

Activities and Uses of Aghien Lagoon (South-East of Côte d'Ivoire)

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Abstract

This study aims to identify human uses and activities in the watershed Aghien lagoon in nine rural communities located downstream, near the lagoon in rural area, and upstream of the lagoon in the urban area. A sample of two thousand two hundred fifty eight (2258) households is selected by the cluster sampling technique to three degrees. To these persons, a survey was administered. An interview guide was submitted to the various economic operators of these areas. The results show that the lagoon is used by localities near the lagoon for the dishes, laundry, bathing and swimming for more than 80% of households. This resource is also used for fishing, transport, irrigation, consumption and defecation but at low levels and as a receptacle for garbage. In the villages bordering the lagoon, the main economic activity is agriculture, unlike trade in upstream urban areas.

Keywords

Aghien Lagoon, Activities, Uses, Household

1. Introduction

Access to clean water is one of the concerns of all humanity. Abidjan is currently supplied with drinking water exclusively from groundwater table of the Continental Terminal. This resource is under threat by contamination from natural sources and anthropogenic source [1] [2] [3]. Thus, the current priority of policymakers is requires an additional water supply to meet pressing water needs of

the Abidjan city. In such a changing environment (rapid population growth, urbanization and declining rainfall), the search for an alternative source of water supply of the city of Abidjan is required.

Therefore, the State of Côte d'Ivoire has identified sources such as: surface water (Lake bakre, Aghien lagoon, the Comoé river) and groundwater table of the Continental Terminal Bonoua (located 60 km from Abidjan) but focused mainly Bonoua groundwater table which feeds a part of the city of Abidjan since March 2015 and the Aghien lagoon object of this study. Aghien lagoon is a part of the lagoon Ebrié system. It is separated from the Ebrié lagoon by Potou lagoon with which it communicates by a natural channel. It is the largest reserve of fresh water near the District of Abidjan. Unlike the groundwater of Bonoua naturally protected. It is located south of the Côte d'Ivoire, in the District of Abidjan, Aghien lagoon is between latitudes $5^{\circ}22'N$ $5^{\circ}26'N$ and longitudes $3^{\circ}49'W$ and $3^{\circ}55'W$ and spread over several locations, Abidjan, Bingerville and Anyama [3] [4] [5] [6]. Aghien lagoon has an area of 20 km^2 for a perimeter of 40.72 km , an estimated volume of 25 km^3 and a maximum depth of 13 m. Its watershed is drained by a river system, which consists of in a one hand by the Beté and Djibi rivers that drain directly in the upstream basin and partly by Mé intercepting its downstream course [3] (Figure 1).

The main body of water inflows in the lagoon is the direct precipitation, the contributions of the two upstream tributaries and inflows of groundwater. The main outputs are Real Evapo Transpiration (RET) and losses via the channel downstream connecting it to the lagoon Potou.

The climate of the study area is equatorial characterized by four seasons with a long dry season from December to March, a big rain season from April to July, a small dry season from August to September and a small season of rain from October to November.

