WHAT DOES THE FISHERMAN WANT?

Report on the survey among fishers around Lake Nokoué and Porto-Novo Lagoon in Benin

Ben Sonneveld | **Frejus Thoto** | **Donald Houessou**

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ACRONYMS

ACED	*Centre d'Actions pour l'Environnement et le Développement Durable*
ACWFS	*Amsterdam Centre for World Food Studies*
HIV/AIDS	*Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome*
ARF	*Food & Business Applied Research Fund*
ASMAB	*Association pour la solidarité des marchés du Bénin*
CFA	*Communauté Financière Africaine (African Financial Community)*
CLCAM	*Caisse Locale de Crédit Agricole Mutuelle*
CPR	*Common Pool Resources*
FAO	*United Nations Food and Agriculture Organisation*
FCWC	*Fishery Committee of the West Central Gulf of Guinea*
NWO	*Netherlands Organisation for Scientific Research*
SAS	*Statistical Analysis System*

ABSTRACT

The study analyses a survey of 839 fishermen active in Lake Nokoué and the Porto-Novo Lagoon in Benin. The survey aims to analyse the regulations among fishermen of sharing the common water resources and evaluates whether these customary rules can cope with new challenges. The survey elicits information on household characteristics, food security, ownership, organisation, regulations governing shared water resources and constraints for development. Food insecurity prevails among 32 per cent of the fishermen while a high illiteracy rate restricts employment opportunities to low-wage labour. Fishermen are true entrepreneurs who organise labour when needed, have access to credit and invest in the improvement of their fisheries. The shared water resource management is not functioning well, given the high incidence of conflicts, half of which have ended in violence. Comparing the current situation in the inland lakes of Benin with Elinor Ostrom's eight pre-requisites for sustainable and equitable development of common pool resources, we observe that five out of eight required conditions are not met.

It is recommended that the fisher community repairs this omission, specifically, by: defining clear group boundaries; implementing a monitoring system to follow members' behavior; organising a joint responsibility for governing the common resource in nested tiers from the lowest level up to the entire interconnected system; using graduated sanctions for rule violators and; finally, making sure that the rule-making rights of community members are respected by outside authorities. Yet, the degree of organisation among fishermen is low, caused by mistrust and loss of faith in the functioning of government institutions.There is, however, a clear recognition that collective interventions coordinated by public institutions are needed because the constraints indicated by fishermen like water pollution, the functioning of markets and overfishing, require interventions that go beyond the control of the individual. The creation of a platform with a solid collaboration between fishermen and local authorities should pave the way for future sustainable solutions.

1. INTRODUCTION

This section relates the management of inland lakes to the custodianship of common resources with a special focus on the complex of Lake Nokoué and the Lagoon of Porto-Novo in Benin (1.1). It introduces the study objective (1.2) and briefly sketches the economic importance of the inland fishery sector of Benin (1.3).

1.1 TRAGEDY OF THE COMMONS

The inland lakes of Benin allude to the large and indivisible ecosystems whose regeneration processes are complex, largely hidden from view and full of interactions among multiple stakeholders. In principle, these inland lakes are considered open access resources that are difficult to protect from unpaid use or to exercise property rights over (Keyzer, Sonneveld and Van Veen, 2009). This excludability problem is known as the 'Tragedy of the Commons'[1] (Hardin, 1968), referring to communal rangelands in England where livestock owners individually reaped benefits without paying for forage, resulting in persistent overgrazing and the degradation of meadows. As an analogy, without supervision, uncontrolled fishery activities in the inland lakes will overexploit fish stocks long before a sustainable economic and ecological equilibrium has been reached. As the regeneration processes of inland lakes operate at a level higher than the individual and are not subject to self-regulation through market (pricing) mechanisms, a collective action is required to avoid tragedies of the commons.

Hence, many fishing communities regulate fishery activities through operational agreements, in addition to social controls. Olomola (1993) found that regimes of common property management in traditional inland fisher communities in Nigeria, are more effective than privatisation or public control. Berkes (1985) found that Canadian lakes are succesfully managed when fishermen jointly agreed on limited property rights. Inland lakes in Bangladesh are well managed when members apply clearly defined rights to resource use within defined physical boundaries, and ensure long-term security of user rights (Mamun and Brook, 2015; Nathan and Ahmed, accessed 2017). These findings are also in line with the theory of Ostrom (Nobel price winner in 2009) showing that succesful collective action of communities can convert commons into an epitome of sustainability. Contrary, failing institutions that weaken the management of the commons can seriously threaten their long-term use and might spark conflicts that wreak havoc upon involved communities.

[1] *Though Hardin is the most cited source on failure of common properties, Gordon, in 1954, postulated a similar theory of the commons for fisheries to explain the dual problems of low income among Canadian fishermen and overfishing.*

In Benin, there seems to be a clear historical angle on the functioning of local institutions for inland lake management. In pre-colonial times, self-regulation among fisher communities was well structured, organised through respected social lines and reflecting a deep, religiously motivated, respect for cultural heritage and natural endowments. These institutions were undermined under French occupation when new legislation on the use of land and water resources was introduced and different responsibilities were assigned to local leaders. After the colonial period, various efforts followed to recover and improve inland lake institutions. Yet, this was not an easy task (Dangbégnon, 2000). The question is now whether current local regulations and customary rules among the fisher communities in the inland lakes are effective and if they are ready to cope with new challenges like population pressure, climate change, urban pollution and contested territorial claims by different fisher communities. Collectively these challenges might undermine the capacity to survive in the fisher communities.

1.2 PURPOSE OF THE STUDY

This study aims to reveal the functioning of local institutions and, therefore, interviewed 839 fishermen active in Lake Nokoué and the Lagoon of Porto-Novo. The survey elicits information on household characteristics, food security, ownership, regulations governing shared water resources and constraints on development. The study[2] is conducted within the framework of the project 'Improving the resilience of the inland fisher communities and aquatic systems to overfishing and water resource degradation in Benin' kindly sponsored by the Dutch Science Foundation, through the Applied Research Fund. The project's focus on studying the vulnerability of the inland fishing sector is in line with the national fishery policies that aim for a sustainable development of the sector, as worded in the Fishery Act. Within the project, integration between biophysical information on water quality, fish species and catch, and the collected survey information will constitute the empirical basis for a decision support tool that should motivate fisher communities to implement new and sustainable regulations that guarantee long-term development of the inland fishery sector. The project, therefore, primarily focuses on avenues through which the resilience of fisher communities can be improved. The approach of the project is to identify potential conflict areas and evaluate the impact of various policy interventions (e.g. control of urban waste, prohibited fishing systems and fish quota) on the welfare of the fisher communities.

Figure 1. Net fishing in Lake Nokoué

[2] *Separate studies (Sonneveld, forthcoming) will report on a survey among women in the fisher communities and leaders of the fisher communities.*

1.3 INLAND FISHERY IN BENIN

In the period 1960-2013, the inland fishery sector produced an average of 27 000 tons of fish[3] annually ***(Figure 2)***, employing approximately 57 500 fishers. Forty thousand women are employed in the fish-processing sector (FCWC, accessed 2017). Activities related to inland fishing, such as logging for acadjas, construction of canoes, and fish processing and storing provide employment for another 300 000 people.

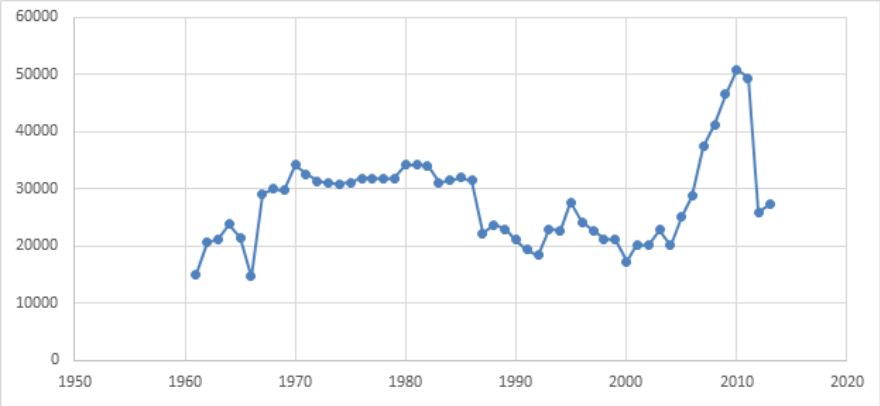

Figure 2. Annual yield of freshwater fish in tons, Benin (1960-2013). Source: FAOSTAT (accessed 2017)

