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Would the abundance of *Plagioscion squamosissimus* (Heckel, 1840) in a Brazilian semiarid reservoir be influenced by climatic seasonality and land cover?

Seria a abundância de Plagioscion squamosissimus (Heckel, 1840) em reservatório do semiárido brasileiro influenciada pela sazonalidade climática e cobertura da terra?

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Abstract: This study investigated how climate seasonality, volume, and land cover affect the abundance of the non-native fish population *Plagioscion squamosissimus* (Heckel, 1840) in the Santa Cruz reservoir, located in the municipality of Apodi, Rio Grande do Norte. Fish were collected at eight different points during the dry and rainy seasons of 2013, 2015, and 2017. Temperature, precipitation, reservoir volume, and land cover data were analyzed. The results showed no significant differences in fish abundance among years, quarters, and rainy and dry periods. Reservoir volume, temperature, precipitation, water surface area, and some land cover categories did not affect the quantity of collected fish. However, uncovered areas had a negative effect on fish abundance, likely due to the influx of sediments and debris. On the other hand, the presence of herbaceous vegetation had a positive effect. These findings emphasize the importance of land cover and vegetation in the dynamics of fish populations in aquatic ecosystems, providing relevant information for biodiversity conservation and reservoir management.

Keywords: Introduced species; Satellite imagery; Northeast Brazil.

Resumo: Este estudo investigou como a sazonalidade climática, volume e cobertura da terra afetam a abundância da população do peixe não nativo *Plagioscion squamosissimus* (Heckel, 1840) no reservatório de Santa Cruz, município de Apodi, Rio Grande do Norte. Foram coletados peixes em oito pontos durante as estações seca e chuvosa de 2013, 2015 e 2017. Dados de temperatura, precipitação, volume do reservatório e cobertura da terra foram analisados. Os resultados mostraram que não houve diferenças significativas na abundância de peixes entre os anos, trimestres e períodos de chuva e seca. O volume do reservatório, temperatura, precipitação, área de lâmina de água e algumas categorias de cobertura da terra não afetaram a quantidade de peixes coletados. No entanto, áreas descobertas tiveram efeito negativo na abundância de peixes devido à entrada de sedimentos e detritos. Por outro lado, a presença de vegetação herbácea teve efeito positivo. Esses resultados ressaltam a importância da cobertura da terra e da vegetação na dinâmica de populações de peixes em ecossistemas aquáticos, fornecendo informações relevantes para a conservação da biodiversidade e o manejo de reservatórios.

Palavras-chave: Espécie introduzida; Imagens de Satélite; Nordeste do Brasil.

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1. Introduction

The silver croaker, *Plagioscion squamosissimus* (Heckel, 1840), is a non-native species of significant economic importance, notably present in the Santa Cruz Reservoir, Rio Grande do Norte, Brazil (NOVAES et al., 2015). Its abundance in reservoirs within the Brazilian semi-arid region is sensitive to the climatic seasonality of the area, characterized by prolonged periods of drought and negative water balance (MARENGO; TORRES; ALVES, 2017). During such periods, reservoirs experience reductions in available water levels, affecting habitat area and water quality, potentially impacting the survival and reproduction of *P. squamosissimus* (SOUZA et al., 2017). Thus, the climatic seasonality of the semi-arid region plays a critical role in regulating fish abundance in the area.

The composition of land use and land cover categories in semi-arid reservoirs may influence the abundance of *Plagioscion squamosissimus*. Different types of cover, such as forested areas, pastures, urban areas, and adjacent water bodies, have the potential to affect habitat availability, food supply, and water quality, key factors for species success (FILGUEIRA et al., 2016). These land cover categories play a crucial role in controlling the input of nutrients, sediments, and debris into the reservoirs (NOBRE et al., 2020). Urban areas and intensive agricultural activities can result in water pollution due to chemical runoff and sedimentation, as well as reduce the availability of suitable habitats (COSTA et al., 2022). Junger et al. (2019) assert that the conversion of natural areas into pastures can cause alterations in aquatic habitat structure and quality, affecting species reproduction and success.

It is important to highlight the use of technologies such as digital processing of satellite images as a fundamental tool for obtaining land cover data. These technologies allow for accurate and efficient mapping and monitoring of different land cover classes around reservoirs (NOVO, 2010), enabling a more detailed analysis of the relationships between silver croaker abundance and landscape composition. The use of geoprocessing tools aids in obtaining relevant spatial information (KNIGHT et al., 2005), contributing to a better understanding of the patterns and processes governing the ecology of this non-native species in semi-arid Brazilian reservoirs.

In this study, the aim is to investigate the potential relationships between climatic seasonality, land cover, and the abundance of *Plagioscion squamosissimus* in a reservoir located in the semi-arid region of Brazil. To achieve this, the following hypotheses were formulated: i) the abundance of *P. squamosissimus* varies as a function of climatic seasonality; ii) reservoir volume influences species abundance; and iii) land cover around the reservoir affects species abundance. By examining the temporal patterns of fish abundance and analyzing the influence of climatic variability and land cover characteristics, we hope to provide information on the ecological dynamics of the species in the Santa Cruz Reservoir, RN.

Overall, this study aims to contribute to understanding the ecological factors that modulate fish abundance in semi-arid Brazilian reservoirs. Climatic variability and land cover characteristics are among the main factors that may influence the success of fish species. However, little is known about the specific effects of climatic seasonality and land cover on the abundance of *Plagioscion squamosissimus*. This information can be applied in the development of effective management policies for biodiversity conservation and protection of aquatic ecosystems, contributing to the sustainability of these systems in the context of constantly changing climates, which may affect species survival (SERVILI et al., 2020). Thus, understanding how climatic seasonality and reservoir land cover categories interact with the ecology of *P. squamosissimus* is crucial for assessing its abundance.

2. Methodology

2.1 Study Area

The Santa Cruz Reservoir (SCR, 5° 45' 59" S and 37° 47' 57" W), located in the municipality of Apodi, is part of the second-largest hydrographic basin in extent in Rio Grande do Norte (Figure 1), the Apodi-Mossoró basin. The SCR has a total drainage area of 4,385.80 km² and a volumetric capacity of 599.71 hm³ (ANA, 2017).

