
Labridae	<i>Lachnolaimus maximus</i>	Boquinete	Hogfish				***	< 5 años	23	100-20,000 eggs per year
Lutjanidae	<i>Lutjanus analis</i>	Pargo criollo, pargo lunarejo	Mutton snapper		***		***	5-15 años	29	> 20,000 eggs per year
Lutjanidae	<i>Lutjanus buccanella</i>	Huachinango boca negra	Blackfin snapper	***	***		***	5-15 años		> 20,000 eggs per year
Lutjanidae	<i>Lutjanus campechanus</i>	Huachinango de castilla	Northern red snapper	***	***	***	***	5-15 años	57	> 20,000 eggs per year
Lutjanidae	<i>Lutjanus cyanopterus</i>	Pargo Cubera	Cubera Snapper		***			5-15 años		> 20,000 eggs per year
Lutjanidae	<i>Lutjanus griseus</i>	Pargo mulato, pargo gris	Grey Snapper		***	***	***	5-15 años	21	> 20,000 eggs per year
Lutjanidae	<i>Lutjanus jocu</i>	Pargo perro, cabellera	Dog snapper			***	***	5-15 años		> 20,000 eggs per year
Lutjanidae	<i>Lutjanus synagris</i>	Rubia, villajaiba	Lane Snapper		***	***	***	5-15 años	10	> 20,000 eggs per year
Lutjanidae	<i>Lutjanus vivanus</i>	Huachinango ojo amarillo	Silk snapper	***	***		***	5-15 años		> 20,000 eggs per year
Lutjanidae	<i>Orthopristis chrysoptera</i>	Rubia, canane	Yellowtail snapper			***	***	< 5 años	4	> 20,000 eggs per year
Lutjanidae	<i>Rhomboplites aurorubens</i>	Besugo	Vermilion snapper			***	***	< 5 años	10	> 20,000 eggs per year
Malacanthidae	<i>Lopholatilus chamaeleonticeps</i>	Corvinato	Great northern tilefish			***		5-15 años	35	> 20,000 eggs per year
Rachycentridae	<i>Rachycentrum canadum</i>	Esmedregal	Cobia		***	***	***		15	
Serranidae	<i>Cephalopholis cruentata</i>	Cabrilla o cherna enjambre	Graysby			***	***	5-15 años	13	> 20,000 eggs per year
Serranidae	<i>Cephalopholis fulva</i>	Mero payaso, cabrilla roja,	Coney		***	***	***	5-15 años	11	> 20,000 eggs per year
Serranidae	<i>Dematolepis inermis</i>	Mero mármol	Marbled grouper				***			
Serranidae	<i>Epinephelus adscensionis</i>	Cabrilla, payaso verde	Rock hind			***	***	5-15 años	12	> 20,000 eggs per year
Serranidae	<i>Epinephelus drummondhayi</i>	Speckled Hind	Lenteja abadejo Speckled hind		***	***	***	5-15 años	45	> 20,000 eggs per year
Serranidae	<i>Epinephelus guttatus</i>	Red Hind	Mero colorado Red hind		***	***	***	5-15 años	22	> 20,000 eggs per year
Serranidae	<i>Epinephelus itajara</i>	Cherna	Atlantic goliath grouper			***	***	5-15 años	37	> 20,000 eggs per year

Family name	Scientific name	Common name	Average max length	Average size at maturity	Reproductive strategy	Trophic level	Fishery descriptor	Fishery descriptor	IUCN	Resiliencia	vulnerabilidad
Balistidae	<i>Balistes capriscus</i>	Gray Triggerfish	60	16.3	Broadcast spawner	4.1	longline	handline	Vulnerable	Medium (1.4 - 4.4 años)	Low to moderate (31)
Carangidae	<i>Seriola zonata</i>	Banded rudderfish	75		Broadcast spawner	4.4	longline		Least concern	Medium (1.4 - 4.4 años)	Moderate to high (50)
Carangidae	<i>Trachinotus carolinus</i>	Florida Pompano	64	54	Broadcast spawner	3.5	longline	handline	Least concern	Medium (1.4 - 4.4 años)	Low to moderate (27)
Dasyatidae	<i>Dasyatis americana</i>	Southern stingray	200	81.3	Live bearer	3.5	longline		near threatened	Low (4.5 - 14 años)	Very high (77)
