Local Ecological Knowledge and Trend of Catcheson*Pseudotolithustypus, Lutjanusgoreensis* and *Sphyraenaafra*from Lagos coastal waters, Lagos State, Nigeria

Abstract

The present study examined the fishers' knowledge and a ten-year (2009 -2018) trend analysis of prices and catches on *Pseudotolithustypus, Lutjanusgoreensis* and *Sphyraenaafra*from Lagos coastal waters. While data for local ecological knowledge (LEK)were obtained with the aid of a semi-structured questionnaire, secondary data collected from both the field andthe Federal Department of Fisheries were used to estimate the trend analysis of prices and catch composition respectively. The results showed that prices of all the fish species changed annually, with an annual average increase of 10.85%, 9.25% and 12.03% for *P. typus, L. goreensis* and *S. afra* respectively. *L. goreensis* and *S. afra* had an annual average increase of fish catch landed of 5.39% and 2.77%, while *P. typus*had -8.98% annual average decrease of fish landed.All the fishers were males and their modal age group was 41-60years (92.31%), while the least was 21-24years (7.69%). Sixty-nine percent (69%) and 31% of the fishers had secondary and primary school education respectively. Most fishers (69%) had a fishing experience of 21-25 years while the least fishing experience was 6-10 years. Most of the fishers had vast knowledge of the habitat of the fish species, morphological identification, causes of declined fish catches, conservation strategy, seasons of catch and problems of overfishing. In conclusion, this study showed a high level of agreement of fishers' ecological knowledge with the scientific literature, and such synergy could provide important additional biological information that could be used in the process of participative and sustainable management of marine resources.

Keywords: Local ecological knowledge, Lagos coastal waters, catches' trend, *Pseudotolithustypus, Lutjanusgoreensis*, *Sphyraenaafra*

Introduction

Understanding how fishing and environmental variability interact to produce an effect on target fish species has been an evolving and interesting question in fisheries science for decades. Adding to that, there is also the question that fisheries have to be evaluated in the context of a changing environment [1], which is better done under an ecosystem approach [2]. For most small-scale fisheries, the understanding of the environmental factors that affect and determine their catches over temporal and spatial scales is usually limited and often inferred without sound scientific information or technological geo-location support [3]. However, Fishers have enough accumulated knowledge to make them sensitive to some environmental changes, with the ability to interpret them and provide production estimates [4]. Such fishers' local ecological knowledge (LEK) is especially important in areas with scarce information on fishing statistics, and it can be sometimes the only information available to build up fisheries management strategies.

Today, there is a growing recognition that fishers' LEK could fill up gaps in biological, ecological and management knowledge as long as there is some caution in interpreting its quality and accuracy to science. Research findings have shown that the large extension of marine

Comment [W1]: It is necessary to clarify this abbreviation in the introduction and not only in the abstract.

ecosystems makes it difficult, financially and technically, to gather detailed scientific information about them along the time [5]. On the other hand, fishers' LEK can cover large coastal and offshore areas, and can also track changes over large temporal scales, potentially minimizing costs and improving management success [6]. Since LEK is acquired by an individual's hands-on experience and observations of the environment in which they work, heterogeneity of ecological knowledge between fishers can arise between different groups of fishers [7].

Davis and Wagner[8] highlighted the importance of identifying "experts" when researching LEK, to be able to use the most reliable and comprehensive LEK in fisheries management.Local ecological knowledge (LEK) is increasingly recognized as an important component of scientific research, conservation, and resource management [9].LEK has contributed to structuring and refining the focus of scientific research projects [10]. Despite some classic studies on LEK, marine LEK research especially in Nigeria is relatively young and is evolving rapidly, and there is a critical need for more substantive, deep ethnographic andmulti-scale research on marine ecosystems, as the ocean-dominated planet continues to evolve and change. It is against this background that this study opined to examine the local ecological knowledge of fishers on *Pseudotolithustypus, Lutjanusgoreensis* and *Sphyraenaafra*from Lagos coastal waters, and as well investigate the trend of catches and prices of the fish species.

Comment [W2]: Kindly, add the year

Materials and Methods

Study Area

The catches from Lekki and Badagry marine coastal waters landed at Kirikiri Terminal Station were focused for this study (Figure 1). The fishing grounds of Lagos coastal waters extend approximately from 6° 24' 54" - 6° 25' 30" N and 3° 23' 06 - 3° 23' 06" E covering the Nigerian – Benin Republic Border in the West and to Lekki in the East. To the North, it is bounded by Five Cowrie Creek and to the South by the vast Atlantic Ocean [11]. The Lagos coast is a narrow coastal shelf that is relatively narrow about 15 km and predominantly soft and muddy [12].

