

Awareness and Utilization of Indigenous Knowledge Systems in Artisanal and Coastal Fishing in Southwest, Nigeria

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Received: August 18, 2015; **Published:** May 19, 2016

Abstract

Use of indigenous knowledge systems (IKS) is critically important in agricultural production techniques and environmental management in Nigeria. Despite the importance of fisheries to the Nigerian economy and the indispensable role of IKS in it, the use of IKS in fishing households have not been adequately researched. This study identified and examined the extent of awareness and utilization of IKS in fishing in Southwest, Nigeria. Data obtained from 171 fisher-folks, eight key informants and eight FGDs were analyzed using descriptive and inferential statistics and the logistic regression model. The study revealed that 26 IKS items were in use in the study area. A categorization of IKS items based on IKS use index (IKSUI) revealed that 19.0%, 35.0% and 46.0% of IKS items were poorly-used, moderately-used and highly-used, respectively. Also, 15.0%, 33.0% and 52.0% of fisher-folks were categorized as low-users, moderate-users and high-users of IKS items, respectively. About 71.0% of the fisher-folks believed that fishing is not profitable without use or observation of IKS, 87.0% believed that IKS is better and more effective than Western Knowledge Systems (WKS), 71.0% believed that IKS reduces production cost and 70.0% affirmed that it increases fish catch. About 92.0% of fisher-folks posited that IKS was their only means of increasing catch, sustaining fishing and fishing income. Age of household head, fishing experience and number of elderly people in the household were significantly positively related to IKS use while household's fishing income, household head's education and number of fishing boats/canoes showed negative relationships with IKS use. It is concluded that IKS is very important in fisheries in the study area and that a documentation of fishing IKS be carried out in all major fishing communities in Nigeria.

Keywords: *Indigenous knowledge; Utilization; Categorization; Fishing folks; Environmental management; Rural populace; Nigeria*

Introduction and Problem Statement

Nigeria is a protein deficient country [1,2] and fish accounts for about 50% of ingested animal proteins [3]. The Nigerian fisheries sector is largely characterized by both artisanal and coastal fishing and fish supply from domestic sources trails behind the demand [4,5]. In bridging the supply-demand gap, efforts need to be directed towards improving the fisheries sector and fishing grounds management to achieve an overall improvement in fish production [1,6]. The use of indigenous knowledge systems (IKS) items has, from time immemorial, played a major role in agricultural/fisheries production and management of natural resources in rural Africa in general and Nigeria in particular [7-9].

The fisheries sector has not been given adequate attention in past development and policy frameworks in Nigeria with the consequence that the sector is poorly developed despite the importance of fish and fish products in solving the pervasive malnutrition and hunger problems [10]. Apart from being a potential solution to malnutrition and hunger, the fisheries sector also has the potential for other wide ranging contributions to the nation's economy [11]. Nigeria is a developing country that has majority of its citizens as rural people who are engaged in agriculture and fisheries and marketing of products from these sectors as their primary livelihoods activi-

ties [12]. Therefore, the role and potential contributions of the fisheries sector to national development necessitate that it be accorded a priority position in development planning [13]. This planning effort will yield no worthwhile results if the army of artisanal and coastal fisher-folks, who produce about 90% of the nation's fish [4] and majority of who, at present, rely on IKS for sustaining their production processes and managing fishing grounds, are not carried along.

Nigeria is endowed with substantial marine and inland fishing grounds and fisheries resources which, in the authors' opinion, are regarded as an adequate asset upon which the sustainability of the fisheries sector can be predicated. However, starting from the 1980s, it was discovered that production trend in the sector has taken a downward turn, especially in the coastal and artisanal sub-sectors which provide the bulk of domestic production [4]. For example, from a peak output of 377, 683 tones in 1982, the total landings from the coastal and artisanal sub-sectors diminished to 106, 276 tones in 1993 [14]. Researchers have attributed this declining production to increased water pollution from oil exploration activities [1] and disregard of IKS by the relatively young emerging rural fisher-folks in some fishing communities in Nigeria [15]. IKS are often elaborate and adapted to local culture and environmental conditions of a people and are in alignment with their needs and the quality and quantity of locally available resources [16,17]. The development and use of IKS has been a crucial issue in the survival of African people [8,18,19]. Many elderly folks in Africa have been found to be a repository of IKS and are in most cases entrusted with the role of jealously guarding IKS, ensuring compliance with and handing it on to the younger generations [11,20,21].

IKS are cumulative, representing generations of experience, careful observations and trial and error experiments. Indigenous knowledge is stored in people's memories and preserved in their activities. It is expressed in stories, songs, folklore, proverbs, dances, myths, cultural values, beliefs, rituals, community taboos, local languages and taxonomy, agricultural practices, equipment/tools, materials and treatment of plant, animal and humans diseases [6,11,20,22]. Therefore, many researchers are of the opinion that IKS and scientific or technical or western knowledge should be integrated for the benefit of humans. This integration will enhance mutual learning by reducing knowledge gaps between rural producers who are the target end-users of research outcomes and researchers [7,19,23,24].