Haemulidae	<i>Haemulon plumieri</i>	White grunt	53	18.3	Broadcast spawner	3.8	longline	handline	Least concern	Medium (1.4 - 4.4 años)	High (62)
Labridae	<i>Lachnolaimus maximus</i>	Hogfish	91	18	Broadcast spawner	4.2	longline,handline, net		Vulnerable	Medium (1.4 - 4.4 años)	High (59)
Lutjanidae	<i>Lutjanus analis</i>	Mutton snapper	94	43.8	Broadcast spawner	3.9	longline	handline	Near threatened	Medium (1.4 - 4.4 años)	High (55)
Lutjanidae	<i>Lutjanus buccanella</i>	Blackfin snapper	75	28.7	Broadcast spawner	3.9	longline		DD	Medium (1.4 - 4.4 años)	High (62)
Lutjanidae	<i>Lutjanus campechanus</i>	Northern red snapper	100	39.3	Broadcast spawner	3.9	longline		Vulnerable	Medium (1.4 - 4.4 años)	Moderate to high (54)
Lutjanidae	<i>Lutjanus cyanopterus</i>	Cubera Snapper	160		Broadcast spawner	4.4	longline	handline	Vulnerable	Very Low (14 años)	Very high (83)
Lutjanidae	<i>Lutjanus griseus</i>	Grey Snapper	89	32	Broadcast spawner	4.2	handline	longline	Least concern	Medium (1.4 - 4.4 años)	Moderate (41)
Lutjanidae	<i>Lutjanus jocu</i>	Dog snapper	128	32.4	Broadcast spawner	4.4	longline		DD	Low (4.5 - 14 años)	High to very high (66)
Lutjanidae	<i>Lutjanus synagris</i>	Lane Snapper	60	23.8	Broadcast spawner	3.8	longline	handline	Near threatened	Medium	Moderate vulnerability (37)
Lutjanidae	<i>Lutjanus vivanus</i>	Silk snapper	83	41.6	Broadcast spawner	3.1	longline		Least concern	Low (4.5 - 14 años)	Moderate (37)
Lutjanidae	<i>Orthopristis chrysoptera</i>	Yellowtail snapper	46		Broadcast spawner	3.4	longline	handline	DD	Medium (1.4 - 4.4 años)	Moderate (42)
Lutjanidae	<i>Rhomboplites aurorubens</i>	Vermilion snapper	60	18.8	Broadcast spawner	4.4	longline	handline	Vulnerable	Medium (1.4 - 4.4 años)	Moderate to high (50)
Malacanthid	<i>Lopholatilus chamaeleonticeps</i>	Great northern tilefish	125	42.2	Broadcast spawner	3.9	longline		Endangered	Low (4.5 - 14 años)	High to very high (73)
Rachycentrid	<i>Rachycentrum canadum</i>	Cobia	200		Broadcast spawner	4	longline		Least concern	Medium (1.4 - 4.4 años)	Moderate (42)
Serranidae	<i>Cephalopholis cruentata</i>	Graysby	42.6	16	Broadcast spawner	4.3	longline		Least concern	Medium	Low to moderate (33)
Serranidae	<i>Cephalopholis fulva</i>	Coney	44	14.7	Broadcast spawner	4.1	longline	handline	Least concern	Medium (1.4 - 4.4 años)	High (58 to 100)
Serranidae	<i>Dematolepis inermis</i>	Marbled grouper	91		Broadcast spawner	4.5			DD	Low (4.5 - 14 años)	High (56)
Serranidae	<i>Epinephelus adscensionis</i>	Rock hind	65	32	Broadcast spawner	3.5	longline		Least concern	Low (4.5 - 14 años)	Low to moderate (34)
Serranidae	<i>Epinephelus drummondhayi</i>	Lenteja abadejo Speckled	110		Broadcast spawner	4	longline		DD	Low (4.5 - 14 años)	High (62)
Serranidae	<i>Epinephelus guttatus</i>	Mero colorado Red hind	76	25	Broadcast spawner	3.8	handline	longline?	Least concern	Medium (1.4 - 4.4 años)	Moderate to high (52)
Serranidae	<i>Epinephelus itajara</i>	Atlantic goliath grouper	250	128	Broadcast spawner	4.1	longline		vulnerable	Low (4.5 - 14 años)	High to very high (70)



