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# Arthropod Community Structure of Jaja Creek and Downstream Sections of Imo River in Uta Ewa Village, Akwa Ibom State, Nigeria

***[1]AKPAN, AU; [2]UKPAI, OM; [2]EHISIANYA, CN; [1]ESENOWO, IK**

**[1]Department of Animal and Environmental Biology, Faculty of Biological Sciences, University of Uyo, Uyo. Akwa Ibom State. Nigeria.*

*[2]Department of Zoology and Environmental Biology, College of Natural Science, Michael Okpara University of Agriculture, Umudike. Abia State. Nigeria.*

**Corresponding Author Email: akpanau13001f@gmail.com*
**ORCID: https://orcid.org/0000-0002-2298-1642*
**Tel: +2348038981129*

*Co-Authors Email: nnokeukpai@yahoo.com; cnehisianya@gmail.com; imehesenowo@yahoo.com*

**ABSTRACT:** Arthropods are considered the most successful animals on earth. They are an essential part of the aquatic food chain and efficient bioindicators depicting the biotic community structure and water quality. This study aimed to generate baseline data on the arthropod community structure of Jaja Creek and downstream sections of Imo River in Uta Ewa village, Ikot-Abasi Local Government Area, Akwa-Ibom State, Nigeria. A variety of sampling techniques, including the scoop net method at low tides in the littoral zone, square lift net anchored on a paddling boat, sweep net, and locally made crab traps were adopted for the sampling of the arthropods. Fourty-six arthropod species were identified and classified into three classes: Arachnida, Crustaceans, and Insecta, with nine orders and twenty-six families. *Sesarma alberti, Aratus pisonii, Sesarma elegans, Armases sp, Neosarmatium meinerti, Nematopalaemon sp, and Macrobrachium caledonicum* were among the various arthropod species identified in this study. The class Crustaceans had the highest individual abundance of 135,809 (94.74%), followed by the class Insecta, which had a total numerical individual abundance of 7,339 (5.12%), and the order Arachnida (206; 0.14%). For the first time, members of the class Insecta and the families Sesarmidae, Pilumnidae, and Penaeidae (Penaeus sp.) were collected and identified in this portion of the Niger Delta Creek and Imo River. Given the importance of aquatic arthropod species to the catchment region and the country, a comprehensive conservation strategy should be developed to conserve and defend their survival.

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Arthropods account for the majority of the world's biodiversity, with the highest species richness found in the world's tropical rain forests (Hamilton *et al*., 2011; Basset *et al*., 2012). They have far more species than the rest of the phyla when combined (Eyo and Ekwonye, 1995; Obiezue *et al*., 2012). Arthropods have had unprecedented success in most ecosystems (Dallas and Mosepele, 2007). They are known to be common features of the aquatic ecosystem and play a wide range of ecological roles (Barnes *et al*., 2002). They are typically very active and energetic animals that feed in a variety of ways, including carnivorous, herbivorous, and omnivorous, though the majority of them are herbivorous (Obiezue *et al.,* 2012).

**Corresponding Author Email: akpanau13001f@gmail.com*
**ORCID: https://orcid.org/0000-0002-2298-1642*
**Tel: +2348038981129*

Arthropods have no competitors in terms of ecological distribution in diversity. Still, they have an unrivaled ability to adapt to all terrestrial and aquatic environments, as well as virtually all climates (Batzer and Wissinger, 1996; Saunders *et al*., 2002).

Arthropods are important in many aquatic systems because they contribute significantly to energy flow (Carpenter and Lodge, 1986; Cattanneo *et al*., 1998). Aquatic arthropods play an important role in the aquatic food chain, providing food for fish, aquatic birds, and humans (Grubh and Mitsch, 2004; Dallas and Mosepele, 2007). They promote nutrient cycling by shrinking organic particles (Callisto *et al*., 2001). In many aquatic habitats, they are frequently the most diverse and abundant group of macroinvertebrate taxa. They eat a wide range of foods, including tree leaves, algae, wood, detritus, other invertebrates, and even some vertebrates like small fish and tadpoles (Reece and Richardson, 2000). Uwadiae (2018) reported a total abundance of 58 arthropod species in Epe Lagoon, Nigeria, including 16 species from ten (10) Families; Gammaridae, Corophidae, Penaeidae, Ocypodidae, Clibanaridae, Chironomidae, Gomphidae, Libellulidae, Baetoidae, Tenthredinidae. *Ocypoda cursor, O. africana, Uca tangeri, Penaeus notialis, Sersama huzardi, Clibanarius africanus, C. senegalenses, C. chapini, Palaemonetes vulgaris, and Gammarus fasciatus* were among the crustaceans recorded by Uwadiae (2018). According to Uwadiae (2017), all of the crustaceans in the Epe Lagoon are estuary species, while members of the Family Chironomidae (Class: Insecta) were discovered to inhabit a saline region of the Lagoon, and all of the insect species found in Aber Estuary also occurred in the system's purely freshwater portion. The world is witnessing the early stages of the spread of insects into estuarine environments because their ability to tolerate saltwater inundation may be related to changing osmotic, physiological, and possibly behavioral capabilities in the face of changing salinity regimes of their habitat (Williams and Williams, 1998).