Due to its location in the Brazilian semiarid region, the rainfall regime is irregular, with most precipitation concentrated in just three or four months, totaling about 800 mm annually. Temperatures are high, ranging from 23 to 27°C, and relative humidity hovers around 50%. Moreover, evaporation rates reach approximately 2000 mm per year. According to the Köppen classification, this region is classified as hot and dry, designated as BSh (PIMENTEL; ASSIS, 2022).

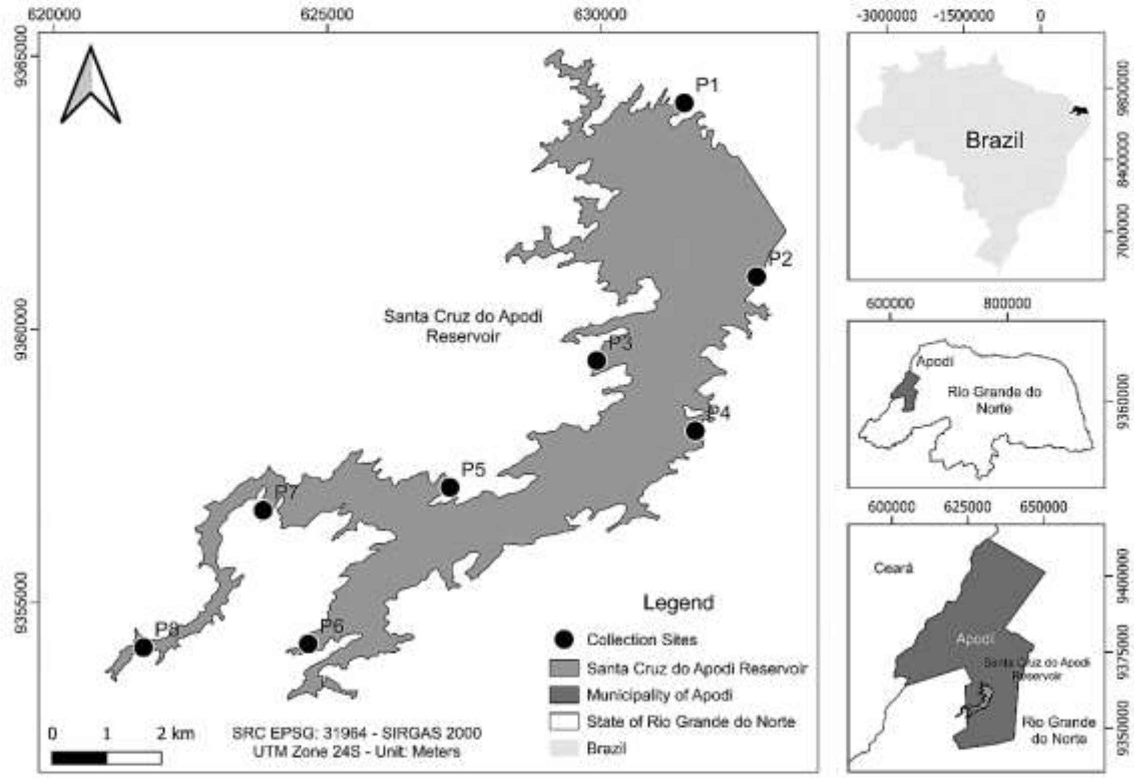

Figure 1 – Location of the Santa Cruz Reservoir, Rio Grande do Norte, Brazil.
Source: Authors (2024); IBGE (2020), INPE (2020).

2.2 Fish Sampling

The captures occurred during the dry and rainy seasons in the years 2013, 2015, and 2017, at eight sites distributed along the perimeter of the reservoir. The collections were standardized using 11 gill nets, with mesh sizes ranging from 12 to 70 mm between adjacent knots, with dimensions of 15 m in length by 1.8 and 2.0 m in height, totaling an area of 301.8 m². The gear was set at 17:00, checked at 21:00, and removed at 05:00 the next day, totaling 12 hours of exposure. Each collected individual was taken to the laboratory for identification.

2.3 Temperature, Precipitation, and Volume of the Santa Cruz Reservoir

To obtain the data on average temperature and accumulated precipitation, information from the conventional meteorological station (Code 82590) in Apodi, Rio Grande do Norte (5° 37’ S and 37° 49’ W), located approximately 16 km from SCR, was used through the historical data portal of the National Institute of Meteorology (INMET, 2020). Climatological normals were obtained for this dataset covering 30 years (1987 to 2017) using monthly averages, serving as the basis for obtaining the climograph of Apodi (Figure 2).

Volumetric data for the Santa Cruz reservoir were obtained from the historical database of the Environmental and Water Resources Secretariat of Rio Grande do Norte (SEMARH, 2020). The months of February and May 2015 had no records; in this case, the average values between the records of the previous and subsequent dates were adopted to fill in the information gaps.

