



ISSN: 2230-9926

Available online at <http://www.journalijdr.com>

IJDR

International Journal of Development Research
Vol. 15, Issue, 06, pp. 68559-68562, June, 2025
<https://doi.org/10.37118/ijdr.29730.06.2025>



RESEARCH ARTICLE

OPEN ACCESS

ECOLOGICAL QUALITY OF THE WATER IN LAKE EHUIKRO, THE DRINKING WATER RESERVOIR FOR THE TOWN OF BONGOUANOU (CÔTE D'IVOIRE)

LOZO Roméo N'Guessan*, KOMOE Koffi, KONAN Yao Aristide, ABOUA Béné Rose Danielle and BERTE Siaka

Félix-Houphouët-Boigny University, Laboratory of Natural Environments and Conservation of Biodiversity, UFR Biosciences, 22 BP 582 Abidjan, Côte d'Ivoire

ARTICLE INFO

Article History:

Received 18th March, 2025
Received in revised form
17th April, 2025
Accepted 20th May, 2025
Published online 28th June, 2025

Key Words:

Microalgae, Organic pollution, Palmer index, Ehuikro, Bongouanou (Côte d'Ivoire)

*Corresponding author:

LOZO Roméo N'Guessan,

ABSTRACT

This study assessed the biological quality of Lake Ehuikro (Bongouanou, Côte d'Ivoire) using microalgae from February to July 2023. We used microalgae as biological indicators of water quality at three selected stations on the lake. The method used is that proposed by Palmer (1969), which consists of translating the level of contamination in water samples. The samples taken enabled 75 taxa belonging to 29 genera to be inventoried, including 39 taxa belonging to the Euglenophyta (52%), 17 to the Chlorophyta (22.66%), 11 to the Cyanoprokaryota (14.66%) and 6 to the Heterokontophyta (8%) and finally 2 to the Dinophyta (2.66%). The pollution-tolerant genera identified were *Euglena*, *Oscillatoria*, *Scenedesmus*, *Ankistrodesmus*, *Phacus*, *Closterium*, *Gomphonema* and *Lepocinlis*. The Palmer algal pollution index showed that the lake's three stations have little organic pollution. The total scores at stations 1 and 2 were 8 and 9 respectively, indicating the absence of organic pollution, and 15 at station 3, indicating moderate organic pollution. The results also show that the lake is moderately polluted, with an index of 10. This study is part of the process of making available the results, which will serve as a reference for subsequent investigations into the state of water quality in this water supply source.

Copyright©2025, LOZO Roméo N'Guessan et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: LOZO Roméo N'Guessan, KOMOE Koffi, KONAN Yao Aristide, ABOUA Béné Rose Danielle and BERTE Siaka, 2025. "Ecological Quality of the Water in Lake Ehuikro, the Drinking water Reservoir for the Town of Bongouanou (Côte D'Ivoire)". *International Journal of Development Research*, 15, (06), 68559-68562.

INTRODUCTION

Chemical, physiological or behavioural disturbances in a species or group of species indicate a change in water quality within their ecosystem. Although some work has been done on the use of microalgae as pollution indicators, their application in the assessment of water quality in Côte d'Ivoire is proving necessary for several localities. Their use as biological indicators of water quality has become commonplace in environmental management (Iltis, 1980). Excessive phytoplankton production often leads to ecological changes that affect the quality of drinking water and the composition of flora and fauna, as well as the excessive development of certain species that produce toxic substances (Smith, 2003; Carmichael et al., 2010). It would therefore be more judicious to assess the state of health of water reservoirs, including Lake Ehuikro, using micro-algae, especially as the Moronou region, and more specifically the town of Bongouanou, our study area and the subject of this work, is not immune to environmental problems. Lake Ehuikro is currently the only source of water supplied by SODECI to the town of Bongouanou and the surrounding area.

The general objective of this work is to assess the biological quality of the water in Lake Ehuikro using micro-algae, with a view to the conservation and sustainable management of the lake.