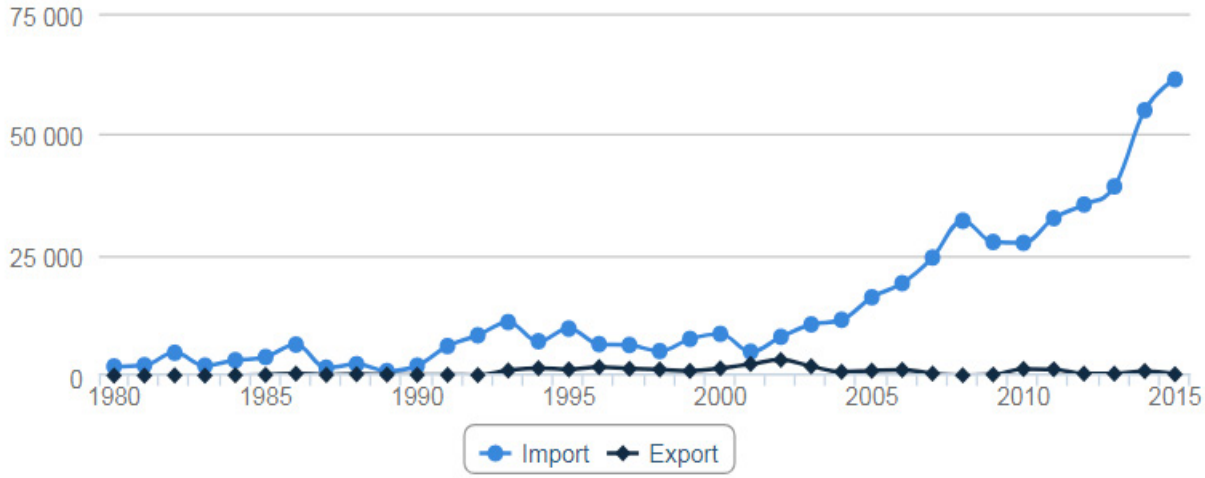

Figure 3. Fish import and export in 1 000 USD for Benin Source: FAO (2010-2017)

The demand for fish in Benin clearly exceeds supply. Annually, fish imports increased in the last decade from 20 to 40 million USD (Figure 3). The annual fish consumption was 13.6 kg per person in 2011 (FAO, 2008). A major stimulation to develop the fishery sector is the high demand for fish in the region, especially by giant neighbour Nigeria.

Organisation of the report

The report is subdivided over the following sections. Section 2 presents the sampling framework, survey design, instructions for surveyors and processing of the collected information. Section 3 reports on the findings of the survey by subject: general information and rules, ownership, rules governing shared water resources and constraints. Section 4 synthesises the findings and concludes.

[3] *The marine fishery sector captures between 10 000 and 16 000 tons per year.*

2.APPROACH

This section describes the implementation of the survey, the sampling method, design of the survey and processing of the data.

2.1 SAMPLING

Aggregation of individual datasets and focus group discussions with local agricultural agencies revealed the existence of 75 fisher communities which comprise 20 868 fishermen, and 5 665 women in the four municipalities (So-Ava, Cotonou, Porto-Novo, and Aguégués) where the survey was conducted. A random sample from fishermen populations was taken, proportional to the share of the municipality's population (where no data were available, the community's population was estimated by local authorities) with respect to the total number of people of all municipalities. All fisher communities were interviewed. In each of them, the community leader and at least two fishermen from each income segment[4] (small fishermen, middle fishermen and big fishermen; six fishermen in total) and three women who are active in the fishery sector were interviewed. Households were drawn from each segment at random with replacements, if required. The first household of each segment was selected for the interview. If the first household was not available it was replaced by the second household, etc.,until a household was found that could participate in the interview.

Figure 4. Harvesting an acadja

2.2 SURVEY INSTRUCTIONS

The survey instructions gave interviewers detailed guidelines for using the paper and the digital questionnaires; sampling schemes for fishery populations; approaching the fishermen; and dealing with controversial answers. A storyline was written to introduce the purpose of the survey, its processing and translation into policy measures and the follow-up of the project through an active participation of a delegation of fishermen.

2.3 DESIGN

The survey was designed in spreadsheet format with validated lists in scroll-down menus as a standard response, fields for open answers and automated collection of the response for further processing. Data collected on fishermen encompass formal rules, ownership, rules governing shared water resources, constraints and mitigation.

2.4 PROCESSING

The survey was processed in SAS. The collated output was read as a vector and labelled according to the question codes. Answers were standardised where needed. Categorical answers were harmonised in standard formats and presented as frequencies. Numerical answers were processed and presented as mean.

[4] *A knowledge brief produced by ACED categorises the fisher communities in three income segments locally named big fishermen, middle fishermen, and small fishermen.*

3. RESULTS

cover four categories: general information and formal rules (3.1), *ownership* (3.2), *rules governing shared water resources* (3.3) *and constraints and mitigation* (3.4).

3.1 GENERAL INFORMATION AND FORMAL RULES

Concerning the spatial distribution of the respondents, Table 1, presents respondents by city. About 24 per cent reside in Cotonou, 19 per cent in Vekky while Ganvie, Houedome and Porto-Novo report 17, 15 and 11 per cent, respectively. Dekanmey, So-Ava and Zoungame report less than 10 per cent. For 79 respondents the locality could not be traced.

Table 1. Number of respondents by city

City	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Cotonou	182	23.95	182	23.95
Dekanmey	38	5.00	220	28.95
Ganvie	132	17.37	352	46.32
Houedome	112	14.74	464	61.05
Porto-Novo	85	11.18	549	72.24
So-Ava	24	3.16	573	75.39
Vekky	143	18.82	716	94.21
Zoungame	44	5.79	760	100.00
Frequency Missing = 79				

Figure 5 maps survey locations and their frequencies. Optically, the locations are nicely divided over Lake Nokoué and Lake Porto-Novo.

Figure 5. Mapping survey frequencies

Education

Seventy-nine per cent of the respondents indicated they did not attend any school (Appendix; Table A 1). This contradicts the 79 per cent (Table 2) who responded that they went to the primary (and other) schools. Most likely respondents meant that they did not finish primary school because 79 per cent could not read nor write (Table A 2, Table A 3). It can be concluded that the illiteracy rate is very high among fishermen. Illiteracy rate among spouses was even higher (93 per cent; Table A 4 and Table A 5).

Table 2. School attendance

What was the highest school level you attended?				
A3_1_	Frequency	Per cent	Cumulative Frequency	Cumulative Per cent
Primary	665	79.26	665	79.26
Secondary	112	14.54	787	93.80
College	50	5.96	837	99.76
University	1	0.12	838	99.88
Others	1	0.12	839	100.00

Group or alone?

On the question whether the fishermen went fishing alone or in a group, 65 per cent responded that they went alone (Table 3). Of the 17 per cent that indicated that they went fishing in a group, 74 per cent indicated that the group had an informal setting, 4 per cent were members of a cooperative or went with another form of group (Table A 6). We can conclude that most fishermen conduct their fishery activities alone and are not dependent on other fishermen.

Table 3. Fishing in group or alone?

Do you fish alone or in a group?				
A7_	Frequency	Per cent	Cumulative Frequency	Cumulative Per cent
Alone	540	64.59	540	64.59
Group	142	16.99	682	81.58
Sometimes in a group	154	18.42	836	100.00

Other activities

Forty-two per cent of the respondents worked in other sectors (Table 4), in addition to their fishing activities. Of those working in other sectors, 15 per cent farmed, 65 per cent indicated other activities like livestock farming and 5 per cent indicated commercial activities.

Table 4. Other activities

Do you have other work in addition to your fishery activities?				
A8_	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Na	8	0.95	8	0.95
Yes	354	42.19	362	43.15
No	477	56.85	839	100.00

It is interesting that considerable time was spent on activities other than fishing (Table 5). Fifty-eight per cent spent more than 20 days per month on other activities, while 23 and 19 per cent spent a maximum of 10 to 20 days per month, respectively, outside fishery activities. We observe that 78 per cent spent more than 10 days per month on other activities. We can conclude that 40 per cent of the fishermen have a side job that is taking a serious amount of time.

Table 5. Days spent on other working activities

How many days per month do you practise these other work activities?				
A8_2_	Frequency	Per cent	Cumulative Frequency	Cumulative Per cent
na*	2	0.56	2	0.56
0-10	80	22.60	82	23.16
10-20	66	18.64	148	41.81
20-30	206	58.19	354	100.00

*na = not applicable answer

Food security

An important indicator of welfare and health is food security, that people have access to good food without interruption. We tested the food security by asking fishermen if they had experienced the situation where there were days during a month that there was no meal or one meal only. We also focus on the location where the poor are found. Table 6 shows the of the very poor (one day without a meal) and the poor (one meal per day) according to the cities they live in. In total, 32 per cent of the fisher population experienced a situation where they had no meal (5 per cent) or only a single meal (28 per cent) one day a month. Column percentages show that this share of people with no meal or a single meal per day is highest in Porto-Novo with 12 and 64 per cent, respectively. There is a large middle group of Cotonou, Ganvie, Houedome, So-Ava, Vekky and Zoungame where approximately 30-35 per cent of the fishermen populations had no or a single meal per day. Only Dekanmey shows a low percentage (3 per cent).

Table 6. Cross frequency table for number of meals per day by city

Frequency Percent Row Pct Col Pct	No meal	Single meal a day	Single meal or more per day	Total
Cotonou	17 2.24 9.34 44.74	36 4.74 19.78 16.82	129 16.97 70.88 25.39	182 23.95
Dekanmey	0 0.00 0.00 0.00	1 0.13 2.63 0.47	37 4.87 97.37 7.28	38 5.00
Ganvie	8 1.05 6.06 21.05	38 5.00 28.79 17.76	86 11.32 65.15 16.93	132 17.37
Houedome	0 0.00 0.00 0.00	36 4.74 32.14 16.82	76 10.00 67.86 14.96	112 14.74
Porto-Novo	10 1.32 11.76 26.32	39 5.13 45.88 18.22	36 4.74 42.35 7.09	85 11.18
So-Ava	0 0.00 0.00 0.00	7 0.92 29.17 3.27	17 2.24 70.83 3.35	24 3.16
Vekky	3 0.39 2.10 7.89	42 5.53 29.37 19.63	98 12.89 68.53 19.29	143 18.82
Zoungame	0 0.00 0.00 0.00	15 1.97 34.09 7.01	29 3.82 65.91 5.71	44 5.79
Total	38 5.00	214 28.16	508 66.84	760 100.00
Frequency Missing = 79				

Housing

More than 90 per cent of the fishermen owned a house (Table A 9). Only 32 per cent reported having electricity in their houses (Table A 10) and less than 3 per cent had access to a refrigerator (Table A 11). On average, houses have 3 rooms with percentiles indicating 20 per cent of respondents with a maximum of two rooms or fewer, 50 per cent a maximum of three or fewer and 75 per cent have at most four rooms.