Collection of Dataand Analysis

Data for local ecological knowledge (LEK)were obtained with the aid of a semi-structured questionnaire. A total of13 fishers were interviewed individually after they were introduced to the objectives of the study. To verify the consistency and validity of the responses, interviews were applied in a synchronic and diachronic situation as opined by Ferreira [13]. The individual interview responses were compiled and analyzed as qualitative data.

On the other hand, secondary data collected from the field and the Federal Department of Fisheries were used to estimate the trend analysis of prices and catch composition of *P. typus,L. goreensis* and *S. afra*. All values were presented in percentages and tabular form.

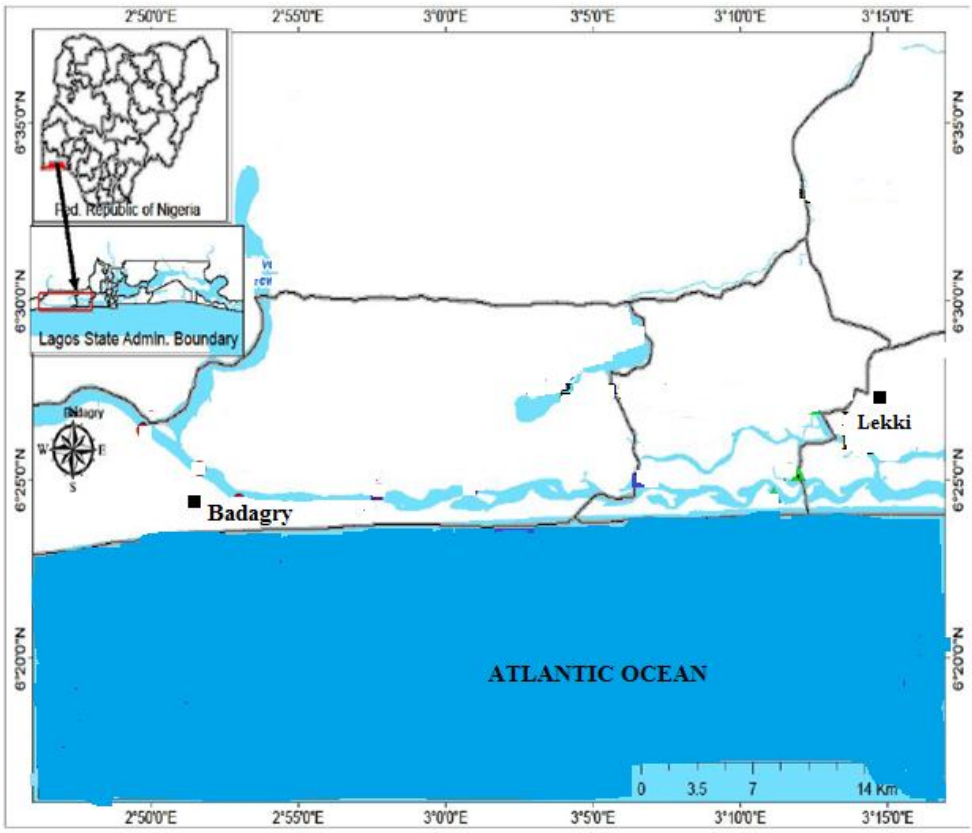

Figure 1: Location of study areas within Lagos coastal waters.

Results

Socio-Economic Characteristics of Fishers in Coastal Water of Lagos State

The socio-economic feature of the fishers is presented in Table 1. The results revealed that the modal age group of the interviewed fishers was 41-60years (92.31%), while the least was 21-24years (7.69%).All the fishers were males and operate the job on full-time bases. Sixty-nine percent (69%) of the fishers had secondary school education while 31% had primary school education. Most fishers (69%) had fishing experience of 21-25 years while the least fishing experience was 6-10 years. Sixty-two percent of the fishers had initiation on fish through the training while 38% of them had their initiation on fishing via the family. The vessel and gears used on this coastal water are trawlers and trawl nets, while the type of fishing license is for fishing only. The common number of days was 4-5days (100%), locations to set gear are detected via echo sounder while 4 hours (100%) was the time between ~~shooting~~ fishingand pulling the nets~~hauling.~~