MATERIAL AND METHODS

Study area: Lake Ehuikro, the drinking water supply dam for the town of Bongouanou, was built in 1973 as part of the national water supply programme on the sacred river Yakpo. It is located just outside the town of Bongouanou, between latitudes 6°38'12" and 6°38'40" North and longitudes 4°09'48" and 4°10'30" West (Fig. 1). The regime of the dam depends on the regimes of the sacred river Yakpo and to some extent Lake Kaby. It receives run-off water from the village from which it takes its name, Ehuikro. The Ehuikro AEP dam is bordered to the south by a poultry farm, a pig farm and crops (rubber tree nurseries, maize, tomatoes and okra), and to the east by the village of Ehuikro. The north and west are planted with cassava and cocoa, as well as tomatoes, chillies and okra. Situated in a vast depression and surrounded by hills, it is used by SODECI in the Bongouanou department to supply the town with drinking water (Fofana et al., 2020).

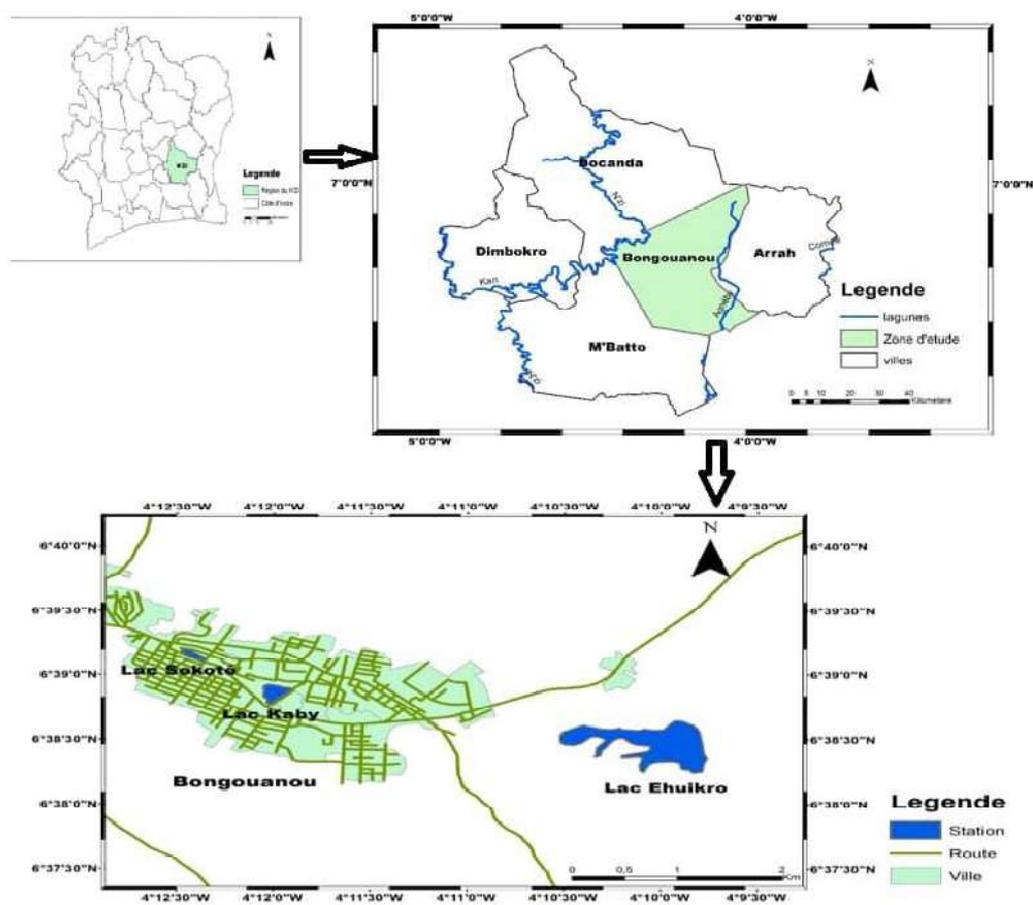


Fig.1. Geographical location of Lake Ehuikro in the town of Bongouanou (Côte d'Ivoire)

Measurement of physico-chemical parameters: The physico-chemical parameters (temperature, pH, conductivity, dissolved oxygen, salinity) were measured in the first 50 cm of water. The measurements were carried out in situ using a HANNA-HI 9828 multiparameter from February to July 2023. In terms of transparency, the Secchi disc was immersed in water until it disappeared completely and then slowly raised until it reappeared. The thickness of the euphotic zone was determined from the length of the thread running from the surface of the water to the disc.

Collection of microalgae samples: Samples were collected using a plankton net with a mesh size of 20 μm . Samples were collected by filtering five buckets of 10litre using the plankton net. The filtrate collected in the net collector was then preserved in a pillbox and fixed with 5% formalin at each station. The samples obtained were transported to the laboratory for analysis.