There has been a bias towards the dissemination of scientific knowledge in many facets of life (social relationship, production, health, religion, eating habit, environmental management) in Africa, starting from the colonial era [20,25,26]. This is a result of the fact that colonial rule in Africa promoted the dissemination and use of Western Knowledge Systems (WKS) items at the expense of IKS and provided the context for the fashioning of 'scientific knowledge' about Africa [8]. This bias led to the marginalization or total abandonment of IKS by African elites that were privileged to acquire western education and this attitude is gradually spreading [17,24,27]. However, the teeming uneducated rural food producers including farmers and fisher-folks, who are disadvantaged by incompetence to use WKS or lack of access to it, depend, to a greater extent, on IKS, for their productive activities and aquatic habitat management. In most rural riverine or coastal communities where fishing and fish-based economic activities are the preponderant livelihood strategies, fishing is viewed not just as a means of income generation but as a way of life [2,10].

According to Hansen and Erbaugh (1987), Vanek (1989), Alcon (1999), Orimoloye (2011), it has been observed over time that indigenous agricultural/fisheries practices are cost-effective and pose less problems of production risks and environmental degradation. Okunlola (1997) and Mafimisebi and Oguntade (2010) also asserted that the rural people to which all development research efforts are directed have their own body of knowledge that enables them arrive at welfare-enhance decisions. Although, Bro-Kensha *et al.* (1980) was of the opinion that rural people's knowledge should be ignored but Osunade (1996), Odugbemi, (2009), Mafimisebi and Oguntade, (2010) and Khodamoradi and Abedi, (2011a) countered this view by arguing that the expertise of the indigenous people has come to be regarded as a major contribution to development thinking. Also, it was reported that the consequences of dismissing and jettisoning IKS were huge failures in various projects ranging from management of epidemics of sleeping sickness and malaria [28,29] to irrigation, forestry and agricultural mechanization [18,30]. These projects failed partly because those that executed them did not consider IKS as having any useful role.

In spite of the importance of fisheries to the Nigerian economy and the important role that IKS plays in fish production and fish habitat management, the use of IKS in fishing households in Nigeria has not been given adequate research attention as done for crop cultivation and livestock rearing. In view of the fact that the fisheries sub-sector in Nigeria is largely characterized by artisanal and coastal fishing, efforts need to be directed towards the improvement of these two sources of fish so as to bring about an overall improvement in fish production and fish habitat management. The use of IKS is vital in achieving this goal. In view of the importance of fish and fish products in the Nigerian economy [2] as well as the desire for sustainable fishing activities, this study was designed to specifically identify the items of IKS in use and obtain indices of fisher-folks’ awareness and utilization of IKS in artisanal and coastal fishing in Southwest, Nigeria. A categorization of IKS and IKS users was also attempted while users’ perceptions of the role of IKS in fishing were also obtained. Finally, the study attempted to bring to the fore the factors influencing use of IKS in the study area.

Research Methodology

Study Area, Sampling and Sampling Technique

The study was carried out in Southwest, Nigeria. Nigeria lies on 10° 0’ 0” N latitude and 8° 0’ 0” E longitude. Farming is a major source of livelihood to the people of the Southwest Nigeria. Southwest Zone, one of the six geo-political divisions of Nigeria, consists of six states and three of these (Ondo, Ogun and Lagos States) are maritime or coastal states. These three states have within their borders a large number of freshwater bodies in addition to varying coast lengths. Thus, considerable inland and coastal fishing activities take place in this region of Nigeria [10].

A multi-stage sampling procedure was used in selection of respondents for the study. In the first stage, purposive sampling technique was used to select two (Ondo and Ogun) out of the six states in Southwest, Nigeria. These states have the highest fish production figures in Southwest, Nigeria. Next, using data from Agricultural Development Project (ADP) offices of the two states, the Local Government Area (LGA) with the highest figure of fish landings was purposively selected from each state. These included Ilaje LGA in Ondo State and Ogun Waterside LGA in Ogun State. Then, two communities (one in which coastal fishing is the predominant livelihoods strategy and another in which artisanal fishing preponderates) were purposively selected. These selected coastal communities were Igbokoda and Araromi (Ondo State) and Eba-Ijebu and Akede Nla (Ogun State). In the final stage, 240 respondents, at that rate of 60 per community, were randomly selected from a sampling frame obtained from the respective state ADP to provide the data necessary to fulfill set objectives. Data were obtained with the aid of a structured, pre-tested questionnaire. Question checklists were also drawn up and used to conduct key informant interview and focus group discussions (FGDs) held separately for male and female in the communities selected. The FGDs were conducted to validate the data collected through questionnaire administration.

In the artisanal fishing communities, only eighty four (84) set of the individual questionnaire was completely filled and included in the analysis. Forty four (44) of these respondents were from Ondo State while 40 respondents were from Ogun State. In the coastal fishing communities, 87 set of the questionnaire were validly filled. Forty six (46) of the respondents were from Ondo State while forty-one (41) were from Ogun State. Another 96 fisher-folks (48 each from both states) who were not interviewed through the individual questionnaire participated in the FGD.

Data Analysis

The data collected were analyzed using descriptive and inferential statistics and the logistic regression model. The extent of use of IKS was expressed by the use of a five-point rating scale with the scoring order of 5,4,3,2 and 1 for frequently used (FU), occasionally used (OU), rarely used (RU), aware but not used (ANU) and not aware (NA), respectively. Two methods of computation were used in capturing the utilization of IKS. The first one was IKS use index (IKSUI). Following Islam and Kashem (1996) and Mafimisebi and Oguntade (2011), the IKSUI was calculated as follows.

$$IKSUI = N_1 \times 5 + N_2 \times 4 + N_3 \times 3 + N_4 \times 2 + N_5 \times 1 \text{ -----(1)}$$

Where

IKSUI is as already defined

N₁ = No of fisher-folks using IKS item frequently

N₂ = No of fisher-folks using IKS item occasionally

N₃ = No of fisher-folks using IKS item rarely

N₄ = No of fisher-folks aware of but not using IKS item

N₅ = No of fisher-folks not aware of IKS item

To reflect the relative position of each IKS item in terms of its use, it was ranked alongside others. The second is the use of IKS by individual fishers. This level of utilization of IKS for each fisher-folk was calculated by adding up the scores obtained by the fisher-folk in all the identified IKS items compiled for the study.