Comment [W3]: Kindly, add the force and the length of this vessel

Ecological knowledge of *P. typus,L. goreensis* and *S. afra*Held by Fishers on the Fish Species

The reports from the fishers as regards their knowledge of the environment and morphology of the fish species, size distribution and market prices; and conservation of the fish species were presented in Table 2-4 respectively. Fishers divulged that the habitat of *Pseudotolithustypus*is muddy area(43.48%) and shallow water (56%) while 92% of the respondents opined that the habitat of *Lutjanusgoreensis* is a rocky area. However, the fishers believed that *Sphyraenaafra*are caught by chance as they move everywhere for feeding ~~in search of food.~~ In response to the question on what the fish species usually eat, 81%, 43% and 50% of the fishers respectively declared that the common food of *P. typus,L. goreensis and Sphyraenaafra*are shrimp and fish. In respect of morphological identification of the fish species, 50% of the fishers believed that *P. typus* could be identified using the long neck and upturned head shapes. Fifty-nine percent (59%) and 41% of them respectively disclosed colour and blue band for identification of *L. goreensis,*while all respondents(100%) opined that they do not know any physical morphological characteristics for *S. afra.* In response to questions on the exact season and months by which the fish species are in abundant in Lagos coastal waters, fishers (21.43%) revealed that *P. typus*are usually in abundance between September and January. On the other hand, 84.82% and 92.31% of them divulged that *L. goreensis and S. afra*respectively are caught all year round. To investigate the size distribution of the fish species usually caught, fishers were asked to give an estimate of the total weight of their fish landings as well as the common weight range of the fish species. In this regard, they reported that the most common minimum weight of fish caught by them included < 50 g, 100-150g and 150-200g for *P. typus, L. goreensis and S. afra*respectively. However, the common maximum weight included 5000-10000g, 5000-10000g and 15000-20000g for *P. typus, L. goreensis and S. afra*respectively. The fishers when asked about the form, current selling price and scale of sale for the fish species, responded that all the fresh fish species at landing sites are sold in kilograms to distributors or agents. *P. typus*are sold at #1700 per kilogram while *L. goreensis and S. afra* respectively are sold at #2300/kg. In respect of how they determine the spawning period of the fish species, fishers disclosed that it was difficult to know the exact spawning period of the fish since they don't catch ~~baby fish~~(fingerlings~~,~~) due to the mesh size of cod-end (76mm) being used by them. Furthermore, they believed that they can't determine the wet and dry seasons again because of the climate change which has altered the conventional seasons. In response to the question on how the sex of the fish species can be determined apart from using the gravity of the egg on the females, all respondents (100%) were not able to distinguish the sexes using any other features.

Some questions in the structured questionnaires require the fishers to comment on the status of the current catch of the fish species and as well suggest panacea to the problem combating their fishing effort's efficiency. In response to these questions, all fishers (100%) revealed that there was a drastic decrease in the catch of the fish species, and most of them attributed the problem to overfishing. However, 23% of them indict plastic debris as the cause of the catch decreased.

Comment [W4]: ??

Comment [W5]: needs clarification

Comment [W6]: this idea needs clarification

More so, a closed season was the conservation strategy opined by all respondents to solve the catch decrease menace.

In this study, fishers were asked if there are species that usually co-exist with *P. typus, L. goreensis and S. afra*. Sequel to this question, fishers in Lagos coastal waters divulged that other fish species that co-exist with *P. typus*include Cephalopoda species, shrimps, lobster,*Pseudotolithussenegalensis*, *Pseudotolithusepipercus*, *Pseudotolithusmoorii*, *Pseudotolithuselongatus*, and other Polynemidae and Polydactylus families. While *Lutjanusgoreensis*co-exist with *Lutjanus dentatus*, *Lutjanus edencacanthus*, *Lethrinus* species, and Syrranidae families, *Sphyraenaafra*co-exists with *Sphyraena guachancho*.

