Stock Health Tracker

FIP camarón blanco - fauna acompañamiento - Jaiba

Equipo FIP

19 December, 2024

Contents

Life history

Common name: Jaiba verde

Species: Callinectes bellicosus

Author: Bernardo Sánchez

Affiliation: The Nature Conservancy

Life history identifier: 1079

Version identifier: 1079 - 271

Created: 2024-01-26 18:34:56

Version summary:

Preparado por Vania Henriquez (Nature Analytics) para la pesca de jaiba en el Pacífico mexicano (incluyendo el Golfo de California).

1

Version details:

Los parámetros de crecimiento de von Bertalanffy (VB) y relación longitud-peso (LW) fueron reportados en Escamilla-Montes et al. (2018) para Laguna El Colorado (Ahome), Sinaloa, México. Escamilla-Montes et al. (2018) contribuyeron a la literatura existente al introducir un diseño de muestra más robusto y un tamaño de muestra más grande. Sus estimaciones de parámetros de VB se alinean con las reportadas en estudios anteriores (p. ej., Hernández y Arreola-Lizárraga (2006); López-Martínez et al. (2014)). Los parámetros de VB y LW que reporte en el archivo de Excel representan los valores promedio combinados para ambos sexos.

Los valores de Lmax y edad máxima (Amax) solo se encontraron en Castro-Salgado et al. (2019) (Bahía Magdalena, Baja California Sur), donde los autores evalúan los patrones de distribución espacial y temporal de la especie.

L50 fue estimado por Rodríguez-Domínguez et al. (2012b) (Bahía Santa María la Reforma, Baja California). El valor reportado por estos autores fue consistente con estimaciones de otros autores (p. ej., Rodríguez-Domínguez et al. (2015)). Elegí el parámetro L50 reportado por Rodríguez-Domínguez et al. (2012b) porque estos autores presentaron la ojiva de madurez logística (gráfico), lo que permitió una inspección visual de ΔL95. Aunque las estimaciones de L50 en este estudio fueron ligeramente menores que las reportadas por Diarte-Plata et al. 2021 (Laguna El Colorado, Ahome, Sinaloa), el primero tuvo un tamaño de muestra mayor. El valor M (derivado de Pauly, 1984) fue reportado por López-Martínez et al. (2014).

Castro-Salgado, J. C., Ramírez-Rodríguez, M., & Castañeda-Fernández-de-Lara, V. (2019). Distribution patterns of the warrior swimming crab, Callinectes bellicosus, fishery in Bahía Magdalena, Baja California Sur, Mexico. Crustaceana, 92(11-12), 1279-1293.

Diarte-Plata, G., Escamilla-Montes, R., Granados-Alcantar, S., & Luna-Gonzalez, A. (2021). Reproductive Cycle and Size at First Maturity in Females of Brown Crab (Stimpson 1859) in the Southwestern Gulf of California, Mexico. Croatian Journal of Fisheries, 79(3), 125-135.

Escamilla-Montes, R., Diarte-Plata, G., Ruíz-Verdugo, C. A., Granados-Alcantar, S., Luna-González, A., Vázquez-López, H., … & Villalejo-Fuerte, M. T. (2018). Patrones de crecimiento y proporción de sexos de la jaiba Callinectes bellicosus (Decapoda: Portunidae). Hidrobiológica, 28(3), 301-311.

Hernández, L., & Arreola-Lizárraga, J. A. (2007). Estructura de tallas y crecimiento de los cangrejos Callinectes arcuatus y C. bellicosus (Decapoda: Portunidae) en la laguna costera Las Guásimas, México. Revista de Biología Tropical, 55(1), 225-233.

López-Martínez, J., López-Herrera, L., Valdez-Holguín, J. E., & Rábago-Quiroz, C. H. (2014). Population dynamics of the swimming crabs Callinectes (Portunidae) components of shrimp bycatch in the eastern coast of the Gulf of California. Revista de biología marina y oceanografía, 49(1), 17-29.

Rodríguez-Domínguez, G., Castillo-Vargasmachuca, S. G., Pérez-González, R., & Aragón-Noriega, E. A. (2015). The interannual variability of size at maturity of the brown crab Callinectes bellicosus Stimpson, 1859 (Brachyura, Portunidae) in the Gulf of California. Crustaceana, 88(12-14), 1339-1350.

Table 1: Life history parameters used to define the species' biological characteristics.

Parameter	**Value**
Length type	TL
Length units	cm
Weight units	cm, gr
Length-weight alpha	0.6975
Length-weight beta	2.99
von Bertalanffy Loo	17.4
von Bertalanffy K (per year)	1.05
von Bertalanffy t0	0.12
Length at 50% maturity	10.8
Length increment to 95% maturity	2
Natural mortality (per year)	1.95
Protogynous hermaphrodite	0
Length at which cohort is 50% male	
Length increment to which cohort is 95% male	
M/K	1.86
Length at 50% maturity / von Bertalanffy Loo	0.62
Theoretical maximum age (years)	2.36

Key terms and quantities:

The life history of fish species describes their key biological characteristics, such as how fast, large and heavy they grow, when they become sexually mature, and their natural mortality rate, among other aspects. These parameters are used in calculation of metrics and other analyses.

Length type is the method used to measure the fish size; TL is total length, FL is fork length, SL is standard length, CL is carapace length, SHL is shell length, ML is mantle length.

Length units is the unit of length in which the fish sizes were recorded.

Weight units is the unit of weight in which the fish sizes were recorded.

Length-weight alpha and beta are parameters defining fish weight as a function of their length.

von Bertalanffy Loo is the average maximum size a fish of this species will grow to and the asymptotic length parameter of the von Bertalanffy function.

von Bertalanffy K is a curvature parameter that affects the speed at which size approaches the average maximum size (Loo).

von Bertalanffy t0 is a theoretical quantity necessary to describe the shape of the von Bertalanffy function.

Length at 50% maturity is the size at which 50% of the fish is population is mature.

Length increment to 95% maturity is the size increase needed to reach 95% of the fish population being mature.

Natural mortality (M per year) represents the mortality due to natural causes and not associated to fishing.

Protogynous hermaphrodite describes species that transition from female to male with parameters: length at which cohort is 50% male and length increment to which cohort is 95% male.

M/K is the ratio of the natural mortality M to the growth coefficient K.

Length at 50% maturity / von Bertalanffy Loo is the ratio of maturity to average maximum size.

Theoretical maximum age (years) is calculated as -ln(0.01)/M, which is the age to which one percent of a cohort would survive under constant natural mortality of M.

Length data

Title: Monitoreo biologico MaNa

Summary: Datos procedentes del monitoreo biologico del FIP de camarón blanco en Marismas Nacionales,Nayarit

Table 2: Length data set

Parameter	Value
Length type	CL
Length units	cm
Length format	Length
Source	Fishery catch
Bin width	1

Table above provides information on the fish length dataset which was provided to conduct the analysis. It includes details such as the type of length measurement used, the units in which lengths were recorded, the format in which the length data is presented (frequencies or raw length measurements), and the source of the dataset. The table aims to provide an overview of the characteristics and origin of the fish length data.

Table 3: Length data details

Parameter	Value
Minimum length	2 cm
Average length	7.68 cm
Maximum length	13.3 cm
Length measurements	133
Groups	2
Group name	MaNa

Table above provides details contained in the length dataset, such as the number of observations ('Length measurements'), information on the recorded lengths ('Minimum length', 'Maximum length' and 'Mean length'), and the structure of the records ('Groups' and 'Group name'), e.g. if and how they are organized. The groups will be used in the analysis to evaluate the differences between groups.

Key terms and quantities:

Length type is the method used to measure the fish size; TL is total length, FL is fork length, SL is standard length, CL is carapace length, SHL is shell length, ML is mantel length.

Length units is the unit of length in which the fish sizes were recorded.

Length format refers to the options of raw lengths or frequency. Raw lengths (lengths) is a collection of length measurements stored as a vector. These are typically original length measurements of fish, which have not been binned. Multiple columns can be used, with each column pertaining to a level of a grouping variable, such as year or fleet. Frequencies is a collection of length measurements organized

using two or more columns. The left-most column must contain bin mid points. The next column contains the number of length measurement observations in each bin. While the first column is reserved for the bin mid points, multiple columns to its left can be used with each pertaining to a level of a grouping variable, such as year or fleet.

Source refers to the options of fisery catch or fishery independent. Fishery catch indicates that the source of the length data set is fishery-dependent. Fishery-independent (deprecated) indicates that the source of the length data set is fishery-independent, such as a research survey. Existing data sets assigned to this category will still function correctly in FishKit; however, new data sets of this type are not allowed.

Bin width is reported when a length data set contains frequencies. For histograms created from raw lengths, a bin width of 1 cm or 1 inch is used, depending on how user choses to display plots.

Groups and group name refer to an optional grouping variable included in the length data set.

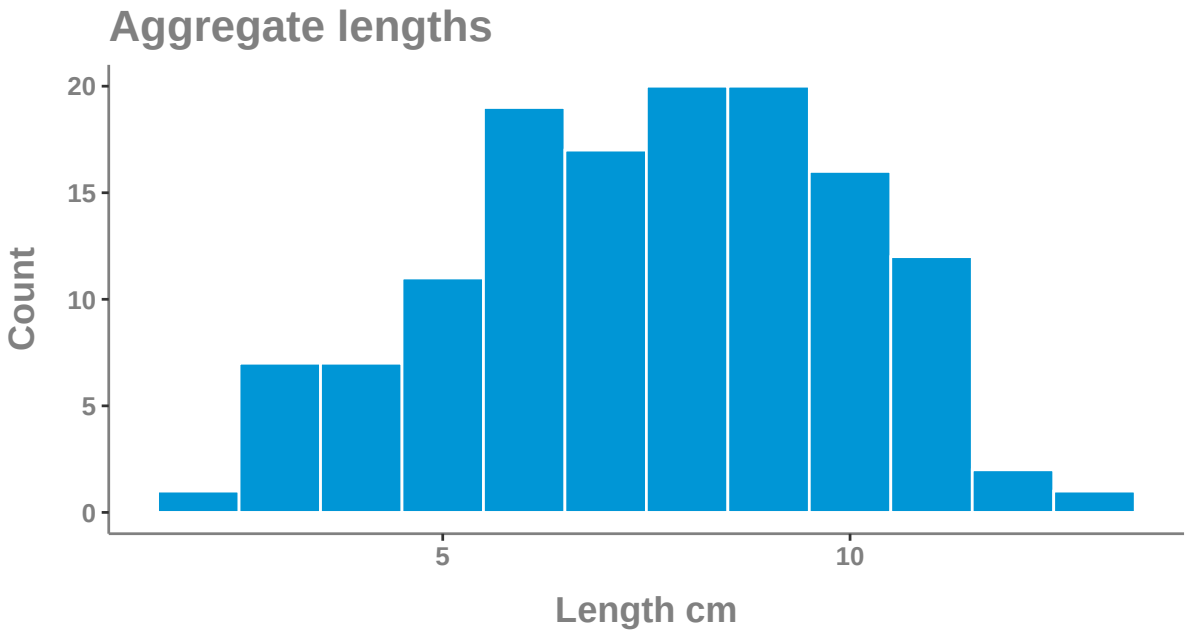


Figure above illustrates the distribution of lengths in the catch. The x-axis represents length, and the y-axis represents the number of individuals. Each bar corresponds to a length bin.

