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# Digitizing biodiversity: Enhancing online access to indigenous aquatic species of the nun river

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## Abstract

Data management involves data collection, analysis, interpretation and presentation for easy communication of findings to enhance knowledge advancement and innovations for development and nation building. The fisheries sector in Nigeria and Africa as a whole need detailed electronic database of indigenous aquatic fisheries resources and this can only be made possible with proper data collection, analysis, documentation to enhance their availability, accessibility and presented in formats that are usable for easy retrieval. This research involved a field study on the species composition of Nun River and a desktop survey of fisheries reports on aquatic macro-fauna such as the fin fishes and the respective researchers and/or authors involved. The tools for database development to organize the fisheries data are HTML, CSS, for structuring and styling the web pages for front-end development, PHP for back-end development, MySQL, XAMPP and AJAX for relational database management, development environment, and data communication. By this project, the local, common and scientific names of Nun River species are uploaded on the database for a start since there are many other rivers bifurcating from the Niger River in the study area (Nigeria) which will be retrieved from the desktop survey on other researchers. These fisheries data are organized for evidence-based decision making and policy development which is key in resource management and sustainable development of the fisheries sector.

**Keywords:** Environmental Resource Management; Database Development; Data Management; Nun River; Fisheries

## 1. Introduction

The online database management of Nun River ecosystem is of great importance to enhance availability and accessibility of data on indigenous aquatic species of the Niger Delta region in Bayelsa State, Nigeria. This region as mentioned by Ogbe (2011) is approximately 70,000 km2. A comprehensive online database is needed to manage and enhance conservation practices and also raise awareness about the unique species inhabiting this river. Challenges such as unavailable online databases, ineffective management systems, and limited online accessibility prevent conservation efforts, particularly in remote areas where no online database is yet to be done about the indigenous species (Samuel, 2022). There is a need for the development and cultivation of indigenous species, (Similoluwa, Abiodun, & Ibraheem, 2022) through extensive research, and an accessible online database available to the users and stakeholders of Nun River ecosystem on the aquatic species found. Several information can be made available through research on natural feed source (Ashfaq & Syed, 2023) and fish disease management towards the development of aquatic species (Kelly & Nilima , 2020) to reduce production costs in fish farming, and help address food security needs in the country and the region, which is crucial given the economic challenges currently faced by the nation (Chin , et al., 2019).

An online database incorporating global positioning system (GPS), and tagging technology can help track the migration patterns of endangered species, and the use of Geographic Information System (GIS) to provide valuable mapping

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insights for conservationists that will make available attributes of aquatic species on an online database to users (Maciej, Katarzyna , Łukasz , & Julian , 2020). Empowering policymakers, researchers, and local communities in Bayelsa State and across Africa with good data will enhance informed decisions that will contribute to the conservation of Nun River ecosystem and its biodiversity (Okogbue, 2021).

Data availability will foster data-driven programmes for community engagement to enhance stakeholder participation and efficient collaboration to involve them in conservation efforts and environmental stewardship programmes such as field projects and training workshops to create awareness on the importance of conserving wildlife (Infield & Tolisano, 2019). For instance, implementing sustainable fishing practices to prevent over exploitation of aquatic resources according to ( Tony , Sjarief , Hassan , & Stephanie , 2020) and promoting eco-tourism as a means to generate income and protect the natural environment with government support, advocacy for policies that prioritize environmental conservation (Yunfeng , et al., 2023).will require pre-project sensitization and planning.

These online databases will support the communities to partner with corporations to sponsor conservation initiatives and support local communities in eco-friendly project (ICCA Consortium, 2024). International collaborations with organizations and NGOs will expose locals to best practices and resources for protecting the biodiversity of the Nun River. Online database if well managed will promote participation of local and global conservation agreements and initiatives to enhance long-term sustainability of the region's natural resources (Sanna, 2015). Online database can attract tourism and promote responsible tourism practices; that will minimize negative impacts on the Nun River ecosystem.

Government Policies are influenced by available data which should be made available online for easy accessibility. Advocacy for the implementation of strict environmental regulations will protect Nun River ecosystem by workings with local authorities to enforce laws against illegal logging, fishing, and pollution in the region, a good example is the Tantita security services Nigeria limited, similar organizations can be employed to maintain sustainable fishing practices.

Research and monitoring conducted regularly and made available on an online database will inform users of the health status of Nun River ecosystem by partnerships with institutions. Thus, this research work aimed to contribute to data generation and imputing for documentation on online database for indigenous aquatic species of the Nun River in Bayelsa State, Nigeria as a case study.