Family name	Scientific name	Nombre común	Common name	Snapper target species, CNP 2018	Especies Comerciales de la pesca artesanal PY Ramos-Miranda, et al. 2021	CNP 2018 Grouper fishery	NOM 065 grouper fishery	Average age at maturity	Average max	Fecundity
Serranidae	<i>Epinephelus mystacinus</i>	Mero listado	Misty grouper				***	5-15 años		
Serranidae	<i>Epinephelus striatus</i>	Mero del caribe, cherna	Nassau grouper			***	***	5-15 años	29	> 20,000 eggs per year
Serranidae	<i>Hyporthodus flavolimbatus (antes E.)</i>	Mero negro, fiat	Yellowedge grouper			***	***	5-15 años	35	
Serranidae	<i>Hyporthodus nigritus (antes E.)</i>	Cherna pintada	Warsaw grouper			***	***	5-15 años		
Serranidae	<i>Hyporthodus niveatus (antes E.)</i>	Corvinato	Snowy grouper			***	***	5-15 años	27	
Serranidae	<i>Mycteroperca interstitialis</i>	Gallina, mero boca amarilla	Yellowmouth grouper	***		***	***	5-15 años	41	> 20,000 eggs per year
Serranidae	<i>Mycteroperca microlepis</i>	Abadejo, Gag	Gag			***	***	5-15 años	31	> 20,000 eggs per year
Serranidae	<i>Mycteroperca phenax</i>	Cabrilla, negrilla, abadejo	Scamp	***		***	***	5-15 años	21	> 20,000 eggs per year
Serranidae	<i>Mycteroperca tigris</i>	Cuna gata o vampiro	Tiger grouper				***	5-15 años		> 20,000 eggs per year
Serranidae	<i>Mycteroperca venenosa</i>	Guacamayo, arigua	Yellowfin grouper	***		***	***	5-15 años		> 20,000 eggs per year
Sparidae	<i>Calamus bajonado</i>	Mojarron	Jolthead Porgy	***		***	***	< 5 años	10	
Sparidae	<i>Calamus calamus</i>	Pluma calamo	Saucereye Porgy	***				< 5 años		
Sparidae	<i>Calamus campechanus</i>	Cachipluma	Campeche Porgy				***	< 5 años		
Sparidae	<i>Calamus nodosus</i>	Mojarra, pluma, cachipluma	Knobbed Porgy	***		***		< 5 años	17	
Carcharhidae	<i>Carcharhinus acronotus</i>	Cazón	Blacknose shark				***			6 < 100 eggs per year
Sphyrnidae	<i>Sphyrna tiburo</i>	Cornuda cabeza pata	Bonnethead				***			12 < 100 eggs per year

Family name	Scientific name	Common name	Average max length	Average size at maturity	Reproductive strategy	Trophic level	Fishery descriptor	Fishery descriptor	IUCN	Resiliencia	vulnerabilidad
Serranidae	<i>Epinephelus mystacinus</i>	Misty grouper	160		Broadcast spawner	4.6			Least concern	Very Low (14 años)	Very high (90)
Serranidae	<i>Epinephelus striatus</i>	Nassau grouper	122	48	Broadcast spawner	4.1	longline		Critically Endangered	Low (4.5 - 14 años)	High (63)
Serranidae	<i>Hyporthodus flavolimbatus (antes E.)</i>	Yellowedge grouper	115		Broadcast spawner	3.8	longline		Vulnerable	Low (4.5 - 14 años)	High to very high (66)
Serranidae	<i>Hyporthodus nigritus (antes E.)</i>	Warsaw grouper	230		Broadcast spawner	4	longline		Near threatened	Low (4.5 - 14 años)	High to very high (68)
Serranidae	<i>Hyporthodus niveatus (antes E.)</i>	Snowy grouper	122	54	Broadcast spawner	4	longline		Vulnerable	Low (4.5 - 14 años)	High (64)
Serranidae	<i>Mycteroperca interstitialis</i>	Yellowmouth grouper	84		Broadcast spawner	4.5	longline	handline	Vulnerable	Low (4.5 - 14 años)	High to very high (67)
Serranidae	<i>Mycteroperca microlepis</i>	Gag	145	63.1	Broadcast spawner	3.7	longline		Vulnerable	Medium (1.4-4.4 y)	High (62)