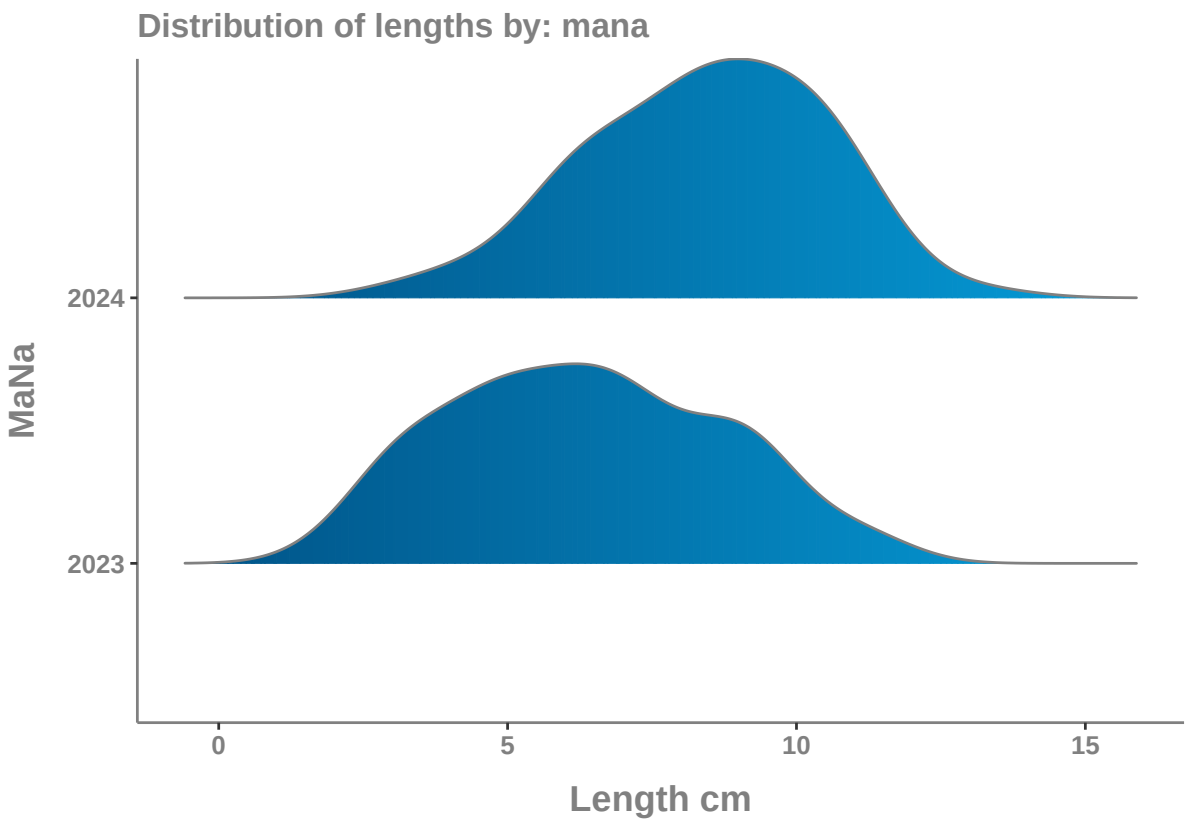


Figure above illustrates the distribution of lengths in the catch for each group. The x-axis represents length, and the y-axis represents the number of individuals. Each plot corresponds to a specific grouping category.

The length distribution shows the length structure of the catch, which can reflect the condition of the population, signs of overfishing (prevalence of smaller individuals), or the effect changes to fishing gears (disproportionate removal of specific size classes). Stock Health Tracker uses this information to monitor changes over time to track the impacts of fishing.

Various factors can alter fish populations' size structure, such as location, the intensity of fishing effort, the type of gear, or the environment. Hence, the variety of sizes in a population can change, particularly in populations that are being heavily fished. This is because fishing tends to target specific sizes. For example, if a fishing method is designed to catch larger individuals and the fishing pressure remains the same or increases over time, the distribution of sizes in the population will shift towards smaller ones in recent years. This is visible by examining the peak of the distribution (e.g. the length with the highest frequency/number) and the range of sizes (e.g. smallest and largest lengths on the curve).

Metrics

Mature fish in the catch

Group name: mana; Included: All

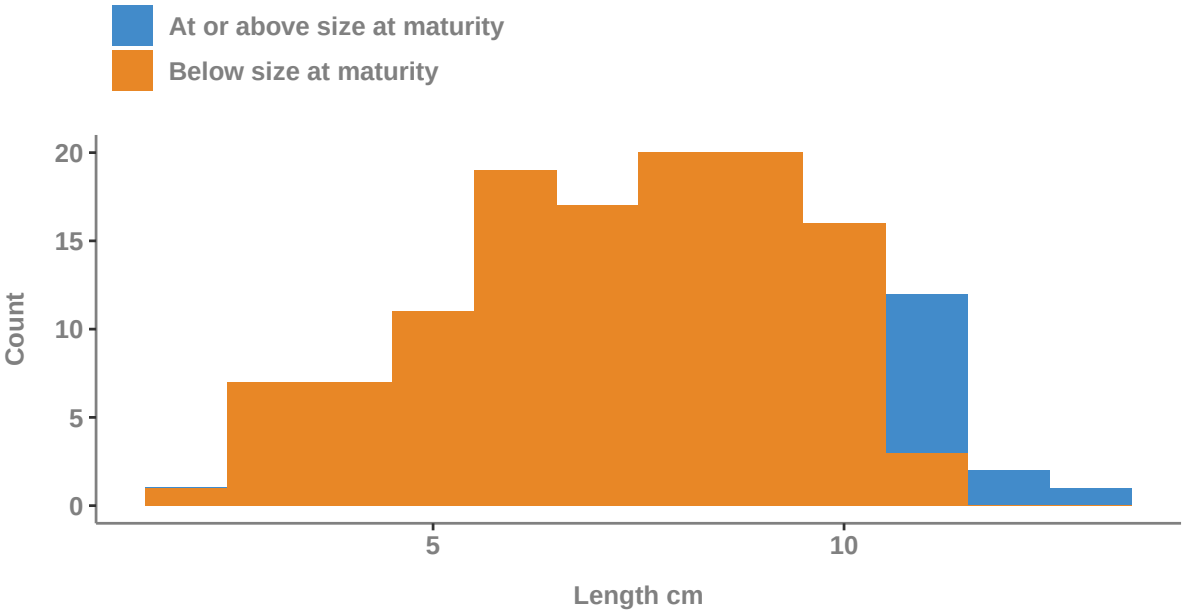
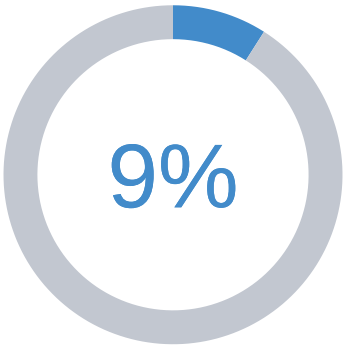


Figure above illustrates the distribution of the lengths in catches, with fish below the length at 50% maturity shown in orange and fish which have already matured in blue. The x-axis represents length and the y-axis represents the number of individuals. Each bar corresponds to a length bin.



Target is 100%

Length at 50% maturity 10.8 cm

Figure above shows the percentage of mature fish in the catch.

This metric is calculated relative to the length at 50% maturity. The goal for mature fish in the catch is 100%, as it is generally recommended to allow fish to reproduce at least once before becoming vulnerable to fishing. Managing sizes in the catch in relation to size at maturity can help to ensure population replenishment while conserving pretty good fishery yields (Hilborn 2010, Prince and Hordyk 2019).

Optimal sizes in the catch

Group name: mana; Included: All

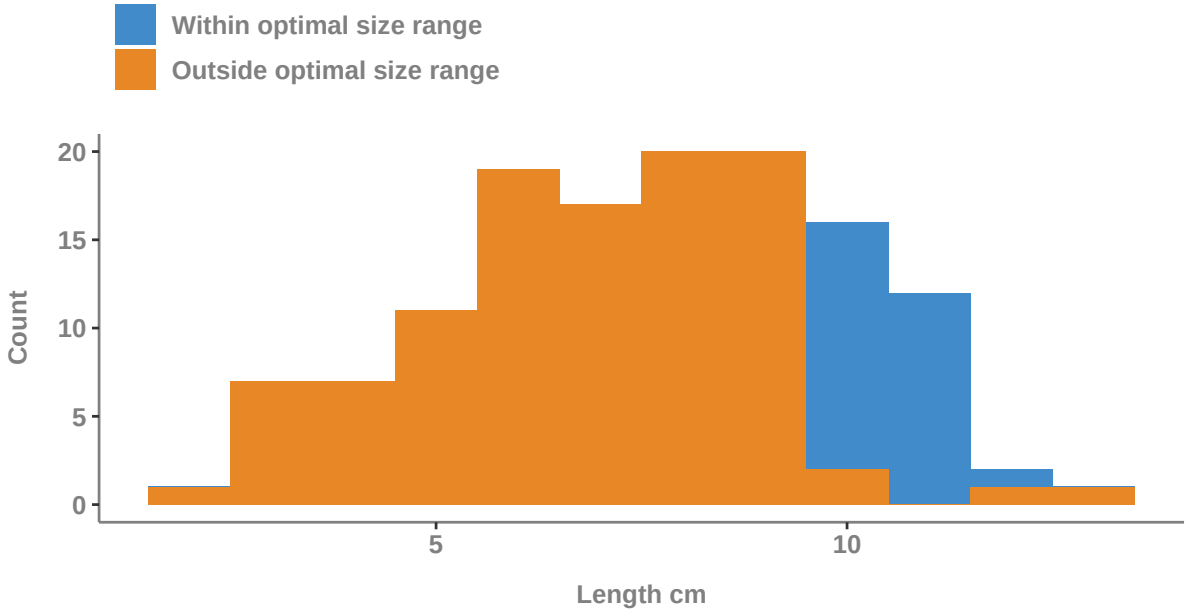
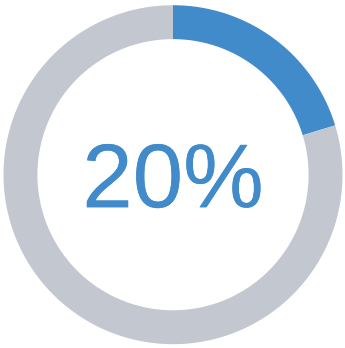


Figure above illustrates the distribution of the lengths in catches, with fish below and above the optimal size range in orange, and fish within the optimal size range in blue. The x-axis represents length and the y-axis represents the number of individuals. Each bar corresponds to a length bin.



Target is 100%

Optimal size range 9.67 to 11.82 cm

Figure above shows the percentage of optimal sizes in the catch.

Percent optimal sizes in the catch is calculated in three steps. First the quantity known as optimal length in the catch, Lopt, is approximated as (Beverton 1992; Froese 2004): Lopt = Loo / (3 + m/K). Second, a range of optimal lengths in the catch is defined as Lopt +/-10%. Finally, percent optimal sizes in the catch is calculated as the percentage of the length composition that fall within the defined range. Optimal size refers to the length at which a fish cohort achieves its maximum biomass, and thus, represents the size range that should be prioritized for fishing to maximize yield. The target here is also 100%, as it is preferable to avoid catching fish outside of this range.

Mega-spawners

Group name: mana; Included: All

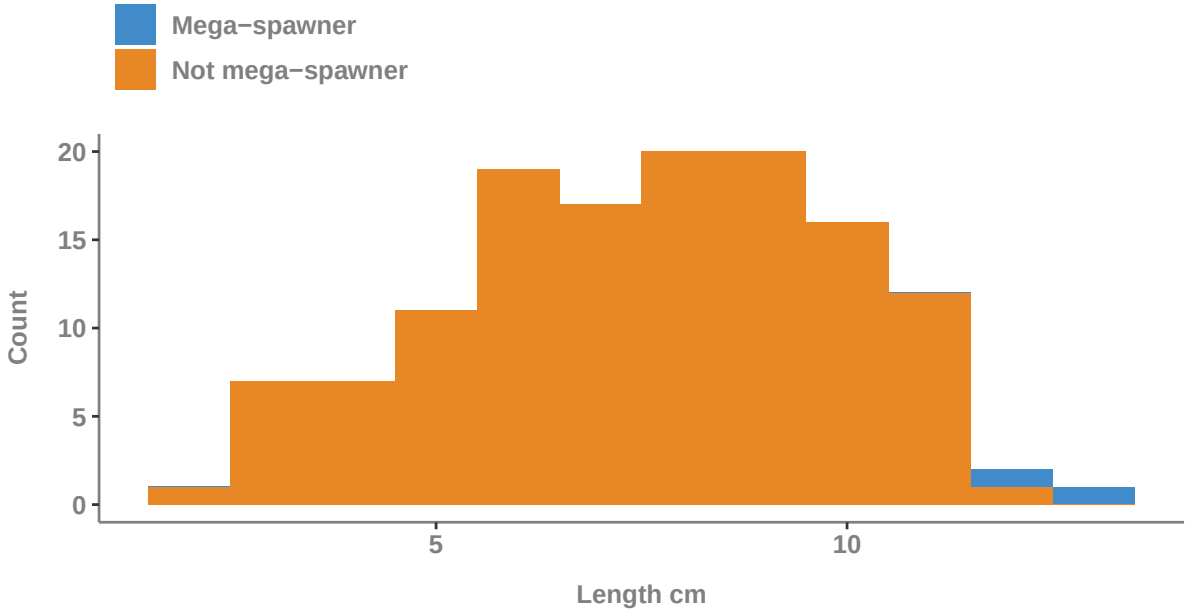
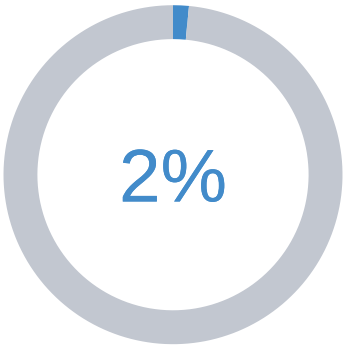


Figure above illustrates the distribution of the lengths in catches, with fish below the mega-spawner size in orange, and fish above the mega-spawner size in blue. The x-axis represents length and the y-axis represents the number of individuals. Each bar corresponds to a length bin.



