Full Length Research Paper

Fishing Units And Systems Used In The Porto-Novo Lagoon Fisheries In Benin

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The fishing activities are nowadays practised by the surrounding populations of the valleys, lakes, lagoons, the sea and other aquatic ecosystems, sources of the fish species that man needs. The objective of this research is to analyze the current fishing units and systems in the Porto-Novo lagoon. To do this, data on the socio-economic characteristics of fishermen, the different gears and fishing units were collected in order to analyze the determining factors. The study was conducted in Porto-Novo, a total of 200 fishermen on the lagoon were randomly sampled and then interviewed. Generally speaking, fishing activities in the Porto-Novo lagoon are practised by men and women, mostly in couples (93%). They are mainly Goun (42%), (35%), Toffin (19%). Thirteen (13) fishing gears (hawk net, sleeping net, Thion, trailing fishing net, fixed net avê, Crab scale trap, Fish traps, Shrimp traps, baited longlines, unbaited longlines, Mêdokpokonou, Lines and Scoops) exist on the lagoon with a preference for the hawk net (25%), the sleeping net (19%), the fish traps (16%) and the trailing net (13%). The fishing units are categorized into six (06) groups introduced into the multivariate regression model. This model reveals that the use of fishing units depends on the socioeconomic characteristics of fishermen.

Keywords: Systems, Units, fishery, lagoon, Porto-Novo.

INTRODUCTION

Globally, the population is growing at a breakneck pace. Already in 2007, (PISON, 2007) in: GNIMADI (2012, p. 1) estimated the world population at 6.625 billion people. Two years later, that same population reached 6.8 billion, an increase of 185 million. At this rate, this population, estimated at 7 billion in 2012, will be 9.4 billion in 2050 (PISON, 2009; PRB, 2009; UN, 2008) in: GNIMADI, 2012, p. 1). This trend of increasing world population is most evident in Third World countries. Indeed, according to PRB

(2009) in: GNIMADI, 2012, p. 1. 97% of this increase goes to Asia, Africa, Latin America and the Caribbean.

GNIMADI (2012, p. 2), point out that the indicators of demographic movement highlight the tremendous dynamism of the demography of sub-Saharan Africa, with West Africa participating in a remarkable way. High population growth rates are regularly recorded there, close to 3% (2.7% per year on regional average over the period 1960-1990 and without the slightest sign of decline from 1991 to 2005),

indicates GNIMADI (2012, p. 2). The induced effects are, among others, an increase in the need for water, food and equipment. This evolution of the population keeps a good number of people in precariousness with a low Human Development Index (HDI).

Benin is a country with low human development, with an HDI estimated at 0.48 in 2014, i.e. an annual average increase over the period 1980-2014. This improvement is driven mainly by the progress made in the health and educational fields and then to a lesser extent by the gains linked to economic growth. Taking inequalities into account, the "corrected" Human Development Index stood at 0.30 in 2014. Thus, in Benin, 37.4% of the potential level of human development is lost due to inequalities. The latter persist in income. Nationally, the proportion of the multidimensionally poor population is estimated at 59.7%. This situation reveals that nearly 6 out of 10 people suffer from multidimensional poverty. These poor people are often engaged in agriculture.

Everyone is aware of the vital role played by agriculture in Benin's economy. Agriculture is interrelated with food, wealth creation, education, health and nutrition. According to the National Report on Human Development of Benin (RNDH) of Benin, (2015, p. 18), agriculture weighs on average 36% of the GDP and employs more than 70% of the national working population (2015, p. 18). However, agricultural income remains low and ranges from US $ 100 to US $ 300 per rural household. In addition, agriculture is a sector where women are involved to a large extent. About 70% of women live in rural areas where they perform 60 to 80% of the agricultural work and provide up to 44% of the services necessary to feed their families (National Report on Human Development of Benin, 2015, p. 18).

According to NDIAYE et al. (2012), in Africa, fishery production has experienced a slight decline since the end of the 1980s due to the full exploitation of stocks. For more than two decades, the African continent has recorded a significant drop in market share in world trade in fishery products. Benin has not escaped this process of degradation of fishery resources. Indeed, fishing activity is characterized by qualitative and quantitative changes in the abundance of fishery resources, following their abusive exploitation and significant environmental changes. Multifaceted threats and attacks, of anthropogenic origin, are developing in coastal areas with a negative impact on fishery resources. The situation observed in Africa is the same as that of Benin.