Observation and identification of microalgae: The samples obtained were analysed as follows: after the formalin species (5%) had been deposited at the bottom of the pill box, a drop of water was taken from this deposit using a pipette without homogenising the contents. This drop was then placed between the slide and the coverslip and observed using a photonic microscope (CKX 41) coupled to a computer, at objective 40. Identification is made once the taxon is well positioned and the cells are clearly visible. The cells obtained are then photographed. This identification was carried out thanks to the work of Bourrelly (1961), Iltis (1980), Compère (1975), Ouattara (2000), Zongo (2007), Djimaet *al.* (2010), Komoé (2010), Seu-Anoï (2012), Kouassi (2013), Adon (2013), Konan(2014) andLozo (2016).

Method for assessing water quality using microalgae: The method used to assess water quality is that described by Palmer (1969), which is the algal pollution index using 20 genera of micro-algae most tolerant of organic pollution. This index is based on a relative number of total points marked by each alga present in a particular body of

water. It was developed to classify water bodies as heavily, moderately or lightly organically polluted (Hosmani, 2013). According to the algal pollution index of Palmer (1969), a score between 0 and 10 indicates a lack of organic pollution; 10-15 indicates moderate pollution. Scores of 15-20 indicate probable high organic pollution and scores of 20 and above are considered high organic pollution (Jose et Kumar, 2011). Table I shows the values of the algal pollution index from Palmer (1969) indicating the score attributed to each of the 20 algal genera.

Table 1. Pollution index for the algal genus

Genus	Index	Genus	Index
<i>Anacystis</i>	1	<i>Micractinium</i>	1
<i>Ankistrodesmus</i>	2	<i>Navicula</i>	3
<i>Chlamydomonas</i>	4	<i>Nitzschia</i>	3
<i>Chlorella</i>	3	<i>Oscillatoria</i>	5
<i>Closterium</i>	1	<i>Pandorina</i>	1
<i>Cyclotella</i>	1	<i>Phacus</i>	2
<i>Euglena</i>	5	<i>Phormidium</i>	1
<i>Gomphonema</i>	1	<i>Scenedesmus</i>	4
<i>Lepocinclis</i>	1	<i>Stigeoclonium</i>	2
<i>Melosira</i>	1	<i>Syndra</i>	2

RESULTS AND DISCUSSION

Physico-chemical parameters: The average nitrate concentration is 0.024 mg/l and the average orthophosphate concentration is 0.033 mg/l. These values recorded at the stations could be explained by the cultivation of crops such as coffee, cacao and rubber with the use of fertilizers, and also by the presence of farms on the coast close to the reservoir. In addition, during the rainy season, runoff from the hillside could carry fertilizer runoff into the reservoir. These effluents are gradually mineralized and increase the level of nutrient salts. Our results are in agreement with those of Kouassi (2017) who found a

high level of nutrient salts in the waters of Lake Ehuikro. The mean values of pH and transparency were 7.84 and 52 cm, respectively. Such high transparency could be due to the intense solar radiation on these environments induced by the absence of a canopy on the reservoir. High transparency also favors good light penetration into these ecosystems, which in turn favors photosynthesis in this environment. For dissolved oxygen, the average value recorded during the study was 5.49 mg/l. This level of dissolved oxygen at the stations indicates that the reservoir is well oxygenated, which could be related to the transparency of these environments. With regard to conductivity, the average value was 355.5 $\mu\text{S}/\text{cm}$, which reflects the mineralization of the lake water due to the accumulation of nutrient salts. The average value recorded for this parameter during the present study is higher than those obtained by Yao (2010) at the Banco reservoirs (19 and 81 $\mu\text{S}/\text{cm}$) and Kouassi (2013) at Agboville (160.67 to 188.44 $\mu\text{S}/\text{cm}$). With regard to temperature, it should be noted that the water of Lake Ehuikro is warm with an average value of 30.29°C. This high temperature in these waters could be due to the lack of canopy cover in this pond. These values are higher than those of Adon (2013) (25.95 and 28.65°C) for the Agboville reservoirs.

Composition of the microalgae population and ecological quality of the lake: In the present study, the algal flora recorded at our various stations is represented by 75 taxa divided into 29 genera, 23 families, 13 orders, 8 classes and 5 phyla. The Euglenophyta phylum has the largest number of taxa with 39 taxa, i.e. 52%, followed by the Chlorophyta (17 taxa, i.e. 22.67%), the Cyanoprokaryota (11 taxa, i.e. 14.67%), the Heterokontophyta (6 taxa, i.e. 8%) and finally the Dinophyta (2 taxa, i.e. 2.67%) (Fig. 2).