Fischer *et al*. (1981) and Schneider (1992) found three species of *Callinectes* in West Africa: *C. amnicola, C. pallidus, and C. marginatus. C. amnicola* was identified as the most common species in estuaries and Lagoons in West Africa, where it forms a regular trap fishery. Addo *et al*. (2018) reported that this species is of particular interest because it lives only occasionally in the sea and spends the majority of its time in estuaries, lagoons, and creeks. Cumberlidge (1999) reported that 32 endemic West African crab species belonging to six genera account for roughly one-quarter (23%) of the species currently known from the entire Afrotropical region. Cumberlidge (1999) and Cumberlidge and Sternberg (2002) reported that *Sudanonautes* range into central Africa and *Potamonautes* are underrepresented in western Africa, but the majority of species are found throughout continental Africa but not in Madagascar. The arthropod species of Western Africa are slightly less diverse than those of Eastern Africa (Cumberlidge 1997, 1998, Corace *et al*., 2001, Cumberlidge and Vannini, 2004, Reed and Cumberlidge 2004, 2006a), but similar to those of Central Africa (24 species, five genera) (Cumberlidge *et al*. 2002, Cumberlidge and Boyko 2000, Cumberlidge and Reed 2004), and relatively rich in comparison to southern Africa species.

Two water bodies of distinguished ecological characteristics in Uta Ewa village, Ikot Abasi Local Government; namely Jaja Creek and Imo River; downstream segment, were chosen for this study. The objectives of this paper are to examine the composition, seasonal variation, individual and relative abundance, sex ratio, and diversity of arthropod species of the Jaja Creek and the downstream sections of the Imo River in Uta Ewa Village, Akwa Ibom State, Nigeria

## MATERIALS AND METHODS

*Study Area:* The study region is located in the coastal area of Akwa Ibom State, Nigeria, between longitudes 7º 30'E and 7º 45'E and latitudes 4º 30'W and 4º 45'N (Figure 1) (Ekpo and Ukpong, 2014). Ikot Abasi LGA borders Oruk Anam Local Government Area to the north, Mkpat Enin and Eastern Obolo LGAs to the east, and the Atlantic Ocean to the south. The Imo River constitutes the natural western border, dividing it from Rivers State. The climate in the area is typical of a tropical region, with two distinct seasons: wet and dry. The wet season begins in March and lasts until early November, with average annual rainfall ranging from 2500mm to 4000mm, whereas the dry season begins in late November and lasts until early February (Gbaruko and Friday, 2007; Onyekuru *et al*., 2017). Jaja Creek is an ideal home for aquatic organisms, which serve as a health indicator for the water body system and a source of aquatic food for humans in the catchment areas. Riparian vegetation supports a diverse range of aquatic macroinvertebrates, including crabs and prawns, as well as other commercially important animal species (Dittmann, 2001; Mohapatra *et al.*, 2007; Hutchison *et al*., 2014). The Imo River begins at Umuaku village in Isuochi Local Government Area, southeast of Abia State in Nigeria's south-east geopolitical zone, and flows into the Atlantic Ocean via various tributaries in Rivers State in Nigeria's south-south geopolitical zone (Okonko *et al.*, 1997). Jaja Creek, also known as the Uta Ewa

estuary, is located at Latitude 4º32'44.082"N and Longitude 7º33'15.108"E (Figure 1) in Uta Ewa village and extends into Opukalama village, all of which are in the Ikot Abasi Local Government Area. The Jaja Creek is distinguished by an estuarine tidal water zone fed by freshwater from the upper reaches of the downstream section of the Imo River, as well as vast mangrove swamps and intertidal mud flats composed of peaty fibrous muddy patches. The Creek is surrounded by dense mangrove vegetation dominated by the Nipa palm (*Nypa fruticans*) and interspersed with Rhizophora species (Esenowo *et al*., 2016; Akpan *et al.,* 2019), which are harvested and sold in huge quantities as firewood. The Creek has been utilised to dispose of residential waste and for passenger and cargo transportation via hand-paddled canoes and engine boats. Logging, farming, and sand dredging are common industries along the creek's banks. The Aluminium Smelter Company of Nigeria (ALSCON) plant is also situated along this section of the river (Edet and Ukpong, 2014; Abiaobo and Asuquo, 2020). Seven (7) sampling sites were established, three (3) from Jaja Creek, one (1) at the confluence of the two bodies of water, and three (3) from the Imo River's downstream segment (Figure 1). Each location was 50m apart and measured with a 50m/165FT Measuring Tape, model Fibre Glass Bouncing Rabbit.