Target is 30% to 40%

Mega−spawners minimum size 11.82 cm

Figure above shows the percentage of mega-spawners in the catch.

Mega-spawners are individuals equal to or greater than Lopt +10%. The optimal length in the catch, Lopt, is approximated as (Beverton 1992; Froese 2004): Lopt = Loo / (3 + m/K). Interpretation of mega-spawners in the catch requries understanding the selectivity of the fishery. If fishers select for mega-spawners, their absence in the catch could be an indication of overfishing. Froese (2004) suggests a target of 30% to 40% of mega-spawners in the catch. If fishers actively avoid mega-spawners, their absence in the catch suggests larger-older fish may be protected and contributing to spawning to replenish the population.

Fish above the size limit

Group name: mana; Included: All

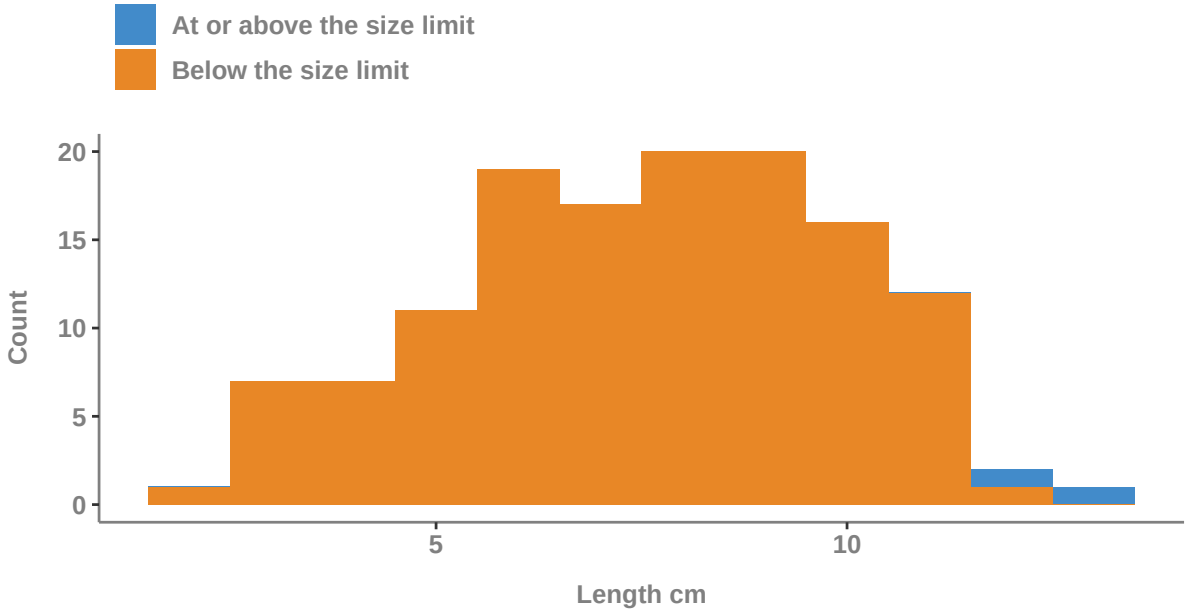
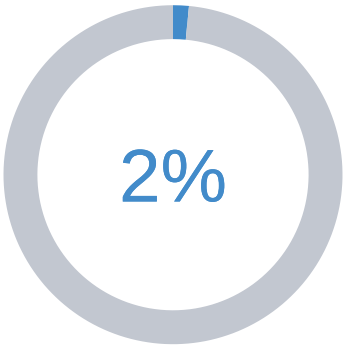


Figure above illustrates the distribution of the lengths in catches, with fish above the size limit size in blue. The x-axis represents length and the y-axis represents the number of individuals. Each bar corresponds to a length bin.



Target is 100%

Minimum size limit 12 cm

Figure above shows the percentage of individuals in the catch above the size limit.

For fisheries with size limits, fish above the size limit is calculated as the percentage of the length composition that are equal or greater than the size limit.

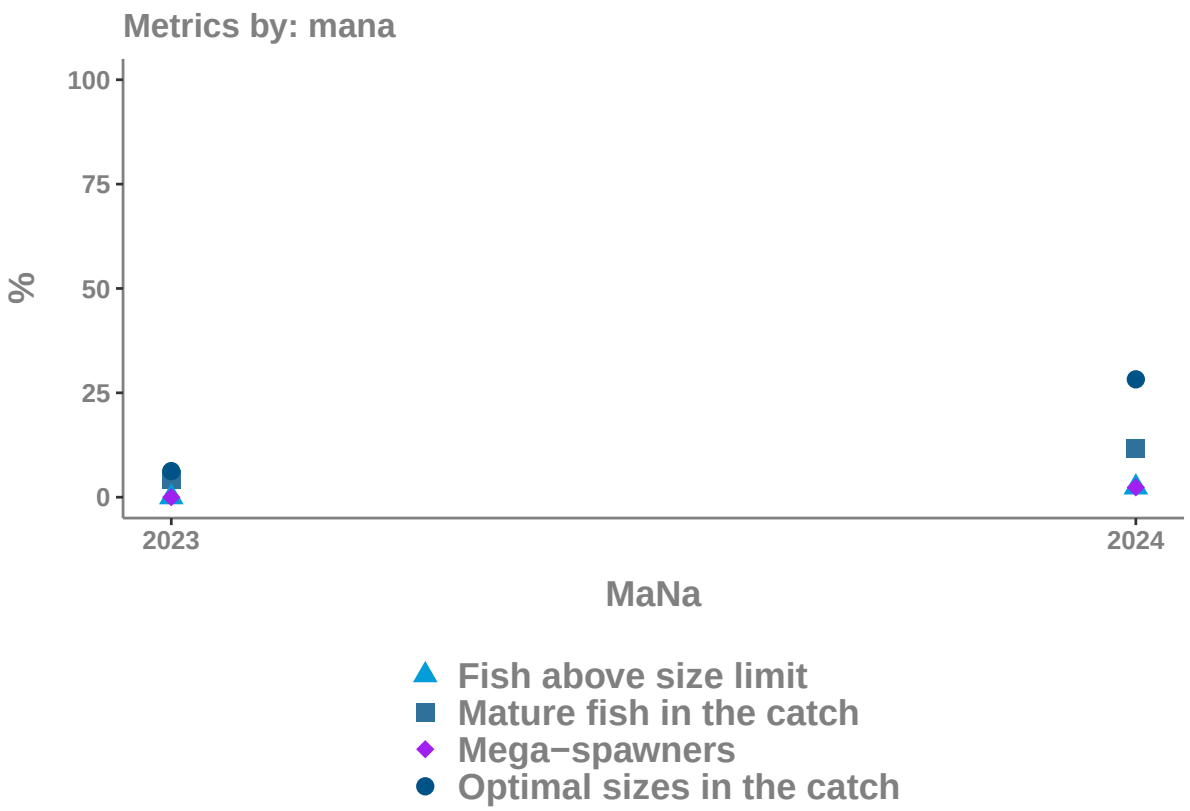


Table 4: Number of lengths measurements in the dataset (n) for each group.

Group	Percent	Metric
2023	4.17	Mature fish in the catch
2024	11.76	Mature fish in the catch
2023	6.25	Optimal sizes in the catch
2024	28.24	Optimal sizes in the catch
2023	0.00	Fish above size limit
2024	2.35	Fish above size limit
2023	0.00	Mega-spawners
2024	2.35	Mega-spawners

Sample size

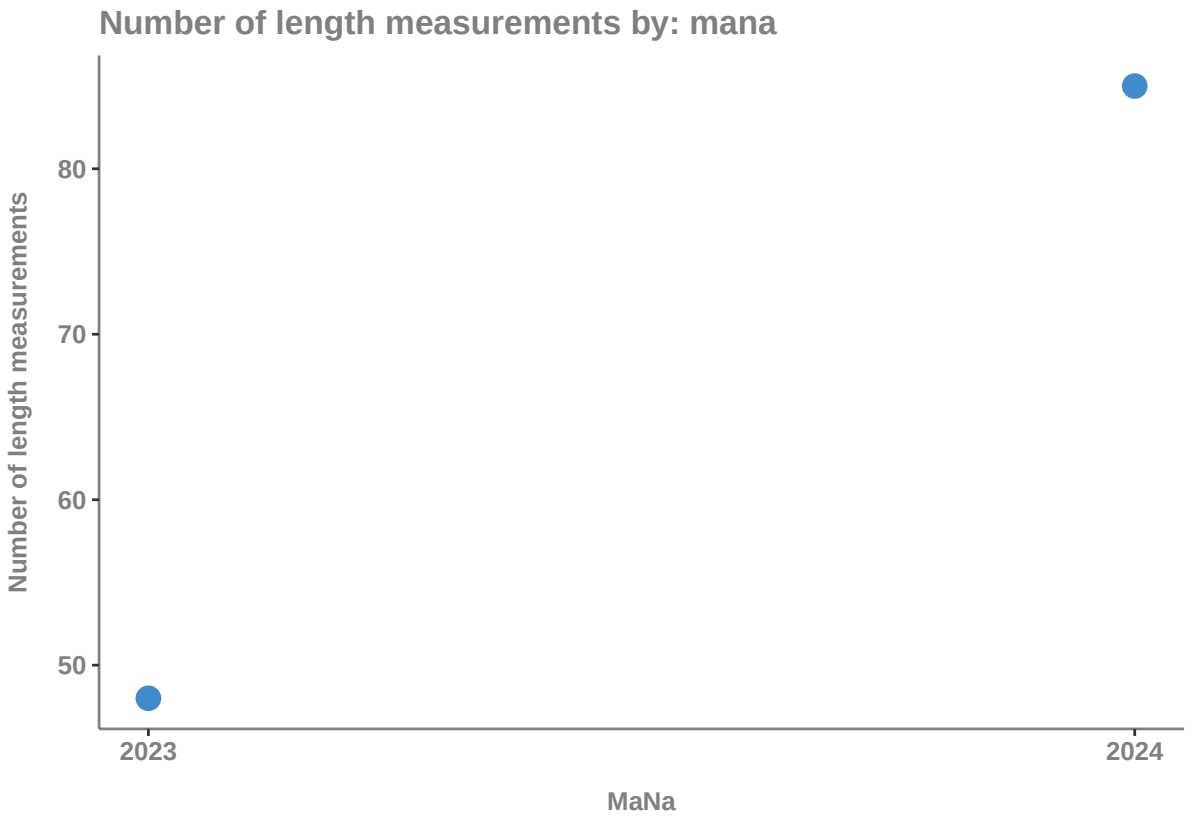


Figure above illustrates the number of lengths measurements in the dataset, for each group. The x-axis represents the grouping categories in the dataset, and the y-axis represents the number of observations recorded for fish length. This metric can be a useful summary of sufficiency of monitoring programs or participation in length-sampling programs by fishers. It is intended to capture a simple but fundamental metric of length sampling sufficiency.

Table 5: Number of lengths measurements in the dataset (n) for each group.