Table 1: Socio-Economic Characteristics of the Fishers

Variables	Frequency	Percentage
Age Class(Years)		
<20	0	0
21-40	1	7.69
41-60	12	92.31
>60	0	0
Sex		
Male	13	100
Female	0	0
Educational Level		
Illiterate	0	0
Primary school	4	30.77
Secondary school	9	69.23
Tertiary	0	
Fishing Experience(Years)		
6-10	1	7.69
11-15	0	0
16-20	3	23.08
21-25	9	69.23
Initiation on Fish		
Family	5	38.46
Training	8	61.54
Fishing Occupation Status		
Full Time	13	100
Part-Time	0	0
Type of Vessel used		
Trawler	13	100
Type of fishing License		
Shrimping	0	0
Fishing	13	100
Fishing gears		
Trawl net	13	100
Hook and Line	0	0
Trawl net/Hook and Line	0	0
No of days/fishing trip		
1- 2 days	0	0

4-5 days	13	100
>5 days	0	0
Location to set gear		
Fish finder	0	0
Colour of water	0	0
Spawning area	0	0
Water depth(Echo sounder)	13	100
Time between shooting and hauling		
1 hour	0	0
2 hours	0	0
3 hours	13	100
4 hours	0	0
No of Vessels	95	100
No of crew/ month	570	570

Source: Field Survey, 2019

Table 2: Local Knowledge of the Environment and Morphology of the Fish Species

Habitat	Croaker (Pseudotolithustypus)		Red Snapper (Lutjanusgoreensis)		Barracuda (Sphyraenaafra)	
	Number	Frequency (%)	Number	Frequency (%)	Number	Frequency (%)
Muddy area	10	43.48	0	0	0	0
Sandy area	0	0	0	0	0	0
Shallow water	13	56.52	0	0	0	0
Deepwater	0	0	0	0	0	0
Rocky area	0	0	12	92.31	0	0
Everywhere	0	0	0	0	0	0
Don't Know	0	0	1	7.69	13	100
Food						
Fish	3	18.75	3	17.65	13	50
Shrimp	13	81.25	8	47.06	13	50
Don't know	0	0	6	35.29	0	0
Morphological characteristics						
Narrow head	13	50	0	0	0	0
Upturned head	13	50	0	0	0	0
Blue band	0	0	9	40.91	0	0
Colour	0	0	13	59.09	0	0
Do not know	0	0	0	0	13	100
Seasons of abundance						
June-Aug	1	7.14	0	0	0	0
June-Aug	1	7.14	0	0	0	0
July Aug	1	7.14	0	0	0	0
Aug-Dec	2	14.29	0	0	0	0
Sept –Nov	1	7.14	0	0	0	0

Sept-Dec	3	21.43	2	15.38	1	7.69
Oct-Jan	3	21.43	0	0	0	0
Nov Jan	2	14.29	0	0	0	0
All Season	0	0	11	84.62	12	92.31
Reproductive period						
Wet season	0	0	0	0	0	0
Dry Season	0	0	0	0	0	0
Through the year	0	0	0	0	0	0
Don't know	13	100	13	100	13	100
Where do they spend their juvenile stage						
Shallow water	9	69.23	0	0	0	0
Don't know	4	30.77	13	100	13	100

Source: Field Survey, 2019

Table 3: Local Knowledge of the Fishers on Size Distribution and Market Prices of the Fish Species

Variables	Croaker (Pseudotolithustypus)		Red Snapper (Lutjanusgoreensis)		Barracuda (Sphyraenaafra)	
	Number	Frequency (%)	Number	Frequency (%)	Number	Frequency (%)
Minimum weight of fish caught(g)						
<50	13	100	0	0	0	0
50-100	0	0	0	0-	0	0
100-150	0	0	13	100	4	30.77
150-200	0	0	0	0	9	69.23
Maximum weight of fish caught(g)						
<5,000	0	0	1	7.69	0	0
5,000-10,000	9	69.23	6	46.15	3	23.08
10,000-15,000	3	23.08	5	38/46	1	7.69
15,000-20,000	1	7.69	1	7.69	9	69.23
Mode of selling						
Fresh	13	100	13	100	13	100
Processed	0	0	0	0	0	0
Method Used in selling						
By Scale	13	100	13	100	13	100
By hand	0	0	0	0	0	0
By Bowl	0	0	0	0	0	0
Price Rate/kg of the species						
#1700	13	100	0	0	0	0
#2300	0	0	13	100	13	100
To whom do you sell						
International Market	0	0	0	0	0	0

Agent/Distributor	13	100	13	100	13	100
Market women	0	0	0	0	0	0
Consumers	0	0	0	0	0	0