*Jaja Creek sampling sites:* Site 1 (JCS One) is located at Latitude N 4º32'41.2692" and Longitude E 7º32'44.5164" of the Jaja Creek, with human settlement and a local market on the left flank of the shoreline. It serves as a landing station for fishermen and a buying point for fish, primarily by women. The vegetation is limited, consisting mainly of mangrove *Rhizophora* sp. and Nipa palm. The station is relatively shallow, with fine sand on the bottom when exposed at low tide. High-impact human activities at the site include mangrove logging, boat washing, canoeing, fishing nets, and swimming (Akpan *et al.,* 2019). Site 2 (JCS Two) is located between the coordinates N 4º32'45.6684" and E 7º33'12.276". It has a sand and silt substrate, making some portions of the site mushy and lacking in materials. There is no human settlement or farming activities, however mangrove logging occurs. Site 3 (JCS Three) is located at Latitude N 4º32'44.1636"and Longitude E 7º33' 48.474". The substrate is mixed yet solid, and it might be used to build locally produced bricks. There is limited vegetation, with only a few mangrove *Rhizophora* spp. and *Nypa fruticans*. This location does not have any human settlements. The most common human activities in this location are farming, fishing, and logging. Site 4 (the control) is located at Latitude N 4º32'26.08" and Longitude E 7º32'32.2188". It connects the Jaja Creek to the Imo River's downstream part. The substrate is sandy and mixed, and the floodplain is firm.

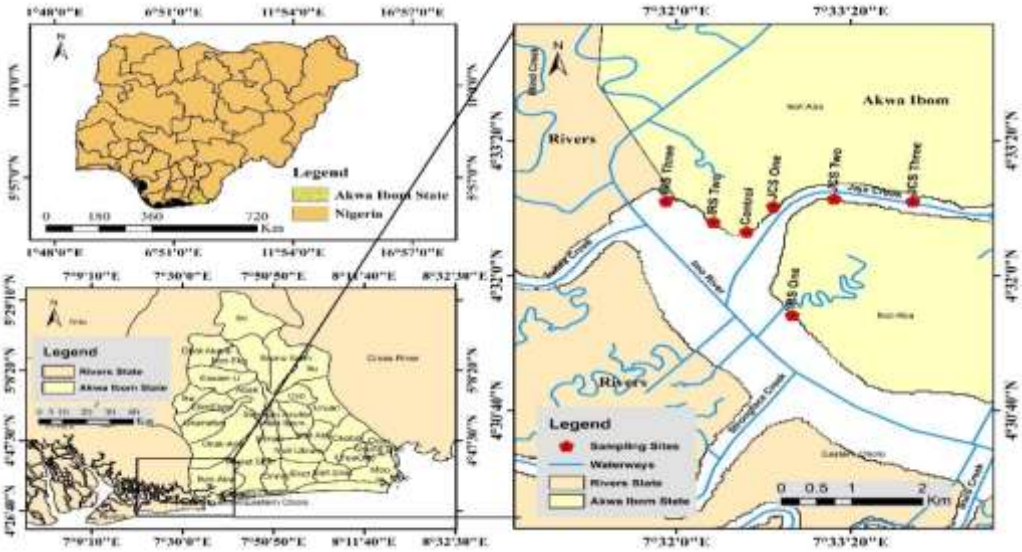


***Figure 1****: Map showing the study area and the sampling sites.*
*Sources: Cartography Studio, Department of Geography and Natural Resources Management, University of Uyo.*

*Imo River sampling locations* Site 5 (IRS One) (Imo River) is located at N 4º31' 36.5592" and E 7º32'53.188" along the Imo River's downstream section. The substrate is mainly sandy, with occasional hard minerals. It is notable for its clear water, which allows one to view the coastline.

There is no human settlement on this site, however, the mangroves have been destroyed. Site 6 (IRS Two)

(Imo River) is located at Latitude N 4º32'31.8444" and Longitude E 7º22'49.908". The site is distinguished by a dense interlocking of *Rhizophora* sp. and *Nypa fruticans*, and the water is clear, with a hard mixed bottom that is mostly sandy.

Fishing and sand dredging are the most popular human activities at this location. Site 7 (IRS Three) (Imo River) is located at the following latitude and longitude coordinates: N 4º32'44.1636" and E 7º31'55.3332". This sampling location is near the ALSCON facility. The ALSCON facility drained into the Imo River downstream, near this site 7.

*Collection of arthropod samples:* Arthropod samples were collected from January 2020 to December 2021 in seven (7) sampling sites every month in the morning from 7:00 a.m. to 10:00 a.m. and afternoon/evening; from 3:00 p.m. to 5:00 p.m. A variety of collection methods were used.

A scoop net was used to collect arthropod fauna from the littoral zone, a Van veen grab of size $0.1m^{2,}$ and a square lift net at low tide from an anchored paddling boat (Esenowo *et al*., 2016; Uwadiae, 2018; Akpan *et al*., 2019), a locally made crab trap (Addo *et al.*, 2018) was also set at the sampling sites during flood tide and later harvested at ebbing tide, a seine net with a mesh diameter of 1.0cm, six (6) meters long, and one (1) meter tall was used to set traps for the collection of prawns and shrimp arthropods at the sampling sites, according to Carmona-Suâres and Conde (2002), though with modifications. Sweep nets were used to collect Ariel arthropods, which were then placed inside a white envelope and properly stored (Oku *et al.*, 2013), while the elutriation technique was used to extract sediment-dwelling arthropods (Alonso-Zarazaga and Domingo-Quero, 2010).