The z-test was used to test whether or not there was significant difference in IKSUI between fisher-folks in the two states covered in the survey. The z-test formula is as presented below.

$$z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} \dots\dots\dots(2)$$

Where z = standard “Z” distribution value (z calculated)

\bar{x}_1 = mean value of IKSUI for Ondo State fisher-folks

\bar{x}_2 = mean value of IKSUI for Ogun State fisher-folks

S₁ = standard deviation of sample mean value of IKSUI for Ondo State fisher-folks

S₂ = standard deviation of sample mean value of IKSUI for Ogun State fisher-folks

n₁ = sample size for Ondo State (90)

n₂ = sample size for Ogun State (81)

The comparisons of means between the two locations were done separately for the artisanal and coastal fisher-folks.

The logistic regression was adopted in analyzing the influence of postulated independent variables on the probability of use of IKS. In using the logistic regression, a dichotomous variable indicating the probability of using household uses IKS was developed. This dichotomous variable is in this study called household’s use of IKS (HUIKS). HUIKS is 1 if a household uses IKS more often than WKS and zero otherwise. The predictor variables are a set of socio-economic and demographic status indicators.

$$\text{Logit (p)} = \ln \left(\frac{P}{1-P} \right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_7 x_7$$

p = probability that the household uses IKS

x₁ = Age of household head (in years)

x₂ = Years of experience in fishing of fisher-folk or oldest crew member

x₃ = Household head’s number of years of formal education

x₄ = Number of elderly people above 70 years in the household

x₅ = Household income from fishing (N per annum)

x₆ = Number of fishing boat/vessels owned by household

x₇ = Religion of household head (Christianity or Islam)

The equation was estimated using the maximum likelihood method because the procedure does not require the assumptions of normality or homoscedasticity of errors in the predictor variable. A separate model was fitted for each of artisanal and coastal fishing households.

Results and Discussion

Socio-economic characteristics of respondents

The information in Table 1 showed that about 75.0% of the respondents was male while 25.0% was female. This distribution pattern showed that the male gender dominated the fishing venture in the study area and this could be as a result of the many taboos relating to women's participation in fishing. Until recently when it was changed, a popular taboo in the study area is that women cannot be an occupant of ocean-bound fishing boat. Thus, women were restricted to artisanal fishing, which, for them, is advantageous in being characterized by less risk, low start-up capital and therefore easy entry. Contrariwise, there were no taboos or traditional practices hindering the participation of males in fishing. This may be a plausible explanation for their dominance in both artisanal and coastal fishing ventures in the study area.

Also from Table 1, the modal age range of respondents was 36-45 and 38.1% of respondents fell into this age bracket. It can be seen from the table that majority of the fisher folks are still in their active years with about 64.0% being less than 47 years of age. This implies that majority of the respondents possess the physical agility to participate fully in sole or team fishing in the study area. On the same Table 1 is also shown the fact that majority of the fisher-folks (76.0%) was married. Being married entails some responsibility on the part of the man and the woman. Thus, married adults probably engage in fishing so as to enable them have access to a steady income source to meet their obligations.

Table 1 also showed the distribution of respondents by the number of years of formal education. About 38.0% of the respondents had between 1-6 years of formal education while about 35.0% had formal education of about 7-12 years. Only about 7.0% had formal education of 13 years and above and about 20.0% did not have formal education. As low years of formal education leads to increasing difficulty in securing white-collar jobs in Nigeria, artisanal and coastal fishing ventures had provided alternative income-generating employment opportunities for the rural riverine populace in the study area who take to fishing both as a business and a way of life [10].

One other important information revealed in Table 1 is that about 82.0% of the respondents practice the Christian religion while 14.0% were Moslems. The balance of about 4.0% claimed to practice African Traditional Religion. This implies that Christianity is the most prominent religion in the study area. Majority (about 75.0%) of the respondents had between 6-10 household members, while only 4.7% had household members greater than 10. The table also revealed that a high percentage (about 80.0%) of the fisher-folks had been fishing for about 11-40 years. This revealed that fishing is an important income-generating activity in the study area.

Variable	Frequency	Percentage
Gender		
Male	128	74.9
Female	43	25.1
Age group (years)		
<24	10	6.0
25-35	37	21.4
36-46	65	38.1
47-57	39	22.6
>58	20	11.9
Marital status		
Single	18	10.5
Married	130	76.0
Widowed	21	12.3

Divorced	2	1.2
No of Years of Formal Education		
Primary education (1-6 years)	65	38.0
Secondary education (7-12 years)	60	35.1
Tertiary education (>13 years)	12	7.0
None	34	19.9
Religion		
Christianity	140	81.9
Islam	24	14.0
African Traditional Religion	7	4.1
Household size		
1-5	35	20.4
6-10	128	74.9
>10	8	4.7
Years of fishing experience		
1-10	22	12.9
11-20	61	35.7
21-30	65	38.0
31-40	10	5.8
41-50	12	7.0

Table 1: Demographic characteristics of respondents (n= 171).