Serranidae	<i>Mycteroperca phenax</i>	Scamp	107	32.2	Broadcast spawner	4.5	longline	handline	DD	Low (4.5 - 14 años)	Moderate to high (69)
Serranidae	<i>Mycteroperca tigris</i>	Tiger grouper	101	46	Broadcast spawner	4.5			DD	Low (4.5 - 14 años)	High (64)
Serranidae	<i>Mycteroperca venenosa</i>	Yellowfin grouper	100	53.6	Broadcast spawner	4.5	longline	handline	Near threatened	Low (4.5 - 14 años)	High (62)
Sparidae	<i>Calamus bajonado</i>	Jolthead Porgy	76	36	Broadcast spawner	3.5	longline	handline	Least concern	Medium (1.4 - 4.4 años)	High (56)
Sparidae	<i>Calamus calamus</i>	Saucereye Porgy	56		Broadcast spawner	3.5	longline	handline	Least concern	Low (4.5 - 14 años)	Moderate (42)
Sparidae	<i>Calamus campechanus</i>	Campeche Porgy	21		Broadcast spawner	3.4			Data deficient (DD)	Medium (1.4 - 4.4 años)	Low (11)
Sparidae	<i>Calamus nodosus</i>	Knobbed Porgy	54		Broadcast spawner	3.6	longline		Least concern	Medium (1.4 - 4.4 años)	Moderate to high (50)
Carcharhidae	<i>Carcharhinus acronotus</i>	Blacknose shark	200	115.4	Live bearer	4.4	longline		Endangered	Low (4.5 - 14 años)	High to very high (70)
Sphyrnidae	<i>Sphyrna tiburo</i>	Bonnethead	150	85	Live bearer	3.9	longline		Endangered	Very Low (14 años)	High (57)



The final table that includes the scores for each attribute is presented below. According to this results, the MSC score for PI 2.2.1 would fail to pass MSC score Status.

Scoring element	First of each scoring element	Species Grouping only ID 'At Risk' species by selecting associated species group	Species Grouping only Number of species in species group which this species represents (N/2)	Family name	Scientific name	Common name	Species type	Fishery descriptor	Average age at maturity	Average max age	Fecundity	Average max size	Average size at Maturity	Reproductive strategy	Trophic level	Density Dependence	Total Productivity (average)
1	First			Balistidae	Balistes capricus	Gray Triggerfish	Non-invertebrate	longline	1	2	1	1	1	1	3		1.43
2	First			Carangidae	Seriola zonata	Banded rudderfish	Non-invertebrate	longline	1	1	1	1	1	1	3		1.40
3	First			Carangidae	Trachinotus carolinus	Florida Pompano	Non-invertebrate	longline	1	1	1	1	2	1	3		1.43
4	First			Dasyatidae	Dasyatis americana	Southern stingray	Non-invertebrate	longline	2	2	3	2	2	3	3		2.43
5	First			Haemulidae	Haemulon plumieri	White grunt	Non-invertebrate	longline	1	2	2	1	1	1	3		1.50
6	First			Labridae	Lachnolaimus maximus	Hogfish	Non-invertebrate	longline	1	3	2	1	1	1	3		1.71
7	First			Lutjanidae	Lutjanus analis	Mutton snapper	Non-invertebrate	longline	2	3	1	1	2	1	3		1.86
8	First			Lutjanidae	Lutjanus buccanella	Blackfin snapper	Non-invertebrate	longline	2	1	1	1	1	1	3		1.50
9	First			Lutjanidae	Lutjanus campechanus	Northern red snapper	Non-invertebrate	longline	2	3	1	2	1	1	3		1.86
10	First			Lutjanidae	Lutjanus cyanopterus	Cubera Snapper	Non-invertebrate	longline	2	1	1	2	1	1	3		1.80
11	First			Lutjanidae	Lutjanus griseus	Grey Snapper	Non-invertebrate	longline	2	2	1	1	1	1	3		1.57
12	First			Lutjanidae	Lutjanus jocu	Dog snapper	Non-invertebrate	longline	2	1	2	1	1	1	3		1.67