MaNa	n
2023	48
2024	85

Average length

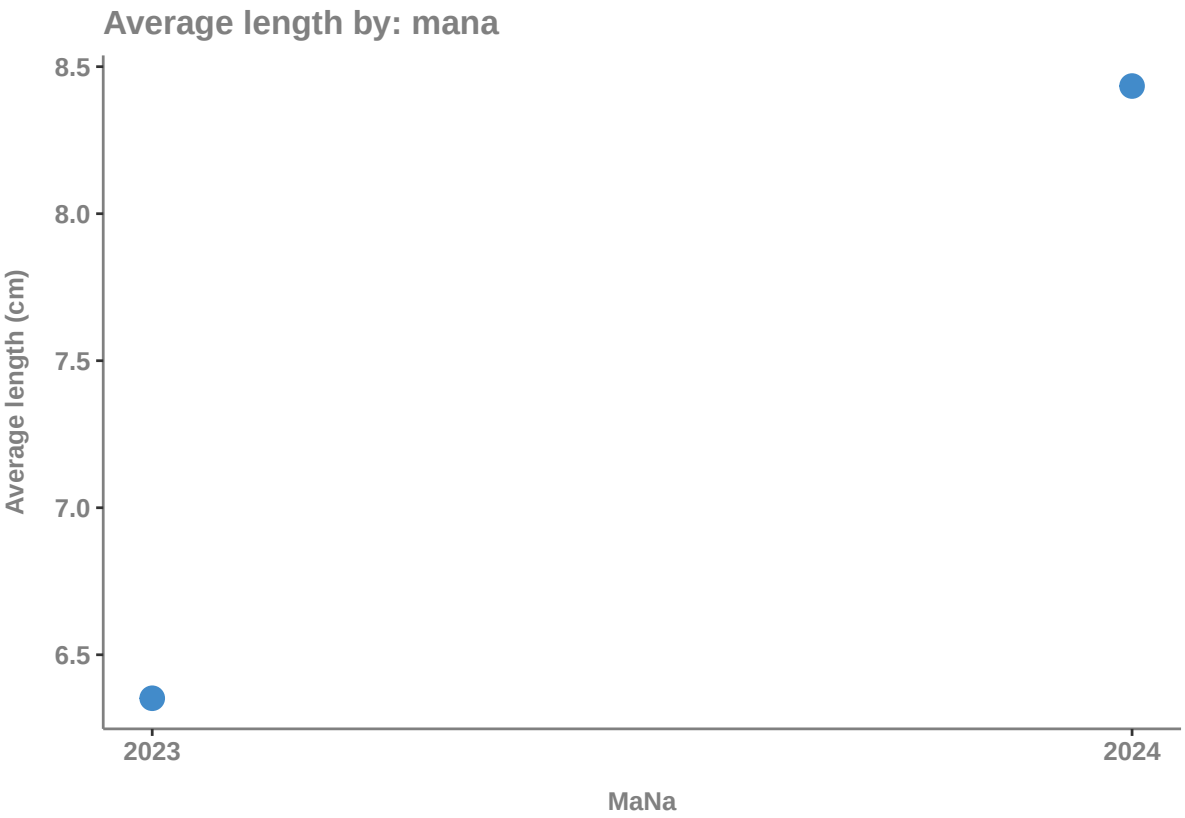


Figure above illustrates the average length in the dataset, for each group. The x-axis represents the grouping categories in the dataset, and the y-axis represents the average length of the sample. Changes in average length can be an indicator of fishery sustainability, with downward trends typically indicative of an increase in fishing mortality.

Table 6: Average length measured for each group.

	MaNa	Average length (cm)
2023	2023	6.35
2024	2024	8.43

Length-Based Spawning Potential Ratio (LBSPR)

Table 7: Length-based spawning potential ratio (LBSPR) model description

Item	Details
Source	Fishery catch
Bin width	1
Fishery selectivity	Estimated by model
CV Loo	0.1 (LBSPR default)
Model type	GTG

Table above provides information on the LBSPR analysis. The table aims to provide an overview of the characteristics of this length-based assessment model. Fishery selectivity is noted as a remineder that selectivity is always estimated by the LBSPR model; CV Loo is the coefficient of variation around the average maximum length (Loo); Model type is the subtype of model used in the analysis, e.g. growth-type-group (GTG) or absel, with GTG the recommended default.

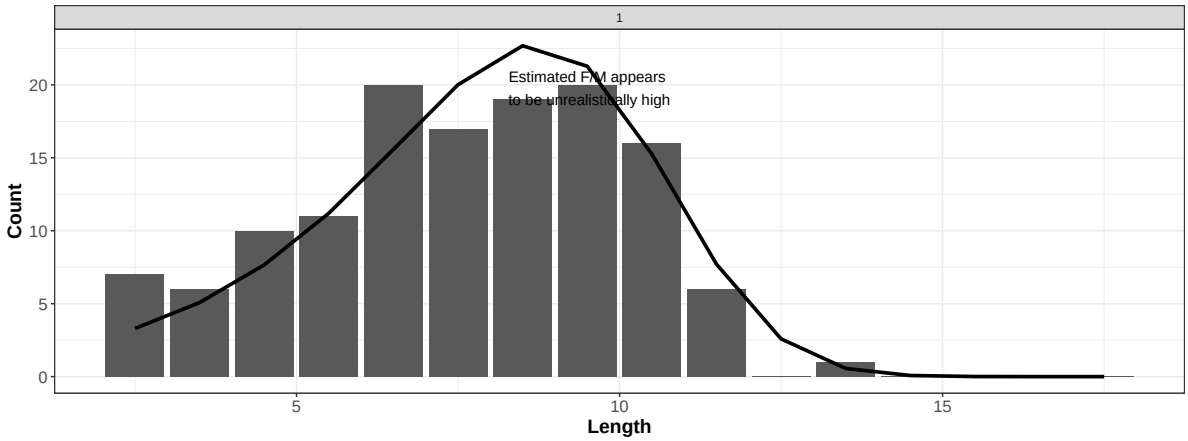


Figure above shows LBSPR model fit (solid line) to the length-frequency data in cm. The x-axis represents length, and the y-axis represents the number of individuals. Each bar corresponds to a length bin. The solid line represents the prediction by the LBSPR model. Figures shows the extent to which the LBSPR model predictions (line) align with the observed length-frequency data (vertical bars). A good model fit should capture the shape and distribution of fish lengths, ensuring that the predicted lengths corresponds to the observed size structure in the dataset.

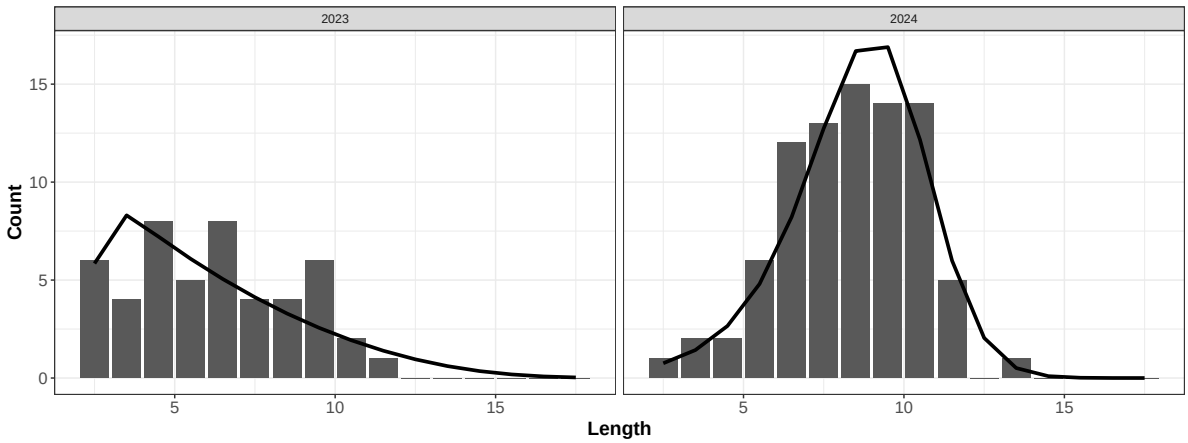


Figure above shows LBSPR model fits (solid lines) to the length-frequency data in cm, for each group. The x-axis represents length, and the y-axis represents the number of individuals. Each bar corresponds to a length bin. The solid line represents the prediction by the LBSPR model.

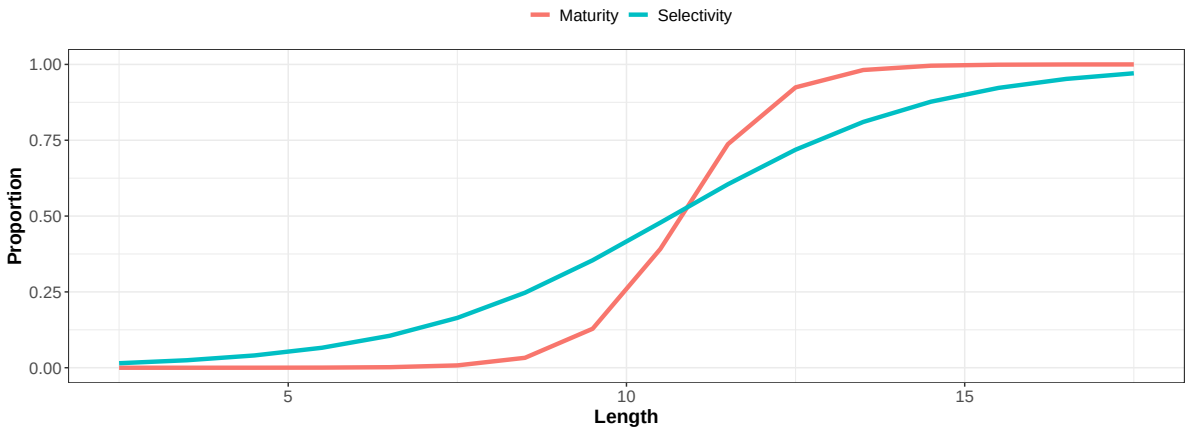


Figure above shows LBSPR model estimates of selectivity at length (blue line) and maturity-at-length (pink line). The x-axis represents length in cm, and the y-axis represents proportion. In this analysis, the selectivity curve represents the proportion of fish retained by the fishing gear at each length. For the maturity curve, the y-axis represents the proportion of fish in the population which are sexually mature, at each length. If the ascending limb of selectivity is positioned to the right of the maturity ascending limb, this will help to ensure that sexually mature fish are targeted (low risk of capturing immature individuals) and promote fishery sustainability.

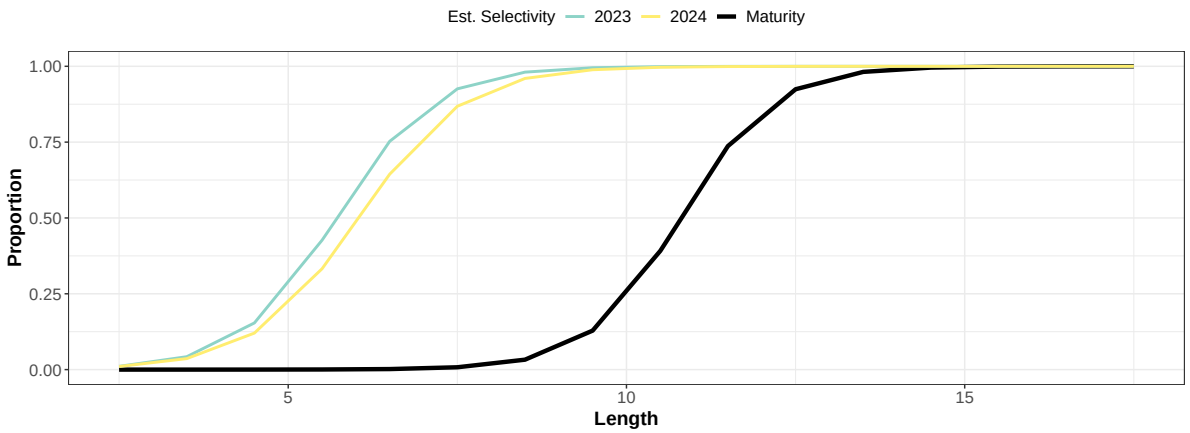


Figure above shows LBSPR model estimates of selectivity at length (blue line) and maturity-at-length (pink line), for each group. The x-axis represents length in cm, and the y-axis axis represents proportion. In this analysis, the selectivity curve represents the proportion of fish retained by the fishing gear at each length. For the maturity curve, the y-axis represents the proportion of fish in the population which are sexually mature, at each length category.

Table 8: Parameters estimated by the LBSPR model.

Group	**Selectivity 50% (SL50; cm)**	**Selectivity 95% (SL95; cm)**	**F/M**	**SPR**
All	10.67	16.41	6.94	0.0502666
2023	2.45	2.71	0.65	0.2154897
2024	9.35	13.49	4.43	0.0659823

Table above provides model results such as the estimated logistic selectivity parameters ('Selectivity 50% (SL50)' and 'Selectivity 95% (SL95)', the relative fishing mortality to natural mortality ratio (F/M), and the Spawning Potential Ratio (SPR). These estimates are provided for the overall dataset, as well as for each grouping category. Point estimates by group are reported, not smoothed estimates.

Logistic selectivity is specified with parameters SL50 and SL95, reflecting the length at which 50% of the population is vulnerable to the gear and the length at which 95% of the population is vulnerable to the gear, respectively.

Figure above shows estimates of Spawning Potential Ratio (SPR) for each group with 95% confidence intervals. The x-axis represents the groups, and the y-axis represents the estimates. SPR compares the spawning potential of the population under current fishing conditions to the potential spawning if there were no fishing. SPR values range from 0 to 1, where 0 represents a situation where spawning potential is completely depleted, and 1 indicates full spawning potential.