Table 7. Housing: number of rooms

Mean	20th Pctl	50th Pctl	75th Pctl
3.2073897	2.0000000	3.0000000	4.0000000

We can conclude that the ownership of houses is high, but electricity is absent. A refrigerator and, most likely, other electric devices are lacking. The housing conditions confirm the rather poor environment of the fishermen and the restrictions to working at night. The absence of electricity is also closely related to risks when open fires are used for cooking and light sources at night.

3.2 OWNERSHIP

Approximately 70 per cent of the fishermen indicated that they owned an acadja[5] (Table A 12), 13 per cent of the respondents indicated that they owned a medokpokonou[6] (Table A 13). A fraction less than 9 per cent owned both an acadja and a medokpokonou while 27 per cent did own either. The 8 per cent of respondents who owned crab baskets (Table A 15) and the 17 per cent practising line fishing (Table A 17) also owned acadjas (50 and 62 per cent, respectively) and medokpokonous (7 and 9 per cent, respectively; Table A 16 and Table A 18). Only 3 per cent of the respondents practised fish farming (Table A 19).

Acadja

As the acadja is the most prominent fishing technique, we will characterise its management in more depth than other fishing systems. Most fishermen who worked with acadjas were also the owners (96 per cent; Table A 21). On average, the fishermen owned one acadja each, bordering on two acadjas owned at the 70th percentile (Table A 20). A large majority (68 per cent) had owned their acadjas for 10 years or more (Table 8).

[5] *An acadja encloses an area in the lake using wooden poles, creating a safe habitat and breeding ground for fish; it is harvested once or twice a year.*
[6] *A medokpokonou uses fine-mesh nets to trap fish.*

Table 8. Length of ownership of the acadja

How long have you owned this acadja?				
B_2_1_1__	Frequency	Per cent	Cumulative	Cumulative Per cent
0-5	71	12.33	71	12.33
6-10	113	19.62	184	31.94
11-15	101	17.53	285	49.48
16-20	98	17.01	383	66.49
21-25	44	7.64	427	74.13
26-30	76	13.19	503	87.33
>30	73	12.67	576	100.00

Respondents indicated that 50 per cent inherited the acadja from their fathers, 33 per cent had constructed the acadja themselves and 14 per cent had purchased the acadja (Table A 22). The price of an acadja (Table 9) was a maximum 250 000 CFA[7] (€381) for 47 per cent of the respondents while 20 per cent paid more than 500 000 CFA (€762). With a GDP per capita of €1 714 (World Bank, World Development indicators, 2017) this would mean that an acadja equates 22 to 44 per cent of a fisherman's annual income.

Location, size and price

Eighty-two per cent of respondents indicated that they were the sole owner of the location of the acadja (Table A 21). This is an interesting feature because there is no formal cadaster for the division of inland waters. Obviously, traditional rights are transferred from one generation to the next and ownership of location is considered a right by the owners (Table A 23). None of the respondents leased or rented out their acadja; most respondents indicated that the question was not applicable in their situation (Table A 24).

Concerning the size of the acadja, 31 per cent of the respondents indicated that their acadja was less than 0.5 ha, (14 per cent had less than 0.25 ha), 27 per cent had an acadja between 0,5 and 1 ha, while 42 per cent had an acadja larger than 1 ha (Table A 25).

Harvest

Most fishermen (54 per cent) harvest their acadja once a year, 21 per cent harvest once every two years and 16 per cent every three years. Approximately 3 per cent harvest multiple times per year (Table A 26). The average catch per acadja is 2 635 kg, about 33 per cent of the respondents catches less than 500 kg, 18 per cent between 500 and 1 500 kg and more than 46 per cent catches more than 3 000 kg (Table A 27 and Table A 28). In CFA, the average catch (Table A 29) is 2 650 829 (€4 041), 40 per cent earn less than 1 500 000 CFA (€2 287) and 40 per cent earn more than 2 500 000 CFA (€3 811) (Table A 30). On average 10 people assist harvesting acadjas, and 75 per cent receivs a wage of 41 670 CFA (€63) or less per day (Table A 32).

[7] *CFA stands for Communauté Financière Africaine (African Financial Community). One CFA is 0.00152449 €(10/8/2017).*

Table 9. Price of an acadja in CFA

B2_1_2_3_N	Frequency	Per cent	Cumulative	Cumulative Percent
1-250000	31	46.97	31	46.97
250001-500000	22	33.33	53	80.30
500001-750000	6	9.09	59	89.39
750001-1000000	7	10.61	66	100.00

Earnings

To get an idea on the earnings of the fishermen we take average figures of the previous paragraph and assume that harvest of an acadja lasts 3 days, using 10 helpers (Table A 31) each receiving 40 000 CFA (Table A 32) a day. We calculate the average annual net income per acadja as:

Value catch	2 650 829 CFA
Labour costs (10 man *3 days *40 000 CFA)	1 200 000 CFA
Write-off poles	60 000 CFA
Net income	1 390 829 CFA

A medokpokonou is harvested multiple times per year (Table A 34); 54 per cent of the respondents indicated they harvested fewer than 200 times per year. Using the 50th and 75th percentile of the data (the mean is here not very informative as it is determined largely by a few outliers) we observe that one catch has the value of 8 500 and 16 750 CFA, respectively. Using the value of the 50th percentile and for 200 catches per year (Table A 35), the harvested annual value would be 1 700 000 CFA (2 591 €). Maintenance costs are considered negligible.

We observe that for crab fishing, the frequency (Table A 36 and Table A 37) and mean value (Table A 38) of the catch varies largely, which makes a meaningful assessment for income generated by crab fishermen difficult. Taking the average value for frequency and the value of the 50th percentile we would get an annual income of 395 000 CFA (602 €).

Time spent

Table 10 shows the share of time fishermen spend on their various production systems. Most time is spent on the acadja and medokpokonou. The medokpokonou system especially is labour intensive due to its multiple harvests per year. Obviously the acadja also requires time for maintenance.

Table 10. Share of time per fishery system

Share	Acadja	Medokpokonou	Crab	Line fishing
0-<25	13	14	42	40
25-<50	33	37	42	37
50-<75	30	44	11	21
75-<100	25	6	6	3

3.3 RULES SHARING WATER RESOURCES

This section contains information on the joint sharing of water resources in Lake Nokoué and the Lagoon of Porto-Novo. The provide insights into the agreements among fishermen in partitioning and managing the water resources.

Restrictions

Respondents indicate (Table 11) that the construction of acadjas is restricted (81 per cent) and cannot be located just anywhere. The selection of locations is more relaxed for production systems that are less invasive and have a fewer permanent structures, such as medokpokonou, crab and line fishing according to 67–88 per cent of the fishermen. Locations for fish farming are also restricted.

Table 11. Can you develop your fishery activities anywhere on the lake?

	Acadja	Medokpoknou	Crab	Line fishing	Fish farming
No	81	33	24	12	80
Yes	19	67	76	88	20

On the question “Why are you not allowed to develop fishery activities in other areas?” most fishermen referred to agreements at community level (Table 12). Of the respondents 19 per cent indicated that they had agreements at individual level. There were a limited number of agreements with government authorities (8 per cent). Concerning the category “others” (32 per cent), 13 per cent referred to arrangements that were done at the level of the community and 15 per cent mentioned that private property had to be respected.

Table 12. Agreements with various institutions on fishery developments

Why are you not allowed to develop fishery activities in other areas?				
C2_	Frequency	Per cent	Cumulative Frequency	Cumulative Per cent
1=agreements with other communities	227	40.32	227	40.32
2= agreements with individual fishermen	107	19.01	334	59.33
3=agreements with government	4	0.71	338	60.04
4=agreements with local authorities	41	7.28	379	67.32
5=other (specify)	184	32.68	563	100.00

On the question "What happens when you develop fishery activities in forbidden areas?", 11 per cent of the fishermen (Table A 39) answered that they be fined or subjected to public shaming. Of the 66 per cent who gave a different answer as categorised, 5 per cent indicated: 'destruction of acadja' and 10 per cent wanted to warn local police. If a fine had to be paid, 88 per cent of the respondents had to pay in cash.

Table 13 shows that 40 per cent of the respondents indicated that fishermen near an acadja should remain at a distance, with 27 per cent indicating that 0-5 m was sufficient. Most fishermen did not require any distance from nearby fishermen to their medokpokonou production system (86 per cent), crab fishing (90 per cent) and line fishing (84 per cent). Obviously, fishermen believe that the presence of individuals near their production systems does not influence the catch.

Table 13. Share (in per cent) of fishermen requiring distance to fish production system.