Source: Field survey, 2012

Operational characteristics of the fisher-folks

Information about the fishing grounds in which the fisher-folks operated is shown in Table 2. From the table, the artisanal fisher-folks operated within the creeks and rivers while the coastal fisher-folks operated in the Atlantic Ocean. Considering the four towns from which respondents were drawn, majority (50.8%) of the respondents in Araromi and Akede-Nla engaged in coastal fishing because of the proximity of their communities to the Atlantic Ocean. The remaining 50.2% mostly from Igbokoda and Eba-Ijebu practised artisanal fishing because the Atlantic Ocean is far from them. Therefore it can be concluded that majority of the fisher-folks in Araromi and Akede-Nla communities were coastal fisher-folks while those in Igbokoda and Eba-Ijebu communities were artisanal fisher-folks.

Table 2 also revealed that about 39.0% of the respondents was using only traditional method of fishing while about 61.0% used a combination of traditional and modern methods. None of the respondents used the modern method alone. It can be inferred from the table that majority of the fisher-folks relied on the use of both traditional and modern fishing methods.

Information on the type of traditional equipment used in fishing is shown in Table 2. From this Table, it can be seen that majority of the respondents used net, hook and trap (41.7%), followed by 33.3% that used net and hook. Also, 19.0% of the respondents used net and trap, while 4.8% used net and other traditional equipment. A very small proportion (1.2%) used only net for fishing. Table 2 also showed that the only modern equipment used for fishing by the respondents who used both traditional and modern equipment, was outboard engine.

Majority (84.0%) of the respondents stated that part of the fish captured is consumed while part is sold while 10.0% said most of fish captured is consumed. Only 6.0% of the respondents sell all their captured fish.

Variable	Frequency	Percentage
Fishing Ground		
Artisanal		
Igbokoda	25	14.6
Araromi	17	9.9
Eba-Ijebu	29	17.0
Akede Nla	13	7.6
Coastal (Atlantic Ocean)		
Araromi	43	25.1
Akede Nla	44	25.7
Total	171	100
		89.2
Fishing Method		
Traditional alone	67	39.18
Traditional and modern	104	60.82
Fishing Equipment Used*		
Cast Net	40	23.4
Drag Net	132	77.2
Set Net	84	49.1
Fish Traps	84	49.1
Paddle/pulling pole	84	49.1
Spear	38	22.2
Gun	08	4.7
Dug-out canoe	84	49.1
Motorized fishing boat	87	50.9
Uses of Fish Caught		
Sales alone	11	6.4
Consumption alone	17	9.9
Both Sales and Consumption	143	83.6

Table 2: Operational characteristics of the fisher folks (n= 171).

Source: Field survey, 2012

Iks Identified, Their Characteristics and Purpose Of Use

The various items of IKS identified in the study area, their characteristics, purpose and the supposed implications of using or not using them are shown in Table 3. From the information provided on this table, it is obvious that most of these IKS were instituted for the purpose of enhancing high level of fish capture.

Identified IKS Item	Characteristics	Purpose	Implications/Indications
<p>Predicting the direction of movement of the river/ocean water:</p> <p>Movement of water away from the community</p> <p>Movement of water towards the community</p>	<p>Change in the direction of flow of water.</p>	<p>Used for predicting the volume of fish caught</p>	<p>Reduction in the level of catch.</p> <p>Enhance high level of fish capture.</p>
<p>Use of <i>Agugu</i> wood for fishing boat construction</p>	<p><i>Agugu</i> wood is light and moves faster on water.</p>	<p>Boat construction</p>	<p>It enhances fish capture as boat moves faster when a school of fish is to be pursued and rounded off by a group of fishers in one or more fishing boats.</p>
<p>Use of <i>Aghen</i></p>	<p>Locally produced small wood carvings which play the same role as the needle in sewing. A piece of rope is wound round it.</p>	<p>It is used for mending a torn net so as to reduce escape of fish from the net.</p>	<p>It is believed that the Sea/Ocean goddess would be pleased with the fisher-folks carrying it in their boats. It is believed to increase the fortune of the fisher-folks with a good capture.</p>
<p>Prohibition of carrying of charms or practice of voodoo in fishing boats.</p>			<p>The Sea/ River goddess, who is said to be in control of sea/river affairs sees this as an affront. She therefore instigates dangerous sea/river turbulence that attempts to sink the boat until the item is thrown away. If the defaulter refuses to own up, the result may be capsize of fishing boat and death of the defaulter and his fellow crew members. If boat capsize and deaths are averted, mysterious ailment and serial calamities or income poverty may be the follow up consequences for the erring fisher-folks.</p>
<p>Prohibition of menstruating women from fishing or approaching the river bank, sea/ocean shore.</p>		<p>To avoid offending the river/sea/ocean goddess that can get angry and prevent access to good fish capture</p>	<p>Violation is believed to cause a reduction in fish capture and mysterious calamities or untimely death not only for the erring woman but also members of her households.</p>