According to DECREE N ° 20I3.30 OF FEBRUARY 2, 2013, Benin has an annual production of around 40,000 tonnes of fish, crustaceans and molluscs. Fishing is practiced by more than 110,722 people including or less 60,000 inland fishermen, 5,722 artisanal marine fishermen as well as 45,000 fishmongers and product processors. It contributes 3% of the gross domestic product (GDP), occupies 15% of the total working population and 25% of the working population of the agricultural sector of the country. Fishing provides around 600,000 direct and indirect jobs and then provides a significant part of the total quantity of protein of animal origin consumed.

Today, this contribution of fishing to the national economy is experiencing difficulties due to (i) the critical state of fishery resources and their exploitation systems almost unauthorized by Beninese legislation (ii) weak regulation of activities of fishing based on the principle of free and open access to traditional fisheries, among others.

For EL AYOUBI and FAILLER (2013, p. 43), inland fishing in Benin annually produces around 30,000 tonnes, 90% of which come from the lagoon environment. It is the first segment in terms of total production, with a share of 75%. It is mainly developed in southern waters, such as Lake Nokoué, the Porto-Novo Lagoon and Lake Ahémé, one of the major bodies of water in Benin which is home to significant biodiversity. This activity contributes to the reduction of poverty in the southern part of Benin. How to ensure that this activity is sustainable? This is the reason why this research was initiated and is interested in fishing units and systems in the Porto-Novo lagoon where inland fishing remains a very important activity for rural communities, by offering social support to many young people looking for jobs, the majority of whom do not own land and have no other means of existence than fishing. The objective of this research is to analyze the fishing units and systems deployed in the Porto-Novo lagoon and to propose measures for the sustainability of inland

METHODOLOGY

The methodological approach used focuses on collecting and processing data and then analyzing the results.

1. Research environment

Located in the south-east of the Republic of Benin, the Porto-Novo lagoon lies between the parallels 6 ° 24 'and 6 ° 30' north latitude and the meridians 2 ° 33 'and 2 ° 42' east longitude (Figure 1). The surface of the Porto-Novo lagoon at low water is 20 km2.
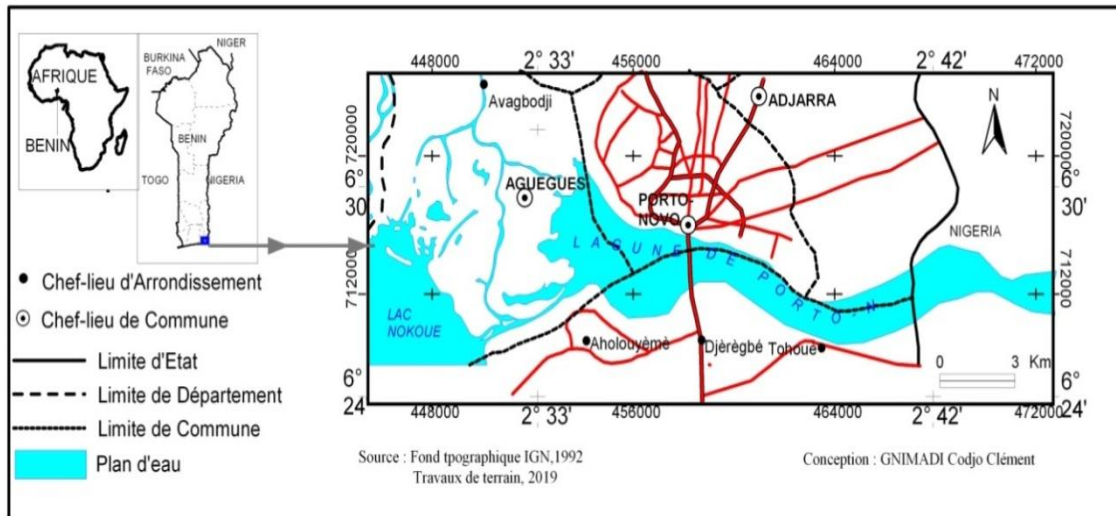
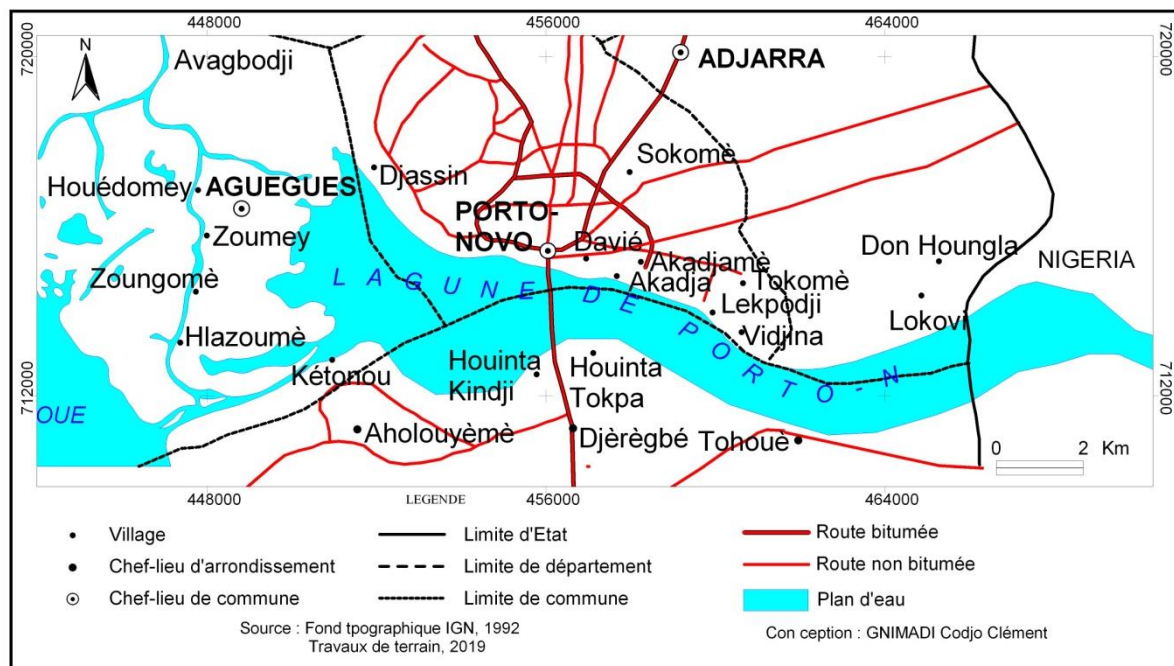**Figure 1:** Location of the Porto-Novo lagoon in Benin.