Source: Field Survey, 2019

Table 4: Local Ecological Knowledge on Conservation of the Fish Species

Variables	Croaker (Pseudotolithustypus)		Red Snapper (Lutjanusgoreensis)		Barracuda (Sphyraenaafra)	
	Number	Frequency (%)	Number	Frequency (%)	Number	Frequency (%)
Population Status(Conservation)						
Increasing	0	0	0	0	0	0
Decreasing	13	100	13	100	13	100
The Same	0	0	0	0	0	0
Do not know	0	0	0	0	0	0
What is responsible for the decrease						
Overfishing	13	100	13	100	13	100
anthropogenic factors that could be responsible for the present status of the fish stocks						
Plastic Debris	3	23.08	3	23.08	3	23.08
No idea	10	76.92	10	76.92	10	76.92
Conservation Strategy						
At Sea Inspection	0	0	0	0	0	0
Non-trawling Zone	0	0	0	0	0	0
Close Season	13	100	13	100	13	100
Use of BRD	0	0	0	0	0	0

Source: Field Survey, 2019

Analysis of Trends in Catch and Average Price for *P. typus,L. goreensis* and *S. afra* from Trawl Fish Landings Off Lagos Coast.

The summary of the percentage(%) change in prices (₦/kg) for *P. typus,L. goreensis* and *S. afra* within Lagos Coastal waters terminal is shown in Table 5, while the percentage change in total catch(metric tons, mt) of the fish species is presented in Table 6. The highest % change in price for *P. typus* (25.8%) was recorded in 2018 while the least % change in price (4.68%) was recorded in 2010. On the other hand, the least % change in price (5.80%) for *L. goreensis*was recorded in 2016 while the peak % change in price (17.73%) was recorded in 2011. Similarly,

the least % change in price (0%) was recorded in 2010 for *S. afra*while the highest % price change was 30.77% in 2011. *L. goreensis and* S.afra had similar % changes in price in 2016(5.80%), 2017(18.61%) and 2018(10.16%). The results showed that the prices of all the fish species change annually, with an annual average change of 10.85%, 9.25% and 12.03% for *P. typus,L. goreensis* and *S. afra* respectively.

As shown in Table 6, the maximum percent change in the total catch landed for *P. typus was* 20.17% while the lowest was -29.88%. Both percentages were recorded in 2011 and 2016 respectively. For *L. goreensis and S. afra*respectively, the highest % change in catch landed were 47.52% and 36.40%. On the other hand, their corresponding least % change in catch landed were -27.19% and -26.95%. Comparatively, *L. goreensis* which had the least % change in price (3.88%) in 2011had the highest % change in catch (47.52%) in the same year.

Table 5: Percentage Change in Price of *P. typus,L. goreensis* and *S. afra* at Landing Sites in Lagos

Year	*P. typus* Price(₦/Kg)	% Change in Price	*L.goreensis* Price(₦/Kg)	% Change in Price	*S. afra* Price(₦/Kg)	% Change in Price
2009	587.5	-	800	-	650	-
2010	615	4.68	850	6.25	650	0
2011	716	16.42	883	3.88	850	30.77
2012	800	11.73	1000	13.25	1000	17.65
2013	887.5	10.94	1075	7.50	1075	7.50
2014	937.5	5.63	1175	9.30	1175	9.30
2015	1000	6.67	1275	8.51	1275	8.51
2016	1047.5	4.75	1349	5.80	1349	5.80
2017	1162.5	10.98	1600	18.60	1600	18.61
2018	1462.5	25.80	1762.5	10.16	1762.5	10.16
Mean	921.6	10.85	1176.95	9.25	1138.65	12.03

Source: Field Survey, 2019

Table 6: Total Quantity (Mt) of *P. typus,L. goreensis* and *S. afra* Landed in Lagos(2009-2018)

Year	*P. typus*	% Change	*L. goreensis*	*% Change*	*S. afra*	*% Change*
2009	81.325	-	2.214	-	0.751	-
2010	77.898	-4.21	1.612	-27.19	0.608	-19.04
2011	93.61	20.17	2.378	47.52	0.798	31.25
2012	73.042	-21.97	2.383	0.21	0.883	10.65
2013	52.223	-28.50	2.455	3.02	0.645	-26.95
2014	52.522	0.57	2.307	-6.03	0.684	6.05
2015	36.902	-29.74	2.663	15.43	0.933	36.40
2016	25.877	-29.88	2.774	4.17	0.815	-12.65
2017	30.428	17.59	2.798	0.87	0.851	4.42
2018	28.957	-4.83	3.092	10.51	0.807	-5.17
Mean±SD	55.28±24.73	-8.98	2.47±0.40	5.39	0.78±0.10	2.77