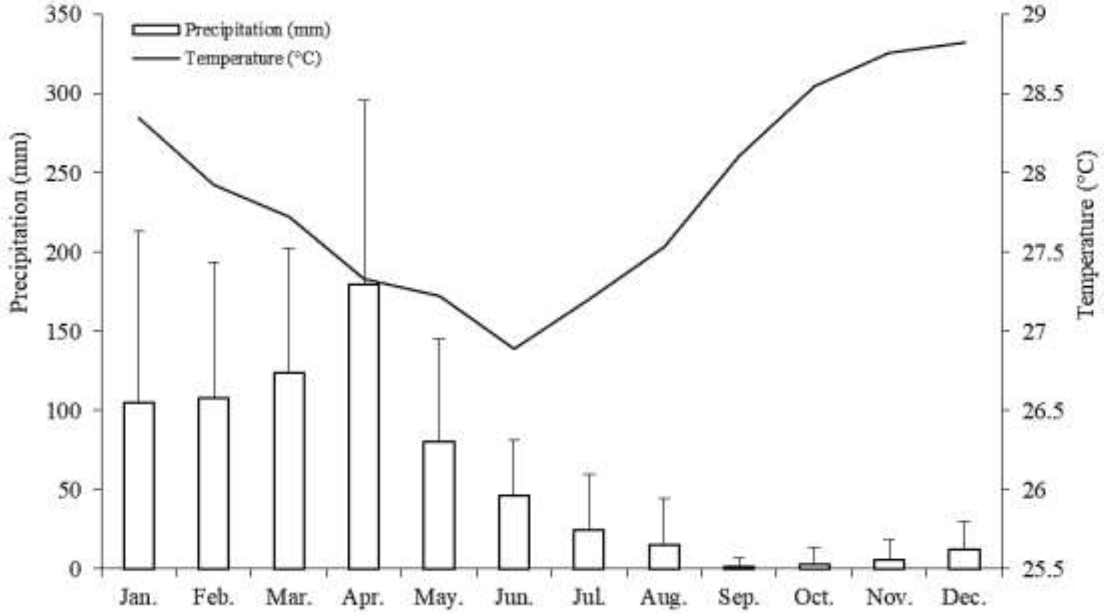

Figure 2 – Climograph of the municipality of Apodi, Rio Grande do Norte, based on 30 years of temperature and precipitation data (1987–2017). Showing the monthly historical average precipitation (with standard deviation), and monthly historical average temperature.
Source: Authors (2024); INMET (2020).

2.4 Geographic Data Processing

To obtain the water surface area and quantify the proportion of different land cover types around the reservoir, images from different satellites with similar spectral characteristics were used, acquired from the image catalog of the National Institute for Space Research (INPE, 2020) and the Earth Explorer portal (USGS, 2020) (Table 1). The criteria for choosing the images were those that coincided or came close to the field collection dates, with low cloud cover.

Table 1 – Spectral characteristics of the sensors used to obtain land cover information over the Santa Cruz Reservoir, Rio Grande do Norte. Showing spatial and temporal resolutions, as well as wavelength values for green, red, and near-infrared bands.

Satellite	Sensor / Correction Level	Center Wavelength (µm)			Resolution	
		Green	Red	Near Infrared	Spatial (m)	Temporal (Days)
Landsat 8	OLI/L2-C2	0.560	0.655	0,865	30	16
CBERS4	MUX/L2-L4	0.555	0.660	0,830	20	26
Resource Sat 1 e 2	LISS III/L2	0.555	0.650	0,815	23,5	24

Source: Authors (2020); USGS (2020), INPE (2020).

With the use of the programming environment in the R language (R Core Development Team, 2020) and the raster and rgdal packages, the green, red, and near-infrared bands were pre-processed, first converting digital numbers to top-of-atmosphere reflectance (CHANDER, 2007; RUHOFF, NOVO; ROCHA, 2015; NASCIMENTO et al., 2020), and then applying the Dark Object Subtraction (DOS) atmospheric correction to the image set (BATUR; MAKTAV, 2017).

Using the QGIS free geographic information system version 3.22 (QGIS.ORG, 2020), the images were converted to the SIRGAS 2000 UTM Zone 24S projection and georeferenced using a LANDSAT image as a reference, using the georeferencing tool. After this step, the Normalized Difference Water Index (NDWI) (Equation 1) was calculated to obtain the water surface area, and the Soil Adjusted Vegetation Index (SAVI) (Equation 2) was calculated to obtain the proportions of each land cover category. These indices are formed by the normalized difference, in the first case: bands of the green and near-infrared spectrum (MCFEETERS, 1996), and in the second case, of the red and near-infrared, with the addition of a constant L that minimizes the effects of soil on the result (HUETE, 1988). Specifically, for semi-arid regions, the use of a value of 0.5 for the constant L is recommended (PONZONI; SHIMABUKURO; KUPLICH, 2015).

$$\text{NDWI} = \frac{(\text{Green - Near Infrared})}{(\text{Green + Near Infrared})} \qquad \text{(Equation 1)}$$

$$\text{SAVI} = \frac{(\text{Near Infrared – Red}) \times (1 + L)}{(\text{Red + Near Infrared} + L)} \qquad \text{(Equation 2)}$$

To select the reservoir's water surface area, the NDWI product was converted to vector format using the Raster to Vector tool, generating the polygon representing the reservoir's water surface area, where the area in km² was calculated using the Field Calculator tool (Figure 3).

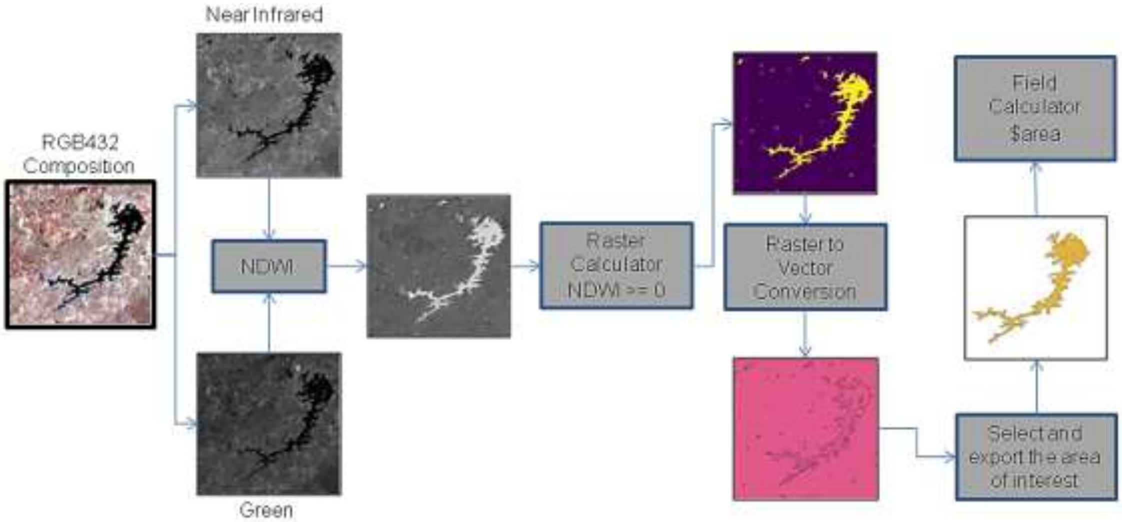

Figure 3 – Obtaining the water surface area of the Santa Cruz Reservoir, Rio Grande do Norte. Resourcesat 2 satellite image in RGB432 false color composition.
Source: Authors (2024); INPE (2020).