Distance in m.	Acadja (n = 792)	Medokpokonou (n= 834)	Crab fishing (n = 838)	Line fishing (n = 836)
No distance	60,1	85,73	90,21	83,97
0-<5	27,02	9,95	7,88	12,44
5-<10	10,1	0,24	0,95	2,03
10-<15	2,27	1,2	0,72	0,84
15-<25	0,51	2,88	0,12	0,48
>25	0	0	0,12	0,24

In reply to the question "What would happen if people from your own community are fishing near your area? " 78 per cent (Table A 41) answered that nothing would happen. In 13 per cent of the cases, people would talk to each other, 6 per cent would tell the other fishermen to move and 2 per cent would warn the community leader.

Conflicts

Thirty-four per cent indicated that there had been conflicts with members of their own community over the use of water resources (Table 14). The respondents indicated that in 12 per cent of cases conflict had been experienced in the past year. In 50 per cent of the conflicts, there was a violent encounter where people needed medical attention or were killed (Table A 43). Fishermen indicated that in 87 per cent of the cases, the conflict was settled but 7 per cent reported that the conflict was under mediation (Table A 44). In 52 per cent of the cases, the local community leader mediated, while elderly (13 per cent) and local authorities (13 per cent) were also actively involved (Table A 45).

Table 14. Conflicts over water resources; members of own community

Are there conflicts with the members of your community about the use of water resources?				
C3_2_1C	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
No	547	65.59	547	65.59
Yes	287	34.41	834	100.00

The same series of questions on conflicts was repeated but with regards to members of another community. In cases that people from another community were fishing nearby, 68 per cent indicated that this was no problem while 20 per cent would talk to the person. In 8 per cent of the cases, respondents would ask the person to leave (Table A 46).

Thirty-five per cent of the respondents had experienced conflict with individuals from another community (Table 15), 50 per cent of which, ended in a violent encounter where people needed medical aid or were killed (Table A 48). Twelve per cent of the cases occurred last year (Table A 47). Seventy-eight per cent of the conflicts were settled and 15 per cent were still under mediation (Table A 49). Community leaders (58 per cent) and local authorities (22 per cent) were leading the mediation process (Table A 50).

Table 15. Conflicts over water resources; members of another community

Are there conflicts with members of another community about the use of water resources?				
C3_3_1C	Frequency	Per cent	Cumulative Frequency	Cumulative Per cent
No	546	65.31	546	65.31
Yes	290	34.69	836	100.00

Trust

Eighty-one per cent of the fishermen trusted their own family more compared to members of their own community, 10 per cent trusted their own family moderately more and 7 per cent answered that the level of trust was equal (Table A 51). Eighty-nine per cent answered that they trusted their own community members much (62 per cent) or moderately (26 per cent) more than members of another community; for 11 per cent there was no difference in trust between the two groups (Table A 52).

Organisation

Sixty-three per cent of the respondents indicated that they did not belong to an organisation. The 37 per cent of the fishermen who were members of an organisation belonged to informal groups (54 per cent), groups affiliated to the community (35 per cent) or cooperatives (8 per cent); 3 per cent belonged to another kind of organisation (Table 16).

Table 16. Kind of organisation

What kind of organisation is this?				
C5_1	Frequency	Per cent	Cumulative Frequency	Cumulative Per cent
Community	111	35.13	111	35.13
Cooperative	26	8.23	137	43.35
Informal group	171	54.11	308	97.47
Others (specify)	8	2.53	316	100.00

Of those who were members of a group 80 per cent were satisfied with the functioning of the organisation and how the organisation represented their interests, 16 per cent were moderately satisfied (Table A 54). The small percentage who were not satisfied gave as reasons (Table A 55) that there was no leadership (45 per cent) and there was no membership consultation (18 per cent).

Table 17. Organisation reasons for non-membership

Why don't you belong to an organisation?				
C5_2	Frequency	Per cent	Cumulative Frequency	Cumulative Per cent
Existing groups do not function well	165	31.73	165	31.73
There are no groups	184	35.38	349	67.12
I can do it myself	78	15.00	427	82.12
Others specify)	93	17.88	520	100.00

The reasons for not belonging to an organisation were: 'existing groups did not function well' (32 per cent); 'there are no groups' (35 per cent); 'I can do it myself' (15 per cent) other reasons (17 per cent). Obviously, there is a lack of coherence among the fishermen to organize themselves. Groups are not recognised and the initiative to organise a lobby or interest group is largely absent. The low reported participation rate and participation in informal groups confirms this hypothesis.

3.4 CONSTRAINTS

Fishermen were asked about the various constraints that formed a threat to their production system. The constraints that were discussed are: water pollution, overfishing, theft, markets, conflicts, HIV/AIDS and access to credit. Below we report on the findings.

Water pollution

Sixty-four per cent indicated that water quality was a constraint for their fishery activities (Table A 56). Urban areas were the main polluters (53 per cent), boats contributed 7 per cent and the category "others" was 40 per cent (Table A 57). By recategorising "others", we get the presented in Table 18. Twenty per cent indicated that flow problems caused the pollution; the water was not refreshed enough. This is also related to the closure issue where water could not flow due to barriers in the water. It is not known which barriers are meant. Low water quality was indicated in 23 per cent of the cases; water was either too sweet (11 per cent) or too salty (10 per cent). Flooding was mentioned by 11 per cent, pollution by water hyacinth 14 per cent and degraded acadjas 4 per cent. The findings confirm the constraints identified by Yehouenou et al. (2014) and Sohounhloue et al. (2012).

Table 18. Other causes of pollution.

Other causes	frequency	percentage
Acadja degraded	8	4
Closure	31	14
Flood	25	11
Flow problem	45	20
Water hyacinth	32	14
Other	30	14
Salt	21	10
Low-quality sea water	4	2
Sweet	25	11

A large majority of the fishermen (78 per cent) did not believe that local authorities would help in solving the problem of water pollution. Cotonou (69 per cent) was, according to the fishermen (Table A 59,) the main polluter, followed by Porto-Novo (17 per cent). Dumping of market waste (32 per cent; Table A 61), household waste (26 per cent; Table A 62) and the release of water by the sewage systems (11 per cent; Table A 60) were indicated as major sources of urban pollution.
The category "others" was small (< 1 per cent; Table A 63).

Overfishing

Seventy-seven per cent of the fishermen indicated overfishing as a constraint for their activities (Table 19). Yet, 88 per cent indicated that control was not a feasible option (Table A 65). Overfishing (Table A 67) was done deliberately (51 per cent), due to lack of control/supervision (16 per cent) and ignorance (11 per cent).

Table 19. Constraints: overfishing

Do you consider overfishing as a constraint for your fishery activities?				
D2_	Frequency	Per cent	Cumulative Frequency	Cumulative Per cent
Yes	646	77.27	646	77.27
No	190	22.73	836	100.00

Theft and robbery

Sixty-four per cent of the respondents indicated that theft and robbery were a constraint for their fishery activities (Table A 68). The main items stolen were canoes (14 per cent; Table A 69), nets (38 per cent; Table A 70) fish (35 per cent; Table A 71). (See also Table A 72, Table A 73, Table A 74.) Only in 23 per cent of the cases was the thief caught (Table A 75), in most cases, (Table A 76) by the victim himself (60 per cent), sometimes by members of the community (40 per cent) but seldom by the police (1 per cent). In 43 per cent of the cases, the robbery caused a conflict with other communities (Table A 77), which was settled in 81 per cent of the cases (Table A 78) either through mediation (76 per cent) or compensation (4 per cent).

Markets

Markets were considered a constraint for 29 per cent of the respondents (Table A 79). The main reason was the distance (43 per cent) and the low prices in general (22 per cent) and during the fishing season (22 per cent). Unreliable relationships with brokers and traders were only mentioned by 5 per cent of the respondents (Table 20). Markets would function better (Table A 80) if there was more competition (26 per cent) and if the access to markets in the cities (14 per cent) or outside the lakes (14 per cent) could be improved. Government authorities should take in lead in market reforms according to 50 per cent of the respondents (Table A 81), followed by community councils (31 per cent) and local authorities (19 per cent). The fishermen see no role for themselves or fishermen organisations in improving the market system.

Table 20. Main reason for market dysfunction

What is the main reason?				
D4_1_	Frequency	Per cent	Cumulative Frequency	Cumulative Per cent
Others	22	9.13	22	9.13
Distance	104	43.15	126	52.28
Low prices in general	52	21.58	178	73.86
Low prices during fishing season	52	21.58	230	95.44
Unreliable relation with brokers	2	0.83	232	96.27
Unreliable relation with traders	9	3.73	241	100.00

Only 13 per cent of the respondents indicated that the relationship with other communities formed a constraint (Table A 82). On the question of which communities the relationship formed a constraint, the neighbouring communities (85 per cent) were mentioned most (Table A 83). Better agreements (61 per cent) on water use and negotiations (35 per cent) were indicated as best measures to improve relationships (Table 21). Again community (58 per cent), governmental (35 per cent) and local authorities (5 per cent) should take the lead in improving the relationship with other communities (Table A 84).