Figure 2 : The Porto-Novo lagoon and the municipalities of Aguégués and Porto-Novo

The Landscape of the Porto-Novo lagoon is directly linked to the Atlantic Ocean, like that of Lake Nokoué, by the Cotonou channel. Relations with the ocean can however be interrupted by the more or less seasonal formation of a sand spit.

The Lac Nokoué and Porto-Novo lagoon complex is supplied with fresh water by the Ouémé rivers and the Sô river and by rainwater. The Totché channel connects it to the Porto-Novo lagoon which extends to the west by the Badagry-Creek, the route of

which continues for more than 100 km to Lagos. The Ouémé delta separates the two lagoons. During the flood period (September-October), the low plains are submerged except for a few banks of banks where the villages are located. In most of the Porto-Novo lagoon, the depths are between 0.7 m and 1.10 m. A channel runs along the northeast shore of the lagoon.

The climate is characterized by four main seasons: dry season (November to mid-March), rainy season (mid-March to August), dry season (August to

mid-September), rainy season (mid-September to October.

2. Sampling and database

The observation units are the fishermen represented by the activity manager. A sample was drawn up at random (using the random number table) from the fishermen's bases placed at the fisherman's head around the Porto-Novo lagoon. A total of 200 fishermen were interviewed across the study area. The main data collected from the sampled fishermen related to their demographic and socioeconomic characteristics (sex, age, marital status, level of education, ethnicity, professional activity), the fishing systems and units adopted. Data collection was carried out through surveys conducted in the form of semi-structured interviews. In addition, the triangulation of information through focus groups was organized to ensure the veracity of the data collected.

3. Data processing and analysis of results

Qualitative data was coded and entered using an Excel spreadsheet. Analysis of survey data was done using SPSS software (Statistical Package for the Social Sciences, version 16.0) for descriptive statistics (numbers, percentage of modalities). The Stata 13 software was used to perform the regression model.

3. RESULTS AND DISCUSSION

3.1. Results

• Socio-economic and demographic characteristics

Both discontinuous and continuous variables make it possible to characterize the surveyed sample. The following tables present the descriptive statistics for these variables.