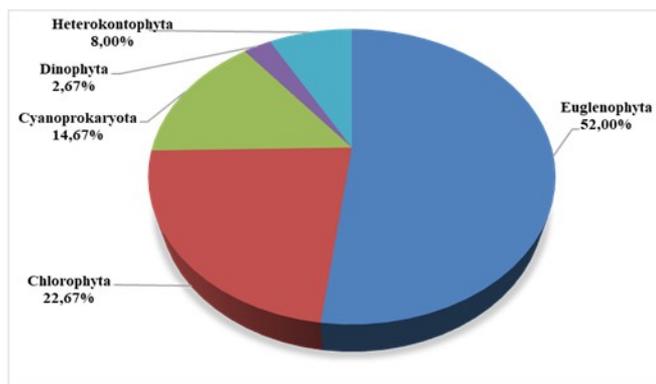


Fig. 2. Different proportions of phytoplankton phyla in Lake Ehuikro

The results show that the study area is very rich in species, which can be explained by the number of taxa recorded in two campaigns. This species diversity could be due to the fact that the study took place in a lake environment. In fact, lake environments that are similar to each other are more diverse than river environments. This richness could also be linked to their lentic character, as the stagnant nature of lakes favours biological processes such as the complete reproduction and development cycles of algae. This algal richness in relation to water stability was observed by Ouattara (2000) on Lake Ayamé in Côte d'Ivoire. The dominance of the Euglenophyta and Chlorophyta phyla could also be due to the fact that our study was carried out in a freshwater environment. According to Sanaa (2006), Euglenophyceae can only produce biomass peaks in association with Chlorophyceae. Our results do not agree with those obtained by Ouattara (2000) on Lake Ayamé. In fact, this author showed that Lake Ayamé contains a low presence of Euglenophyceae and emphasised a high percentage of Chlorophyta in the algal flora of this lake. The algal pollution index of Palmer (1969) is used in all the stations and the results obtained are presented in Table II. With the exception of station 3, which shows moderate pollution, stations 1 and 2 show no pollution. Of the 20 genera presented by Palmer as bioindicators of organic pollution, we identified 8 genera in our study. The genera *Phacus*, *Lepocinclis* and *Gomphonema* are the most represented in all the stations, with a low index score according to Palmer (1969). Next, the

genera *Euglena* and *Oscillatoria*, which are poorly represented, have a high index score. Finally, the genus *Scenedesmus*, which also has a high index score, is moderately represented. In addition, the table shows that the results are not identical at the various sampling stations, indicating several levels of organic pollution. Stations 1 and 2 are characterised by an absence of pollution, with indices of 8 and 9 respectively according to Palmer (1969). Station 3, on the other hand, had a score of 15, indicating moderate pollution. The average score for the stations surveyed was 10.66 (a score between 10 and 15), which according to Palmer is an indicator of moderately organically polluted water.

Table 2. Different genera of pollution-tolerant microalgae (Palmer pollution index in descending order) found in our water samples taken from Lake Ehuikro (Bongouanou, Côte d'Ivoire).

Genus	Palmer Pollution index	Station 1	Station 2	Station 3
<i>Euglena</i>	5	-	-	+5
<i>Oscillatoria</i>	5	-	+5	-
<i>Chlamydomonas</i>	4	-	-	-
<i>Scenedesmus</i>	4	+4	-	+4
<i>Chlorella</i>	3	-	-	-
<i>Navicula</i>	3	-	-	-
<i>Nitzschia</i>	3	-	-	-
<i>Ankistrodesmus</i>	2	-	-	+2
<i>Phacus</i>	2	+2	+2	+2
<i>Stigeoclonium</i>	2	-	-	-
<i>Synedra</i>	2	-	-	-
<i>Anacystis</i>	1	-	-	-
<i>Closterium</i>	1	-	+1	-
<i>Cyrotella</i>	1	-	-	-
<i>Gomphonema</i>	1	+1	+1	+1
<i>Lepocinclis</i>	1	+1	+1	+1
<i>Melosira</i>	1	-	-	-
<i>Micractinium</i>	1	-	-	-
<i>Pandorina</i>	1	-	-	-
<i>Phormidium</i>	1	-	-	-
Total		8	10	15