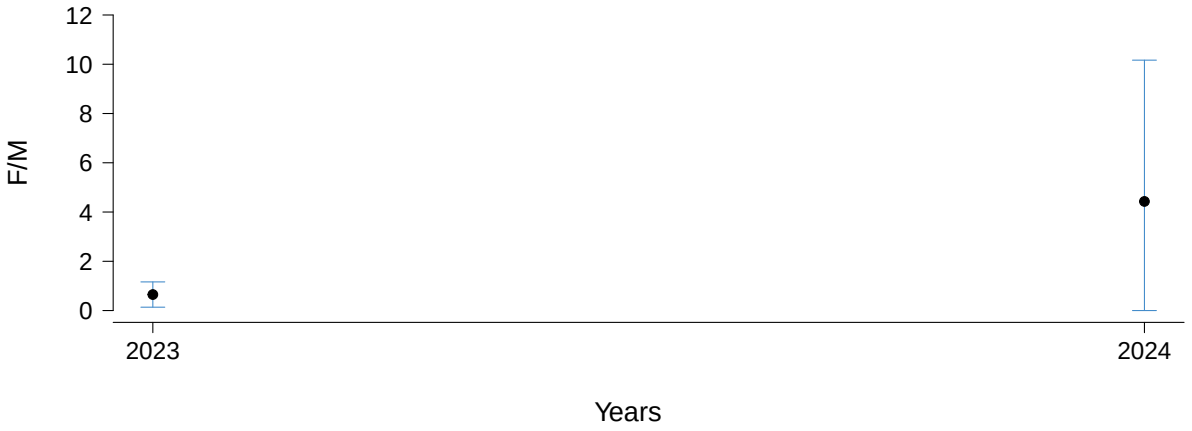


Figure above shows estimates of the fishing mortality to natural mortality ratio (F/M) for each group with 95% confidence intervals. The x-axis represents the groups, and the y-axis represents the estimates. F/M is measure of fishing pressure.

Reference

Beverton, R.J.H. 1992. Patterns of reproductive strategy parameters in some marine teleost fishes. Journal of Fish Biology 41(sB): 137–160. doi:10.1111/j.1095-8649.1992.tb03875.x.

Froese, R. 2004. Keep it simple: three indicators to deal with overfishing. Fish and Fisheries 5(1): 86–91. doi:10.1111/j.1467-2979.2004.00144.x.

Hilborn, R. 2010. Pretty good yield and exploited fisheries. Mar. Policy 34: 193–196.

Hordyk, A.R., Ono, K., Prince, J.D., and Walters, C.J. 2016. A simple length-structured model based on life history ratios and incorporating size-dependent selectivity: application to spawning potential ratios for data-poor stocks. Can. J. Fish. Aquat. Sci. 73(12): 1787–1799. doi:10.1139/cjfas-2015-0422.

Prince, J., and Hordyk, A. 2019. What to do when you have almost nothing: A simple quantitative prescription for managing extremely data-poor fisheries. Fish Fish 20(2): 224–238. doi:10.1111/faf.12335.

Report identifier

User identifier: bernardo.sanchez@tnc.org

Report identifier: auth0|62993848d7925a006fb6a669-192647094

Report sharing

Report sharing: I agree to share the results of my FishKit session with the FishKit team.

Response: No

Report type: In which contexts is the FishKit Tool being used?

Response: None selected

Stock Health Tracker

FIP camarón blanco - fauna acompañamiento - Robalo

Equipo FIP

19 December, 2024

Contents

Life history

Common name: Robalo aleta amarilla

Species: Centropomus robalito

Author: Bernardo Sanchez

Affiliation: The Nature Conservancy, Mexico

Life history identifier: 1212

Version identifier: 1212 - 471

Created: 2024-12-19 19:11:29

Version summary:

Version details:

Preparado para el reporte del FIP camarón blanco de Marismas Nacionales, Nayarit

Espino-Barr, Elaine. (2019). Study of the Age of Centropomus robalito by Otoliths Analysis of sagitta, asteriscus and lapillus in Mexican Central Pacific. Aquaculture & Fisheries. 3. 1-10. 10.24966/AAF-5523/100013.

E. Espino-Barr, M. Gallardo-Cabello, M. Puente-Gómez, A. García-Boa & M. Salas-Maldonado 2019. Reproduction of the yellowfin snook Centropomus robalito (Teleostei: Centropomidae) in Cuyutlan Lagoon, Mexican Central Pacific. Ciencia Pesquera (2019) 27(2): 17-25

Gallardo-Cabello M, E Espino-Barr, A GarciaBoa, M Puente-Gómez. 2018. Growth of the yellowfin snook Centropomus robalito (Teleostei: Centropomidae) in Cuyutlan Lagoon, Mexican Central Pacific. International Journal of Scientific Research 7(12): 28-31. DOI: 10.36106/ijsr

M.G. Gómez-Ortiz, H. López-Navarrete, R. Arteaga-Peña, J. Balderas-Telles y G. Acosta-Barbosa. 2015. Parámetros poblacionales, biológicos y pesqueros de robalo blanco Centropomus undecimalis del sur de Tamaulipas y norte de Veracruz, México. Ciencia Pesquera (2015) 23(2): 45-57

Key terms and quantities:

The life history of fish species describes their key biological characteristics, such as how fast, large and heavy they grow, when they become sexually mature, and their natural mortality rate, among other aspects. These parameters are used in calculation of metrics and other analyses.

Length type is the method used to measure the fish size; TL is total length, FL is fork length, SL is standard length, CL is carapace length, SHL is shell length, ML is mantle length.

Length units is the unit of length in which the fish sizes were recorded.

Weight units is the unit of weight in which the fish sizes were recorded.

Length-weight alpha and beta are parameters defining fish weight as a function of their length.

von Bertalanffy Loo is the average maximum size a fish of this species will grow to and the asymptotic length parameter of the von Bertalanffy function.

von Bertalanffy K is a curvature parameter that affects the speed at which size approaches the average maximum size (Loo).

von Bertalanffy t0 is a theoretical quantity necessary to describe the shape of the von Bertalanffy function.

Length at 50% maturity is the size at which 50% of the fish is population is mature.

Table 1: Life history parameters used to define the species' biological characteristics.

Parameter	**Value**
Length type	TL
Length units	cm
Weight units	g
Length-weight alpha	0.0057
Length-weight beta	3.14
von Bertalanffy Loo	39.55
von Bertalanffy K (per year)	0.21
von Bertalanffy t0	-0.81
Length at 50% maturity	22.29
Length increment to 95% maturity	3.34
Natural mortality (per year)	0.21
Protogynous hermaphrodite	0
Length at which cohort is 50% male	
Length increment to which cohort is 95% male	
M/K	1.01
Length at 50% maturity / von Bertalanffy Loo	0.56
Theoretical maximum age (years)	21.93

Length increment to 95% maturity is the size increase needed to reach 95% of the fish population being mature.

Natural mortality (M per year) represents the mortality due to natural causes and not associated to fishing.

Protogynous hermaphrodite describes species that transition from female to male with parameters: length at which cohort is 50% male and length increment to which cohort is 95% male.

M/K is the ratio of the natural mortality M to the growth coefficient K.

Length at 50% maturity / von Bertalanffy Loo is the ratio of maturity to average maximum size.

Theoretical maximum age (years) is calculated as -ln(0.01)/M, which is the age to which one percent of a cohort would survive under constant natural mortality of M.

Length data

Title: Monitoreo biologico MaNa

Summary: Datos del monitoreo biologico del FIP de camarón blanco de Marismas Nacionales, Nayarit

Table 2: Length data set

Parameter	Value
Length type	TL
Length units	cm
Length format	Length
Source	Fishery catch
Bin width	1

Table above provides information on the fish length dataset which was provided to conduct the analysis. It includes details such as the type of length measurement used, the units in which lengths were recorded, the format in which the length data is presented (frequencies or raw length measurements), and the source of the dataset. The table aims to provide an overview of the characteristics and origin of the fish length data.

Table 3: Length data details

Parameter	Value
Minimum length	4.6 cm
Average length	11.06 cm
Maximum length	24 cm
Length measurements	100
Groups	2
Group name	

Table above provides details contained in the length dataset, such as the number of observations ('Length measurements'), information on the recorded lengths ('Minimum length', 'Maximum length' and 'Mean length'), and the structure of the records ('Groups' and 'Group name'), e.g. if and how they are organized. The groups will be used in the analysis to evaluate the differences between groups.

Key terms and quantities:

Length type is the method used to measure the fish size; TL is total length, FL is fork length, SL is standard length, CL is carapace length, SHL is shell length, ML is mantel length.

Length units is the unit of length in which the fish sizes were recorded.

Length format refers to the options of raw lengths or frequency. Raw lengths (lengths) is a collection of length measurements stored as a vector. These are typically original length measurements of fish, which have not been binned. Multiple columns can be used, with each column pertaining to a level of a grouping variable, such as year or fleet. Frequencies is a collection of length measurements organized using two or more columns. The left-most column must contain bin mid points. The next column

contains the number of length measurement observations in each bin. While the first column is reserved for the bin mid points, multiple columns to its left can be used with each pertaining to a level of a grouping variable, such as year or fleet.

Source refers to the options of fisery catch or fishery independent. Fishery catch indicates that the source of the length data set is fishery-dependent. Fishery-independent (deprecated) indicates that the source of the length data set is fishery-independent, such as a research survey. Existing data sets assigned to this category will still function correctly in FishKit; however, new data sets of this type are not allowed.

Bin width is reported when a length data set contains frequencies. For histograms created from raw lengths, a bin width of 1 cm or 1 inch is used, depending on how user choses to display plots.

Groups and group name refer to an optional grouping variable included in the length data set.

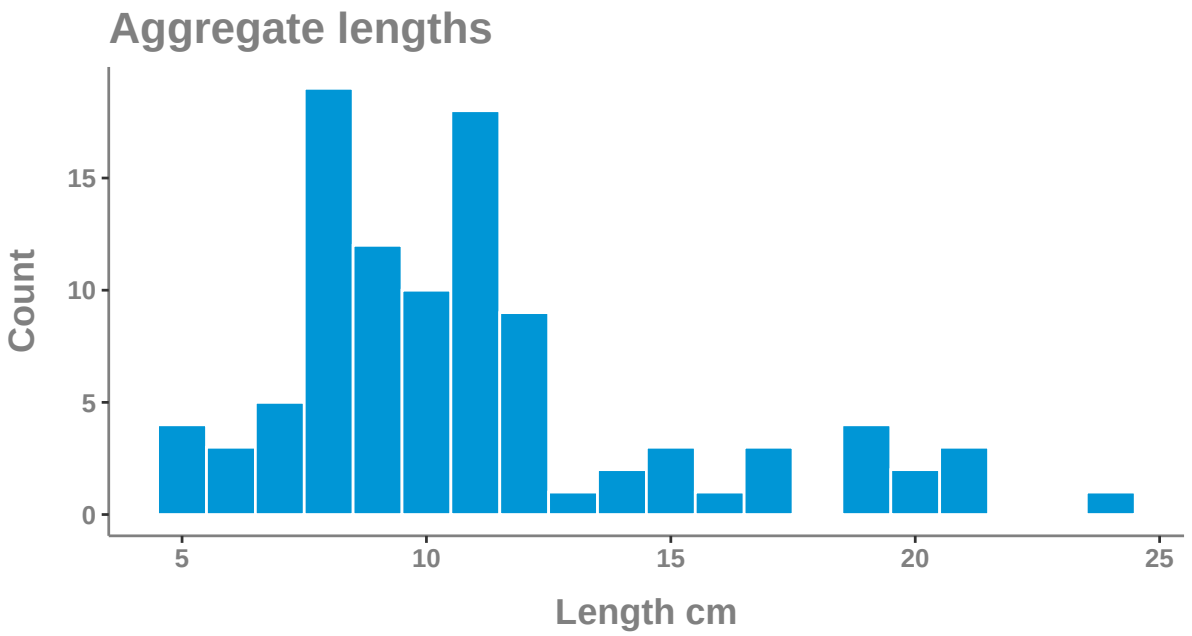


Figure above illustrates the distribution of lengths in the catch. The x-axis represents length, and the y-axis represents the number of individuals. Each bar corresponds to a length bin.

