ABUNDANCE AND DENSITY OF *Acrostichum aureum* L. IN COASTAL ECOSYSTEMS OF SOUTERN NIGERIA

ABSTRACT

Acrostichum aureum Linnaeus is a rhizomatous fern of the Pteridaceae Kirchner family, which is generally found in elevated areas of mangrove forests or around agricultural fields. Over the years, the mangrove ecosystems in Akwa Ibom State have been reported to be degraded due to anthropogenic activities and pollutants from oil mining activities that act as stressors to endemic mangrove vegetation. This vegetation acts as a natural sea wall against the incursion of sea water intrusion landward amongst several other important functions; thus necessitating explorative studies on the population status of plant species in the ecosystem. This study was carried out at three mangrove locations within Iko Town, Okoroutip and Uta Ewa in Eastern Obolo, Ibeno and Ikot Abasi Local Government Areas respectively. The abundance of the plant species was done by enumerating the total number of *A. aureum* individuals observed within each sample plot across two seasons. Iko Town mangrove recorded the highest abundance and density of *A. aureum* with 34.25±2.78 and 856.25±69.50 (st/ha) in the dry season and 42.00±2.86 and 1050.00±71.44 (st/ha) in the wet season respectively. While Okoroutip mangrove had the least abundance and density of 13.25±1.03 and 331.25±25.77 (st/ha) respectively for dry season and 21.50±1.19 and 537.50±29.76 (st/ha) respectively for wet season. Whereas, Uta Ewa had an abundance value of 27.75±1.11 and 693.75±27.72 (st/ha) and 36.00±1.29 and 900.00±32.28 (st/ha) for dry and wet seasons respectively. The variations in abundance and density values of *A. aureum* were significantly different ($p < 0.05$) across the mangrove locations in both seasons. However, the abundance of *A. aureum* was notably higher in the wet compared to the dry season. This signifies that increased precipitation positively influenced the abundance of this mangroves species.

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Keywords: Abundance, Density, Mangrove, *Acrostichum aureum*, Seasonality

1.0. Introduction

Nigeria's vegetation belts reflect a very close link between vegetation and climate (Ubom *et al.*, 2012). Vegetation belts are demarcated on west-to-east zonation pattern characterized by transitional zones from one belt to another, hence resulting into different types of vegetation including the littoral vegetation that occurs along the shorelines of water bodies (Wang *et al.*,

2011; Olowokudejo and Oyebanji, 2016). The study area is part of the Niger Delta Region (NDR) which is characterized by rich biodiversity, highly diverse and productive ecosystems, good agricultural land and excellent fisheries (Ogbemudia *et al.,* 2018). The ecological significance of the region is underlined by some important characteristics, biodiversity, ecosystem services ,soil remediation e.t.c (NDES, 1997). The mangrove trees conserve water resources and serve as wind breaks in many communities. Specifically, in the Niger Delta, there are several uses of mangroves by the indigenous people, these include; fire wood, building materials, medicinal products, food baskets and fishing tools etc. (Ukoima *et al.*, 2010). Acrostichum (Linnaeus) is a rhizomatous fern of the Pteridaceae Kirchner family (Smith *et al.*, 2006). This plant is a common part of the understory of mangrove backwaters and is the only fern that can grow in brackish water (Tomlinson, 1986). In particular, the most characteristic habitat for Acrostichum is inshore marsh areas that receive some saline water from high tides and some fresh water from inflowing streams (Arnold and Daugherty, 1963). It grows in groups, sometimes gregariously colonising an area, and it is characterised by a pantropical distribution (Nooteboom *et al.,* 2012). It usually develops in organic and clay-rich soils of high salinity, with pH acidic to neutral (García-Massini *et al.*, 2010). Acrostichum is one of the rare terrestrial erect fern belonging to the family Pteridaceae having woody glabrous stipes which arise from a stout woody rhizome, with unipinnate fronds, which are alternate, linear and oblong. Acrostichum is generally found in elevated areas of mangrove forests or around agricultural fields. Over the years, the mangrove ecosystems in Akwa Ibom State have been reported to be degraded due to anthropogenic activities from industrial, agricultural, urban and domestic sources (Akpabio *et al.,* 2024). Despite the high level of pollution *Acrostichum aureum* grows luxuriantly in these ecosystems. The fact that it survives in an ecosystem that is prone to pollution by anthropogenic activities within the area is of particular interest to ecologists. thus necessitating explorative studies on the population status of plant species in the ecosystem.