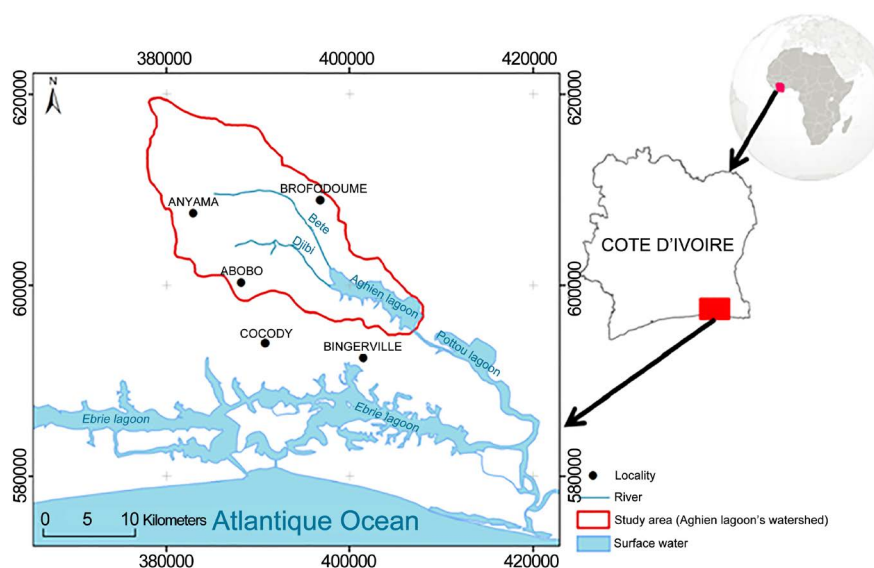


Figure 1. Watershed Aghien lagoon [7].

The watershed formerly mostly covered by dense evergreen forest and rain, is gradually cleared (traditional crops, cash crops (oil palm, rubber) and undergoes growth of housing on the outskirts of Abidjan (towns of Azaguié, Anyama).

What are the different uses and practices of Aghien lagoon by the neighboring populations? What forms of activities in the lagoon area?

2. Material and Methods

The population of this study is composed of men, women and young people living in the identified areas. The villages are divided into two (2) ethnic groups namely the Tchaman or Ebrié and Akyé or Attie. The population is the Akan lagoon belonging to KWA language group.

The population also comprises the Indigenous Attie, Ébrié, the allogeneic from all regions of Côte d'Ivoire. The foreign community in turn is composed of nationals of the countries of Africa, particularly West Africa. The technique used for the sampling is the cluster sampling method. It causes division of the population into groups or clusters. Randomly selecting a number of clusters to represent the population. Then ask all individuals selected clusters. In this study, the cluster sampling technique was to determine first, the municipalities crossed by the Aghien lagoon, then the villages in rural areas, neighborhoods in the city and finally to select households. Thus, the sampling unit is the household here. A total of 2258 households were surveyed out of a total of 6730 households, with a total estimated population of 51,914 inhabitants. To these, is submitted a questionnaire designed for this purpose comprises three main sections: a first part that gives information on the socio-economic situation of the household, the second part information on the mode of supply of household water, the third part presents the activities in the watershed of the Aghien lagoon, different uses and method of management of household waste, which could influence the quality of this resource. The surveys were conducted with households in the months from June to September 2015. The surveys were conducted himself both in rural areas, in the immediate vicinity of the lagoon (Achokoi, Akoyaté, Akandjé, Aghien Bingerville, Adjin Telegraphe, Débarcadère) that in urban areas, upstream of the lagoon (Abobo Kclouecha, Abobo Djibi, Ahoue) (**Figure 2**).

The data collected were processed using the softwares "Sphinx 2 Plus" and "Excel". The mapping process was performed using the software "Arc Gis 9.3".

3. Results

The processing of survey data will be analyzed.

3.1. Uses of Aghien Lagoon by Local Residents

3.1.1. Water Use of Aghien Lagoon in All Population Activities

The use of the lagoon by location is shown in (**Figure 3**).

Figure 3 shows that the villages downstream that overlook the lagoon use this water for their daily needs with the following proportions: Akoyaté (98.1%), Aghien Bingerville (94.5%), Akandjé (92.9 %), Adjin Telegraphe (94.10%) and De-

barcadère (67.8%).

However, the upstream sites of Aghien lagoon as Abobo Klouetcha, Abobo Djibi and Ahoue 100% of these households do not use this water for their needs because of the distance between this localities and the lagoon. As for Achokoi, only 15.80% of households use this lagoon.

3.1.2. Different Forms of Use of Aghien Lagoon

Table 1 presents the practices made using water from Aghien lagoon.