For the classification of land cover areas, the area was delimited based on its drainage basin. Thus, digital elevation models (DEM) were acquired through the TOPODATA portal (INPE, 2009). The files covering the RSC are coded as 06s39_ZN and 05s39_ZN. After downloading, the images were merged, imperfections were corrected using the fill sinks tool, and the upslope area tool was used to delimit the drainage area, which was later converted to a vector.

After generating the drainage basin (Figure 4), a 1 km buffer was applied to the area of the water surface with the highest record in February 2013. Subsequently, the water surface area was removed using the symmetric difference tool with the file generated by NDWI, leaving only the area surrounding the reservoir for classification (Figure 4).

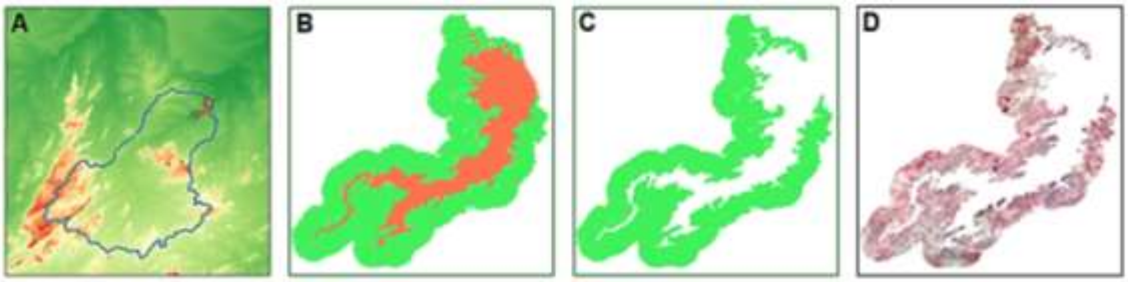

Figure 4 – Obtaining the classification area of satellite images. A) Delimitation of the reservoir drainage basin, B) Application of a 1 km buffer to the reservoir water surface area within the drainage basin limits, C) Removal of the water surface area, and D) Satellite image cropped by the buffer area in the drainage basin of the Santa Cruz Reservoir, Rio Grande do Norte, ready for classification.
Source: Authors (2024); INPE (2009), INPE (2020).

The classification was performed using the K-means clustering for grids tool from the SAGA module. Through this process, the images were automatically classified into four classes: Herbaceous Vegetation, Bare Area, Arboreal-Shrub Vegetation, and Water Resources (Figure 5).

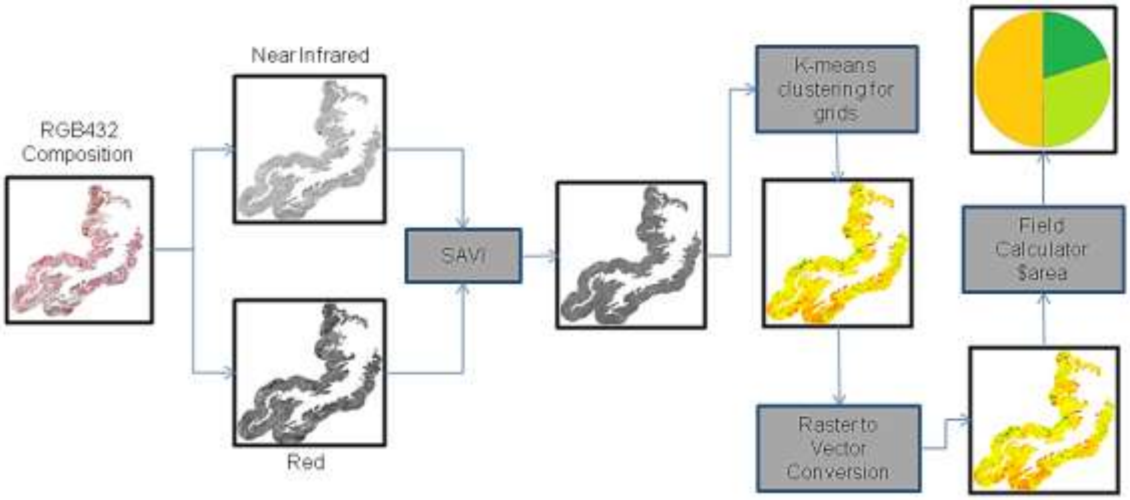

Figure 5 – Obtaining land cover data using unsupervised classification of images derived from the Soil-Adjusted Vegetation Index (SAVI).
Source: Authors (2024); INPE (2020).

After completing this stage, the data were added to a CSV spreadsheet, enabling their use in the R programming environment (R Core Development Team, 2020).

2.5 Statistical Analyses

To visualize the difference in the number of *Plagioscion squamosissimus* captures concerning climatic seasonality, specific statistical tests were conducted to compare the collection years, rainy and dry periods, as well as quarters. The non-parametric Kruskal-Walli's test was used to identify the statistical significance of these comparisons. Subsequently, the Dunn post-hoc test was applied to identify significant differences between groups.

Pairwise regression analyses were conducted to test the effects of rainfall, temperature, reservoir volume and water surface area, as well as land cover categories, on the number of collected fish. Models with p-value < 0.05, meeting the assumptions of linear regression, were considered statistically significant. The Shapiro-Wilk test was used to check the normality of residuals, the Durbin-Watson test for residual independence, and the Breusch-Pagan test for residual homogeneity. Statistical analyses related to this work were conducted using the R programming environment (R Core Development Team, 2020).

3. Results and Discussion

In the Santa Cruz Reservoir, Rio Grande do Norte, 417 individuals of *Plagioscion squamosissimus* were collected during the study: 141 in 2013, 202 in 2015, and 74 in 2017. A fluctuation pattern in the population over time was observed (Figure 6). The highest numbers of captures were recorded in the first quarters of 2013 and 2015 (56 and 75, respectively), indicating a possible peak of activity or recruitment. However, over these years, captures gradually decreased, suggesting a decline in abundance or displacement of individuals. In contrast, in 2017, there was a gradual growth throughout the year, culminating in a peak of 43 captures in the last quarter. This increase may be attributed to factors such as food availability, environmental conditions, competitive interactions, predation, and species reproduction patterns (LIAUTAUD et al., 2019).

