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PROXIMATE COMPOSITION OF *SAROTHERODON MELANOTHERON* AND SOCIO-ECONOMIC ANALYSES OF CAST NET AMONG ARTISANAL FISHERS IN LAGOS LAGOON (NIGERIA)

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ABSTRACT

Proximate composition of the wild-caught *Sarotherodon melanotheron* and the socio-economic analyses of cast net among artisanal fishers in Lagos Lagoon (Nigeria), were examined in the dry season of 2021 and 2022. No significant ($P < 0.05$) variation was found in the proximate content of the fish. The protein content ranged from 61.74 ± 3.20 g/100 g to 63.13 ± 0.64 g/100 g in 2021 and from 53.13 ± 3.27 g/100 g to 58.38 ± 0.47 g/100 g in 2022, with highest value in November 2021 and decreased thereafter till late dry season (April). Lipid content showed the opposite trend (except in February), increasing from early to late dry season. The return on investment averaged at 10.72, with lowest being –0.60 and highest found to be 24.00. The use of cast nets fishing gear is profitable.

RÉSUMÉ: La composition approximative de *Sarotherodon melanotheron* et les analyses socio-économiques des captures à l'épervier des pêcheurs artisans du Lagon de Lagos (Nigéria).

La composition approximative des captures sauvages de *Sarotherodon melanotheron*, ainsi que l'analyse socio-économique des captures à l'épervier parmi les pêcheurs artisans du Lagon de Lagos ont été examinées durant les saisons sèches de 2021 et 2022. La composition approximative des poissons n'a pas varié de manière signifiante ($P < 0,05$). Le contenu protéique a varié entre 61,74 ± 3,20 g/100 g à 63,13 ± 0,64 g/100 g en 2021 et de 53,13 ± 3,27 g/100 g à 58,38 ± 0,47 g/100 g en 2022, avec la valeur la plus grande en novembre 2021, en baisse par la suite, jusqu'à la fin de la saison sèche (avril). Le contenu de lipides a enregistré une tendance opposée (à l'exception du mois de février), en hausse du début vers la fin de la saison sèche. Le retour sur investissement a été en moyenne 10,72, le plus bas étant de –0,60 et de 24,00 pour le plus élevé. La pêche à l'épervier est profitable.

REZUMAT: Compoziția aproximativă la *Sarotherodon melanotheron* și analizele socio-economice ale pescuitului cu prostovolul de către pescari în Laguna Lagos (Nigeria).

Au fost analizate compoziția aproximativă a capturilor de *Sarotherodon melanotheron* din natură și datele socio-economice pentru pescuitul cu prostovolul de către pescari profesioniști de pe Laguna Lagos pe durata sezonului secetos din 2021 și 2022. Compoziția aproximativă a peștelui nu a variat semnificativ ($P < 0,05$). Conținutul proteic a variat între 61,74 ± 3,20 g/100 g și 63,13 ± 0,64 g/100 g în 2021 și între 53,13 ± 3,27 g/100 g și 58,38 ± 0,47 g/100 g în 2022, cea mai mare valoare fiind obținută pentru noiembrie 2021, scăzând apoi până la finalul sezonului secetos (aprilie). Valorile lipidelor au înregistrat din contră o creștere (cu excepția lunii februarie), crescând pe durata sezonului secetos. Rentabilitatea medie a fost de 10,72, cu valori absolute cuprinse între –0,60 și 24,00. Pescuitul cu prostovolul este profitabil.

INTRODUCTION

One of the most important food sources which are invaluable for protein and industrial products are fish from freshwater and ocean ecosystems (Monte-Luna et al., 2016). In spite of the fact that Nigeria is characterized by a relatively rich fish fauna (Olopade, 2013; Adaka et al., 2015; Olopade et al., 2015) this country is the fourth largest importer of fish in the world, where the top suppliers are the United States and Chile, but fish is also sourced from Europe, Asia, and a few African countries, including Mauritania, Algeria, and Mauritius (Daniels et al., 2016; Lawal-Are et al., 2021). More than 41% of the total animal protein intake in Nigeria is obtained from fishery products because it is relatively cheaper than other animals meat and the total fish consumption rate has risen to 2.66 million metric tons annually (Onyia et al., 2014; Moruf et al., 2019). Consumers have favored fish over red meat in recent decades; since red meat production has been endangered by a number of crises and challenges, seafood products have emerged as the greatest alternative (Moruf, 2022).