The data show that people who use this source do it for washing, namely dishes, laundry, bathing and swimming. The data for all surveyed localities and vil-lages that lead directly to the water indicate that 20.18% of the population uses

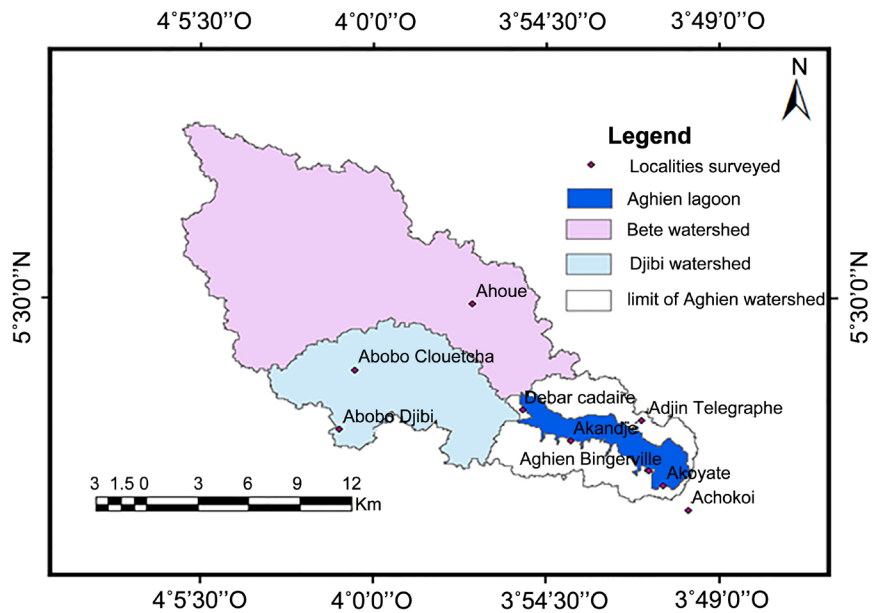


Figure 2. Map of localities surveyed.

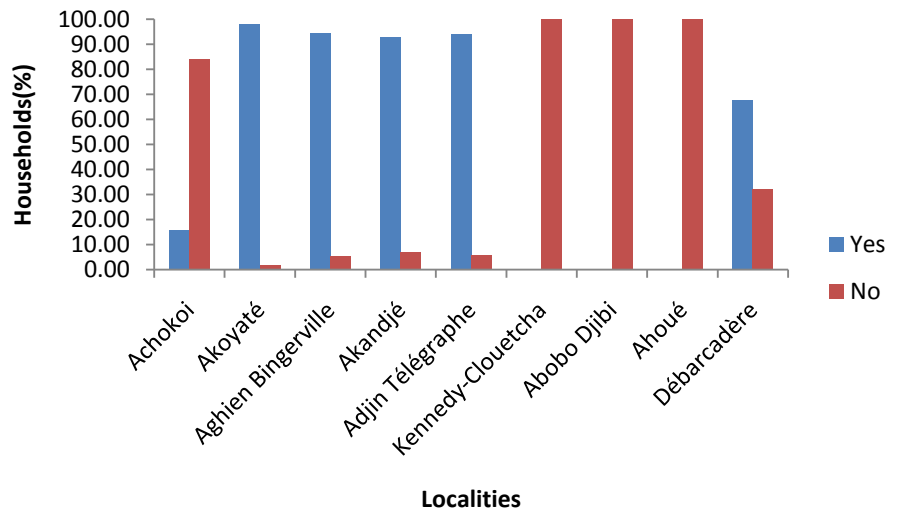


Figure 3. Use of the lagoon by locality.

the lagoon for laundry, 17.48% for dishes, 16.62% for bath, and 14.55% for swimming.

The lagoon is also used for transportation, fishing, irrigation and defecation in riparian areas.

3.1.3 Modes of Drinking Water Supply

Figure 4 illustrates the different modes of supply of the populations in the Aghien watershed.

The data in (**Figure 4**) show that all localities feed mainly from drilling for their drinking water. However, the village of Adjin Telegraph who received a social housing project has been connected to the drinking water distribution network SODECI (Company of water supply in Côte d'Ivoire). Thus, 56.60% of households use water provided by SODECI. Indeed, in Achokoi, Akoyaté, Aghien Bingerville, Akandjé, Abobo Djibi, Ahoue and Débarcadère localities population proportion who use drilling for drinking water are 57%; 47.8%; 78%; 83.70%; 97.6%; 82.8% and 50.4% respectively.

Table 1. User forms of Aghien lagoon by locality.