## 2. Methodology

This chapter outlines the methodology adopted to create a comprehensive online database of aquatic species found in the Nun River, Bayelsa State, Nigeria. The research followed a pragmatic philosophy, integrating both qualitative and quantitative approaches to ensure a holistic understanding. Primary data were collected through field sampling, interviews with local fishermen, and observations, while secondary data were obtained from scientific literature and existing databases. Tools such as GPS devices, digital cameras, and database management software were used for data capture and development. Data processing involved classification, validation, and analysis. Ethical considerations included informed consent and respect for local ecological knowledge.

### 2.1. Research Philosophy and Approach

This study adopted a pragmatic research philosophy, focusing on practical results rather than theoretical knowledge. Pragmatism allows the integration of different research methods to solve global problems, in this case, the need to find, an accessible, accurate, and sustainable database of indigenous aquatic species. This study aims to assist decision-making on environmental protection and fisheries management using technology. This philosophy is consistent with the need to provide tangible results that stakeholders - researchers, conservationists and local groups - can use to promote sustainable improvement in the Nun River ecosystem. This research combines qualitative and quantitative methods to better understand the nature of the species. This method was chosen to make the best use of all types of research data. The quantitative part focuses on the systematic collection and recording of biological data (e.g. species diversity, scientific classification), while the qualitative part includes information on aquatic ecosystems, local information and species names in the Ijaw language, and natural fisheries management. In addition, the qualitative part included discussions with local fishermen and regional authorities, including the nature of scientific statistics.

### 2.2. Data Collection

The data collection process was divided into two main parts: Field Study: A field survey along the Nun River was conducted to document various aquatic species, with a focus on finfish. Species were identified, collected, and classified according to their scientific, common, and local (Ijaw) names. The data collection was conducted using nets, traps, and visual identification techniques guided by local fishermen.

Survey: In addition to field observations, a thorough review was undertaken to gather secondary data from existing literature, reports, and online databases such as Fish Base. This helped to cross-reference the species identified during the field study and provided further information on previously documented species.

### 2.3. Tools for Database Development

Various tools are used to create online databases to ensure efficient storage and retrieval of fish data

- HTML and CSS: Used to create and design websites. The function of HTML is to organize database entries in an accessible format, while CSS ensures that the user interface is modern and convenient. Chapter.
- PHP: Use PHP to develop a backend that provides powerful data processing capabilities. It allows applications to interact with MySQL databases, and manage import, update, and query operations. Chapter.
- MySQL: Choose a MySQL database to store and manage fishing data. Use relationship charts to correctly classify species by their name, scientific name, and region, as well as other important characteristics. Chapter.
- XAMPP: Used as an internal development environment for building and testing processes before final delivery. XAMPP provides the Apache, PHP, and MySQL servers required for testing. Chapter.
- AJAX: AJAX improves the user experience by providing real-time updates and interactions with servers without reloading the page.

The scientific names, common names (in English), local names (in Ijaw), and corresponding images of each fish species—collected both from fieldwork and reputable online sources—were compiled and validated. This information was systematically structured and stored in a relational database to ensure efficient organization and easy access. The database was integrated into an interactive online platform, enabling users to retrieve information seamlessly. The platform features a powerful search function that allows users to access specific data by entering scientific names, common names, local names, or other relevant keywords, thereby enhancing usability and supporting research, education, and conservation efforts.

### 2.4. Research Platform Development

The online platform is developed to ensure broad accessibility of the aquatic species database to researchers, students, policymakers, and local communities. It features an intuitive and user-friendly front end that allows easy navigation and interaction with the data. The back end supports robust data management and visualization through color-coded categorization for quick identification of species attributes. Integrated with the official website of the Department of Fisheries Technology, Federal Polytechnic Ekowe, the platform enhances visibility, encourages academic collaboration, and provides users with extended access to relevant resources, updates, and opportunities for engagement in fisheries research and conservation initiatives.

## 3. Results and Discussion

**Table 1** List of fish with scientific, Common, local names, fishing Gear used, season of occurrence and habitat caught. From Nun River

| S\NO | Family | Scientific name | Common Name | Local Name (Ijaw) | Gear Type | Season of Occurrence | Habitat Caught |
|---|---|---|---|---|---|---|---|
| 1 | Ariidae | *Arius gigas* | Giant sea Catfish | Oburu | Fishing Net,hook and Trap | Dry season | River |
| 2 | Arapaimidae | *Heterotis niloticus* | Bony tongue, African arowana | Ekeu | Fishing Nets/Hooks | Rainy season | Rivers,lakes |