Economically, fish serves as an important source of food and income for human beings and it also has an important social and cultural role in riverine communities (FAO, 2012). In typical fishing landing sites, men are predominantly the harvester of wild fish species while women are engaged in fish processing, marketing, and in near shore harvesting activities (Olaoye et al., 2017). Other ancillary related activities such as net-making, boat-building, engine repair, and maintenance, etc. can provide additional fishery-related employment and income opportunities in marine and inland fishing communities. The small-scale artisanal fishery sector remains the backbone of fish production in Nigeria, contributing a minimum of 70% of the total fish production in the last decade (Olaoye et al., 2017). The total domestic fish production is far less than the total domestic demand thereby creating an unmet need for fish which is being met through importation (Bada and Rahji, 2010). In spite of the fact that actions are geared towards improving the domestic production of fish in a sustainable way, Nigeria continues to be a large importer of fish in Africa (Rahji et al., 2001). This involves paying attention to the type of fishing gears used by the fisher men and/or women involved in capture fisheries.

The cast net is the one of the most widely used in artisanal fishing in all the Nigerian brackish as well as coastal waters (FAO, 2012). The cast nets are falling gear, conical in shape with lead sunken or weights attracted at regular intervals on the lead rope forming the circumference of the cone. Some cast nets are designed such that the lead rope per net is tucked underneath and attached at intervals to the inner side of the net to form pockets for trapping fish. The nets are usually cast at random in depths of up to four meters. When fishing for certain species of fish, the fisherman remains poised at alert until the tell-tale whirl of a fish is seen and then throws the net which encircles the exact spot (Emmanuel et al., 2008). Since group cast netting is practiced in Lagos Lagoon in Nigeria mainly by the migrant Beninois fishermen using eight to 15 canoes each manned by at least two men, it is important to determine the socio-economics of the fishers and fishing gear.

Hence, this study was set to document information on the socioeconomic parameters of fishermen who utilize cast net in Lagos Lagoon as well as the changes in nutritional values of the harvested fish.

MATERIAL AND METHODS

Study area

The study area is the western part of Lagos Lagoon at Oworonshoki fishing community with latitudes 6°58'N and longitude 3°40'E. The people occupying this area are known to earn a livelihood mainly from fishing and related business like smoke-drying.