Localities	Practices (%)					
	Wash	Fishing	Transport	Defecation	Drinking water	Irrigation
Achokoi	57.10	22.90	11.40	5.70	2.90	0
Akoyaté	69	13.30	11.80	4.30	0.40	1.20
Aghien Bingerville	71.40	10.80	7.50	6.90	1.60	1.80
Akandjé	64.80	14	8.70	12.10	0.50	0
Adjin Télégraphe	73.60	13.80	9.40	1	1	1.30
Débarcadère	77.10	13	0.50	6	1.20	2.30

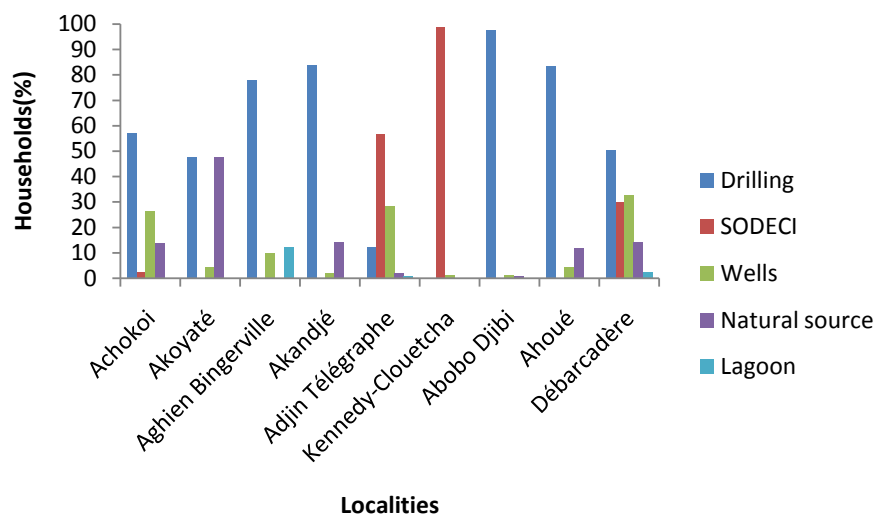


Figure 4. Source of drinking water by localities.

As for Abobo Klouetcha, 98.90% of the population use water of SODECI to supply drinking water.

We record 4 drillings in the locality of Ahoué, against one in the localities of Achokoi, Akoyaté, Akandjé, Adjin Télégraphe, Aghien Bingerville, Débarcadère and Abobo Djibi. As far as the wells are concerned, we have 2 in Achokoi and one in the localities of Akoyaté, Akandjé, Adjin Télégraphe, Aghien Bingerville, Ahoué and Abobo Djibi. Débarcadère holds the largest number with 7 wells. It should be noted, however, that the wells are very shallow in the majority, with an interval of 2 to 9 m. Indeed, the waters of these wells are for the most part the waters of the Aghien lagoon.

3.1.4. Aghien Lagoon as a Receptacle for Household Waste

The analysis of the collected data was used to develop the distribution of waste rejection close to the lagoon (**Table 2**). Households of Akandjé in majority reject their garbage near the lagoon, unlike Adjin Telegraph when only a minority of households is concerned.

3.1.5. Aghien Lagoon as a Receptacle of Wastewater

Table 3 shows the distribution of household residents of different localities which discharge their waste water into Aghien lagoon. The majority percentage is observed at Akandjé unlike Achokoi which records a zero discharge.

3.2. Activities of People along the Watershed Aghien

Analysis of the data allows to draw (**Table 4**) for the activities of the respondents.

The data in (**Table 4**) show that the dominant activity in the villages of Achokoi 51% of Aghien Bingerville 35.1%, 45.4% Akandjé, Adjin Telegraph 46.4%, 62.70% Ahoue Debarcadère 60% is farming. In the urbanized portion represented by Abobo Klouetcha and Abobo Djibi, trade is dominant with percentages of 75% and 46.80%. The processing of attiéké (casava) remains the predominant activity in Aghien Bingerville and Akoyaté. The data also indicate the presence of livestock farming (pigs, poultry). The farms are generally small size (mostly less than 5 000 m² or less than 1 ha). The watershed also includes

Table 2. Percentage of waste discharge near Aghien lagoon by locality.