Throwing of dirty things into the river/ sea/ocean.	Dirty things such as decaying food substances, ragged clothes and human wastes are forbidden from being thrown into the river/sea/ocean.	To maintain cleanliness and enhance good fish capture	This will lead to dangerous turbulence and continuous rising of the water level that may lead to sea incursion and displacement of coastal communities. Also, untimely death of the defaulter or his/her household members may be a penalty.
Continuous bubbling of the sea at a particular point for many days.			This means there is a dead body in the sea and if it is not removed, there can be no fishing. Fish catch will be greatly reduced in the area where the bubbles are observed.
Any person going to the river/sea/ocean to fish for the first time must dance.	A debuting member of the fishing crew must rise up to dance at the approach of certain points in the river/sea/ocean before fishing begins	Increased fish capture	This is believed to be a sign of homage to the River/Sea goddess (<i>Oluwari/Malokun</i>) and this increases safety of crew members and enhances fish capture
Any woman nursing a child that is less than 3 months is forbidden from fishing.	It is believed that 90 days are required for total cleansing of a woman who has just given birth to a baby.	Safety	Untimely death of the mother or the child.
Reduction in the size of the full Moon.		Enhanced fish capture	Enhanced fish capture
Appearance of the new moon.	A sign from the River/Sea goddess that some species of big fishes can be caught	Enhanced fish capture	Enhanced fish capture
Use of <i>Arere</i> wood	<i>Arere</i> wood is light and moves faster on water.	Boat construction	Enhanced fish capture
Appearance of <i>Aromi</i>	<i>Aromi</i> is a light blue colouration that appears on the surface of the river/sea/ocean.	Enhanced fish capture. It is a sign of bumper harvest	Enhanced fish capture
Use of Iyanma (river) and Madogba (Sea)	A fish trap set at a strategic point in the river or sea to trap fish that enters it. A bait may or may not be put inside it.	Fish capture	Enhanced fish capture
Eating coconut prior to going on a fishing expedition is forbidden		Safety	Dysentery and untimely death.

The time to capture a particular species of fish: For example, for Tongue sole fish (<i>cynoglossus species</i>) the time is around the hours of 4 pm-8am. In rivers, mudfish are caught at 7am-11am especially when there is a very heavy downpour.	It is believed that the River/Sea/Ocean goddess brings out particular species of fish at specified times of the day.	Fish capture	Enhanced fish capture
Swimming of the fishes towards the river/sea/ocean water surface.	A sign of bumper harvest	Fish capture	Enhanced fish capture
Use of lead and floater as part of the fishing net.	Lead helps to sink a net deeper into the bottom of the river/ sea/ocean to be able to catch bottom dwelling fishes while the floater keeps the top portion of the net floating so that the fishing crew and other people can see that a net has been set in that area	Fish capture	Enhanced fish capture
Standing up when fishing	A sign of homage to the river/sea/ocean goddess.	Fish capture	Enhanced fish capture
Decision on which of <i>Iyanma</i> or <i>Ighere</i> to use in a particular water body.	When a portion of the river/sea is condoned off with artificial structures that can trap fishes, <i>Ighere</i> is used since outlets left for fishes to swim out of the structure are very small. If this structure is not necessary, <i>Iyanma</i> is preferred and can be placed near natural structures in the river where fishes can build their nests.	Fish capture	Enhanced fish capture
Use of by-catch fish species (<i>Doje/Palamu</i>) as bait	These are by-catch species of fish not used for human consumption in the study area. When consumed species are being used as baits, then the fish is either under-sized, diseased or deformed.	To attract big fishes that come to see these materials as food. In doing this, they are trapped and captured.	Enhanced fish capture
Use of <i>Egungun</i> wood		Boat construction	Enhanced fish capture and fishing boat durability
Appearance of two layers of water		Help to predict fish capture	Reduced fish capture

Table 3: Identified IKS, Operational Characteristics and Primary Purpose of Use.

Source: Field survey, 2012

Assessment Of The Extent Of Use Of IKS

Distribution of respondents by IKS Awareness and Utilization

The twenty-six (26) IKS items identified in the study area are contained in Table 4. The IKS listed in the table are unique traditional practices used in fishing based on local beliefs, folklores and resources available in the study locale. Table 4 revealed the level of awareness and utilization of the identified IKS items. From the table, the IKS with the highest level of awareness/utilization included those which directly impacted on volume of catch or safety of fisher-folks. Examples are prohibition of eating of coconut before fishing (796), maintaining a standing position when fishing (764), predicting catch through tidal and ocean current movements and other natural phenomena that have been observed to be related to catch volume over the years. These were followed by IKS items that border on health and safety such as prohibition of use of charms and prohibition of a menstruating woman from approaching the river bank or sea/ocean shore. The ones that border on safety are in fact, sometimes enforced to avoid mysterious deaths in the community. Ranking after those ones bordering on safety are those related to the nature of resources used in fishing such as the materials for carving or constructing the fishing boat/canoe, fishing gears and materials for effecting repairs of damaged gears. As reported by FGD participants, the high scores recorded by these IKS items is an indication that they are known to and utilized by a majority of fisher-folks either voluntarily owing to being tested and proven or by enforcement. The IKS items that ranked very low were those that had elements of occultism, superstition or fun. FGD respondents reported that an example of IKS item which was thought to be observed just for the fun of it is the step-wise dance by a first timer at fishing. Another IKS item now regarded as demonic is the worship of the river/sea/ocean goddess owing to the spread of the Christian religion in the study area.