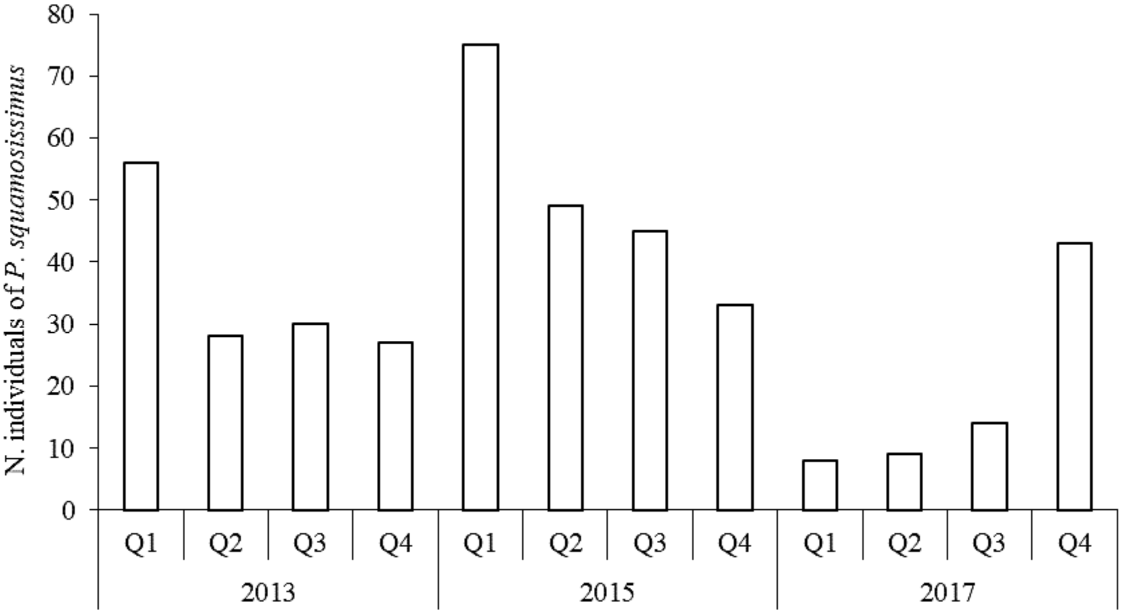

Figure 6 – Number of individuals of Plagioscion squamosissimus (Heckel, 1840) captured in 12 quarterly collections conducted between February and November in 2013, 2015, and 2017, in the Santa Cruz Reservoir, Rio Grande do Norte.

Source: Authors (2024).

Temporal factors influence fish population dynamics, shaping their reproduction, migration, and survival patterns over time (PENNOCK et al., 2023). Considering the reality of the Brazilian semi-arid region, the population of *P. squamosissimus* was subject to adverse climatic conditions. There was an average reduction of approximately 50% in precipitation between 2013 and 2015, while average temperatures slightly increased from 28.16 to 28.27 °C. As a result, there was a reduction in the volume of the SCR from 349.62 to 194.92 hm^3. During the year 2017, precipitation showed the highest average compared to the other years. However, the reservoir volume, besides recording the lowest average value among the years studied, also registered the lowest minimum value in 2017 (Table 2; Figure 7).

During the year 2015, the peak of captures occurred in the first quarter, a period characterized by the lowest average precipitation and the highest average temperature, reducing the reservoir volume, accompanied by a reduction in the number of captures in the dry season. These results are in agreement with the study by Souza et al. (2017), which investigated the species in the same reservoir between 2010 and 2014. These researchers indicated that the abundance of *P. squamosissimus* decreased as the reservoir volume decreased. Water scarcity and changes in habitat availability may have affected the reproduction, recruitment, and survival of these fish (MORID; SHIMATANI; SATO, 2020). The results highlight the importance of considering the climatic context and changes in reservoir volumes in understanding the patterns and trends of fish populations in the Brazilian semi-arid region.

Table 2 – Descriptive statistics for quarterly climate data from the municipality of Apodi, Rio Grande do Norte, and the volumetric capacity of the Santa Cruz do Apodi reservoir for the years 2013, 2015, and 2017.

Year	Descriptive Statistics	Precipitation (mm)	Temperature (°C)	Volume (hm³)
2013	Standard	41.48	28.16	330.46
	Deviation	63.95	1.07	13.21
	Minimum	0.00	26.34	305.06
	Maximum	223.50	29.54	349.62
2015	Standard	24.46	28.27	218.57
	Deviation	38.65	0.51	16.78
	Minimum	0.00	27.59	194.92
	Maximum	110.80	29.27	245.4
2017	Standard	48.93	28.23	116.53
	Deviation	71.50	0.71	13.35
	Minimum	0.00	27.09	94.89
	Maximum	217.70	29.19	135.79

Source: Authors (2024); INMET (2020), SEMARH (2020).

Although the year 2016 recorded the highest precipitation value in the entire time series, this peak was concentrated in the first month of the year. On the other hand, the year 2017 presented a more prolonged rainy period, which resulted in an increase in the reservoir water level between January and May. However, after this period, the climatic conditions returned to the previous state, characterized by high temperatures. This climatic pattern contributed to the reservoir volume reaching its lowest value in December, of the entire study period (Figure 7).