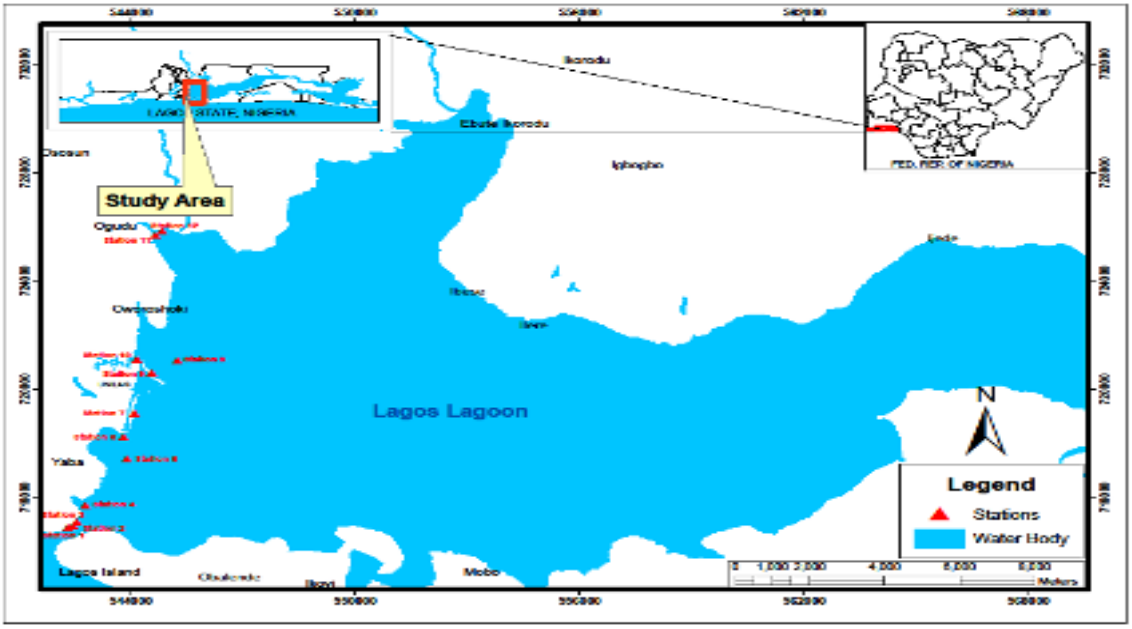

Figure 1: Map of Lagos coast showing sampling location.

Collection of samples

Samples of *Sarotherodon melanotheron* were caught using cast net on a monthly basis from November 2021 to April 2022 between the time period of 6 am to 9 am. The fish samples were washed with distilled de-ionised water to remove any adhering contamination, drained and identified (Schneider, 1990). The specimens were kept in crushed ice in insulated containers and brought to the laboratory for refrigeration (–20℃) prior to analysis.

Laboratory analysis

After removing from the freezer, samples were defrosted for about one hour, while fillets (muscles) were extracted. These parts were dried at 105°C and homogenised. The analysis of the moisture, ash, protein, fat, and carbohydrate contents was determined using the methods described by AOAC (2006).

Questionnaire administration

Fifty-five fishermen using cast nets were randomly selected at the fishing community for this study. Structured questionnaires were then administered through personal interviews and were used to collect data from the fishermen. The cost return structure of the fishermen which involves cost on investment, gain on investment and return on investment was calculated using the equation.

$$ROI = \frac{(GOI - COI)}{COI}$$

where, ROI = Return on Investment; GOI = Gain on Investment, and COI = Cost on Investment.

Statistical analysis

The statistical analysis was performed using Microsoft Excel 2010. Descriptive statistics (mean and measure of frequency) were used to describe the socio-economic characteristics of the respondents and the economic characteristics of cast net.

RESULTS AND DISCUSSION

The monthly variation in proximate composition of *Sarotherodon melanotheron* for 2021 and 2022 is shown in table 1. No significant ($P < 0.05$) variation was found in the proximate content of the fish. The protein content ranged from 61.74 ± 3.20 g/100 g to 63.13 ± 0.64 g/100 g in 2021 and from 53.13 ± 3.27 g/100 g to 58.38 ± 0.47 g/100 g in 2022. Fat content ranged from 6.63 ± 3.26 g/100 g to 14.75 ± 4.37 g/100 g in 2021 and from 7.62 ± 4.58 g/100 g to 20.63 ± 1.75 g/100 g in 2022. The ash content ranged from 17.50 ± 0.41 g/100 g to 23.62 ± 4.1 g/100 g in 2021 and from 15.24 ± 1.85 g/100 g to 18.20 ± 0.81 g/100 g in 2022; moisture ranged from 4.26 ± 0.29 g/100 g to 5.62 ± 0.76 g/100 g in 2021 and from 4.75 ± 0.50 g/100 g to 19.24 ± 1.70 g/100 g in 2022. The highest protein content was observed in the month of November and generally decreased till April (late dry season). Lipid content showed the opposite trend (except in February), increasing from early to late dry season. The high protein and lipid content of the tissues also reveals their involvement in energy production at cellular level (Moruf et al., 2021a). The protein values obtained in this study were higher than the values reported for penaeid and caridean prawns of Lagos Lagoon (Moruf et al., 2021b; Moruf and Akinwunmi, 2022), but lower than that reported for portunid and gercacind species from same lagoon (Moruf and Lawal-Are, 2019; Moruf et al., 2021c). The proximate composition of fish is primarily affected by environmental factors, spawning, feeding, sex, and the stage of the life cycle (Kim et al., 2016; Lawal-Are et al., 2018).