The collected arthropod samples in the field were stored in a clean container and packed inside a cooler before being transported to the Laboratory of the Department of Animal and Environmental Biology, University of Uyo. The white envelopes containing ariel arthropods were oven-dried at 50 ºC for 15 minutes in the Laboratory. The sediment samples to extract sediment-dwelling arthropods were placed on a white enamel tray and gently rubbed with water from the tap running over it until the water on the sediment became clear.
Sediment-dwelling arthropods exposed were collected with forceps and a soft-haired brush and preserved in 10% and 70% ethyl alcohol until identification and counting. They were identified using the morphological identification guides by Williams (1974), Fischer *et al.* (1981), Abby-Kalio (1982), Carpenter and Niem (1998), Bezerra (2012), Carpenter and De Angelis (2014), and Jose and Vivek (2020). The sex determination for each of the arthropod samples collected was determined using the guides provided by Fischer *et al.* (1981); Abby-Kalio (1982) with the aid of a Laboratory Technologist.

*Statistical analysis:* Data obtained were entered and analyzed using Microsoft Excel version 2013, to determine the relative abundance. Diversity indices (Shannon diversity indices, Simpson diversity indices, evenness, dominance) were performed using PAST version 4.0.

## RESULTS AND DISCUSSIONS

*Arthropod species sampled at the Jaja Creek and downstream section of the Imo River:* 46 species of arthropods were collected from Jaja Creek and the Imo River's downstream part (Table 1).

*Sesarma alberti*, *Aratus pisonii*, *Sesarma elegans*, *Armases* sp, and *Neosarmatium meinerti* were collected and identified to belong to the Family; Sesarmidae, while two arthropod species; *Nematopalaemon* sp and *Macrobrachium caledonicum*, were identified to belong to the family; Palaemonidae. The Portunidae family was represented by *Callinectes marginatus*, *Callinectes amnicola*, *Callinectes pellidus*, and *Carcinus* sp. The class Insecta was categorized into seven orders, with the family Libellulidae having three (3) bug species.

*Seasonal distribution and abundance of the arthropod taxa at the Jaja Creek and downstream section of the Imo River:* The results of the seasonal distribution and abundance of the arthropod taxa revealed that a total of 55749 (38.89%) of the arthropod taxa were collected in the dry season, whereas individual abundance of 87605 (61.11%) of the arthropod taxa were collected in the wet season (Table 2).

*Individual and relative abundance (%), and distribution of the arthropod species across sampling locations of the Jaja Creek and the downstream section of Imo River:* The] distribution and abundance of the arthropod species encountered are shown in Table 3. A relative abundance of 31.19% with a total individual of 44719 of the arthropod species was recorded for sites along the stretch of Jaja Creek, where site 2 of Jaja Creek encountered a total individual of 21179(14.77%), which the class Insecta accounted for individuals' abundance of 636(0.44%), wherein *Pelocoris* sp accounted for 0.091% of the relative abundance with 131 individuals recorded, followed by *Mesovelia* sp 91 (0.064%) and *Sialis lutaria* 75 (0.052%).

**Table 1:** Arthropod species sampled in the Jaja Creek and downstream section of Imo River.

| S/N | CLASS | ORDER | FAMILY | SCIENTIFIC NAME |
|---|---|---|---|---|
| 1 | | | Palaemonidae | *Nematopalaemon* sp (Aurivillius, 1898) |
| 2 | | | | *Macrobrachium caledonicum* |
| 3 | | | Pandalidae | *Pandalus* sp |
| 4 | | | Penaeidae | *Penaeus* sp |
| 5 | | | Ocypodidae | *Ocypode* sp |
| 6 | | | | *Uca tangeri* |
| 7 | | | | *Uca pugilator* |
| 8 | | | Portunidae | *Callinectes marginatus* (A. Milne-Edwards, 1861) |
| 9 | | | | *Callinectes amnicola* (Rochebrune, 1883) |
| 10 | | | | *Callinectes pellidus* (Rochebrune, 1883) |
| 11 | | | | *Carcinus* sp |
| 12 | | | Gecarcinidae | *Cardisoma carnifex* |
| 13 | | | | *Cardisoma armatum* |
| 14 | | | Grapsidae | *Goniopsis pellii* |
| 15 | | | | *Chiromanthes* sp |
| 16 | Crustacean | Decapoda | | *Holometopus* sp (Milne Edwards). |
| 17 | | | Panopeidae/Xanthidae | *Panopeus africanus* A. Milne-Edwards, 1867. |
| 18 | | | Sesarmidae | *Sesarma alberti* (Rathbun, 1921) |
| 19 | | | | *Aratus pisonii* |
| 20 | | | | *Sesarma elegans* (Herklots, 1851) |
| 21 | | | | *Armases* sp |
| 22 | | | | *Neosarmatium meinerti* (de Man, 1887) |
| 23 | | | Pilumnidae | *Pilumnopeus sp* |
| 24 | | | | *Potamonautes s**p*** |
| 25 | Insecta | Diptera | Dixidae | *Dixa sp (adults)* |
| 26 | | | Chironomidae | *Chironomus sp* Meigen, 1803 (adults) |
| 27 | | | | *Tanypus sp* Meigen, 1803 |
| 28 | | Hymenoptera | | *Polynema natans* Lubbock, 1864 |
| 29 | | | Mymaridae | *Polynema sp* |
| 30 | | | Hydrometridae | *Hydrometra* sp |
| 31 | | | Mesoveliidae | *Mesovelia sp* Mulsant & Rey, 1852 |
| 32 | | Hemiptera | Notonectidae | *Notonecta sp* Linnaeus, 1758 |
| 33 | | | Naucoridae | *Pelocoris* sp (Stål, 1876) |
| 34 | | | Nepidae | *Nepa* sp (Adults) |
| 35 | | | Gerridae | *Gerris* sp (Adults) |
| 36 | | Coleoptera | Dytiscidae | *Cybister sp* (Adults) (Curtis, 1827) |
| 37 | | | | *Libellula sp* (Adults) (Linnaeus, 1758) |
| 38 | | | Libellulidae | *Aethriamanta* sp |
| 39 | | Odonata | | *Brachythemis sp* |
| 40 | | | | *Aciagrion* sp |
| 41 | | | Coenagrionidae | *Pseudagrion* sp |
| 42 | | | Protoneuridae | *Elattoneura sp* |
| 43 | | Megaloptera | Sialidae | *Sialis lutaria* (Adult) (Linnaeus, 1758) |
| 44 | | Trichoptera | Polycentropodidae | *Polycentropus* sp (larva) |
| 45 | Arachnida | Araneae | Dictynidae | *Dictyna* sp (Sundevall, 1833) |
| 46 | | | | *Myrmarachne sp* |