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|---|---|---|---|---|---|---|---|
| 3 | Alestidae | *Hydrocynus brevis* | Tigerfish | Ekolokolo | Fishing Nets | Rainy Season | Rivers |
| 4 | Alestidae | *Brycinus nurse* | Nurse tetra | Adegi | Fishing Nets | Dry Season | Rivers |
| 5 | Bagridae | *Bagrus bajad* | Bayad | Aboro | Fishing Nets | Dry Season | River |
| 6 | Cytharinidae | *Citharinus citharus* | Moonfish | Apete | Fishing Nets | Dry Season | Rivers, lakes |
| 7 | Clariidae | *Clarias gariepinus* | African catfish | Emunu | Hooks | Rainy season | Lakes |
| 8 | | *Gymnallabes typus* | Flat head Eel catfish | Alomo -yin | Fishing Traps | Dry/Rainy season | Lakes |
| 9 | | *Heterobranchus bidorsalis* | African catfish | Toriye | Fishing Nets/traps | Rainy season | Rivers |
| 10 | Carangidae | *Caranx hippos* | *Crevalle Jack* | *Ekwe* | Fishing Nets | Dry/Rainy season | Marine /Brackish waters |
| 11 | Claroteidae | *Chrysichthys nigrodigitatus* | *Silver catfish* | *Ongolo* | Fishing Nets | Rainy season | Rivers |
| 12 | Cynoglossidae | *Cynoglossus senegalensis* | *Tongue sole* | *Sakpo-bumo* | Fishing Nets | Dry season | Rivers |
| 13 | Channidae | *Parachanna obscura* | *Obscura Snakehead* | *Iyoro* | Fishing Traps | Rainy/Dry season | Lakes |
| 14 | Cyprinidae | *Labeo parvus* | *African Carps* | *Kopio* | Fishing Net | Rainy Season | Rivers |
| 15 | Cichlidae | *Sarotherodon galilaeus* | *mango tilapia* | *Otoin* | Fishing Traps | Raining season | Lakes |
| 16 | | *Hemichromis fasciatus* | *Banded jewelfish* | *Boro-Otoin* | Fishing Traps | Dry Season | Lakes/ponds |
| 17 | | *Tilapia Zilli* | *Redbelly Tilapia* | *Kuwei* | Fishing Traps/Nets | Dry Season | Lakes |
| 18 | *Dasyatidae* | *Fontitrygon garouaensis* | *Niger stingray or smooth freshwater stingray* | *Sika* | *Fishing Nets* | *Dry Season* | Rivers |
| 19 | *Eleotridae* | *Eleotris senegalensis* | | *Ukuli* | *Nets\fishing traps* | *Rainy season* | Lakes |
| 20 | *Gobiidae* | *Gobionellus occidentalis* | *Delta goby* | *Atilai* | *Fishing Nets* | *Rainy/Dry season* | Rivers |
| 21 | *Gymnarchidae* | *Gymnarchus niloticus* | *Frank fish, Aba* | *Aba* | *Fishing Nets* | *Dry /Raining season* | Lakes |
| 22 | *Hepsetidae* | *Hepsetus odoe* | *African pike characin* | *Osau* | *Nets/fishing traps* | *Dry Season* | Lakes,ponds |
| 23 | *Latidae* | *Lates niloticus* | *Nile perch* | *Kerede* | *Fishing Nets* | *Rainy season* | Rivers |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 24 | *Lutjanidae* | *Lutjanus dentatus* | *African brown snapper* | *Keu* | *Fishing Nets* | *Dry Season* | Rivers |
| 25 | *Mochokidae* | *Synodontis budgetti* | *upside-down catfish* | *Ekpo* | *Fishing Nets/Hooks* | *Rainy Season* | Rivers |
| 26 | *Monodactylidae* | *Monodactylus sebae* | *African moony* | *Palia* | *Fishing Nets* | *Rainy Season* | Rivers |
| 27 | *Mormyridae* | *Mormyrus tapirus* | *Trunkfish* | *Ogidi-Ekpa* | *Fishing Nets* | *Rainy Season* | Rivers |
| 28 | *Mugilidae* | *Mugil bananensis* | *Banana mullet* | *Pina-kopio* | *Fishing Nets* | *Rainy Season* | Rivers |
| 29 | *Malapteruridae* | *Malapterurus electricus* | *Electric Catfish* | *Oma* | *Nets/fishing traps* | *Rainy Season* | Rivers,lakes |
| 30 | *Nandidae* | *Polycentropsis abbreviate* | *African leaffish* | *Belegbulupei* | *Fishing Traps* | *Dry Season* | Lakes |
| 31 | *Notopteridae* | *Papyrocranus afer* | *Reticulate knifefish* | *Pomi* | *Fishing Nets* | *Dry Season* | Lakes |
| 32 | *Protopteridae* | *Protopterus annectens* | *West african lungfish* | *Ebiesini* | *Fishing Traps* | *Rainy Season* | Lakes |
| 33 | *Phractolaemidae* | *Phractolaemus ansorgii* | *Hingemouth* | *Okuwon* | *Fishing Traps* | *Dry Season* | Lakes,ponds |
| 34 | *Polypteridae* | *Polypterus bichir* | *Bichir* | *Ogboro* | *Fishing Traps/Nets* | *Rainy Season* | Lakes |
| 35 | | *Erpetoichthys calabaricus* | *Reedfish* | *Ogbaru* | *Fishing Traps* | *Rainy season* | Lakes |
| 36 | *Pantodontidae* | *Pantodon buchholzi* | *Freshwater butterflyfish* | *Bini-eroplani* | *Fishing Traps* | *Dry Season* | Lakes/ponds |
| 37 | *Polynemidae* | *Polydactylus quadrifilis* | *Giant African threadfin* | *Inda* | *Fishing Nets* | *Dry Season* | Rivers |
| 38 | *Synbranchidae* | *Ophisternon afrum* | *Guinea swamp eel* | *Toru-Ogbo* | *Fishing Nets* | *Rainy Season* | Rivers |
| 39 | *Schilbeidae* | *Schilbe uranoscopus* | *Egyptian butter catfish* | *Hain* | *Fishing Nets/Hooks* | *Raining season* | Rivers |
| 40 | *Sciaenidae* | *Pseudotolithus elongatus* | *Bobo Croaker, Corb* | *Ona* | *Fishing Nets* | *Dry/Rainy season* | Marine /Brackish waters |