No.	Indigenous Knowledge System	IKS Scores					IK-SUI	Rank by Score
		FU	OU	RU	ANU	NA		
1	Eating coconut prior to going on fishing expedition is forbidden.	130	27	10	4	0	796	1
2	Maintaining a standing position when fishing.	126	24	11	10	0	764	2
3	Tidal movement of sea waves or ocean currents away from the direction of coastal communities (Forcados).	116	30	15	5	4	748	3
4	Tidal movement of sea waves or ocean currents towards the direction of coastal communities (Lagos).	114	25	12	7	2	722	4
5	Use of lead and floater as part of the accessories in a fishing net	120	11	17	33	0	718	5
6	Avoidance of carrying and using charms or practice of voodoo in a fishing boat.	102	15	32	22	0	710	6
7	Prohibition of menstruating women from approaching the river bank or sea shore for washing, fishing or any reason.	103	11	26	13	18	681	7
8	Appearance of the full moon increases fish catch.	103	24	7	9	28	678	8
9	Use of Doje or Palamu as bait.	104	25	3	8	31	676	9
10	Decrease in fish catch as the moon reduces in size.	97	28	10	12	26	675	10
11	Appearance of Aromi.	97	24	12	12	26	667	11
12	Appearance of two layers of water.	93	26	15	15	22	666	12
13	Continuous bubbling of the sea at a particular spot for many days to indicate the presence of a dead body.	92	22	15	18	24	653	13
14	Swimming of fishes towards the surface of the sea water.	90	18	17	18	28	637	14
15	Fish at 4pm-8am in the sea to capture Tongue sole fish while to capture mudfish in the river, fish at 7am-11am in the morning especially under heavy downpour.	90	10	22	27	22	632	15
16	Use of Egungun wood for fishing boat construction	82	12	23	30	24	611	16

17	Use of Arere wood for fishing boat construction	80	15	19	30	27	604	17
18	Observance of no fishing rule during the 30 days in October when the Ahoro rituals that precede the Sea goddess (Olokun) festival is being observed in the Aboriginal Community.	52	40	36	26	17	597	18
19	Use of Agugu wood for fishing boat construction.	80	14	16	31	30	596	19
20	Carrying of the Aghen in the fishing boat always whether required for use or not.	71	14	31	30	25	593	20
21	A nursing woman whose baby is less than 3months old is forbidden from fishing.	74	19	24	30	34	592	21
22	Determination of which of Ighere or Iyanma to be used in a particular water body.	67	25	18	23	38	573	22
23	Emptying or throwing of dirty things into the river or sea.	64	22	15	42	30	567	23
24	Use of Iyanma for fishing (in rivers) and Madogba (in the sea) by women.	55	14	28	74	0	563	24
25	Full participation in all the rituals prescribed for fisher-folks during the one-day Sea goddess (Olokun) festival in the first day of November.	44	18	27	20	62	477	25
26	Step-wise dance by anybody going to fish in the river or sea for the first time.	44	18	27	20	62	475	26

Table 4: IKS Use Index in Artisanal and Coastal Fishing.

NB: FU = frequently used, OU = occasionally used, RU = rarely used, ANU = aware but not used, NA = Not aware

Level of Awareness of Identified IKS

Information on the extent of knowledge of IKS items by sampled fisher-folks is presented on Table 5. The table showed that the sum total of respondents who claimed to be aware of the IKS practices presented in Table 5 was 3,874 while the sum total of fisher-folks who claimed not to be aware of the practices (summation of not aware for all IKS was 584). The mean number of fisher-folks who claimed to be aware of the 26 practices in Table 5 (3874 divided by 26) was 149.0 while the mean number of fisher-folks who were not aware of the practices (584 divided by 26) was 22.0. These mean values indicate that about 149 fisher-folks out of 171, representing about 87.15% acknowledged that they know these practices.

	Had Knowledge	Lacked Knowledge*
Total	3874	584
Mean	149	22
Percent	87.13	12.87

Table 5: Fisher-folks' Awareness of the IKS Items.

* Computed from NA (Not Aware) column of Table 2

Categorization of IKS by Extent of Use

Using the IKSUI, the IKS items listed in Table 3 were classified as poorly-used, moderately-used and highly-used. The IKSUI ranged between 796 and 475. Using an approximate class interval system for grouping data, about 19.0% of the IKS items were poorly-used while 35.0% and 46.0% were regarded as moderately-used and highly-used, respectively (Table 6). These findings are similar to those of Islam and Kashem (1999). The fact that none of the IKS items had an IKSUI of zero may be an indication that no IKS item has been completely discarded by fisher-folks in the study area in spite of the availability of WKS and fisher-folks' dispositions towards some of them. This may mean that they probably benefit the fisher-folks in some ways. The IKS items that were poorly used by fisher-folks may have come to assume that status because they were known to a restricted number of fisher-folks and/or had repeatedly failed to achieve the expected effects on fishing, the fisher-folks and his/her households. FGD responses indicated that certain IKS items were avoided either because they are condemned by doctrinal principles of the religious faith been embraced by fisher-folks or because of lack of obvious

positive effects on fishing. This may be an indication of repeated poor efficacy of the IKS item. It was also opined that availability of WKS items that are more efficacious and convenient to use than the corresponding IKS items has led to the abandonment of some IKS items. Example of this is the annual worship festival of the river/sea/ocean goddess (Oluwari/Olokun) which recorded one of the lowest IKSUI scores. This was followed by the step-wise dance by a first timer at fishing in the river/sea/ocean. About 80% of FGDs participant opined that nowadays whether or not a new crew member danced or not does not have anything to do with fish catch or safety of fishing crew.

The IKS items in the poorly-used category had lower IKSUI scores and therefore ranked very low. They are probably characterized by the afore-stated attributes. IKS items having low IKSUI scores are probably at the precipice of extinction in fishing in the study area. Contrariwise, the IKS items that were moderately or highly used may be relatively more efficacious, less complex and more compatible with the tools, techniques, needs and realities of the fisher-folks. Fisher-folks may also have been utilizing these practices because of inaccessibility to the corresponding WKS items.