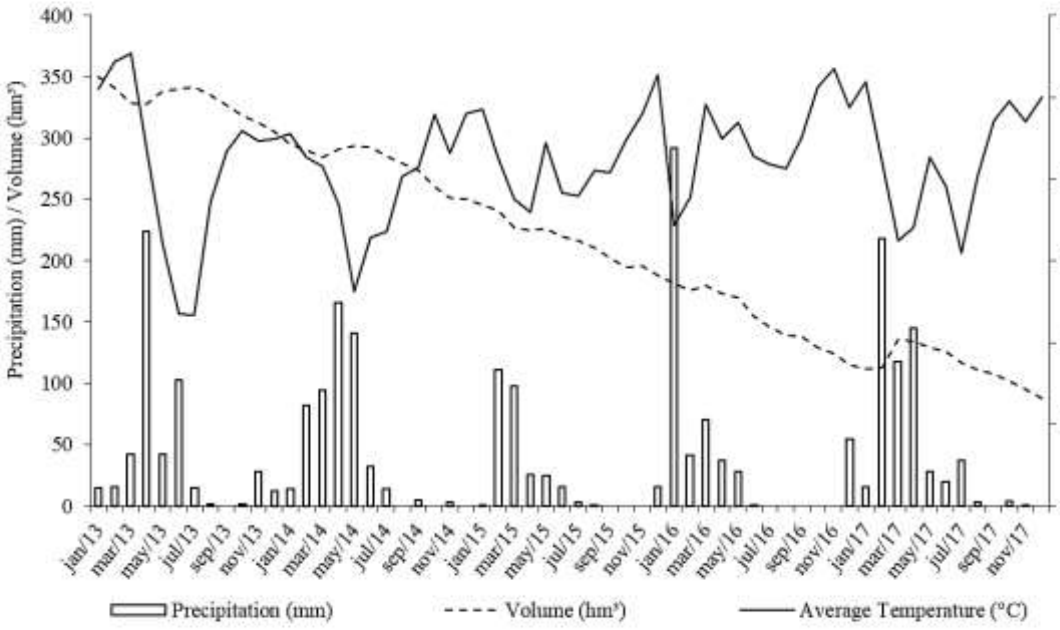

Figure 7 – Monthly accumulated precipitation, monthly average temperature recorded in the municipality of Apodi, Rio Grande do Norte, and volume of the Santa Cruz Reservoir, between 2013 and 2017.
Source: Authors (2024); INMET (2020), SEMARH–RN (2020).

In the subsequent year, which was distinguished by a prolonged period of precipitation compared to previous years, there was an exponential increase in *P. squamosissimus* captures. Remarkably, the highest captures occurred during the dry season, possibly reflecting the previous climatic pattern (Figure 7).

In early 2017, there was a low number of individuals collected, however, with a gradual increase during subsequent collections. This situation may be related to the increase in organic matter and water turbidity, derived from the rains transported by rivers and deposited in the reservoir water body. This allochthonous material serves as food supplement for *P. squamosissimus* (OLIVEIRA et al., 2016), allowing for a greater population development during this year's dry season.

Between the first quarter of 2013 and November 2017, the total area of the reservoir decreased from 18.62 km² to 9.69 km², following a decreasing trend in volume. In 2015 and 2017, both the water surface area and volume showed similar reductions, suggesting changes in reservoir morphology (Figure 8). Oliveira (2017) found that exposure, reducing refuge areas for predators and facilitating prey visualization, such as shrimp, made them more vulnerable to capture. This may have contributed to the increase in *P. squamosissimus* captures in 2015, as the increased vulnerability of shrimp may have increased food availability for the species, resulting in an increased capture rate. Additionally, the predominant herbaceous vegetation in 2015 may have provided a favorable habitat for both shrimp and *P. squamosissimus*, facilitating hunting and increasing predator abundance. The combination of lower water volume, increased exposure of shallow areas, and changes in vegetation cover may have created ideal conditions for the predatory efficiency of *P. squamosissimus*, reflected in the observed capture peaks.

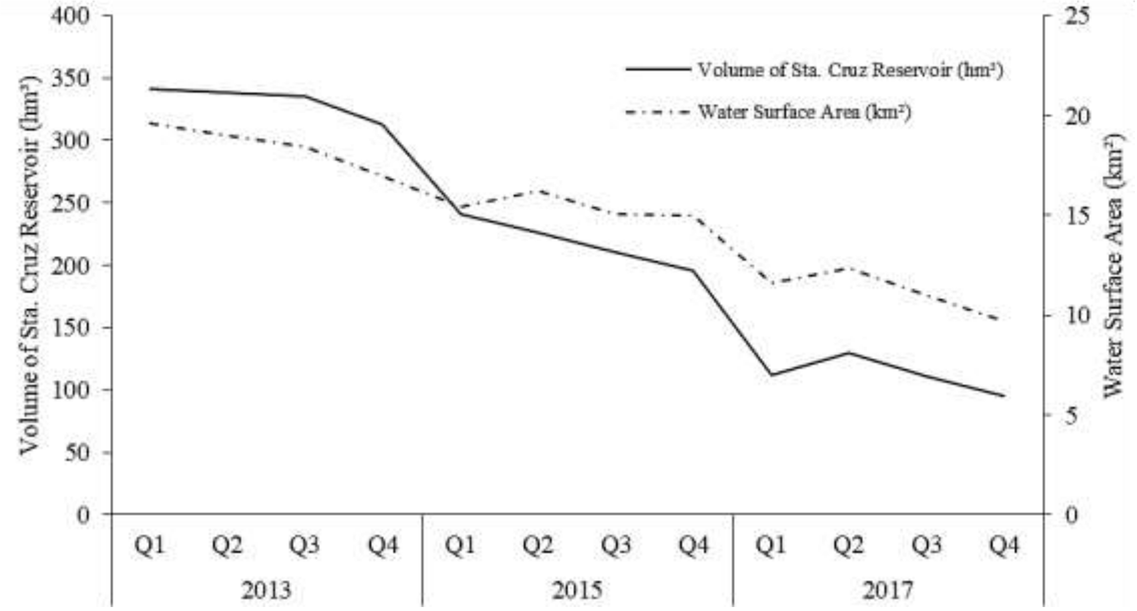

Figure 8 – Temporal variation between reservoir volume and surface area of the Santa Cruz Reservoir, Rio Grande do Norte, in 2013, 2015, and 2017.
Source: Authors (2024); SEMARH/RN (2020), INPE (2020), USGS (2020).

In the surroundings f the SCR, land cover was predominantly composed of two main categories: herbaceous vegetation and bare areas. There was a higher expression of herbaceous vegetation on average during the year 2015, while bare areas were more prominent during the year 2017 (Figure 9; Table 3). Herbaceous vegetation, characterized by grasses and herbaceous plants, had greater predominance in 2015, suggesting favorable conditions for the growth and development of these species during that period. On the other hand, bare areas, corresponding to exposed soils, areas without vegetation, or low vegetation cover, were more pronounced in 2017.