13	First			Lutjanidae	Lutjanus synagris	Lane Snapper	Non-invertebrate	longline	2	2	1	1	1	1	3		1.57
14	First			Lutjanidae	Lutjanus vivanus	Silk snapper	Invertebrate	longline	2	1	1	2	1	2			1.50
15	First			Lutjanidae	Orthopristis chrysoptera	Yellow w tail snapper	Invertebrate	longline	1	1	1	1	1	1	3		1.40
16	First			Lutjanidae	Rhomboplites aurorubus	Vermilion snapper	Invertebrate	longline	1	2	1	1	1	1	3		1.60
17	First			Malacanthidae	Lopholatilus chamaeleus	Great northern tilefish	Invertebrate	longline	2	3	1	2	2	1	3		2.00
18	First			Rachycentridae	Rachycentrum canadense	Cobia	Invertebrate	longline	2	2	2	2	1	1	3		2.00
19	First			Serranidae	Cephalopholis cruenta	Graysby	Invertebrate	longline	2	2	1	1	1	1	3		1.80
20	First			Serranidae	Cephalopholis fulva	Coney	Invertebrate	longline	2	1	1	1	1	1	3		1.60
21	First			Serranidae	Demotolepis inermis	Marbled grouper	Invertebrate	longline	2	1	1	1	1	1	3		2.00
22	First			Serranidae	Epinephelus adscensionis	Rock hind	Invertebrate	longline	2	1	1	1	1	1	3		1.75
23	First			Serranidae	Epinephelus drummondii	Lenteja abadejo	Invertebrate	longline	2	3	1	2	1	1	3		2.00
24	First			Serranidae	Epinephelus guttatus	Mero colorado	Invertebrate	longline	2	2	1	1	1	1	3		1.80
25	First			Serranidae	Epinephelus itajara	Atlantic goliath grouper	Invertebrate	longline	2	3	1	2	2	1	3		2.00
26	First			Serranidae	Epinephelus mystacinus	Misty grouper	Invertebrate	longline	2	2	2	2	1	1	3		2.00
27	First			Serranidae	Epinephelus striatus	Nassau grouper	Invertebrate	longline	2	3	1	2	2	1	3		2.00
28	First			Serranidae	Hyporthodus flavolimbatus	Yellow edge grouper	Invertebrate	longline	2	3	2	2	1	1	3		2.25
29	First			Serranidae	Hyporthodus nigrurus	Warsaw grouper	Invertebrate	longline	2	2	2	2	1	1	3		2.00
30	First			Serranidae	Hyporthodus niveatus	Snowy grouper	Invertebrate	longline	2	3	2	2	2	1	3		2.25
31	First			Serranidae	Mycteroperca interstiti	Yellow mouth grouper	Invertebrate	longline	2	3	1	1	1	1	3		2.00
32	First			Serranidae	Mycteroperca microlepis	Gag	Invertebrate	longline	2	3	1	2	2	1	3		2.00
33	First			Serranidae	Mycteroperca phenax	Scamp	Invertebrate	longline	2	2	1	2	1	1	3		1.80
34	First			Serranidae	Mycteroperca tigris	Tiger grouper	Invertebrate	longline	2	1	2	2	1	1	3		1.75
35	First			Serranidae	Mycteroperca venenosa	Yellow fin grouper	Invertebrate	longline	2	1	2	2	1	1	3		1.75
36	First			Sparidae	Calamus bajonado	Jolthead Porgy	Invertebrate	longline	1	2	1	1	1	1	3		1.75
37	First			Sparidae	Calamus calamus	Saucereye Porgy	Invertebrate	longline	1	1	1	1	1	1	3		1.67
38	First			Sparidae	Calamus campechanus	Campeche Porgy	Invertebrate	longline	1	1	1	1	1	1	3		1.67
39	First			Sparidae	Calamus nodosus	Knobbed Porgy	Invertebrate	longline	1	2	1	1	1	1	3		1.75
40	First			Carcharhidae	Carcharhinus acronotus	Blacknose shark	Invertebrate	longline	3	1	3	2	2	3	3		2.60
41	First			Sphyrnidae	Sphyrna tiburo	Bonnethead	Invertebrate	longline	1	2	3	2	2	3	3		2.40