**Table 2:** Seasonal distribution and abundance (i/r) of the arthropod taxa sampled

| S/N | CLASS | SEASONS | | TOTAL |
|---|---|---|---|---|
| | | Dry i(r) | Wet i(r) | |
| 1 | Arachnida | 99(0.07) | 107(0.08) | |
| 2 | Insecta | 3630(2.53) | 3709(2.59) | |
| 3 | Crustacean | 52020(36.29) | 83789(58.45) | |
| | Total | 55749(38.89) | 87605(61.11) | **143345** |

*Note: i = individual abundance; r = relative abundance (%)*

The crustacean class accounted for 20527 individuals, with *Nematopalaemon hastatus* (Family: Palaemonidae) being the most abundant with a relative abundance of 2.797% with 4009 individuals recorded, *Callinectes amnicola* accounted for 2.399% of relative abundance with 3439 individuals recorded, and *Neosarmatium meinerti* 12 individual representing 0.008%, the least abundant. The two-way analysis of variance results showed a significant difference between members of the class Insecta and with sites along the Jaja Creek stretch. A total of 70586 individual arthropod species with a relative abundance of 49.24% were collected along the downstream section of Imo River, with site 5 accounting for the

highest individual arthropod species collected with individuals of 29608(20.65%), the class Arachnida accounting for the relative abundance of 0.042% with individuals of 60 recorded, the class Insecta accounting for total individuals of 1538, and the class crustacean accounting for 28010(19.54%). The two-way ANOVA for members of the class Crustacean and sites along the Jaja Creek water body revealed a significant difference between members of the class Crustacean and sites.

**Table 3: Relative abundance (%), and distribution of the arthropod species across the Jaja Creek and the downstream section of Imo River**