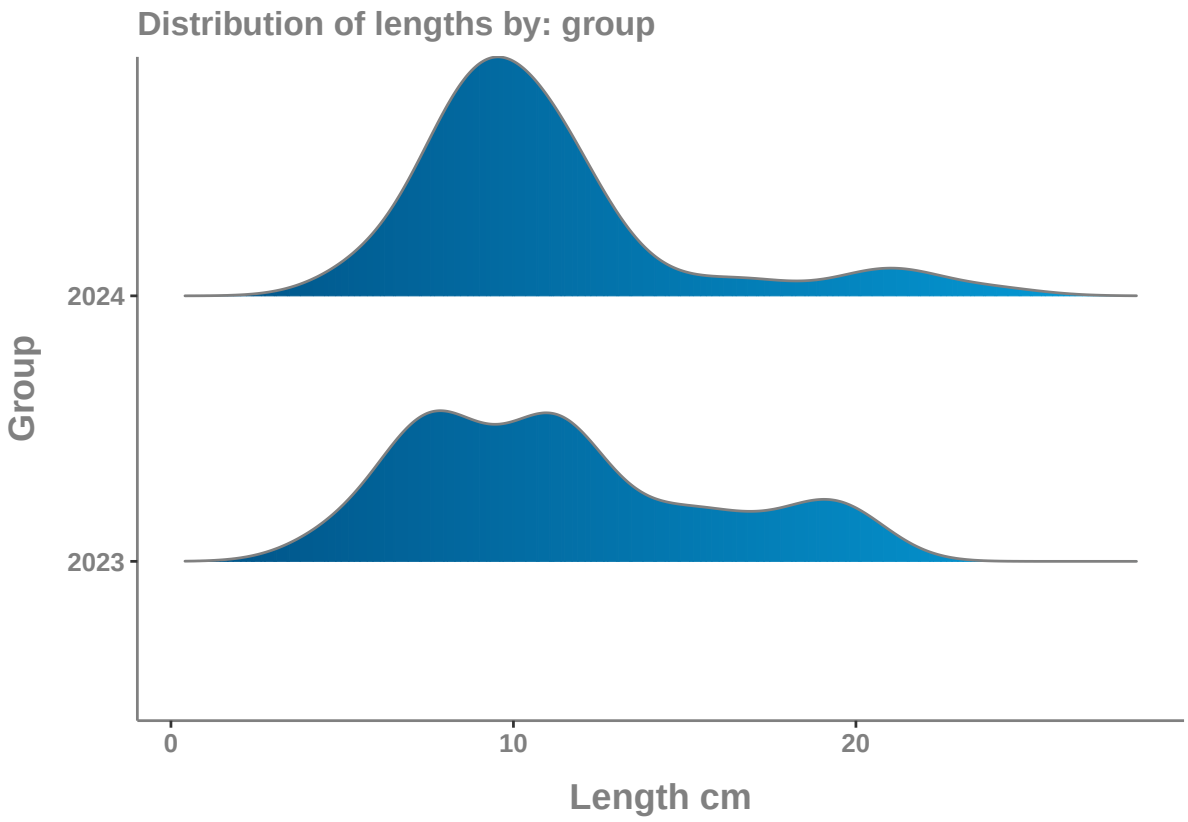


Figure above illustrates the distribution of lengths in the catch for each group. The x-axis represents length, and the y-axis represents the number of individuals. Each plot corresponds to a specific grouping category.

The length distribution shows the length structure of the catch, which can reflect the condition of the population, signs of overfishing (prevalence of smaller individuals), or the effect changes to fishing gears (disproportionate removal of specific size classes). Stock Health Tracker uses this information to monitor changes over time to track the impacts of fishing.

Various factors can alter fish populations' size structure, such as location, the intensity of fishing effort, the type of gear, or the environment. Hence, the variety of sizes in a population can change, particularly in populations that are being heavily fished. This is because fishing tends to target specific sizes. For example, if a fishing method is designed to catch larger individuals and the fishing pressure remains the same or increases over time, the distribution of sizes in the population will shift towards smaller ones in recent years. This is visible by examining the peak of the distribution (e.g. the length with the highest frequency/number) and the range of sizes (e.g. smallest and largest lengths on the curve).

Metrics

Mature fish in the catch

Group name: group; Included: All

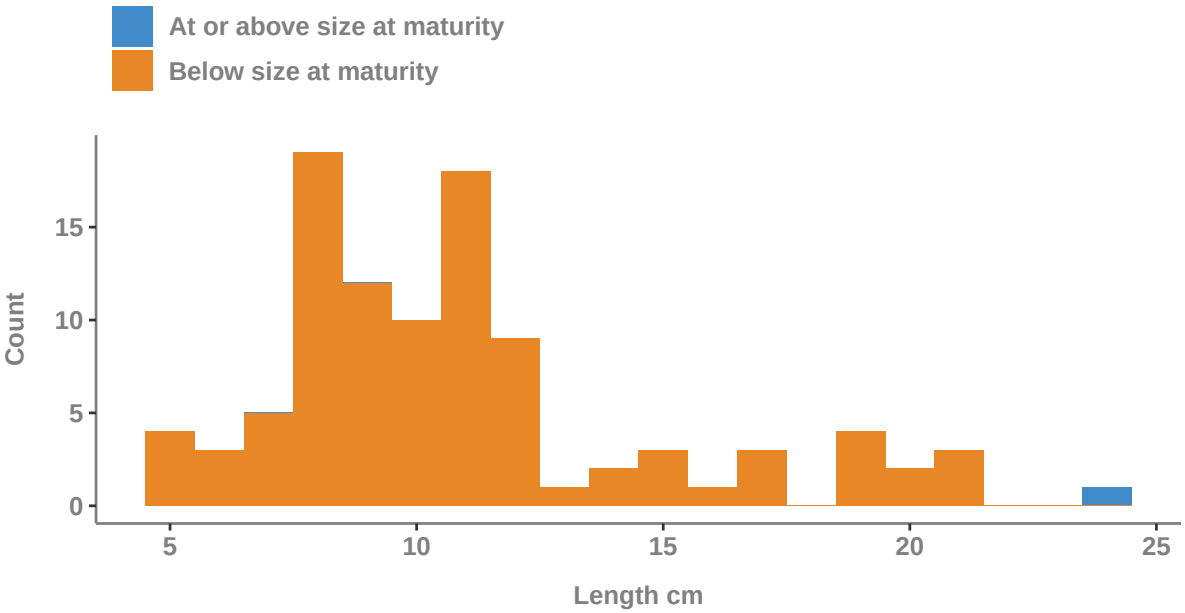
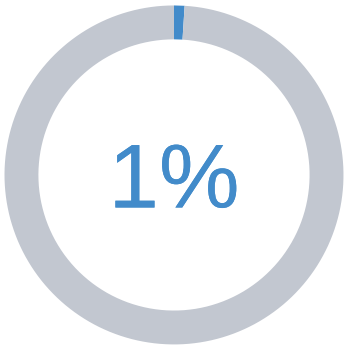


Figure above illustrates the distribution of the lengths in catches, with fish below the length at 50% maturity shown in orange and fish which have already matured in blue. The x-axis represents length and the y-axis represents the number of individuals. Each bar corresponds to a length bin.



Target is 100%

Length at 50% maturity 22.29 cm

Figure above shows the percentage of mature fish in the catch.

This metric is calculated relative to the length at 50% maturity. The goal for mature fish in the catch is 100%, as it is generally recommended to allow fish to reproduce at least once before becoming vulnerable to fishing. Managing sizes in the catch in relation to size at maturity can help to ensure population replenishment while conserving pretty good fishery yields (Hilborn 2010, Prince and Hordyk 2019).

Optimal sizes in the catch

Group name: group; Included: All

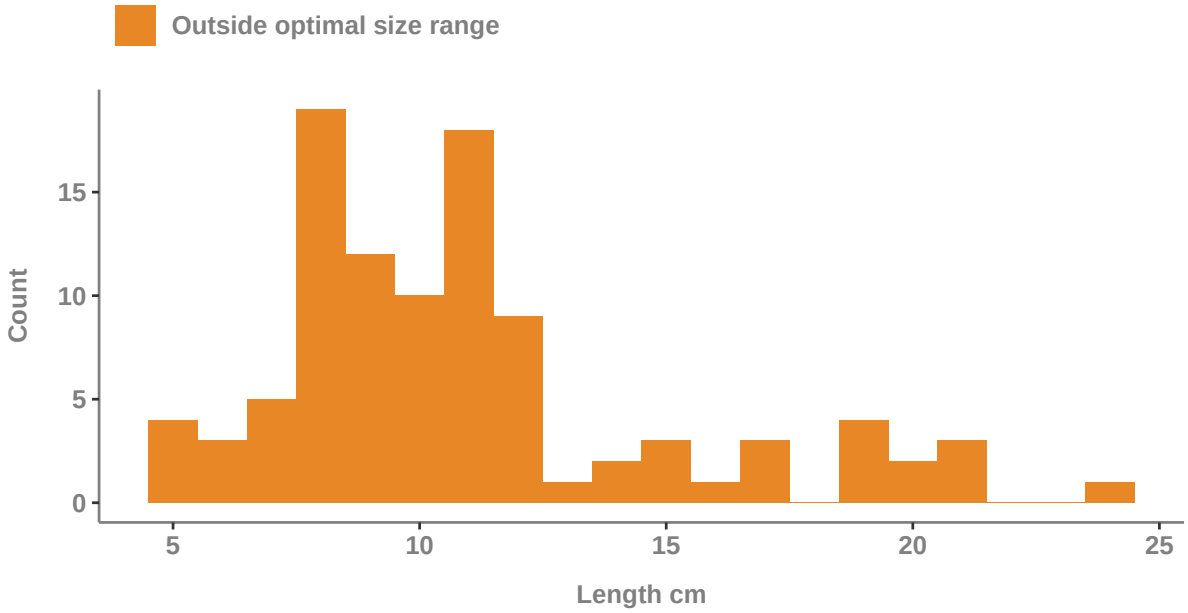
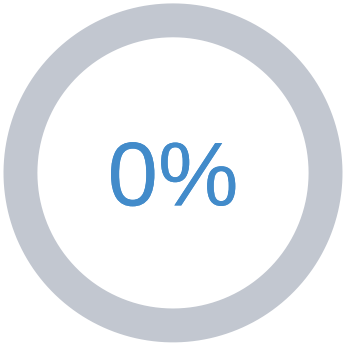


Figure above illustrates the distribution of the lengths in catches, with fish below and above the optimal size range in orange, and fish within the optimal size range in blue. The x-axis represents length and the y-axis represents the number of individuals. Each bar corresponds to a length bin.



Target is 100%

Optimal size range 26.63 to 32.55 cm

Figure above shows the percentage of optimal sizes in the catch.

Percent optimal sizes in the catch is calculated in three steps. First the quantity known as optimal length in the catch, Lopt, is approximated as (Beverton 1992; Froese 2004): Lopt = Loo / (3 + m/K). Second, a range of optimal lengths in the catch is defined as Lopt +/-10%. Finally, percent optimal sizes in the catch is calculated as the percentage of the length composition that fall within the defined range. Optimal size refers to the length at which a fish cohort achieves its maximum biomass, and thus, represents the size range that should be prioritized for fishing to maximize yield. The target here is also 100%, as it is preferable to avoid catching fish outside of this range.

Mega-spawners

Group name: group; Included: All

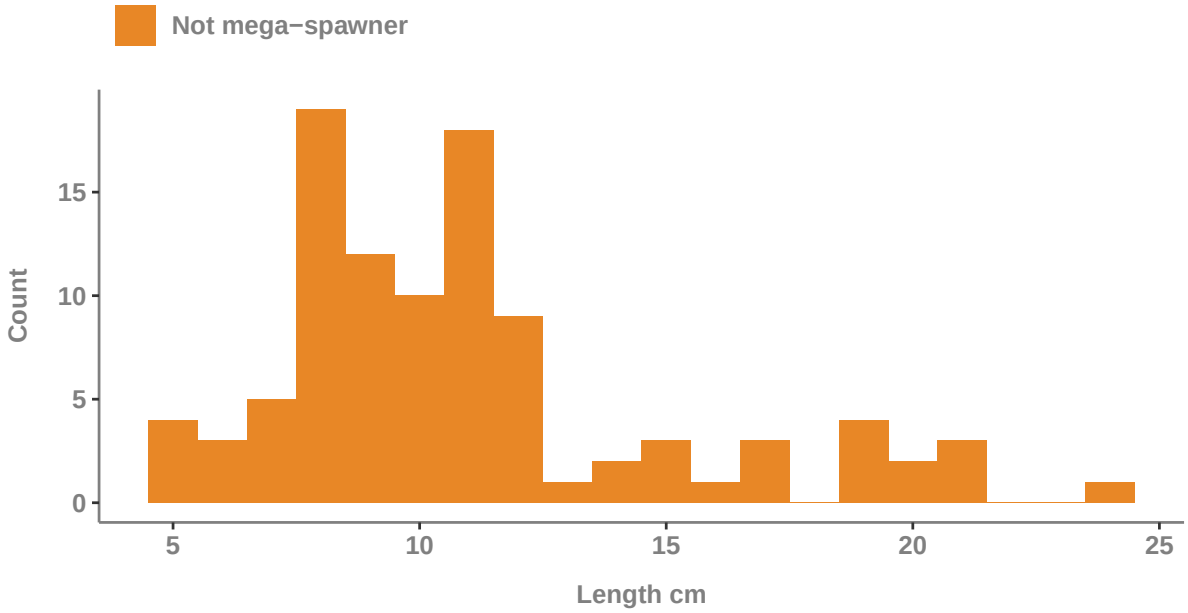


Figure above illustrates the distribution of the lengths in catches, with fish below the mega-spawner size in orange, and fish above the mega-spawner size in blue. The x-axis represents length and the y-axis represents the number of individuals. Each bar corresponds to a length bin.