Table 21. Improvement of relationship with other communities

How can relationships with other communities could be improved most efficiently?				
D5_2_	Frequency	Per cent	Cumulative Frequency	Cumulative Per cent
Negotiations	38	34.55	38	34.55
Trade	2	1.82	40	36.36
Better agreements on use of water	67	60.91	107	97.27
Others (specify)	3	2.73	110	100.00

HIV/AIDS and other diseases

HIV/AIDS was considered a constraint by 21 per cent of the respondents (Table A 85). Extension services (84 per cent) was indicated as the best way to stop the spread of HIV/AIDS (Table A 86), followed by free distribution of condoms (13 per cent). Seventy-three per cent of the fishermen indicated (Table A 87) that the government was not doing enough to stop the spread of HIV/ AIDS in fisher communities. Malaria (95 per cent) and diarrhoea (65 per cent) were considered constraints on the fishing activities, (respectively, Table A 88 and Table A 89).

Access to credit

A large share of the respondents (95 per cent) said that access to credit is a constraint for their fishery activities (Table 22), while 98 per cent would get a loan if they had access to credit (Table A 91). Yet, 55 per cent of the respondents were able to obtain a loan (Table A 92), from family (31 per cent), a bank (15 per cent) or otherwise (53 per cent). Under the category "others", we find microfinance institutions like the 'institut de microfinance' (26 per cent), Caisse Locale de Credit Agricole Mutuelle (CLCAM) (19 per cent), Association pour la solidarité des marchés du Bénin (ASMAB) (8 per cent), governmental programmes which provide credit to populations (Etat) (18 per cent), and the Tontine Group whereby participants contribute equally to a prize that is awarded entirely to one participant (5 per cent). Most of the loans are used for (Table A 93) buying wood for the acadja (60 per cent), for purchasing a boat (16 per cent) or boat repair (7 per cent). The acadja (38 per cent), boat (18 per cent) and house (17 per cent) are the main collaterals (Table A 94).

Table 22. Constraints: access to credit

Do you consider access to credit to be a constraint for your fishery activities?				
D7_	Frequency	Per cent	Cumulative Frequency	Cumulative Per cent
Yes	794	94.64	794	94.64
No	45	5.36	839	100.00

3.5 VALIDATION

A focus group discussion with fisher community leaders (11), fisherwomen (4), and local agencies of the Ministry of Agriculture (4) was organised to corroborate main findings of the study on: food security, enterpreneurship, water sharing rules and lack of self organization.

Food security. Participants confirm that during the period (7 to 9 months) when fish traps (Acadja, Medokpokonou, etc.) are installed, it is difficult for many households to secure one meal per day. That period coincides with the high-water period during which the traditional fishing is not efficient because most fishes deeply hide under the water. Fishers then practice other small revenue generating activities as a solution (agriculture, retail, animal production, transport, etc.) which do not generate enough revenue.

Entrepreneurship. Fishermen are entrepreneurial but access to credit through financial institutions is difficult for them because of conditions (collaterals, short term payment period while an Acadja can take up to 1-3 years to generate revenues, etc.). Hence, they manage to informally get loans from family or pawnbrokers whose reimbursement conditions are not favourable (eg. high interest rate).

Water sharing rules (conflicts with violence). Fishermen agree that regulations exist but are not applied by them because there is no enforcement system in place. Government institutions that should enforce them are not doing that and seem to neglect the issue even when fishers themselves call them for actions. For instance, a fisher shared his story where he was threatened because he denounced someone who violated rules.

Lack of self-organization. They validate the finding arguing that there is a lack of cohesion within members of the same community and among different communities. In addition, they are not professionally well organized because their associations and federation are not functioning well and lack of resources to maintain contact with members. Furthermore, they progressively mistrust the board members of their federation. Key among the reasons mentioned are the lack of dynamism to defend their interests, no democratic alternation (leaders who are elected for life), weak governing capacities, etc. Moreover, participants mentioned the deficiencies at the governmental institutions level. They criticize the fact that these institutions are not enforcing the rules. For instance, a public hospital discharges its waste into the lake Nokoué with no penalty. Such deficiencies at the governmental level create a lack of faith in fishers' communities.

4.SYNTHESIS AND RECOMMENDATIONS

From the of the survey, some remarkable insights in the functioning of the fisher community are gained. Concerning personal characteristics, 32 per cent of the fishermen experienced a situation where there was no meal (5 per cent) or only a single meal (28 per cent) one day or more in a month, with highest percentages in Porto-Novo (12 and 64 per cent, respectively) followed by a large middle group (Cotonou, Ganvie, Houedome, So-Ava, Vekky and Zoungame). Fishermen are also characterised by a high illiteracy rate (approximately 80 per cent), which restricts labour opportunities; the large percentage of fishermen (58 per cent) who work outside the sector are mostly involved in low-wage labour activities. Hence, a substantial part of the fisher community faces food insecurity and limited opportunities to improve this situation by finding other well-paid jobs. The focus group indicated that technical and financial support is needed to develop aquaculture activities, finance capacity building initiatives, increase credit access, organise fishers' associations to cooperatives and facilitate school attendance to fishers' children,

Fishermen are clearly entrepreneurs who invest in their own techniques and tools. Despite their illiteracy, most know how to approach banks or micro-financing institutes and 55 per cent are able to get a loan. t, acadja owners know how to organise the labour for harvesting and have good conduits to markets.

Despite concrete agreements with colleagues on fishing arrangements, there is a high number of conflicts (34 per cent), where 12 per cent indicated this happened in the past year. In 50 per cent of the conflicts with members of their own community, there was a violent encounter where people needed medical attention or were killed. Similar numbers were given for conflicts with members of other communities. This is a clear indication that the common property resource management is not functioning well. Comparing Ostrom's eight prerequisites for sustainable and equitable development of common pool resources with the current situation in the inland lakes of Benin, we see that the required conditions are only partly met (Table 23). The focus group suggested to increase awareness of fishers on fishery regulations and to reinforce the fishery police on rules enforcement and conflict management

With 63 per cent of the respondents indicating that they do not belong to an association, while another 20 per cent belong to an informal group, we can conclude that the degree of organisation among fishermen is low. There might be three reasons – all three substantiated by findings of this survey and discussions with the national fishermen association. First, mistrust among members of the communities, illustrated by the high percentage (91 per cent) who trusted their own family members more than members of the community, the high incidence of conflict with members of their own community, half of which ended in violence, and the relative high percentage of robberies and thefts. Jointly, this leaves little enthusiasm for a constructive collaboration.

Table 23. Comparing Ostrom rules for CPR with Benin's inland fishery situation

Ostrom Rules	Fishery system
1.Define clear group boundaries.	Not present
2.Match rules governing use of common goods to local needs and conditions.	Present
3. Ensure that those affected by the rules can participate in modifying the rules	Present
4. Make sure the rule-making rights of community members are respected by outside authorities.	Not present
5. Develop a system, carried out by community members, for monitoring members' behaviour.	Not present
6. Use graduated sanctions for rule violators.	Not Present
7. Provide accessible, low-cost means for dispute resolution.	Present
8. Build responsibility for governing the common resource in nested tiers from the lowest level up to the entire interconnected system.	Not present.

The second reason is the loss of faith in government institutions, witnessed by the high percentage (78 per cent) of respondents who indicated that the government would not solve the pollution problems, and the low participation rate of the government concerning agreements on sharing water (8 per cent) and conflict solution (13 per cent). Yet, there is a clear recognition by fishermen that government interventions are needed because many identified constraints like water pollution, markets, overfishing and HIV/AIDS and other diseases require interventions that go beyond the control of individual fishermen. Indeed, a constructive dialogue between the fishermen community and the government is required to address the major issues identified by the respondents. Considering the externalities identified, there seems to be enough motivation to create a common platform where proven collaboration between fishermen and local authorities might thrive.

The third reason is the sparse contact between the executive board of the national federation of fishermen and its members. Discussions with the executive board revealed that there is a lack of resources to meet and communicate regularly with the fishermen.

Consequently, fishermen do not feel represented by their own association. Yet, the association occupies powerful positions in high-level government committees where they can influence decisions and solve problems that are identified in the survey. Hence, in theory, the fisher association seems well positioned in the governmental decision-making structure. What is lacking is a well-established platform where fishermen can timely express their needs, are actively involved in formulation of policies and receive regular feedback from the association concerning their proposals. Furthermore, such a platform should:

1	be representative for the fishers involved;
2	operational at the level of inland lakes:
3	use technical, material and financial capacities to implement mechanisms for concerted action; and
4	regularly and timely provide feedback to the fisher community.

It is recommended that the government releases resources and facilitates this transdisciplinary process by re-establishing such a platform to formalise and facilitate the contact between the fisher association and its members.

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APPENDIX

Table A 1. School attendance

Did you go to school?				
A3_	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
Yes	176	20.98	176	20.98
No	663	79.02	839	100.00

Table A 2. Illiteracy reading

Can you read?				
A3_3_	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
na	3	0.36	3	0.36
yes	173	20.62	176	20.98
no	663	79.02	839	100.00

Table A 3. Illiteracy writing

Can you write?				
A3_4_	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
Na	5	0.60	5	0.60
Yes	170	20.26	175	20.86
No	664	79.14	839	100.00

Table A 4. Illiteracy spouse: reading

Can she read?				
A4_4_	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
na	9	1.07	9	1.07
yes	50	5.96	59	7.03
no	780	92.97	839	100.00

Table A 5. Illiteracy spouse: writing

Can she write?				
A4_5_	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
na	8	0.95	8	0.95
yes	49	5.84	57	6.79
no	782	93.21	839	100.00

Table A 6. Type of organisation when fishing in group

If you fish in a group, what is the type of organisation?				
A7_1_C	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
informal group	225	75.50	225	75.50
Cooperation	12	4.03	237	79.53
Others	61	20.47	298	100.00

Table A 7. Other working activities_option 1.