Source: Federal Department of Fisheries (FDF),2019

Discussion

The socio-economic features of fishers in this study are similar to those reported for marine fishermen in the Gulf of California, Mexico[14]. The information revealed by the fishers on habitat, food and feeding habits of the fish species agreed with the reports already in the literature.The modal age group of the interviewed fishers which was 41-60 years implies that majority of them are matured adults with vast experience in fishing activities and this was seen in their taking fishing job for full time. Similar age groups have been reported among fish marketers in Bayelsa State [15], and among fish marketers in Igbokoda [16]. It is a general belief that fishing activities are carried out by people with little or no formal education. However, in this study, majority of fishers had formal education. Similar results had been reported among fish marketers[17-18]. In this study, fishers had their initiation on fish through the training. The vessel and gears used on this coastal water are trawlers and trawl nets, while the type of fishing license is for fishing only. This was in line with the regulation of responsible fisheries. Reports from the fishers interviewed showed that the habitats of *Pseudotolithustypus* are muddy areas and shallow water while the habitat of *Lutjanusgoreensis* was rocky area.

Majority of the fishers disclosed that the commonfood for *P. typus, L. goreensis and Sphyraenaafra*was shrimp and fish.This implies that the three fish species are carnivores. Fakoya*et al* [19-20] confirmed snappers as carnivores, Froese and Pauly [21] discovered *S. afra*to be carnivores while carnivorous feeding of *P typus* was reported by Edwards *et a*l. [22].In searching for a solution to the lack of technical information to preserve the aquatic ecosystem and its endangered species, scientists have been finding that the knowledge accumulated over generations by local fishermen can provide an alternative useful source of data [23]. By comparing the information provided by experts with the available scientific literature, similarities can be noted between the two sources of knowledge. The morphological characteristics used by fishermen in this study for identification of the fish species agreed with that reported by literature such as on *L. goreensis*from five Cowrie creeks.Also in Brazil [24] in order to identify and distinguish the species of the snapper group, the fishermen use criteria related to their morphological aspects, such as coloration and body shape have been adopted by fishers.

Most of the fishers could not use physical vision to identify the sexual dimorphism of the fish and this was in agreement with the scientific view [25]. However, all the fishers opined that some species of fish sex can be distinguished externally by color differences or by distinctive behaviors, although other species females may become so swollen with eggs. This statement is connoted with the report of Colin *et al*.[26].The sales of fish species in kilograms as reported by fishers give them vast knowledge about the weight of the fish. According to the fishers, itbecomes difficult to know the spawning period of the fish since they don't catch ~~baby fish~~ (fingerlings) due to the mesh size of cod-end (76mm) being used. They believed that they can't determine the wet and dry seasons again because of climate change which has altered the conventional seasons.

Although, the integration of scientific study with the local ecological knowledge (LEK) of fishermen is a new area of investigation that integrates the efforts and interests of researchers in

Comment [W7]: Is the use of trawl nets compatible with responsible fishing?

Comment [W8]: Add the year of this reference

Comment [W9]: This idea needs clarification

both natural and human sciences [8]. Numerous investigations have shown, however, that the importance of LEK for the conservation and management of fishing resources is important [27]. Also, most of the revealed LEK by fisher folks especially on the growth pattern and population structure of the fish species examined in this study was in line with the findings of Akinbobolaand Fakoya [28]**.**The results from the present study may be highly valuable due to the lack of studies from Africa, with only 2–8% of the published articles on marine LEK from this region [9].

The summary of the percentage (%) change in prices showed that*L. goreensis and* S.afra had similar % change in price in 2016, 2017 and 2018; however, there are fluctuations in % change in the total catch for these fish species. The annual average percentage change in price (2009-2018) for *P. typus,L. goreensis and S. afra* are significantly different from the peak recorded in *S. afra*.However, the quantities of the fish landing were smaller in comparison with annual barracuda caught in Cochin, south-west coast of India and *P. typus* from Liberia coastal water. The metric tonnes of fish landed at Kirikiri landing sites were comparatively lower than metric tons of fish landed at catch Similar Cochinin India[29]. Similar results of low catch composition have been documented for Yovoyan Coastal waters in Badagry[30].

Comment [W10]: It is necessary to add an explanation of the reasons for this difference, is it overfishing or other reasons?