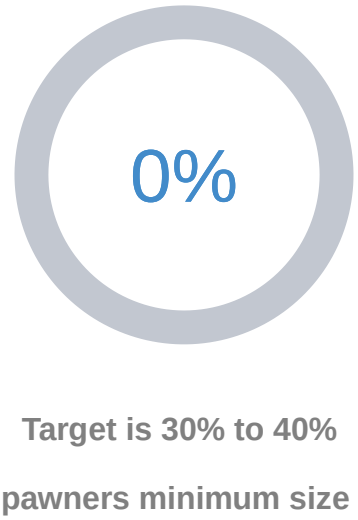


Figure above shows the percentage of mega-spawners in the catch.

Mega-spawners are individuals equal to or greater than Lopt +10%. The optimal length in the catch, Lopt, is approximated as (Beverton 1992; Froese 2004): Lopt = Loo / (3 + m/K). Interpretation of mega-spawners in the catch requries understanding the selectivity of the fishery. If fishers select for mega-spawners, their absence in the catch could be an indication of overfishing. Froese (2004) suggests a target of 30% to 40% of mega-spawners in the catch. If fishers actively avoid mega-spawners, their absence in the catch suggests larger-older fish may be protected and contributing to spawning to replenish the population.

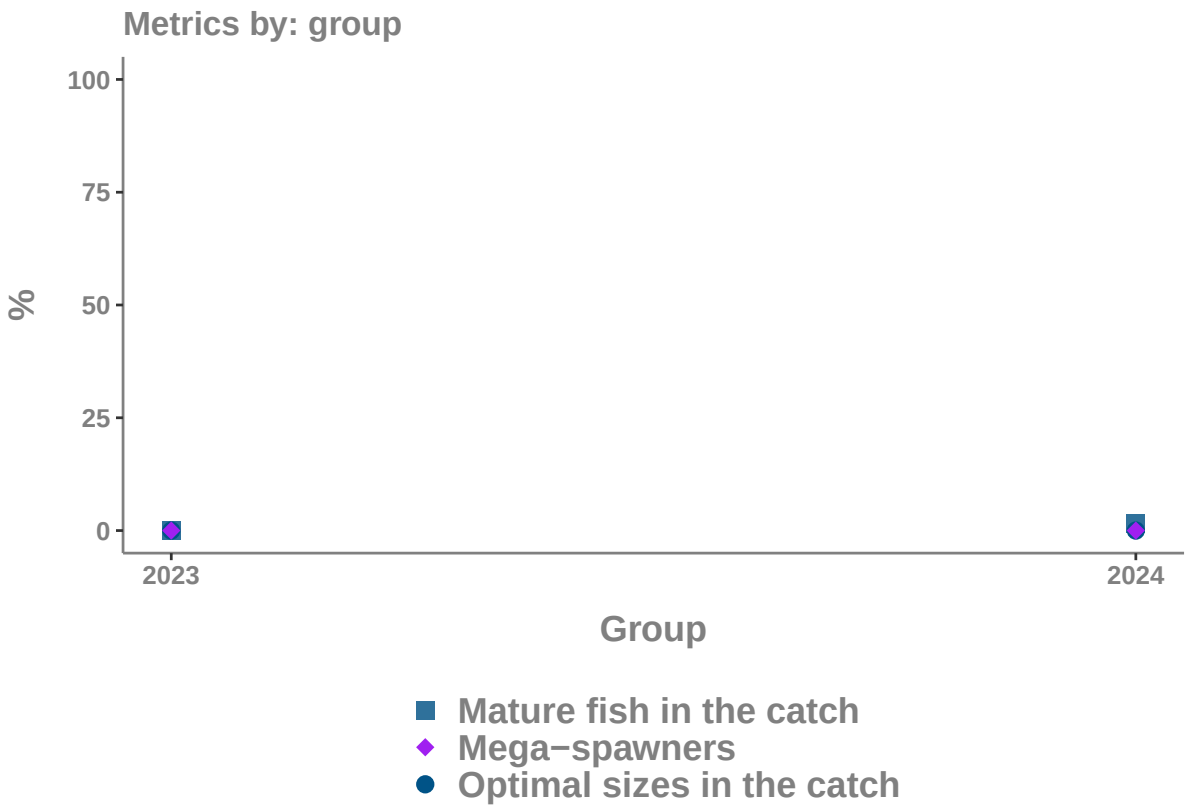


Table 4: Number of lengths measurements in the dataset (n) for each group.

Group	Percent	Metric
2023	0.00	Mature fish in the catch
2024	1.64	Mature fish in the catch
2023	0.00	Optimal sizes in the catch
2024	0.00	Optimal sizes in the catch
2023	0.00	Mega-spawners
2024	0.00	Mega-spawners

Sample size

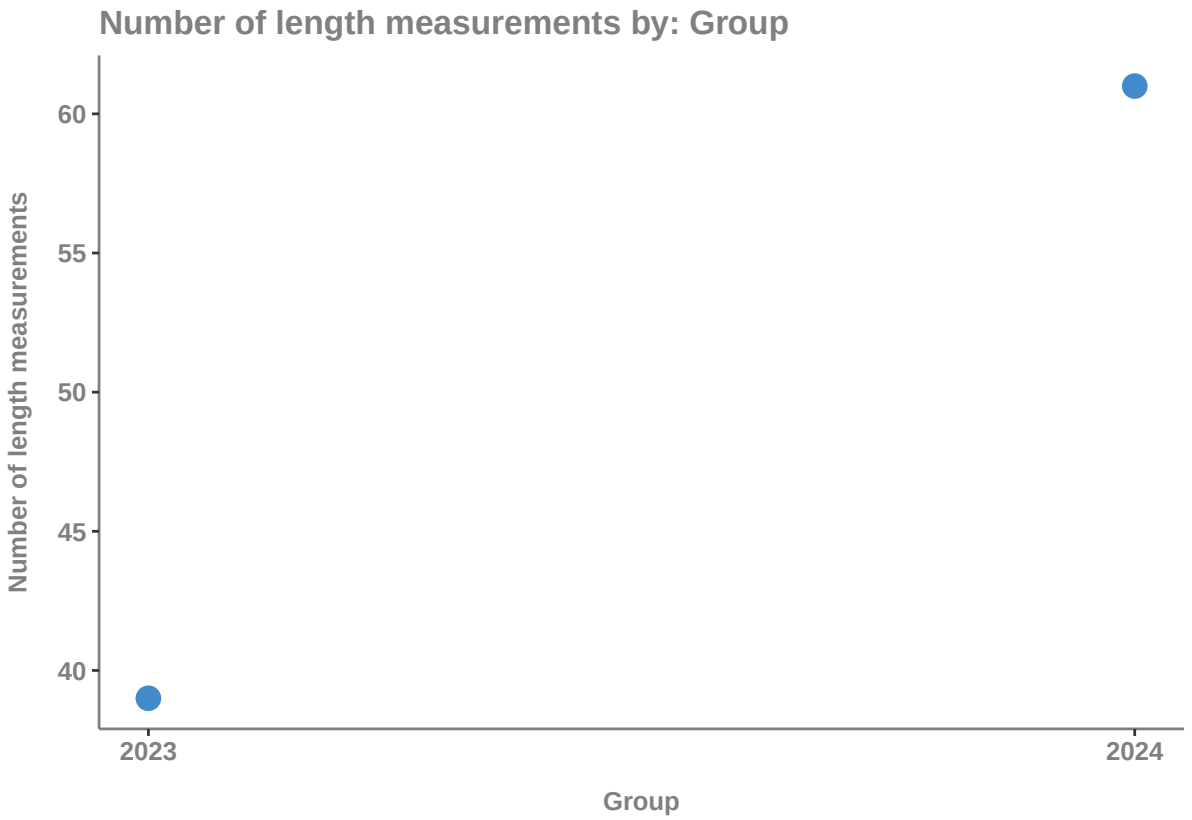


Figure above illustrates the number of lengths measurements in the dataset, for each group. The x-axis represents the grouping categories in the dataset, and the y-axis represents the number of observations recorded for fish length. This metric can be a useful summary of sufficiency of monitoring programs or participation in length-sampling programs by fishers. It is intended to capture a simple but fundamental metric of length sampling sufficiency.

Table 5: Number of lengths measurements in the dataset (n) for each group.

Group	n
2023	39
2024	61

Average length

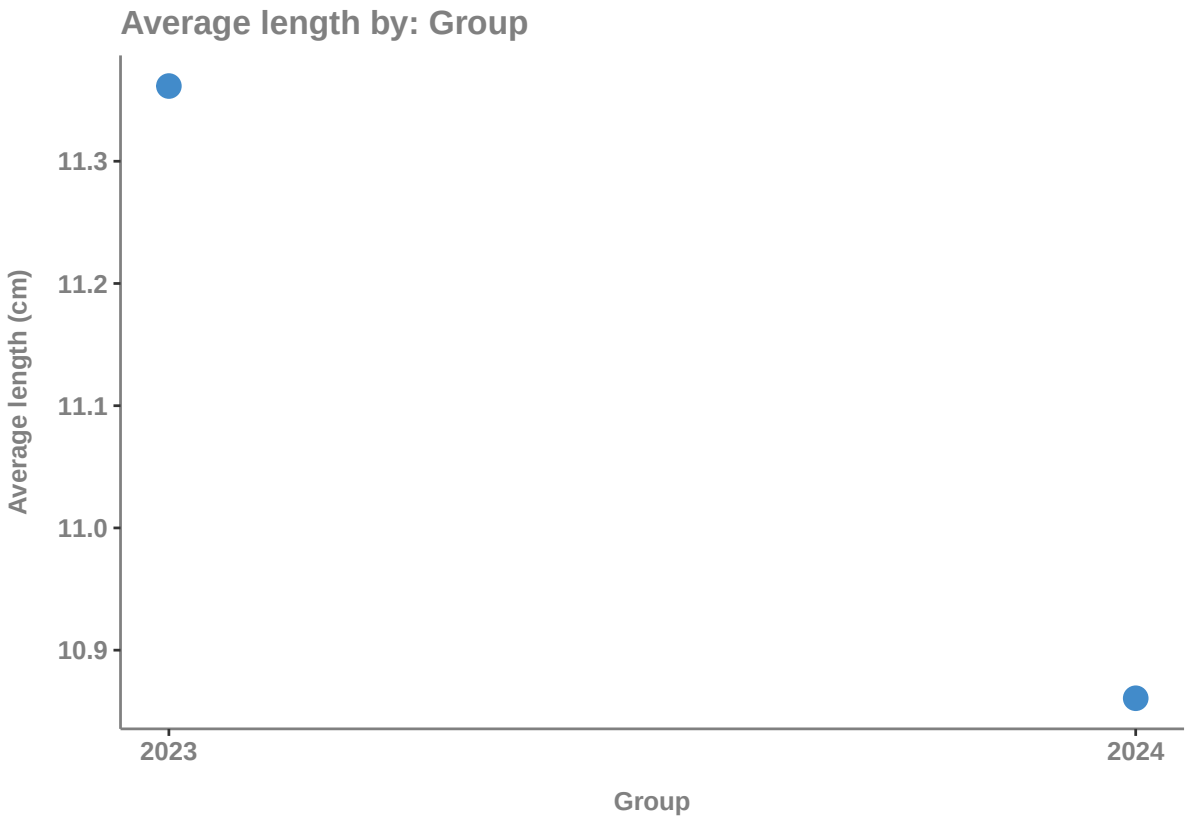


Figure above illustrates the average length in the dataset, for each group. The x-axis represents the grouping categories in the dataset, and the y-axis represents the average length of the sample. Changes in average length can be an indicator of fishery sustainability, with downward trends typically indicative of an increase in fishing mortality.

Table 6: Average length measured for each group.

	Group	Average length (cm)
2023	2023	11.36
2024	2024	10.86

Length-Based Spawning Potential Ratio (LBSPR)

Table 7: Length-based spawning potential ratio (LBSPR) model description

Item	Details
Source	Fishery catch
Bin width	1
Fishery selectivity	Estimated by model
CV Loo	0.1 (LBSPR default)
Model type	GTG

Table above provides information on the LBSPR analysis. The table aims to provide an overview of the characteristics of this length-based assessment model. Fishery selectivity is noted as a remineder that selectivity is always estimated by the LBSPR model; CV Loo is the coefficient of variation around the average maximum length (Loo); Model type is the subtype of model used in the analysis, e.g. growth-type-group (GTG) or absel, with GTG the recommended default.