Scoring element	First of each scoring element	Species Grouping only ID 'At Risk' species by selecting associated species group	Species Grouping only Number of species in species group which this species represents (N/2)	Family name	Scientific name	Common name	Species type	Fishery descriptor	Availability	Encounterability	Selectivity	Post-capture mortality	Total (multiplicative)	PSA Score	Catch (tons)	Weighting	Weighted Total	Weighted PSA Score	MSC PSA-derived score	Risk Category Name	MSC scoring guidepost
1	First			Balistidae	Balistes capricus	Gray Triggerfish	Non-invertebrate	longline	2	3	3	3	2.33	2.73				81	Low	≥80	
2	First			Carangidae	Seriola zonata	Banded rudderfish	Non-invertebrate	longline	2	3	3	3	2.33	2.71				81	Low	≥80	
3	First			Carangidae	Trachinotus carolinus	Florida Pompano	Non-invertebrate	longline	2	3	3	3	2.33	2.73				81	Low	≥80	
4	First			Dasyatidae	Dasyatis americana	Southern stingray	Non-invertebrate	longline	2	3	3	3	2.33	3.36				63	Med	60-79	
5	First			Haemulidae	Haemulon plumieri	White grunt	Non-invertebrate	longline	2	3	3	3	2.33	2.77				80	Low	≥80	
6	First			Labridae	Lachnolaimus maximus	Hogfish	Non-invertebrate	longline	2	3	3	3	2.33	2.89				77	Med	60-79	
7	First			Lutjanidae	Lutjanus analis	Mutton snapper	Non-invertebrate	longline	2	3	3	3	2.33	2.98				74	Med	60-79	
8	First			Lutjanidae	Lutjanus buccanella	Blackfin snapper	Non-invertebrate	longline	2	3	3	3	2.33	2.77				80	Low	≥80	
9	First			Lutjanidae	Lutjanus campechanus	Northern red snapper	Non-invertebrate	longline	2	3	3	3	2.33	2.98				74	Med	60-79	
10	First			Lutjanidae	Lutjanus cyanopterus	Cubera Snapper	Non-invertebrate	longline	2	3	3	3	2.33	2.94				75	Med	60-79	
11	First			Lutjanidae	Lutjanus griseus	Grey Snapper	Non-invertebrate	longline	2	3	3	3	2.33	2.81				79	Med	60-79	
12	First			Lutjanidae	Lutjanus jocu	Dog snapper	Non-invertebrate	longline	2	3	3	3	2.33	2.86				77	Med	60-79	
13	First			Lutjanidae	Lutjanus synagris	Lane Snapper	Non-invertebrate	longline	2	3	3	3	2.33	2.81				79	Med	60-79	
14	First			Lutjanidae	Lutjanus vivanus	Silk snapper	Invertebrate	longline	2	3	3	3	2.33	2.77				80	Low	≥80	
15	First			Lutjanidae	Orthopristis chrysoptera	Yellowtail snapper	Invertebrate	longline	2	3	3	3	2.33	2.71				81	Low	≥80	
16	First			Lutjanidae	Rhomboplites aurorubus	Vermilion snapper	Invertebrate	longline	2	3	3	3	2.33	2.82				78	Med	60-79	
17	First			Malacanthidae	Lopholatilus chamaeleus	Great northern tilefish	Invertebrate	longline	2	3	3	3	2.33	3.07				72	Med	60-79	
18	First			Rachycentridae	Rachycentrus canadensis	Cobia	Invertebrate	longline	2	3	3	3	2.33	3.07				72	Med	60-79	
19	First			Serranidae	Cephalopholis cruentata	Graysby	Invertebrate	longline	2	3	3	3	2.33	2.94				75	Med	60-79	
20	First			Serranidae	Cephalopholis fulva	Coney	Invertebrate	longline	2	3	3	3	2.33	2.82				78	Med	60-79	
21	First			Serranidae	Dematolepis inermis	Marbled grouper	Invertebrate	longline	2	3	3	3	2.33	3.07				72	Med	60-79	
22	First			Serranidae	Epinephelus adscensionis	Rock hind	Invertebrate	longline	2	3	3	3	2.33	2.91				76	Med	60-79	
23	First			Serranidae	Epinephelus drummondi	Lenteja abadejo	Invertebrate	longline	2	3	3	3	2.33	3.07				72	Med	60-79	
24	First			Serranidae	Epinephelus guttatus	Mero colorado	Invertebrate	longline	2	3	3	3	2.33	2.94				75	Med	60-79	