Table 1: Socio-economic and demographic characteristics

Qualitative variable	Modality	Relative frequency	(%) Quantitative	variable Mean	Standard deviation
Sex	Male Feminine	78 22	Age of the interviewee (years)	45	25,96
Matrimonial situation	Single Married Divorced Widower Fiancé (e)	3 93 1 1 2	Household size	6	0,58
Socio-cultural groups	Goun Weme Toffin Other	42 35 19 4	Number of years of experience	13	5,29
Educational level	Unschooled Literate Primary level Secondary leve	84 2 11 3	Average number of children	6	0,57

All the respondents are of both sexes, with a large predominance of men. This indicates that fishing in the study area is an activity which falls mainly under the competence of men and the other fields of activity (fishmonger, shrimp collection, smoking, drying) are dominated by women. The respondents are from several ethnic groups, with Goun and Wémè as dominant ethnic groups. This predominance is explained by the fact that these two languages are indigenous and Goun is the main language of the study

area. In addition, the study's research units are predominantly out of school. This explains, to some extent, the fact that most of the respondents are married men and women, with an average of six (06) children. The individuals surveyed have on average an experience of thirteen (13) years in the execution of the different activities around the lagoon and this can be explained by the fact that the population lives from these different activities.

• **Fishing gear and methods on the Porto-Novo lagoon**

Fishing gear and methods are the different fishing systems or techniques observed along the

Porto-Novo lagoon. These fishing techniques or systems vary from one fisherman to another and depend on their knowledge or training for the job.

Several fishing gears exist in Benin. However, in this study, only the fishing gears recorded in our study area are listed. Therefore, one cannot speak of the fishing unit without the intervention of the fishing systems. It is through the different systems or gear and methods of fishing that we refer to fishing units. Figure 3 below shows the fishing gear.
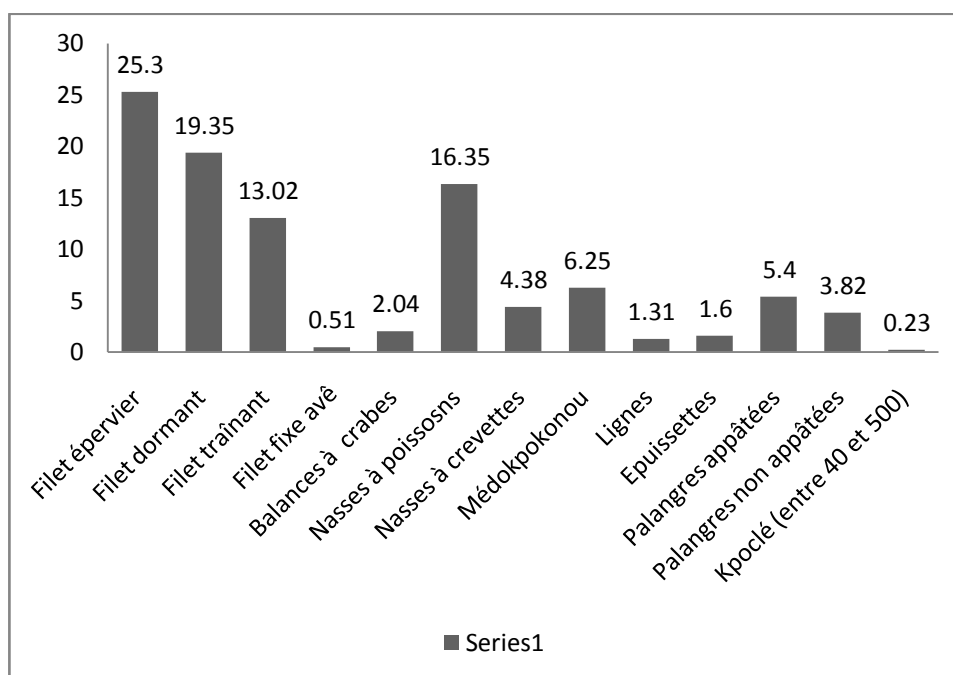