Table 1: Monthly variation in proximate composition of *Sarotherodon melanotheron*; No significant ($P < 0.05$) variation.

Parameter (g/100 g)	Nov. 21	Dec. 21	Jan. 22	Feb. 22	Mar. 22	Apr. 22
Protein	63.13 ± 0.64	61.74 ± 3.20	58.38 ± 0.47	54.27 ± 2.73	53.13 ± 3.27	51.10 ± 0.14
Fat	6.63 ± 3.26	14.75 ± 4.37	20.63 ± 1.75	7.62 ± 4.58	14.06 ± 0.50	15.13 ± 0.48
Fibre	1.0 ± 1.01	1.75 ± 0.87	1.00 ± 0.00	0.87 ± 0.58	1.61 ± 0.22	1.95 ± 0.49
Ash	23.62 ± 4.10	17.50 ± 0.41	15.24 ± 1.85	18.00 ± 0.71	18.20 ± 0.81	17.82 ± 0.86
Moisture	5.62 ± 0.76	4.26 ± 0.29	4.75 ± 0.50	19.24 ± 1.70	13.00 ± 4.62	14.00 ± 0.00

The socio-economic characteristics of the cast net fishers are presented in table 2. It reveals that 40% of the respondents using cast net were within the age range of 26-35 years while 25% was between 36-45 years. The mean ages indicated that fishers using cast nets were youth (mean age = 39.04 ± 6.96 years). It has been ascertained that age has positive correlation with acceptance of innovation and risk taking (Bello, 2000). Furthermore, 70% of the respondents were found to be of male gender, 30% were female and 70% of the sample population declared themselves to be married. This is in agreement with a previous report, which discovered that majority of the artisanal fishers in coastal waters of Southwest Nigeria were married (Olaoye et al., 2017). Marriage is considered very important in African culture as it denotes responsibility and maturity. Highest percentage of the sample population at 80% had no formal education followed by 15% being primary school certificate holders and only 5% were found to have secondary school education. It however indicated that most of the fish farmers are either uneducated or had low level of education. Similar findings were reported noting that the choice of cast net is not affected by the educational level of the fishers (Kingdom and Kwen, 2009). Highest fishing experience was found to be 20 years amounting to 10%, lowest was three years at 5% with the average number of fishing years being 10 years at 40%. Fishing experience averaged ten years in this study and was as high as twenty years, showing that fishing is a business that endures and is often passed on from one generation to the next (Mireku et al., 2016).

Table 2: Socio-economic characteristics of fishermen in western part of Lagos Lagoon.

Variables	Categories	Frequency	Percentage (%)
Gender	Male	14	70.0
	Female	6	30.0
Age	0-15	2	10.0
	16-25	2	10.0
	26-35	8	40.0
	36-45	5	25.0
	46 and above	3	15.0
Educational background	No formal education	16	80.0
	Primary education	3	15.0
	SSCE	1	5.0
Marital status	Single	6	30.0
	Married	14	70.0
Years of experience in the fishing	3	1	5.0
	5	5	25.0
	7	1	5.0
	10	8	40.0
	15	3	15.0
	20	2	10.0

The costs and returns from cast net fishing are presented in table 3. The return on investment averaged at 10.72, with lowest being –0.60 and highest found to be 24.00. The price variation downwards which the fishermen introduce to their selling prices from the time the fish is freshly caught to the end of the day with highest being 300 ₦ at 10% and lowest being 100 ₦ at 35%. The average cost return in this study indicates that the use of cast net as a fishing gear for *S. melanotheron* is profitable, agreeing with work of Olaoye et al. (2017) on the use of cast net fishing gears among artisanal fishers in lagoon waters of Ogun State. It however showed minimum cost return of –0.60 which means that if not properly managed, can lead to financial losses (Suleiman and Fregene, 2011). It was observed that the fishermen also reviewed their prices downwards as the day progressed from a minimum of 100 ₦ to a maximum of 300 ₦ in order to try and sell all of their catch. If such fishermen were given access to resources such as ice chests, it would help them make more profit each time they fished.