Formatted: Font: Italic

Formatted: Font: Italic

Formatted: Font: Italic

Comment [W11]: It is better to put some proposals in order to protect fish stocks based on this study It is better to put some proposals in order to protect fish stocks based on this study

Conclusion

Local ecological knowledge (LEK) is increasingly recognized as an important component of scientific research, conservation, and resource management. This study has shown that the local knowledge of the interviewed fishers regarding the biological and ecological characteristics of *P. typus*, *L. goreensis* and *S. afra* had a refined level of detail and a high agreement with the scientific literature, thereby confirming the potential integration between these two knowledge systems. Also, there is a fluctuation in the catch and prices of the fish species examined in this study.

References

[1].Pikitch, E., Santora, C., Babcock, E.A., Bakun, A., Bonfil, R. and Conover, D.O. (2004). Ecosystem-based fishery management.Science.305:346–347.

[2].Cryer, M., Mace, P.M. and Sullivan, K.J. (2016).New Zealand's ecosystem approach to fisheries management. *Fish Oceanography*, 25:57–70.

[3].Hazin, F.H.V., Broadhurst, M.K. andHazin, H.G. (2000). Preliminary Analysis of the Feasibility of Transferring New Longline Technology to Small Artisanal Vessels off Northeastern Brazil. Marine Fisheries Review.http://aquaticcommons.org/9757/1/mfr6213.pdf.

[4].Silvano, R.A.M., McCord, P.F.L., Lima, R.V. andBegossi, A. (2006). When Does this Fish Spawn? Fishermen's Local Knowledge of Migration and Reproduction of Brazilian Coastal Fishes. *Environmental Biology*, 76:371–386.

[5].Duda, A.M. and Sherman, K. (2002).A new imperative for improving management of large marine ecosystems.*Ocean and Coastal Management* 45 (2002): 797–833.

[6]. Berkes, F., Colding, J. and Folke, C. (2000).Rediscovery of Traditional Ecological Knowledge as Adaptive Management. Ecological Application, 10:1251–1262.
[7].Crona, B., and Bodin. O,(2006). What you know is who you know? Communication patterns among resource users as a prerequisite for co-management. *Ecology and Society* 11(2): 7p.
[8].Davis, A. and Wagner, J.R. (2003). Who knows? On the importance of identifying"experts" when researching local ecological knowledge.*Human Ecology*, 31(3):463–489.
[9].Thornton, T.F. and Scheer, A.M.(2012). Collaborative Engagement of Local and Traditional Knowledge and Science in Marine Environments: A Review. *Ecology and Society*,17(3): 8-33.
[10].Moreno, G., Dagorn, I., Sancho, G., Garcia, D. and Itano, D. (2007). Using local ecological knowledge (LEK) to provide insight on the tuna purse seine fleets of the Indian Ocean useful for management.*Aquatic Living Resources* 20:367-376.
[11].Ediang, O.A. and Ediang, A.A. (2013). Beyond data regulation: finding a solution to the persistent problem of marine debris and sea surface temperature measurement along the coastline of Lagos, Nigeria. *Data Science Journal*, 12: 129-133.
[12]. George, F.O.A., Ogbolu, A.O. Olaoye, O.J., Obasa, S.O., Idowu A.A. and Odulate, D.O. (2014). Fish Processing Technologies in Nigeria: A Case Study of Ibeju-Lekki Local Government Area, Lagos State. *American Journal of Food Technology, 9: 302-310*
[13].Ferreira,H.M., Reuss-Strenzel,G.M., Alves, J.A. and Schiavetti, A.(2014).Local ecological knowledge of the artisanalfishers on Epinephelusitajara (Lichtenstein, 1822)(Teleostei: Epinephelidae) on Ilhéus coast – BahiaState, Brazil.*Journal of Ethnobiology and Ethnomedicine,* 10:3-15.
[14].Sáenz-Arroyo, A., Roberts, C.M., Torre, J. and Carino-Olvera, M. (2005): Using fishers' anecdotes, naturalists' observations and grey literature to reassess marine species at risk: the case of the Gulf grouper in the Gulf of California, Mexico. Fish and Fisheries, 6(6):121–133.
[15].Kainga, E. and Adeyemo,A.O.(2012).Socioeconomics characteristics of fish marketers in Yenagoa Local Government Area of Bayelsa State,Nigeria.*World Journal for YoungResearchers*. 2(1): 22-31.
[16]. Agbebi F.O. and Adetuwo, K.I. (2018).Analysis of Socio-Economic Factors Affecting Fish Marketing in Igbokoda Fish Market, Ondo State, Nigeria.*International Journal of Environment, Agriculture and Biotechnology* (IJEAB), 3(2):512-521.
[17].Nwabueze, A.A. and Nwabueze, E.O.(2010).An investigation into the problems of fresh fish marketing in Oshimili South Local Government of Delta State, Nigeria.*Agricultural and Biological Journal of North America*, 2(2) 23-35.
[18].Folayan, J.A.and Folayan, O.F.(2017).Socio – Economic and Profitability Analysis of Catfish Production in Akure North Local Government of Ondo State, Nigeria.*Current Journal of Applied Science and Technology*, 23(6): 1-8.
[19].Fakoya, K.A., Abass, M.A., Owodeinde, F.G., Lawson, E.O. and Ojo, F.R. (2010).A preliminary study of dietin the juvenile Gorean snapper, *Lutjanusgoreensis*(Valenciennes, 1830), pp. 232-236. In H. A. Fashina-Bombata, E. J. Ansa, & P. E. Ndimele (Eds.),*Proceedings of the*