Localities	Achokoi	Akoyaté	Aghien B.	Akandjé	Adjin T.	Débarcadère
% Junk rejection	5.20	30.40	2.60	56.50	1.20	6.70

B. Bingerville, T. Télégraphe.

Table 3. Percentage discharge of waste water into the lagoon Aghien by locality.

Localities	Achokoi	Akoyaté	Aghien B.	Akandjé	Adjin T	Débarcadère
% Rejection wastewater	0	30.40	24.70	56.60	37.40	18.40

B. Bingerville, T. Télégraphe.

Table 4. Distribution of activities by location.

Localities	Activities (%)						Job*
	Agriculture	Fishing	Trade	Breeding	Oil processing unit	Attiéké processing unit	
Achokoi	51	14	12	4	6	4	8
Akoyaté	34.60	23.10	0.00	1.90	0.00	40.40	0.00
Aghien Bingerville	35.10	7.00	3.50	5.30	0.00	35.10	14.00
Akandjé	45.50	11.40	10.60	0	0	29.60	3
Adjin télégraphe	46.40	11.60	18.80	2.90	8.70	7.20	4.30
Abobo Kclouetcha	0	0	75	0	0	9	15
Abobo Djibi	30.60	0.00	46.80	9.70	0.00	3.20	9.70
Ahoué	62.70	0.00	19.70	5.00	0.00	7.50	5.00
Débarcadère	60.80	10.10	12.20	9.70	0.00	0.80	6.30

*job: (joinery, hairdressing shops, sewing workshops, garage, transporters).

industrial rubber and oil palm farms like (Rubber Company Pakidié (CCP), 1 100 ha), experimental (National Centre for Agronomic Research (CNRA), 1600 ha) and large personal holdings (1 operating 62 Ha). Concerning the villages, the center of pre collection of rubber of the CCP, is an industrial unit. However, according to information collected from leaders, it does not constitute a processing unit. This is a transit cup of assets (gross latex) before being routed to the MACACI to be transformed into mattresses. Nurseries and experimental plots of the CNRA located 7 km from the lagoon and extending over an area of 1.60 hectares. CNRA is devoted to the production of palm oil and rubber plants. Finally, there is also the planting (rubber and oil palm) of the EXAT company (YACE camp). There are vegetable crops (eggplant, tomato, cucumber, cabbage, parsley, chili, salad) and fish farms (tilapia, catfish, carp) in villages around the lagoon Aghien.

Industrial activities also include the level of the urban area of Abobo, a few industrial units including Coco Service, ADM COCOA and food industries, materials production industries or transport enterprises in urban area.

4. Discussion

Socio-economic surveys in 9 localities have allowed us to understand the behavior against the residents of Aghien lagoon. The results of the study show that the majority of surveyed localities used mainly drillings for their water supply. However, only the village of Adjin Telegraphe which is connected to the network of the Society of Water Distribution in Ivory Coast (SODECI) explaining 56.60% of households using water supplied by SODECI. Households of the villages in the immediate vicinity such Akoyaté, Aghien Bingerville Akandjé, Debarcadère and Adjin Telegraphe use the lagoon for laundry, dishwashing, bathing and

bath, rejecting their waste water directly into the lagoon. These practices are daily release on water chemical compounds like detergents causing lagoon pollution. Also, people who haven't toilet defecate in the lagoon.

Our results are in agreement with those of [8] who argue that the lagoon is a defecation place for local residents. Villagers whose fields are located near the lagoon do also their need in the water. According to [9] water intended for human consumption must not contain any faecal coliform.

56% of households met directly dump their garbage in the Aghien lagoon in the village of Akandjé. Preparing attiéké (casava) near the lake leads to the rejection of leachate and waste directly into the lagoon. Also, closely located houses of rivers also dump their garbage there.

The wastewater is discharged near Aghien lagoon by illegal pipeline connections, but also by the presence of latrines directly near the river. This finding is noticed in all downstream villages in the immediate vicinity of the Aghien lagoon, with a large percentage Akandjé for 56.60% and 37.40% for Adjin Telegraphe. In contrast, we observe zero% rejection of sewage in Achokoi; this is due to the fact that concessions for households in the village of Achokoi are somewhat distant from the lagoon.