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2.0. Methodology

2.1 Study Area

This study covered three mangrove locations in Akwa Ibom State. These were Iko Town in Eastern Obolo Local Government Area, Okoroutip community in Ibeno Local Government Area and Uta Ewa community in Ikot Abasi Local Government Area. The coordinates of the Mangrove locations were Latitudes and Longitudes 4° 33' N to 23 °02' N and 7° 44' E to 50

°60' E and 4° 33' N to 06° 74' N and 7° 32' E to 48 °64' E and 4° 32' N to 48 °50' N and 7°32' E to 4 °83' E Iko Town, Okoroutip and Uta Ewa respectively

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2.2. Determination of Abundance and Density of *A. aureum*

The quantification of *A. aureum* abundance was done by enumerating the total number of *A. aureum* individuals observed within each sample plot. The mean abundance of *A. aureum* was determined by calculating the proportion of individuals of *A. aureum* relative to the number of transects. The mean value was subsequently calculated as a ratio of the quadrat's area, yielding density in square meters. This value was then multiplied by 10,000 square meters to obtain density per hectare, as described by Morris (1995). The mean was determined using the following formula:

D = M/V

Where D = Density

M = Mass

V = Volume

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3.0. Results

3.1. Seasonal Abundance and Density of *Acrostichum aureum* across the Mangrove Ecosystems

The abundance and densities of *A. aureum* seasonally across the mangrove communities are presented in Table 1. In the dry seasons, the mangrove ecosystems recorded abundance value and density to range between 13.25±1.03 to 34.25±2.78 and 21.50±1.19 to 42.00±2.86 respectively. While in the and wet season, it ranged between 331.25±25.77 to 856.25±69.50 and 537.50±29.76 st/ha and 1050.00±71.44 st/ha abundance and density respectively for *A. aureum* The variations in abundance and density values of *A. aureum* were significantly different ($p < 0.05$) across the mangrove locations in both seasons.

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Table 1: Mean values of seasonal abundance and density of *A. aureum* across the mangrove communities

Mangrove location	Dry season		Wet season	
	Abundance	Density (st/ha)	Abundance	Density (st/ha)
Iko Town	34.25±2.78[a]	856.25±69.50[a]	42.00±2.86[a]	1050.00±71.44[a]
Okoroutip	13.25±1.03[c]	331.25±25.77[c]	21.50±1.19[c]	537.50±29.76[c]

Uta Ewa	27.75±1.11[b]	693.75±27.72[b]	36.00±1.29[b]	900.00±32.28[b]

± Standard error

Means with different superscripts along the same column are significantly different ($p < 0.05$)

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4.0. Discussion and Conclusion

4.1. Discussion

This study observed spartial differences in the number and density of *A. aureum* within the mangrove communities. The Iko town community mangrove exhibited the highest levels of abundance and density in relation to *A. aureum*, whereas the Okoroutip community mangrove displayed the lowest levels. The presence of diverse anthropogenic activities, such as encroachments, disturbances, and destruction, has led to the degradation of mangroves in these communities. The aforementioned disruptions are observed in the form of onshore prospecting conducted by corporations, wood cutting carried out by local communities, invasion, and secondary succession caused by *Nypa fruticans* (Ukpong, 1997). The levels of disturbances in the mangroves of Okoroutip are significantly higher as compared to the mangroves of Iko Town. According to Ukpong (1997), secondary succession by *Nypa fruticans* along the Atlantic coastal beachridge leads to the displacement of native mangrove species, such as *Acrostichum aureum* and *Phoenix reclinata*. This phenomenon contributes to the low abundance and density values observed in the Okoroutip community. There was a significant variation in the abundance and density of *A. aureum* between seasons, with higher values seen during the wet season compared to the dry season. This finding provides evidence for the impact of rainfall on the establishment and proliferation of this species within the ecosystem. The study conducted by Record *et al.*, (2013) and Ita (2018) yielded comparable results, which indicated that increased precipitation positively influenced the abundance of mangroves. Furthermore, the promotion of mangrove growth can be achieved through the augmentation of nitrogen levels within the soil, as demonstrated by Feller *et al*., (2013). The potential cause for the rise in soil nutrient levels can be attributed to runoff and intense precipitation (Castaneda-Moya *et al.*, 2010). Furthermore, the notable prevalence and concentration of *A. aureum* throughout the rainy season underscores the innate capacity of this plant to endure and adjust to elevated water levels and oxygen-deprived environments (Ita, 2018).

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4.2. Conclusion

Acrostichum aureum were observed in both dry and wet seasons at different abundance and densities in the mangrove vegetation at Iko Town, Okoroutip and Uta Ewa, Akwa Ibom State. This signifies that the presence and availability of *Acrostichum aureum* species is indicative to its ability to thrive in polluted ecosystem.

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