Of the 20 genera presented by Palmer (1969) as bioindicators of organic pollution, we identified 7 in the studied environment. The communities of microalgae represented by the genera *Phacus*, *Trachelomonas*, *Lepocinclis*, *Gomphonema*, *Euglena* and *Scenedesmus* identified in the studied environment are, according to Palmer (1969), Robert *et al.*, (1974) et Hosmani et Bharati (1980), indicators of organic pollution of the water. The genera *Phacus* and *Trachelomonas*, which are the most abundant in the lake, are known to prefer eutrophic environments. Stations 1 and 2, with indices of 8 and 9 respectively, have values between 0 and 10, indicating a lack of organic pollution according to the Palmer scale. As for station 3, we recorded a score of 15, this score being between 10-15 indicates moderate organic pollution according to Palmer (1969). Although the pollution observed at station 3 is moderate, it is close to the threshold for probable organic pollution according to the Palmer index. The qualitative state of station 3 can be explained by the presence of heavy activities in the vicinity of the station, such as rubber, cocoa and coffee plantations and corn fields. The average score for the stations studied was 10, which is on the borderline between no pollution and moderate pollution according to the Palmer scale. The massive presence of microalgae could be due to the quality of the water in the area studied. According to some authors, the physico-chemical data recorded are favorable for the massive proliferation of microalgae (Skulberget *et al.*, 1984). Indeed, the composition of the microalgal phyla in Lake Ehuikro shows a dominance of Euglenophyta (52%) and Chlorophyta (22.66%), despite its moderate organic pollution (index = 10). Our results confirm those of Saikia *et al.* (2010), who found that the less polluted stations are dominated by Euglenophyceae and Chlorophyceae.

CONCLUSION

This study assessed the biological quality of the water in Lake Ehuikro through the microalgae present in the environment. The micro-algae inventory identified 75 species. The results show that the

microalgae community is made up of five phyla, two of which are more representative in terms of the number of species. These are the Chlorophyta and Euglenophyta. In this study, we used micro-algae as bioindicators of the biological quality of the water according to Palmer's organic pollution index in Lake Ehuikro. The average of the total scores was 10, which, according to Palmer, shows that the waters of Lake Ehuikro can be considered to be unpolluted. The waters of the lake are certainly not polluted, but the average score is the threshold for moderate pollution, so if nothing is done to improve conservation, these environments will probably be polluted in a few years' time.