Figure 3 : The existing fishing gear on the Porto-Novo lagoon

It appears from this figure that there are thirteen (13) fishing gears in the Porto-Novo lagoon. These are: hawk net, sleeping gillnet (Tohounga), shrimp trailing net (Thion), fixed ave net, crab scales, fish traps, shrimp traps, medokpokonou, lines, landing nets, baited longlines, longlines not baited and Kpocles (between 40 and 500 Kpocles). From the analysis of this figure, we also note that all the systems are used in varying proportions. Thus, we note that in the Porto-Novo lagoon, the hawk net is used more (25%) than the sleeping net (19%), the fish traps (16%), the trailing net (13%) and the other systems that are seldom used

Number of fishing units with canoes

A fishing unit assumes the presence of one or two fishermen (the second fisherman often being the assistant of the first), a fishing gear and a canoe or not. It is possible to use different fishing units depending on the type of fishing you are doing. Thus, several fishing units are observed on the Porto-Novo lagoon. Figure 4 below tells us more about these fishing units.
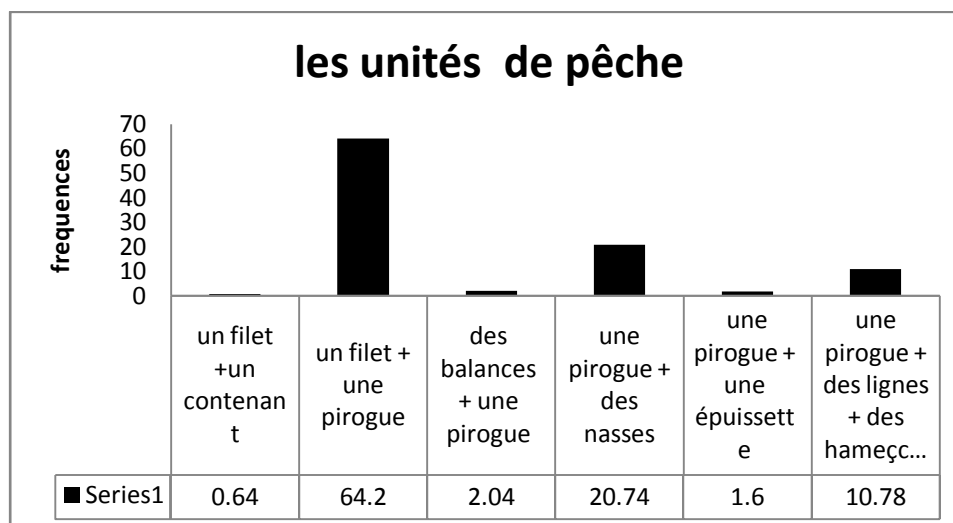
Figure 4 : Porto-Novo lagoon fishing units

It should be noted that around thirty fishing units for the various fishing systems with and without canoes have been recorded in the field. These different units have been grouped into six categorized as shown in the figure. This categorization is based on removing the number of fishermen and relying on the repetition of the same expressions.

It emerges from this figure that the fishermen of the Porto-Novo lagoon mainly use the net unit plus a canoe (64%) than the trap unit plus a canoe (21%) which, in turn, is used more than the unit of lines plus hooks (10%) at the moment when units such as net plus a container (calabash, etc.), scales plus canoe and landing nets plus canoe are not widely used. Consequently, the dominant fishing units at the Porto-Novo lagoon are net plus a canoe, traps plus a canoe and lines plus hooks plus canoe.

• **Determinants of application of fishing units in the Porto-Novo lagoon**

To assess the choice of different fishing practices, a multiple regression model was estimated. The different fishing units and socioeconomic characteristics were introduced into said model as independent and dependent variables respectively.

The variables introduced into the different regression models explain 47.2% of the variations in the use of fishing units. All models are globally significant at the 1% level. In general, the determinants of practice from one fishing unit to another are: marital status, professional activity, age, sex and ethnicity.

Table 2: Results of models for estimating the determinants of the use of fishing units.

	A canoe plus a landing net	A canoe plus scales	A canoe plus lines and hooks	A net plus a container	A canoe plus a net	A canoe plus traps
Marital situations	0,023** (0.00)	0,800* (0.045)		0.002*** (0.021)	0.000*** (-0.350)	0.000*** (-0.101)
Professional activity	0.020** (-0.006)	0.070* (0.905)	0.000*** (-2.13)	0.159 (0.044)	0.000*** (-0.387)	0.000*** (-1.185)
Age	0.320 (-0.002)	0.004*** (2.980)		0.432 (0.052)		0.008*** (0.336)
Sex	0.263 (0.209)	0.704 (0.000)	0.000*** (0.000)	0.530 (0.007)	0.001*** (0.007)	0.033** (0.200)
Ethnic group		0.096* (0.056)	0.035** (0.023)	0.141 (-0.000)	0.035** (0.003)	0.039** (0.003)
Educational level	0.419 (-1.720)	0.006*** (-0.000)	0.000*** (-0.000)	0.091* (4.093)	0.001*** (-0.000)	0.410 (-0.600)
Model summary	F : 9,757 ; Obs : 200 ; R-sq : 0.472 ; p : 0,000					