25th Annual FISON InternationalConference and Exhibition, Topo-Badagry, Lagos,Nigeria. October 25-29, 2010. [CD - ROM].
[20]. Fakoya, K.A., Anetekhai, M.A., Akintola, S.L., Saba, A.O. and Abass, M.A. (2015). Life-stages, exploitation status, and habitat use of *Lutjanus goreensis* (Perciformes: Lutjanidae) in coastal marine environments of Lagos, South West, Nigeria. *Revista De Biologia Tropical*, 63 (1): 199-212.
[21].Froese, R. andPauly, D. (2019). FishBase – World Wide Web electronicpublication, www.fishbase.org, version (02/2019).
[22].Edwards, A.J., Anthony, C.G. andAbohweyere, P.O. (2001). A revision of Irvine's marine fishes of tropical West Africa.DarwinInitiative Report 2, Ref. 162/7/451. 2001,157.
[23].Begossi, A. andSilvano, R.A.M. (2008).Ecology and ethnoecology of dusky groupergaroupa, epinephelusmarginatus (Lowe, 1834) along the coast of Brazil.*Journal of Ethnobiology and Ethnomedicine*, 4:20p.
[24]. Mourão, J.S. andNordi, N. (2006).Pescadores, peixes, espaço e tempo: umaabordagemetnoecológica. Interciencia, 31(5):1–7.
[25].Ayo-Olalusi, C.I. and Ayoade, A.A**.** (2019).Length-weight relationship and condition factor of *Sphyraenaafra*from the coastal waters of Lagos State.Fisheries and Aquatic Life, 27: 27 – 31.
[26].Colin, P.L., Sadovy, Y.J. and Domeier, M.L. (2003).Manual for the study and conservationof reef fish spawning aggregations. Society for the Conservation of Reef FishAggregations Special Publication, 1:1–98.
[27].Gerhardinger L.C, Freitas M.O, Medeiros R.P, Godoy E.A, Marenzi R.C, Hostim-Silva M. (2007).Local Ecological Knowledge in the Planning and Management ofMarine Protected Areas and in the Conservation of Fish SpawningAggregations: The Experience of MerosdoBrasil Project. In ÁreasProtegidas do Brasil4.Brasília, Brasil: MMA:107–129.
[28]. Akinbobola, A.P. and Fakoya, K.A. (2021).Aspects of Population Structure of *Pseudotolithus typus, Lutjanus goreensis* and *Sphyraena afra* From Lagos Coastal Waters, Lagos State, Nigeria.*Nigerian Journal of Fisheries* Vol. 18, No. 2:2239-2247.
[29].Kadison, E., Evan, K D., Davis, G. O. and Hood, P. B. (2010).Age, growth, and reproductive patterns of the great barracuda, *Sphyraenabarracuda*, from the Florida Keys.*Bulletin of Marine Science*, 86(4): 773–784.
[30]. Whenu, O.O., Mekuleyi, G.O. and Osodein, O.A.(2017).The Fishes of Agorin and Yovoyan Coastal Waters in Badagry, Lagos State, Nigeria.*Nigerian Journal of Fisheries and Aquaculture*, 5(2):76-85.