The table presents a detailed inventory of 40 fish species inhabiting the Nun River in Bayelsa State, Nigeria, highlighting their scientific names, common names, local (Ijaw) names, fishing gear types, seasons of occurrence, and habitats. This comprehensive data underscores the rich biodiversity and ecological complexity of the Nun River ecosystem.

Fish species span across numerous families such as Ariidae, *Alestidae, Clariidae, and Cichlidae*, with notable representatives including the Giant Sea catfish (*Arius gigas*), Tigerfish (*Hydrocynus brevis*), and African catfish (*Clarias gariepinus*). These species are not only ecologically significant but also form an important part of local subsistence and commercial fisheries.

The local *Ijaw names—such as Oburu, Ekeu, Emunu, and Aba—reflect* the deep cultural knowledge and interaction of indigenous communities with their aquatic environment. The documentation of these names aids both ethnobiological studies and community-based conservation efforts.

In terms of fishing methods, a variety of gear types are employed including fishing nets, hooks, and traps. While fishing nets are the most widely used gear across species and seasons, traps are more common for lake-dwelling or slow-moving species such as Parachanna obscura (Iyoro) and Protopterus annectens (Ebiesini). Hooks are typically reserved for species like Clarias gariepinus and Synodontis budgetti.

The seasonality of occurrence reveals how fish availability aligns with the region's climatic patterns. Many species such as Brycinus nurse, Citharinus citharus, and Chrysichthys nigrodigitatus are more abundant in the dry season, likely due to reduced water volume concentrating fish populations. In contrast, others such as Lates niloticus and Mormyrus tapirus appear predominantly in the rainy season, possibly due to spawning behavior or expanded habitat range.

Habitats include rivers, lakes, ponds, and marine/brackish waters. Most species are riverine, while lake and pond species—like the banded jewelfish (Hemichromis fasciatus)—illustrate habitat-specific diversity. A few species, such as Caranx hippos and Pseudotolithus elongatus, indicate the interface of freshwater and marine systems.

Overall, this table not only serves as a baseline for biodiversity monitoring and fishery management but also informs sustainable exploitation, conservation planning, and the development of a localized aquatic species database.

## 4. Conclusion

Database of the Nun River indigenous fish species was developed in this work to compute the species to have an online presence and be made available for researchers, policymakers, conservationists, taxonomists and organizations of both governmental and non-governmental origin who work in or with the freshwater aquatic environments. The species' names were recorded in their common names (English names), scientific names, local names in Ijaw language and with their locally generated images from the site and also from fish-base.org and google images for a comparative position. The site is linked to the website of the institution, Department of Fisheries Technology, Federal Polytechnic Ekowe in Bayelsa State, Nigeria where the study was conducted. This will enhance data-driven programme development, teaching aids and referential data for researchers and other stakeholders. There is the need for constant updating of the site as more species are discovered in the study area.

## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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