What kind of other work do you practise?; option 1.				
A8_1__Option_1	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
sand digging;	23	6.50	23	6.50
Na	15	4.24	38	10.73
boat repair	11	3.11	49	13.84
Construction	7	1.98	56	15.82
wood harvesting	17	4.80	73	20.62
Farming	54	15.25	127	35.88
other (specify)	227	64.12	354	100.00

Table A 8. Other working activities_option 2.

What kind of other work do you practise?; option 2.				
A8_1__Option_2	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
Na	310	87.57	310	87.57
boat repair	2	0.56	312	88.14
Construction	1	0.28	313	88.42
wood harvesting	3	0.85	316	89.27
Farming	4	1.13	320	90.40
other (specify)	34	9.60	354	100.00

Table A 9. Housing: ownership.

Do you have a house?				
A10_	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
na	4	0.48	4	0.48
yes	765	91.18	769	91.66
no	70	8.34	839	100.00

Table A 10. Housing: electricity.

Do you have electricity in your house?				
A10_2	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
Na	68	8.10	68	8.10
yes	271	32.30	339	40.41
no	500	59.59	839	100.00

Table A 11. Housing: refrigerator.

Do you have a refrigerator in your house?				
A10_3	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
Na	70	8.34	70	8.34
Yes	21	2.50	91	10.85
No	748	89.15	839	100.00

Table A 12. Ownership: acadja

Indicate fishery production system practised? _ACADJA				
B1__Acadja	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
No	255	30.39	255	30.39
Yes	584	69.61	839	100.00

Table A 13. Ownership: medokpokonou

Indicate fishery production system practised?_MEDOKPOKONOU				
B1__ Medokpokonou	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
No	733	87.37	733	87.37
Yes	106	12.63	839	100.00

Table A 14. Ownership: acadja and medokpokonou

Table of B1__Acadja by B1__Medokpokonou				
Table of B1__Acadja by B1__Medokpokonou	B1__Medokpokonou *(Indicate fishery production system practised? _MEDOKPOKONOU)*			
Frequency Per Row Pct Col Pct	Cent	No	Yes	Total
No		224 26.70 87.84 30.56	31 3.69 12.16 29.25	255 30.39
Yes		509 60.67 87.16 69.44	75 8.94 12.84 70.75	584 69.61
Total		733 87.37	106 12.63	839 100.00

Table A 15. Ownership: crab baskets

Indicate fishery production system practised? Crab Fishing				
B1__Balance___crabe	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
No	775	92.37	775	92.37
Yes	64	7.63	839	100.00

Table A 16. Ownership: acadja and medokpokonou ownership among fishermen catching crab

Table A 16. Ownership: acadja and medokpokonou ownership among fishermen catching crab				
B1__ACADJA (Indicate fishery production system practised?_ACADJA)	*B1__MEDOKPOKONOU (Indicate fishery production system practised? _MEDOKPOKONOU)*			
Frequency Per Row Pct Col Pct	Cent	No	Yes	Total
No		26 40.63 92.86 44.83	2 3.13 7.14 33.33	28 43.75
Yes		32 50.00 88.89 55.17	4 6.25 11.11 66.67	36 56.25
Total		58 90.63	6 9.38	64 100.00

Table A 17. Ownership: line fishing.

Indicate fishery production system practised?_LIGNE				
B1__Ligne	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
No	693	82.60	693	82.60
Yes	146	17.40	839	100.00

Table A 18. Acadja and medokpokonou ownership among fishermen practising line fishing

Table of B1__Acadja by B1__Medokpokonou				
B1__ACADJA(Indicate fishery production system practised?_ACADJA)	B1__Medokpokonou *(Indicate fishery production system practised? _MEDOKPOKONOU)*			
Frequency Per Row Pct Col Pct	Cent	No	Yes	Total
No		39 26.71 90.70 30.23	4 2.74 9.30 23.53	43 29.45
Yes		90 61.64 87.38 69.77	13 8.90 12.62 76.47	103 70.55
Total		129 88.36	17 11.64	146 100.00

Table A 19. Ownership: fish culture

Indicate fishery production system practised?_PISCICULTURE				
B1__Pisciculture	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
No	813	96.90	813	96.90
Yes	26	3.10	839	100.00

Table A 20. Number of Acadjas per owner

Analysis Variable : B2_0_N				
Mean	20th Pctl	50th Pctl	75th Pctl	Cumulative Percent
1.1002387	0	1.0000000	2.0000000	82.60

Table A 21. Sole owner of acadja.

Do you consider yourself the sole owner of this Acadja?				
B2_1__	Frequency	Per cent	Cumulative	Cumulative Percent
Yes	565	96.42	565	96.42
No	21	3.58	586	100.00

Table A 22. How did you become the owner of this acadja?

How did you become the owner of this acadja?				
B_2_1_2__	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
inherited from father	290	50.35	290	50.35
inherited from other family member	12	2.08	302	52.43
I bought it	82	14.24	384	66.67
I was the first one to construct	192	33.33	576	100.00

Table A 23. Ownership: location of acadja

Do you consider yourself the owner of the location of this Acadja?				
B2_1_2_4__	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
Yes	465	82.01	465	82.01
No	102	17.99	567	100.00

Table A 24. Acadja leasing

Do you lease the acadja?				
B2_2_1__	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
No	13	100.00	13	100.00

Table A 25. Size of the acadja.

What is the size of your acadja in ha				
B2_3__ACADJA_1_ SURFACE_F	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
0.01 - 0.25	82	14.11	82	14.11
0.26 - 0.50	98	16.87	180	30.98
0.51 - 0.75	34	5.85	214	36.83
0.76 - 1.00	121	20.83	335	57.66
1.01-4.00	223	38.38	558	96.04
> 4	23	3.96	581	100.00

Table A 26. Frequency of acadja harvests.

How many times per year do you harvest your acadja?				
B2_3_1_	Frequency	Per cent	Cumulative Frequency	Cumulative Percent
once a year	238	53.97	238	53.97
once every two years	91	20.63	329	74.60
once every three years	69	15.65	398	90.25
once every four years	10	2.27	408	92.52
once every two/three years	13	2.95	421	95.46
once every three/four years	2	0.45	423	95.92
once every one/two years	1	0.23	424	96.15
once every two/four years	1	0.23	425	96.37
once every five years	3	0.68	428	97.05
once a month	1	0.23	429	97.28
twice every three years	1	0.23	430	97.51
twice every year	1	0.23	431	97.73
twice every season	2	0.45	433	98.19
three times per year	3	0.68	436	98.87
twice per year	5	1.13	441	100.00

Table A 27. Average and per centile of catch in acadja in kg.

Analysis Variable : B2_3_2_N			
Mean	20th Pctl	50th Pctl	75th Pctl
2635.74	220.0000000	950.0000000	2500.00

Table A 28. Categorized catch in kg per acadja

What is the catch in kg of you largest acadja				
B2_3_2_C	Frequency	Percent	Cumulative	Cumulative Percent
1-500	178	33.21	178	33.21
501-1000	73	13.62	251	46.83
1001-1500	22	4.10	273	50.93
1501-2000	8	1.49	281	52.43
2001-2500	3	0.56	284	52.99
2501-3000	3	0.56	287	53.54
>3000	249	46.46	536	100.00

Table A 29. Average and percentile of catch in acadja in CFA.

Analysis Variable : B2_3_3_N			
Mean	20th Pctl	50th Pctl	75th Pctl
2650828.78	300000.00	1000000.00	3000000.00

Table A 30. Categorized catch in CFA per acadja

How much fish do you catch in one time in your biggest acadja? (in CFA)				
B2_3_3_C	Frequency	Percent	Cumulative	Cumulative Percent
1 -<500000	148	25.43	148	25.43
1000000-<1500000	84	14.43	232	39.86
1500000-<2000000	33	5.67	265	45.53
2000000-<2500000	53	9.11	318	54.64
500000-<1000000	94	16.15	412	70.79
>2500000	170	29.21	582	100.00
>3000	249	46.46	536	100.00

Table A 31. Average number of persons (and percentiles) assisting in harvesting an acadja

Analysis Variable : B2_4_N			
Mean	20th Pctl	50th Pctl	75th Pctl
15.0087260	8.0000000	15.0000000	20.0000000

Table A 32. Wage per day for labour assisting in harvesting an acadja.

How much do you pay each man? (CFA/day)				
B2_4_1_C	Frequency	Percent	Cumulative	Cumulative Percent
0-<10000	60	10.43	60	10.43
10000-<20000	73	12.70	133	23.13
20000-<30000	102	17.74	235	40.87
30000-<40000	69	12.00	304	52.87
40000-<50000	78	13.57	382	66.43
50000-<60000	40	6.96	422	73.39
>60000	153	26.61	575	100.00

Table A 33. Average catch (and percentiles) of a Medokpokonou (in CFA)

Analysis Variable : B3_3_3_N			
Mean	20th Pctl	50th Pctl	75th Pctl
34703.85	3000.00	8500.00	16750.00

Table A 34. Frequency of harvesting a Medokpokonou

How many time per year do you harvest your Medokpokonou?				
B3_3_1_C	Frequency	Percent	Cumulative	Cumulative Percent
1-< 50	27	25.96	27	25.96
50 -<100	5	4.81	32	30.77
150 -<200	24	23.08	56	53.85
200 -<150	18	17.31	74	71.15
> 200	30	28.85	104	100.00
>2500000	170	29.21	582	100.00
>3000	249	46.46	536	100.00

Table A 35. Average value per catch of a Medokpokonou.