REFERENCES

- Adon M.P. 2013. Variations spatiale et saisonnière du phytoplancton de la retenue d'eau d'Adzopé (Côte d'Ivoire): composition, structure, biomasse et production primaire. Thèse de doctorat de l'Université Nangui Abrogoua, Abidjan, Côte d'Ivoire, 89 p.
- Bourrelly P. 1961. Algues d'eau douce de la République de Côte d'Ivoire. *Bulletin de l'Institut Français de l'Afrique Noire, série A*, 23 (2): 283-374.
- Carmichael W.W., Jones C.L.A., Mahmood N.A., Theiss W.C. & Krogh P. (2010). Algal toxins and water-based diseases. *Critical Reviews in Environmental Science and Technology*, 15 (3) : 275 - 313.
- Compère P. 1975. Algues de la région du Lac Tchad. III-Rhodophycées, Euglénophycées, Cryptophycées, Dinophycées, Chrysophycées et Xanthophycées. *Cahiers de l'O.R.S.T.O.M., Série Hydrobiologie*, 9 (3) : 167-192.
- Djima T.I, N'diaye M, Da P.K. & Saadou M. 2010. Micro-algues de la mare et des bassins d'arrosage à Port-Bouët (Abidjan, Côte d'Ivoire). *Agronomie Africaine* 22 (3): 247-261.
- Fofana, N.M., Etilé, R.N., Konan, A.Y., Yao, S.S., & Bi G.G., 2020. Impact De L'anthropisation Sur Les Variations SpatioTemporelles Et Du Peuplement Zooplanctonique : Exemple Des Retenues D'eau De Bongouanou (Afrique De L'ouest, Côte D'ivoire). *Eur. Sci. J.* ESJ 16. <https://doi.org/10.19044/esj.2020.v16n30p187>
- Hosmani, S.P. et Bharati, S.G. 1980. Les algues comme indicateurs de la pollution organique, *phykos*, 19(1) : 23-26.
- Hosmani, SP. 2013. Les algues d'eau douce comme indicateur de la qualité de l'eau. *Revue universelle de recherche et technologie environnementale*, 3(4), 473-482.
- Itis A., 1980. Les algues. In : *Flore et Faune aquatiques de l'Afrique Sahélo-Soudanaïenne*. Durand J. R. & Lévêque C. (Eds.). Tome I. Éditions O.R.S.T.O.M, pp. 9-61.
- José L & Kumar C.(2011). Evaluation de la pollution par l'indice d'algale de Pamer et analyse physico-chimique de l'eau de quatre bassins de temple de Mattancherry, Emakulam, Kerala. *Technologie de la nature, de l'environnement et de la pollution*, 10(3), 471-472.
- Komoé K., 2010. Distribution du phytoplancton dans le complexe lagunaire de Grand- Lahou en Côte d'Ivoire. Thèse de Doctorat, université de Cocody-Abidjan, 282 p.
- Konan E.S. 2014. Distribution spatio-temporelle du peuplement phytoplanctonique et variabilité des facteurs abiotiques de la lagune de Fresco (Côte d'Ivoire). Thèse de Doctorat, Université Félix Houphouët-Boigny, (Côte d'Ivoire), 174 p.
- Kouassi B.A.T. 2013. Taxinomie, composition floristique et dynamique spatio-saisonnière des algues périphytiques de la retenue d'eau d'Adzopé (Côte d'Ivoire). Thèse de Doctorat, Université Félix Houphouët-Boigny, Côte d'Ivoire, 190 p.
- Kouassi Y. G. 2017. Premières données systématiques du phytoplancton des lacs de Bongouanou (Côte d'Ivoire). Mémoire de Master de Biodiversité et valorisation des écosystèmes, UFR Biosciences, Université Félix Houphouët-Boigny, Abidjan, Côte d'Ivoire, 79 p.
- Lozo R. N. 2016. Composition floristique et distribution du peuplement de micro-algues du fleuve Bandama (Côte d'Ivoire). Thèse de doctorat de l'Université de Cocody, Abidjan (Côte d'Ivoire), 188p.
- Ouattara A.2000. Premières données systématiques et écologiques du phytoplancton du lac d'Ayamé (Côte d'Ivoire). Thèse de doctorat, Université Catholique Leuven, Belgique, 226 p.
- Palmer C. M. 1969. A composite rating of algaetoleratingorganic pollution. *Journal of Phycology*, 5 (1), 78-82.
- Robert, DS, Robert, WH et Everett, LG. 1974. Distribution du phytoplancton et indices de qualité de l'eau pour le lac Mead (fleuve Colorado). *J. Phycol.*, 10 : 323-331.
- Saikia M.K., Kalita S. & Sanna G.C. 2010. Indices algaux pour évaluer la pollution causée par l'usine de papiers d'ElengaBeel (Wetland) Assam (Inde). *Asian Journal of Experimental Biological Sciences*, Vol. 1(4), 815-821.
- Seu-Anoï. N.M. 2012. Structuration spatiale et saisonnière des peuplements phytoplanctoniques et variabilité des facteurs abiotiques dans trois complexes lagunaires de Côte-d'Ivoire (Aby, Ébrié et Grand-Lahou). Thèse de doctorat de l'Université Nangui Abrogoua (Côte d'Ivoire), 137 p.
- Skulberg, O.M, Codd, G.A & Carmichael, W. 1984. Toxic blue-green algal blooms in Europe: a growing problem. *Amibo*. 13, pp 244-246.
- Sanaa B., 2006. Structure, dynamique et typologies physico-chimiques et phytoplanctoniques de l'estuaire du Bou Regreg (Côte Atlantique Marocaine). Thèse de doctorat de l'Université Mohammed V-Agdal, Rabat, 252 p.
- Smith V. (2003). Eutrophication of freshwater and coastal marine ecosystems - A global problem. *Environmental Science and Pollution Research*, 10 : 126 - 139.
- Yao A.A. 2010. Diversité des poissons de la rivière du Banco (Parc National du Banco). Mémoire de D.E.A. Laboratoire d'Environnement et de Biologie Aquatique, Université d'Abobo-Adjamé, Côte d'Ivoire 54 p.
- Zongo F. 2007. Inventaire et systématique des micro-algues dulçaquicoles du réservoir de Bagré au Burkina Faso (Province de Boulgou). Thèse de Doctorat d'Etat, Université de Ouagadougou, Burkina Faso, 164 p.