| Arthropod Species | Site 1 (Jaja Creek) | Site 2 (Jaja Creek) | Site 3 (Jaja Creek) | Site 4 (Control) | Site 5 (Imo River) | Site 6 (Imo River) | Site 7 (Imo River) |
|---|---|---|---|---|---|---|---|
| *Dictyna sp (Adults)* | **11(0.008)** | **16(0.011)** | **9(0.006)** | **14(0.010)** | **60(0.042)** | **50(0.035)** | **46(0.032)** |
| *Chronomus sp (Adults)* | 4(0.003) | 23(0.016) | 40(0.028) | 28(0.020) | 110(0.077) | 703(0.490) | 126(0.088) |
| *Tanypus sp* | 3(0.002) | 66(0.046) | 83(0.058) | 31(0.022) | 97(0.068) | 114(0.080) | 126(0.088) |
| *Dixa sp (Adults)* | 2(0.001) | 11(0.008) | 12(0.008) | 41(0.029) | 348(0.243) | 317(0.221) | 168(0.117) |
| *Cybister* | 16(0.011) | 27(0.019) | 42(0.029) | 145(0.101) | 114(0.080) | 86(0.060) | 63(0.044) |
| *Gerris sp* | 3(0.002) | 39(0.027) | 29(0.020) | 87(0.061) | 49(0.034) | 34(0.024) | 98(0.068) |
| *Hydrometra sp* | 7(0.005) | 19(0.013) | 23(0.016) | 32(0.022) | 88(0.061) | 41(0.029) | 115(0.080) |
| *Libellula sp* | 8(0.006) | 39(0.027) | 53(0.037) | 27(0.019) | 55(0.038) | 56(0.039) | 84(0.059) |
| *Mesovelia sp* | 6(0.004) | 91(0.064) | 21(0.015) | 31(0.021) | 159(0.111) | 72(0.050) | 19(0.013) |
| *Nepa sp* | 10(0.007) | 21(0.015) | 11(0.008) | 181(0.126) | 122(0.085) | 117(0.082) | 26(0.018) |
| *Notonecta sp* | 3(0.002) | 13(0.009) | 19(0.013) | 47(0.033) | 32(0.022) | 154(0.107) | 37(0.026) |
| *Polycentropus sp* | 3(0.002) | 8(0.006) | 36(0.025) | 30(0.021) | 16(0.011) | 125(0.087) | 97(0.068) |
| *Polynema natans* | 15(0.010) | 7(0.005) | 36(0.025) | 15(0.011) | 47(0.033) | 105(0.073) | 133(0.093) |
| *Polynema sp* | 38(0.027) | 66(0.046) | 33(0.023) | 8(0.006) | 37(0.026) | 129(0.090) | 161(0.112) |
| *Sialis lutaria* | 14(0.010) | 75(0.052) | 24(0.017) | 11(0.008) | 151(0.105) | 77(0.054) | 88(0.061) |
| *Pelocoris sp* | 24(0.017) | 131(0.091) | 74(0.052) | 35(0.024) | 113(0.079) | 108(0.075) | 145(0.101) |
| ***SUBTOTAL*** | **156 (0.11)** | **636(0.44)** | **536(0.37)** | **749(0.52)** | **1538(1.01)** | **2238(1.56)** | **1486(1.04)** |
| *Aratus pisonii* | 100(0.070) | 71(0.050) | 127(0.089) | 37(0.026) | 81(0.057) | 68(0.047) | 25(0.017) |
| *Armases sp* | 8(0.006) | 699(0.488) | 99(0.069) | 66(0.046) | 95(0.067) | 38(0.027) | 124(0.087) |
| *Callinectes amnicola* | 39(0.027) | 3439(2.399) | 4874(3.400) | 404(0.282) | 666(0.465) | 588(0.410) | 230(0.160) |
| *Callinectes marginatus* | 38(0.027) | 1005(0.701) | 766(0.534) | 951(0.663) | 1320(0.921) | 1730(1.207) | 270(0.188) |
| *Callinectes pellidus* | 19(0.013) | 293(0.204) | 514(0.359) | 1411(0.984) | 441(0.308) | 688(0.480) | 318(0.222) |
| *Carcinus sp* | 86(0.060) | 1454(1.014) | 145(0.101) | 103(0.072) | 243(0.170) | 68(0.047) | 19(0.013) |
| *Cardisoma armatum* | 207(0.144) | 296(0.206) | 100(0.070) | 411(0.287) | 142(0.099) | 69(0.048) | 41(0.029) |
| *Cardisoma carnifex* | 20(0.014) | 41(0.029) | 198(0.138) | 233(0.163) | 96(0.067) | 93(0.065) | 17(0.012) |
| *Ocypode Africana* | 22(0.015) | 373(0.260) | 692(0.483) | 1704(1.187) | 692(0.483) | 409(0.285) | 1072(0.748) |
| *Goniopsis sp* | 16(0.011) | 181(0.126) | 164(0.114) | 209(0.146) | 69(0.048) | 66(0.046) | 9(0.006) |
| *Macrobrachium caledonicum* | 235(0.164) | 3045(2.124) | 1352(0.943) | 7359(5.133) | 4742(3.308) | 6393(4.460) | 6040(4.213) |
| *Nematopalaemon hastatus* | 1320(0.921) | 4009(2.797) | 7018(4.896) | 6520(4.548) | 9167(6.395) | 2960(2.065) | 7936(5.536) |
| *Neosarmatium meinerti* | 8(0.006) | 12(0.008) | 44(0.031) | 28(0.020) | 234(0.163) | 208(0.145) | 315(0.220) |
| *Pandalus sp* | 1203(0.260) | 503(0.351) | 1804(1.258) | 6249(4.359) | 9181(6.404) | 2909(2.029) | 2471(1.724) |
| *Panopeus africanus* | 20(0.014) | 2793(1.948) | 137(0.096) | 566(0.395) | 190(0.133) | 588(0.410) | 663(0.463) |
| *Pilumnopeus sp* | 25(0.017) | 25(0.017) | 749(0.523) | 129(0.090) | 174(0.121) | 104(0.073) | 41(0.029) |
| *Sesarma alberti* | 21(0.015) | 1429(0.997) | 87(0.061) | 371(0.259) | 110(0.077) | 55(0.038) | 11(0.008) |
| *Sesarma elegans* | 22(0.015) | 215(0.150) | 83(0.058) | 309(0.216) | 40(0.028) | 53(0.037) | 150(0.105) |
| *Uca pugilator* | 27(0.019) | 265(0.185) | 151(0.105) | 142(0.099) | 240(0.167) | 167(0.117) | 55(0.038) |
| *Uca tangeri* | 174(0.121) | 379(0.264) | 114(0.080) | 84(0.059) | 87(0.061) | 74(0.052) | 23(0.016) |
| ***SUBTOTAL*** | **3610(2.52)** | **20527(0.14)** | **19218(13.41)** | **27286(19.03)** | **28010(19.54)** | **17328(12.09)** | **19830(13.83)** |
| **Grand Total** | **3777(2.63)** | **21179(14.77)** | **19763(13.79)** | **28049(19.57)** | **29608(20.65)** | **19616(13.68)** | **21362(14.90)** |