The dominant activity in the villages of Akoyaté, Adjin Telegraphe, Debarcadère, Akandjé and Ahoue is agriculture, as mentioned in the work of [7]. Trade is the main activity in Abobo Djibi and Abobo-Klouetcha because of the effect of urbanization.

5. Conclusion

The surveys of households in the vicinity and upstream of Aghien lagoon have determined the power operation of drinking water, the uses and activities of Aghien watershed. The supply of drinking water of the population remains the drilling except the village of Adjin Telegraphe and Abobo Klouetcha neighborhood where potable water supply comes from SODECI. In villages near the lagoon, 67.8% to 98.1% of households met use the lagoon for their needs. The lagoon is mainly used for washing dishes, washing clothes, bathing and bath with proportions varying between 57.10% and 77.10%. This resource is also used for fishing, transport, irrigation, consumption and defecation but at low levels and as receptacle refuse and sewage. In the neighboring villages of the lagoon, the main economic activity is agriculture, unlike trade in urban areas upstream.

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References

- [1] Jourda, J.P.R., Saley, M.B., Djagoua, E.V., Kouame, K.J., Biemi, J. and Razack, M.

- (2006) Utilisation des données ETM+ de Landsat et d'un SIG pour l'évaluation du potentiel en eau souterraine dans le milieu fissuré précambrien de la région de Korhogo (Nord de la Côte d'Ivoire): Approche par analyse multicritère et test de validation. *Téledétection*, **4**, 339-357.
- [2] Ahoussi, K.E., Soro, N., Soro, G., Lasm, T., Oga, M.S. and Zadé, S. (2008) Ground-water Pollution in Africans Biggest Towns: Case of the Town of Abidjan (Côte d'Ivoire). *European Journal of Scientific Research*, **20**, 302-316.
- [3] Traoré, A., Soro, G., Kouadio, K.E., Bamba, S.B., Oga, M.S., Soro, N. and Biémi, J. (2012) Evaluation des paramètres physiques, chimiques et bactériologiques des eaux d'une lagune tropicale en période d'étiage: La lagune Aghien (Côte d'Ivoire). *International Journal of Biological and Chemical Sciences*, **6**, 7048-7058.
- [4] Tastet, J.P. and Guiral, D. (1994) Géologie et sédimentologie. In: Durand, J.-R., Dufour, P., Guiral, D. and Soko, G.F.Z., Eds., *Environnement et ressources aquatiques de Côte d'Ivoire, Tome II: Les milieux lagunaires*, édition ORSTOM, 35-57.
- [5] Bedia, A.T., N'zi, K.G. , Yao, S.S., Kouamelan, E.P., N'douba, V. and Kouassi, N.J. (2009) Typologie de la pêche en lagune Aghien-potou (Côte d'Ivoire, Afrique de l'Ouest): Acteurs et engins de pêche. *Agronomie Africaine*, **21**, 197-204.
- [6] Humbert, J.F. (2012) Lagune Aghien, Rapport sur la mission, 25.
- [7] Koffi, K.J.-P., N'Go, Y.A., Kone, D., Kouassi, K.H. and Issiaka, S. (2015) Mapping of Pollution Risk of Surface Waters by Runoff from Watershed: Case of Aghien Lagoon (South of Côte d'Ivoire). *Journal of Water Resource and Protection*, **7**, 1457-1466. <https://doi.org/10.4236/jwarp.2015.717119>
- [8] Abou, T., Gbombélé, S., Kouassi Ernest, A., Siaka, B.B., Nagnin, S. and Jean, B. (2014) Niveau de contamination en métaux lourds des sédiments d'une lagune tropicale: La lagune Aghien (Sud-Est de la Côte d'Ivoire). *Afrique Science*, **10**, 73-88. <http://www.afriquescience.info/document.php?id=3720>
- [9] WHO (1992) Directives de la qualité pour l'eau de boisson OMS, N°1, 192.



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