Analysis Variable : B3_3_3_N			
Mean	20th Pctl	50th Pctl	75th Pctl
34703.85	3000.00	8500.00	16750.00

Table A 36. Mean and percentiles for frequency of crab harvesting.

Analysis Variable: B4_3_1_N How many time per year do you harvest your baskets for crab fishing?			
Mean	20th Pctl	50th Pctl	75th Pctl
79.0000000	1.0000000	1.0000000	87.0000000

Table A 37. Frequency of crab harvesting.

How many time per year do you harvest your baskets for crab fishing?				
B4_3_1_N	Frequency	Percent	Cumulative	Cumulative Percent
1	32	53.33	32	53.33
2	3	5.00	35	58.33
4	2	3.33	37	61.67
5	1	1.67	38	63.33
6	1	1.67	39	65.00
8	1	1.67	40	66.67
10	1	1.67	41	68.33
12	3	5.00	44	73.33
24	1	1.67	45	75.00
150	1	1.67	46	76.67
156	1	1.67	47	78.33
182	1	1.67	48	80.00
208	1	1.67	49	81.67
312	2	3.33	51	85.00
365	9	15.00	60	100.00

Table A 38. Value of a catch of crabs.

Analysis Variable: B4_3_3_N How much crabs do you catch in one time? (in CFA)			
Mean	20th Pctl	50th Pctl	75th Pctl
21068.33	2000.00	5000.00	11500.00

Table A 39. What happens when you fish in forbidden waters?

B3_3_1_C	Frequency	Percent	Cumulative	Cumulative Percent
1=a fine	64	11.15	64	11.15
2=exclusion from fishing for a certain period	20	3.48	84	14.63
3=exclusion from fishing in a certain area	47	8.19	131	22.82
4= public shaming	64	11.15	195	33.97
5 = other (specify))	379	66.03	574	100.00

Table A 40. Fine to pay.

What is the fine you have to pay?				
C2_2__	Frequency	Percent	Cumulative	Cumulative Percent
1=pay in cash	61	88.41	61	88.41
2=pay with fish/catch	1	1.45	62	89.86
3=others (specify))	7	10.14	69	100.00

Table A 41. What happens when people from your own community are fishing near your area?

C3_2_C	Frequency	Percent	Cumulative	Cumulative Percent
I fish elsewhere	2	0.24	2	0.24
I tell him to move	53	6.35	55	6.59
I warn my community leader	16	1.92	71	8.51
Nothing	650	77.94	721	86.45
Other	2	0.24	723	86.69
We talk	111	13.31	834	100.00

Table A 42. Conflicts last year: own community

How many of such clashes with the members of your community were there last year?				
C3_2_3_N_C	Frequency	Percent	Cumulative	Cumulative Percent
0	745	88.80	745	88.80
1	35	4.17	780	92.97
2	31	3.69	811	96.66
3	9	1.07	820	97.74
> 3	19	2.26	839	100.00

Table A 43. Violent conflicts: own community.

Do conflicts with the members of your community result in violent encounters; people needed medical attention or killed?				
C3_2_2C	Frequency	Percent	Cumulative	Cumulative Percent
No	146	49.83	146	49.83
Yes	147	50.17	293	100.00

Table A 44. Current status conflict: own community

What is the current status of the conflict(s)?				
C3_2_4C	Frequency	Percent	Cumulative	Cumulative Percent
Not mediated at all	13	4.58	13	4.58
Other (specify)	3	1.06	16	5.63
Settled	247	86.97	263	92.61
Under mediation	21	7.39	284	100.00

Table A 45. Mediator: own community.

Who mediated in the conflict?				
C3_2_5C	Frequency	Percent	Cumulative	Cumulative Percent
Community leaders	143	52.57	143	52.57
Elderly	38	13.97	181	66.54
Local authorities	37	13.60	218	80.15
Myself	42	15.44	260	95.59
Other	12	4.41	272	100.00

Table A 46. What happens when people from another community are fishing near your area?

What happens when people from another community are fishing near your area?				
C3_3_C	Frequency	Percent	Cumulative	Cumulative Percent
I fish elsewhere	3	0.36	3	0.36
I tell him to move	63	7.59	66	7.95
I warn my community leader	24	2.89	90	10.84
Nothing	566	68.19	656	79.04
Other	2	0.24	658	79.28
We talk	172	20.72	830	100.00

Table A 47. Conflicts last year: members of another community

Number of conflicts with members of another community				
C3_3_3_N_C	Frequency	Percent	Cumulative	Cumulative Percent
0	692	82.48	692	82.48
1	49	5.84	741	88.32
2	48	5.72	789	94.04
3	25	2.98	814	97.02
> 3	25	2.98	839	100.00

Table A 48. Violent conflicts: another community.

Do conflicts with members of other communities result in violent encounters; people needed medical attention or killed?				
C3_3_2C	Frequency	Percent	Cumulative	Cumulative Percent
No	145	49.49	145	49.49
Yes	148	50.51	293	100.00

Table A 49. Current status conflict: another community

What is the current status of the conflict(s)?				
C3_3_4C	Frequency	Percent	Cumulative	Cumulative Percent
Not mediated at all	15	5.30	15	5.30
Other (specify)	2	0.71	17	6.01
Settled	221	78.09	238	84.10
Under mediation	45	15.90	283	100.00

Table A 50. Mediator: another community.

Who mediated in the conflict?				
C3_3_5C	Frequency	Percent	Cumulative	Cumulative Percent
Community leaders	160	58.39	160	58.39
Elderly	19	6.93	179	65.33
Local authorities	59	21.53	238	86.86
Myself	24	8.76	262	95.62
Other	12	4.38	274	100.00

Table A 51. Trust: family and own community members

Do you trust your family members more that you own community members?				
C4	Frequency	Percent	Cumulative	Cumulative Percent
Much more	680	81.24	680	81.24
Moderately more	85	10.16	765	91.40
The same	72	8.60	837	100.00

Table A 52. Trust: members of own and another community.

Do you trust the members of your own community more than members of another community?				
C4_1_	Frequency	Percent	Cumulative	Cumulative Percent
Much more	523	62.49	523	62.49
Moderately more	220	26.28	743	88.77
The same	94	11.23	837	100.00

Table A 53. Organisation: membership.

Do you belong to an organization?				
C5	Frequency	Percent	Cumulative	Cumulative Percent
Yes	315	37.63	315	37.63
No	522	62.37	837	100.00

Table A 54. Organisation: representing interests.

Does the organization represent your interests well?				
C5_1_1_	Frequency	Percent	Cumulative	Cumulative Percent
Yes	251	79.68	251	79.68
Moderately well	50	15.87	301	95.56
Not well	14	4.44	315	100.00

Table A 55. Organisation: not satisfied

What is the reason that your organisation does not represent your interests well?				
C5_1_2_	Frequency	Percent	Cumulative	Cumulative Percent
No leadership	28	45.90	28	45.90
No consultation with members	11	18.03	39	63.93
Others specify)	22	36.07	61	100.00

Table A 56. Constraints: water pollution.

Do you consider the water quality in your lake as a constraint for your fishery activities?				
D1_	Frequency	Percent	Cumulative	Cumulative Percent
Yes	539	64.24	539	64.24
No	300	35.76	839	100.00

Table A 57. Constraints: reasons for water pollution

What is the main reason?				
D1_1_	Frequency	Percent	Cumulative	Cumulative Percent
Urban pollution	284	52.69	284	52.69
Pollution by boats	37	6.86	321	59.55
Others (specify)	218	40.45	539	100.00

Table A 58. Constraints: water pollution and help from municipality

Do you think that the municipality is willing to solve the problem?				
D1_1_2_1_	Frequency	Percent	Cumulative	Cumulative Percent
Yes	68	22.44	68	22.44
No	235	77.56	303	100.00

Table A 59. Cities polluting water.