Arboreal-shrub vegetation and water resources had a more discreet presence. The vegetation categories were more expressive during rainy periods and relatively lower during the driest periods of each year. However, bare areas were more pronounced during drier periods, with the exception of 2017 (Figure 9). Additionally, among the observed categories, water bodies presented the lowest proportions of land cover around the reservoir. Specifically, the year 2015 recorded the lowest average land cover by water bodies, with only 0.40% compared to the other years studied (Figure 9, Table 3).

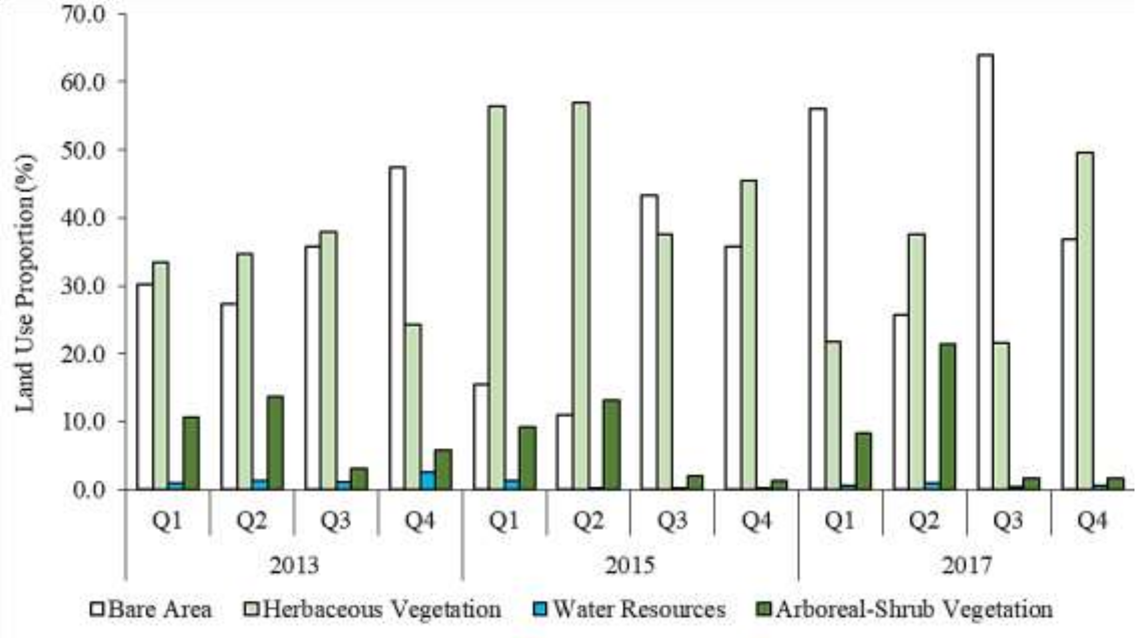

Figure 9 – Percentage proportion of land cover categories in quarters (Q1, Q2, Q3, Q4) for the years 2013, 2015, and 2017. Derived from digital satellite image processing within a 1 km radius of the waterline margin in the drainage area of the Santa Cruz reservoir, Rio Grande do Norte.
Source: Authors (2024).

Table 3 – Descriptive statistics for land cover proportions around the reservoir, obtained for the years 2013, 2015, and 2017. Using digital satellite image processing for the Santa Cruz reservoir area, Rio Grande do Norte.

Ano	Descriptive Statistics	Bare Area (%)	Herbaceous Vegetation (%)	Water Resources (%)	Arboreal-Shrub Vegetation (%)
2013	Standard	35.21	32.55	1.51	8.29
	Deviation	8.89	5.86	0.72	4.75
	Minimum	27.37	24.26	1.00	3.15
	Maximum	47.50	37.99	2.58	13.70
2015	Standard	26.42	49.05	0.40	6.43
	Deviation	15.56	9.36	0.55	5.76
	Minimum	11.07	37.46	0.03	1.34
	Maximum	43.29	56.88	1.23	13.22
2017	Standard	45.66	32.61	0.56	8.21
	Deviation	17.52	13.57	0.20	9.31
	Minimum	25.67	21.49	0.38	1.57
	Maximum	63.99	49.5	0.86	21.36

Source: Authors (2020).

Meanwhile, despite observations of variations in the number of *P. squamosissimus* individuals related to climatic seasonality, Kruskal-Wallis statistical analyses indicated no differences between the years (χ^2=5.54; p=0.063), as well as between rainy and dry periods (χ^2=0.10; p=0.74), and among quarters (χ^2=0.74; p=0.86) (Figure 10).

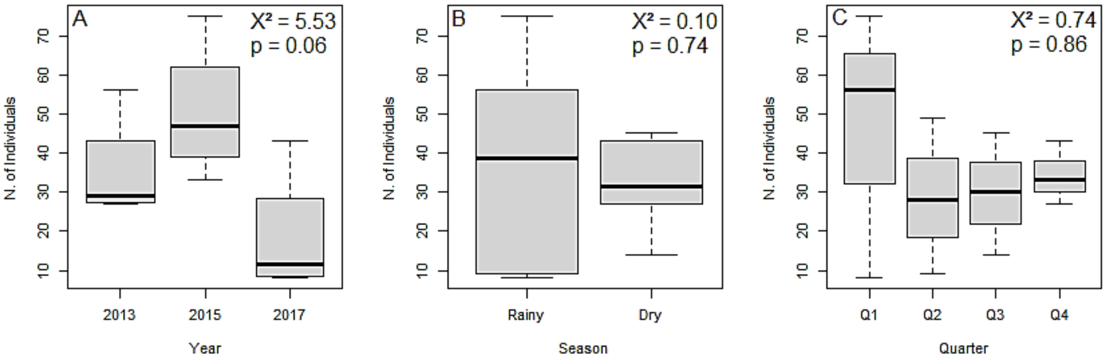

Figure 10 – Annual (A), periodic (B), and quarterly (C) differences in the number of collected individuals of Plagioscion squamosissimus (Heckel, 1840), during the years 2013, 2015, and 2017, in the Santa Cruz Reservoir, Apodi, Rio Grande do Norte, presenting for each boxplot graph the value of χ^2 (chi-square) and p-value, for Kruskal-Wallis non-parametric tests.
Source: Authors (2024).