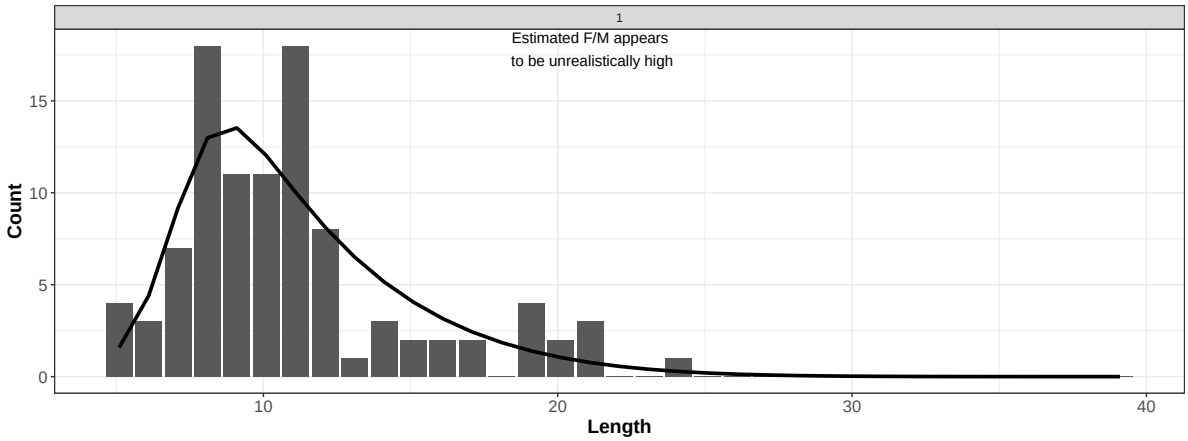


Figure above shows LBSPR model fit (solid line) to the length-frequency data in cm. The x-axis represents length, and the y-axis represents the number of individuals. Each bar corresponds to a length bin. The solid line represents the prediction by the LBSPR model. Figures shows the extent to which the LBSPR model predictions (line) align with the observed length-frequency data (vertical bars). A good model fit should capture the shape and distribution of fish lengths, ensuring that the predicted lengths corresponds to the observed size structure in the dataset.

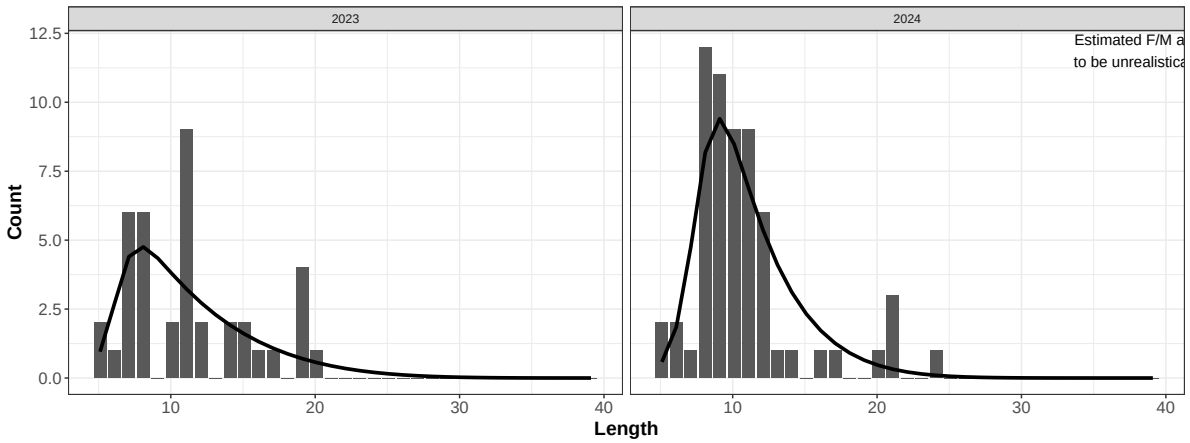


Figure above shows LBSPR model fits (solid lines) to the length-frequency data in cm, for each group. The x-axis represents length, and the y-axis represents the number of individuals. Each bar corresponds to a length bin. The solid line represents the prediction by the LBSPR model.

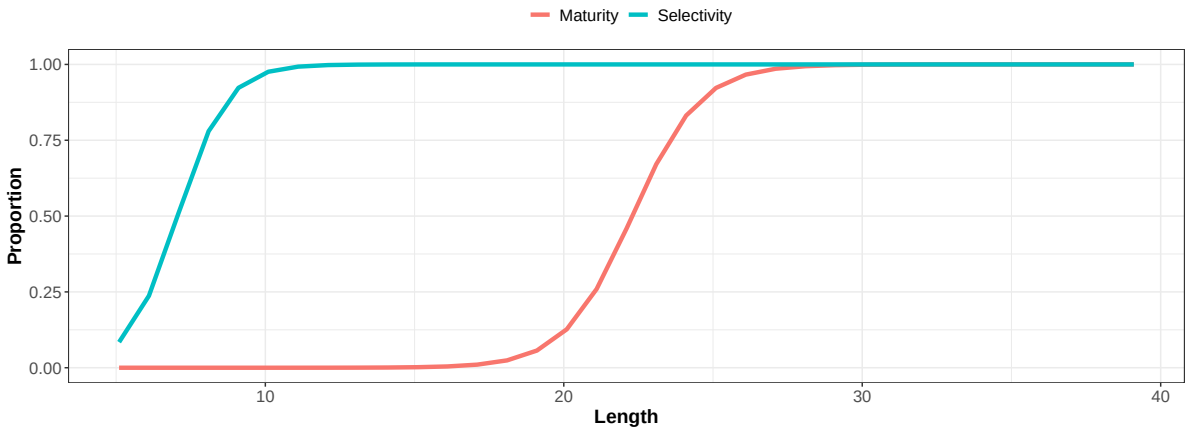


Figure above shows LBSPR model estimates of selectivity at length (blue line) and maturity-at-length (pink line). The x-axis represents length in cm, and the y-axis represents proportion. In this analysis, the selectivity curve represents the proportion of fish retained by the fishing gear at each length. For the maturity curve, the y-axis represents the proportion of fish in the population which are sexually mature, at each length. If the ascending limb of selectivity is positioned to the right of the maturity ascending limb, this will help to ensure that sexually mature fish are targeted (low risk of capturing immature individuals) and promote fishery sustainability.

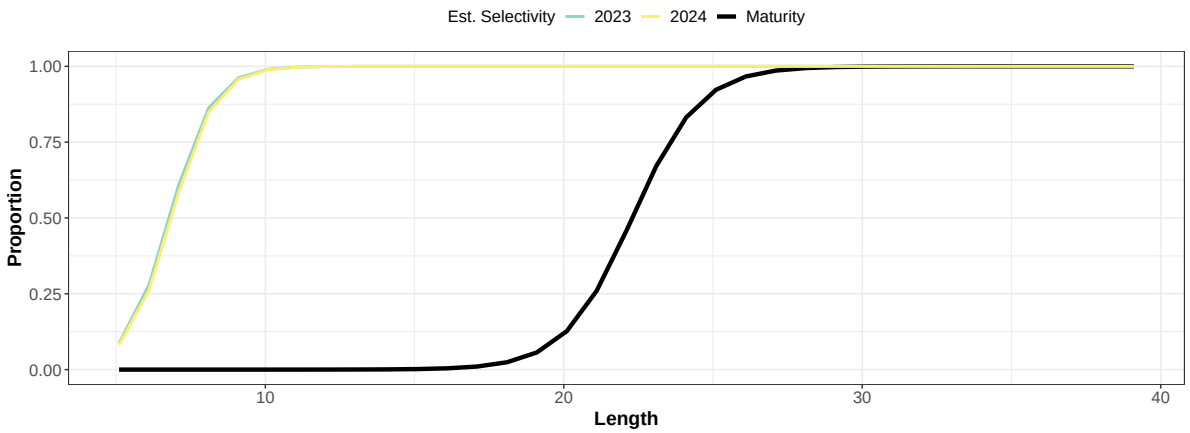


Figure above shows LBSPR model estimates of selectivity at length (blue line) and maturity-at-length (pink line), for each group. The x-axis represents length in cm, and the y-axis axis represents proportion. In this analysis, the selectivity curve represents the proportion of fish retained by the fishing gear at each length. For the maturity curve, the y-axis represents the proportion of fish in the population which are sexually mature, at each length category.

Table 8: Parameters estimated by the LBSPR model.

Group	Selectivity 50% (SL50; cm)	Selectivity 95% (SL95; cm)	F/M	SPR
All	7.06	9.48	5.92	0.0024358
2023	6.18	8.13	4.52	0.0063096
2024	7.52	9.83	7.15	0.0011298

SPR is near parameter bounds and may be unreliable

Table above provides model results such as the estimated logistic selectivity parameters ('Selectivity 50% (SL50)' and 'Selectivity 95% (SL95)', the relative fishing mortality to natural mortality ratio (F/M), and the Spawning Potential Ratio (SPR). These estimates are provided for the overall dataset, as well as for each grouping category. Point estimates by group are reported, not smoothed estimates.

Logistic selectivity is specified with parameters SL50 and SL95, reflecting the length at which 50% of the population is vulnerable to the gear and the length at which 95% of the population is vulnerable to the gear, respectively.

Figure above shows estimates of Spawning Potential Ratio (SPR) for each group with 95% confidence intervals. The x-axis represents the groups, and the y-axis represents the estimates. SPR compares the spawning potential of the population under current fishing conditions to the potential spawning if there were no fishing. SPR values range from 0 to 1, where 0 represents a situation where spawning potential is completely depleted, and 1 indicates full spawning potential.

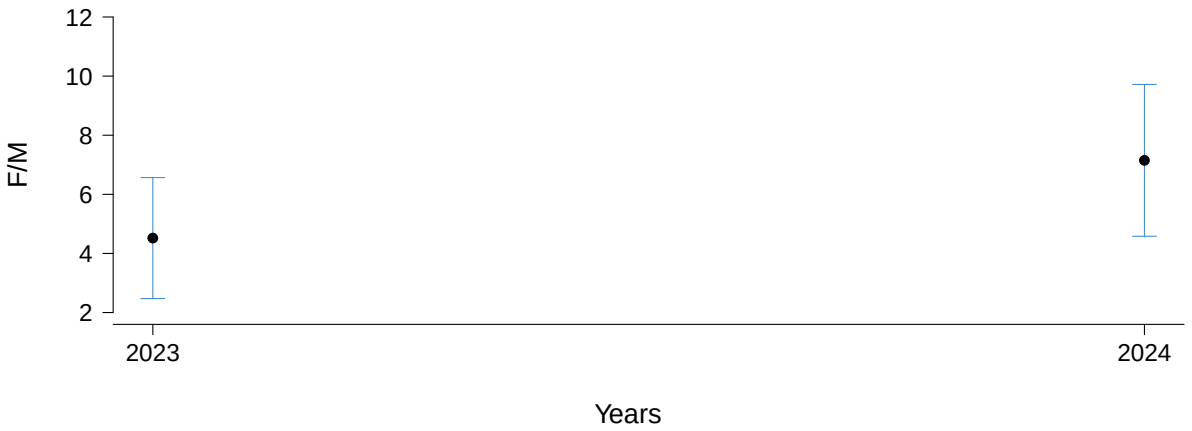


Figure above shows estimates of the fishing mortality to natural mortality ratio (F/M) for each group with 95% confidence intervals. The x-axis represents the groups, and the y-axis represents the estimates. F/M is measure of fishing pressure.

Reference

Beverton, R.J.H. 1992. Patterns of reproductive strategy parameters in some marine teleost fishes. Journal of Fish Biology 41(sB): 137–160. doi:10.1111/j.1095-8649.1992.tb03875.x.

Froese, R. 2004. Keep it simple: three indicators to deal with overfishing. Fish and Fisheries 5(1): 86–91. doi:10.1111/j.1467-2979.2004.00144.x.

Hilborn, R. 2010. Pretty good yield and exploited fisheries. Mar. Policy 34: 193–196.

Hordyk, A.R., Ono, K., Prince, J.D., and Walters, C.J. 2016. A simple length-structured model based on life history ratios and incorporating size-dependent selectivity: application to spawning potential ratios for data-poor stocks. Can. J. Fish. Aquat. Sci. 73(12): 1787–1799. doi:10.1139/cjfas-2015-0422.

Prince, J., and Hordyk, A. 2019. What to do when you have almost nothing: A simple quantitative prescription for managing extremely data-poor fisheries. Fish Fish 20(2): 224–238. doi:10.1111/faf.12335.

Report identifier

User identifier: bernardo.sanchez@tnc.org

Report identifier: auth0|62993848d7925a006fb6a669-192430705

Report sharing

Report sharing: I agree to share the results of my FishKit session with the FishKit team.

Response: No

Report type: In which contexts is the FishKit Tool being used?

Response: None selected