25	First			Serranidae	Epinephelus itajara	Atlantic goliath grouper	Invertebrate	longline	2	3	3	3	2.33	3.07				72	Med	60-79	
26	First			Serranidae	Epinephelus mystacinus	Misty grouper	Invertebrate	longline	2	3	3	3	2.33	3.07				72	Med	60-79	
27	First			Serranidae	Epinephelus striatus	Nassau grouper	Invertebrate	longline	2	3	3	3	2.33	3.07				72	Med	60-79	
28	First			Serranidae	Hyporhamphus flavolimbatus	Yellowwedge grouper	Invertebrate	longline	2	3	3	3	2.33	3.24				67	Med	60-79	
29	First			Serranidae	Hyporhamphus nigrifrons	Warsaw grouper	Invertebrate	longline	2	3	3	3	2.33	3.07				72	Med	60-79	
30	First			Serranidae	Hyporhamphus niveatus	Snowy grouper	Invertebrate	longline	2	3	3	3	2.33	3.24				67	Med	60-79	
31	First			Serranidae	Mycteroperca interstitia	Yellowmouth grouper	Invertebrate	longline	2	3	3	3	2.33	3.07				72	Med	60-79	
32	First			Serranidae	Mycteroperca microlepis	Gag	Invertebrate	longline	2	3	3	3	2.33	3.07				72	Med	60-79	
33	First			Serranidae	Mycteroperca phenax	Scamp	Invertebrate	longline	2	3	3	3	2.33	2.94				75	Med	60-79	
34	First			Serranidae	Mycteroperca tigris	Tiger grouper	Invertebrate	longline	2	3	3	3	2.33	2.91				76	Med	60-79	
35	First			Serranidae	Mycteroperca venenosa	Yellowfin grouper	Invertebrate	longline	2	3	3	3	2.33	2.91				76	Med	60-79	
36	First			Sparidae	Calamus bajonado	Jothhead Porgy	Invertebrate	longline	2	3	3	3	2.33	2.91				76	Med	60-79	
37	First			Sparidae	Calamus calamus	Saucereye Porgy	Invertebrate	longline	2	3	3	3	2.33	2.86				77	Med	60-79	
38	First			Sparidae	Calamus campechanus	Campeche Porgy	Invertebrate	longline	3	3	3	3	3.00	3.43				60	Med	60-79	
39	First			Sparidae	Calamus nodosus	Knobbed Porgy	Invertebrate	longline	2	3	3	3	2.33	2.91				76	Med	60-79	
40	First			Carcharidae	Carcharhinus acronotus	Blacknose shark	Invertebrate	longline	2	3	3	3	2.33	3.49				59	High	≤60	
41	First			Sphyrnidae	Sphyrna tiburo	Bonnethead	Invertebrate	longline	2	3	3	3	2.33	3.34				63	Med	60-79	



Conclusions

Considering a precautionary approach, the fishery **would not pass Performance Indicator 2.2.1**. Through the Biological Monitoring Program 36 of the 41 species listed were identified at least once. In recent years, The FIP has reduced the amount of catch and over the years the associated species have changed depending on the catch objective of each fisherman.

This report attempts to include information on the species ever captured or recorded in order to have base information from which to start and detect the species at greatest risk. As more information is generated and gathered, these results may vary. **The Productivity Susceptibility Analysis results show seven species at low risk score, one of them, the *Carcharhinus acronotus* score <60 posing a high risk, and 28 species poses medium risk (60-79), thus the Performance Indicator 2.2.1** of the MSC standard would fail.

The complexity of this fishery makes it necessary for these results to be completed and validated by both expert researchers and fishermen, an activity planned for the second half of 2022.

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