Table 3: Cost return structure and price variations of cast net fishers in western part of Lagos Lagoon, Nigeria.

S/N	Cost on Investment (₦)	Gain on Investment (₦)	Return on Investment ₦	Price Variation (₦)
1	2000	37500	17.75	200
2	2000	12500	5.25	150
3	3500	37500	9.71	300
4	2000	37500	17.75	200
5	2000	22500	10.25	100
6	1500	30000	19.00	150
7	1500	37500	24.00	150
8	1500	37500	24.00	200
9	3000	12500	3.17	300
10	200	3000	14.00	100
11	2500	30000	11.00	200
12	1500	37500	24.00	200
13	2000	7500	2.75	100
14	2000	22500	10.25	100
15	2500	2000	-0.20	100
16	2500	7500	2.00	100
17	3000	12500	3.17	200
18	3000	12500	3.17	100
19	2500	37500	14.00	200
20	2500	1000	-0.60	200

CONCLUSIONS

No significant ($P < 0.05$) variation was found in the proximate content of the fish *S. melanotheron* during the dry season. The highest protein content was observed in the month of November and generally decreased till April (late dry season). Lipid content showed the opposite trend (except in February), increasing from early to late dry season. Fishing experience averaged ten years in this study and was as high as twenty years, showing that fishing is a business that endures and is often passed on from one generation to the next. The use of cast nets is profitable as it yielded a good return on investment.

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REFERENCES

1. AOAC, 2006 – Association of Official Analytical Chemists, Official Methods of Analysis, 17th edition, Washington D.C, 21-447.
2. Bada T. and Rahji M. A. Y., 2010 – Market delineation study of the fish market in Nigeria: an application of co-integration analysis, *Journal of Agricultural Science*, 2, 3, 158-168.
3. Bello M. O., 2000 – Cauterization of potential adopters for organic-based fertilizer among vegetable farmers in Ojo LGA in Lagos State, Bachelor of agriculture project, University of Agriculture, Abeokuta, Nigeria, 75.
4. Daniels A., Gutiérrez M., Fanjul G., Guereña A., Matheson I. and Watkins K., 2016 – Western Africa's missing fish, The impacts of unreported and unregulated fishing and under-reporting catches by foreign fleets, London, Overseas Development Institute, 45.
5. Del Monte-Luna P., Lluch-Belda D., Arreguin-Sáncez F., Lluch-Cota S. and Villalobos-Ortiz H., 2016 – Approaching the potential of world marine fish, *Transylvanian Review of Systematical and Ecological Research*, 18.1, 45-56.
6. Emmanuel B. E., Chukwu L. O. and Azeez L. O., 2018 – Cast net design characteristics, catch composition and selectivity in tropical open lagoon, *African Journal of Biotechnology*, 7, 12, 2081-2089.
7. FAO – The state of world fisheries and aquaculture, Rome, Food and Agricultural Organization, 209.
8. Kim S. M., Lee H., Kim W. C., Lee H. C., Kwak H., Lee S. H., 2016 – Monthly variation in the proximate composition of jack mackerel (Trachurus japonicus) from Geumo Island, Korea, *Fisheries Research*, 183, 371-378.
9. Kingdom T. and Kwen K., 2009 – Survey of fishing gear and methods in the lower taylor Greek area, Bayelsa State, Nigeria, *World Journal of Fish and Marine Science*, 1, 4, 313-319.
10. Lawal-Are A. O., Moruf R. O., Ojeah F. L., Taiwo L. O. and Aligbeh O. E., 2021 – Weight yield factor, chemical composition and energy value of three imported shellfish species in Nigeria, *Nigerian Journal of Animal Production*, 48, 3, 63-70, DOI: 10.51791/njap.v48i3.2967.
11. Lawal-Are A. O., Moruf R. O. and Afolayan O. A., 2018 – Proximate composition, mineral profile and cholesterol level in whole and fillet of the Guinean Mantis Prawn, Squilla aculeata calmani (Holthuis, 1959) (Crustacea: Stomatopoda), *Albanian Journal of Agricultural Sciences*, 17, 3, 160-165.
12. Mireku K. K., Blay J. and Yankson K., 2016 – Reproductive biology of Blackchin Tilapia, Sarotherodon melanotheron (Pisces: Cichlidae) from Brimsu Reservoir, Cape Coast, Ghana, *International Journal of Fisheries and Aquaculture*, 8, 4, 42-54.
13. Moruf R. O. and Lawal-Are A. O., 2019 – Protein, amino acid and fatty acid profiles of two edible crabs of Lagos coast, Nigeria, *Journal of Bangladesh Agricultural University*, 17, 3, 396-401, DOI: 10.3329/jbau.v17i3.43222.