***: significant value at 1% (P 0.01); **: significant value at 5% (0.01 <P 0.05); *: significant value at 10% (0.05 <P _0.10).

• A canoe plus a landing net

Only marital status and professional activity determine the use of a canoe plus a landing net, at the 1% threshold. Marital status has a positive influence, while professional activities influence it negatively; the choice of this unit is high with the marital status of the fishermen. Those who do not fish as their main activity use this unit less.

• A canoe plus scales

The use of the unit "a canoe plus scales" depends on age, level of education, at the 1% threshold and on ethnicity, professional activity, marital status, at 10 %. They influence positively except the level of education which has a negative influence. The higher the level of education, the lower the use of this unit, on the one hand, and when fishing is the main activity of fishing, it is oriented towards the use of this unit, on the other hand. The same observation can be made with regard to age, while we note that there are ethnic groups that prefer this unity to others.

• A canoe plus lines and hooks

This unit is a function of professional activity, level of education, sex (at 1%) and ethnicity at 5%, with negative effects on the first two variables and positive on the last two. This means, on the one hand, that when fishing is a secondary activity and the fisherman has a low level of study, the use of this unit is high. In addition, the more male and the more native of the study area, the more this fishing unit is used.

• A fillet plus a container (Calabash, etc.)

The "one net plus one boat" fishing unit is a function of marital status at the 1% threshold and educational level at the 10% threshold with positive effects. So married fishermen who have a high level of education prefer the use of this unit over others.

• A canoe plus a net

The analysis shows that all the variables introduced into the model (except age) depend on this unit (at 1%) and on ethnicity at 5%. The variables gender and ethnicity positively influence the unit and the variables marital status, level of education, professional activity have negative effects. This is reflected, on the one hand, by the fact that married fishermen, those who have a high level of education and do not have the fishing activity as a professional activity use less a canoe more a net and, on the other hand, male fishermen are more interested in the use of this unit. The more a fisherman is of the dominant Goun ethnicity, the higher the choice of this unit.

• A canoe plus traps

The unit "a canoe plus traps" is a function of variables such as: marital status, ethnicity, age at the 1% threshold and the variables sex, professional activity - at 5%, with negative effects in terms of marital status and professional activity, with however positive effects for the other variables. The possibility of using traps plus a canoe is reduced when fishermen are married with many children, as well as when fishing is not their professional activity. The option to choose this fishing unit becomes high when the age is advanced, when one is male.

3.2. DISCUSSION

Fishing activities on the Porto-Novo lagoon are shared by three socio-cultural groups (Goun, Wémè, Toffin) without distinction of sex. These results are consistent with the results of MONTCHOWUI et al. (2008, p. 482). They reveal that all categories of individuals regardless of sex and age practice fishing activities in the base valley of the Ouémé. Thus, fishing is an activity carried out regardless of sex and age. Thirteen (13) fishing gears are used on the lagoon, namely: hawk net, sleeping gillnet, Thion (shrimp trailing net, fixed net with avê, crab scale, fish traps, shrimp traps, baited longlines, longlines unbaited, Mêdokpokonou, Lines and landing nets. Three (03) of these fishing gears including the fixed net (called Avè in the local language Goun), the hawk net (called Djètowlé in the local language Goun), the shrimp traps are encountered on the Cotonou channel (BADAHOUI et al. 2009, p. 991). These results confirm the real existence of these fishing gear in Benin. According to the work carried out by ATTINGLI et al. (2016, p. 54), eight (08) fishing gear and techniques are frequently used in the Ouémé Valley Base. Our work confirms these results. Among our thirteen (13) registered fishing gears, it should be noted that there are two - shrimp trailing net and shrimp traps - which are used only for fishing for shrimps, crab scales and unbaited longlines than the others. studies have not been mentioned despite their existence in the lagoon fisheries. In the research carried out on the characterization of the inland fishery in the communes of Adjohoun and Dangbo in south-eastern Benin (ADEOTI et al., 2018, p. 117), around ten fishing gears were observed in the fisheries of the two municipalities. Thus, we can say that the use of each fishing gear depends on the specificities of the environment and socio-cultural groups. Our results confirm those obtained previously, while emphasizing the presence of other fishing gears that previous studies did not mention, given the study area, the study year and the socio-cultural groups. Only four (04) of these devices are more used in our study area. The use of fishing