**Table 4:** Sex ratio (%) of the arthropod taxa across the sampling locations

| S/N | Taxa group | Sites (Jaja Creek) | | | | | | Control site | | Sites (Imo River) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Site 1 | | Site 2 | | Site 3 | | Site 4 | | Site 5 | | Site 6 | | Site 7 | |
| | | M | F | M | F | M | F | M | F | M | F | M | F | M | F |
| 1 | **Arachnida** | 5 (0.9) | 6 (1.1) | 2 (0.1) | 14 (1.0) | 4 (0.2) | 5 (0.3) | 8 (0.4) | 6(0.3) | 24( 0.9) | 36 (1.4) | 20(0.5) | 30 (0.8) | 26 (0.8) | 20 (0.6) |
| 2 | **Insecta** | 87 (16.5) | 69 (13.1) | 319 (23.6) | 317 (23.4) | 283 (17.9) | 253 (16.0) | 351 (17.3) | 378 (18.6) | 743 (28.5) | 795 (30.5) | 1261 (34.9) | 977 (27.0) | 633 (18.8) | 853 (25.4) |
| 3 | **Crustacean** | 208 (39.5) | 152 (28.8) | 313 (23.1) | 389 (28.7) | 307 (19.4) | 731 (46.2) | 781 (38.5) | 505 (24.9) | 608 (23.3) | 402 (15.4) | 478 (13.2) | 850 (23.5) | 910 ((27.1) | 920 (27.4) |
| | **Total** | **300 (56.9)** | **227 (43.1)** | **634 (46.8)** | **720 (53.2)** | **594 (37.5)** | **989 (62.5)** | **1140 (56.2)** | **889 (43.8)** | **1375 (52.7)** | **1233 (47.3)** | **1759 (48.6)** | **1857 (51.4)** | **1569 (46.7)** | **1793 (53.3)** |

*Note: M = Male; F = Female*

*Sex ratio of Arthropod species abundance across sites:* The sex ratio distribution of the aquatic arthropod taxa across the sampling sites revealed that throughout Jaja Creek, site 2 had the maximum abundance of males (634; 46.8%), with arachnids recording; 2(0.1%), males and 14(1.0%) females. At Site 1, 300(56.9%)

males of the arthropod species were collected. Females outnumbered males at Site 3; 989(62.5%) to 594(37.5%). Site 4 had 1140(56.2%) males and 889(43.8%) females, while site 6 along the downstream section of the Imo River had 1857(51.4%) females and 1759(48.6%) males (Table 4).

*Diversity indices:* The diversity indices results revealed dominance, Shannon (H) diversity, and evenness for the sampling sites along the Jaja Creek and the adjoining downstream section of the Imo River (Table 5). Along the stretch of Jaja Creek, site 1 reported 0.23 for dominance (D), site 3 (0.21), and site 2 (0.11), while site 7 of the Imo River recorded 0.24 and site 5 (0.22). The Shannon H diversity results revealed that site 2 of Jaja Creek had a relatively high diversity of 2.50, followed by site 3 (2.12) and site 1 (2.02), whereas site 6 of the Imo River had a relatively high arthropod species diversity of 2.37, while site 5 had 2.01 and site 4 had 2.13 (Table 5).

**Table 5:** Diversity indices for the arthropod species collected across the sampling stations.

| Sites | Individuals | Dominance (D) | Simpson (1-D) | Shannon (H) | Evenness |
|---|---|---|---|---|---|
| Site 1 (Jaja Creek) | 3777 | 0.23 (0.23 - 0.24) | 0.77 (0.76 - 0.77) | 2.02 (1.97 - 2.06) | 0.21 (0.20 - 0.22) |
| Site 2 (Jaja Creek) | 21179 | 0.11 (0.11 - 0.12) | 0.89 (0.88 - 0.89) | 2.50 (2.48 - 2.51) | 0.34 (0.33 - 0.34) |
| Site 3 (Jaja Creek) | 19763 | 0.21 (0.20 - 0.21) | 0.79 (0.79 - 0.80) | 2.12 (2.10 - 2.14) | 0.23 (0.23 - 0.24) |
| Site 4 (Control) | 28049 | 0.18 (0.18 - 0.18) | 0.82 (0.82 - 0.82) | 2.13 (2.11 - 2.14) | 0.23 (0.23 - 0.24) |
| Site 5 (Imo River) | 29608 | 0.22 (0.22 - 0.22) | 0.78 (0.78 - 0.78) | 2.01 (1.99 - 2.02) | 0.21 (0.20 - 0.21) |
| Site 6 (Imo River) | 19616 | 0.16 (0.16 - 0.17) | 0.84 (0.83 - 0.84) | 2.37 (2.35 - 2.39) | 0.30 (0.29 - 0.30) |
| Site 7 (Imo River) | 21362 | 0.24 (0.23 - 0.24) | 0.76 (0.76 - 0.77) | 1.98 (1.96 - 2.00) | 0.20 (0.20 - 0.20) |