14. Moruf R. O., 2022 – Functional potential of the edible portion in wild and cultured crabs, *Agricultural Science and Technology*, 14, 1, 86-92, DOI: 10.15547/ast.2022.01.012.
15. Moruf R. O., Saba A. O., Chukwu-Osazuwa J. and Elegbede I. O., 2019 – Seasonal variation in macro-micronutrient compositions of the flesh and shell of the Portunid Crab, Callinectes amnicola (De Rochebrune, 1883) from the coastal waters of Southwest Nigeria, *Agricultura*, 102, 1-2, 200-209, DOI: 10.15835/agrisp.v109i1-2.13198.
16. Moruf R. O., Afolayan O. A., Taiwo M. A. and Ogunbambo M. M., 2021a – Estimation of nutritional energy values, mineral ratio and mineral safety index in the Royal Spiny Lobster, Panulirus regius (De Brito Capello, 1864), *Croatian Journal of Food Science and Technology*, 13, 1, 105-110, DOI: 10.17508/CJFST.2021.13.1.13.
17. Moruf R. O. and Akinwunmi M. F., 2022 – Compositional energy values, macro and trace elements in the caridean species, Macrobrachium macrobrachion (Herklots, 1851), *Food and Environment Safety*, 21, 1, 39-46.
18. Moruf R. O., Taiwo M. A. and Adebayo Q., 2021c – Nutritional and functional attributes of raw and grilled crabmeat, *Agricultural Science and Technology*, 13, 1, 83-90, DOI: 10.15547/ast.2021.01.016.
19. Moruf R. O., Akinwunmi M. F. and Lawal-Are A. O., 2021b – Chemometric estimation of captured Farfantepenaeus notialis, Pérez-farfante 1967 (Crustacea: Penaeidae), *Acta Scientiarum Polonorum Technologia Alimenteria*, 20, 3, 291-299, DOI: 10.17306/J.AFS.2021.0947.
20. Olaoye O. J., Ojebiyi W. G. and Ojo, O. O., 2017 – Profitability of gill net and cast net fishing gears among artisanal fishers in lagoon waters of Ogun State, *Nigerian Journal of Agriculture, Food and Environment*, 13, 3, 84-89.
21. Olopade O. A., 2013 – Preliminary observations on the Family Mormyridae in Oyan Dam lake (Nigeria), *Transylvanian Review of Systematical and Ecological Research*, 15.1, 33-48.
22. Olopade O. A., Taiwo I. O., Oluwoleand C. O. and Akankali J. A., 2015 – Water quality and haematological indices of Clarias garipeinus from Ogun River, Nigeria, *Transylvanian Review of Systematical and Ecological Research*, 17.2, 105-112.
23. Onyia L., Adebayo E. F., Adewuyi K., Ekwunife E. and Ochokwu I., 2014 – Comparative economics of fresh and smoked fish marketing in some local government areas in Adamawa State, Nigeria, IIFET 2014 Australia Conference Proceedings.
24. Rahji M. A. Y., Popoola L. and Adebisi L. A., 2001 – Analyses of the demand for and supply of fish in Nigeria (1986-1997), *Journal of West African Fisheries*, 10, 543-550.
25. Schneider W., 1990 – Field guide to the marine commercial resources of the Gulf of Guinea, FAO Species Identification Guide for Fishery Purposes, Rome.
26. Suleiman A. and Fregene T., 2011 – Analysis of costs and returns of artisanal fish marketing in Kebbi State, Nigeria, *Journal of Rural Economics and Development*, 20, 1, 1-9.