Linear regression analyses revealed that the number of collected individuals of *P. squamosissimus* showed no difference concerning the examined variables, including average temperature, monthly accumulated precipitation, volume and area of water sheet in the RSC, proportion of arboreal-shrub vegetation, and water resources. Conversely, the presence of herbaceous vegetation (F: 10.13; R²adj: 0.4535; $p<0.01$) and open areas (F: 6.198; R²adj: 0.3209; $p<0.05$) were statistically relevant (Table 4).

Table 4 – Linear regression analyses, modeling the number of individuals of Plagioscion squamosissimus (Heckel, 1840) by average temperature, precipitation, volume, and water sheet area of the Santa Cruz Reservoir, Rio Grande do Norte, land cover proportion around the reservoir: arboreal-shrub vegetation, herbaceous vegetation, open areas, and water resources. For each analysis, there are F-Stat, adjusted R² (R²adj), and p-value values.

Variables	**N. individuals of *P. squamosissimus***		
	F-Stat	**R^2_{adj}**	**p-value**
Average Temperature (°C)	1.39	0.03	0.26
Precipitation (mm)	0.19	-0.07	0.66
Reservoir Volume (hm³)	1.64	0.05	0.22
Reservoir Water Surface Area (km²)	1.69	0.05	0.22
Arboreal-Shrub Vegetation (%)	0.10	-0.08	0.75
Herbaceous Vegetation (%)	**10.13**	**0.45**	**0.01**
Uncovered Areas (%)	**6.19**	**0.32**	**0.03**
Water Resources (%)	3.945e-07	-0.1	0.99

Source: Authors (2024).

These results indicate that the presence of herbaceous vegetation has a positive impact (Figure 11, F) on the abundance of *P. squamosissimus*, while the presence of uncovered areas is associated with a reduction in species abundance (Figure 11, E). When considering the regression line fit to the data points and the values of R²adj, it can be observed that the effect promoted by herbaceous vegetation is stronger compared to the effect promoted by uncovered areas around the reservoir. This suggests that the presence of herbaceous vegetation may provide favorable conditions for increasing fish abundance, such as shelter, food, or other important resources for the species (BERTORA et al., 2022). On the other hand, the presence of uncovered areas may have negative effects on species abundance, possibly due to lack of vegetation cover or exposure to unfavorable conditions (ZENI; HOEINGHAUS; CASATTI, 2017).

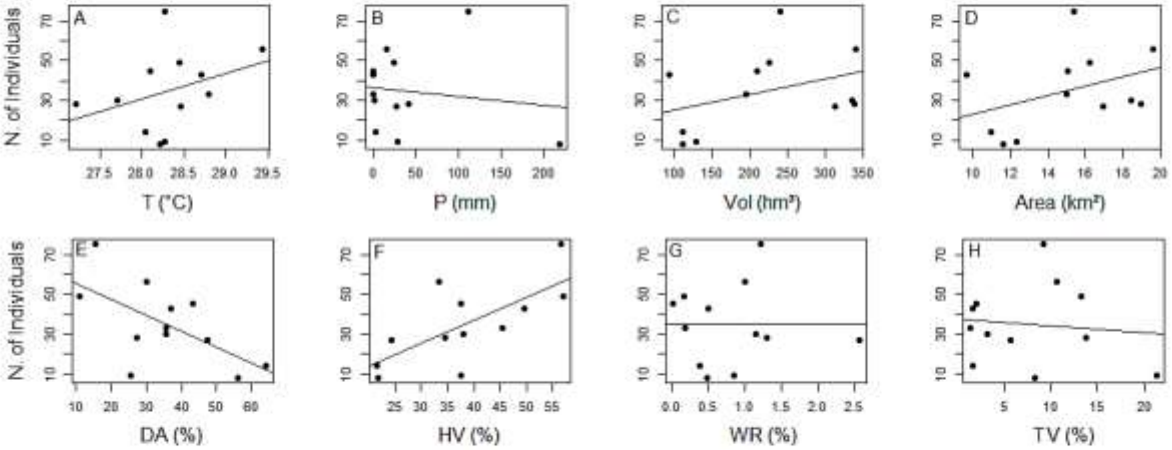

Figure 11 – Linear regression models between the number of Plagioscion squamosissimus (Heckel, 1840) individuals and the Average temperature (A), Accumulated precipitation (B), Santa Cruz Reservoir volume (C), Water surface area of the reservoir (D), Bare areas (E), Herbaceous Vegetation (F), Water Resources (G), and Arboreal-shrub Vegetation (H) obtained during the years 2013, 2015, and 2017, in the Santa Cruz Reservoir, Apodi, Rio Grande do Norte. Source: Authors (2024).

It is important to mention that *P. squamosissimus* in the semi-arid region of RN is classified as carcinophagous due to its main feeding habit: consumption of shrimp, especially *Macrobrachium amazonicum* (Crustacea, Decapoda). The presence of vegetation around the reservoir is important as a refuge for shrimp development. As the reservoir level decreases, previously flooded areas become exposed, resulting in the proliferation of microalgae, increasing the availability of shrimp as prey for *P. squamosissimus* (OLIVEIRA et al., 2018). *Plagioscion squamosissimus* demonstrates a tendency to specialize in shrimp consumption when this resource is abundant in the ecosystem (SOUZA et al., 2017).

Environments with natural vegetation tend to harbor fish species specialized in their feeding, but the conversion of these areas into urban or agricultural environments favors species with more generalist feeding strategies (BARBOSA; PIRES; SCHULZ, 2020). However, *P. squamosissimus* exhibits wide trophic plasticity and can diversify its diet in response to environmental conditions. In the Sobradinho reservoir, in Bahia, the availability of fish led the species to be predominantly piscivorous, with aquatic insects and shrimp as secondary items, with riparian vegetation inundation being important for the provision of these food resources (SANTOS et al., 2014). Trophic plasticity allows the species to adapt and diversify its diet in response to environmental conditions, positively influencing its abundance.

4. Conclusion

No significant differences were found in the number of *Plagioscion squamosissimus* individuals captured concerning climatic seasonality and reservoir volume. However, it was observed that land cover categories, specifically bare areas and herbaceous vegetation, influenced the number of individuals collected, which influences their carcinophagous feeding, due to their main feeding habit: consumption of shrimp, especially *Macrobrachium amazonicum*.

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