The documented arthropod species community in this study revealed that a variety of arthropod species live in Jaja Creek and the downstream sections of the Imo River in the Uta Ewa catchment. This study documented two Araneae species, one of which was previously documented by Oku *et al*. (2013) in Southern Nigeria's Great Kwa River Mangrove Swamp. Notably, Araneae were more abundant in site 5 (Imo River) of the downstream sections of the adjoining Imo River, and could be inferred that they are freshwater Araneae. Some of the insects found in this study had previously been documented by other researchers in similar environments around the country. Uwadiae (2018) reported *Chironomus sp* (Larvae) and *L. luctosa* (Larvae) in a Weak-tidal Tropical Lagoon in southwest Nigeria. Hart and Zabbey (2005) documented *Chironomus* sp (Larvae) in Woji Creek, Niger Delta, Nigeria. Sikoki and Zabbey (2006) documented *Chronomus, Tanypus sp, Sialis luteria, Polycentropus sp, Dixa sp (*Larva*),* and *Polynema natans* in the middle reaches of the Imo River. Site 6 in the Imo River's downstream section reported more insect species than the other sampling sites in the two water bodies, with members of the Chironomidae family predominant. A few insect species from diverse families were observed along the Jaja Creek sites, with site 2 being more abundant than sites 1 and 3. In contrast to reports by Barnes *et al* (1988), who asserted that insects are predominantly restricted to freshwater habitats, According to Uwadiae (2018), Chironomids are the only group of insects documented in brackish water habitats. Insects at the adult stage, the migratory stage, from diverse families were observed in the Jaja Creek. This finding complements the findings of Williams and Williams (1998), who discovered that insects are expanding into saltwater habitats. According to Péqueux (1995), Charmantier *et al.* (1998), Rainbow and Back (2001), Charmantier *et al.* (2004), Freire *et al*. (2003), Cieluch *et al.* (2004), Augusto *et al.* (2009), and Uwadiae (2018), the ability of insect species to thrive in changing salinity regimes of aquatic environments ranges from changing behavioural capabilities to reductions in integumental permeability to the strong capability of intra- and extra-cellular osmo- and ion-regulation. According to Alberts-Hubatsch (2015) explanation, the documentation of bug species in Jaja Creek could indicate that the insects adapted to changes in the two aquatic environments, to find food and avoid predatory attacks. Confirmatory, this study is the first to report on the insect species of the Creek and the downstream sections of the Imo River. Fischer *et al*. (1981), Schneider (1992), and Addo *et al*. (2018) reported the presence of three species of the Decapoda order; *C. amnicola, C. pallidus, and C. marginatus. C. amnicola*, in West Africa has been found to be the most widespread species in West African creeks, accounting for the majority of the trapped fisheries in Nigeria (Mensah, 1979; Lawal-Are 2009; Oku *et al*., 2013; Ekpo and Ukpong, 2014). Addo *et al.* (2018) reported that C. *amnicola* is a special interest species since it spends most of its life in Creeks. Abby-Kalio (1982) identified common crustaceans in the Niger Delta as *Cardisoma sp., Chiromanthes sp., Uca sp., Goniopsis sp., Holometopus*, and *Panopeus sp*. Akpan *et al*. (2019) identified *N. hastatus, M. caledonium, G. pellii, C. armatum, O. africana, C. amnicola,* and *P. africana* in a preliminary investigation on the composition and quantity of shellfish (Decapoda: Crustacea) in the Uta Ewa estuary. Nonetheless, this study is the first to document members of the families Sesarmidae, Pilumnidae, and Penaeidae

(*Penaeus* sp.) in this stretch of the Niger Delta Creek. Site 5 of the Imo River had a greater diversity of arthropod species than the other sampling locations. Site 1 has a lower number of arthropod species. According to Uwadiae (2018), a small number of arthropod species may have occurred in the area since only a few arthropods with the requisite adaption traits can live in an unstable environment. The presence of more Crustaceans at site 4 (Control site), indicates that the environment, including sediment composition, is generally constant, promoting the abundance of *M. caledonicum, N. hastatus*, and *Pandalus sp*. This explains why the Local fishermen fixed their nets for prawns and shrimps at this spot. Site 2 (Jaja Creek) had the highest abundance of Crustaceans, with *C. amnicola* being the main species, and also had more arthropod species than other sites along its length. The mixed nature of the silt and plant roots, as well as other favourable circumstances at the location (Uwiadae, 2018), could have contributed to the increasing abundance of the arthropod fauna population. The abundance of the different sexes of the arthropod species found in this study varied between the Creek and River sites. The study's findings revealed that males were more abundant than females at each location over the two years of sampling, except site 6 (Imo River), in which females of diverse arthropod species outnumbered males.

According to Razek (2006) and Hosseini *et al*. (2012), factors such as migration in search of food, a suitable female mate for reproduction and habitat, and the relatively stable water quality and sediment composition of the two water bodies, which are sandy with little silt, may have favoured the male sex of the individual arthropod species over the female sex. Site 2, on the other hand, had a larger Shannon diversity H (2.50) and evenness of species distribution than other sites along Jaja Creek and the adjacent Imo River stretch. In comparison to John and Ebehiremhen (2015) description, the Shannon diversity H values for the two water bodies, though not equal to 3, indicate that the two water bodies are stable and less contaminated.

*Conclusion* The catchment area's arthropod species community structure, as indicated by the arthropod species collected, abundance, and diversity, exists in good population size across the two water bodies. This study is the first to report on the insect fauna of the Creek and the downstream stretch of the Imo River, which is of great importance to the field of Entomology. The results of the diversity indices confirm that the water bodies are steady and less polluted.

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