gear may require the assistance of one or two people, whether or not there is a boat. With each fishing gear, the assistance of a fisherman or two is possible with a canoe or not: Fishing unit. This is called a fishing unit.

In the Porto-Novo lagoon, the number of fishing units each equipped with a canoe is 99.36 compared to 0.64 fishing units without a canoe. On the lagoon, the majority of fishing units consist of a canoe and a net with one or more fishermen. The use of these fishing units is determined by the socioeconomic and demographic characteristics of the fishing community. We can cite: marital status, professional activity, age, ethnicity and level of education. Previous work has not addressed this aspect which associates fishing gear with the number of fishermen with possession of a canoe or not.

CONCLUSION

At the end of this study, we retain that fishing activities in the fisheries of the Porto-Novo lagoon are practiced by both men and women, with a predominance of the Goun, Wémè and Toffin ethnic groups and a high school attendance rate. very weak. The study identified the types of fishing gear, the fishing units and the determinants of the use of each of these fishing units. In total, thirteen (13) types of fishing gear have been identified in the Porto-Novo lagoon: hawk net, sleeping gillnet, Thion (shrimp trailing net, fixed net, crab scales, fish traps, Shrimp traps, baited longlines, non-baited longlines, Mêdokpokonou, lines and landing nets. Fishermen no longer use the cast net, the sleeping gillnet, the fish traps and the trolling net. About 30 fishing units are present on the shore. Porto-Novo lagoon and are divided into six (06) groups including a pirogue plus a landing net, a pirogue plus traps, a pirogue plus lines and hooks, a net plus a container (calabash, etc.), a pirogue plus a net and canoe plus crab scales The use of these units is determined by the characteristics of the fishermen.

REFERENCES

Adeoti, B. O. E., Ibouraïma, Y. A. B. I., Medeou, F., & Ogouwale, E. (2018). Characterization of the inland fishery in the communes of Adjohoun and Dangbo in south-eastern Benin. Africa SCIENCE, 14 (4), 177 p.

Attingli, A. H., Montcho, S. A., Vissin, E. W., Zinsou, L. H., & Laleye, P. A. (2017). Influence of fishing gear and techniques on the relative abundance of species in the Lower Oueme Valley in Benin. African Crop Science Journal, 25 (1), 54 p.

Badahoui, A., Fiogbe, E., & Boko, M. (2009). The causes of the degradation of the Cotonou channel. International Journal of biological and chemical sciences, 3 (5), 991 p.

El Ayoubi, H., and Failler, P. (2013). Report n 5 of the review of the fisheries and aquaculture industry in the ATLAFCO zone, 144 p.

FAO, 2009, The State of World Fisheries and Aquaculture, Rome, Italy, 195 p.

FAO. 2008. Global Study of Shrimp Fisheries, by Robert Gillett. Rome. (In press April 2008).

Gnimadi, C. C. (2012). Population growth and socio-spatial changes on the Allada plateau (Atlantic department) in southern Benin. Unique doctoral thesis from the University of Lomé, Togo, Lomé. 473 p.

Montchowui, E., Tobada, P., Chikou, A., & Laleye, P. (2008). Characteristics and impact of artisanal fishing on the exploitation of Labeo senegalensis (Valenciennes, 1842) in the lower valley of the Ouémé river in Benin. International Journal of Biological and Chemical Sciences, 2 (4), 407 p.

Pison, G. All the countries of the world. National Institute of Demographic Study (INED). In population and societies, 2017, n ° 436, July-August 2007, Paris, 8 p.

Prime Minister, in charge of Economic Development, the Evaluation of Public Policies and the Promotion of Good Governance and United Nations Development Program, 2015, National Report on Human Development 2015: Agriculture, food security and human development in Benin, Cotonou, 141 p.

Population Reference Bureau. (2009). World Population Data Sheet, Washington, 19 p. downloaded on 06/10/2020 from the site www.prb.org.