Categories based on IKS Use Index	Number of IKS items in each category	Percentage
Poorly-used (465-579)	05	19.2
Moderately-used (580-659)	09	34.6
Highly-used (660-799)	12	46.2
Total	26	100.0

Table 6: Classification of Indigenous Knowledge Systems based on IKS Use Index.

Source: Computed from survey data, 2011

Categorization of Fisher-folks by Extent of Utilization of IKS Items

An attempt was made to classify fisher-folks on the basis of how well they utilized the identified IKS items. The result of this is presented on Table 7. The table revealed that about 33.0% of fisher-folks used the IKS items moderately while 52.0% used them highly. The remaining 15.0% of the fisher-folks were low/poor users of IKS items. This result attests to a significant knowledge and use of the IKS items by rural fisher-folks in the study area. Also, no individual respondent recorded a zero score in the overall use of IKS items. This implies that the IKS items probably offer some positive benefits to users.

Categories	Respondents	
	Number	Percent
Low users (22-44)	26	15.0
Moderate users (45-79)	56	33.0
High users (80-140)	89	52.0
Total	171	100.0

Table 7: Level of Utilization of IKS by Fisher-folks.

Mean = 37.497

Standard Deviation = 17.229

Comparison of Level of Use of IKS Items between States

The mean IKSUI for Ogun and Ondo States were compared in both artisanal fishing and coastal fishing communities to see whether there are significant differences between the two states in the study area. In artisanal fishing, the mean IKSUI for Ogun and Ondo States was 487 and 524; respectively. The corresponding value was 583 and 624 in coastal fishing. The results of the mean comparison by z-test (Table 8) in both groups showed that there was no significant difference in mean IKSUI between the two geographical entities in the study area. This result may have been due to the fact that Ijebus of Ogun State and Ilajes of Ondo State even though found in different states,

have a propinquity of characteristics in terms of ancestry, folklores, linguistic and cultural practices. Prominent among these attributes are dwelling in riverine or coastline areas and having fishing, fish processing and marketing as the major livelihood strategies [5].The implication of these results is that individual fisher-folk’s extent of use of IKS items was comparable in the two states.

Location	Mean IKS Level of Use		Z value	P value
	Ogun	Ondo		
Artisanal	487	524	6.08	0.16
Standard Error	(160.4)	(173.5)		
Coastal				
Mean	583	624	5.53	0.21
Standard Error	(178)	(227)		

Table 8: Comparison of Mean IKS Level of Use across State.

*Values in parentheses are standard errors

A further comparison of IKSUI across the two states is presented in Table 9. The table showed that among the moderate and high-users of IKS items, Ogun State accounted for 44.6% and 47.2% of the sample, while Ondo State accounted for 55.4% and 52.8%, respectively. On superficial considerations, these are outright comparable figures which are not wide enough to lead to statistically significant differences.

States	Category		Category		Category		Total
	Low Users		Moderate Users		High Users		
	No	%	No	%	No	%	
Ogun	12	46.15	25	44.64	42	47.19	81
Ondo	14	53.85	31	55.36	47	52.81	90
Total	26	100.0	56	100.0	89	100.0	171

Table 9: Comparison of Level of Utilization of IKS Items.

Perceptions about IKS and Factors Determining Use of IKS Items

Fisher-folks’ Perceptions on the Relevance of IKS to Fishing

Table 10 revealed that majority of the respondents opined that fishing is not profitable without IKS and that IKS is better than WKS. They were also of the perception that it saves labour in fishing, reduces production cost, as well as increasing fish catch and income.

Statement	Agree		Disagree		Undecided	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Fishing is profitable without IK	24	28.6	60	71.4	0	0
IK is better than modern Knowledge	73	86.9	10	11.9	1	1.2
IK saves labor	68	81.0	15	17.9	1	1.2
IK reduces production cost	60	71.4	21	25.0	3	3.6
IK increases income	47	56.0	13	15.5	24	28.6
IK increases outputs	59	70.2	18	21.4	7	8.3

Table 10: Respondents’ Perception of the Relevance of Use of IK to Fishing.

Source: Field survey, 2011

Factors Determining Use of IKS Items

The estimates of the Binary Logistic (BL) Regression for both artisanal and coastal fisher-folks are shown on Table 11. Generally, the BL Model showed a commendably good fit to the data for both sets of fisher-folks. The value of the Chi-square test was significant at 1% in the model for both artisanal and coastal fisher-folks. This denotes that the null hypothesis that the model lacks explanatory power could not be accepted. The model correctly predicted about 78.0% and 90.0% of the observations for artisanal and coastal fisher-folks, respectively. From Table 11, it could be seen that experience and income were significant at 1% while education and the number of fishing canoes/boats were significant at 5% in both models. Number of elderly persons in the household, which was significant at 5% in artisanal households, showed statistical significance at 1% in coastal households. Furthermore, age which was not significant in the model for artisanal households, showed statistical significance at 5% in the model for coastal fisher-folk households. Thus, experience, education, number of elderly people in the households, income and number of fishing boats/canoes had the greatest influence on use of IKS items by fisher-folks in the study area.