How many time per year do you harvest your baskets for crab fishing?				
D1_1_1_	Frequency	Percent	Cumulative	Cumulative Percent
Abomey-calavi/So ava centre	10	3.56	10	3.56
Other	7	2.49	17	6.05
Cotonou	195	69.40	212	75.44
Fifadji/Menontin	7	2.49	219	77.94
Cotonou/Abomey-calavi	4	1.42	223	79.36
Cotonou/Tokpa	5	1.78	228	81.14
Porto-Novo	48	17.08	276	98.22
Porto-Novo/Cotonou	5	1.78	281	100.00

Table A 60. Causes of urban water pollution: sewage system

How do they pollute your water?_sewage system				
D1_1_2__SYST_ME_D__GOUT	Frequency	Percent	Cumulative	Cumulative Percent
No	746	88.92	746	88.92
Yes	93	11.08	839	100.00

Table A 61. Causes of urban water pollution: market waste

How do they pollute your water?_market waste				
D1_1_2__D_CHETS_DE_MARCH_S	Frequency	Percent	Cumulative	Cumulative Percentv
No	564	67.22	564	67.22
Yes	275	32.78	839	100.00

Table A 62. Causes of urban water pollution: household waste

How do they pollute your water?_market waste				
D1_1_2__D_CHETS_M_NAGERS	Frequency	Percent	Cumulative	Cumulative Percentv
No	623	74.26	623	74.26
Yes	216	25.74	839	100.00

Table A 63. Causes of urban water pollution: others

How do they pollute your water?_Others				
D1_1_2__Autres	Frequency	Percent	Cumulative	Cumulative Percent
0	832	99.17	832	99.17
X	4	0.48	836	99.64
X	3	0.36	839	100.00

Table A 64. Reason for overfishing

What is the main reason for overfishing?				
D2_1_	Frequency	Percent	Cumulative	Cumulative Percent
ignorance	75	11.68	75	11.68
unawareness	12	1.87	87	13.55
deliberate overfishing	330	51.40	417	64.95
no control/supervision	104	16.20	521	81.15
others)	121	18.85	642	100.00

Table A 65. Controlling overfishing

Can you control the overfishing?				
D2_3_	Frequency	Percent	Cumulative	Cumulative Percent
Yes	124	19.20	124	19.20
No	522	80.80	646	100.00

Table A 66. Overfishing: penalty

What penalty is given?				
D2_3_1_2_	Frequency	Percent	Cumulative	Cumulative Percent
a fine	11	21.57	11	21.57
exclusion from fishing for a certain period	18	35.29	29	56.86
exclusion from fishing in a certain area	3	5.88	32	62.75
public shaming	6	11.76	38	74.51
other (specify)	13	25.49	51	100.00

Table A 67. Overfishing: reasons

What is the main reason for overfishing?				
D2_1_	Frequency	Percent	Cumulative	Cumulative Percent
Ignorance	75	11.68	75	11.68
unawareness	12	1.87	87	13.55
deliberate overfishing	330	51.40	417	64.95
no control/supervision	104	16.20	521	81.15
others)	121	18.85	642	100.00

Table A 68. Constraint: theft and robbery

Do you consider theft and robbery as a constraint for your fishery activities?				
D3_	Frequency	Percent	Cumulative	Cumulative Percent
na	6	0.72	6	0.72
Yes	534	63.65	540	64.36
No	299	35.64	839	100.00

Table A 69. Constraint: theft and robbery of a canoe

What has been stolen from you?_canoe				
D3_1__PIROGUE	Frequency	Percent	Cumulative	Cumulative Percent
No	721	85.94	721	85.94
Yes	118	14.06	839	100.00

Table A 70. Constraint: theft and robbery of nets

What has been stolen from you?_nets				
D3_1__FILETS	Frequency	Percent	Cumulative	Cumulative Percent
No	517	61.62	517	61.62
Yes	322	38.38	839	100.00

Table A 71. Constraint: theft and robbery of fish

What has been stolen from you?_fish				
D3_1__POISSON	Frequency	Percent	Cumulative	Cumulative Percent
No	540	64.36	540	64.36
Yes	299	35.64	839	100.00

Table A 72. Constraint: theft and robbery of baskets

What has been stolen from you?_baskets				
D3_1__PANIERS	Frequency	Percent	Cumulative	Cumulative Percent
No	807	96.19	807	96.19
Yes	32	3.81	839	100.00

Table A 73. Constraint: theft and robbery of crabs

What has been stolen from you?_crabs				
D3_1__CRABE	Frequency	Percent	Cumulative	Cumulative Percent
No	828	98.69	828	98.69
Yes	11	1.31	839	100.00

Table A 74. Constraint: theft and robbery others

What has been stolen from you?_Others				
D3_1__Autres	Frequency	Percent	Cumulative	Cumulative Percent
0	793	94.52	793	94.52
X	22	2.62	815	97.14
x	24	2.86	839	100.00

Table A 75. Catch the thief

Were you able to catch the thief?				
D3_2_	Frequency	Percent	Cumulative	Cumulative Percent
Yes	129	23.98	129	23.98
No	409	76.02	538	100.00

Table A 76. Who caught the thief?

Who caught the thief?				
D3_2_1__	Frequency	Percent	Cumulative	Cumulative Percent
Myself	77	59.69	77	59.69
members of community	51	39.53	128	99.22
Police	1	0.78	129	100.00

Table A 77. Robbery causing conflicts with other communities

Did the robbery cause a conflict with other communities?				
D3_2_2__	Frequency	Percent	Cumulative	Cumulative Percent
Yes	55	42.64	55	42.64
No	74	57.36	129	100.00

Table A 78. Settle conflicts caused by robbery.

How did you settle this conflict?				
D3_2_3__	Frequency	Percent	Cumulative	Cumulative Percent
was not settled	14	19.44	14	19.44
through mediation	55	76.39	69	95.83
through compensation	3	4.17	72	100.00

Table A 79. Constraints: markets

Do you consider markets a constraint for your fishery activities?				
D4_	Frequency	Percent	Cumulative	Cumulative Percent
Yes	242	28.95	242	28.95
No	594	71.05	836	100.00

Table A 80. Constraints: functioning of markets

How do you think that the functioning of fish markets can be improved most efficiently?				
D4_2_	Frequency	Percent	Cumulative	Cumulative Percent
more competition,	62	25.73	62	25.73
avoid fixed arrangements	22	9.13	84	34.85
direct contact with traders,	21	8.71	105	43.57
access to other markets outside the lake	33	13.69	138	57.26
access to markets in the cities,	34	14.11	172	71.37
access to export markets,	11	4.56	183	75.93
others (specify))	58	24.07	241	100.00

Table A 81. Taking the lead in market improvement.

At what level of the social organisation should the improvement of fish market situation be organized?				
D4_3_	Frequency	Percent	Cumulative	Cumulative Percent
community council	74	30.96	74	30.96
government authorities	120	50.21	194	81.17
local (city) authorities	45	18.83	239	100.00

Table A 82. Constraint: relationship with other communities

Do you consider your relationship with other communities as a constraint for your fishery activities?				
D5_	Frequency	Percent	Cumulative	Cumulative Percent
Yes	112	13.48	112	13.48
No	719	86.52	831	100.00

Table A 83. Other communities

Who caught the thief?				
D3_2_1__	Frequency	Percent	Cumulative	Cumulative Percent
neighboring community	95	84.82	95	84.82
other (specify)	17	15.18	112	100.00

Table A 84. Organisation that should improve relationship with other communities.

At what level of the social organisation should the improvement of the conflict resolution be organized?				
D5_3_	Frequency	Percent	Cumulative	Cumulative Percent
community council	64	57.66	64	57.66
government authorities	39	35.14	103	92.79
local (city) authorities	6	5.41	109	98.20
others (specify)	2	1.80	111	100.00

Table A 85. Constraints: HIV/AIDS

Do you consider HIV/AIDS as a constraint for your fishery activities?				
D6_	Frequency	Percent	Cumulative	Cumulative Percent
Yes	177	21.10	177	21.10
No	662	78.90	839	100.00

Table A 86. Measures against HIV/AIDS

What measures could be taken to control the spread of HIV/AIDS?				
D6_1_	Frequency	Percent	Cumulative	Cumulative Percent
Extension	604	83.89	604	83.89
Free distribution of condoms	93	12.92	697	96.81
Improve social control	9	1.25	706	98.06
others (specify))	14	1.94	720	100.00

Table A 87. Does the government do enough to control the spread of HIV/AIDS in fisher communities?

Do you think that the government is doing enough to control aids in the fisher communities?				
D6_2_	Frequency	Percent	Cumulative	Cumulative Percent
not enough	529	72.97	529	72.97
enough;	144	19.86	673	92.83
others (specify)	52	7.17	725	100.00

Table A 88. Constraint: malaria.

Do you consider malaria as a constraint for your fishery activities?				
D6_3_	Frequency	Percent	Cumulative	Cumulative Percent
Yes	792	94.85	792	94.85
No	43	5.15	835	100.00

Table A 89. Constraint: diarrhea

Do you consider diarrhea as a constraint for your fishery activities?				
D6_4_	Frequency	Percent	Cumulative	Cumulative Percent
Yes	540	64.83	540	64.83
No	293	35.17	833	100.00

Table A 90. Constraint: obtaining a loan

Can you get a loan?				
D7_1_	Frequency	Percent	Cumulative	Cumulative Percent
Yes	457	54.80	457	54.80
No	377	45.20	834	100.00

Table A 91. Would you like to get a loan?

Would you like to get a loan?				
D7_2_	Frequency	Percent	Cumulative	Cumulative Percent
Yes	819	98.20	819	98.20
No	15	1.80	834	100.00

Table A 92. Institutions for loans

From who or where can you get a loan?				
D7_1_1_	Frequency	Percent	Cumulative	Cumulative Percent
family	144	31.44	144	31.44
bank	70	15.28	214	46.72
others (specify))	244	53.28	458	100.00

Table A 93. Purpose of loan

For what purpose did you get a loan?				
D7_1_2_	Frequency	Percent	Cumulative	Cumulative Percent
purchase of boat	74	16.26	74	16.26
boat repair	33	7.25	107	23.52
family support	22	4.84	129	28.35
Food	11	2.42	140	30.77
buying wood for Acadja	272	59.78	412	90.55
others (specify)	43	9.45	455	100.00

Table A 94. Collateral for loan.

What kind of collateral do you have?				
D7_3_1_	Frequency	Percent	Cumulative	Cumulative Percent
boat	142	18.25	142	18.25
house	134	17.22	276	35.48
acadja	292	37.53	568	73.01
Medokpokonou	12	1.54	580	74.55
Crab baskets	9	1.16	589	75.71
others (specify)	189	24.29	778	100.00

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