The marginal effects of each variable provided additional insights. The marginal effects were computed as the partial derivatives of the non-linear probability function being evaluated at each variable's sample mean. For instance, for the artisanal fisher-folks, a unit increase in years of formal education and number of fishing boats/canoes owned, after the mean values, reduced the probability of using IKS by 0.0269 and 0.0366 for artisanal fisher-folks and 0.0183 and 0.0189 for coastal fisher-folks, respectively. This could be due to the fact that educated people have greater tendencies to accept WKS and dismiss IKS items as unclean, occultic and sinful [20,26,31]. In the same vein, increase in number of fishing canoes/boats may tend to give a household the confidence that even if a mishap were to befall a fishing boat/canoe as a consequence of disobeying an IKS item, that is unlikely to happen to all the household fishing vessels at the same time. Thus, this may explain the finding that as the number of fishing vessels increased, the probability of using IKS decreased.

Also, with increasing income, the probability of using IKS increased in both types of fishing households. These findings contradict earlier result by Mafimisebi and Oguntade (2011) that increasing income decreased the probability of using traditional medicines in rural farming households which was attributed to the fact that increasing income enhanced access to the more expensive orthodox medicines regarded as more efficacious and prestigious. As expected, an increase in fishing experience and the number of elderly people in the household beyond the mean value increased the probability of using IKS by 0.0559 and 0.0429 in artisanal fishing households and 0.0377 and 0.2564 in coastal fishing households, respectively. This is understandable because increased experience will have helped IKS users to confirm or refute attributed outcomes of use over the years. Thus, where an IKS item is adjudged efficacious after a long term use, users may tend to hold to it tenaciously leading to preference for IKS compared to WKS in the fishing business. In the same way, with increase in the number of elderly people that are usually custodians of IKS knowledge and sometime also enforcers of them in African rural households, there is a higher probability of use of IKS. This concurred with findings by [11].

Surprisingly, age that was not significant in the model for artisanal fisher-folks was significant at 5% in the model for coastal fisher-folks. This may have arisen from the fact that both children and adults are sometimes involved in artisanal fishing in freshwater fishing grounds which is not so with coastal fishing. Coastal fishing is regarded as more risky than artisanal fishing and more often than not, there are between two to five members in a fishing boat as it is impossible for one person to man the boat and fish effectively. Also, there must be one or two experienced adults who direct the affairs in a fishing boat to ensure a successful expedition. For coastal fisher-folks, a unit increase in the age of the most elderly crew member increased the probability of using IKS by 0.0665. Also, it is reported that higher age confers higher and better information on and knowledge of IKS items in rural Nigeria where such knowledge is most willingly shared among the elderly and between the elderly and the youth [11,32].

Variable	Artisanal Fisher-folks	Coastal Fisher-folks
	Estimated Mag. Coefficient Effects	Estimated Mag. Coefficient Effects
Constant	-4.1372 -----	-5.0243 -----
Age of fisher-folks or oldest crew members	0.4096 0.0009	1.1916* 0.0665
Fishing Experience	1.5509** 0.0559	1.3156** 0.0377
Household head's years of formal education	-2.1753* 0.0269	-2.0395* 0.0183
Number of elderly people in household	1.5629* 0.0429	1.0798** 0.2564
Household income from fishing	1.9423** 0.5221	0.0972** 0.5806
Number of fishing boats/canoes	-0.1359* 0.0366	-0.1173 * 0.0189
Religion of household head	-0.0745 0.0008	-0.0497 0.0004
Observation number	84	87
LR statistic (χ^2)	148.279**	171.602**
Degree of freedom	12.000	12.000
Log likelihood	-306.748	-275.788
McFadden R ²	0.655	0.593
% Predicted right	78.13%	89.83%

Table 11: Logistic Model of Determinants of Use of IKS.

*Significant at 5% level and ** significant at 1% level.

Note: The marginal effects are calculated at the mean of the predictor variables.

Conclusion and Recommendations

This study set out to identify the IKS items used in fishing in the study area and obtain their extent of utilization among artisanal and coastal fisher-folks. It was also intended to compare the level of utilization of IKS items across the two different locations in the study area and identify the factors influencing fisher-folks' utilization of IKS items.

A total of 26 IKS items were identified in the study area. There was considerable knowledge about the identified IKS items among the fisher-folks as about 81.0% of the respondents used IKS items to moderate/high extents. The level of utilization of IKS items was comparable between the two states. Six socio-economic variables influenced the utilization of IKS significantly in both artisanal and coastal fishing. These included age, experience, formal education, number of elderly people in households, income and number of fishing boats/canoes owned. All these variables, except formal education and number of fishing boats/canoes, bore positive signs indicating that they exerted increasing effects on the probability of using IKS.

There was significant knowledge about IKS in the study area. Due to strong attachment to IKS by fisher-folks, most of these IKS items will most likely continue to be relevant in fishing and fisheries management in the future. There is a need to preserve local knowledge and practice of IKS and this could be achieved through collaborative research with fisher-folks by researchers who should rely on direct observation method for gathering research data. This will enable groups of fisher-folks and researchers, through a discovery learning process, find out about the efficacies of various IKS items while the younger fisher-folks and researchers learn from the older fisher-folks who are regarded as custodians of IKS knowledge. This process will facilitate the documentation of IKS with proven efficacies either in terms of catch volume, fisheries and fishing ground management.

Acknowledgements

Thanks are due to the International Institute of Fisheries Economics and Trade (IIFET) and NORAD for a joint travel award of up to \$5000 to enable the lead author present a work-in-progress version of the paper in IIFET 2014 Biennial Conference which held at the Queensland University of Technology, Brisbane, Australia, from 7-11 July. The authors also gratefully acknowledge the participants in the parallel session in which this paper was presented for their inputs that have helped to improve the quality of the paper.

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Volume 3 Issue 2 May 2016

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